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Three new species of *Acacia* (Mimosaceae) from Western Australia

by A. B. Court*

Abstract

Three new species of *Acacia* from Western Australia (*A. anomala*, *A. flagelliformis* and *A. unifissilis*) are described and illustrated. Their affinities are discussed briefly and a note on the extreme rarity of *A. anomala* is included.

Acacia anomala C. A. Gardner ex A. B. Court, sp. nov. (Figures 1 and 4).

Frutex parvus, erectus, ad 35 cm altus, ramis pluribus prope basim exorientibus; inferioribus plerumque \pm teretibus sed interdum paulo angulatis, interdum \pm striatis; superioribus manifeste alatis; alae ad 2 mm latae, phyllodia alata *A. willdenowianae* H. Wendl. simulant, glabrae. *Phyllodia* interdum nulla sed ubi praesentia articulata cum pulvino, nunc lineraria nunc angusto-linearia, 40–100 mm longa et 3–7 mm lata, plerumque parum curvata, ad basim gradatim angustata et acumine parvo duro acuto terminata, supra centrum latissima, glabra, interdum leviter penninervia et nervo \pm centrale. *Stipulae* lanceolatae, late triangulares et acutae vel oblongae et obtusae, 1–1.5 mm longae et 0.3–1 mm latae, interdum obscurae. *Glands marginalis* obscura vel nulla. *Spicae* 15–25 mm longae et 6–9 mm diam. sub anthesi. *Pedunculi* 1–4 mm longi et ca 0.2 mm diam., glabri; a 3–4 bracteis scariosis striatis, \pm ovatis, 1–3 mm longis et ad ca 2 mm latis, interdum demum auriantescentibus, subtentae. *Bracteolae* nullae. *Calyx* irregulariter 4- vel 5-partitus, ca 1 mm longus; lobis non facile secedentibus, oblongis, ad 0.5 mm longis et 0.2–0.4 mm latis, obtusis, incurvatis praeter cilia minuta in apicem glabris. *Corolla* plerumque 5-partita, raro 4-partita; petala \pm lanceolata ellipticave, ca 2 mm longa et ca 0.8 mm lata, glabra, ad apicem paulo incrassata. *Ovarium* breviter stipitatum, glabrum, \perp ellipsoideale. *Legumina* et *semina* ignota.

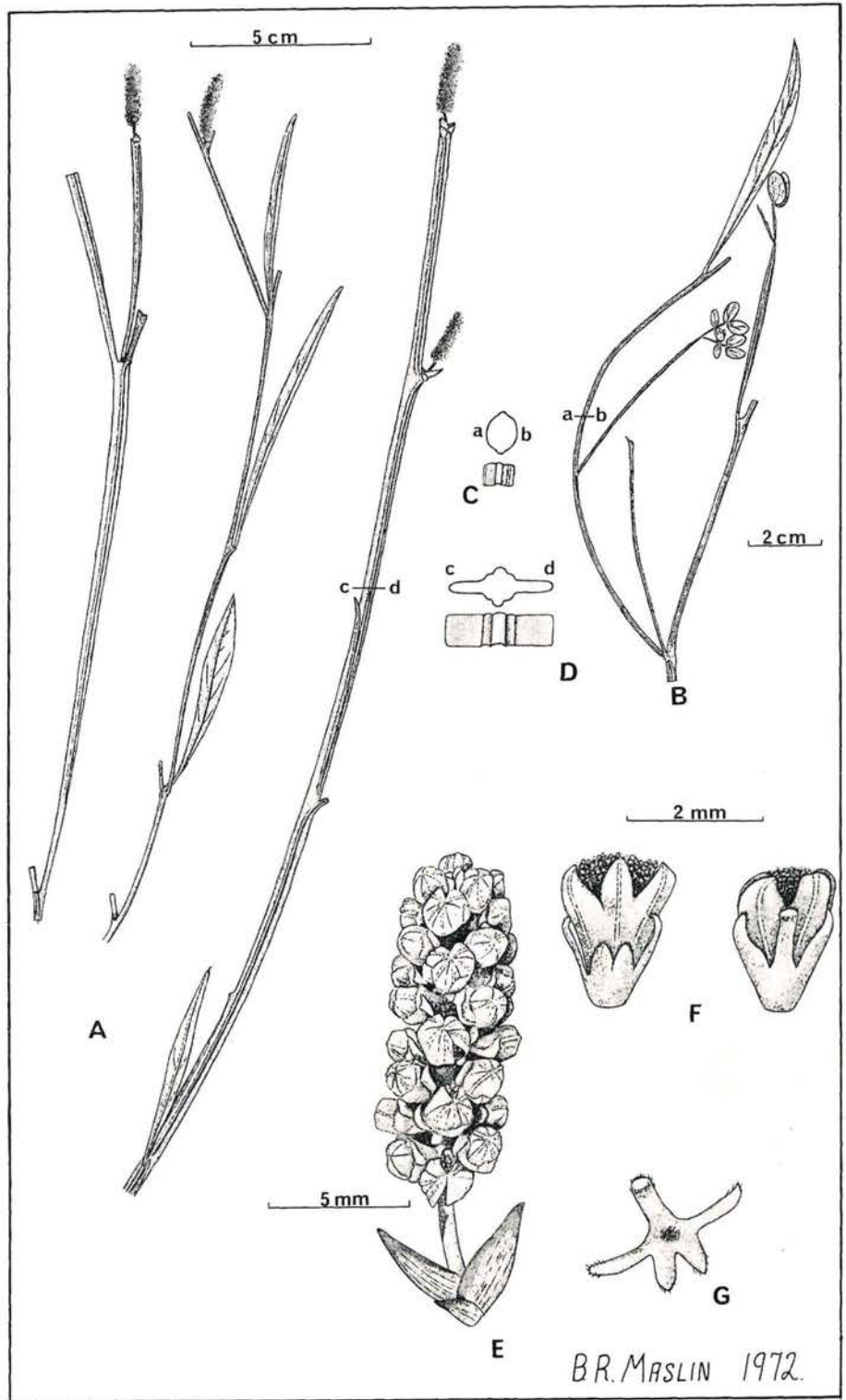
Holotype: Between Muchea and Chittering, Western Australia. In gravelly sand on sides of hills. August 1961 *H. H. Kretchmar* and *C. A. Gardner* s.n., fl. (PERTH—Herb. Gardnerianum).

Small erect *shrub* to 35 cm high with several stems arising from near the base; *lower stems* usually \pm terete but sometimes somewhat angled, sometimes \pm striate; *upper stems* prominently winged; wings to 2 mm wide, resembling the winged phyllodes of *A. willdenowiana* H. Wendl., glabrous. *Phyllodes* sometimes absent but when present then articulated and with a basal pulvinus, linear to narrow-linear, 40–100 mm long and 3–7 mm wide, usually slightly curved, narrowing gradually towards the base, broadest above the centre, glabrous, terminated by a small hard sharp point, sometimes faintly penninerved and with a \pm central midrib. *Stipules* lanceolate, broadly triangular and acute or oblong and blunt, 1–1.5 mm long and 0.3–1 mm wide, sometimes obscure. *Marginal gland* obscure or absent. *Spikes* 15–25 mm long and 6–9 mm diameter at anthesis. *Peduncles* 1–4 mm long and about 0.2 mm diameter, glabrous; peduncles subtended by 3–4 scarios, striated, \pm ovate bracts 1–3 mm long and to about 2 mm wide, sometimes becoming tinged with orange upon aging. *Bracteoles* absent. *Calyx* irregularly 4- or 5-partite, about 1 mm

* 3 Trenwith Close, Spence, A.C.T., 2615.

Figure 1. *Acacia anomala*. A—Three flowering branches. B—Young plant with juvenile foliage. C—Transverse section and surface view of young stem. D—Transverse section and surface view of mature stem. E—Inflorescence. F—Flowers, front and back views showing unequal lobing of calyx. G—Calyx (flattened out).

A, C–G from *H. H. Kretchmar* and *C. A. Gardner* s.n., Aug. 1961 (the type); B from *H. H. Kretchmar*, Aug. 1965.



long; lobes not separating easily, oblong, to 0.5 mm long and 0.2–0.4 mm wide, obtuse, incurved, glabrous except for minute cilia at the apex. *Corolla* usually 5-partite, rarely 4-partite; petals \pm lanceolate or elliptic, about 2 mm long and about 0.8 mm wide, glabrous, somewhat thickened towards their tips. *Ovary* shortly stipitate, glabrous, \pm ellipsoidal. *Legumes* and *seeds* not seen.

Flowering during August and September; fruiting period unknown.

Specimens examined: WESTERN AUSTRALIA: In glareosis prope Bullsbrook in collibus Darling Range, ix. 1966, C. A. Gardner s.n., fl. (PERTH); Muchea, Aug. 1965, H. H. Kretschmar s.n., fl. (PERTH); Bickley, Darling Range, W. H. Loaring s.n., fl. (PERTH).

It seems likely that *Acacia anomala* is now an extinct species or if it is not, then it is certainly extremely rare. This fact has prompted me to name and describe it as new even though no fruiting material has ever been found.

Presumably *A. anomala* is (or was?) confined to lateritic soils in the Darling Range near Perth where it is known from only two localities viz. about 4 km due east of Muchea (40 km NNE of Perth) and Bickley (22 km ESE of Perth).

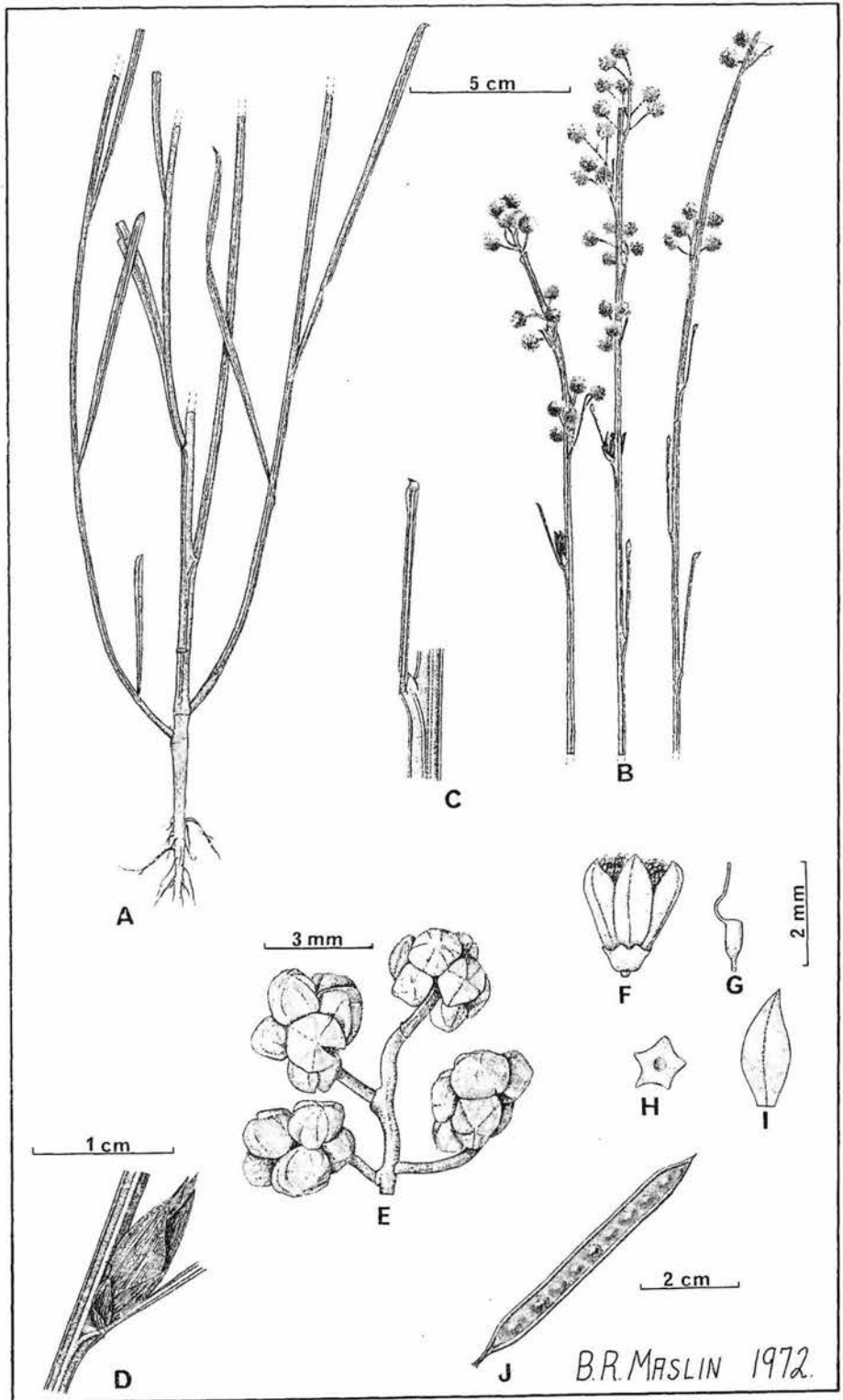
The affinities of this most interesting species are quite obscure. However, for the time being it will be placed in Bentham's series *Alatae* although it could be placed in his series *Juliflorae* perhaps with more justification. It is anomalous because its stems are often winged like those of *A. willdenowiana* H. Wendl. (syn.: *A. diptera* Lindl.) but it can be distinguished at once from that species by its spicate inflorescence. Sometimes phyllodes are present and then they are distinctly articulate on the stems. All specimens have small callous-like extensions to the stem-wings and in this respect *A. anomala* resembles *A. willdenowiana* in particular. Its relationships in the *Juliflorae* are quite unknown to me.

Acacia flagelliformis A. B. Court, sp. nov. (Figures 2 and 4).

Frutex apertus, erectus, 0.4–1.3 m altus, interdum ramis multis ex vel prope basim exorientibus; inferioribus \pm teretibus sed interdum \pm angulatis vel distincte costatis, interdum viridibus vel \pm ferrugineis; superioribus plerumque ad angulum ca 30–35° ex axe finitimo exorientibus, distincte angulatis, costatis alatisve, glabris vel interdum paulo asperulatis, \pm flavoviridibus. *Stipulae* triangulares, 0.6–1.2 mm longae, planae, \pm acutae, virides vel ferrugineae vel obscurae. *Phyllodia* saepe nulla sed cum praesentia interdum e caulibus vix dissimilia, angusto-linearia, 20–110 mm longa et plerumque 0.6–1.5 mm lata, raro ad 5 mm lata, recta, interdum ad apices dilatata, plerumque erecta, nunc obtuse quadrangulata nunc distincte compressa, glabra, in caule articulata, 4-nervata; apex plerumque obtusus interdum uncinatus. *Glans marginalis* obscura vel nulla. *Bracteae* quae racemos juvenes includunt usque ad 10, plerumque equitantes imbricatae, ovatae vel lanceolatae, inferiores ca 1.5 mm longae et superiores fere 10 mm longae, majores plerumque pedunculos singulos subtentes sed mox cadentes, scariosae, subtiliter striatae, acutae, saepe ad bases angustatae, glabrae, plerumque ferrugineae in dimidiis superioribus et infra pallidiores. *Racemi* ad 30 mm longi, plerumque cum 4–9 capitulis. *Rhachis* teres vel interdum sulcata, glabra. *Capitula* globulosa, 5–10 mm diam. sub anthesi, ex 6–9 floribus cum pedicellis glabris minus quam 0.3 mm longis et 0.3 mm diam. constantia. *Bracteolae* florales nullae. *Calyx* \pm cupulatus cum lobis obtusis, lobis non facile secedentibus, \pm diaphanus, ca 0.3–0.5 mm longus, glaber. *Corolla* 5-partita; petala facile secedentia, \pm lanceolato-elliptica, \pm diaphana, 2–2.3 mm longa et 1–1.3 mm lata, glabra, luteola, costibus centralibus \pm obscuris. *Ovarium* ellipsoideale, breviter stipitatum, glabrum. *Legumina* angusto-linearia, 40–50 mm longa et 6 mm lata, 8–9 semina capientia, distincte compressa, super semina convexa, in apices acuminatos longos subtiles extensa, \pm olivacea; *marginis* leguminium incrassati, inter semina non angustati,

Figure 2. *Acacia flagelliformis*. A–B—Young plant. C—Portion of upper branch (inflorescence removed) showing reduced phyllode with stipule at its base. D—Developing inflorescence showing large bracts (completely enclosing young flower-heads). E—Inflorescence. F—Flower. G—Gynoecium. H—Calyx (flattened out). I—Petal. J—Legume.

A–C from E. Dell s.n., June 1929; D–I from B. R. Maslin 457; J from F. W. Went 52.



hepatici. *Semina* longitudinalia vel parum obliqua, elliptica, ca. 3.5 mm longa et 2.5 mm lata, compressa, laevia, porphyrea; *pleurogramma* non conspicua; *areola* ca 2 mm longa et 1 mm lata; *funiculus* ca 1 mm longus et 0.2-0.3 mm diam., luteolus flexo uno, in *arillum* ± clavatum incrassatus.

Type: 0.6 km S of Bussell Highway on Ruabon Road (between Bunbury and Busselton), Western Australia. White sandy loam in swampy area. 3 Sept. 1972, *B. R. Maslin* 2811, fl. et fr. (holo: PERTH; iso: CANB, K).

Open, erect *shrub* 0.4-1.3 m high, sometimes much branched at or near the base; lower stems ± terete but sometimes ± angled or distinctly ribbed, sometimes green or ± red-brown; *upper stems* usually arising at an angle of about 30-35° or less with the adjacent axis, distinctly angled, ribbed or winged, glabrous or occasionally slightly asperulate, ± yellowish green. *Stipules* triangular, 0.6-1.2 mm long, flat, ± acute, green or red-brown, sometimes obscure. *Phyllodes* often absent but when present sometimes scarcely distinguishable from the stems, narrow-linear, 20-110 mm long and usually 0.6-1.5 mm wide, rarely to 5 mm wide, straight, sometimes broadening towards the apex, usually erect, distinctly flattened to obtusely quadrangular, glabrous, articulated, 4-nerved (1-nerved on each margin, 1-nerved on each face); *apex* normally blunt but sometimes uncinat. *Marginal gland* obscure or absent. *Bracts* enclosing the young racemes to 10 in number, mostly equitant or imbricate, ovate or lanceolate, the lower ones about 1.5 mm long and the upper nearly 10 mm long, each of the larger bracts usually subtending a peduncle but soon falling away, scarious, finely striate, acute, often narrowed at base, glabrous, usually red-brown in the upper half and paler below. *Racemes* to 30 mm long, usually with 4-9 flower-heads. *Rachis* terete or occasionally grooved, glabrous. *Flower-heads* globular, 5-10 mm diameter at anthesis, consisting of 6-9 flowers with glabrous pedicels less than 0.3 mm long and 0.3 mm diameter. *Bracteoles* absent. *Calyx* ± cupular with broad blunt lobes which do not readily separate, ± diaphanous, about 0.3-0.5 mm long, glabrous. *Corolla* 5-partite; petals readily separating, ± lanceolate-elliptic, ± diaphanous, 2-2.3 mm long and 1-1.3 mm wide, glabrous, pale yellow, midrib ± obscure. *Ovary* ellipsoidal, shortly stipitate, glabrous. *Legumes* narrow-linear, 40-50 mm long and 6 mm wide, containing 8-9 seeds, distinctly flattened, convex over the seeds, drawn out into a fine acuminate point, ± green-brown; *margins* of legume thickened, not constricted between the seeds, pale yellow-brown. *Seeds* longitudinal or slightly oblique in legume, about 3.5 mm long and 2.5 mm wide, flattened, smooth, red-brown; *pleurogram* not conspicuous, horseshoe-shaped; *areole* about 2 mm long and 1 mm wide; *funicle* about 1 mm long and 0.2-0.3 mm diameter, pale yellow, once-folded and thickened into a ± clavate *aril*.

Flowering during June and fruiting during September.

Selected specimens examined: WESTERN AUSTRALIA: Argyle, vi. 1929, *E. Dell* s.n., fl. (PERTH); in gravelly soil 12.3 mi (20 km) W of Donnybrook on the road to Capel, 9.vi.1970, *B. R. Maslin* 454, fl. (PERTH); in gravelly sand along a creek bed with *A. extensa* Lindl., 12.6 mi (20 km) W of Donnybrook on the road to Capel, 9.vi.1970, *B. R. Maslin* 457, fl. (PERTH); along roadside in grey clayey loam, 1.6 km E of Nannup-Busselton road towards Tutunup, 3.ix.1972, *B. R. Maslin* 2817, fl. (CANB, NSW, PERTH); in swamp near Jindong, ca. 18 km due SW of Busselton, 8.vi.1973, *B. R. Maslin* 3211, fl. (AD, E, K, PERTH); in dry sclerophyll forest, Whicher Range, 33°52'S, 115°15'E, 19.vii.1973, *J. Pulley* 1528 (CBG 052701); roadside near Busselton, 13.ix.1962, *F. W. Went* 52, fl. et fr. (PERTH).

Acacia flagelliformis has been collected in a number of swamps along the southern extremity of the Swan Coastal Plain between Ruabon (11 km due E of Busselton) and Jindong (18 km due SW of Busselton). It has also been collected in the adjacent Whicher and Darling Ranges and in these areas it is normally associated with water courses.

This plant bears a remarkable resemblance to grass culms but it is not caespitose. Generally it is quite insignificant but sometimes it forms dense colonies along the roadside.

Its affinities appear to lie with *Acacia restiacea* Benth. but it differs from that species in its usually thinner stems, longer racemes, fewer flowers in the head, diaphanous calyx and its much thinner pods.

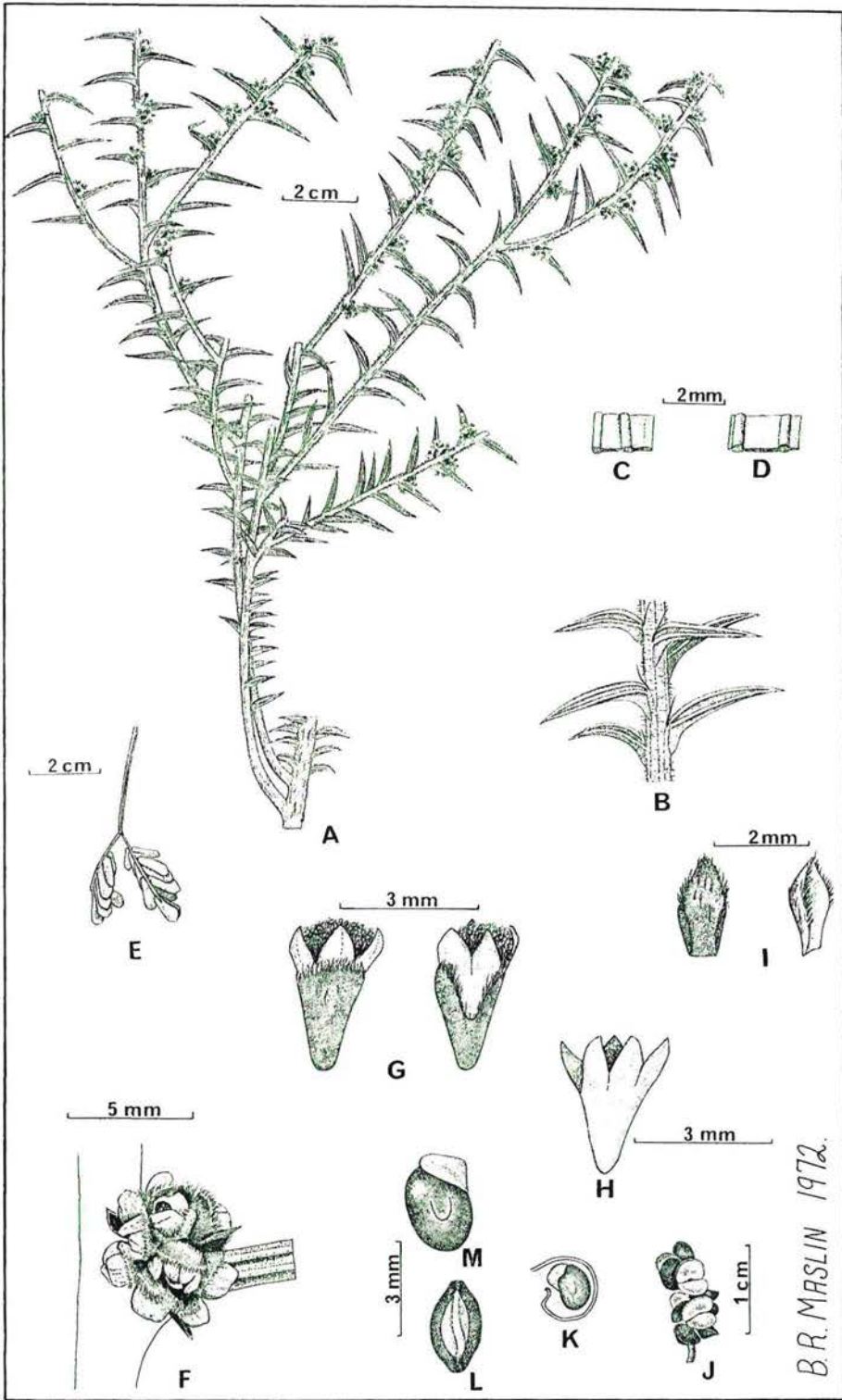
***Acacia unifissilis* A. B. Court, sp. nov. (Figures 3 and 4).**

Frutex compactus expanseusve, 15–60 cm altus, ramis plerumque 2–6 prope basim exorientibus, inferioribus \pm erectis et teretibus, plerumque albido- vel cano-pubescentibus, aut interdum pubetem sparsam pro parte maxima in nervos flavidos \pm prominentes aut in strias longitudinales ferentes, superioribus plerumque erectis, rigidis, \pm teretibus vel angulatis, praecipue in nervos \pm flavidos albido-pubescentibus atque inter eosdem manifeste farinosus. *Folia juvenalia* bipinnata, ca 50 mm longa et 20–25 mm lata, \pm glauca; *petioli* \pm angulati, glabri; *pinnae* 1-jugae, 20–25 mm longae at 10–12 mm latae; *glandibus* singulis obscuris nullisve; *rhachis pinnarum* \pm angulata, glabra; *pinnulae* 4–6-jugae, plerumque obovatae, glabrae vel subglabrae, interdum acuminibus singulis minutis duris \pm acutis, petiolis brevissimis, plerumque nervis obscuris \pm centralibus. *Stipulae* subulatae vel \pm setosae, 1.5–4 mm longae et 0.1–0.5 mm latae, plerumque chartaceae et fuscae vel fumosae, marginibus plerumque ciliatis et interdum hyalinis. *Phyllodia* asymmetrica, triangularia subulatae, 8–30 mm longa, 1.5–3 mm lata ad bases, rigida, plerumque leniter interdum valde recurvata vel etiam tortilia sed numquam recta, distincte complanata ad fere pentagona, interdum sparsim pubescentia et saepe asperulata, saepe flavovirentia, plerumque breviter interdum \pm late decurrentia, plerumque in acumina acuta obliqua \pm abrupte terminantia et interdum ad bases angustata; *nervis* 5–6 in quoque phyllodio (utraque facie 2-nervata, margine abaxiali 1-nervato, adaxiali enervio vel obscure 1-nervato), flavescens, ad apicem coalescentibus et in acuminem durum pungentem productis, saepe in quoque facie nervo superno prope marginem adaxialem posito et siccitate costam latam marginalem facienti. *Glans marginalis* obscura nullave. *Pedunculi* \pm teretes, minus quam 1 mm longi et 1 mm diam., dense candido-pubescentes; a bracteis \pm ovatis, chartaceis, brunneis, ca 3 mm longis et 2 mm latis, plerumque subtiliter striatis subtenti. *Capitula* saepe in fasciculis axillaribus, globulosa vel obloidea, 4–8 mm diam. sub anthesi, ex 8–20 floribus constantia. *Bracteolae* \pm ovatae, ca 2 mm longae et 1.2–1.5 mm latae, parum concavae, chartaceae, plerumque subtiliter striatae, acutae, interdum laciniatae, brunneae cum aliquot pilis dispersis et marginibus \pm ciliatis. *Calyx* integer, \pm cupulatus vel turbinatus sed parum obliquus ut latus abaxiale quam latus adaxiale fissum longius sit, ca 1.5–2 mm longus, initio adaxiale sed postea irregulariter in aliquot lobos \pm inaequales findens, plerumque subtiliter striatus, fere glaber praeter margines valde ciliatos, porphyreus. *Corolla* pentamera; petala secus ipsorum longitudinem fere dimidium libera sed facile ad basim corollae fidentia, anguste oblonga, 2.5–3.2 mm longa et 0.6–1 mm lata, dilutiora quam calycem, interdum incurvata, ad apices incrassata; ovarium ellipsoideale, \pm sessile, glabrum. *Legumina* irregulariter torsiva vel tortilia ut non extendentur, cum tortis ca 10–15 mm longa et 5–10 mm lata, 4–8 semina plerumque capientia; valvae leguminis \pm compressae super semina, ca 4–5 mm latae, \pm tenues, rugulosae, umbrinae, parum angustatae inter semina. *Semina* \pm ellipsoidalia sed oblique truncata prope funiculos, ca 3–4 mm longa et 2–3 mm diam., manifeste porcata, laevia; *pleurogramma* conspicua; *areola* ca 1 mm longa et 0.7 mm lata; *funiculus* filamentosus, \pm rectus, minus quam 0.1 mm diam. et ca 0.5 mm longus, pallidus, in arillum incrassatus; *arillus* obliquus, pallidus, \pm turbinatus, ca 1.5–2 mm altus et 1.5 mm diam.

Holotype: About 6 mi (9.6 km) E of Rabbit Proof Fence No. 1 (E of Muntadgin) towards Mt. Hampton, Western Australia. 5 Aug. 1971, B. R. Maslin 1826, fl. et fr. (PERTH).

Flowering from July until September and fruiting from November until March.

Compact, erect or spreading *shrub* 15–60 cm high, usually with 2–6 branches arising from near the base; lower branches \pm erect, terete or almost so, usually white- or grey-pubescent or occasionally with sparse pubescence mainly restricted to the \pm prominent yellowish nerves or longitudinal markings; *upper branches* usually erect, rigid, \pm terete or somewhat angled, white-pubescent mainly along the \pm yellowish nerves and prominently farinaceous between them. *Juvenile leaves* bipinnate, about 50 mm long and 20–25 mm wide, \pm glaucous; *petiole* \pm angled, glabrous; *pinnae* 1 pair, 20–25 mm long and 10–12 mm wide; *gland* obscure or absent; *pinna rachis* \pm angled, glabrous;



B.R. MASLIN 1972.

pinnules 4–6 pairs, generally obovate, glabrous or almost so, sometimes with a minute hard \pm acute point, very shortly stalked, usually with an obscure \pm central nerve. *Stipules* subulate or \pm setaceous, 1.5–4 mm long and 0.1–0.5 mm wide, usually chartaceous and dark brown or grey, margins usually ciliate and sometimes hyaline. *Phyllodes* asymmetric, triangular or subulate, 8–30 mm long, 1.5–3 mm wide at base, rigid, usually gently recurved but sometimes strongly so or even twisted but rarely straight, distinctly flattened to almost pentagonal, occasionally sparsely pubescent and often asperulate, often yellowish green, usually shortly decurrent but occasionally \pm broadly decurrent, usually terminated \pm abruptly in a sharp oblique point and sometimes narrowed at the base; *nerves* 5–6 to each phyllode (2-nerved on each face, abaxial margin 1-nerved, adaxial margin nerveless or obscurely 1-nerved), yellowish, coalescing towards the apex and then extended into a hard sharp point, often the upper nerve on each face situated close to the adaxial margin and on drying forming a broad upper marginal rib. *Marginal gland* obscure or absent. *Peduncles* \pm terete, less than 1 mm long and 1 mm diameter, densely white-pubescent; subtended by \pm ovate, chartaceous, very finely striate, brown bracts about 3 mm long and 2 mm wide. *Flower-heads* often in axillary clusters, globular or obloid, 4–8 mm diameter at anthesis, consisting of 8–20 flowers. *Bracteoles* \pm ovate, about 2 mm long and 1.2–1.5 mm wide, somewhat concave, chartaceous, usually finely striate, acute, occasionally lacinate, brown, with a few scattered hairs, margins \pm ciliate. *Calyx* entire, \pm cupulate or turbinate but somewhat oblique with the abaxial side longer than the cleft adaxial side, about 1.5–2 mm long, splitting easily adaxially at first but later irregularly into several \pm unequal lobes, usually finely striate, essentially glabrous except for the markedly ciliate margins, red-brown. *Corolla* 5-partite; petals connate for about half their length but separating easily to the base, narrowly oblong, 2.5–3.2 mm long and 0.6–1 mm wide, paler than the calyx, sometimes incurved, thickened towards the apex; ovary ellipsoidal, \pm sessile, glabrous. *Legumes* irregularly coiled or twisted so that they cannot be straightened out, about 10–15 mm long and 5–10 mm wide in the distorted state, usually containing 4–8 seeds; valves of legume \pm compressed over the seeds, about 4–5 mm wide, thin, somewhat rugose, dark brown, somewhat narrowed between the seeds. *Seeds* \pm ellipsoidal but obliquely truncated near the funicle, about 3–4 mm long and 2–3 mm diameter, prominently ridged, smooth, pale brown; *pleurogram* conspicuous, horseshoe-shaped; areole about 1 mm long and 0.7 mm wide; *funicle* filamentous, \pm straight, less than 0.1 mm diameter and about 0.5 mm long, pale, thickened into a oblique, pale, \pm turbinate *aril* about 1.5–2 mm high and 1.5 mm diameter.

Selected specimens examined: WESTERN AUSTRALIA: S of Merredin on Naremben road, 8.vii.1966, *A. M. Ashby* 1803, fl. (PERTH); between Pingrup and Lake Magenta SE of Lake Grace, 23.ix.1933, *W. E. Blackall* 3078, fl. (PERTH); on sandplain, S of Twertup Creek, Fitzgerald River Reserve, 11.vii.1970, *A. S. George* 9910, fl. (PERTH); north of Bendering, 21.xi.1962, *F. Lullfitz* 1761, fr. (PERTH); ca. 6.5 mi (10.5 km) W of Holt Rock on the road to Hyden (E of Hyden), 14.vii.1970, *B. R. Maslin* 565, fl. (PERTH); in white sand 8 mi (12.8 km) N of Kellerberrin on the road to Yelbeni, 16.vii.1970, *B. R. Maslin* 590, fl. et fr. (PERTH); in sand, 22 mi (35 km) NE of Ongerup, 13.ix.1964, *K. Newbey* 3042, fl. (PERTH); 30 mi (48 km) from Ravensthorpe towards Lake King, 14.ix.1971, *S. Paust* 825, fl. (PERTH); in sandy soil in the Fitzgerald River Reserve at the junction of the Susetta and Fitzgerald (rivers), 14.vii.1970, *R. D. Royce* 9005, fl. (PERTH); causeway in the middle of Lake King, 15.viii.1968, *R. A. Saffrey* 582, fl. et fr. (PERTH); on densely vegetated sandplain in cream sand over laterite, 0.5 mi (0.8 km) E of Newdegate towards Lake King, 28.viii.1973, *M. D. Tindale* 3761, fl.

Figure 3. *Acacia unifissilis*. A—Portion of branch system. B—Close-up of branch. C—D—Surface of phyllode showing variability in position of the primary nerves. E—Juvenile leaf. F—Sessile flower-head. G—Flowers (note cleft calyx). H—Corolla. I—Bracteoles (surface and side views). J—Legume. K—Seed in legume. L—Seed (top view). M—Seed side view.

A–C from *B. R. Maslin* 1826 (the type); D–I from *A. S. George* 9910; J–M from *M. D. Tindale* 238 and *B. R. Maslin*.

(A, AD, CBG 059339, K, NSW 107662—orig. spec., PERTH, US); in white sandy soil on a plain with scrub dominated by *Eucalyptus tetragona*, 11.9 mi (19.1 km) SSE of Lake King township on main road to Ravensthorpe, 28.viii.1973, M. D. Tindale 3783, fl. et fr. (CBG 059338, K, NSW—orig. spec., PERTH); on white sand beside Lake King (on) western side of causeway, 20.iii.1970, M. D. Tindale 238 and B. R. Maslin, fr. (NSW 104618—orig. spec., PERTH); sandy heath, 15 mi (24 km) west of Ravensthorpe, 30.viii.1965, E. Wittwer 454, fl. (PERTH).

Acacia unifissilis is a relatively common species in the central and southern wheatbelt regions extending from near Kellerberrin to Ravensthorpe. It is common in sandy regions.

This species belongs to Bentham's series *Alatae* and *Acacia incurva* seems to be its closest relative. It differs from *A. incurva* in its white-pubescent branchlets, 5–6-nerved phyllodes, irregularly split calyx, 5-partite corolla and irregularly contorted pod. In *A. incurva* the uppermost branches are almost glabrous, the phyllodes are 4-nerved, the calyx is regularly 4-lobed, the corolla is 5-partite and the pod is never contorted.

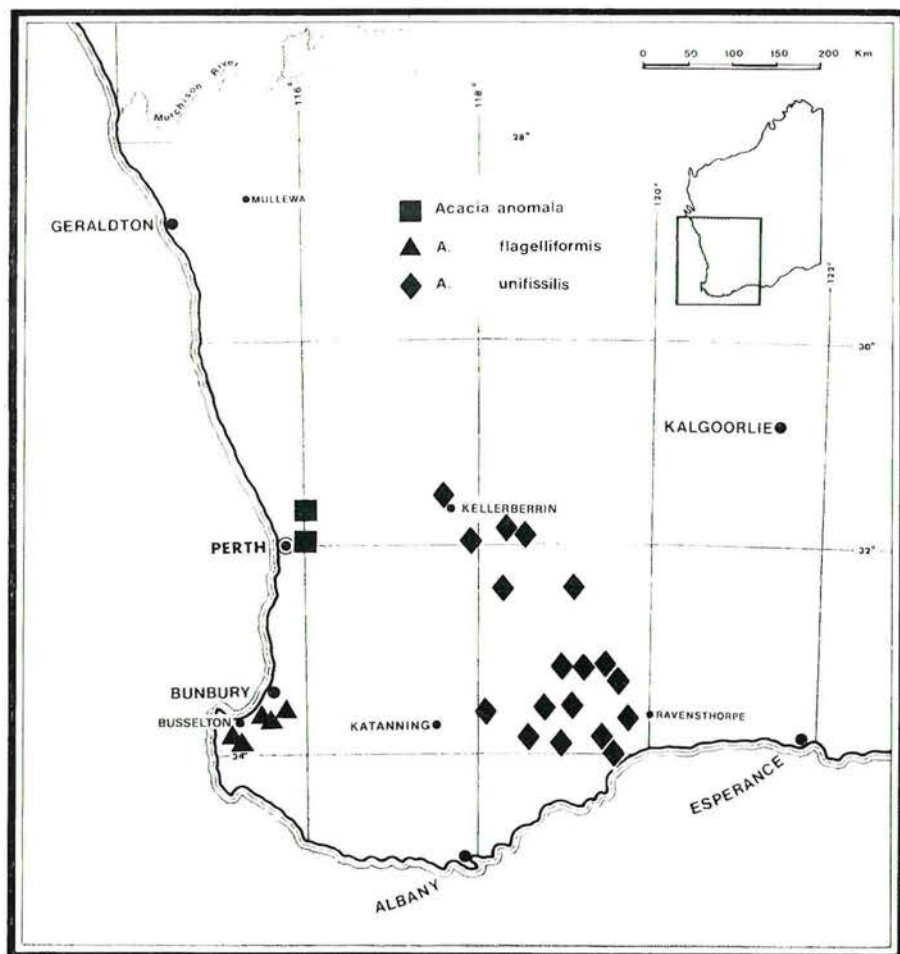


Figure 4. Distribution of *Acacia anomala*, *A. flagelliformis* and *A. unifissilis*.

Acknowledgments

The author extends his thanks to Mr. B. R. Maslin and Mr. A. S. George of the Western Australian Herbarium for their helpful comments. Dr. M. D. Crisp of the Herbarium, Canberra Botanic Gardens, kindly prepared the Latin descriptions. The author also extends his thanks to the directors of the National Herbaria in Melbourne (where this study was initiated) and Sydney and to the Curator of the Western Australian Herbarium for their assistance.

The line drawings and map were prepared by Mr. B. R. Maslin to whom the author expresses his deep appreciation.

A new character for distinguishing vegetative material of the mangrove genera *Bruguiera* and *Rhizophora* (Rhizophoraceae)

by K. F. Kenneally*, P. G. Wilson* and V. Semeniuk†

Abstract

A character based on vascular traces in leaf abscission scars enables identification of vegetative material of the mangroves *Bruguiera* and *Rhizophora*. In *Bruguiera* the leaf traces are aggregated into three distinct bundles whereas in *Rhizophora* they are arranged in a crescentic pattern.

The mangrove genera *Bruguiera* and *Rhizophora* (Rhizophoraceae) occupy overlapping ecological zones in mangals (mangrove communities). Because species of these genera often occur sympatrically and because vegetatively they are very similar their names may be incorrectly applied both in the field and on herbarium sheets.

In many instances mangals occur in remote areas (e.g. the north-west Kimberley coast of Western Australia) and collections by botanists and others tend to be opportunistic. Hence, much of the material collected is in a vegetative condition.

In field situations plants of the two genera can be distinguished by the presence or absence of stilt roots (present in *Rhizophora*, absent in *Bruguiera*). However, as they are otherwise so similar vegetatively and as their crowns often interlace, collections are sometimes mixed.

The authors are currently preparing a field guide to the mangroves of Western Australia and this has involved the consultation of previously published keys on their identification (e.g. Jones, 1971; Pervival and Womersley, 1975). In all keys consulted, morphological characters used to separate *Bruguiera* and *Rhizophora* have been based on the presence or absence of stilt roots and/or floral features. For the reasons mentioned above, identification of the two genera must often be made on non-flowering material, and a character was therefore sought that would enable such material of *Bruguiera* and *Rhizophora* to be distinguished.

Examination of the prominent leaf scars on both genera, using a x10 hand lens, has revealed a character that appears to have been previously overlooked. The scars of *Bruguiera* show three distinct, usually horseshoe-shaped, bundles of leaf traces. These are most evident on scars of newly abscised leaves (Fig. 1A). In *Rhizophora* however, the scars show small groups of leaf traces in a crescentic pattern but never aggregated into three discrete bundles (Fig. 1B). Examination of a wide range of flowering material of *Bruguiera* and *Rhizophora* at the Western Australian Herbarium (PERTH) and Herbarium Australiense (CANB) has shown this character to be constant.

Selected specimens examined: *Bruguiera cylindrica* (L.) Bl.: Yule Is., New Guinea, *Darbyshire* 765 (CANB). *B. exaristata* Ding Hou: Napier Broome Bay, 13°59'S, 126°36'E, Western Australia, *Gardner* 1045 (PERTH); Prince Regent River, 15°32'S, 125°13'E, Western Australia, *George* 12607 (PERTH); 12°05'S, 132°38'E, Northern Territory, *Lazarides* 7501 (CANB); Augustus Is., Bonaparte Archipelago, 15°25'S, 124°35'E, Western Australia, *P. G. Wilson* 10692 (PERTH); Champagne Is., Bonaparte Archipelago, 15°18'S, 124°15'E, Western Australia, *P. G. Wilson* s.n. (PERTH). *B. parviflora* (Roxb) Wight and Arn. ex Griff.:

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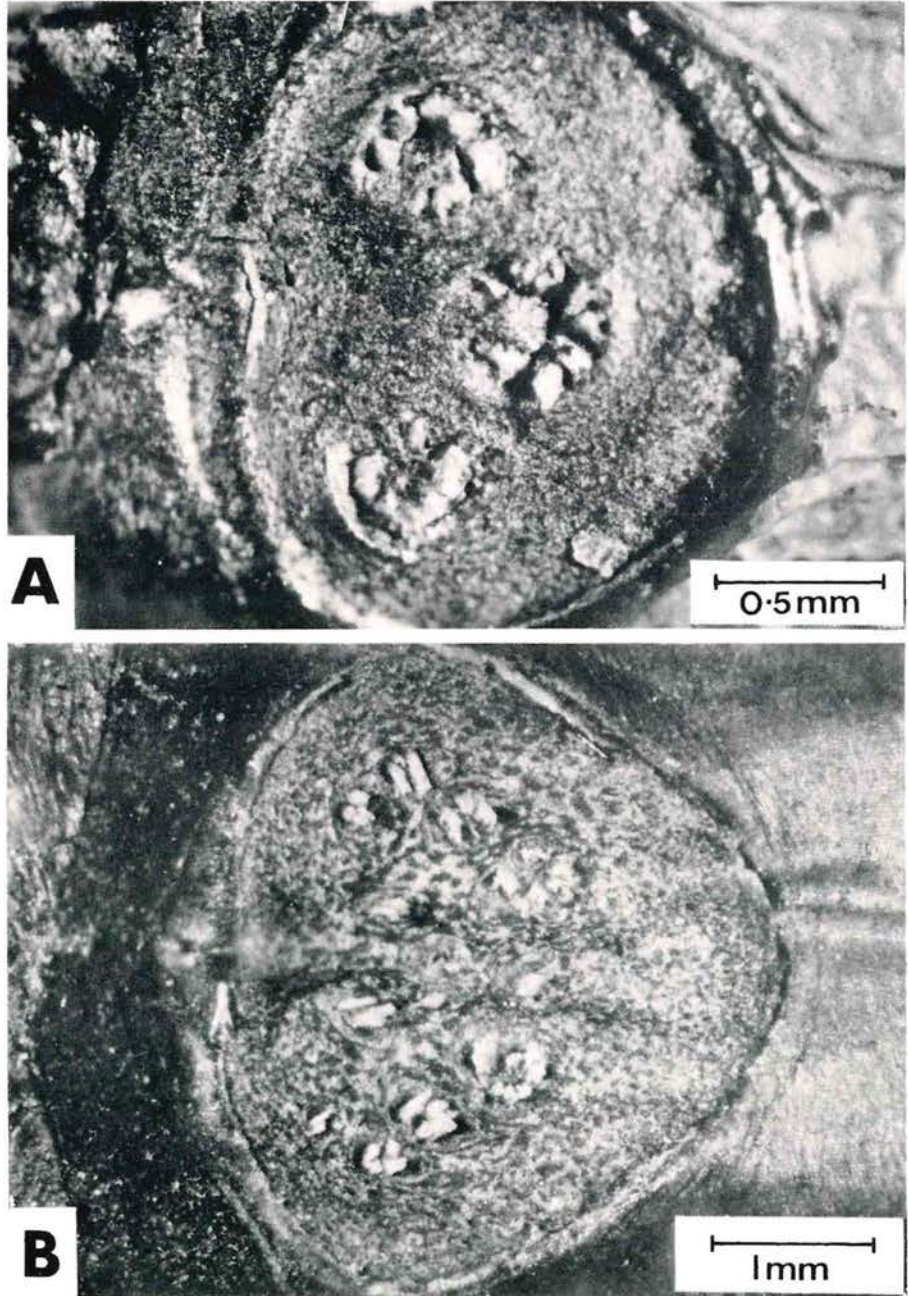


Figure 1. Leaf scars of *Bruguiera* and *Rhizophora*. A=*B. exaristata* leaf scar showing 3 horseshoe-shaped bundles of leaf traces. B=*R. stylosa* leaf scar showing numerous vascular traces arranged in a crescentic pattern.

A from P. G. Wilson 10692; B from K. F. Kenneally 5247.

Darwin, Northern Territory, *Balgooy* 1415 (CANB); Prince Regent River, 15°32'S, 125°13'E, Western Australia, *George* 12619 (PERTH). **B. sexangula** (Lour.) Poir.: Darwin, Northern Territory, *Must* 928 (CANB).

Rhizophora apiculata Bl.: Tonolei Harbour, New Guinea, *Sayers* (NGF 19713) (CANB). **R. mucronata** Lamk.: Kanosia, Papua, *Carr* 11513 (CANB). **R. stylosa** Griff.: Prince Regent River, 15°17'S, 125°04'E, Western Australia, *George* 12732 (PERTH); Port Warrender, Admiralty Gulf, 14°34'S, 125°50'E, Western Australia, *Kenncally* 5247 (PERTH); Papa, Papua, *Schodde* 2695 (CANB); Augustus Is., Bonaparte Archipelago, 15°25'S, 124°25'E, Western Australia, *P. G. Wilson* 10693 (PERTH); Sir Graham Moore Is., 13°56'S, 120°33'E, Western Australia, *P. G. Wilson* 11316 (PERTH).

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A new species of *Anigozanthos* Labill. from the Murchison River sandheaths of Western Australia

By S. D. Hopper*

Abstract

Anigozanthos kalbarriensis sp. nov. is described and illustrated. It is related to *A. humilis* Lindl., *A. bicolor* Endl. and *A. gabrielae* Domin.

Anigozanthos kalbarriensis Hopper sp. nov. (Figure 1).

Ab *A. humile* Lindl. lobis perianthii reflexis, ovariis semper rubris, staminibus 2 externis ex 4 centralibus dissitis, florescentia seriori, differt; ab *A. bicolor* Endl. et *A. gabrielae* Domin staminibus in perianthio in paribus 3 separatis insertis, differt.

Type: \pm 1.5 km north of Lake Culcurdoo (north of Murchison River mouth), Western Australia— \pm 114°09'E, 27°24'S, 29 Aug. 1969, *A. S. George* 9604. "In sand with *Acacia* scrub; flowers red and green outside, green inside." Holo: PERTH; iso: CANB, PERTH.

Herb with short rhizome, the leaves and scapes ephemeral. *Roots* thin, wiry. *Rhizome* horizontal, a few centimetres below ground level, covered with broad, glabrous blue-black bracts (leaf bases). *Lowest leaves* several, broadly linear, carinate in lower $\frac{1}{2}$ — $\frac{3}{4}$, curved as in *A. humilis* Lindl., with ensheathing bases, acuminate, to 12 cm long, 3–10 mm wide, usually glabrous, but sometimes with tomentose margins. *Intermediate leaves* similar but less curved. *Leaves on scape* broadly linear, carinate, glabrous or sparsely tomentose, the margins usually tomentose, the lowest leaves up to 10 cm long, upper ones shorter. *Scapes* several, unbranched, 10–20 cm high, bearing single terminal racemes. *Stems* densely tomentose-hirsute above ground, with red branched hairs. *Racemes* of 3 to 20 flowers, densely tomentose-hirsute, red throughout except for perianths, which may be yellow suffused with red, green suffused with red, pale green or golden yellow, giving flowers a two-tone coloration. *Pedicels* at anthesis 2–4 mm long, each subtended by a subulate bract; bracts to 15 mm long on lowest pedicel, shorter above, tomentose abaxially, hirsute adaxially. *Perianth* 2.5–4.5 cm long, 1–2 cm wide when flattened, glabrous within. *Perianth tube* split on lower (anterior) side to within 2–10 mm of the ovary; *lobes* subulate, reflexed as in *A. bicolor* Endl., closely stellate-tomentose within, central (apical) lobes straight and 6–10 mm long, outer (lateral) lobes falcate and 8–14 mm long, all 2–4.5 mm broad at the base. *Stamens* inserted at three levels, the central and second upper pairs near the base of perianth lobes, 2.5–3.5 and 2–3 cm above the ovary respectively; the outer (lateral) pair low in the perianth, 1.3–2.2 cm above the ovary; filaments equal in length to anthers, 1.5–3.5 mm long. *Style* equal to or half the length of the perianth; *stigma* small. *Ovary* always red on the outside, 3-celled; *ovules* 15–30 per locule. *Fruit* hirsute, the hairs white, dehiscence loculicidal. *Seeds* pyramidal, 0.5–1.0 mm long, black, with shallow furrows on the surface.

Distribution: Western Australia—Murchison River sandheaths, within 40 km of the town of Kalbarri.

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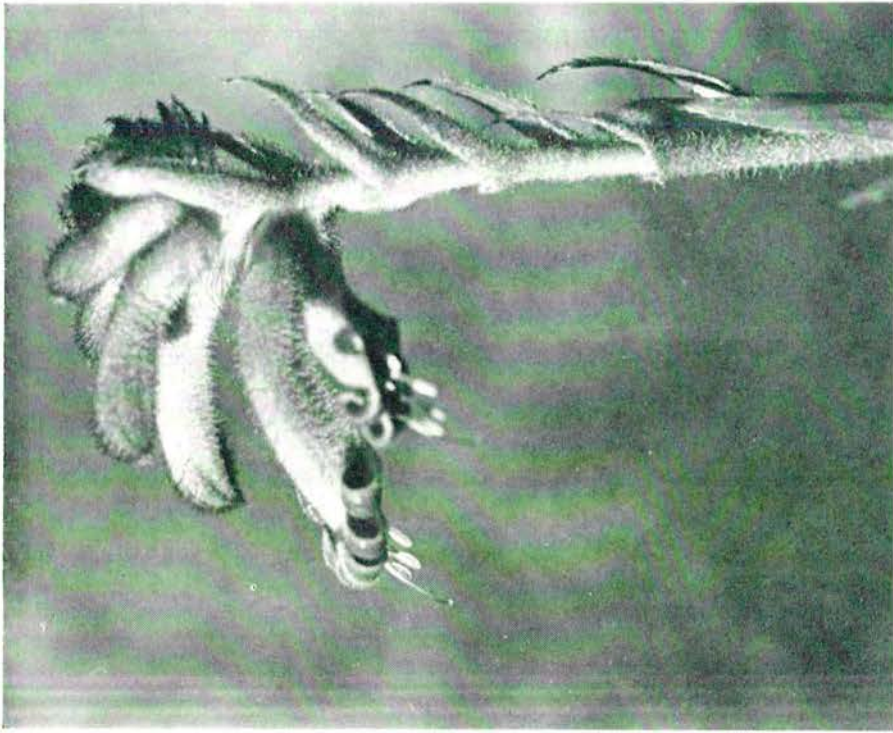


Figure 1. Photographs of a plant of *Anigozanthos kalbarriensis* sp. nov. from a population 3.7 km east of the Hawk's Head turn off on the road in to Kalbarri. Note the resemblance to *A. humilis* Lindl. in vegetative morphology, and the distinctive backward reflexion of the perianth lobes.

Specimens examined: Near Mt. Curious, lower Murchison River, W.A., 29 Aug. 1969, A. S. George 9619b (PERTH); 40 km E of Kalbarri, 3·7 km E of T.O. to Hawkshead Lookout, "In low proteaceous heath, winter-wet sandy flats, south side of road, recently burnt", 19 Aug. 1975, S. D. Hopper 126 (PERTH).

The new species is allied to *A. humilis* Lindl., from which it differs in having reflexed perianth lobes, consistently red ovaries, outer stamens more distant from the central four, a later flowering season (beginning in August), and a preference for winter-wet depressions in sandplain rather than hill slopes and rises. It is readily distinguished from *A. bicolor* Endl. and *A. gabriellae* Domin in having stamens inserted at three levels in the perianth.

Anigozanthos kalbarriensis appears to be a fire opportunist, occurring in large numbers the first spring after a bushfire and rapidly declining in subsequent years. It has been found in sympatry with *A. humilis* and hybrids at one locality. The two species showed some ecological segregation along soil moisture gradients associated with changes in topography: *A. kalbarriensis* occurred in wetter flats and depressions at the base of elevated rises occupied by *A. humilis*. Hybrids occurred mainly in ecotonal regions between these habitats. Hybrids also had lower pollen fertility than individuals of either parental species.

The variation in perianth colour shown by *A. kalbarriensis* is without parallel in the rest of the genus. The species should provide a rich source of colour variation of use in horticultural hybridization programmes. Present work by the author indicates that *A. kalbarriensis* can be successfully hybridized with all other species of *Anigozanthos* including *A. flavidus* DC., and that these synthetic hybrids can be brought to flower within 6–9 months of sowing under glasshouse conditions.

The specific epithet of the new species is taken from the town of Kalbarri which lies at the mouth of the Murchison River.

Acknowledgements

I would like to thank Mr. A. S. George for providing the Latin diagnosis, and Mr. M. Lucks for assistance with photography.

Field surveys and investigations of the population biology of *A. kalbarriensis* were supported by Grant No. 74/692 from the Australian Biological Resources Study Interim Council. Research leading to the description of the new species was undertaken while I was in receipt of a Commonwealth Postgraduate Research Award.

New taxa and new combinations in Australian Pittosporaceae

By Eleanor M. Bennett*

Abstract

The following four new species are described—*Billardiera uniflora*, *Bursaria occidentalis*, *Bursaria lasiophylla* and *Cheiranthera alternifolia*. In addition 12 new varieties are described—1 in *Cheiranthera*, 9 in *Bursaria* and 2 in *Billardiera*. The genus *Rhytidosporum* F. Muell. is placed in synonymy under *Billardiera*. A revised systematic arrangement within the genus *Billardiera* is outlined.

Introduction

The following new names and new combinations are published in order to validate their inclusion in a forthcoming paper on the Pittosporaceae. This it is hoped will appear as a family part in the proposed Flora of Australia.

Apart from the publication of a number of new combinations and the description of several new species and varieties, a revised classification of the genus *Billardiera* is provided. The division into sections is based on the fruit, and that into series on overall morphology since it is considered that the use of fruit characters alone is insufficient to provide natural groupings within the sections.

Billardiera

In a previous paper (1972) I combined the then two accepted genera *Billardiera* and *Marianthus* under the former name. McGillivray (1975) reinstated the genus *Rhytidosporum* F. Muell. (which was included under *Marianthus* by Bentham) and which I have here placed in synonymy under *Billardiera* series *Procumbentes*. The species described under *Rhytidosporum* have a habit and capsule similar to those of the Western Australian *Billardiera villosa*. Because *Billardiera* already shows much morphological variation between species it seems better to consider *Rhytidosporum* as belonging to it also.

In the following systematic arrangement I have decided to follow the previously accepted characters and to divide the genus into two sections based on the fruit. In the section *Billardiera*, two series have been made, based on the number of loculi in the ovary. Series *Biloculares* shows variation in the corolla, but a division below series seems unwarranted.

In the section *Marianthus* several characters have been used in combination to distinguish the series.

1. Habit; typically the plants are twiners but in one series they are low or bushy shrubs.
2. Flower; whether the petals are free or coherent.
3. Fruit; a considerable amount of variation is present particularly in the shape and method of dehiscence.

The series *Parviflorae* I believe to be the "bridging" group between the two sections. This series has a loculicidally dehiscent capsule, but is distinct from the other series in having pithy compartments for the seeds. In the

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series *Biloculares* the seeds are embedded in pith in a 2-locular ovary, but in the series *Uniloculares* the seeds are in a 1-locular ovary but not embedded in pith. I have placed the section *Marianthus* before *Billardiera* as I consider there to be a trend from a 2-celled fruit through the series *Parviflorae* to the 1-celled fruit of the series *Uniloculares*.

Billardiera Sm., Spec. Bot. Nov. Holl. 1: t.1 (1793)

Section I **Marianthus** (Hueg. ex Endl.) E.M. Bennett, comb. et stat. nov.

Basionym: *Marianthus* Hueg. ex Endl., in Endl. et al., Enum. Pl. Hueg. 8(1837).

Type species: *M. candidus* Hueg. ex Endl.

Fruit a capsule.

Series 1: **Pictae** (Benth.) E.M. Bennett, comb. nov. (Fig. 1a)

Basionym: *Marianthus* ser. *Pictae* Benth., Fl. Austr. 1:116 (1863)

Lectotype species: *B. bicolor* (Putterl.) E.M. Bennett (*M. pictus* Lindl.) lecto. nov.

Marianthus series *Normales* Benth., loc. cit. Lectotype species: *M. candidus* Hueg. ex Endl. lecto. nov.

Twining or flexuose shrubs. *Flowers* solitary to corymbose. *Petals* free, linear or spatulate (in *B. erubescens* connate at anthesis but eventually free).

Capsules septically and loculicidally dehiscent, glabrous.

Included species: *Billardiera bicolor* (Putterl.) E.M. Bennett, *B. candida* (Hueg. ex Endl.) E.M. Bennett, *B. erubescens* (Putterl.) E.M. Bennett.

Series 2: **Bignoniae** E.M. Bennett, ser. nov. (Fig. 1 b, c)

Marianthus ser. *Oncosporeae* Benth., Fl. Austr. 1:116 (1863) in part, not as to lectotype.

Type species: *B. bignoniacea* (F. Muell.) E.M. Bennett.

Corolla tubulosa, supra medium contracta, extus pubescens, demum versus basim libera. *Capsula* cylindrica, puberula; dehiscentia loculicidali.

Twining. *Flowers* solitary, *Corolla* tubular, contracted above ovary, pubescent outside, eventually petals free towards base. *Capsule* loculicidal, cylindrical, puberulous.

Only species: *B. bignoniacea* (F. Muell.) E.M. Bennett.

Billardiera bignoniacea (F. Muell.) E.M. Bennett, comb. nov.

Basionym: *Marianthus bignoniaceus* F. Muell., Trans. Phil. Soc. Vict. 1:6 (1853)

Series 3: **Calopetalae** E.M. Bennett, ser. nov. (Fig. 1 d,e)

Marianthus ser. *Pictae* Benth., Fl. Austr. 1:116 (1863), in part, not as to lectotype.

Type species: *Billardiera ringens* (Drumm. ex Harv.) E.M. Bennett

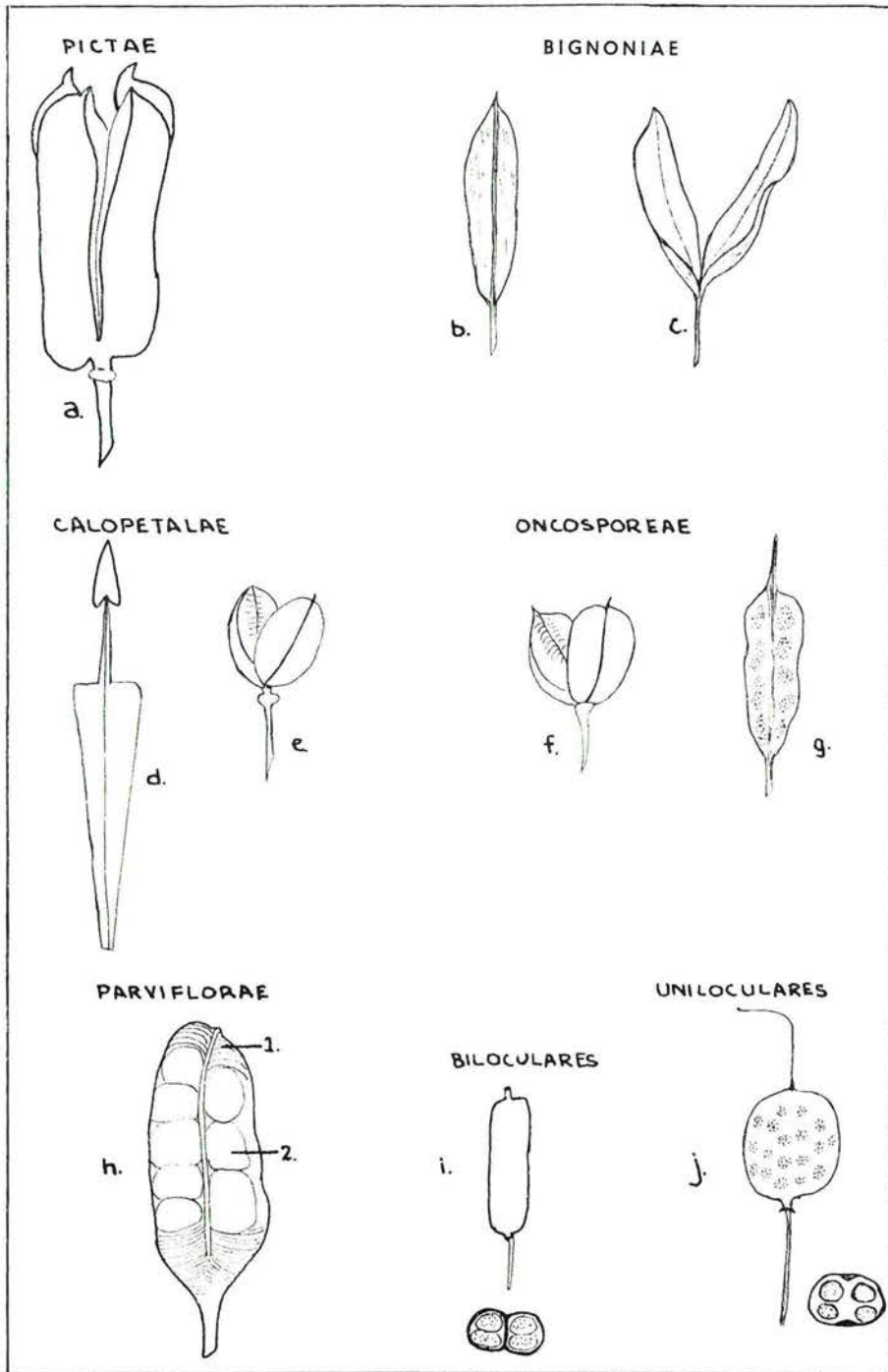


Figure 1—Fruit of *Billardiera* Series. A—Pictae (*B. bicolor*). B—C—Bignoniae (*B. bignoniacea*). D—E—Calopetalae. D—Stamen, x 3.5. E—Capsule (*B. ringens*). F—G—Oncosporeae (F—*B. granulata*. G—*B. caeruleo-punctata*). H—Parviflorae (*B. parviflora*); 1—pith, 2—pithy compartments for seed. I—Biloculares (*B. coriacea*), berry and t.s. of berry. J—Uniloculares (*B. longiflora*); berry and t.s. of berry.

Petala primum connata, sed demum libear. Antherarum filamenta per tres longitudinis quadrante dilatata, deinde in acumen brevis subula abrupte contracta. Capsula ovoidea chartacea dehiscentia loculicidali.

Twiner. Inflorescence densely corymbose. Petals at first connate, but eventually free. Anther filaments dilated for three quarters of length then abruptly contracted with a short subulate point. Capsule loculicidally dehiscent, chartaceous.

Only species: *Billardiera ringens* (Drumm. ex Harv.) E.M. Bennett

Series 4: **Procumbentes** (Benth.) E.M. Bennett, comb. nov.

Basionym: *Marianthus* ser. *Procumbentes* Benth., Fl. Austr. 1:116 (1863).
Lectotype species: *Billardiera procumbens* (Hook.) E.M. Bennett, lecto. nov.

Rhytidosporum F. Muell. Pl. Indig. Colony Victoria 1 : 75 (1860).

Small, erect, suberect or prostrate shrubs. Flowers solitary or few and corymbose. Petals lanceolate or linear. Capsule loculicidally dehiscent, ovoid or shortly cylindrical.

Included species: *Billardiera villosa* (Turcz.) E.M. Bennett, *B. procumbens* (Hook.) E.M. Bennett, *B. prostrata* (D. McGillivray) E.M. Bennett, *B. alpina* (D. McGillivray) E.M. Bennett.

Billardiera alpina (D. McGillivray) E.M. Bennett, comb. nov.

Basionym: *Rhytidosporum alpinum* D. McGillivray, Telopea 1:56 (1975)

Billardiera procumbens (Hook.) E.M. Bennett, comb. nov.

Basionym: *Pittosporum procumbens* Hook., Companion Bot. Mag. 1:275(1836)

Bursaria procumbens (Hook.) Putterl., Syn. Pittosp. 20(1839)

Rhytidosporum procumbens (Hook.) F. Muell., Pl. Indig. Col. Vict. 1:75(1860)

Marianthus procumbens (Hook.) Benth., Fl. Austr. 1:117(1863)

Pittosporum nanum Hook., Companion Bot. Mag. 1:275(1836)

Campylanthera ericoides Lindl. in Mitch., Three Exped. 2:277(1838)

Bursaria diosmoides Putterl., Syn. Pittosp. 20(1839)

Bursaria stuartiana Klatt, Linnaea 28:568(1857)

Billardiera prostrata (D. McGillivray) E.M. Bennett, comb. nov.

Basionym: *Rhytidosporum prostratum* D. McGillivray, Telopea 1:55(1975)

Series 5: **Oncosporeae** (Benth.) E.M. Bennett, comb. nov. (Fig. 1 f,g)

Basionym: *Marianthus* ser. *Oncosporeae* Benth., Fl. Austr. 1:116(1863)

Lectotype species: *Billardiera granulata* (Turcz.) E.M. Bennett lecto. nov. (*M. granulatus* (Turcz.) Benth. being the only species in Bentham's series which had been described in the genus *Oncosporum*)

Marianthus series *Normales* Benth., Fl. Austr. 1:116(1863) in part, not as to lectotype.

Twiners. *Flowers* solitary or in few-flowered corymbs. *Petals* free, lanceolate or linear. *Capsule* loculicidally dehiscent, ovoid or cylindrical, glabrous.

Included species: *Billardiera granulata* (Turcz.) E.M. Bennett, *B. drummondiana* (Putterl.) E.M. Bennett, *B. coeruleo-punctata* (Klotsch) E.M. Bennett.

Series 6: **Parviflorae** E.M. Bennett, ser. nov. (Fig. 1 h)

Marianthus ser. *Normales* Benth., Fl. Austr. 1:116(1863), in part, not as to lectotype.

Marianthus series *Procumbentes* Benth., loc. cit, in part, not as to lectotype.

Type species: *Billardiera parviflora* DC.

Capsula dehiscentia loculicidalis seminibus in carpellis fibrosis inclusis.

Slender twiner. *Inflorescence* corymbose with up to 5 flowers. *Petals* free, linear. *Capsule* loculicidally dehiscent with fibrous compartments in which the seeds are embedded.

Included species: *Billardiera parviflora* DC.

Section II: **Billardiera**

Billardiera Sm., Spec. Bot. New Holl. 1:t.1(1793). Type: *B. scandens* Sm.
Fruit a berry.

Series 1: **Biloculares** E.M. Bennett, ser. nov. (Fig. 1i)

Section *Eubillardiera* Pax in Engler and Prantl, Nat. Pflanzenfam. III, 2a: 113(1891) nom. illeg.

Type species: *Billardiera scandens* Sm.

Bacca bicellularis, *stylo* brevi, < 5 mm longo. *Semina* in endocarpo medullosa inclusa.

Berry 2-celled, style short, < 5 mm long. *Seeds* embedded in pithy endocarp.

Included species: *Billardiera scandens* Sm., *B. coriacea* Benth., *B. floribunda* (Putterl.) F. Muell., *B. variifolia* DC., *B. sericea* (Turcz.) E.M. Bennett, *B. laxiflora* (Benth.) E.M. Bennett, *B. lehmanniana* F. Muell., *B. sericophora* F. Muell., *B. cymosa* F. Muell., *B. versicolor* F. Muell., *B. uniflora* E.M. Bennett.

Billardiera scandens Sm. var. **sericata** E.M. Bennett, var. nov. (Fig. 2 A-C).

Folia elliptica-lanceolata, subtus pileis longis hinnuleis sericea, supra adpresso-pubescentia deinde glabrescentia. *Pedicelli* dense sericei.

Type: North of Booti Booti, New South Wales, 13 Oct. 1953, L.A.S. Johnson (HOLOTYPE: NSW 135428).

Leaves elliptic-lanceolate, \pm petiolate 22-70 x 9-25 mm, undersurface sericeous with long fawn hairs, upper surface appressed pubescent becoming glabrescent. *Flowers* terminal, solitary (occasionally 1 or 2 additional flowers in upper axils). *Pedicels* 5-11 mm, densely hirsute.

Distribution: Eastern coastal areas of New South Wales and southern Queensland from Nerang to Twofold Bay.

This differs from the typical variety in having elliptic leaves with a sericeous undersurface, the varietal epithet referring to the latter character.

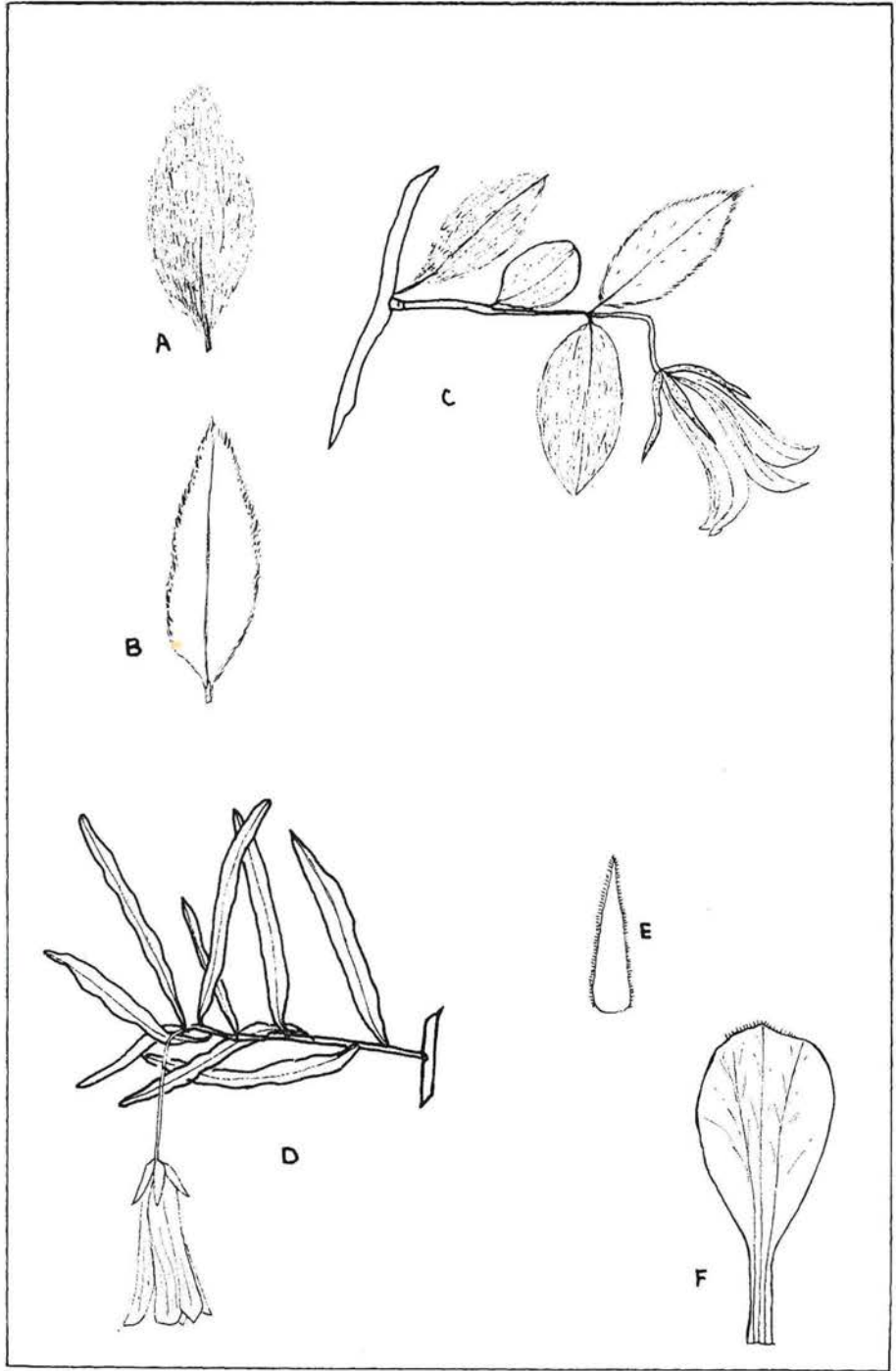


Figure 2—A—C—*Billardiera scandens* Sm. var. *sericata* E.M. Bennett. A—Leaf, lower surface. B—Leaf, upper surface. C—Flowering branchlet. All from NSW 135428, x 1. D—F—*Billardiera uniflora* E.M. Bennett. D—Flowering branchlet, x 1. E—Sepal, x 4. F—Petal, x 2. All from MEL 63268.

Billardiera uniflora E.M. Bennett, sp. nov. (Fig. 2 D-F)

Frutex volubilis. *Folia* linearia ad angusto-lanceolata. *Flores* solitarii, raro 2-3; pedicelli graciles, glabri. *Sepala* ovato-lanceolata; petali lanceolati.

Type: Port Lincoln, South Australia, *N.L. Browne* (HOLOTYPE: MEL 63268).

Twiner or creeper up to 1 m high. *Leaves* linear to narrow-lanceolate, entire or crenate, shortly petiolate, 14-50 x 1-9 mm, glabrous to sparsely pubescent on surface, often densely pubescent along margins. *Flowers* solitary, occasionally 2-3 together, pendulous or erect, cream or white, occasionally suffused purple. *Pedicels* 9-14 mm, glabrous. *Sepals* ovate-lanceolate, glabrous, margin ciliate (2)4-6 x 0.5-1 mm. *Petals* free, lanceolate, 12-16 mm, lamina \pm 4 mm wide. *Ovary* glabrous or hirsute.

Distribution: In South Australia within 60 km S and SE of Adelaide, around Port Lincoln, and on Kangaroo Island.

This species differs from *B. scandens* in the sepals, which are shorter, not as pubescent and do not have a prominent midvein. It differs from *B. versicolor* in having few pendulous flowers, longer sepals, more spreading petals, and in the margins of the leaves not being closely revolute. The specific epithet refers to the inflorescence which is usually 1-flowered.

Series 2: **Uniloculares** E.M. Bennett ser. nov. (Fig. 1j)

Section *Billardieriopsis* Pax in Engler and Prantl, Nat. Pflanzenfam. III, 2a: 113(1891) nom. illeg.

Type species: *Billardiera longiflora* Labill.

Bacca unicellularis sine medulla; *stylus* - 5 mm longus.

Berry 1-celled without pith; *style* > 5 mm long.

Billardiera longiflora Labill., Nov. Holl. Pl. 1:64, t.89(1805)

Billardiera longiflora Labill. var. **ovalis** (Lindl.) E.M. Bennett, stat. et comb. nov.

Basionym: *Billardiera ovalis* Lindl., Bot. Reg. t.1719 (1834).

This variety differs from the typical one in having broad lanceolate or ovate leaves with revolute margins; in the var. *longiflora* the leaves are linear to lanceolate and flat.

Bursaria

Bursaria incana Lindl. in Mitch., Trop. Aust. 224(1848)

Bursaria incana Lindl. var. **septentrionalis** E.M. Bennett, var. nov. (Fig. 3A-D).

Ovarium incanum. *Fructus* pubescens.

Type: East slopes of Spider Summit near Mareeba (Maruba) Queensland; 20 April 1961, *D.W. Goodall* (HOLOTYPE: BRI 041128).

Ovary hoary-pubescent. *Fruit* pubescent.

Distribution: Cook district of Queensland.

This variety differs from the typical one in the hoary ovary and fruit, which in var. *incana* are glabrous. The epithet refers to the northern distribution of the taxon.

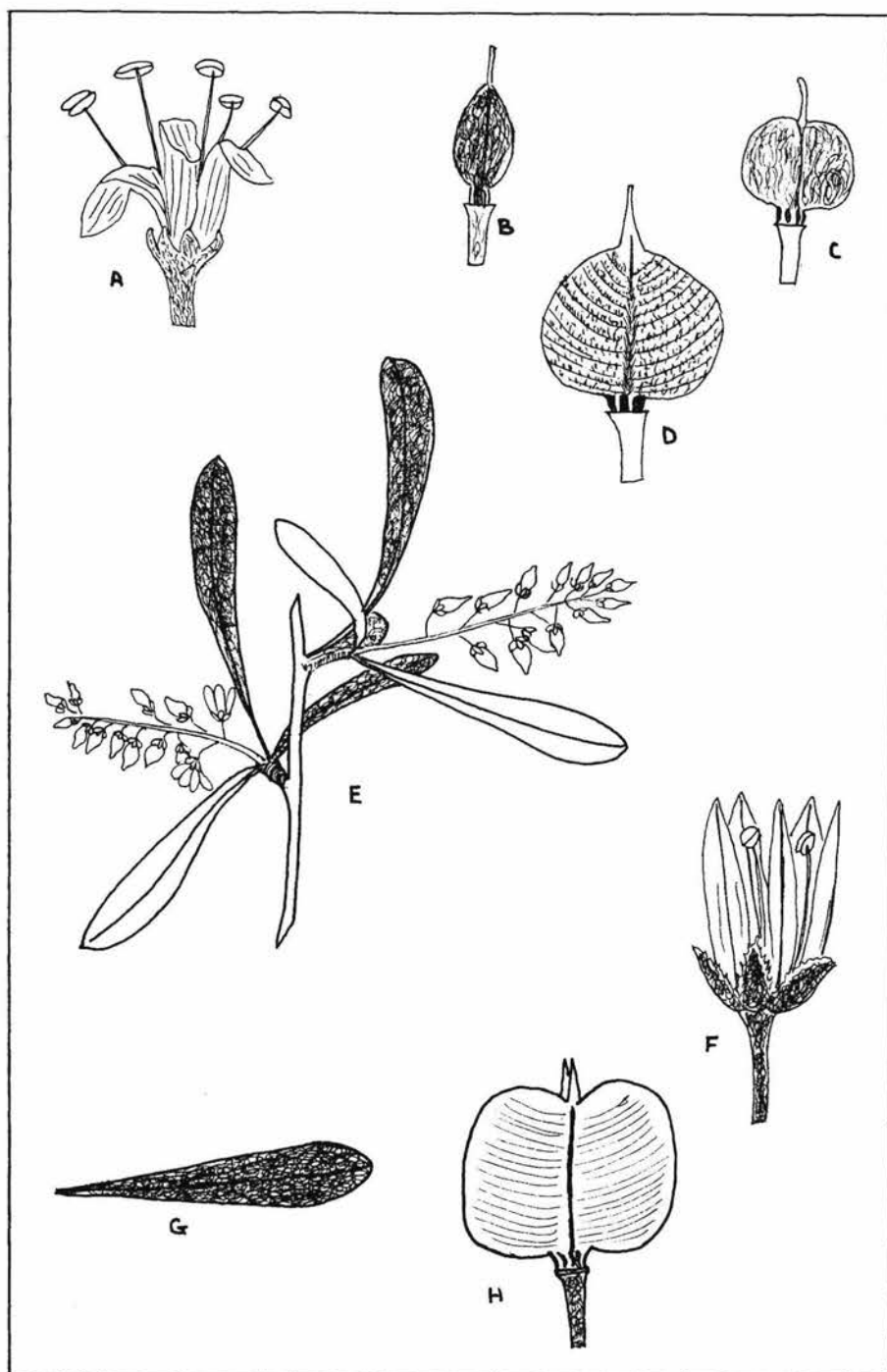


Figure 3—A—D—*Bursaria incana* Lindl. var. *septentrionalis* E.M. Bennett. A—Flower, x 3. B—Ovary, x 5. C—Developing fruit, x 3. D—Immature fruit, x 4. All from BRI 041128. E—F—*Bursaria occidentalis* E.M. Bennett. E—Flowering branchlet, x 1. F—Flower, x 3. G—Leaf, x 1. H—Fruit, x 3. All from E.M. Bennett 3315 (PERTH).

Bursaria lasiophylla E.M. Bennett, sp. nov.

Frutex elatus, usque ad 2.5 mm altus. *Folia* 2-4-fasciculata, ovata, obovata ad lanceolata, glabra vel sparsim pubescentia supra, cinerea ad albida vel aurea incana subtus; margines plani ad revoluti. *Inflorescentia* ab racemo ad paniculam parce ramosam varians, pubescens vel glabra, axillaris vel in ramulo axillari terminalis. *Sepala* lineari-lanceolata, decidua. *Ovarium* glabrum vel pubescens.

Type: East bank of Queanbeyan River above Woolcara Captain Flat, New South Wales, Jan. 1963, *Walker* (HOLOTYPE: CANB 121106; ISOTYPE: NSW)

Tall *shrub* up to 2.5 m high; young stems hoary becoming glabrescent. *Leaves* 2-4 together, ovate, obovate to lanceolate, glabrous or with scattered pubescence above, grey to white or golden hoary below, 4-30 x 2-10 mm; margin flat to revolute. *Inflorescence* varying from a raceme to a sparsely branched panicle, pubescent or glabrous, axillary, or terminal to axillary branchlets. *Sepals* 1-2 x 0.5 mm, linear-lanceolate, deciduous, ciliate \pm glabrous. *Ovary* glabrous to pubescent 2-4 mm high; style 0.5-1 mm long, glabrous. *Capsule* glabrous or pubescent at base and along midline 4-7 x 5-8 mm.

This species differs from *Bursaria incana* in that the panicle and under-surface of the leaf are not densely hoary, and the sepals are not hoary. It differs from *Bursaria spinosa* (which is glabrous) in having a somewhat hoary undersurface to the leaf, and from *Bursaria longisepala* in having deciduous sepals. The specific epithet refers to the hoary undersurface of the leaf.

Bursaria lasiophylla var. *lasiophylla*. (Fig. 4 A-C)

Leaves obovate 6-14 x 3-4 mm glabrous or with scattered hairs on upper surface. *Petals* glabrous 4.5-5 x 1-2 mm. *Ovary* glabrous 2-4 mm.

Distribution: Southern New South Wales and northern to north eastern Victoria.

Bursaria lasiophylla var. *albicoma* E.M. Bennett, var. nov. (Fig. 4 D-F)

Folia lineari-lanceolata; apicibus recurvis \pm uncinatis. *Paniculae* pubescentes, in ramulis axillaribus terminales. *Ovarium* albidum incanum.

Type: Harrison Creek Gully, South Australia, 2 Aug. 1958, *D.N. Kraehenbuehl* s.n. (HOLOTYPE: AD96422084)

Leaves linear-lanceolate, 9-30 x 5-10 mm; apex recurved and \pm uncinata. *Panicle* shortly pubescent, terminal on axillary branchlets. *Ovary* densely white hoary, 3-4 mm high.

Distribution: Palmer to Mannum areas of South Australia.

This variety differs from the typical variety in having broader, longer leaves and a hoary ovary, the epithet referring to the latter character.

Bursaria lasiophylla var. *atriplicina* E.M. Bennett, var. nov. (Fig. 4 G-J)

Folia lanceolata, marginibus revolutis. *Paniculae* pubescentes terminales vel axillares. *Ovarium* glabrum.

Type: Talbingo, 22 miles from Tumut, New South Wales, May 1917, *H.E. Ellen* (HOLOTYPE: NSW)

Leaves lanceolate, (10) 14-30 x 2-6 mm; margin revolute. *Panicle* shortly pubescent, terminal or axillary. *Petals* 3-4 x 0.75-1 mm. *Ovary* glabrous, 2-4 mm high, style 0.5-0.75 mm long, glabrous.

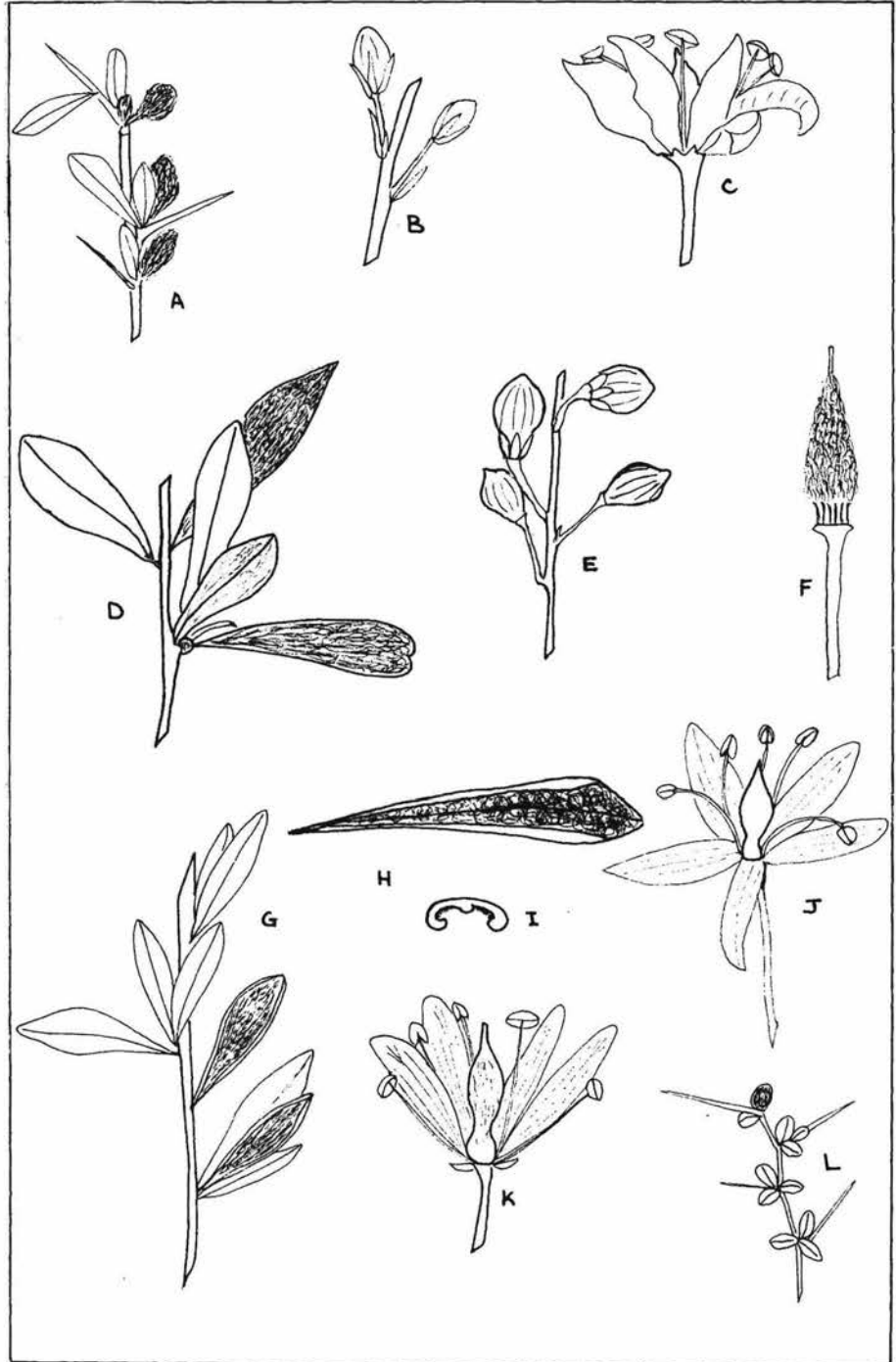


Figure 4—A—C—*Bursaria lasiophylla* E.M. Bennett var. *lasiophylla*. A—Leaves, x 1. B—Buds, x 2. C—Flower, x 4. From CANB 121106. D—F—*Bursaria lasiophylla* var. *albicoma* E.M. Bennett. D—Leaves, x 2. E—Buds, x 3. F—Ovary, x 4·5. From AD 96422084. G—J—*Bursaria lasiophylla* var. *atriplicina* E.M. Bennett. G—Leaves, x 1. H—Under surface of leaf, x 2. I—T.S. of leaf, x 2. J—Flower, x 4. From H. E. Ellen, May 1917 (NSW). K—L—*Bursaria lasiophylla* var. *parvifolia* E.M. Bennett. K—Flower with one petal and sepal removed, x 5. L—Leaves, x 1. From MEL 66145.

Distribution: Eastern areas of central and southern New South Wales, extending into the south eastern and western areas of Victoria.

The epithet refers to the resemblance of the leaves to those of some species of *Atriplex*.

***Bursaria lasiophylla* var. *parvifolia* E.M. Bennett, var. nov. (Fig. 4 K-L)**

Folia ovato-lanceolata, glabra vel \pm pubescentia, deinde glabrescentia. *Paniculae* ramosae, incanae. *Ovarium* leviter ad dense pubescens.

Type: Mt. William, Victoria, Feb. 1872, *D. Sullivan* (HOLOTYPE: MEL 66145)

Leaves ovate-lanceolate, 4-6 x 2-3 mm, glabrous or \pm pubescent becoming glabrescent. *Axillary* spines slender, 7-12 mm long. *Panicle* racemose, shortly hoary pubescent. *Sepals* ovate. *Ovary* slightly to densely pubescent.

Distribution: Inglewood to Stawell in western Victoria.

This variety differs from the other varieties in the small leaves (to which the epithet refers) and in the racemose panicle.

***Bursaria occidentalis* E.M. Bennett, sp. nov. (Fig. 3 E-H)**

Frutex vel arbor parva; rami spinis lateralibus. *Folia* linearia, lanceolata, oblanceolata ad obovata, \pm 4 ad nodam fasciata, infra dense albido-incana, supra parce et breviter pubescentia. *Inflorescentia* racemus, racemus corymbosus, vel panicula parce ramosa, terminalis. *Sepala* deltoidea, incana persistentia. *Ovarium* glabrum.

Type: 10 miles from turnoff to Useless Loop from Denham Road, Shark Bay, Western Australia, 3 Sept. 1975, *E.M. Bennett* 3315 (HOLOTYPE: PERTH)

Shrub or small tree, branches with lateral thorns. *Leaves* linear to lanceolate, oblanceolate to obovate, solitary or up to 4 clustered at node, 20-65 x 3-13 mm, undersurface densely white hoary, upper surface with scattered short pubescence. *Inflorescence* terminal to branchlets, a raceme, corymbose raceme or a very sparsely branched panicle. *Pedicels* hoary. *Sepals* 1-2 x 1-1.5 mm deltoid, acute, hoary, persistent. *Petals* 5-8 x 1-1.5 mm, cream, 3-nerved. *Stamens* 4-6 mm long. *Ovary* glabrous, 2-4 mm high. *Capsule* glabrous, round, 6-9 x 8-12 mm.

Distribution: From Shark Bay-Geraldton area south east to the Kalgoorlie area of Western Australia.

This species differs from *B. incana*, to which it is most closely related, in the panicle being terminal to the short lateral branchlets, the flowering branches bearing lateral thorns and in the sepals having an obvious midvein. *Bursaria incana* has a panicle terminal to the long branches, the flowering branches unarmed and the sepals hoary, obscuring any venation. The epithet *occidentalis* refers to the western distribution of the species.

***Bursaria longisepala* Domin, Biblioth. Bot. 89: 714(1925)**

***Bursaria longisepala* var. *pilosa* E.M. Bennett, var. nov. (Fig. 6 A-C)**

Folia infra incana. *Sepala* ca. 5.5 mm longa. *Petala* ca. 7.5 mm longa.

Type: Nattai River near Colo, New South Wales, 26 Nov. 1911, *E. Cheel* (HOLOTYPE: NSW 728691)

Leaves hoary on undersurface. *Sepals* ca. 5.5 mm long. *Petals* ca. 7 mm long.

Distribution: New South Wales from Yerranderie in the north to Wombeyan Caves in the south.

This differs from the typical variety in having a hoary undersurface to the leaf (from which character the epithet is derived) and in the longer sepals and petals, the typical variety having glabrous leaves.

Bursaria spinosa Cav., Ic. 4:30, t.350 (1797)

I have recognised six varieties within this species but these do not appear to represent clearly distinguishable taxa. I feel that extensive field observations of the habit correlated with leaf and floral morphology are required before a detailed revision of this species can be achieved. The size and shape of the leaves and the degree of spinescence vary with the age of the plant and the position on the plant, so that two collections made from the one plant can appear different. This species is extremely variable and widely distributed. I am retaining two previously described varieties, viz. var. *macrophylla* Hook., J. Bot. (Hooker) 1:249 (1834) and var. *microphylla* Ewart et al., Proc Roy Soc. Vic. N.S.23: 56 (1910).

One group of plants which I include under var. *macrophylla* Hook. has a distinctive leaf and stem surface which appears macroscopically to be a bloom and to warrant its recognition as a separate variety. Dr. N.G. Marchant has examined the bloom and concludes it to be a scurf caused by a fungal infection. As these plants are randomly distributed through the range of the normal var. *macrophylla* I have decided to retain them in this variety.

Bursaria spinosa var. *spinosa*

Spinescent *shrub*, less than 2 m high. *Leaves* linear, lanceolate or oblanceolate, 10–25 x 3–10 mm. *Sepals* less than 1 mm long, deciduous at anthesis. *Petals* 3–4 x 1 mm.

Bursaria spinosa var. *australis* E.M. Bennett, var. nov. (Fig. 5 A-C)

Folia linear-lanceolata, eis longitudinorum dissimilorum aggregatis, \pm recurva. *Petala* linearia. *Sepala* deltoidea sub anthesi praesentia.

Type: Ca. 1 km south of Freeling, South Australia, 27 Nov. 1965, D.N. Kraehenbuehl 1558 (HOLOTYPE: AD 96710134).

Leaves linear-lanceolate, clustered in groups of differing lengths (6) 10–20 x 2–4 mm, \pm recurved. *Sepals* deltoid, 0.5–1 mm, present at anthesis. *Petals* linear (4.5)5.5–6.5 x 1.2–2 mm.

Distribution: South-east of South Australia, north-western Victoria and with a few collections in central New South Wales.

This differs from the typical variety in the larger petals, and in the shape and fasciculation of the leaves. The epithet refers to the southern distribution.

Bursaria spinosa var. *lanceolata* E.M. Bennett, var. nov. (Fig. 5 D,E)

Frutex plerumque \pm 2 m. *Folia* lanceolata. *Stamina* 3–4.5 mm longa, petala excedentia.

Type: Stonyfell, Ferguson Park, South Australia, 1 Nov. 1971, K. Preiss 13 (HOLOTYPE: AD 97118145)

Low to medium *shrub*, usually less than 2 m high. *Leaves* lanceolate 25–70 x 3–9 mm. *Sepals* caducous. *Petals* 2.5–4 x 1 mm. *Stamens* 3–4.5 mm long, exceeding petals.

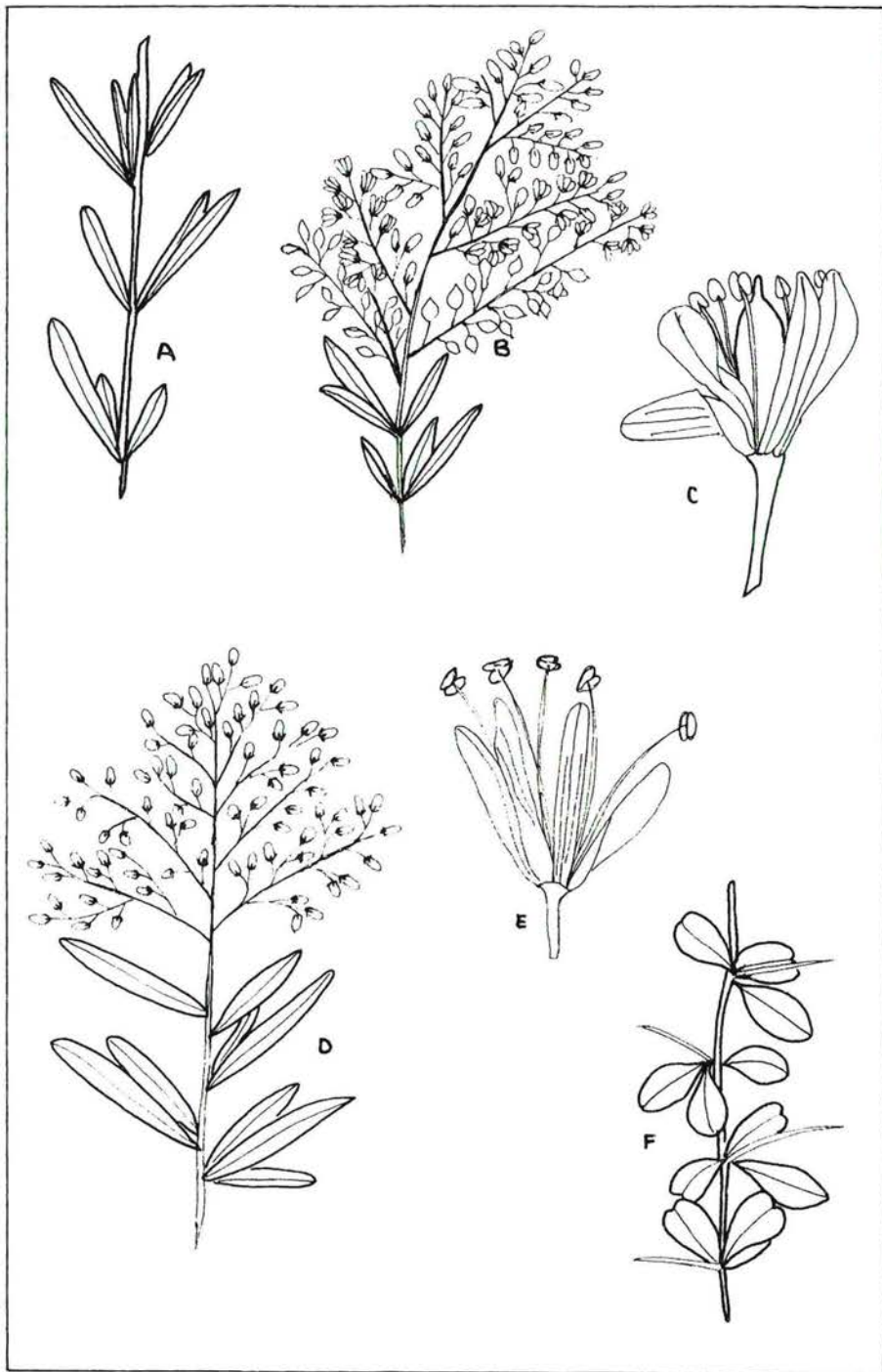


Figure 5—A—C—*Bursaria spinosa* Cav. var. *australis* E.M. Bennett. A—Leaves, x 1. B—Inflorescence, x 0.5. C—Flower, x 4. All from AD 96710134. D—E—*Bursaria spinosa* var. *lanceolata* E.M. Bennett. D—Inflorescence, x 0.5. E—Flower, x 5. From AD 97118145. F—*Bursaria spinosa* var. *obovata* E.M. Bennett. Branchlet with spines and leaves, x 1. From CANB 73151.

Distribution: South Australia—Eyre Peninsula, Kangaroo Island, Port Augusta, Yorke Peninsula and then south-eastwards to Penola.

This variety differs from var. *macrophylla* in being a small to medium shrub and in the leaves being less than 1 cm wide; var. *macrophylla* is a tall shrub or tree and the leaves generally are 1–2 cm wide but often wider. The var. *lanceolata* differs from var. *australis* and var. *spinosa* in the longer leaves. The epithet refers to the lanceolate leaves.

Bursaria spinosa var. **obovata** E.M. Bennett, var. nov. (Fig. 5 F)

Folia dispersa vel fasciculata, obovata vel obovata-lanceolata, glabra. *Spinae* numerosae, graciles. *Sepala* sub anthesi praesentia.

Type: Sandy Harbour, Hunter Valley, New South Wales, 13 Aug. 1959. *R. Story* (HOLOTYPE: CANB 73151; ISO: CANB 69983, NSW)

Leaves scattered or clustered, obovate to obovate-lanceolate 6–12(18) x 3–6 mm, glabrous, midvein prominent on undersurface. *Spines* rather numerous, slender 6–10 mm long. *Stems* and panicle densely short pubescent to glabrous. *Sepals* < 0.5 mm long, persistent at anthesis.

Distribution: This variety has a scattered distribution along the eastern section of Queensland, New South Wales, Victoria and South Australia. Generally the leaves become coriaceous towards the coast and southwards.

This variety differs from all the other varieties in the obovate leaves (to which the epithet refers) and in the small persistent sepals.

Cheiranthera

Cheiranthera alternifolia E.M. Bennett, sp. nov. (Fig. 6 D-H)

Frutex humilis. *Folia* dispersa, linearia, carinata vel plara. *Flores* solitariae vel in corymbium 2-5(11) florum disposita. *Stamina* ± petala aequantia vel eis duplo breviora.

Type: Scott's Creek, South Australia, 20 Oct. 1964, *D.J.E. Whibley* 1494 (HOLOTYPE: AD 96717068).

Small *subshrub* up to 50 cm high. *Leaves* alternate, linear, 7–60 x 0.75–1.5 mm, carinate or flat. *Flowers* solitary or in corymbs of 2–5(11) flowers. *Sepals* free, lanceolate, 4–8 x 1–2 mm, glabrous. *Petals* pale to dark blue, broad-lanceolate, 12–21 x 5–8 mm. *Staminal filaments* 3–5 mm long, anther loculi 3.5–5 mm long. *Ovary* glabrous 5–6.5 mm high. *Capsule* glabrous, seeds black shining.

Distribution: North-west Victoria and southern and western South Australia.

This species differs from *C. cyanea* in the leaves being scattered, not clustered at the node, and from *C. filifolia* in the stamens being equal to or less than half-length of the petals, and the petals being broad.

Two collections of a small-leaved variant of this species have been collected, one from NW Victoria and the other from Kangaroo Island. Other collections of this species have these smaller leaves in the lower part but develop the longer leaves higher up.

Cheiranthera cyanea Brongn., Bot. (Phan.) Voy. La Coquille t.77 (published between 1827 and 1834)

C. linearis A. Cunn. ex Lindl., Bot. Reg. 20, sub t.1719 (Mar-Dec. 1834)

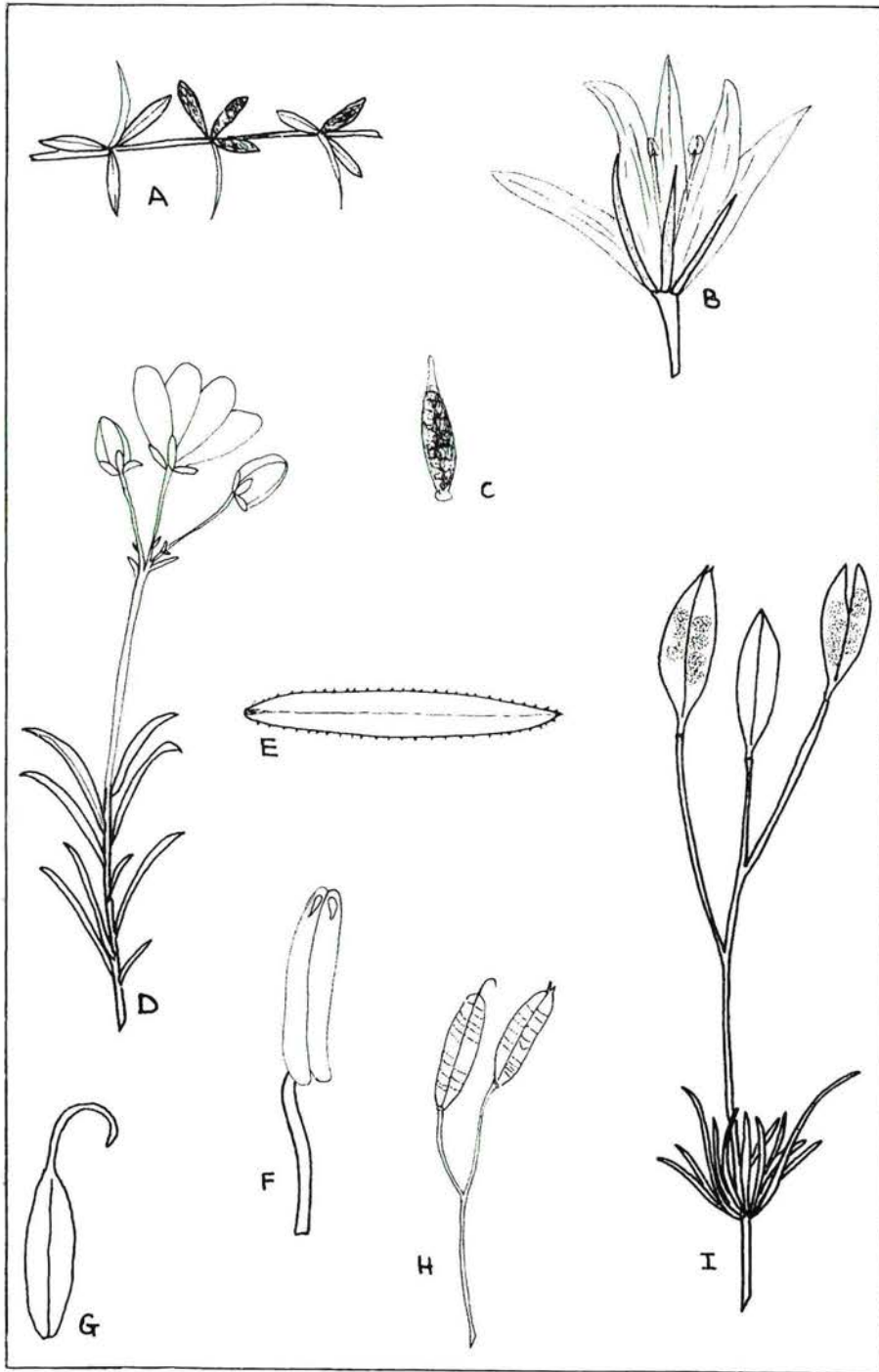


Figure 6—A—C—*Bursaria longisepala* Domin var. *pilosa* E.M. Bennett. A—Leaves, x 1. B—Flower, x 4. C—Ovary, x 3. All from NSW 728691. D—H—*Cheiranthera alternifolia* E.M. Bennett. D—Inflorescence, x 1. E—Leaf, x 1.5. F—Anther, x 9. G—Ovary, x 8. I—*Cheiranthera cyanea* Brongn. var. *borealis* E.M. Bennett. Fruiting branchlet.

In recent literature, particularly Eichler (1965) and Willis (1973), opinions have differed as to which of the above specific names has priority. It is likely that Brongniart's t.77 was published well before 1834 as it is not near the end of the work, whereas *C. linearis* may not have been published until late in 1834. I believe *C. cyanea* to have priority, a conclusion also reached by Stafleu (pers. comm.), until evidence to the contrary is produced.

Cheiranthera cyanea var. **borealis** E.M. Bennett, var. nov. (Fig. 6 I)

Folia dispersa, supra fasciata, arte revoluta ut teretia videntur. *Cymae* terminales ve ramulos axillares superiores terminantes folia excedentes.

Type: Stanthorpe, Queensland Dec. 1962, *W.T. Jones* (HOLOTYPE: BRI 036214)

Lower *leaves* alternate, scattered, upper ones clustered, fasciculate, closely inrolled so as to appear terete, 10–22 x 1·15 mm. *Cymes* terminal or terminating upper axillary branchlets, much exceeding leaves.

Distribution: New South Wales on the border with Queensland and in the Darling Downs and Burnett regions of Queensland.

This differs from the typical variety in the shorter clustered leaves and the cymes much exceeding the leaves; the var. *cyanea* has long, linear leaves and the cymes often do not exceed them. The varietal epithet refers to the northern distribution.

Acknowledgments

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Studies in the genus *Acacia* (Mimosaceae)—7 —The taxonomy of some diaphyllodinous species—

By B. R. Maslin

Abstract

Seven Western Australian species of *Acacia* with horizontally flattened phyllodes (i.e. diaphyllodes) are discussed. Four new species are described: *A. binata* sp. nov., *A. crassuloides* sp. nov., *A. diaphyllodinea* sp. nov. and *A. vassalii* sp. nov. The new name, *A. spathulifolia* nom. nov., replaces the illegitimate homonym, *A. spathulata* F. Muell. ex Benth. non Tausch. Synonymy for *A. ericifolia* is listed. *Acacia leptospermoides* is treated as comprising three subspecies, viz. subsp. *leptospermoides*, subsp. *obovata* subsp. nov. and subsp. *psammophila* (E. Pritzell) comb. et stat. nov.

Except for *A. ericifolia* and *A. spathulifolia*, all taxa are illustrated and their distribution mapped.

Introduction

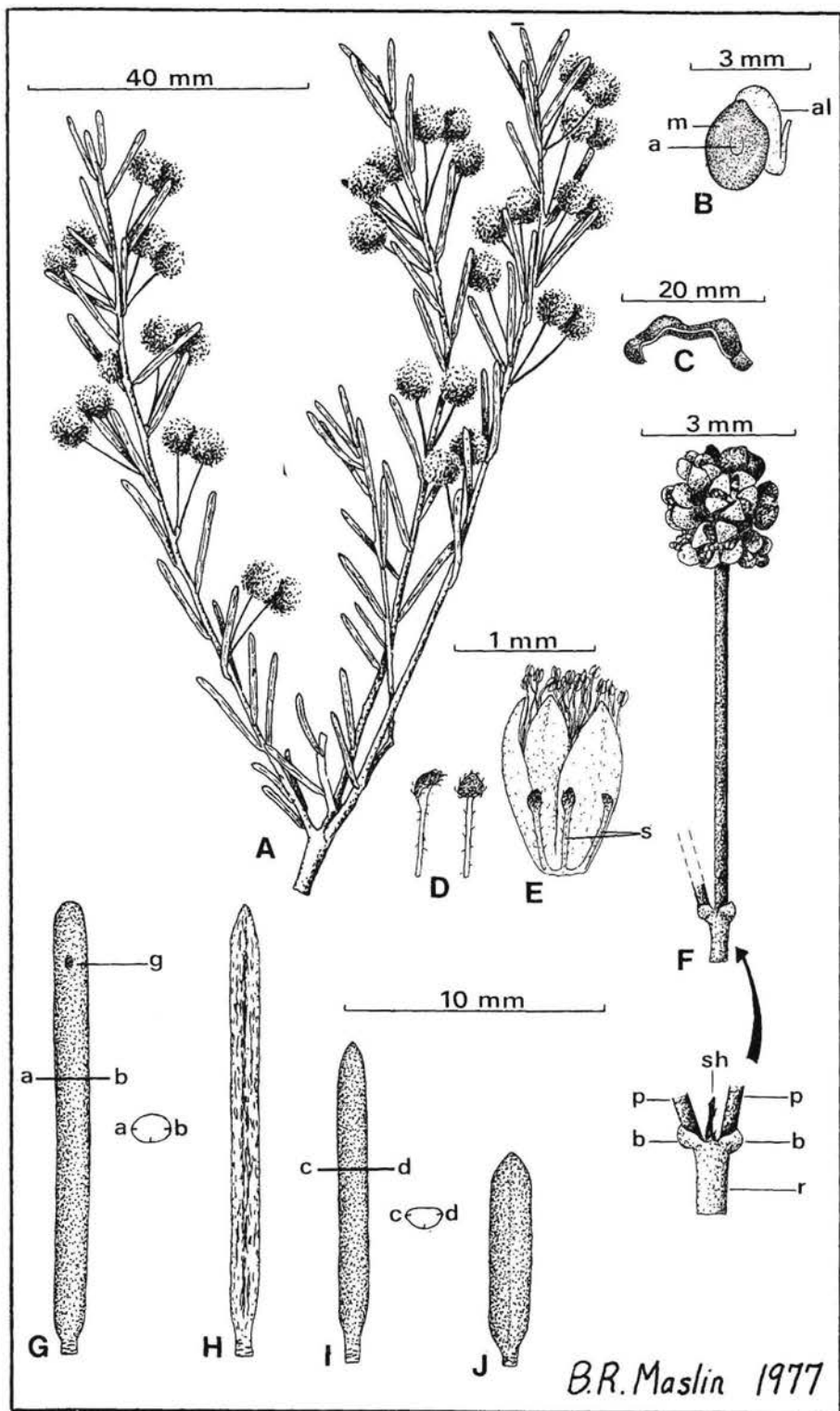
The present work is published so that names will be available for use in forthcoming papers by Ph. Guinet*, J. Vassal† and myself dealing with various aspects of diaphyllodinous acacias. Although diaphyllodinization will be fully discussed elsewhere, some introductory remarks concerning this hitherto little known phenomenon are warranted here. The terms "Diaphyllodineae" and "Orthophyllodineae" were first used in reference to *Acacia* by Hochreutiner (1896). These terms referred to subdivisions of *Acacia* containing species with horizontally flattened phyllodes and vertically flattened phyllodes respectively. The latter is by far the more common condition in the genus. In diaphyllodinous species, the extra-floral nectary (gland) is situated on the upper surface of the phyllode instead of on the upper margin as is the case in orthophyllodinous taxa. With the exception of some members of the predominantly tropical series *Brunioideae*, diaphyllodinous *Acacia* species within Australia are, to my knowledge, restricted to the southwest of Western Australia. It is noted, however, that Vassal and Guinet (1972) reported the occurrence of diaphyllodinization in *A. willardiana* Rose, a Mexican species (see Pedley (1975) for comments regarding Vassal and Guinet's paper).

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Figure 1—*Acacia binata*. A—Upper portion of branch. B—Seed showing small areole (a), relatively large aril (al) and obscure pale mottlings (m). C—Legume. D—Bracteoles (side and back views). E—Flower showing free, spatulate sepals (s) with dark brown laminae. F—Inflorescence with inset showing base of the binate raceme (p—peduncle, b—basal peduncular bract, sh—developing new shoot, r—raceme axis). G to J—Phyllodes showing size variation (g—gland). G (spirit specimen)—Adaxial view of phyllode with transverse section (a—b) showing very slightly horizontally flattened outline and nerve positions. H (dry phyllode)—Adaxial view of same phyllode showing surface wrinkling and obscure medial sulcae. I (reconstituted phyllode)—Adaxial view with transverse section (c—d) showing obscurely plano-convex outline and nerve positions. J (reconstituted phyllode)—Abaxial view showing obscure nerve.

A from P. G. Wilson 5532; B—C from B. R. Maslin 4046; D—E from S. Paust 809; F from B. R. Maslin 3490 (the type); G—H from B. R. Maslin 993; I from K. Newbey 4314; J from E. M. Bennett 2729.



In most cases only a selection of specimens is cited under each taxon. A complete list of specimens seen is given at the end of the paper.

Taxonomy

1. *Acacia binata* Maslin sp. nov.—Figure 1.

Frutex ad 1 (1.3) m altus; rami glabri. *Stipulae* \pm caducae, liberae. *Phyllodia* subteretia vel inconspicue plano-convexa, anguste oblonga ad linearia, (6) 8–17 (20) mm longa, 1–1.5 mm lata, L/B = (4) 6–20, glabra, turgida et laevia in statu vivo, longistrorsum sulcata in statu sicco; nervia principalia 3, nervatio plerumque obscurissima. *Glans* inconspicua, in pagina supera 1–2 mm infra apicem phyllodii. *Inflorescentia* racemosa brevis pedunculorum binorum ad extremum axis brevis (0.5–2 mm); pedunculi 7–13 mm longi; capitula globulosa ad parum obloidea, 14–24 (30) floribus. *Flores* 5-meri; sepala libera, spatulata; petala 1.5 mm longa, glabra. *Legumen* \pm curvum, circinatum vel sigmoideum, ad 35 mm longum, ca. 3.5 mm latum, glabrum. *Semina* in legumine longitudinalia, ellipsoidea ad obloidea vel \pm pyriformia, ca. 2.5 x 1.5 mm, saepe obscure maculata; arillus semine 2–3-plo brevior.

Type: About 12 km due NNW of Ongerup (on Foster Road), Western Australia. "Low, dense, shrub 40–70 cm tall, 1.5–2.5 m diam.; peduncles dark red; flowers deep yellow; phyllodes smooth, ascending to \pm spreading; bark smooth, light grey; branchlets dark red." 31 Aug. 1973, B. R. Maslin 3490 (holo: PERTH; iso: CANB, K, MEL, NSW, NY, P).

Shrub to 1(1.3) m tall and 1.5–2.5 m wide, dense, domed and with many branches radiating from ground level when young, more open, infundibular and single-stemmed (branching ca. 15 cm above ground level) with age; bark smooth, light grey on main trunks; *new shoots* (arising from distal end of raceme axis within angle formed by the twinned peduncles) glabrous, slightly resinous at apex; *branches* terete, finely ribbed, glabrous, dark reddish (normally overlain by a light grey, longitudinally fissured epidermis) but sometimes light brown or yellowish towards apex. *Stipules* \pm caducous, free, deltoid, minute (0.1–0.2 mm long), slightly thickened. *Phyllodes* ascending to slightly spreading, numerous but hardly congested, subterete (very slightly horizontally flattened) or obscurely plano-convex, often slightly flatter and obscurely channelled above when dry, narrowly oblong to linear in plane view, (6) 8–17 (20) mm long, 1–1.5 mm wide, L/B = (4) 6–20, straight or slightly curved upwards, glabrous, bright green to olive green when fresh, generally becoming darker upon drying, turgid and smooth when fresh but longitudinally sulcate when dry; *nervature* normally very obscure (nerves not, or barely, raised and sometimes indiscernible when dry), *principal nerves* 3 (2 marginal, 1 central abaxially), nerveless on adaxial surface, secondary nerves not apparent; *apex* obtuse, often somewhat orange-coloured; *pulvinus* terete, ca. 0.5 mm long, transversely wrinkled, normally orange. *Gland* extremely indistinct (generally not observable in dry specimens), situated on upper surface of phyllode 1–2 mm below the apex. *Inflorescences* reduced racemes consisting of twinned peduncles at the distal end of a short (0.5–2 mm) raceme axis, at anthesis a dormant vegetative bud present within angle formed by the peduncles; *peduncles* 7–13 mm long, glabrous, very finely longitudinally wrinkled when dry, red to brown; *basal peduncular bracts* persistent, solitary, ovate, concave, minute (ca. 0.5 mm long), ciliolate; *flower heads* deep golden yellow, globular to slightly obloid, with 14–24 (30) flowers. *Bracteoles* spatulate, ca. 1 mm long; claws linear, glabrescent, yellow; laminae \pm inflexed, often densely ciliolate, dark brown. *Flowers* 5-merous; *sepals* $\frac{1}{2}$ ($\frac{3}{8}$) length of corolla, free, spatulate, claws linear glabrescent to ciliolate and yellow, laminae \pm concave ciliolate and frequently dark brown; *corolla* 1.5 mm long, readily separating into distinct petals which are glabrous and very obscurely 1-nerved; *ovary* sessile, glabrous. *Legumes* irregular in shape when dry, more or less curved, circinnate or sigmoid, to 35 mm long, ca. 3.5 mm wide, undulate, slightly raised over seeds (more obvious in young legumes), firmly chartaceous yet rather brittle, glabrous, slightly resinous, slightly wrinkled when dry, dark brown; margins

not (or barely) contracted between seeds, barely thickened, yellow to light brown. *Seeds* longitudinal to slightly oblique in legume, ellipsoid to obloid or \pm pyriform, ca. 2.5 x 1.5 mm, dark greyish, often with a few obscure pale-coloured surface mottlings, rather shiny, dark-coloured peripheral line obscure; *pleurogram* obscure, open towards the hilum; *areole* horseshoe-shaped, ca. 0.5 mm long; *funicle* filiform, ca. 0.5 mm long, reflexed below and \pm gradually expanded into a slightly curved \pm clavate cream-coloured aril which extends beyond half the length of the seed.

Distribution: (Figure 6) Western Australia: Ongerup-Ravensthorpe district.

Habitat: *Acacia binata* appears to be restricted to loam or clay soil (often rocky) frequently in low-lying areas near water courses. It is commonly found growing in dense scrub with *Eucalyptus angulosa* and *E. oleosa* var. *oleosa*.

Flowering period: August-October.

Fruiting period: Legumes with mature seed have been collected in mid-December.

Judging from specimens seen, it is likely that the fruiting period extends to about the end of January. This species produces rather copious fruit.

Selected specimens: WESTERN AUSTRALIA:—20 mi (32 km) E of Ravensthorpe, *E. M. Bennett* 2729 (MEL, PERTH); Carracarrup area, ca. 13 mi (20.8 km) S of Ravensthorpe, *B. R. Maslin* 993 (AD, PERTH); 13 km W of Ravensthorpe towards Jerramungup, *B. R. Maslin* 2578 (PERTH, TLF); 15 km S of Ravensthorpe towards Hopetoun, *B. R. Maslin* 4046 (PERTH); 13 km SSE of Ongerup, *K. Newbey* 4314 (PERTH); 15 mi (24 km) from Ravensthorpe towards Lake King, *S. Paust* 809 (PERTH); 5 km E of Ravensthorpe, *P. G. Wilson* 5532 (AD, BRI, K, MEL, PERTH).

Acacia binata has its closest affinities with *A. crassuloides* and *A. diaphyllodinea*. These three species form a close-knit assemblage referred to below as the *A. diaphyllodinea* group (see page 209). *Acacia binata* is most readily distinguished from *A. crassuloides* and *A. diaphyllodinea* by the following characters: phyllodes longer and/or narrower, raceme axes longer and easily observable even to the unaided eye (axes so reduced as to frequently appear absent in the other two species), peduncles normally longer and with insignificant ovate (not rostriform) subtending basal bracts, flowers more numerous in the heads and seeds longitudinal to slightly oblique in the legumes (oblique in the other two species).

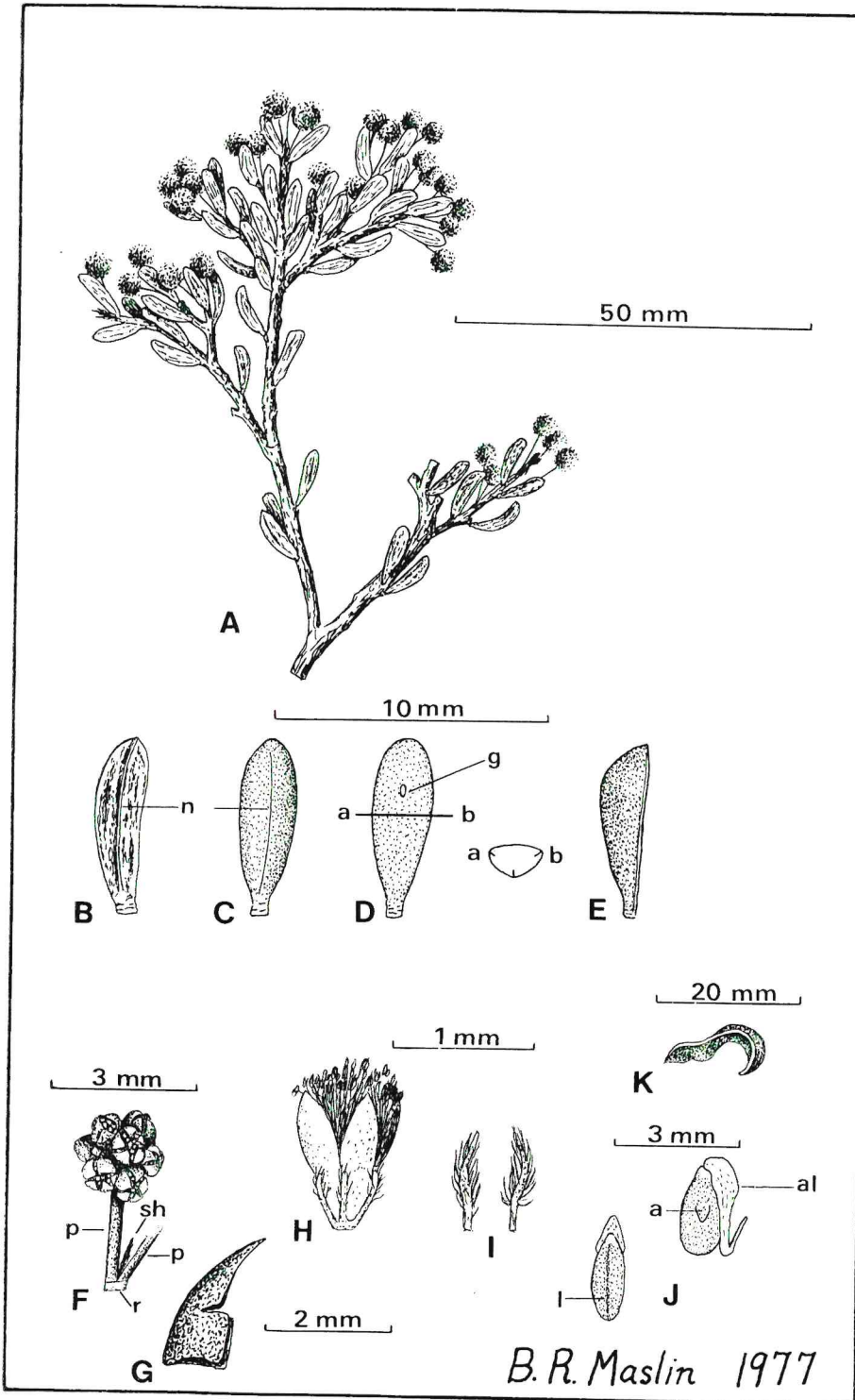
Acacia binata is superficially very similar to the narrow phyllode forms of *A. leptospermoides* subsp. *leptospermoides* but is readily distinguished by its free stipules and its reduced racemose inflorescences.

In the Lake King district a variant of *A. binata* has recently been discovered. *R. Hnatiuk* 760791, 32 km E of Lake King, differs from the other specimens of *A. binata* in the following characters: phyllodes glaucescent, flowers 6–7 per head and sepals minute (ca. 0.2 mm long). Before the true taxonomic position of this variant can be assessed, further gatherings (particularly fruiting specimens) are required.

The specific epithet refers to the diagnostic inflorescences which are reduced racemes consisting of a pair of peduncles positioned at the distal end of a short raceme axis.

2. *Acacia crassuloides* Maslin sp. nov.—Figure 2.

Frustrum pulviniformis, ad 50 cm altus; *rami* glabri. *Stipulae* caducae, liberae. *Phyllodia* applanata, plano-convexa, plerumque anguste obovata, 5–10 mm longa, 1.3–2.5 mm lata (in statu sicco), L/B = 2.5–4.5, carnosae, turgidae et laevia in statu vivo, glabra; *nervia* principalia 3. *Glans* (saepe absens) inconspicua, in dimidium distale paginae superiorae phyllodii. *Inflorescentia* racemosa brevissima pedunculorum binorum ad extremum axis brevis (\leq 0.5 mm); *pedunculi* 2–8 mm longi; *bractae* basales pedunculi rostriformes; *capitula* globulosa, 7–10 floribus. *Flores* 5-meri; *sepala* libera; *petala* 1–1.5 mm longa, glabra, enervia. *Legumen* curvum ad sigmoideum, ad 17 mm longum et 3 mm latum, glabrum. *Semina* in legumine obliqua, pyriformia, 2–2.5 mm longa, 1.3 mm lata; *arillus* clavatus.



Type: Esperance road \pm 69 mi (110.5 km) south of Norseman (i.e. 3 mi (4.8 km) south from Circle Valley Siding), Western Australia. "Low dense cushion-like bushes 20–40 cm tall, among mallee eucalypts on yellow sand plain. Phyllodes cylindro-clavate, turgid and faintly glaucescent when fresh." 7 Sept. 1963, J. H. Willis s.n., MEL 502978 (holo: PERTH; iso: CANB, K, MEL, NSW, NY, PERTH).

Low, dense, cushion-like spreading *shrub* to 50 cm tall and 100 cm wide, much branched at the base; bark grey and slightly roughened (smooth, light brown and slightly resinous on branchlets); *epidermis* light grey, longitudinally fissured, peeling, most evident towards apices of branches; *new shoots* arising from within angle formed by the twinned peduncles; *branches* terete, very obscurely ribbed (ribs most pronounced immediately below insertion of phyllode), glabrous. *Stipules* caducous, present only on new shoots, free, triangular, minute (< 0.5 mm long). *Phyllodes* ascending, rather congested, mostly present only on young branches (deciduous with age), horizontally flattened (i.e. diaphyllodinous) but plano-convex in cross section (concave adaxially when dry), normally narrowly obovate in plane view, 5–10 mm long, 1.3–2.5 mm wide (when dry), L/B = 2.5–4.5, fleshy, turgid and smooth when fresh but coarsely wrinkled when dry, slightly resinous, glabrous, slightly glaucescent when fresh but generally drying dark olive green; *principal nerves* 3 (2 marginal, 1 central abaxially), *secondary nerves* very obscure and only visible when dry; *apex* obtuse but with a minute and innocuous mucro, brown but often grey towards extremity (due to dead epidermal tissue); *pulvinus* transversely wrinkled. *Gland* (frequently absent) situated on distal half of upper surface of phyllode, inconspicuous (comprising a very shallow, circular or elliptical, brown to yellow depression ≤ 0.5 mm diam.). *Inflorescences* extremely reduced racemes (peduncles twinned at distal end of a minute raceme axis which is ≤ 0.5 mm long) new shoots arising from within angle formed by peduncles; *peduncles* 2–8 mm long, glabrous; *basal peduncular bracts* caducous, solitary, rostriform, concave, often auricled at base, 1.5–2.5 mm long, glabrous, dark brown; *flower heads* golden yellow, globular, with 7–10 flowers. *Bracteoles* 0.5–0.7 mm long, variable, either narrowly oblong and straight, or spatulate with acuminate laminae (concave but \pm not inflexed); laminae ciliate and often also tomentose abaxially (hairs \pm glistening and relatively rather long).

Flowers 5-merous; *sepals* $\frac{1}{3}$ length of corolla, free, in a single flower can vary from linear to spatulate, tomentose at apex (hairs as on bracteole laminae); *petals* free, 1–1.5 mm long, glabrous, nerveless; *ovary* sessile, glabrous. *Legumes* curved to sigmoid, to 17 mm long and 3 mm wide, brittle, barely raised over seeds, very finely wrinkled when dry, glabrous, slightly pruinose, dark brown; margins not contracted between seeds, barely thickened, pale. *Seeds* oblique in legume, pyriform, somewhat compressed, 2–2.5 mm long, 1.3 mm wide, lightish grey but paler at hilar end, not mottled, somewhat shiny, with a narrow band of dark brown tissue around periphery; *pleurogram* quite prominent (bordered by a diffuse, narrow band of dark brown tissue); areole "u"- to "v"-shaped, open towards the hilum, < 0.5 mm long; *funicle* filiform,

Figure 2—*Acacia crassuloides*. A—Upper portion of branch. B to E—Phyllodes (g—gland, n—abaxial nerve). B (dry phyllode)—Abaxial view showing coarse surface wrinklins. C (reconstituted phyllode)—Abaxial view of same phyllode. D (reconstituted phyllode)—Adaxial view of same phyllode with transverse section (a—b) showing plano-convex outline and nerve positions. E (reconstituted phyllode)—Side view of same phyllode showing thickness of specimen. F—Inflorescence showing peduncles (p), reduced raceme axis (r) and developing new shoot (sh). G—Rostriform basal peduncular bract. H—Flower. I—Bracteoles (side and back views) showing relatively long hairs. J—Seed (surface and end views) showing dark-coloured peripheral line (l), small areole (a) and relatively long aril (al). K—Legume.

A, F and G from J. H. Willis s.n. (the type); B–E, H–I from E. M. Scrymgeour 790; J–K from Freeman s.n. (PERTH duplicate).

ca. 2 mm long, gradually expanded and reflexed below a conspicuous, clavate, slightly curved, dull, cream-coloured aril which extends beyond half the length of the seed.

Distribution: (Figure 6) Western Australia: The highway between Norseman and Esperance forms the known eastern limit of distribution of *A. crassuloides*. The species is known to extend to about 80 km west of the highway.

Habitat: Not much is known concerning the habitat preferences of this species. It has been recorded as growing in sandy to clayey soils in either open heath vegetation or mallee eucalypt scrub or woodland.

Flowering period: Judging from the specimens at hand, *A. crassuloides* flowers from September to October.

Fruiting period: Only one gathering with legumes containing mature seeds has been seen. This was collected in January.

Selected specimens: WESTERN AUSTRALIA:—527 miles, Coolgardie-Esperance Highway, *E. M. Scrymgeour* 790 (PERTH); Grass Patch, *F. D. Freeman* s.n., Jan. 1960 (MEL 502982, PERTH); 126 km E of Lake King, 32° 42' S and 120° 51' E, *R. Hnatiuk* 760883 (PERTH); 6.5 km N of Salmon Gums towards Norseman, *B. R. Maslin* 2453 (CANB, TLF, PERTH).

Acacia crassuloides is closely allied to *A. binata* and *A. diaphyllodinea*. These three species form a close-knit assemblage referred to below (page 209) as the *A. diaphyllodinea* group. *Acacia crassuloides* is a smaller shrub than the other two species, with thicker and normally shorter phyllodes and also fewer flowers in its heads. In addition, *A. crassuloides* is distinguished from *A. binata* by its usually slightly broader yet shorter phyllodes ($L/B = 2.5-4.5$ compared with (4) 6-20) which are more obviously plano-convex in cross section and often more obviously nerved when dry (although the nerves in both these species are less apparent than in *A. diaphyllodinea*), its shorter raceme axes, its larger, rostriform basal peduncular bracts, its differently shaped bracteoles (compare Figs. 1D and 2I), and its shorter legumes with their paler coloured, obliquely placed seeds (\pm longitudinal in *A. binata*). In addition, *A. crassuloides* is distinguished from *A. diaphyllodinea* by the following features: its phyllodes are less obviously mucronulate, more obviously plano-convex (i.e. less horizontally flattened) and less apparently nerved abaxially when dry, its bracteoles are more hairy (hairs \pm glistening and relatively long), its smaller legumes and its slightly smaller, paler coloured seeds with their longer funicles (relative to seed length).

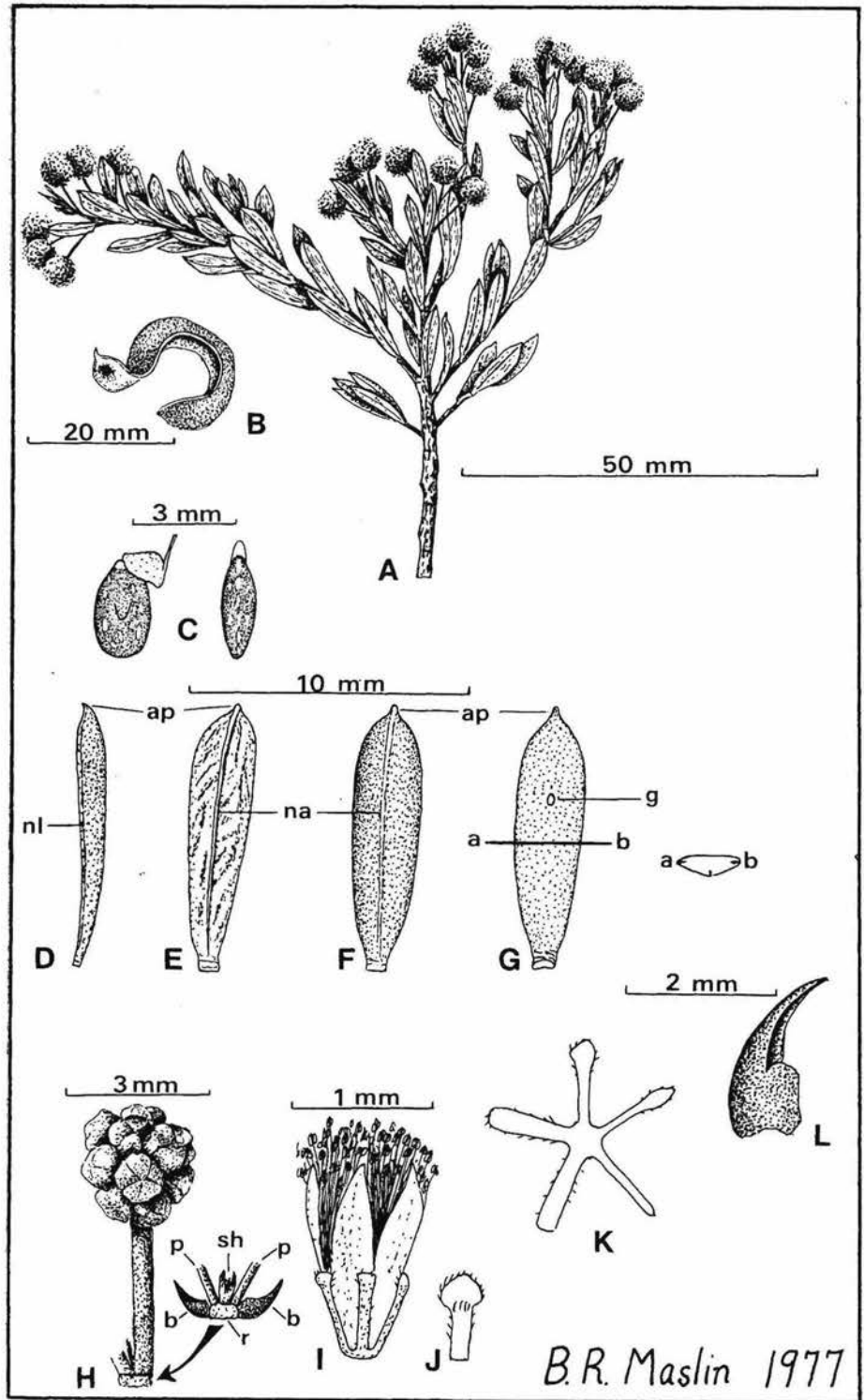
The specific epithet which was suggested to me by Dr. J. H. Willis, formerly of the National Herbarium, Victoria (MEL) refers to the diagnostically thick phyllodes which are reminiscent of leaves in some species of *Crassula*.

3. *Acacia diaphyllodinea* Maslin sp. nov.—Figure 3.

Frutex ad 1 m altus; rami glabri. *Stipulae* caducae, liberae. *Phyllodia* applanata, inconspicue plano-convexa, anguste oblonga ad anguste obovata vel anguste elliptica, 8-15 mm longa, 2-3.5 mm lata, $L/B = 3-6$ (7), glabra, laevia in statu vivo, \pm longitudinaliter sulcata in statu sicco; nervia principalia 3; apex mucronulatus. *Glans* (saepe absens) in-

Figure 3—*Acacia diaphyllodinea*. A—Upper portion of branch. B—Legume valve. C—Seeds (side and end views) showing mottled surface and short aril. D to G—Phyllodes (g—gland, ap—apiculum, na—abaxial nerve, nl—lateral nerve). D (spirit specimen)—Side view of phyllode showing relative lack of thickness. E (dry phyllode)—Abaxial surface showing obvious nerve (na) and surface wrinkling. F (spirit specimen)—Abaxial surface of same phyllode. G (spirit specimen)—Adaxial surface of same phyllode with gland (g) and transverse section (a—b) showing plano-convex outline and nerve positions. H—Inflorescence with inset showing basal arrangement (r—extremely reduced raceme axis, b—basal peduncular bracts (caducous), p—peduncle, sh—new shoot). I—Flower. J—Bracteole. K—Calyx (opened out) showing irregular lobing of sepals. L—Rostriform basal peduncular bract.

A, J from B. R. Maslin 3443 (the type); B-C from K. Newbey 3478; D-G from B. R. Maslin 3872; H-I, K-L from D. Young 128.



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conspicua, in dimidium distale paginae superae phyllodii. *Inflorescentia* racemosa brevissima pedunculorum binorum ad extremum axis brevis (0.5 mm); *pedunculi* 5–8 mm longi; *bracteae* basales pedunculi rostriformes; *capitula* globulosa, 13–15 floribus. *Flores* 5-meri; *sepala* libera; *petala* 1.5 mm longa, glabra. *Legumen* curvum, circinatum vel sigmoideum, ad 40 mm longum et 7 mm latum, glabrum. *Semina* in legumine obliqua, \pm pyriformia, ca. 3 mm longa et 2 mm lata, maculata (interdum obscure); *arillus* \pm strictus.

Type: About 7 km S of Mount Madden towards Ravensthorpe, Western Australia. Shrub 0.6–1 m tall; bark smooth, light grey; phyllodes ascending, smooth, subglaucous. 28 Aug. 1973, B. R. Maslin 3443 (holo: PERTH; iso: CANB, K, MEL, NY, P).

Spreading *shrub* to 1 m tall, moderately branched near base; *bark* grey, smooth or slightly roughened (red-brown to yellow, often very slightly pruinose and slightly resinous on branchlets); *epidermis* light grey, longitudinally fissured, peeling, most evident towards apices of branches; *new shoots* (arising from within angle formed by the twinned peduncles) glaucous, many young phyllodes (especially the terminal ones) tinged purple; *branches* terete, obscurely ribbed (ribs visible only immediately below insertion of phyllodes), glabrous. *Stipules* caducous, present only on new shoots, free, linear to very narrowly triangular, ca. 0.5 mm long. *Phyllodes* ascending, rather congested, present only on young branches (deciduous with age), horizontally flattened (i.e. diaphyllodinous), obscurely plano-convex in cross section (flat or very shallowly concave above and shallowly convex below when dry), narrowly oblong to narrowly obovate or narrowly elliptic in plane view, 8–15 mm long, 2–3.5 mm wide at broadest point, L/B = 3–6 (7), ca. 1 mm thick, straight, glabrous, olive green to subglaucous (except on new shoots), drying a light olive green, smooth when fresh but \pm longitudinally wrinkled when dry; *principal nerves* 3 (2 marginal, 1 central and slightly raised abaxially when dry), nerveless on adaxial surface, secondary nerves indistinct (openly longitudinally reticulate and observable only when dry); *apex* mucronulate (mucro distinct but 0.5 mm long, yellowish); *pulvinus* transversely wrinkled, yellow. *Gland* (frequently absent) situated on distal half of upper surface of phyllode, inconspicuous (comprising a very shallow, circular, brown depression 0.5 mm diam.). *Inflorescences* extremely reduced racemes (peduncles twinned at distal end of a minute raceme axis which is < 0.5 mm long), new shoots arising from within angle formed by peduncles; *peduncles* 5–8 mm long, glabrous; *basal peduncular bracts* caducous, solitary, rostriform, concave, auricled at base, 2–2.5 mm long, glabrous, dark brown; *flower heads* medium golden yellow, globular, with 13–15 flowers. *Bracteoles* ca. 1 mm long, variable, either linear without expanded laminae or, more generally, spatulate with claws expanded into inflexed triangular minutely ciliolate laminae. *Flowers* 5-merous; *sepals* $\frac{1}{3}$ – $\frac{1}{2}$ length of corolla, free, in a single flower can vary from narrowly oblong to linear-spatulate (apex only slightly expanded), claws glabrous or ciliolate, laminae short inflexed and minutely ciliolate; *petals* free, 1.5 mm long, very obscurely 1-nerved, glabrous; *ovary* sessile, glabrous. *Legumes* curved, circinnate or sigmoid, to 40 mm long and 7 mm wide, firmly chartaceous yet quite brittle, very slightly raised over seeds, very finely wrinkled when dry, glabrous, somewhat glaucescent (more apparent when young), brownish (purple in parts when young); margins not contracted between seeds, barely thickened, pale. *Seeds* oblique in legume, not separated by well defined transverse partitions, \pm pyriform, often somewhat compressed, ca. 3 mm long and 2 mm wide, greyish (when young) to dark brown, mottled (sometimes obscurely so), rather dull, dark peripheral line obscure or absent; *pleurogram* fine, sometimes bordered by an obscure and narrow band of pale tissue; *areole* “u”- to “v”-shaped, open towards the hilum, < 0.5 mm long; *funicle* filiform, ca. 1 mm long, abruptly expanded into a relatively short thick cream \pm straight aril.

Distribution: (Figure 6) Western Australia: Ravensthorpe-Lake King area.

Habitat: East of Lake King this species occurs in sandy soil while further south near Ravensthorpe it grows in loamy clay in open scrub. In places near Mount Madden, *A. diaphyllodinea* is quite well developed in lateritic gravel along road verges.

Flowering period: Judging from herbarium label information the flowering period extends from mid-June to about mid-September.

Fruiting period: Legumes with mature seeds have been collected in early January.

Selected specimens: WESTERN AUSTRALIA:—6.5 km S of Mount Madden towards Ravensthorpe, *B. R. Maslin* 3872 (PERTH); 6 mi (9.6 km) S of Mount Madden, *K. Newbey* 3478 (PERTH); 34 km E of Lake King, along Rabbit Proof Fence, *D. Young* 128 (PERTH).

Acacia diaphyllodinea, together with *A. binata* and *A. crassuloides*, forms a close-knit assemblage which is referred to here as the *A. diaphyllodinea* group.

The principal characters shared by these species are as follows: stipules caducous and not united as in members of the related *A. leptospermoides* group; branches glabrous; phyllodes horizontally flattened (but not obviously so in *A. binata*), glabrous, principal nerves 3 (2 marginal, 1 central abaxially, nerveless adaxially); glands not prominent and frequently absent, situated on upper surface of phyllodes generally in their distal halves; inflorescences reduced racemes comprising a pair of peduncles at the distal end of a short raceme axis (axis often so reduced in *A. crassuloides* and *A. diaphyllodinea* as to appear absent), new shoots arising from within angle formed by peduncles; flowers 5-merous; sepals free; petals glabrous and nerveless or obscurely 1-nerved; legumes curved to sigmoid, slightly raised over seeds, glabrous, margins not (or barely) contracted between seeds; areole very small in relation to seed.

Acacia diaphyllodinea is distinguished from both *A. binata* and *A. crassuloides* by its either broader or longer, mucronulate phyllodes which are more obviously 1-nerved abaxially, its broader legumes and its short funicle relative to the seed length (see *A. binata* and *A. crassuloides* for further details).

This is an attractive species especially when making new growth. The glaucous young shoots (with many phyllodes tinged purple) contrast well with the normally olive green mature foliage.

The specific epithet alludes to the obvious horizontal flattening of the phyllodes.

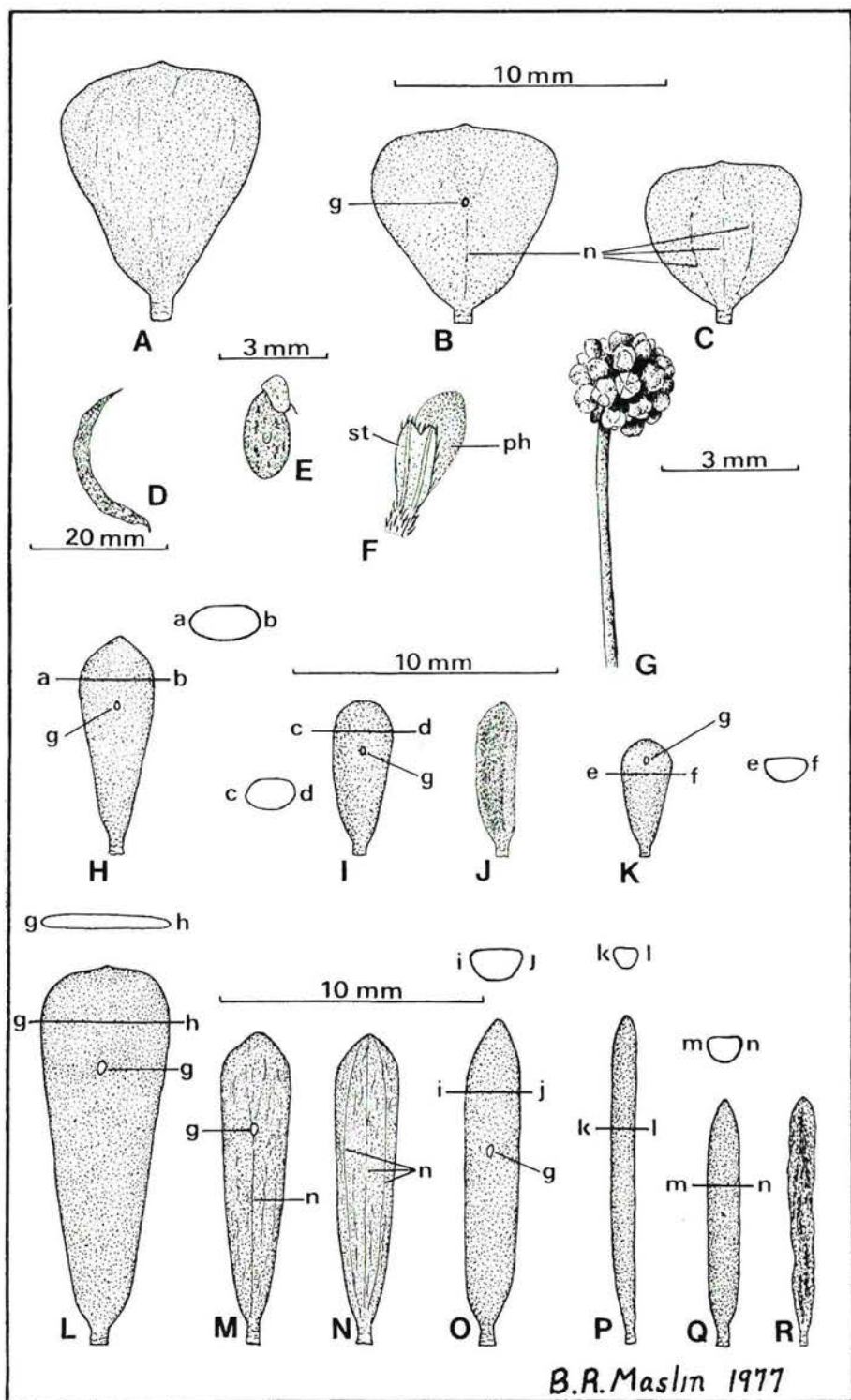
4. *Acacia ericifolia* Benth., London J. Bot. 1:345 (1842). Type: Swan River, Drummond (K-photograph seen).

Acacia hookeri Meisn. in Lehm. et al., Plant. Preiss. 1:12 (1844). *Syntypes:* Preiss 981 (FI, G, GOET, HBG, K, L, MEL, NY, P, PERTH—fragment, STRAS) and Drummond 300 (G, G—DC, MEL, P, PERTH—fragment); Bentham, Flora Austral. 2:341 (1864).

Acacia ericifolia Benth. var. *crassa* E. Pritzel, Bot. Jahrb. Syst. 35:294 (1904). *Type:* North from Mingenew, *L. Diels* 3058 (lecto: PERTH). *Syntype:* Inter flumina Moore et Murchison, *E. Pritzel* 376 (B, E, G, K, L).

Acacia ericifolia Benth. var. *typica* E. Pritzel, l.c., nom. illeg.

Acacia ericifolia is not a particularly common species although its range extends from Perth north to the Geraldton district. In its gross phyllode morphology it closely resembles the narrow, \pm terete phyllode forms of *A. leptospermoides* subsp. *leptospermoides* but is distinguished by a combination of the following characters: branchlets densely pilose (hairs lax and somewhat spreading) to puberulous (hairs rather lax and normally not distinctly antrorse and appressed as in subsp. *leptospermoides*); young phyllodes normally hairy although sometimes sparsely so (glabrous in subsp. *leptospermoides* except rarely in some broad phyllode forms); mature, dry phyllodes normally more obviously concave above and frequently more obviously wrinkled than in subsp. *leptospermoides*.



5. *Acacia leptospermoides* Benth., *Linnaea* 26:626 (1855). *Type*: Swan River, *Drummond* coll. 4, no. 2 (holo: K; iso: MEL, PERTH—fragment)—Figures 4 and 7.

Acacia leptospermoides is widespread in southwest Western Australia (Figure 7). It is closely related to *A. ericifolia* from which it can normally be distinguished by its glabrous and shorter or broader phyllodes. *Acacia leptospermoides* is very variable in its phyllode morphology and is divided here into three subspecies. Subspecies *obovata* and subsp. *psammophila* with their broad, flat and small, thick phyllodes respectively have restricted distributions (the first occurs north of the Murchison River and the second in the Mullewa-Geraldton district). The typical subspecies is more variable and more widely distributed than the other two; its range extends from Dirk Hartog Island in the north to Cranbrook and Lake Grace in the south.

Key to subspecies of *Acacia leptospermoides*.

- 1a. Phyllodes small, 4–7 (9) mm long, 1–2 (2.5) mm wide, L/B = 2–5 (8), obovate to narrowly obovate*, fleshy (turgid when fresh but normally sulcate and often \pm flattened when dry) 5c. subsp. *psammophila*
- b. Phyllode characters not combined as above (either broader and/or longer) 2
- 2a. Phyllodes \pm terete, not above 1.5 mm wide, narrowly oblong to linear 5a. subsp. *leptospermoides*
- b. Phyllodes distinctly horizontally flattened 3
- 3a. Phyllodes obovate to widely obovate or sometimes orbicular, L/B = 0.8–2, 5–10 (13) mm long, 4–7 (8) mm wide 5b. subsp. *obovata*
- b. Phyllodes narrowly oblong to narrowly obovate (very rarely obovate), L/B = (2) \geq 3, (7) 9–17 mm long, 1.5–6 mm wide 5a. subsp. *leptospermoides*

5a. subsp. *leptospermoides*—Figures 4L–R and 7

Acacia ericifolia Benth. var. *crassa* E. Pritzel, *Bot. Jahrb. Syst.* 35:294(1904), pro parte, not as to lectotype, as to Diels 4058 (PERTH).

Acacia ericifolia Benth. var. *glaucescens* E. Pritzel, l.c., *synon. nov.* Type citation: “in distr. Avon pr. Moora in arenosis (D. 3097)” (lecto: PERTH), lecto. nov.

Acacia ericifolia Benth. var. *tenuis* E. Pritzel, l.c., *synon. nov.* Type citation: “In distr. Irwin pr. Greenough River in arenosis (D. 4212)” (lecto: PERTH), lecto. nov.

Selected specimens: WESTERN AUSTRALIA:—70 mi peg (from Perth), Geraldton Highway, T. E. H. Aplin 19 (PERTH); Between Pingrup and Lake Magenta, W. E. Blackall 3079 (PERTH); 13 mi (20.8 km) N of Bolgart, H. Demarz 3919 (PERTH); Cranbrook, L. Diels 4416A (PERTH); \pm 1.5 km N of Herald Bay outcamp, Dirk Hartog Island, 25° 51' S, 113° 05' E, A. S. George 11498 (AD, CANB, K, MEL, NY, PERTH); 4 mi (6.4 km) S of Marchagee, R. T. Lange 4 (PERTH, TLF—fragment); Near 157 mi peg on Geraldton Highway, ca. 4 mi

* Best to observe fresh or reconstituted phyllodes.

Figure 4—*Acacia leptospermoides*. A to G—subsp. *obovata*: A to C—Phyllode variation (A—abaxial view showing very obscure surface wrinklings; B—adaxial view showing nerve (n) extending from pulvinus to gland (g); C—abaxial view showing 3 obscure nerves (n)). D—Legume. E—Seed showing short aril and surface mottlings. F—New shoot showing young phyllode (ph) and connate stipules (st). G—Inflorescence. H to K—subsp. *psammophila*: Phyllode variation (H–I, K—reconstituted phyllodes showing gland (g) position on adaxial surface and transverse sections showing \pm obscurely plano-convex outline; J—dry phyllode concave adaxially). L to R—subsp. *leptospermoides*: Phyllode variation (g—gland). L (reconstituted phyllode)—Adaxial view with transverse section (g–h) showing flattened outline. M (dry phyllode)—Adaxial view showing nerve (n) extending from pulvinus to gland. N (dry phyllode)—Abaxial view of same phyllode showing three nerves (n). O–Q (reconstituted phyllodes)—Adaxial view with transverse section showing plano-convex outline. R (dry phyllode)—Adaxial view showing uneven contraction of lamina.

A from B. R. Maslin 4299 (the type); B, D–E from A. S. George 11227; C from C. H. Gittins 1591; F from B. R. Maslin 3648; G from A. M. Ashby 4620; H from A. M. Ashby 3852; I–J from J. Long 4; K from A. C. Burns 4; L from B. R. Maslin 3075; M–N from B. R. Maslin 3689; O from W. E. Blackall 3079; P from T. E. H. Aplin 19; Q–R from H. Demarz 3919.

(6.4 km) S of Marchagee, *B. R. Maslin* 1445 (CANB. PERTH); 14.5 km W of Three Springs towards Eneabba, *B. R. Maslin* 3075 (PERTH); Tamala Station, *B. R. Maslin* 3689 (L, NT, NSW, PERTH).

There is considerable phyllode variation in the material I have referred here to subsp. *leptospermoides*. The phyllodes seem to vary continuously from narrow and \pm terete to broad and flat (Figs. 4L-R); there is no geographical correlation with the different forms encountered. The type specimens of the three synonyms listed above have phyllodes which are narrow and \pm terete while the type specimen of *A. leptospermoides* is representative of the less frequent broad, flat phyllode forms. It is possible that future mass sampling techniques coupled with statistical methods will reveal a basis for recognizing more than one taxon within this complex.

5b. subsp. obovata Maslin subsp. nov.—Figure 4A-G.

Frutex 1.3 (1.5) m alta, diffusa; *rami* antrorse strigosi ad antrorse puberuli. *Stipulae* caducae, connatae. *Phyllodia* applanata, obovata ad late obovata vel interdum orbiculata 5–10 (13) mm longa, 4–7 (8) mm lata, L/B = 0.8–2, carnosae turgidae et laevia in statu vivo, glabra; *nervia* principalia 6, nervatio plerumque obscurissima. *Glans* proxima medium in pagina supera phyllodii. *Inflorescentia* simplex; *pedunculi* 4–7 mm longi; *capitula* globulosa, 30–35 floribus. *Flores* 5-meri; *sepala* libera vel in dimidio inferiore connata; *petala* 1.5 mm longa, glabra. *Legumen* curvum, ad ca. 30 mm longum, 1.5–2 mm latum. *Semina* in legumine longitudinalia, 2.5 mm longa, 1.5 mm lata, maculata.

Type: 14.5 km N of Murchison River, North West Coastal Highway, Western Australia. "Shrub 1.3 m tall, normally "v"-shaped, sparsely divided at base; bark smooth, grey; phyllodes concentrated towards ends of branches, ascending, subglaucous, thickened; heads medium yellow." 19 Sept. 1976, *B. R. Maslin* 4292 (holo: PERTH; iso: CANB, K, NY).

Spreading, openly branched, normally infundibular *shrub* to 1.3 (1.5) m tall, sparsely divided at base; *branches* antrorsely strigose to antrorsely puberulous, glabrous with age. *Stipules* caducous, present only on new shoots, connate for most of their length, yellowish brown. *Phyllodes* horizontally flattened (i.e. diaphyllodinous), obovate to widely obovate or sometimes orbicular, 5–10 (13) mm long, 4–7 (8) mm wide, L/B = 0.8–2, fleshy smooth and turgid when fresh but quite flat and finely wrinkled when dry, glabrous, very glaucous when young but maturing green; *nervature* generally very obscure but normally \pm apparent on young dry phyllodes, *principal nerves* 6 (3 abaxial extending from pulvinus to apex with the central one generally more apparent than the lateral ones, 1 adaxial extending from pulvinus to gland, 2 marginal—apparent when fresh); *apex* obtuse and normally mucronulate; *pulvinus* horizontally flattened, ca. 0.5 mm long, transversely wrinkled, orange. *Gland* situated on upper surface of phyllode near its middle, not prominent, ca. 0.2 mm diam., lip not raised. *Inflorescences* simple, 1 (2) per node; *peduncles* 4–7 mm long, glabrous; *basal peduncular bracts* often caducous, solitary, rostriform, concave; *flower heads* bright yellow, globular, with 30–35 densely arranged flowers. *Bracteoles* spatulate, ca. 1 mm long, the dark brown laminae visible between adjacent flowers in inflorescence bud. *Flowers* 5-merous; *sepals* $\frac{1}{2}$ – $\frac{3}{4}$ length of petals, free or connate for ca. $\frac{1}{2}$ their length, sparsely puberulous, claws linear, laminae slightly inflexed and keeled; *petals* 1.5 mm long, glabrous, very obscurely 1-nerved. *Legumes* curved, to ca. 30 mm long, 1.5–2 mm wide, sometimes slightly undulate, barely raised over seeds, firmly chartaceous to very slightly coriaceous, reticulate, medium brown; marginal nerve apparent but barely thickened, slightly contracted between seeds. *Seeds* longitudinal in legume, ellipsoidal-obloid but truncated along edge adjacent to aril, narrowed towards the periphery, 2.5 mm long, 1.5 mm wide, brown, mottled; *pleurogram* obscure, open towards the hilum; areole "u"- to "v"-shaped, minute (ca. 0.2 mm long); *funicle* filiform, ca. 0.5 mm long, abruptly expanded into a slightly shiny yellowish to brownish (when dry) aril which is not convoluted and extends $\frac{1}{3}$ – $\frac{1}{2}$ down one side of the seed.

Distribution: (Figure 7) Western Australia: Known only from the North West Coastal Highway between 11 km and 30 km north of the Murchison River. Further sampling of suitable habitats will probably extend the known range of this taxon, especially in an east-west direction.

Habitat: Yellow to light brown sand or sandy loam in open heath or open scrub.

Flowering period: July-August.

Fruiting period: Legumes with mature seeds have been collected in early January. At this time of the year the glaucous young foliage is evident.

Selected specimens: WESTERN AUSTRALIA:—390 mi peg, North West Coastal Highway, *A. M. Ashby* 4620 (PERTH); Near 413 mi peg, North West Coastal Highway, 27° 25' S, 114° 40' E, *A. S. George* 11227 (PERTH); 7 mi (11.2 km) N of Galena, *C. H. Gittins* 1591 (PERTH); 14.5 km N of Murchison River on North West Coastal Highway, *B. R. Maslin* 3648 (PERTH); 12 km N of Murchison River bridge on North West Coastal Highway, *M. E. Trudgen* 1684 (AD, BRI, MEL, NSW, PERTH).

From their respective seed/seedling and pollen studies, Vassal and Guinet (pers. comm.) report the distinctness of this taxon and suggest its possible recognition at the species level. However, considering the overall morphological variation encountered in the *A. leptospermoides* group, I feel it is best treated as a subspecies. The distinguishing gross morphological features of subsp. *obovata* are to be found in its phyllodes. Compared with the other two subspecies of *A. leptospermoides*, the phyllodes in subsp. *obovata* are shorter and/or broader, differently shaped and possess glands which are frequently situated nearer the middle. All the collections so far of subsp. *obovata* are from a small area north of the Murchison River (Fig. 7).

The subspecific epithet refers to the phyllodes whose shape is normally obovate.

5c. subsp. *psammophila* (E. Pritzel) Maslin, comb. et stat. nov.—Figures 4H-K and 7.

Acacia psammophila E. Pritzel, Bot. Jahrb. Syst. 35:294(1904). Type citation: "Hab. in distr. Irwin pr. Greenough River juxta viam Mullewensem in fruticetis arenosis, c. alabastr. m. Julio (D. 3294)". (lecto: PERTH), lecto. nov.

Selected specimens: WESTERN AUSTRALIA:—Yuna, on Mullewa road, *A. M. Ashby* 1580 (PERTH); Eradu, *G. Phillips* for *A. M. Ashby* 3852 (CANB, K, PERTH); 8 mi (12.8 km) along Casuarina Road, SE of Geraldton, *A. C. Burns* 4; 30 mi (48 km) E of Geraldton, *J. Long* 4.

Pritzel originally described this taxon as a distinct species. Both Vassal and Guinet (pers. comm.) report that their respective studies on the seed/seedlings and pollen show that it does not warrant specific rank; both workers suggested close affinities with subsp. *leptospermoides*. My own morphological studies indicate that the taxon is best treated as a subspecies of *A. leptospermoides* being distinguished principally by its short, thick and fleshy phyllodes which are obovate to narrowly obovate. These characters are best observed in fresh or reconstituted specimens. Occasionally very short, thick phyllodes occur in subsp. *leptospermoides* (particularly on plants from around Tammin and Cunderdin). These individuals may superficially resemble subsp. *psammophila* but in most instances the distinguishing characters given in the Key are sufficient to confidently separate these taxa. Although subsp. *psammophila* is restricted to the Geraldton-Mullewa district its range does overlap with the more widely distributed subsp. *leptospermoides* (Fig. 7).

6. *Acacia spathulifolia* Maslin nom. nov., based on *A. spathulata* F. Muell. ex Benth.

Acacia spathulata F. Muell. ex Benth., Flora Austral. 2:356 (1864), non Tausch (1836); Mueller, F., Icon. Austral. Acac. Dec. 5: t.1, 1887. Lectotype: Murray R. (?River—see

discussion below), W.A., *Oldfield* (MEL—specimen seen by Bentham; iso: PERTH—fragment), lecto. nov.

Syntype citations: "Bay of Rest, N.W. Coast, *A. Cunningham*" (n.v.); "Dirk Hartog Island and Shark Bay, *Milne*" (n.v.); "Murchison River, *Oldfield*" (n.v.).

The collecting locality given on the lectotype sheet is puzzling. This sheet is annotated by Mueller "Murray R. W.A. Oldf." Bentham saw the sheet and in his original description of *A. spathulata* listed the locality as "Murray River." The only Murray River known today in Western Australia is 70 km south of Perth and some 250 km south of the most southerly known record of *A. spathulifolia*. There seem to be three possible explanations for the apparently anomalous locality citation: (1) *A. spathulifolia* may have been

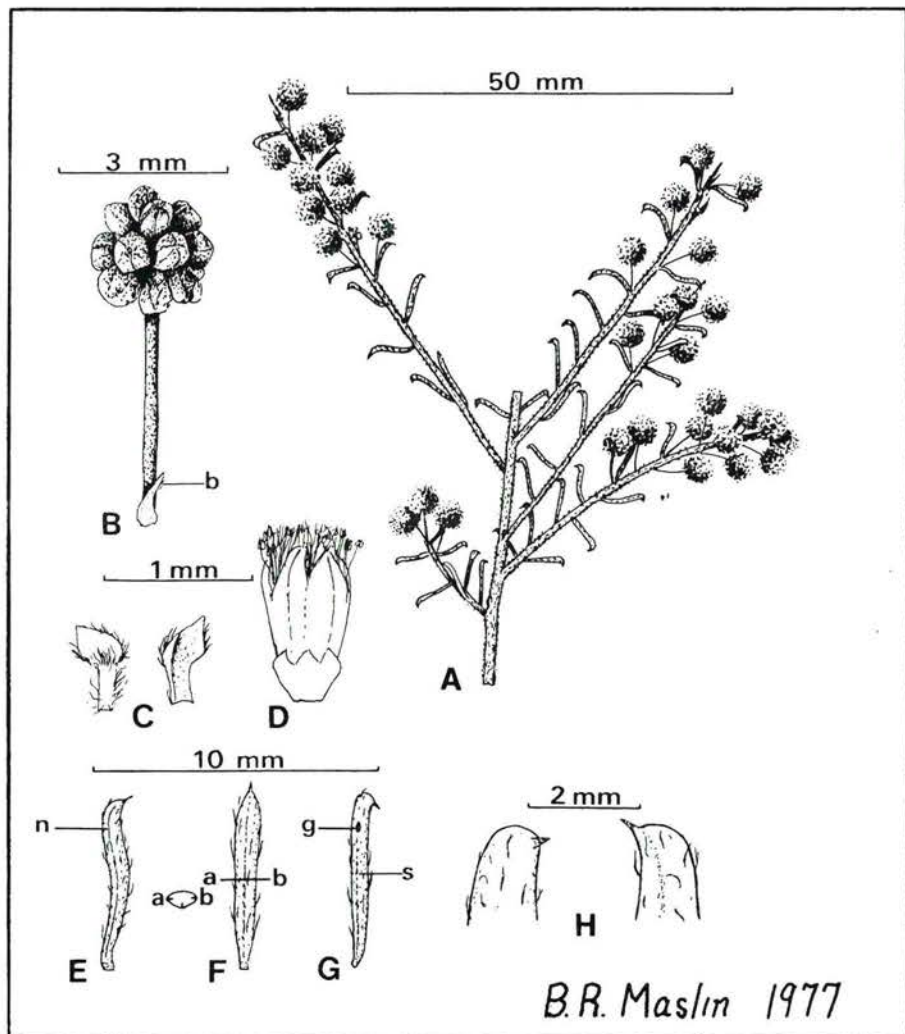


Figure 5—*Acaicia vassalii*. A—Upper portion of branch. B—Inflorescence showing solitary basal peduncular bract (b). C—Bracteoles (abaxial and side views). D—Flowers E to G—Phyllode variation. E (reconstituted phyllode)—Side view showing obscure lateral nerve (n). F (reconstituted phyllode)—Adaxial view with transverse section (a—b) showing \pm plano-convex outline and nerve positions. G (dry phyllode)—Adaxial view showing gland (g) and obscure medial sulcus (s). H (reconstituted phyllodes)—Phyllode apices in side view. A from Gardner s.n.; B, E–F, H from Blackall s.n.; C–D, G from Ising s.n. (the type).

previously more widely distributed than it is today or (2) the locality given in the protologue is incorrect or (3) there once existed in W.A. a watercourse known as the Murray River which today goes under another name.

Acacia spathulifolia is common on coastal limestone in the Jurien Bay district and extends north to the vicinity of North West Cape. The species is obviously diaphyllodinous and in its stipules and phyllodes closely resembles the broad phyllode forms of *A. leptospermoides* subsp. *leptospermoides*. *Acacia spathulifolia* is readily distinguished from this subspecies by its diaphanous, very shortly lobed calyx (lobes broadly triangular), its larger flower buds which are fewer and less compact in the heads and its lack of bracteoles.

7. *Acacia vassalii* Maslin sp. nov.—Figure 5.

Frutex; *rami* apices versus dense tomentosi. *Stipulae* demum caducae, basi versus connatae in statu juvenili. *Phyllodia* parum applanata, inconspicue plano-convexa, anguste oblonga sed in basin gradatim decrescens, 4–8 mm longa, ca. 1 mm lata, recta vel curvata, uncinata, subtiliter puberula ad glabrata; *nervia principalia* 3; apex rostrata. *Glans* (saepe absens) in tertio distale paginae superae phyllodii. *Inflorescentia* simplex; *pedunculi* 3–4.5 mm longi; *capitula* globulosa, 15–16 floribus. *Flores* 5-meri; *calyx* breviter \pm oblongus-lobatus; *petala* 1 mm longa, 1-nervia. *Legumen* et semina n.v.

Type: Wongan Hills, Western Australia. Aug. 1935, E. H. Ising s.n. (holo: PERTH; iso: PERTH; according to C. A. Gardner's annotation on the type sheet, there is a duplicate of this collection at K).

Shrub (further details unknown); *branches* terete, very obscurely ribbed, densely tomentose towards apices but becoming glabrous with age; *epidermis* grey, finely longitudinally fissured (exposing a smooth red bark beneath). *Stipules* deciduous with age, very narrowly triangular, 1–2 mm long, scarious, ciliolate, otherwise glabrous, light brown and connate near base when very young (i.e. on new shoots) but becoming darker and separated (laterally displaced) with age. *Phyllodes* spreading to ascending, rather distant, slightly horizontally flattened (i.e. diaphyllodinous), \pm plano-convex in cross section, sometimes medially sulcate above when dry, narrowly oblong but tapered towards base in plane view, 4–8 mm long, ca. 1 mm wide, straight or gently arched upwards and always prominently uncinata (thus sometimes producing a shallowly sigmoid outline), finely puberulous to glabrescent, obscurely finely wrinkled when dry; *nervature* very obscure, *principal nerves* 3 (2 marginal, 1 central abaxially), nerveless on adaxial surface; *apex* rostellate, apiculum ca. 0.3 mm long and light brown; *pulvinus* ca. 0.5 mm long, orange. *Gland* (often absent) situated on distal $\frac{1}{3}$ of upper surface of phyllode, circular, 0.2 mm diam., lip not raised. *Inflorescences* simple, 1 per node; *peduncles* 3–4.5 mm long, glabrous or glabrescent; *basal peduncular bracts* persistent, solitary, triangular to oblong, concave, slightly curved, \pm 0.5 mm long, ciliolate, sometimes sparsely puberulous abaxially; *flower heads* yellow, globular, with 15–16 flowers. *Bracteoles* spatulate, 0.5 mm long; *claws* linear, \pm equalling laminae in length; *laminae* ovate, inflexed, slightly concave, puberulous abaxially. *Flowers* 5-merous; *calyx* \pm $\frac{1}{3}$ length of corolla, divided for $\frac{1}{4}$ its length into \pm oblong ciliolate lobes which are slightly inflexed at apex, tube very obscurely 5-nerved a little angular when dry and \pm sparsely puberulous; *petals* 1 mm long, connate for $\frac{2}{3}$ their length, glabrous, 1-nerved; *ovary* sessile, glabrous. *Legumes* and seeds not seen.

Distribution: (Figure 6) Western Australia: I have seen only three collections of *A. vassalii*, one of which is without locality. Of the remaining two collections one is labelled Wongan Hills and the other Wararoo. I am unable to establish the position of this last-mentioned locality.

Habitat: Nothing is known of the ecological preferences of this species.

Flowering period: The few specimens at hand are in flower and were collected in July and August.

Specimens seen: WESTERN AUSTRALIA:—*W. E. Blackall* s.n., without other detail (CANB, PERTH); Wararoo, *C. A. Gardner* s.n., July 1939 (PERTH).

Acacia vassalii is poorly represented in herbarium collections. It is a very distinctive taxon with its small, very obscurely nerved, slightly horizontally flattened, uncinately phyllodes with their rostellate apices. In phyllode shape *A. vassalii* is rather reminiscent of some species found in the Series *Brunioideae* e.g. *A. asperulacea* F. Muell. and *A. spondylophylla* F. Muell. but in other characters (especially its non-verticillate phyllodes) it is quite distinct from this Series.

In the absence of legumes, the correct affinities of this species are difficult to establish. The horizontally flattened, 3-nerved phyllodes and the stipule morphology suggest an affinity with the *A. diaphyllodinea* group (page 209) but *A. vassalii* is readily distinguished by its tomentose branchlets, its uncinately, rostellate phyllodes, its simple (not racemose) inflorescences, its persistent, triangular to oblong basal peduncular bracts (not rostriform and caducous) and its united sepals (not free).

This species is named in honour of Jacques Vassal who, since 1963, has published many valuable papers dealing with *Acacia*, especially in relation to their seed and seedling morphology.

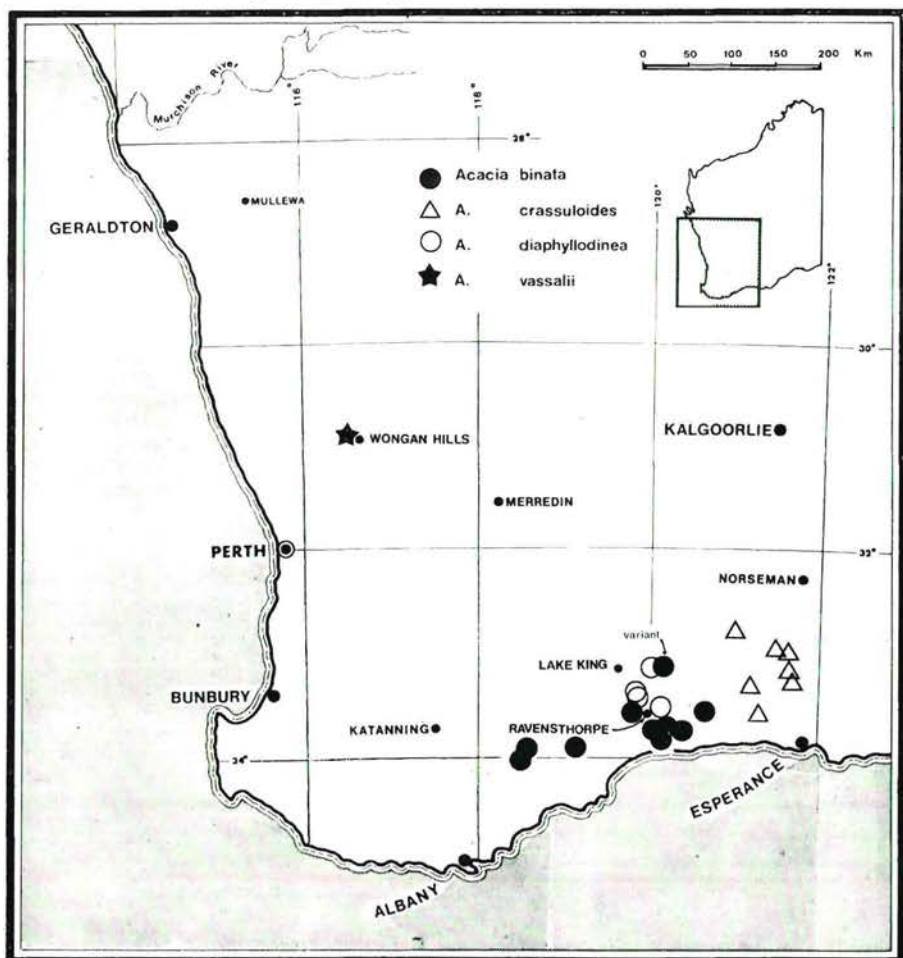


Figure 6—Distribution of *A. binata*, *A. crassuloides*, *A. diaphyllodinea* and *A. vassalii*.

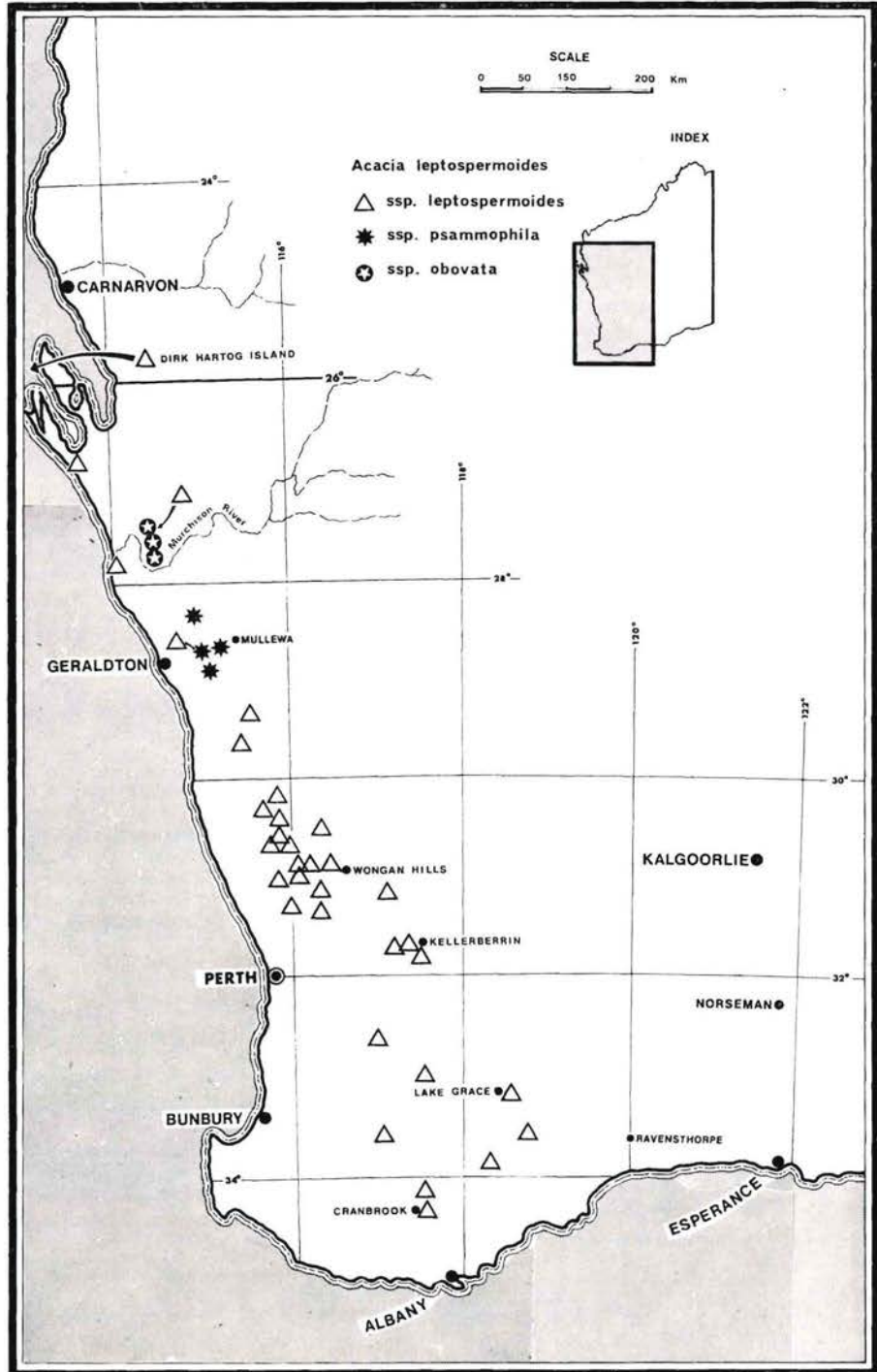


Figure 7—Distribution of *A. leptospermoides* subsp. *leptospermoides*, subsp. *obovata* and subsp. *psammophila*.

Acknowledgements

I wish to express my deep appreciation for assistance received from both Dr. J. Vassal and Dr. Ph. Guinet who made available their respective unpublished results concerning seed/seedling and pollen characteristics of most taxa dealt with here. Dr. J. H. Willis is also acknowledged for his generous assistance in providing material and information concerning *A. crassuloides*.

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- PEDLEY, L. (1975). Revision of the extra-Australian species of *Acacia* subg. *Heterophyllum* Contr. Qd. Herb. No. 18, p. 1-24.
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Index to numbered specimens seen

This index is arranged alphabetically according to the name of the collector. Numbers in parentheses refer to the corresponding taxon in the text. Unless otherwise stated, the specimens are housed at the Western Australian Herbarium (PERTH). Abbreviations for herbaria are those given in Index Herbariorum, Part 1, Edition 6 (1974).

- Aplin, T. E. H. 19(5a), 1989(5a).
- Armitage, I. 518(2).
- Ashby, A. M. 1580(5c), 1897(6), 3787(4), 3852(5c—CANB, K, PERTH: comm. G. Phillips), 4522(4), 4591B(4—CANB, PERTH: comm. G. Phillips), 4620(5b), 4623(5c).
- Barrow, M. M71(5a).
- Beard, J. S. 3524(6), 6885(6), 7246(5a), 7282(6).
- Bennett, E. M. 2388(1), 2729(1—MEL, PERTH).
- Berg, R. Y. 95A(6), 224A(1).
- Blackall, W. E. 550(6), 683(6), 1008(2), 2516(5a), 2745(6), 3079(5a), 4850(6).
- Blockley, J. V. 564(4), 613(4).
- Briggs, B. G. 304(2).
- Burns, A. C. 1(4), 2(4), 4(5c), 5(4), 7(5c), 9(4), 14—9 Aug. 1965(6), 14—23 July 1967(5c), 17(5c), 29(5c), 36(5c), 76(6).
- Chadwick, Y. 2286(6).
- Cossalter, C. 1539(6).
- Coveny, R. 3025(6).
- Demarz, H. 3919(5a), 4175(5b).
- Diels, L. 3058(4—syntype of *A. ericifolia* var. *crassa*), 3097(5a—lectotype of *A. ericifolia* var. *glaucescens*), 3294(5c—lectotype), 4058(5a—syntype of *A. ericifolia* var. *crassa*), 4212(5a—lectotype of *A. ericifolia* var. *tenuis*), 4416A(5a).
- Drummond, J. 300(4—syntype of *A. hookeri*: G, G-DC, MEL, P, PERTH—fragment), 141 or coll.2, no.141(5a—CGE, G, K, P), coll.2, no.144(5a—MEL, PERTH—fragment), 151 or coll.2, no.151(4—G, K, MEL, PERTH—fragment), coll.4, no.11(5a—type: K, MEL, PERTH—fragment).
- Eichler, H. J. 15950(5a), 20254(2).
- Fairall, A. R. 1188(6).
- Freeman, F. D. s.n. (2—MEL 502982, PERTH; MEL 502993).
- Freeman, O. s.n. (2—MEL 502990 and 502991).
- Gardner, C. A. 2635(6), 9001(5a), 13230(6).
- George, A. S. 1420(6), 11227(5b), 11498(5a—AD, CANB, K, MEL, NY, PERTH), 11551(5a), 2533(6).
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- Green, J. W. 481(6), 1373A(5c).

- Hargett, B. 7(4).
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 Preiss, L. 981(4—syntype of *A. hookeri*: FI, G, GOET, HBG, K, L, MEL, NY, P, PERTH—fragment, STRAS).
 Pritzel, E. 376(4—syntype of *A. ericifolia* var. *crassa*: B, E, G, K-photo seen, L).
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 Saffrey, R. A. 1525(4—K, MEL, NSW, PERTH).
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 Simmons, M. 314(2).
 Smith, F. G. 1679(5b).
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Five new species of *Eucalyptus* from Western Australia

By M. I. H. Brooker* and D. F. Blaxell†

Abstract

Five new species of eucalypt are described—*Eucalyptus beardiana* and *E. gittinsii* from the Kalbarri-Shark Bay region, *E. johnsoniana* from the Encabba sand-plain, and *E. georgei* and *E. cerasiformis* from east of Hyden. Their distribution and natural affinity are discussed.

Eucalyptus beardiana Brooker *et* Blaxell, sp. nov. (Figures 1, 6). Pryor and Johnson code SIVAB.‡

Frutex 'mallee' ad 4 m altus, caulibus laevibus.

Folia juvenilia petiolata, non-opposita, lanceolata, 2-9 x 0.5-3.5 cm. *Folia adulta* petiolata, non-opposita, lanceolata, ad 15 x 1.5 cm.

Inflorescentiae axillares, 11-florae. *Pedunculus* c. 3 cm longus, recurvus, teretus. *Alabastra* 3-4 x 1 cm. *Hypanthium* hemisphaericum vel cupulatum, c. 1 cm longum. *Operculum* conicum attenuatum, c. 2 cm longum. *Filamenta* staminum connata in dimidio inferiore et androecium in totum deciduum. *Pedicelli* c. 1 cm longi. *Loculi* 5. *Ovula* 4-seriata.

Fructus pedicellati, hemisphaerici, 12-14 x 10-12 mm. *Valvae* exsertae. *Discus* latus, albidus, planus, leviter depressus.

Type: Northwest of 'Coburn' HS, south of Shark Bay, Western Australia (26° 42'S, 114° 08'E) 8 Oct. 1975, D. F. Blaxell W75/105 (holo: NSW; iso: K, FRI, PERTH).

A mallee to 4 m tall with smooth, grey bark.

Cotyledons bisected, petiole 4-5 mm, arms 5-7 mm. *Juvenile leaves* petiolate, not opposite, broadly lanceolate, 2-9 x 0.5-3.5 cm, green, slightly paler below. *Adult leaves* petiolate (1-2 cm long), not opposite, lanceolate, to 15 cm x 1.5 cm, lateral and intra-marginal veins not prominent. *Glands* obscure in dried material.

Inflorescences axillary, 11-flowered. *Peduncle* c. 3 cm long, terete, recurved. *Buds* 3-4 x 1 cm, hypanthium hemispherical to cup-shaped, c. 1 cm long, operculum conical-attenuate, c. 2 cm long. *Pedicele* c. 1 cm long. *Filaments* basally connate for about half their length, at first erect, and most finally inflected with anthers pendent in bud. *Androecium* deciduous as a whole. *Anthers* dorsifixed, oblong, opening in longitudinal slits. *Style* long, deeply inserted in tube formed by beak of operculum. *Locules* 5. *Ovules* in four vertical rows.

Fruit pedicellate, hemispherical, flaring at the top, 12-14 mm x 10-12 mm. *Disc* broad, whitish, flat, just below rim level. *Operculum scars* and *staminophore* c. 2 mm wide, horizontal. *Valves* exserted.

Seed irregular, light grey-brown, dorsal side rounded and shallowly and finely reticulate, ventral side with shallow ribbing and inconspicuous hilum. *Chaff* cuboid or subulate, reddish brown.

Distribution: Western Australia: northwest and south of Wannoo (South of Shark Bay on NW Coastal Highway).

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‡ Codes have been derived from the Pryor and Johnson classification (1971).

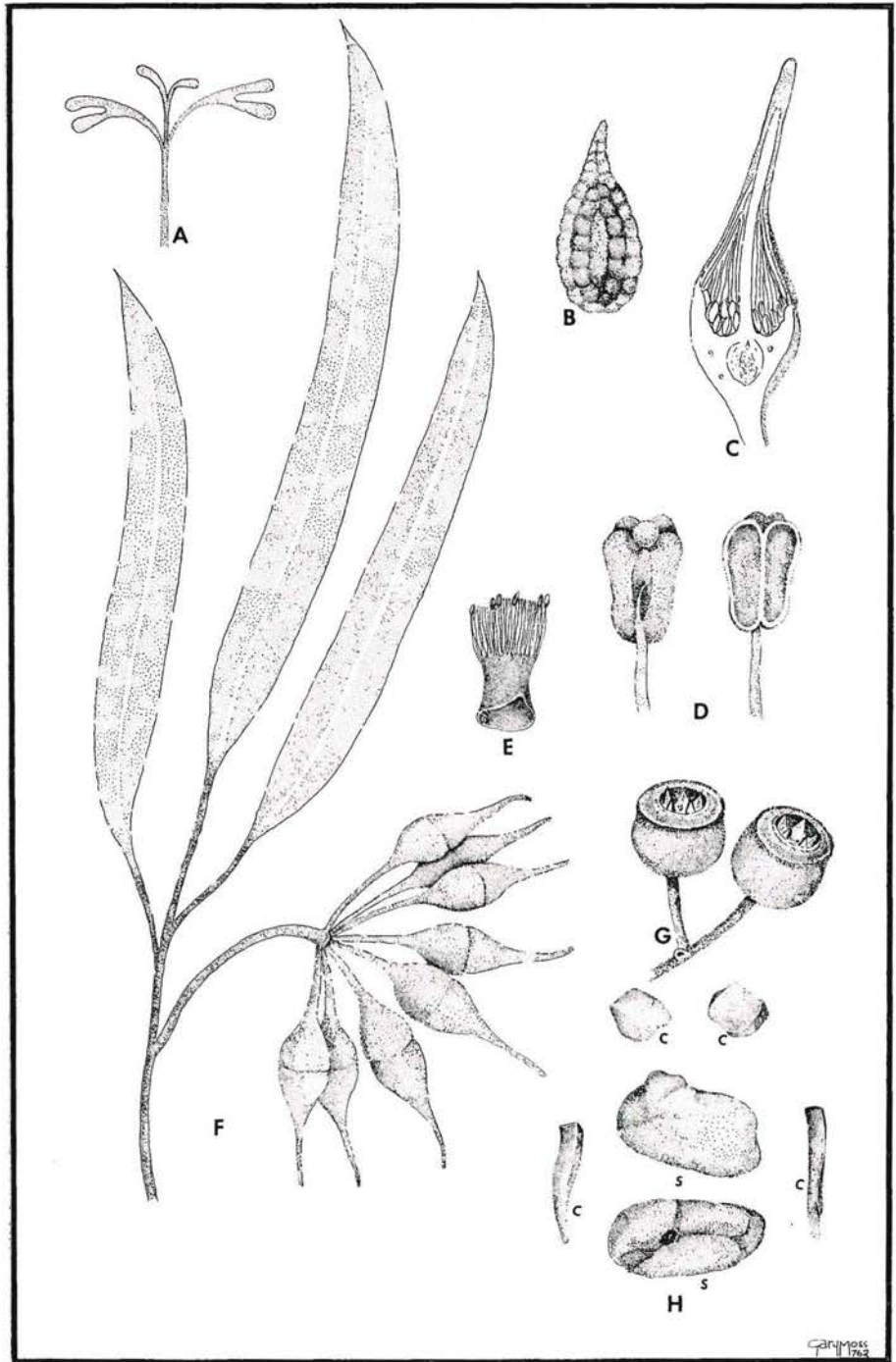


Figure 1—*Eucalyptus beardiana* sp. nov. A—Cotyledons, x 1. B—Ovules, x 30. C—Bud section, x 3. D—Anthers, x 25. E—Androecium (after falling whole), x 2. F—Adult leaves and buds, x 1. G—Fruit, x 1. H—Seed (s) and chaff (c), x 9. From J. S. Beard 7391 except for androecium and seed (MIHB 5014) and seedling grown from MIHB 5014.

Other collections: along a survey line \pm 15 miles west of Coburn Station, 8 April 1975, J. S. Beard 7391 (FRI, PERTH); 71 km south of Wannoo (158 km north of Geraldton) (27° 30' S, 114° 45' E), 9 Oct. 1975, D. F. Blaxell W75/117A (NSW), M. I. H. Brooker 5023 (FRI, PERTH, NSW, AD, MEL) and M. I. H. Brooker 5024 (FRI, PERTH, NSW, AD, MEL).

Only two populations of this species are known to us at present; the Type locality and that 71 km south of the Billabong Roadhouse at Wannoo on the NW Coastal Highway. At the Type locality the site consists of low, red, sand dunes supporting a 'unique community, to be mapped as "Tree heath"' (J. S. Beard pers. comm.). Associated species here are *Eucalyptus roycei*, *Banksia ashbyi*, *Hakea stenophylla*, *Acacia longispina* and *Plectrachne danthonioides*. The southern population occurs in tall open-shrubland on yellow sand with occasional sand ridges supporting *Actinostrobis arenarius*, *Banksia sceptrum* and *Xylomelum angustifolium*.

E. beardiana belongs in the series MACROCARPAE of Pryor & Johnson. It appears to occupy a position near *E. leptopoda* Benth., one population of which (near Queen Victoria Spring) also has the character (almost unique in *Eucalyptus*) of connate filaments. It differs from *E. leptopoda* in the broader leaves, the larger buds and the larger fruit with the sunken though still broad and prominent disc.

The species is named after its collector, Dr. John Beard, formerly Director of Kings Park Botanic Garden, Perth and of the Royal Botanic Gardens, Sydney, who is currently mapping the vegetation of Western Australia. During the course of his travels into remote parts of the State he has discovered several new taxa of *Eucalyptus*, some of which have yet to be published. We consider it appropriate that his long association with the botany of Western Australia should be perpetuated by a species endemic to the State.

***Eucalyptus johnsoniana* Brooker et Blaxell, sp. nov.** (Figs 2, 6). Pryor and Johnson code MADEJ.

Frutex 'mallee' ad 2 m altus.

Folia juvenilia petiolata, opposita, ovata, 3-7 x 1-3 cm. *Folia adulta* petiolata, non-opposita, lanceolata, 5-12 x 1-1.5 cm.

Inflorescentiae axillares, 7-florae. *Pedunculus* c. 1 cm longus, complanatus vel teretus. *Alabastra* c. 10 x 5 mm. *Hypanthium* campanulatum. *Operculum* hemisphaericum interdum umbone parvo. *Pedicellus* c. 5 mm longus. *Antherae* dorsifixae oblongae. *Loculi* 3-4. *Ovula* 2-seriata.

Fructus pedicellati, hemisphaerici vel globosi, c. 1 x 1 cm. *Discus* verticaliter depressus. *Valvae* deltoideae, interdum leviter protrusae. *Semina* pyramidalia, alis prominentibus.

Type: 6 km south of Coorow-Green Head intersection on Highway 1, south of Dongara, Western Australia (30° 06' S, 115° 24' E) 7 Oct. 1975, D. F. Blaxell W75/89 (holo: NSW; iso: K, FRI, PERTH).

A mallee to 2 m high, forming dense and broad clumps up to several metres across. Bark slightly rough, grey-brown, peeling in strips from the stems.

Cotyledons orbicular to reniform, 8 x 6 mm. *Juvenile leaves* petiolate, opposite for c. 9 pairs, ovate, 3-7 x 1-3 cm. *Adult leaves* petiolate, not opposite, lanceolate, 5-12 x 1-1.5 cm, yellow-green, concolorous, with the midrib and leaf edges pale yellow-green. *Glands* obscure in dried material.

Inflorescences axillary, 7-flowered. *Peduncle* c. 1 cm long, terete or slightly flattened. *Mature buds* c. 10 x 5 mm, hypanthium campanulate, operculum hemispherical and sometimes with a small umbo, pedicel c. 5 mm long. *Stamens* inflexed in bud. *Anthers* dorsifixed, oblong. *Style* short. *Locules* 3-4. *Ovules* in 2 vertical rows.

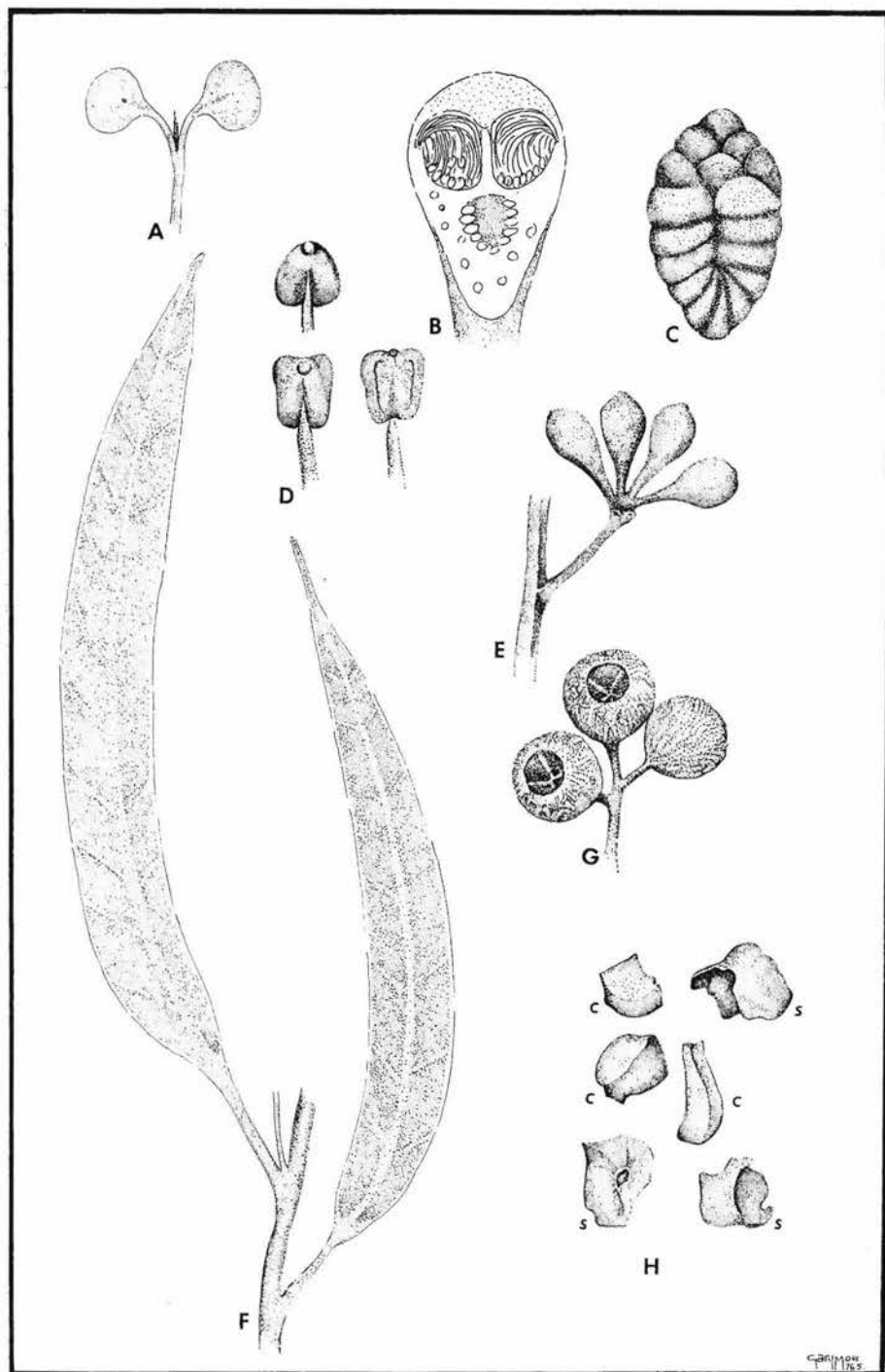


Figure 2—*Eucalyptus johnsoniana* sp. nov. A—Cotyledons, x 1. B—Bud section, x 6. C—Ovules, x 25. D—Anthers, x 25. E—Buds, x 1.5. F—Adult leaves, x 1.5. G—Fruit, x 1.5. H—Seed (s) and chaff (c), x 3.

From MIHB 5002 except for fruit and seed (MIHB 5033) and seedling grown from MIHB 5033.

Fruit pedicellate, hemispherical to globose, c. 1 x 1 cm. *Disc* vertically depressed inside the orifice. *Valves* deltoid, the tips occasionally protruding from the orifice.

Seed pyramidal, with conspicuous wings, brown, smooth on dorsal side, ribbed on ventral side. *Chaff* cuboid, yellow and brown.

Distribution: Western Australia: south of Eneabba, east of Jurien Bay.

Other Collections: 11.8 km south of the Coorow—Green Head road intersection with Highway 1, at the turn-off to Lara Downs (30° 09'S, 115° 26'E) 7 Oct. 1975, D. F. Blaxell W75/88 (NSW) and M. I. H. Brooker 5002 (FRI, PERTH, NSW, AD, K); Type locality, M. I. H. Brooker 5003 (FRI, PERTH, AD, MEL).

Only three small populations of this species are known to us, all along a 10 km stretch of Highway 1 south of Eneabba, and within a few metres of the road. The soil is white sand over laterite with little relief to the topography. The vegetation is closed-heath with isolated patches of *E. johnsoniana* and mallee forms of *E. todtiana* barely emergent amongst dense sclerophyllous shrubbery.

The affinities of this species are not clear, but we here tentatively erect a monotypic sub-series (Johnsonianinae) to be placed between Buprestinae and Marginatinae of the Pryor and Johnson classification (a re-coding of the five series, Preissianae to Acmenoideae, is required to accommodate the dozen or so new taxa of *Monocalyptus* which have been discovered in recent years).

The species is named after Dr. Lawrie Johnson, Director of the Royal Botanic Gardens, Sydney, who has contributed so much over the years to the knowledge of the genus, in particular his enlightening publications of recent years on classification and morphology.

***Eucalyptus georgei* Brooker et Blaxell, sp. nov.** (Figs 3, 6). Pryor and Johnson code SLE:B.

Frutex 'mallee' ad 3 m altus, caulibus laevibus, albis. *Medulla* ramulorum glandulifera.

Folia juvenilia petiolata, non-opposita, ovata ad lanceolata, 6–8 x 2–5 cm. *Folia adulta* petiolata, lanceolata, ad 15 x 6 cm, crassa.

Inflorescentiae axillares, 7-florae. *Pedunculus* ad 3 cm longus, crassus, glaucus. *Alabstra* 11–14 x 6 mm. *Hypanthium* obconicum, c. 7 mm longum. *Operculum* hemisphaericum, 3–4 mm longum. *Filamenta* primum erecta, demum deflexa. *Loculi* 5. *Ovula* 4-seriata.

Fructus campanulati, 12–15 x 9–11 mm, glauci. *Discus* latus, albidus, intro declivis. *Valvae* leviter exsertae. *Semina* rufa, nitentia.

Type: 159 km east of Hyden along the track to Norseman, Western Australia (32° 15'S, 120° 23'E) 3 Oct. 1975, D. F. Blaxell W75/45 (holo: NSW; iso: K, FRI, PERTH).

A whipstick *mallee* to 3 m high with smooth, whitish bark. Pith of branchlets glandular.

Cotyledons reniform. *Juvenile leaves* petiolate, not opposite, ovate to lanceolate, 6–8 x 2–5 cm, becoming intensely glaucous at about the 10th seedling leaf pair. *Adult leaves* petiolate, broadly lanceolate, thick and rigid, to 15 x 6 cm, pale yellow-green, concolorous. *Petioles* and proximal section of mid-rib densely glaucous. *Lateral venation* obscure. *Glands* prominent only on upper surface in dried material. *Young twigs* angular, densely glaucous, reddish brown beneath the waxy coating. *Pith* glandular.

Inflorescences axillary, 7-flowered. *Peduncle* thick, glaucous, up to 3 cm long, 2–3 mm diameter. *Mature buds* 11–14 x 6 mm, glaucous, sessile or with a short, thick pedicel. *Hypanthium* obconical, c. 7 mm long, *Operculum* hemispherical, 3–4 mm long with a short and obscure umbo. *Filaments* at first erect then inflexed. *Anthers* dorsifixed to sub-basifixed, oblong to obovate. *Locules* 5. *Ovules* in 4 vertical rows.

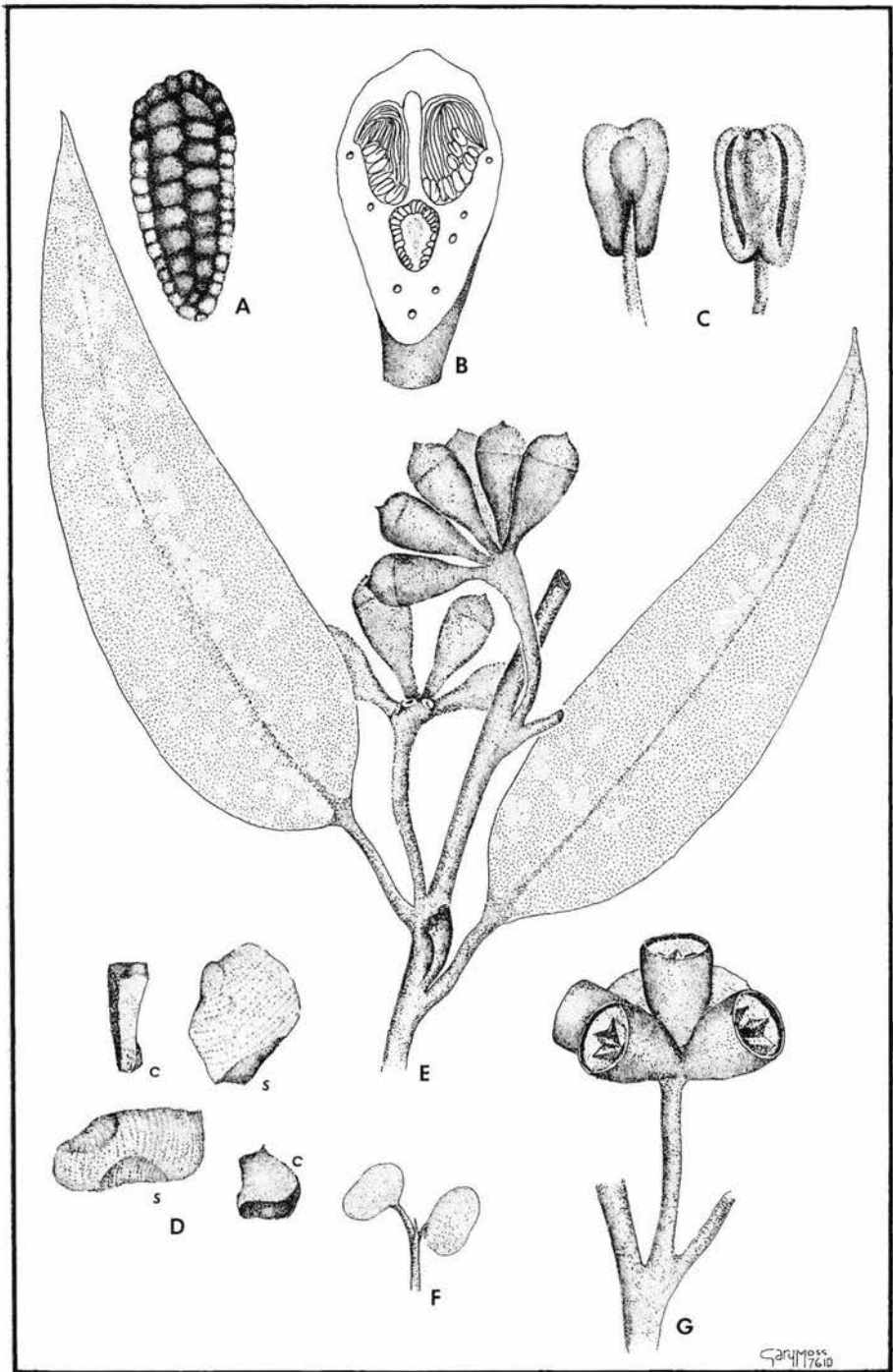


Figure 3—*Eucalyptus georgei* sp. nov. A—Ovules, x 10. B—Bud section, x 4. C—Anthers x 25. D—Seed (s) and chaff (c), x 10. E—Adult leaves and buds, x 1. F—Cotyledons, x 2. G—Fruit, x 1.

From MIHB 4989.

Fruit campanulate to almost cylindrical, densely glaucous, 12–15 x 9–11 mm, with a short, thick pedicel c. 2 x 2 mm. *Disc* broad, whitish, sloping inwards. *Valves* slightly exerted. *Seed* irregular, shining reddish brown, shallowly reticulate. *Chaff* cuboid and subulate, yellow and brown.

Distribution: Western Australia: between Hyden and Norseman, just north of the Johnston Lakes.

Other Collections: east of Mt Holland, July 1930, C. A. Gardner s.n. (PERTH, FRI); 315 mile peg Hyden—Norseman road, 26 Oct. 1964, J. S. Beard 3849 (NSW); Mt Holland area, 16 Aug. 1966, A. Kessell 408 (PERTH, NSW); 315–332 mile peg on Hyden—Norseman track, 16 Aug. 1966, A. Kessell 424 (PERTH, FRI); junction of the Bremer Range road and Hyden track, 4 Feb. 1970, A. Kessell 947 (PERTH, FRI, NSW, K); 159 km east of Hyden on Norseman track, 3 Oct. 1975, M. J. H. Brooker 4989 (FRI, PERTH, NSW, AD); cultivated, Broken Hill, N.S.W., 24 June 1971, R. Gould (NSW).

In the Type locality there are several hundred plants in a relatively small area of c. 1 hectare growing on a lateritic rise, a few metres above the extensive, surrounding sand plains. It forms a pure stand, but with an encircling low open-forest of *E. salubris* and *E. transcontinentalis*. Growing with *E. georgei* are *Triodia scariosa*, *Casuarina* sp. and *Acacia* spp.

This species has been known as 'Hyden Blue Gum' for some time, and although occurring a long way east of Hyden, it seems appropriate to retain this common name.

The natural affinities of *E. georgei* are clear. It belongs in the Pryor & Johnson series DUMOSAE between *E. woodwardii* Maiden and *E. sheathiana* Maiden. The buds and fruit are intermediate in size between these two species and are always glaucous, whereas in *E. sheathiana* this character is variable. It has white flowers, unlike the lemon-coloured filaments of *E. woodwardii*.

The specific epithet honours A. S. George, a botanist at the Western Australian Herbarium, who has a great knowledge of the Western Australian flora, and who has assisted both of us in many ways. We consider it appropriate that Alex have an endemic western species named after him.

Eucalyptus cerasiformis Brooker *et* Blaxell, sp. nov. (Figs 4, 6). Pryor and Johnson code SIF:G.

Frutex 'mallee' ad 3 m altus, caulibus laevibus. *Medulla* ramulorum glandulifera.

Folia juvenilia petiolata, non-opposita, lanceolata, 3–5 x 0.6–1.5 cm. *Folia adulta* petiolata, non-opposita, lanceolata, 6–8 cm x 0.5–1.2 cm, concoloria, glandulis prominentibus.

Inflorescentiae axillares, 7-florae. *Pedunculus* recurvus, 2–3 cm longus, gracilis, teretus. *Alabastra* c. 1 x 0.5 cm. *Hypanthium* urceolatum, 6–7 mm longum. *Operculum* conicum, 3–5 mm longum. *Pedicellus* 10–12 mm longus. *Filamenta* pro parte maxima inflexa. *Loculi* 4–5. *Ovula* ad 8-seriata.

Fructus pedicellati, cylindrico-hemisphaerici, 12–15 mm longi. *Discus* oblique depressus. *Valvae* inclusae.

Type: 164 km (by road) east of Hyden, on track to Norseman, Western Australia (32° 14'S, 120° 25'E) 3 Oct. 1975, D. F. Blaxell W75/51 (holo: NSW; iso: K, FRI, PERTH).

A mallee to 3 m high, with smooth, mottled, grey bark; young branches brown. *Pith* of branchlets glandular.

Cotyledons bisected. *Juvenile leaves* petiolate, not opposite, lanceolate, 3–5 x 0.6–1.5 cm. *Adult leaves* petiolate, not opposite, narrowly lanceolate, 6–8 cm x 5–12 mm, yellow-green, concolorous, uncinata. *Petiole* c. 1 cm long, terete, yellow-brown. *Mid-vein*, intramarginal vein and major lateral veins pale yellow-green. *Glands* prominent on both surfaces.

Inflorescences axillary, 7-flowered. *Peduncle* recurved, 2–3 cm long, slender, terete. *Buds* c. 1 x 0.5 cm. *Hypanthium* urceolate, 6–7 mm long.

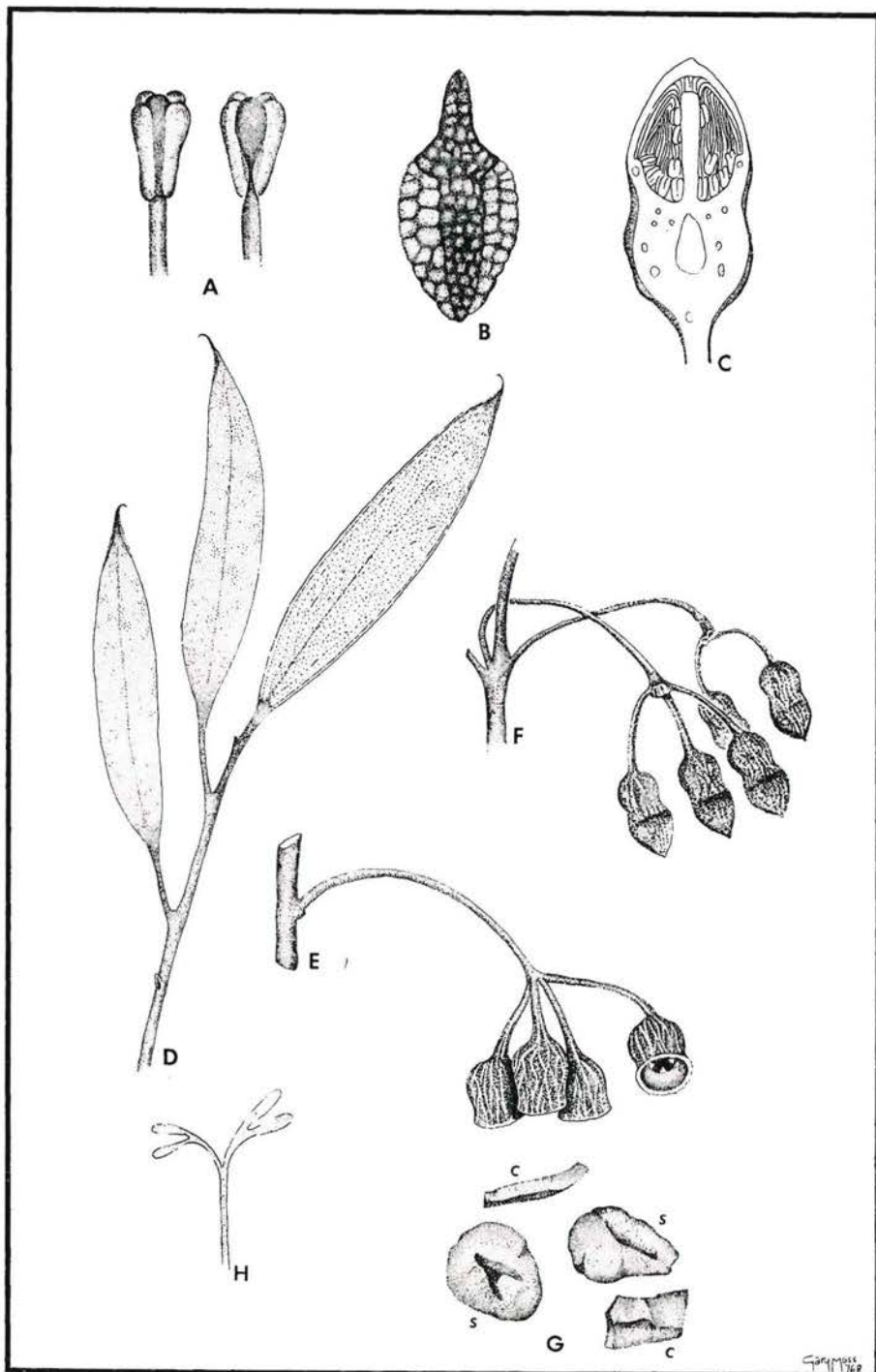


Figure 4—*Eucalyptus cerasiformis* sp. nov. A—Anthers, x 15. B—Ovules, x 10. C—Bud section, x 4. D—Adult leaves, x 1. E—Fruit, x 1. F—Buds, x 1-5. G—Seed (s) and chaff (c), x 20. H—Cotyledons, x 2.

From MIHB 4990.

Operculum conical, 3–5 mm long, brown or yellow-brown, contrasting with the green hypanthium. *Pedicel* terete, 10–12 mm long. *Stamens* yellow, most filaments inflexed in bud. *Anthers* dorsifixed, oblong to obovate. *Locules* 4–5. *Ovules* in 6–8 vertical rows.

Fruit pedicellate, cylindrical to hemispherical, slightly urceolate when immature, 12–15 mm long. *Disc* obliquely depressed. *Valves* depressed.

Seed ovoid, brown, with a shallow reticulum. *Chaff* cuboid, brown.

Distribution: Western Australia: between Hyden and Norseman, just north of the Johnston Lakes.

Other collections: 318 mile peg on Hyden–Norseman track, 8 Feb. 1967 *A. Kessell* 545 (PERTH, FRI, NSW, K); same locality, 3 Oct. 1975, *D. F. Blaxell* W75/51a (NSW), *M. I. H. Brooker* 4990 (FRI, PERTH, NSW, K, AD), *M. I. H. Brooker* 4991 (FRI, PERTH, NSW, AD, MEL).

We know of only one population of this species. It occurs in low open-forest on a reddish loamy soil in association with *E. redunca* and *E. salubris*. It does not seem to occur on the yellow or white sands which are more extensive in the region. The specific epithet is derived from 'cerasus' (Latin: cherry) in allusion to the 'bunch of cherries' appearance of the pendent inflorescences.

The affinities of *E. cerasiformis* are clear. It belongs in the series ERYTHRONEMAE of Pryor & Johnson and is close to *E. dielsii* C. A. Gardn. from which it is distinct in the smaller buds and fruit, fruit shape and particularly the absence of a flared rim to the fruit.

Eucalyptus gittinsii Brooker *et* Blaxell, sp. nov. (Figs 5, 6). Pryor and Johnson code EAAAG.

Frutex 'mallee' ad 5 m altus, caulibus laevibus. *Medulla* ramulorum glandulifera.

Folia juvenilia petiolata, non-opposita, ovata, 4–8 x 2–4 cm. *Folia adulta* lanceolata, ad 15 x 3 cm.

Inflorescentiae axillares 3-florae. *Pedunculus* c. 1 cm longus. *Alabastra* c. 1 x 0.5 cm, quadrangulata. *Operculum* c. 2 mm longum. *Pedicellus* 0.5–1 cm longus. *Filamenta* stamininum 4-aggregata. *Loculi* 3 (4).

Fructus pedicellati, quadrangulati, 1.5–2 x 1 cm. *Discus* latus, verticaliter depressus. *Valvae* inclusae.

Type: 67 km south of 'Billabong Roadhouse', Wannoo, Highway 1, Western Australia (27° 30'S, 114° 45'E) 9 Oct. 1975, *D. F. Blaxell* W75/113 (holo: NSW; iso: K, FRI, PERTH).

A mallee to 5 m tall with a small stocking of peeling rough bark, smooth grey-brown bark above. *Pith* of branchlets glandular.

Cotyledons ovate. *Juvenile leaves* petiolate, not opposite, ovate to elliptical, 4–8 x 2–4 cm, grey-green, densely pilose when young. *Petioles* and *internodes* also densely pilose with trichomes of the 'r(E)' type (Johnson 1972). *Adult leaves* petiolate (1–2 cm long), not opposite, lanceolate, concolorous, to c. 15 x 3 cm; lateral and intra-marginal veins prominent and yellowish in both fresh and dried material. *Glands* not prominent in dried leaves. *Young twigs* and *petioles* markedly angular and also yellowish.

Inflorescences axillary, 3-flowered. *Peduncle* c. 1 cm long, angular. *Buds* c. 1 x 0.5 cm, quadrangular; operculum c. 2 mm long, pyramidal. *Pedicel* 0.5–1 cm long, terete-angular, increasing in diameter distally. *Staminal filaments* in four groups, obliquely erect then deflexed radially with most anthers pendent in bud. *Anthers* dorsifixed, oblong to ovoid, opening in longitudinal slits. *Style* short, slender. *Locules* 3 (4). *Ovules* in 4 vertical rows.

Fruit pedicellate, markedly quadrangular, 1.5–2 x 1 cm; calyx remnants small, persistent. *Disc* broad, vertically depressed. *Valves* 3, deeply recessed.

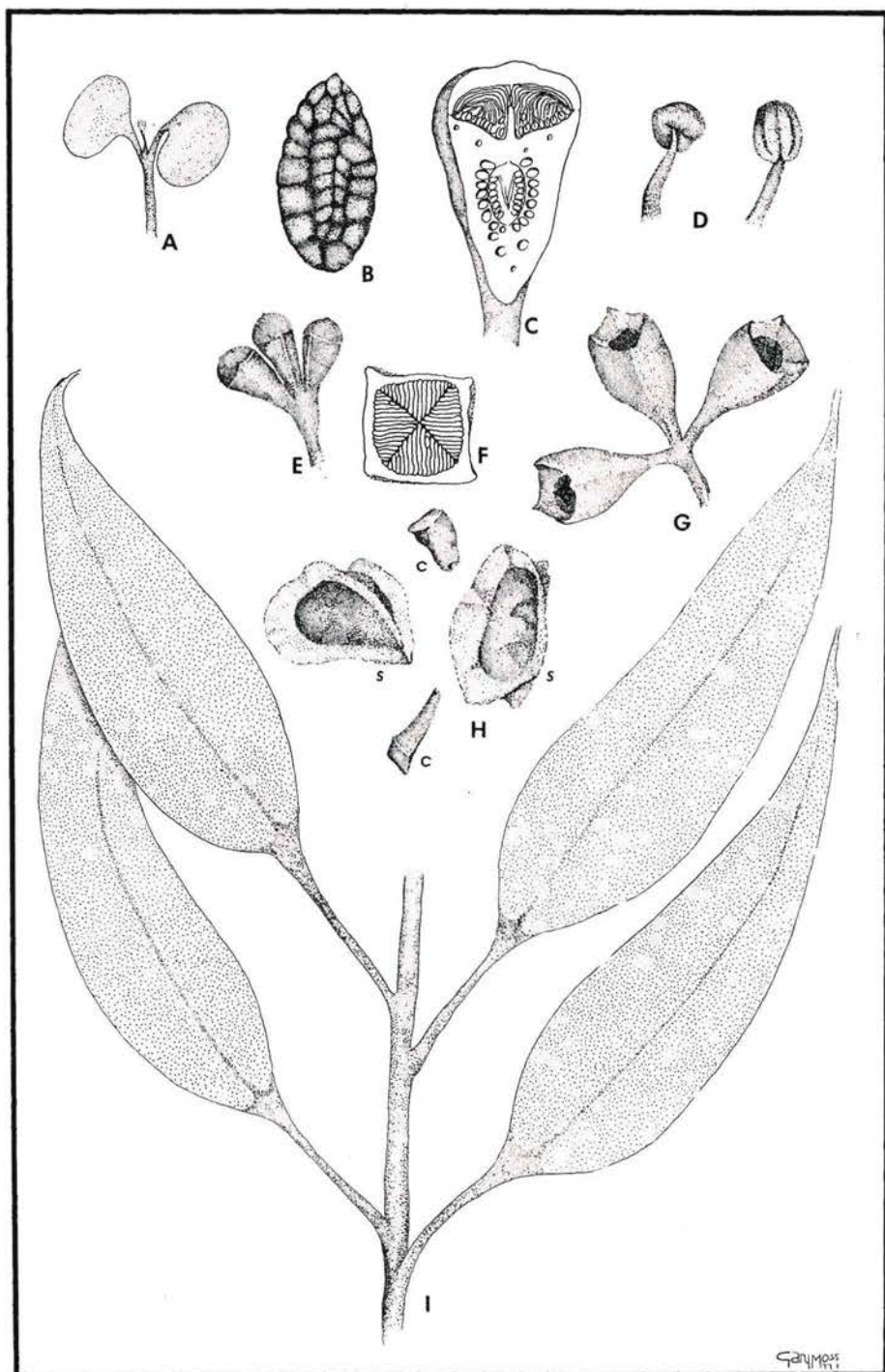


Figure 5—*Eucalyptus gittinsii* sp. nov. A—Cotyledons, x 2. B—Ovules, x 10. C—Bud section, x 4. D—Anthers, x 20. E—Buds, x 1. F—Filament arrangement seen from above with operculum cut away, x 4. G—Fruit, x 1. H—Seed (s) and chaff (c), x 7. I—Adult leaves, x 1.

From MIHB 5022 except buds (MIHB 2391).

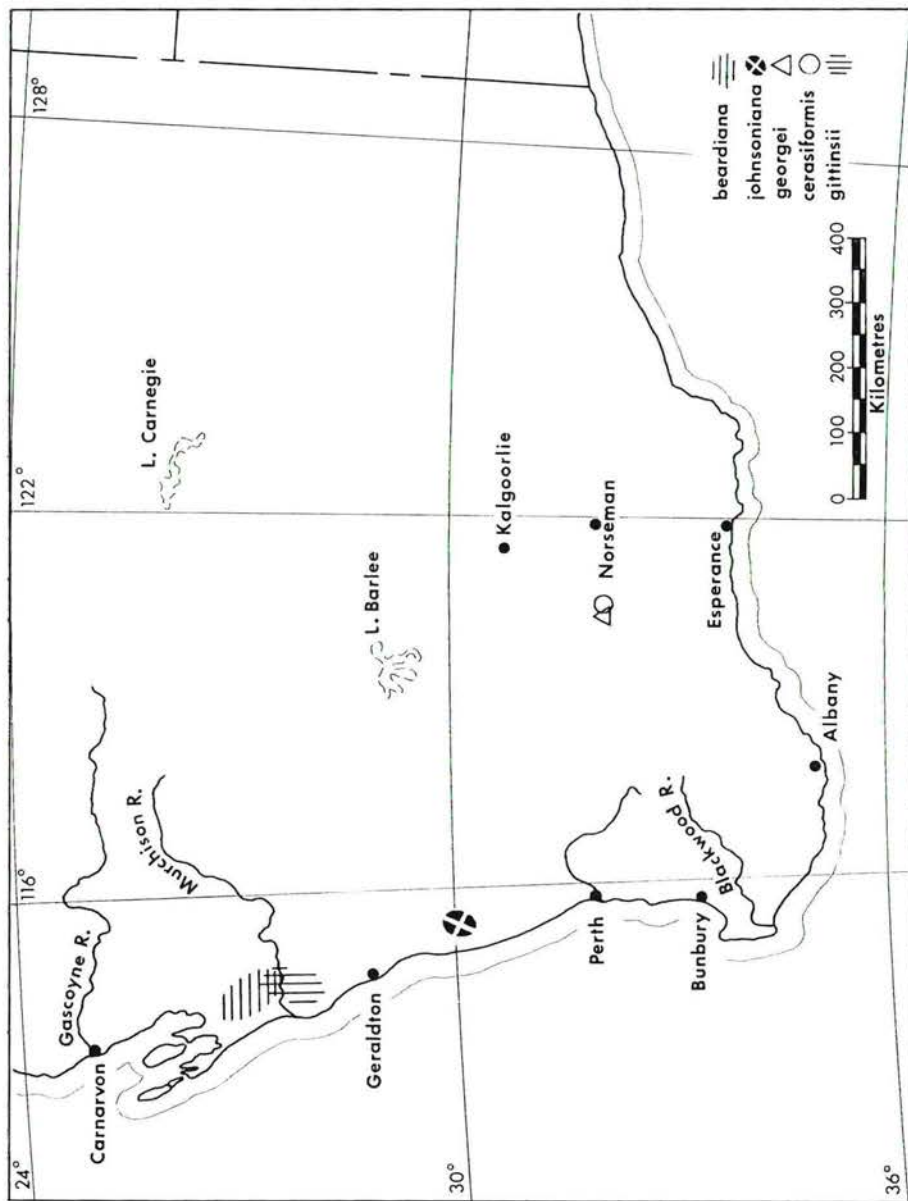


Figure 6—Distribution of *Eucalyptus beardiana* sp. nov., *E. johnsoniana* sp. nov., *E. georgei* sp. nov., *E. cerasiformis* sp. nov. and *E. gittinsii* sp. nov.

Seed pyramidal, black, smooth on the dorsal side with ribs ascending to the hilum on the ventral side; prominent hyaline wings around the edge. Chaff cuboid, black or red-brown, glistening, shallowly reticulate.

Distribution: Western Australia: north of Geraldton (on yellow sand country) and south of Shark Bay.

Other collections: 65.6 km (41 miles) south of Wannoo Roadhouse, Aug. 1967, C. H. Gittins 1562 (NSW); 69.6 km (43.5 miles) south of Wannoo, 17 Sept. 1968, M. E. Phillips, CBG 036807 (FRI); c. 40 km (25 miles) from main road on road to Kalbarri township, 9 Jan. 1970,

M. I. H. Brooker 2391 (PERTH, NSW, FRI); 413 mile peg on NW Coastal Highway c. 48 km (c. 30 miles) north of Murchison River crossing (27° 24'S, 114° 39'E), 21 Aug. 1973, *M. D. Tindale* 2742 (NSW); 65 km south of Wannoo on Highway 1, 9 Oct. 1975, *M. I. H. Brooker* 5022 (FRI, PERTH, AD); 71 km south of Wannoo, Northwest Coastal Highway, north of Geraldton, 9 Oct. 1975, *D. F. Blaxell* W75/118 (NSW, PERTH).

This is a relatively common species, at least on the yellow sand plain and sand-dune country south of Shark Bay to just south of the Murchison River. The vegetation formation is low open-woodland and associated species are *Eucalyptus jucunda*, *Actinostrobos arenarius* and *Banksia sceptrum*.

The affinities of *E. gittinsii* are clearly with *E. eudesmioides* F. Muell. on seedling characters alone. Adult specimens exhibit some characteristics of *E. odontocarpa* F. Muell., but the presence of 'stellate' trichomes on seedlings of both *E. gittinsii* and *E. eudesmioides* and their absence on *E. odontocarpa* confirms our placement of it next to *E. eudesmioides* in the Pryor and Johnson classification.

The species is named after its first collector (at least, to our knowledge), C. H. Gittins, a retired engineer from Epping in Sydney, who has visited many out-of-the-way regions of Australia over the past ten years or so, and who has carefully and meticulously collected many specimens for the National Herbarium of New South Wales and other institutions.

Acknowledgements

We wish to thank Dr J. S. Beard and Mr A. S. George for their help in many ways relating to field collections, checking material etc., Mr G. Moss for the illustrations and map; and Mr J. Turner for growing the seedlings.

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***Ptilotus tetrandrus* Benl sp. nov. (Amaranthaceae)**

By G. Benl, F.L.S.†

Abstract

A new species of *Ptilotus*, *P. tetrandrus* Benl, is described from Western Australia. The type specimen is illustrated and the resemblance to other taxa is discussed.

***Ptilotus tetrandrus* Benl sp. nov. (Figures 1 and 2)**

Diagnosis. Ab omnibus *Ptilotis* adhuc notis staminibus regulariter 4 fertilibus diversus; staminodio uno minimo, pseudostaminodiis nullis.

Distinguished from all previously known species of *Ptilotus* by having 4 stamens; staminodium 1, very small; pseudostaminodia none.

Descriptio. *Herba annua* tenera. *Caules* in speciminibus examinatis singuli, sordidi-virides, 17–28cm longi (inflorescentia interrupta inclusa) et 1.2–2mm diametro, graciles, erecti vel curvati-erecti, angulati-striati, partim sulcati, basim versus lignescens; juveniles puberuli, pilis albidis subrectis vel crispis, nodosi- sive denticulati-articulatis (partim brevissime verticillati-ramosis), 0.5–1.2mm longis; adulti leviter induti, pubescentia tandem ad partes superiores et in axillis foliorum restricta; primo indivisi vel pauciramosi, ramis lateralibus erectis ad 15cm longis (spica inclusa), postea nonnullis pedunculis brevibus floriferis villosis ex axillis orientibus. *Caules* et rami in pedunculum et rhachidem villosam spicarum transcentes; in speciminibus exstantibus parce foliati.

Folia alterna 1.3 ad ca 5cm distantia, plus minusve decurrentia, laminis integris basi petioli-formi gradatim in petiolum indistinctum ad 1cm longum attenuatis, oblongi-lanceolatis vel elongati-ellipticis, ad 3.5:0.4cm longis latisque, obscure viridibus, in apice acutis brevissime mucronatis (mucrone 0.2–0.4mm) nervo medio fusciscente subtus vix prominente; summa in bracteas quasi transeuntia. Ex axillis ramuli floriferi dense villosi haud raro oriri solent.

Inflorescentiae elongati-spicatae: spicae singulae terminales haud spectabiles primo rubiginosae dein pallide viriduli-stramineae ad 10–15cm et ultra longae et 0.8cm diametro, apice excepto remotiflorae (Fig. 1A). *Rhachis* villosa eadem longitudine, pilis (sicut in caulibus) inter flores conspicuis induta.

Flores ca 20 ad 40, superiores densius conferti, inferiores paulum majores dissiti usque ad 1.4cm (raro longius) distantes. *Bractea bracteolaeque* scariosae, nitidae, glaberrimae, inaequiformes: *Bractea* (Fig. 1B) rigidiuscula, ovati-lanceolata, 3–3.8mm longa et 1.6–2.2mm lata, dilute succinea, costam et basim versus (atri-)fusca, acuminata, integerrima. *Bracteolae* (Fig. 1C) cordati-orbitulares ventricosae, breviores (2–2.6mm) at latiores (2–2.8mm), incoloratae hyalinae, apicem obtusatum versus minute sed distincte erosi-denticulatae, vix apiculatae.

Perianthium (rigidi-)erectum, tepalis divergentibus campanulati-patens, basi constricta indurata in tubum angustum brevem (1–1.5mm) -extus pilis strictis dense obiectum-coalitum.

Tepala ± distincte trinervia (Fig. 1D) -nervis lateralibus haud totam areolam medianam impellucidam includentibus-, bicolorata: primo subaequaliter rufescentia, dein areolis incrassatis viridi-flavescentibus (tandem olivacei-brunneis) et marginibus limbatis (basi excepta) membranaceis nitentibus demum incoloratis; marginibus inferne pilis subrectis (numquam crispis) obsessis, superne in apicem nudum integrum acutiusculum haud raro incisum (visu emarginatum) transeuntibus. *Tepala* intus glaberrima, extus pilosa, pilis niveis rigidis (denticulati-)nodosis ad 2mm longis, praecipue dimidio inferiori areolae orientibus, apicem haud attingentibus, subaequiformia: 2 exteriora elongati-linearia 4.5x0.8–1.0mm, in floribus imis solitariis ca 6.5x1.2mm; 3 interiora (Fig. 1D) subelliptica 3.5–4.2x1mm, in floribus imis solitariis ca 5.5x1.3mm.

Stamina 4 (Fig. 1E) fertilia aequalia, uno abortivo ad lacinulam minimam reducto; basi in cupulam vix 0.8mm altam tubo perianthii arcte insidentem connata, anulo libero parvo 0.2–0.25mm alto, glaberrimo vel extus minute fimbriato, in margine minutissime eroso, ciliolato; squamulis intrastamineis nullis.

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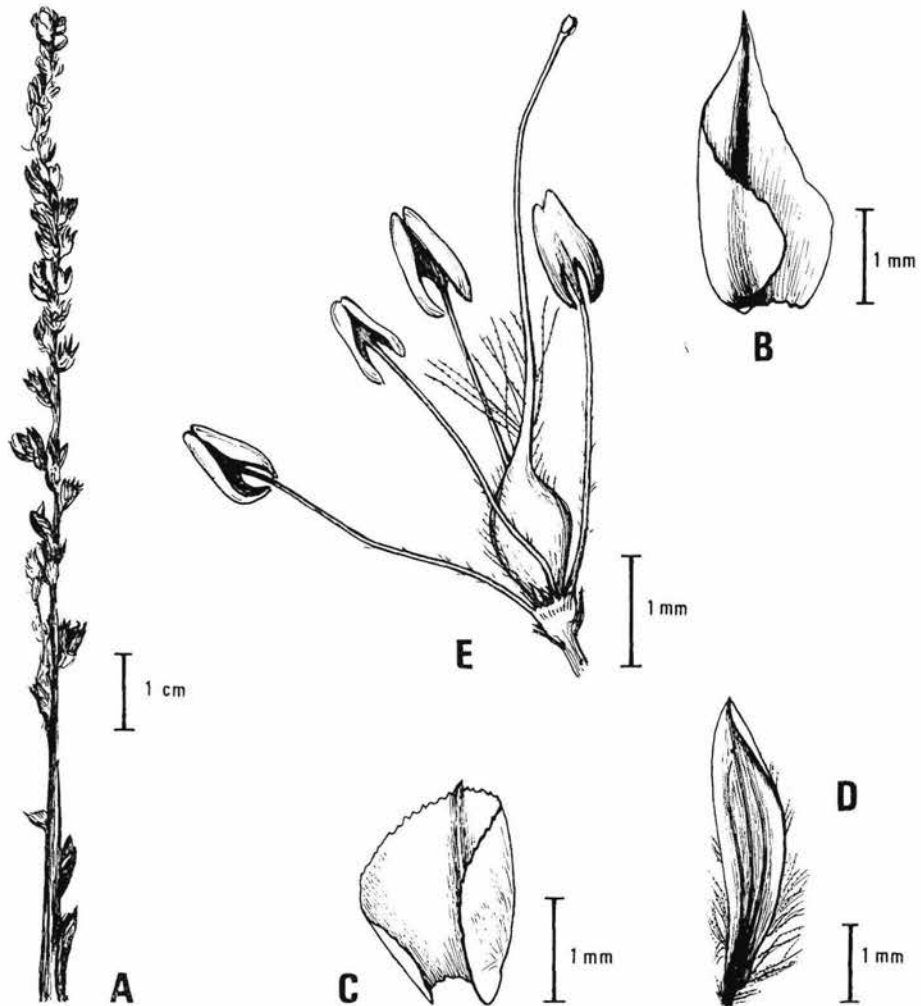


Figure 1. *Ptilotus tetrandrus* Benl. A—Terminal portion of plant, B—Bract, inner face, C—Bracteole, inner face, D—Inner tepal, inner view, E—Androecium and gynoecium.

Filamenta angusti-taeniata 1.5–2.8mm longa, per totam longitudinem aequilata (ca 0.1mm), supra cupulam haud dilatata; juvenilia usque ad antheras pilosa, demum (sub)glabra.

Antherae fulvae longi-ellipsoideae ca 0.8mm longae et 0.3mm latae, basi bilobae.

Ovarium (Fig. 1E) asymmetricum primo complanati-subclavatum dein subglobosum, ad 1.6 (in imis floribus 2.2)mm longum, ad 0.9mm latum, haud stipitatum; in dimidio superiore bilateraliter pilis rectis minimis vel ad 1mm longis obsessum. *Stylus* modice excentricus juvenilis curvatus postea (sub)erectus, ad 3.5mm longus; pubescentia ovarii in stylum transiens. *Stigma* inconspicuum.

Holotype of species: Near Carslakes Well, Glenorn Station, Western Australia; R. B. Hacker no 97, 2 Oct. 1974—PERTH.

Habitat. The species was among “profuse annual flora which established following the 1968–73 drought”, in loamy sand in mulga (*Acacia aneura*).

Material. The description is from the holotype (Fig. 2), a sheet containing six stems with mature spikes, but devoid of stem-bases.

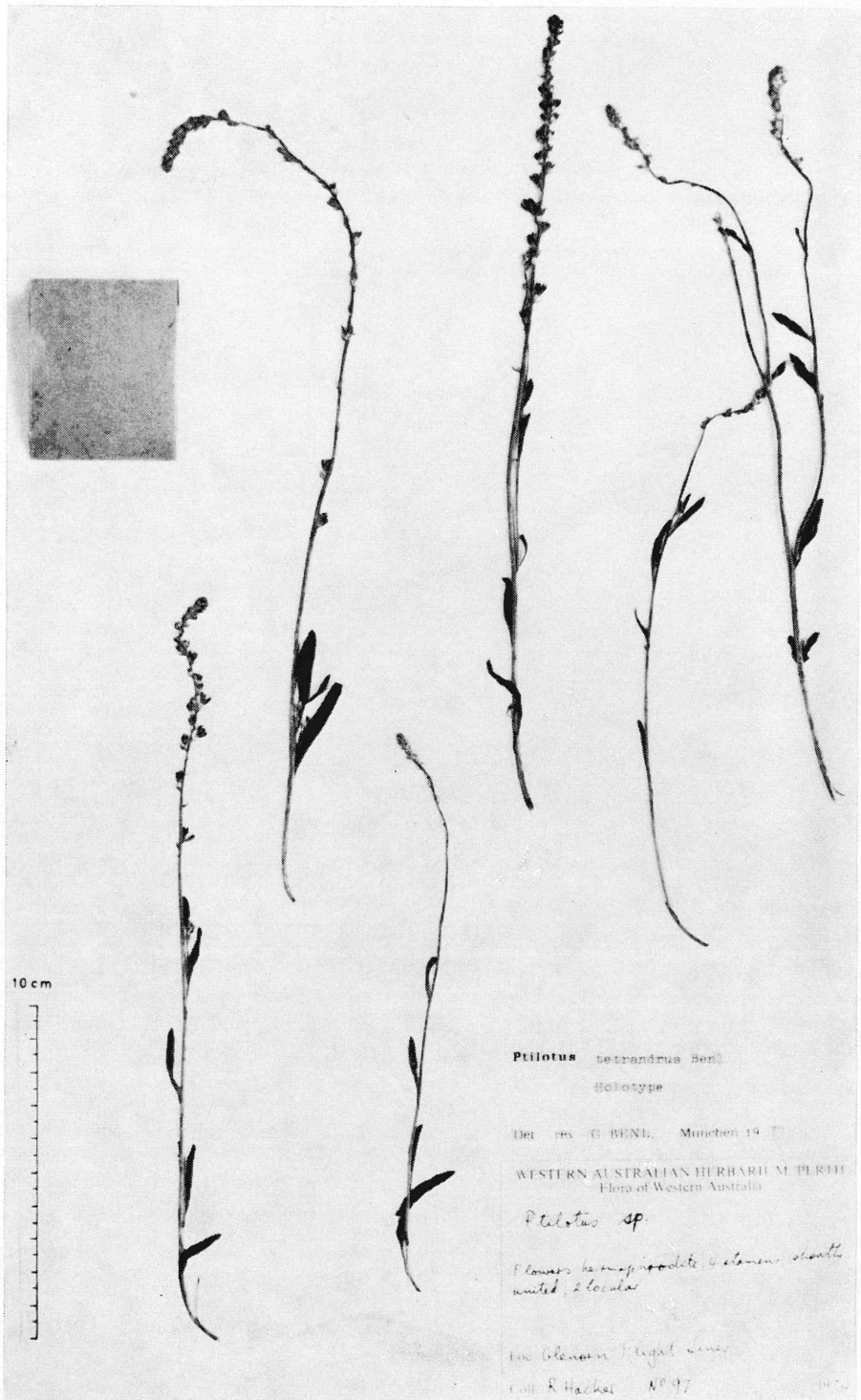


Figure 2. *Pilotus tetrandrus* Benl. Holotype sheet.

Coll. R. B. Hacker No. 97, 2 October, 1974, near Carslakes Well, Glenorn Station, Western Australia. PERTH. (new data supplied by Mr. Hacker after the photograph was taken)

Discussion. There are only a few species within the genus with an inflorescence consisting of conspicuously remote flowers. Interrupted spikes are known so far in

(a) *P. dissitiflorus* (F. Muell.) F. Muell., in which 10–15 solitary flowers form a spike up to 15cm long and 4cm broad, terminating the branches. Tepals will attain lengths of about 2cm; in both var. *dissitiflorus* and var. *longifolius* Benl., crisped woolly hairs occur inside the inner tepals. The species is known from N.T. and Qld., respectively.

(b) *P. remotiflorus* Benl from Queensland, a much-branched undershrub (ca 30cm in height) with tiny leaves. The tepals are up to 11mm in length, the inner ones again with a woolly beard. This species is unique for its peculiar pubescence in the vegetative parts, consisting of various kinds of trichomes (see Mitt. Bot. München 12:337, Fig. a, 1976).

(c) *P. distans* (R.Br.) Poiret, another perennial with very narrow-linear leaves. Here the tepals (up to 1.5cm long) do not form a tube at their base but are free, and the filaments are united below to a free staminal cup with a fringed margin. There is some faint resemblance of *P. distans* (from W.A., N.T., Qld., N.S.W.) to the new western species as to the glabrous bracts and bracteoles, to the hairless inner side of the tepals, to the pilose juvenile filaments etc. However, apart from the differences just indicated, *P. tetrandrus* is characterized by its number of stamens being constantly four, a significant feature not observed in the genus until now and readily distinguishing the present taxon from any previously described species, thus requiring special recognition.

Notes on the genus *Pandanus* (Pandanaceae) in Western Australia

By Benjamin C. Stone*

Abstract

The genus *Pandanus* in Western Australia is known so far to occur only in the northern sector, in the Kimberley District, south to about 18° lat. Only one subgenus, Subg. *Pandanus*, is represented, but there are two distinct Sections, and possibly three, Sect. *Pandanus* (possibly), Sect. *Austrokeura* (herein raised to sectional rank from that of subsection), and Sect. *Semikeura*. The classification of species, especially in Sect. *Austrokeura*, is not as yet satisfactory. The occurrence of *P. spiralis* is documented, and a review of the species most similar to it included, resulting in some new synonyms and new combinations at infraspecific rank. Two new varieties (var. *flammeus*, var. *multimammillatus*) are proposed. The variability of this species is discussed in relation to previously known and newly obtained specimens from both Western Australia and the Northern Territory. Three other species of subg. *Pandanus*, *P. darwinensis*, *P. obblatus* and *P. semiarmatus*, are also reported. Finally a new suite of collections of *P. aquaticus* (syn. *P. kimberleyanus*) is reported.

Introduction

Knowledge of *Pandanus* in Australia goes back a long way, to the exploratory activity of Robert Brown. Brown described only two species, *P. spiralis* and *P. pedunculatus*, in his "Prodromus Florae Novae Hollandiae et Insulae van Diemen" published in 1810. Brown's collections were studied recently by H. St. John, who published an account of these (St. John, 1968). According to St. John, Brown's collection no. 5799 was a mixture, and he selected as lectotype a portion of this gathering to typify *P. spiralis*; the material (one fruit phalange only) is illustrated in his fig. 267. Also assigned to the species but not considered to be part of the lectotype was a staminate specimen. This is correct, as all pandans are dioecious. Two phalanges were excluded from the three which made up the type materials of *P. spiralis*, and served as type (holotype) for St. John's new species *Pandanus brownii*; these phalanges are illustrated in his fig. 270. The lectotype of *P. spiralis* was obtained by Brown in the Gulf of Carpentaria on Allen Island, Wellesley Group (called by Brown "Island C"). The staminate inflorescence came from the same locality. The phalanges discriminated as *P. brownii* have an unknown provenience (except that they are assuredly from Brown's Australian travels). It cannot be assumed that they came from Allen Island, nor can it be proved that they did not.

Brown's second species was *P. pedunculatus*; this has good locality data, showing that it was collected at the north end of Great Sandy Island (now Fraser Island) off the E. coast of Queensland. The lectotype, also in the British Museum, was collected on 31 July 1802, and is given the number 5799A. This species, which in the opinion of Domin was a variety of *Pandanus tectorius*, and in this writer's opinion is certainly part of the *P. tectorius* complex, has never been found in Western Australia; it is common however along the Queensland coast, especially on the offshore islands. It is known currently under a large number of different names, but that subject is dealt with elsewhere.

Further contributions to the knowledge of Australian Pandanaceae, especially *Pandanus*, have come from Martelli and more recently from St. John and Stone. Some of these contributions have dealt with collections

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made in the Northern Territory (St. John, 1962c), and several with Queensland material, but only one specifically refers to *Pandanus* in Western Australia; this is Part 2 of St. John's Revision of the Genus *Pandanus* (St. John, 1961a). In this paper St. John describes *P. kimberleyanus*, a species now assigned (Stone, 1974) to Section *Semikeura* Stone, and considered to be a synonym of, or at most but weakly distinct from, *P. aquaticus* F. Muell. St. John however also describes *P. convexus*, the type being a collection from Dillens Springs, now Dillon Springs, (Fitzgerald 2394). Other collections referred to the same species are a staminate inflorescence (F. 2394) from the same locality, and an unnumbered collection by W. Hulse from Escape Cliffs, Northern Territory, collected in 1874 or perhaps earlier. Martelli treated these as *P. spiralis* (Martelli, Proc. R. S. Qd. 45 (1933) 24.) St. John stated that *P. convexus* is related to *P. spiralis*, differing in its fewer carpels per phalange and a few other minor features.

In another relevant paper St. John (1962c) reports at length on a number of species, all but one described as new, from the Northern Territory. Although he states (p. 409) that *P. spiralis*, *P. delestangii*, *P. basedowii*, *P. whitei*, and *P. solms-laubachii* had been reported previously from the Northern Territory, he accepts only the records of *P. basedowii*. He therefore considers that *P. spiralis* is limited to its type locality, as mentioned above, which geographically is part of Queensland. Thus the key which St. John provides (p. 409) refers, with the sole exception of *P. basedowii*, only to his new species. It is difficult therefore to perceive the differences which would presumably serve to differentiate *P. spiralis* (sensu stricto) from the several highly similar species he describes.

There is of course no reason to suppose that the neat boundary lines which separate the Northern Territory from Western Australia and from Queensland are biogeographically meaningful. On the other hand, the scattered and local *Pandanus* populations of these regions which, away from the shoreline or the rivers, probably become highly disjunct, are a biogeographic feature of some importance.

Therefore, to discuss *Pandanus* in Western Australia, reference to what is known of the genus in the Northern Territory, and even in Queensland, has to be made. There is no evidence as yet to suggest that Western Australia harbours any unequivocal endemic species in this genus. Those few that have been described are at best weakly distinguished from their relatives and, as will be detailed below, recognition of a number of varieties seems to be the appropriate taxonomic solution at least until much more detailed studies, such as cytology, can be made.

The position of *P. spiralis* in the genus *Pandanus*

In Australia there may be found species representing the following three subgenera and six Sections (Subgenera 1 and 3 occurring only in Queensland):

1. Subg. LOPHOSTIGMA; Section *Maysops*
2. Subg. PANDANUS; Sections *Pandanus*, *Austrokeura*, *Semikeura*, and *Australibrassia*
3. Subg. ACROSTIGMA; Sect. *Acrostigma*.

Of these subgenera, only the second, i.e. Subg. *Pandanus*, occurs in Western Australia and in the Northern Territory. This subgenus, divided into several sections (Stone, 1974) is represented in both Western Australia and the Northern Territory by three Sections, viz. Sect. *Pandanus*, Sect. *Austrokeura* and Sect. *Semikeura*. The riverine species *P. aquaticus* ("P. Kimberleyanus") mentioned

above is the only representative of the typical subsection of this latter Section, while *P. basedowii* is the sole representative of Subsect. *Elaphrocarpus*; but this species has not been found so far outside the Northern Territory.

The character of Sect. *Austrokeura* itself is very distinct, and the chief distinguishing features are (1) rigid, very glaucous leaves, very prickly in juveniles, becoming semi-unarmed or nearly toothless, especially toward the apex, in adults; (2) stoloniferous habit; (3) presence of zonate epidermis and high numbers (i.e. density) of stomata on adaxial leaf surface, equalling the density on the undersurface or nearly so; (4) solitary cephalia. Probably other characters can be added to this list which help to distinguish this Section from Sect. *Pandanus*, in which *P. tectorius* (*P. pedunculatus*) is found.

Within *Pandanus*, Section *Austrokeura* is particularly characteristic of Australia (occurring elsewhere only in Papua, the contiguous southern part of West Irian and some immediately adjacent Moluccan islands). This group, founded on *P. solms-laubachii*, includes *P. spiralis*. Here it is raised to sectional rank.

Genus PANDANUS

Subgenus PANDANUS (sensu Stone, 1974b).

Sect. **Austrokeura** (B. C. Stone) B. C. Stone, *stat. nov.*

(*Pandanus* Sect. *Pandanus* Subsect. *Austrokeura* Stone, Bot. Jahrb. Syst. 94 : 517 (1974) Basionym).

(a) Series **Austrokeura**. Type: *Pandanus solms-laubachii*.

Phalanges laterally conspicuously sulcate, within the cephalium the phalanges interlocked by the groove-and-ridge system formed by these sulci. Phalanges various, from rotund to obovoid or suboblong. Mostly Queensland species, but some probably also in the Northern Territory.

(b) Series **Spirales** Stone, ser. nov.

Carpellis phalangiorum fere esulcatis; phalangibus rotundatis.

Type: *Pandanus spiralis* R. Br.

Mainly Western Australia and the Northern Territory.

This difference is not hard and fast but on the whole seems to reflect two real trends. Using this conception a group of 'forms' appears to cluster round *P. spiralis*. This group also shows these additional phalange characters: (1) broad, rounded shape of the phalange, and (2) the comparatively large number of carpels per phalange.

It becomes evident that the conspicuously ridged-and-grooved phalanges characteristic of Ser. *Austrokeura* are particularly common among Queensland species, becoming scarcer along an east-to-west gradient; while the smoother phalanges of the Ser. *Spirales* are most common in Western Australia and the Northern Territory, but scarce to absent in Queensland, especially eastern North Queensland. However, there are enough exceptions to suggest that there is possibly a "hybrid belt" of forms bridging the W. Queensland—E. Northern Territory populations, and that the ridge-and-groove character has "flowed" in a westerly direction.

The species which would be assigned to these groups are, if one simply followed the classification and species concept of St. John (which I do not accept) (Those marked * appear somewhat intermediate between the two series):

Ser. *Austrokeura*: *P. dammannii* Martelli, *P. arnhemensis* St. John, *P. citraceus* St. John, *P. cookii* Martelli, *P. angulatus* St. John, *P. australiensis* St. John, *P. truncatus* St. John, *P. ferrimontanus* St. John, *P. endeavourensis* St. John, *P. subinermis* St. John, **P. darwinensis* St. John, *P. orbicularis* St. John, *P. exarmatus* St. John, *P. pluriangulatus* St. John, *P. punctatus* St. John, *P. stolonifer* St. John, *P. latifructus* St. John, *P. papillosus* St. John, *P. mossmanicus* St. John, *P. radicifer* St. John, *P. kurandaensis* St. John, and *P. rivularis* St. John. Also, *P. brassii* Merr. & Perry of Papua belongs here, and probably *P. ananas* Martelli of Timor.

Ser. *Spirales*: *P. spiralis* R. Br., *P. integer* St. John, *P. convexus* St. John, **P. thermalis* St. John, *P. oblatu*s St. John, *P. somersetensis* St. John, *P. semiarmatus* St. John.

Variability in *P. spiralis*

The very heading here underlines the assumption that forms the argument of this paper; that is, that *P. spiralis* is a variable species, not a local endemic restricted to Allen Island in the Gulf of Carpentaria. The proponent of this second view, St. John, naturally concludes that pandans which strongly resemble, but do not actually match, Brown's specimen (lectotype) of *P. spiralis*, must be assigned to other (usually undescribed) species.

However, the significant question is: wherein does the variability lie? Brown's type specimen being fragmentary, there is really only the fruit to consider, and this is represented only by two phalanges—hardly enough to enable one to form any notion of variability in an individual, let alone a species.

Study of a considerable amount of material of *Pandanus* has shown that there are many kinds of variation to be found among fruits or phalanges from the same plant, and from different plants of the same species. This has been dealt with at length in previous reports (Stone, 1967a, 1967b, 1976) and need not be repeated here. Suffice it to say that some kinds of variation obviously are unsuitable for discriminating species; juvenile characters, features of unfertilized fruits or unripe material, shrinkage in drying, etc., all these must be eliminated. Such variability as remains is then worth serious consideration. However, structures other than fruits must be examined as well; foliage differences do exist between species, and even staminate characters may be of use. Among the Australian species, the whole of Sect. *Austrokeura* is however characterized by a very stereotyped leaf form, and so far, no good characters sufficient to differentiate species have been found in the leaves. So, also, the staminate inflorescences; they are inherently exceedingly similar. If differences exist, they are liable to be subtle, statistical, and ephemeral. Of necessity we fall back on fruits as taxonomic markers. On this basis, almost exclusively, St. John has proposed more than two dozen species in Sect. *Austrokeura*. In this paper however attention will be focussed on those which I have assigned to Ser. *Spirales* and to the apparently intermediate *P. darwinensis*; and it is the intent here to show how and why I prefer to regard *P. spiralis* as a complex species which, for convenience, as much as to facilitate discussion and study, is deemed to consist of several subordinate taxa here called varieties. Some of these may prove to be subspecies, in the stricter biological sense, but others may be ephemeral taxa; hence the decision to use the category *varietas* (see Stone, 1976).

P. spiralis, its varieties and related species

The main variations in phalanges of *P. spiralis* and its nearest relatives involve the following characters:

- (1) Number of carpels per phalange (see Stone, 1967)

- (2) Size of phalange, particularly length
- (3) "Rotundity" versus "complanation" of the phalange apex
- (4) Relative convexity of each component carpal apex
- (5) Presence or absence of lateral sulci (in extreme cases forming a dense series of longitudinal ridges and grooves)
- (6) Size of stigmata

Chiefly using these characters, St. John has discriminated three species (*P. convexus*, *P. integer*, *P. thermalis*), which were considered as close relatives of *P. spiralis*, but which here are regarded as subordinate taxa of that species. St. John in his original diagnoses often indicates a "closest relative" but this seems to be based chiefly on the position of such taxa in his unpublished keys to species. These species, and seven others which on morphological grounds and geographical distribution are thought also to be implicated, with the indicated 'closest relative' according to St. John, are:

- P. convexus* St. John, 1961: "Closest Relative": *P. spiralis*
- P. integer* St. John, 1962: "Closest Relative": *P. convexus*
- P. thermalis* St. John, 1962: "Closest Relative": *P. latifructus*
- P. latifructus* St. John, 1962: "Closest Relative": *P. medialinermis*
- P. medialinermis* St. John, 1962: "Closest Relative": *P. somersetensis*
- P. somersetensis* St. John, 1961: "Closest Relative": Not indicated
- P. darwinensis* St. John, 1962: "Closest Relative": *P. whitei*
- P. arnhemensis* St. John, 1962: "Closest Relative": *P. truncatus*
- P. truncatus* St. John, 1961: "Closest Relative": *P. brookei*

From this sequence it may be seen that a series of forms may be deduced, *convexus—spiralis—integer*; then another series, *thermalis—latifructus—medialinermis—somesetensis*; then a pair, *darwinensis—whitei*; and then another short series, *arnhemensis—truncatus—brookei*. It is a standard feature of the taxonomic papers of Dr. St. John to state such a "closest relative", but it is disputable whether it is correct to assume that a species has always and only one close relative. In any case the sequences noted are instructive. If reference is made (prev. page) to the species listed under each of the newly proposed Series, it is seen that the species of the first sequence (*convexus—spiralis—integer*) have phalanges with smooth faces and no ridge-and-groove system; the species of the second sequence (*thermalis—latifructus—medialinermis—somesetensis*) are mixed with respect to the ridge-and-groove character, *somesetensis* and *thermalis* lacking the system (*thermalis* possesses perhaps a very weak expression of this character), while *latifructus* and *medialinermis* show the character strongly developed; *darwinensis* and *whitei* both show the character; and in the last sequence, *arnhemensis* and *truncatus* strongly show the ridge-and-groove system, but *brookei* lacks it entirely.

To these facts must be added the point that as far as can be determined, *P. brookei* is extremely similar (= closely related?) to *P. somersetensis*, a relationship not indicated by St. John. I do not consider that *P. truncatus* should be considered as a close relative of *P. brookei*, nor do I accept *P. somersetensis* as a close relative of *P. medialinermis*. (The latter in fact is most likely a synonym of *P. dammannii* Warb.). Furthermore I would consider *P. truncatus* as a synonym of *P. whitei* Martelli; this taxonomic interpretation would then link the isolated pair, *darwinensis—whitei*, with the final sequence, where we may substitute *whitei* for *truncatus*, all these species then linking into a single sequence *darwinensis—whitei—arnhemensis*.

On the basis of the ridge-and-groove character, *P. thermalis* links more readily with the *spiralis* group, and we may postulate the sequence *convexus—spiralis—integer—thermalis*.

Having thus removed both *P. thermalis* and *P. somersetensis* from the second sequence, and added *P. dammannii* (to replace its synonym *P. medial-inermis*), only a pair remains: *latifructus—dammannii*. However, it is now evident that *P. dammannii* is similar to *P. arnhemensis*; hence we may form a linkage with the last sequence, which would now be *darwinensis—whitei—arnhemensis—dammannii—latifructus*.

Reviewing the situation we now see only two sequences:

- (1) *P. convexus—P. spiralis—P. integer—P. thermalis*;
and
- (2) *P. darwinensis—P. whitei—P. arnhemensis—P. dammannii—P. latifructus*.

The first of these corresponds to Ser. *Spirales*, the second to Ser. *Austrokeura*. The distinctiveness of the two Series is partly threatened by *P. darwinensis*, which has a strong ridge-and-groove system, but has large, rotund phalanges with a fairly high (11–13) number of carpels per phalange, approaching *P. spiralis*; and by *P. thermalis*, which has a weakly developed ridge-and-groove system but otherwise rather smooth phalange faces, large rotund phalanges, and a moderate number of carpels per phalange (9–11), thus also approaching *P. spiralis*.

In other words, it is possible to view *P. thermalis* and *P. darwinensis* as a linked pair; to do so would necessarily link the two sequences, or Series, as indicated above.

Does this not then make ineffectual the distinction between Series *Spirales* and Ser. *Austrokeura*?

I do not think so, and this is because the distributional and geographic data support the distinction. If the two Series are not completely separate, it is because there is a distributional continuity across the northern tropical region of Australia. It remains a useful distinction, although it may only be an expendable taxonomic tool, as long as a multiplicity of species in these Series is accepted. It affords recognition to the probability that species characters (better to say phalange characters) are subject to reassortment, and that the ridge-and-groove character may be incorporated through inheritance as a randomly assorting character. If this be so then one may postulate that forms such as *P. darwinensis* and *P. thermalis* may be hybrids of a type approximating to the expression: “*spiralis*” type × “*whitei*” type, which in geographic terms is to say “Northern Territory” × “Queensland.” It is what might be expected at the interface of two distributional areas, whence further recombinations might produce, toward the western portion, forms such as *P. thermalis*.

But it is not necessary to assume that *P. darwinensis*, etc., are species, and if these speculations as to origin are anywhere near the historical reality, then other taxonomic dispositions of such ‘species’ might be preferred. Perhaps the designation *P. × darwinensis* would be suitable. However, in the absence of any proofs of hybridization, this designation might be prejudicial. In any case, a suspicion exists (based on other, non-Australian *Pandanus* species) that asexual forms of reproduction may occur. Of course, clonal reproduction by stolons is known to exist in *P. spiralis* and several other Australian species, but it is also possible that apomixis may occur. If so, then the possibility of a taxonomic situation resembling that found in such genera as *Taraxacum*, *Hieracium*, and *Rubus* might exist, which if it did occur would profoundly affect all the taxa enumerated here.

Taxonomy of Western Australian Pandanus

Tentative Key to species and varieties

1. Phalanges slender oblanceoloid, small (mostly 4–5 cm long), usually 1-celled or sometimes 2–3-celled. Cephalia when ripe subglobose-ovoid. Staminal phalanges with racemously disposed filaments, these comparatively few and wide-spaced on the column. Habitat along streams Section SEMIKEURA
(One species, *P. aquaticus*)
1. Phalanges obovoid to subglobose-rotund, often large to massive, always of more than 4 cells and often with 7–22 cells (or more). Cephalia when ripe ellipsoid to subglobose. Staminal phalanges with numerous crowded racemously disposed filaments. Habitats various Section AUSTROKEURA
2. Phalanges with several to many supernumerary ridges and grooves besides the normal intercarpellary sulci, in intact cephalia interlocking adjacent phalanges (mortise-tenon effect). Phalanges usually large (7 cm +), equidiametric, rotund, or somewhat laterally compressed.
 3. Phalanges about 7.5 x 6–7.5 cm, massive, rotund, convex, carpal tips convex 4. *P. darwinensis*
var. *darwinensis*
 3. Phalanges about 5 x 6–7 cm, convex, the carpal tips very low-convex to flattened, whole phalange somewhat laterally compressed 4. *P. darwinensis*
var. *latifructus*
2. Phalanges with no, or very few, supernumerary ridges and grooves, the faces comparatively smooth, broken only by the intercarpellary sulci. Phalanges medium to massive, rotund and equidiametric or somewhat laterally compressed.
 4. Phalanges mostly equidiametric, rotund. Carpels rather numerous to numerous (to 20 or more) within the phalange.
 5. Carpels with sharply acute convex tips; carpal number high (15–23)
..... 1. *P. spiralis* var. *multimammillatus*
 5. Carpels tips low convex to nearly flat.
 6. Phalange apex slightly concave, the carpal tips flat; phalanges tending toward extreme shallowness. 1. *P. spiralis* var. *flammeus*
 6. Phalange apex rotund, low convex, or nearly flat, but not concave; individual carpal tips usually slightly convex.
 7. Phalanges multicarpellate (carpels 12–24), carpels broad.
 8. Phalange apex dome-shaped, carpal tips little prominent. Lateral faces of phalange smooth; carpal number high (up to 24)
..... 1. *P. spiralis* var. *spiralis*
 8. Phalange apex dome-shaped but the individual carpal tips somewhat protruding; lateral faces of phalange with a few supernumerary ridges and grooves; carpal number moderate (9–11, perhaps more)
..... 1. *P. spiralis* var. *thermalis*
 7. Phalanges with mostly 5–15 carpels 1. *P. spiralis* var. *convexus*
 4. Phalanges mostly subcompressed to compressed laterally, not rotund. Carpels mostly 5–12 per phalange.
 9. Phalanges about 6.5–7 x 5 cm 2. *P. oblatus*
 9. Phalanges about 5.5 x 5 cm 3. *P. semiarmatus*

I. Subgenus **Pandanus**, Section **Austrokeura** (Stone) B. C. Stone, *supra*. (1) Series *Spirales* Stone.

1. *Pandanus spiralis* R. Br. (Fig. 1).

var. **spiralis**. Phalanges broad, rotund, about 6 x 7–8 cm, multicarpellate, with as many as 19–23 carpels per phalange; apical sutures shallow, individual carpal apices very low convex, hardly raised above the general dome-like phalange apex; lateral sutures few, shallow, short; stigmas 1.5–2 mm wide.

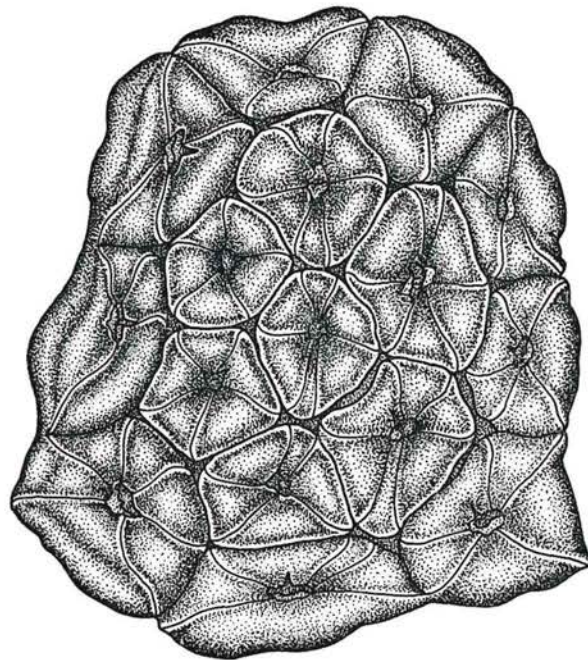
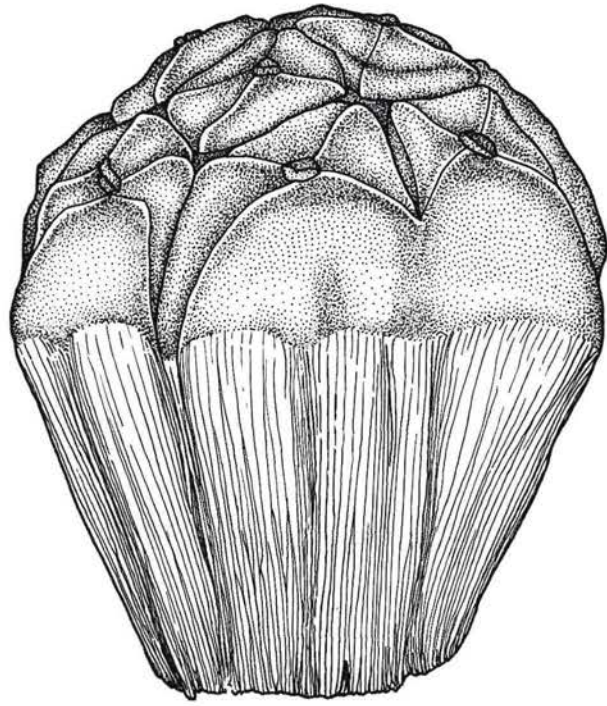


Figure 1—Phalange (top and profile) of *Pandanus spiralis* var. *spiralis*. (From ASG s.n. 8/1975, Drysdale River N.P.).



Figure 2—*Pandanus spiralis* var. *convexus*. Above: habit and habitat; below; a phalange. (From ASG 12634).

New collections: WESTERN AUSTRALIA: Drysdale River National Park, August 1975 A. S. George s. n. (PERTH). (Phalanges precisely as in the R. Brown collection); Prince, Regent River Reserve, 19 August 1974, K. F. Kenneally s.n. (PERTH).

var. **convexus** (St. John) B. C. Stone, stat. nov. (Fig. 2).

Basionym: *P. convexus* St. John, Pacif. Sci. 15 (1961) 183, f. 10.

Type: W. V. Fitzgerald 2394, Dillens Springs, Western Australia (NSW).

Syn. *P. integer* St. John, Pacif. Sci. 16 (1962) 414, f. 142. *Type*: R. A. Perry 2630, 20 mi. S. of Laguna Sta., N.T. in Herb. BRI.

Phalanges broad, rotund, 5–6 x 5–7 cm, with about 6–10 carpels per phalange; apical sutures shallow, carpel tips flattened; lateral sutures none or few; stigmas 3–5 mm long.

New collections: WESTERN AUSTRALIA: Prince Regent River Reserve, W. Kimberley; residual pool in sandstone outcrop; common in this area; 14 August, 1974 K. F. Kenneally 2041 (PERTH); Same locale, Fern Gully, fringing forest along creek, rocky sandy-substrate; tree 10 m tall; fruit top orange-brown, base red; 25 August 1974, A. S. George 12634 (PERTH); Drysdale National Park, August 1975, K. F. Kenneally 3080, 4348, 4518 (PERTH).

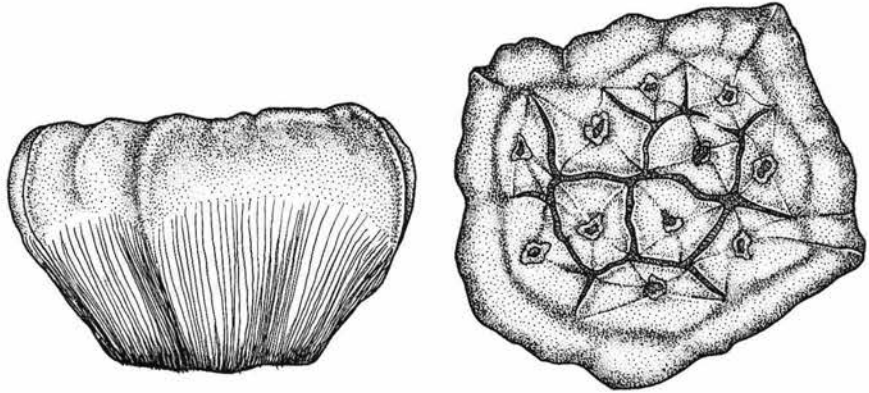


Figure 3—*Pandanus spiralis* var. *flammeus*. Profile and top view of phalange (from holotype).

var. **flammeus** B. C. Stone, var. nov. (Figures 3, 4). *Holotype*: K. F. Kenneally 5680, Logues Springs, W.A. in Herb. PERTH. *Isotype* in KLU.

Phalanges 6–12 carpidiatae, plerumque 3.5–4.5 cm longae, 5–6.5 cm latae, apicaliter complanato-depressae, superficie distali vadose depresso-concava, suturis pervadosis tenuis irregulariter suberosis, suturis lateralibus raris vel carentibus; pericarpio aurantiaco-rubro.

WESTERN AUSTRALIA: Logues Spring (18° 25' S, 123° 05' E) south-east of Broome; screw-pine to 5 m, stems thin, foliage glaucous, fruits scarlet with 16 'drupes' (i.e. phalanges); restricted to small narrow gorge containing a series of water holes fed by a spring; soil rocky, with fine, white, dusty clays. boggy during wet (season); 15 August 1976. K. F. Kenneally 5680 (PERTH).

The slender leaves, those of adults only 4–5 cm wide (the juvenile leaves, as usual, prickly, and the adult leaves almost unarmed), the small cephalium about 13 x 13 cm., and small number of phalanges borne on the cephalium, may be additional characters of this variety.

The carpel number per phalange shows two peaks; analysis of the cephalium gives the following results:

1 phalange with 6 carpels; 2 phalanges with 7 carpels; 4 phalanges with 8 carpels; 2 phalanges with 9 carpels; 2 phalanges with 10 carpels; 3 phalanges with 11 carpels; 1 phalange with 12 carpels.



Figure 4—*Pandanus spiralis* var. *flammeus*. Above: habit and habitat; below; cephalium. (From type locality and holotype).

The stigmas are small and obscure, difficult to make out in the ripe phalanges; most are 1–2 mm long. Several phalanges exhibit abnormal, peripheral, dwarf or undeveloped, partly free and convex supernumerary carpels.

var. **multimammillatus** B. C. Stone, var. nov. (Figure 5). *Holotype*: *A. S. George* 13380, (PERTH), W. of Cape Londonderry, W.A. Isotype in KLU.

Phalanges 15–23-carpidiatae, rotundae, convexae, 5–6 x 5–6·5 cm, fere subglobosae; carpellis subaequalibus, apice alte pyramidato-convexibus, angulatis, pyramidis usque ad 7–9 mm altis, stigmatibus obliquis atrobrunneis 2–3 mm longis. Mesocarpium in basi fibris brevissimis. Epicarpium pauci-caniculatum in medio.

WESTERN AUSTRALIA: Far north west coast, West of Cape Londonderry, tree to 5 m tall in black loam in woodland with dense grass understorey, fruit orange-red, 5 August 1975, *A. S. George* 13380 (PERTH).

In its multicarpellate phalanges of rotund form this variety approaches var. *spiralis*, but the smaller phalange size, and especially the steeply pyramidal carpel tips with obvious slanted stigmas give this variety clearcut distinguishing features. The apical sutures are often dark-tissued (scars) and the phalange sides are fairly smooth, a few shallow ridges and grooves developing unequally in some but not all phalanges. The leaves seem to have no distinguishing features, the adult leaves apparently (as is normal) armed remotely along the margins proximally but the leaf apices minutely and sparsely prickly or for long stretches of margin or even the entire apex unarmed.

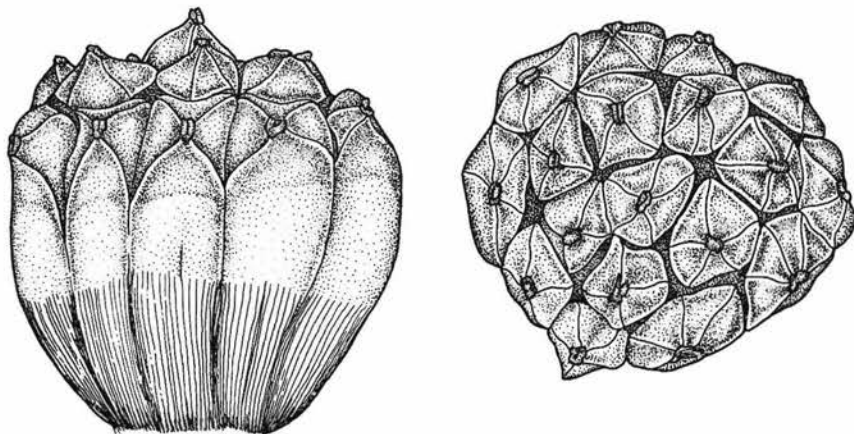


Figure 5—*Pandanus spiralis* var. *multimammillatus*. Profile and top view of phalange (from holotype, ASG 13380).

var. **thermalis** (St. John) B. C. Stone, stat. nov.

Basionym: *P. thermalis* St. John, *Pacif. Sci.* 16 (1962) 423, f. 148.

Type: S. T. Blake 16433, Hot Springs, Douglas R., N.T. in Herb. BRI.

Phalanges broad, rotund, 7–7·5 x 6·8–8·5 cm, with about 9–11 carpels; phalange apex dome-shaped, carpel tips nearly flat, apical sutures shallow, lateral sutures well marked and deep but comprising only, or mainly, inter-carpellar sutures; stigmas 3·5–5 mm wide.

New collections: WESTERN AUSTRALIA: Drysdale River National Park, 14° 49' S, 126° 49' E; tree to 8 m, fruit red, aerial rootlets present; in sand; woodland; 10 August 1975, *A. S. George* 13677 (PERTH) (Carpel tips oblique subdepressed; lateral faces with grooves); Prince Regent River Reserve, Aug. 1974, *K. F. Kenneally* s.n. (PERTH); Drysdale River National Park, 15° 02' S, 126° 49' E, Carson Escarpment, Drysdale River, seepage area at base of sandstone hill, tree 8 m, fruit pale orange-brown, red at base, 16 August 1975, *A. S. George* 13898 (PERTH).

2. *Pandanus* (*Austrokeura*) *oblatus* St. John ? (= *P. somersetensis* St. John) (Figure 6A).

WESTERN AUSTRALIA; Drysdale River National Park, 15° 02' S, 126° 40' E, Worriga Gorge, tree to 8 m tall, with aerial rootlets, fruit red, in damp black loam by creek in grassy woodland, 20 August 1975, A. S. George 14084 (PERTH).

In its phalanges this collection shows a very strong resemblance to *Pandanus oblatus* St. John (Pacif. Sci. 15 (1961) 569, f. 27, 28), described from specimens collected by L. J. Brass in the Iron Range, Cape York, Queensland, at 20 m alt. (no. 19312 Type, in BRI), still the only known collection. However, the leaves in that species are described as fully armed, with the margins denticulate from base to apex. Almost certainly, this indicates that the leaf collected by Brass was from a vigorous juvenile individual, or perhaps a tiller shoot, but this cannot be proven. In the *George* specimen cited above, the leaves are almost unarmed, i.e. perfectly normal for Sect. *Austrokeura* *adult* leaves. In addition the phalanges of the *George* specimen are slightly shorter. Thus I refrain from actually certifying an identity. There is no easy alternative identification and indeed the *George* collection is unique among the Western Australian speci-

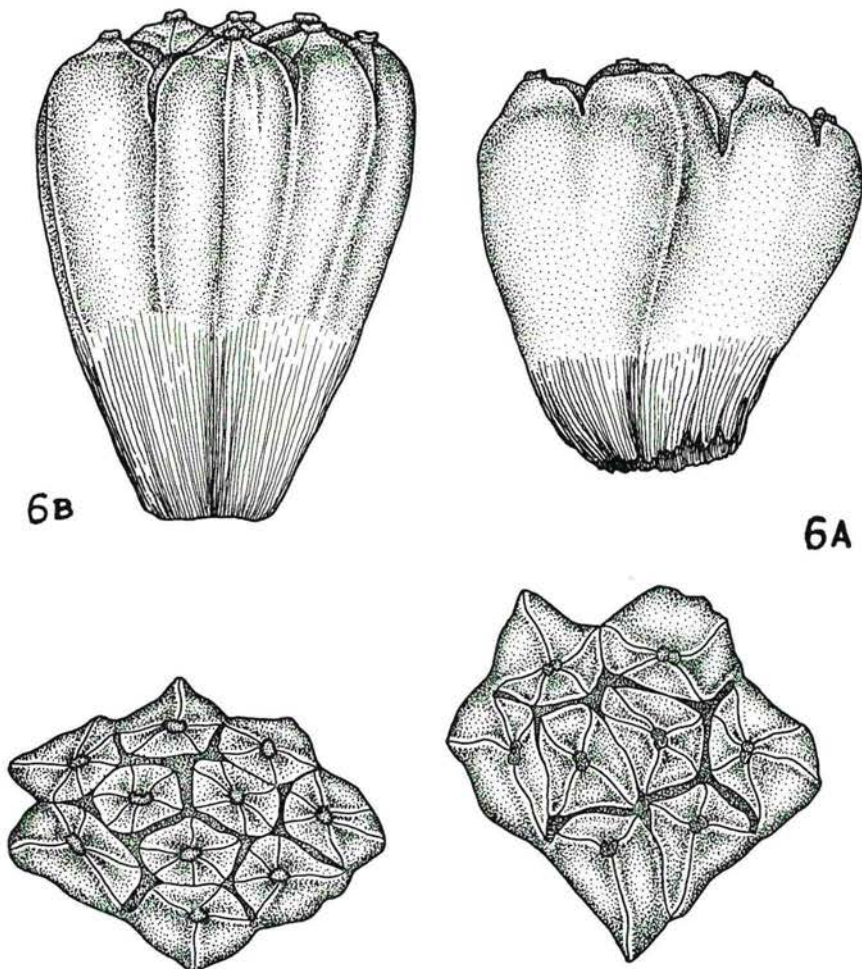


Figure 6—Profiles and top views of phalanges. At right, upper and lower; *Pandanus oblatus* (from ASG 14084). At left, upper and lower; *Pandanus semiarmatus* (from KFK 4514).

mens which I have seen. It may be a new species, but in the welter of already published names, and the evident redundancy (and synonymy) of species names in this deceptive and difficult group, it is not deemed appropriate to make a decision at this stage. It cannot readily be included within the (now broadened) concept of *P. spiralis* because of the very small and paucilocular phalanges (less than 5 cm long), although because of the smooth phalange faces it would appear to correspond with this species insofar as being placed in Ser. *Spirales*. It is possibly a very depauperate form of *P. spiralis* var. *convexus*, or closely related to it. It is obviously a form which is at the extreme border of the concept of one species or another.

I consider *P. somersetensis* St. John (Pacif. Sci. 15 (1961) 570, f. 29) as identical with *P. oblatius*.

3. ***Pandanus semiarmatus*** St. John, Pacif. Sci. 16 (1962) 421, f. 147. (Figure 6B).

Type: Blake 19694 (BRI), from Koolpinyah, N.T.

WESTERN AUSTRALIA: Drysdale River National Park, Site B3, 127° 12' E, 15° 17' S, on edge of remnant pool of Johnson Creek, very common, 9 August 1975, *K. F. Kenneally* 4138 (PERTH); Same locale, 127° 05' E, 14° 47' S, side of dry creekbed, commonly around remnant pools, 10 August 1975, *Kenneally* 4174 (PERTH); Same locale, Site B2, 126° 55' E, 14° 49' S, beside creek, 14 August 1975, *Kenneally* 4318 (PERTH); Same locale, Site C3, 126° 54' E, 14° 43' S, common along edge of creek and by remnant pools, 20 August 1975, *Kenneally* 4514 (PERTH); Same locale, 126° 44' E, 15° 16' S, in sand in woodland, tree 6 m tall, foliage slightly bluish, fruit green, 3 August 1975, *A. S. George* 13202 (PERTH).

All these specimens accord well with each other, and with the diagnosis and illustration of *P. semiarmatus*, though the last cited specimen (*George 13202*), being of a very immature fruit, is less surely placed. These records make this species an addition to the Western Australian flora from their previous local distribution in the Northern Territory (Koolpinyah just E of Darwin), but the distance is not excessive and no doubt this species has an intermittent but probably even wider distribution along the north Australian coast and hinterland.

St. John relates this species to *P. somersetensis* of Queensland. The Blake collection (the type) was until now the only known collection.

P. semiarmatus is clearly a member of Sect. *Austrokeura*, as shown by its unarmed leaf apices and the massive endocarps. It is very close to *P. spiralis* and could well be considered a variety of it, a disposition which may be preferred after further studies in this group; yet it has a certain distinctiveness, in the slightly compressed phalanges and their very smooth lateral faces. The character which suggested the epithet *semiarmatus* (unequal presence of prickles on the leaf margins—one margin often unarmed) is by no means a specific character and should carry no weight at all, for although it is odd it varies from tree to tree and has also been noticed in cultivated plants of the (hardly closely related) *P. tectorius*.

(2) Series *Austrokeura*

4. ***Pandanus darwinensis*** St. John, Pacif. Sci. 16 (1962) 417, f. 144.

Type: Allen in 1927, near Darwin, N. T. (BRI).

var. ***darwinensis*** (Figures 7, 8).

Phalanges massive, rotund, with thick epicarp, very short basal mesocarp; carpel tips convex, whole apex of phalange convex; apical sutures obvious; lateral sutures obvious; phalange sides (carpel sides) with longitudinal ridges and grooves; phalanges about 7.5 x 6–7.5 cm; carpels 11–13 and subequal; stigmas 3–3.5 mm long.

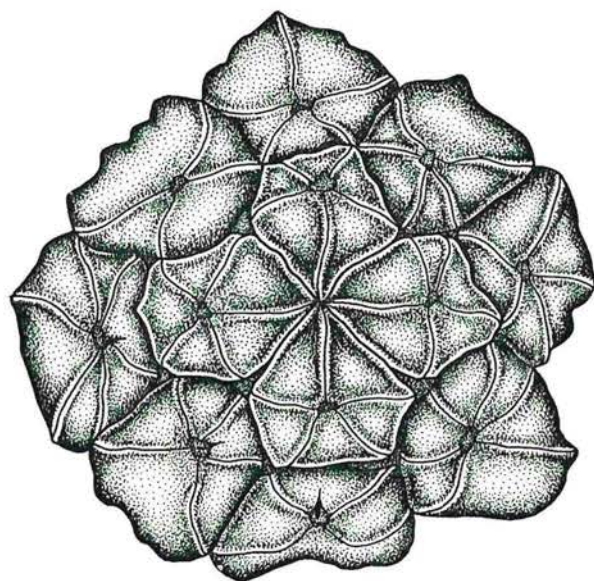
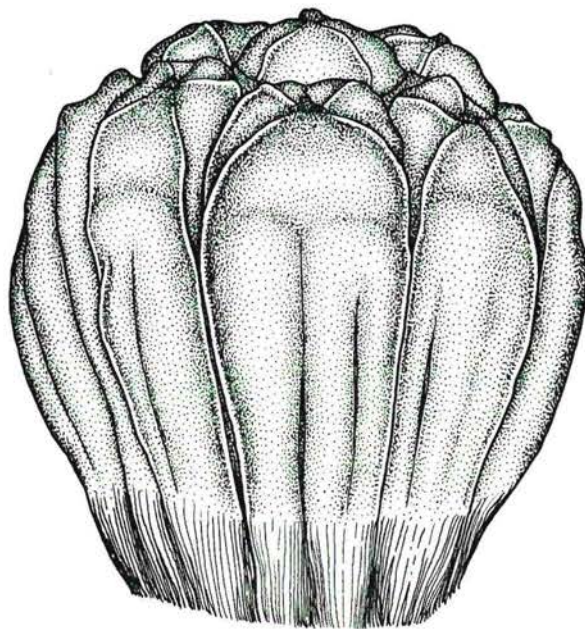


Figure 7—*Pandanus darwinensis*. Phalange, profile and top view. (From BCS 10650).

New collections: WESTERN AUSTRALIA: Prince Regent River Reserve, 19 August 1974, A. S. George 12411 (PERTH); Same locale, 3 August 1974, K. F. Kenneally s.n. (PERTH); Drysdale River National Park, August 1975, A. S. George 13315, 13457 (PERTH). NORTH-EARN TERRITORY: Dashwood Creek, near Darwin, 3 Sept 1971, B. C. Stone 10650, 10651 (KLU).

In relating *P. darwinensis* to *P. spiralis*, I acknowledge that the character of lateral longitudinal ridge-and-groove systems of the phalanges can occur in the species. It appears to me that this character is derived from hybridization with related species in Ser. *Austrokeura* to the east, especially *P. whitei* and its relatives. Indeed, *P. darwinensis* may be in part a recombination of characters from *P. spiralis* and *P. whitei*, the massive size and rotundity of the phalanges from the first, the ridge-and-groove system from the second; of course this is sheer speculation. It is also true that the incidence of the character—which affords a kind of mortise and tenon interlocking (not really effective perhaps)—may vary somewhat within a cephalium, and not every phalange is equally affected.

It is a very obvious character, yet its significance, as well as its heredity, is not well understood.

var. *latifructus* (St. John) B. C. Stone, stat. nov.

Basionym: *P. latifructus* St. John, Pacif. Sci. 16 (1962) 420, f. 146.

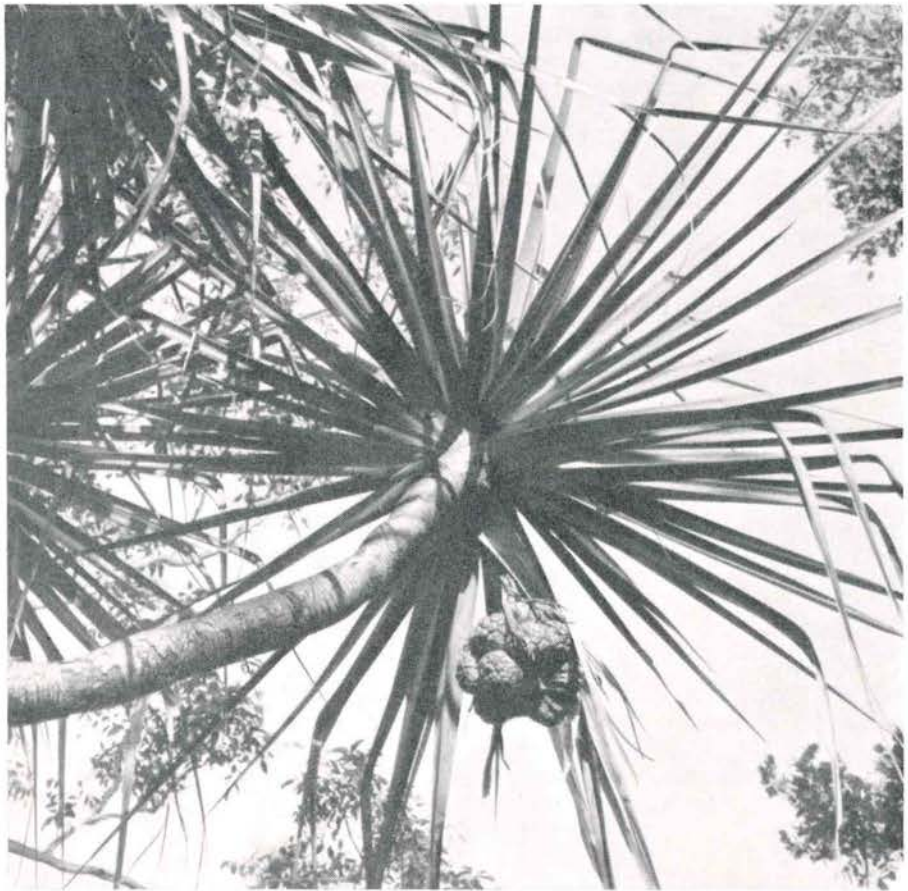


Figure 8—*Pandanus darwinensis*. Habit, showing branch, leaves and cephalium. From ASG 12411, Prince Regent River Reserve.

Type: H. St. John 24225, 22 mi. S. of Darwin, N.T. in BISH.

Phalanges broad, rotund, about 5 x 6-7 cm, with 12-20 carpels per phalange, apex of phalange dome-shaped, carpel tips very low convex to flattened but apical sutures deep and rather wide; lateral sutures deep, numerous; stigmas 1-2 mm.

Very similar to var. *arnhemensis*, also to var. *darwinensis*.

New collections: WESTERN AUSTRALIA; West of Cape Londonderry, 5 August 1975, A. S. George 13375 (PERTH).

II. Pandanus Subg. **Pandanus** Sect. **Semikeura** B. C. Stone, Contrib. Herb. Austral. No. 5, (1974) 42.

This small, characteristic section is composed of two subsections; of these only one so far is known from Western Australia. The other, subsect. *Elaphrocarpus* B. C. Stone, is monotypic, and its single species, *P. basedowii* C. H. Wright, is known to date only from Arnhem Land, Northern Territory.

Subsect. *Semikeura*

Type species: *P. delestangii* Martelli, a synonym of *P. aquaticus* F. Muell.

This subsection, which I consider monotypic, ranges right across north Australia from Queensland to Western Australia. Although five species have been described in this group, there are no useful distinctive characters, although one form, named *P. kimberleyanus* St. John, has fruits of which the drupes are rather short for what seems to be the average. With Blake (1954, 130, pl. 7, f. 3) I consider *P. aquaticus* the correct name of the species, and although slightly variable there seems no justification to recognize additional species.

Some new collections have recently been made, cited here.

5. **Pandanus aquaticus** F. Muell. in Hook. J. Bot. Kew Gard. Misc. 8(1856) 329, nomen provisorium; *Fragm. Phyto. Aust.* 5 (1865) 40 (validation); Stone, Contrib. Herb. Austral. no. 5 (1974) 42.

Syn. *P. kimberleyanus* St. John, *Pacif. Sci.* 15 (1961) 180, f. 9.

Type: Fitzgerald 2395, Fitzroy River, Kimberley, W.A. (NSW).

WESTERN AUSTRALIA: Drysdale National Park, 15° 02' S, 126° 55' E, common on river banks, trees 5-6 m tall, rather slender, aerial rootlets present, fruit fallen, 6 August 1975, A. S. George 13486 (PERTH); Same locale, Carson River, 14° 49' S, 126° 49' E, 11 August 1975, A. S. George 13705 (PERTH); Same locale, Site C2, 15° 03' S, 126° 44' E, very common, 17 August 1975, K. F. Kenneally 4388 (PERTH).

Of these specimens the drupes of 13705 are like those of the form called *P. kimberleyanus*, but not quite so blunt; while in 4388 the drupes are more slender, as in *P. delestangii*.

Addendum

There is in the W.A. Herbarium (PERTH) a collection made by E. M. Bennett, no. 1815, labelled "Pandanus tectorius" and consisting of some phalanges of what is clearly a member of the *Austrokeura* group; however locality data are lacking (collected 20/5/1967) and I refrain from describing it. It is almost certainly an undescribed new variety of *Pandanus spiralis*.

Acknowledgements

I am indebted to the Curator and staff of the Western Australian Herbarium, Perth, for loans of specimens and photographs, and especially to A. S. George and K. F. Kenneally for their interest and cordial assistance in the

study of Australian Pandans. The photographs were provided by them, except for the isolated phalange (A. S. G. 12634) which was photographed for me by the Rijksherbarium, Leiden, and forwarded to me by Mr. A. K. Groenewegen of that institution. The line drawings herein are by Encik Rosali of the Dept. of Botany, University of Malaya.

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Nomenclatural notes and new taxa in the *Conostylis aculeata* group (Haemodoraceae)

By Stephen D. Hopper*

Abstract

On the basis of detailed field studies of the *Conostylis aculeata* R.Br. group and an examination of specimens at the major Australian herbaria, (i) *C. robusta* Diels is reinstated as a species distinct from *C. aculeata*, (ii) confusion concerning the identity of *C. stylidioides* F. Muell. is clarified; this species is redescribed and *C. prolifera* Benth. is reinstated as a distinct species; and (iii) *C. aculeata* ssp. *breviflora* ssp. nov. and *C. pauciflora* sp. nov. are described; both are restricted endemics of the western coastal region of the South West Botanical Province of W.A.

A key to the 7 species now recognized in the *C. aculeata* group is provided.

Introduction

The *Conostylis aculeata* R.Br. group consists of a complex of seven species of perennial herbs which are restricted to the western coastal plain and nearby plateau regions of south-western Australia. The group forms part of the section *Conostylis* (Bentham 1873; Geerinck 1969), and is characterized by leaves with marginal spines or setae, numerous ovules borne all over the placental surface, and a basic chromosome number of $x = 8$.

The taxonomy of this species complex has been notably problematical in previous systematic studies of the genus. Several authors have commented on difficulties in delimiting taxa (Bentham 1873; Ewart 1906; Domin 1912; Green 1960). Indeed, herbarium studies leave the impression of a polymorphic but intergrading assemblage of populations with few forms that are consistently distinct throughout their geographical range.

Elsewhere, the present author has shown that both hybridization and ecologically-correlated intraspecific variation occur in species of the *C. aculeata* group near Dawesville on the Swan Coastal Plain (Hopper 1977). It was there demonstrated that while the identification of specimens from this region could be difficult in the herbarium, critical field observations enabled the satisfactory placement of individuals into morphologically definable species and/or their hybrids. This work suggested that a wider field study of population variation and ecology would facilitate a sound taxonomic understanding of the *C. aculeata* group as a whole.

The present publication seeks to formalize necessary changes in the taxonomy of the group arising out of detailed field surveys conducted in 1975 and 1976 and a critical examination of herbarium specimens lodged at PERTH, UWA, AD, MEL, NSW, CANB, CBG, NE and BRI. This research has revealed (i) evidence in favour of the reinstatement of *C. robusta* Diels as a good species, (ii) past confusion concerning the application of the name *C. stylidioides* F. Muell., and (iii) the existence of two undescribed taxa.

While it is felt that present information allows for a reasonably sound assessment of the species situation in the *C. aculeata* group, a number of problems regarding the status of infraspecific taxa remain unresolved, par-

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ticularly in *C. aculeata* and *C. candicans* Endl. These problems warrant careful studies of geographical and ecological variation throughout the distribution of the species concerned.

Key to species in the *C. aculeata* group

1. Leaves grey-white, tomentose when young, sometimes becoming glabrous with age; perianth lobes golden yellow inside when fresh.
 2. Leaves 10–50 cm long and 2–5 mm broad; habit caespitose inland, proliferous near the coast; chromosome number $n = 8$ (Scott River, Yalgorup—Shark Bay) *C. candicans* Endl.
 2. Leaves 1–5 cm long and less than 1 mm broad; habit proliferous; chromosome number $n = 16$ (Walkaway—Dirk Hartog Island) *C. stylidioides* F. Muell.
1. Leaves green, glabrous except for marginal spines or setae; perianth lobes creamy yellow inside when fresh.
 3. Leaves with rigid, indurate, pungent marginal spines; habit caespitose to proliferous.
 4. Leaves terete or subterete, 1–2 mm broad (Cannington—Jurien Bay) *C. filifolia* F. Muell.
 4. Leaves flat, 2–15 mm broad.
 5. Leaves 5–15 mm broad and 15–50 cm long, faintly glaucescent; scapes usually much longer than the leaves (Mingenew—Murchison River) *C. robusta* Diels
 5. Leaves rarely exceeding 5 mm breadth and 5–50 cm long, olive green; scapes usually shorter than or \pm equal to the leaves (Albany—Murchison River) *C. aculeata* R.Br.
 3. Leaves with flexible, membranous marginal setae; habit proliferous.
 6. Leaves 1–10 cm long and 0.5–2.0 mm broad; flowers 7–13 mm long; anthers 1–2 mm long, \pm equal to the filaments (York—Murchison River) *C. prolifera* Benth.
 6. Leaves 10–25 cm long and 1–2 mm broad; flowers 8–15 mm long; anthers 2–3 mm, longer than the filaments (Busselton—Mandurah, ? Yancheep) *C. pauciflora* Hopper

The status of *Conostylis robusta* Diels

Conostylis robusta was made a subspecies of *C. aculeata* by Green (1960) on the basis that it was difficult to distinguish from some extreme forms of *C. aculeata* and that it appeared to occupy a distinct geographical range.

The two taxa are now known to occur in close proximity to each other at a number of localities (Fig. 1), and their neighbouring populations are readily distinguishable on the characters given in the above key. Moreover, a discriminant function analysis (Fisher 1936; Blackith and Reymont 1971) of 10 perianth measurements made on nearby populations of *C. robusta* and *C. aculeata* at Kalbarri indicates that the taxa are distinct in floral structure as well (Fig. 1). Since their distributional ranges overlap considerably, the recognition of *C. robusta* and *C. aculeata* as geographical subspecies is no longer tenable. The remaining taxonomic options are to regard them as (i) separate species, (ii) ecological and/or morphologically distinguishable subspecies of the same species, or (iii) varieties of the same species. I consider that the morphological differences between *aculeata* and *robusta* are comparable with those used to distinguish other species in the group, and consequently recognize *C. robusta* as a distinct species.

The identity of *Conostylis stylidioides* F. Muell. and *C. prolifera* Benth.

In his revision of *Conostylis*, Green (1960) reduced *C. prolifera* Benth. and *C. racemosa* Benth. to synonymy under *C. stylidioides* F. Muell., stating that "field studies, especially in the Geraldton area, have shown that Bentham's

distinctions between *C. stylidioides*, *C. prolifera* and *C. racemosa* are quite unworkable; in one case, different parts of a single specimen fell into each of the three species". Bentham (1873) distinguished *C. stylidioides* from the other two taxa primarily on leaf shape. It was described as having "leaves nearly terete, short and rigid", whereas *C. prolifera* and *C. racemosa* have "leaves flaccid, very narrow but flat, green and grass-like or white only when very young". The latter species differed in that *racemosa* had flowers $\frac{1}{2}$ in. long in a loose raceme whereas *prolifera* had somewhat shorter flowers in a dense head.

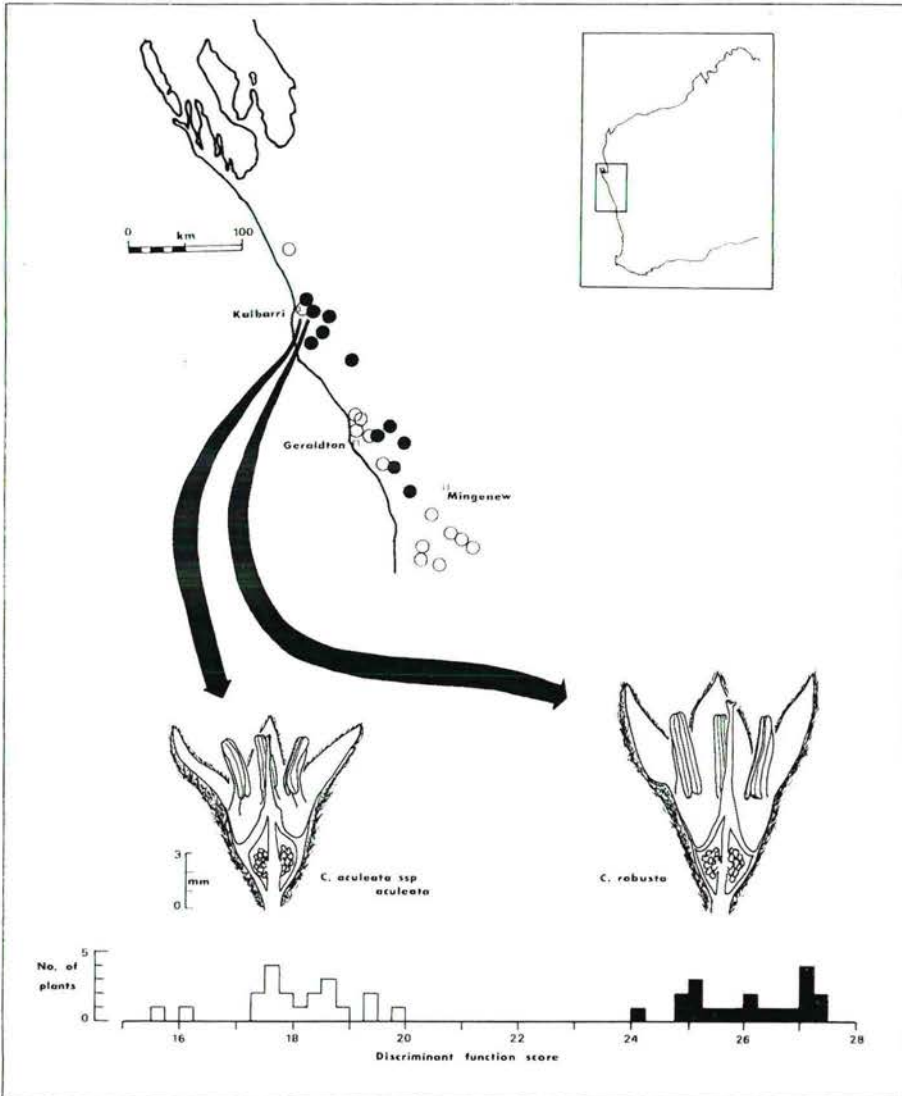


Figure 1. Geographical distribution of *Conostylis robusta* (black circles) and *C. aculeata* (open circles) in the Mingenev—Shark Bay area and results of a discriminant function analysis of 10 floral measurements taken on samples of the two species from near Kalbarri. Camera lucida drawings of representative half-flowers are illustrated. Measurements taken on half-flowers: 1, perianth length; 2, style length; 3, ovary to base of highest anther; 4, ovary to base of lowest anther; 5, ovary to base of lowest filament; 6, perianth lobe length; 7, anther length; 8, perianth width across lobe bases; 9, perianth width at the ovary; 10, perianth lobe width at the base.

My own field surveys in the Geraldton—Shark Bay region confirm Green's (1960) observation that these differences in leaf shape, flower length and inflorescence structure are unreliable taxonomic characters, sometimes varying within single individuals and among different plants of the one population. However, a critical study of populations throughout this region indicates that two morphologically and chromosomally distinct taxa do exist. One has green, usually flat leaves, perianth lobes which are cream-coloured on the inner surface, and is diploid ($n=8$). The other has white, densely tomentose leaves which are often subterete when young, golden yellow perianth lobes, and is tetraploid ($n = 16$).

An examination of those type collections represented at MEL revealed that the types of *C. prolifera* and *C. racemosa* are variants of the diploid taxon while the type of *C. stylidioides* agrees in detail with the tetraploid taxon. On referring back to Bentham's descriptions of the three taxa, it was found that the distinction regarding the presence of a densely white leaf tomentum in *C. stylidioides* was clearly stated but not incorporated in the key to species. Consequently, emphasis was placed on the less-consistent leaf shape differences, a situation which led Green (1960) to regard the three taxa as conspecific.

To clarify the identity of *C. stylidioides* in the light of these findings, this species is redescribed below and its geographical distribution and morphological features are illustrated (Fig. 2A). I consider that *C. prolifera* and *C. racemosa* are conspecific, and since Bentham (1873) regarded the latter as a possible variety of *C. prolifera*, *C. racemosa* will be reduced to synonymy under *C. prolifera*. The reader is referred to Bentham (1873) for an adequate description of *C. prolifera* and to Green (1960) where this species is described and illustrated under the name *C. stylidioides*.

Conostylis stylidioides F. Muell., Fragm., 8: 17 (1873) (Figure 2A)

Type citation: In vicinia fluminis Murchisoni, Aug. Oldfield (holo: MEL; iso: K, not seen.)

Herb, proliferously branched with stolons up to 20 cm long. *Leaves* grey-tomentose when young, sometimes becoming glabrescent with age, distichous, equitant, conduplicate at the base, otherwise flat to subterete, linear, up to 5 cm long (usually 1.5–2.5 cm), less than 1 mm wide. *Inflorescence* a capitulate cyme on a simple undivided scape 3–20 cm long, usually much longer than the leaves. *Flowers* golden yellow, 9–13 mm long; *perianth* tomentose outside, glabrous within, the lobes 4–6 mm long and \pm equal to the tube, the inner surface golden yellow; *stamens* slightly biseriate, filaments 1–2 mm long, anthers 1–2.5 mm long; *style* 5–8 mm long, the stigma \pm level with or slightly higher than the anthers; *placenta* covered all over with numerous ovules. *Seeds* not seen. *Chromosome number* $n = 16$.

Distribution and habitat: (Figure 2). The south-west of Western Australia, within 90 km of the coast from Geraldton to Shark Bay and Dirk Hartog Island. The species occurs predominantly in *Acacia*-mallee scrub in dry red or yellow sands, usually on hillslopes or flat plains.

Selected specimens examined (all housed in PERTH). 3.5 miles NNW of Mt. Curious, 19 May 1968, J. Bannister "O"; Murchison House Station, 21 October 1973, J. S. Beard 6877; Mullewa Plains, 21 September 1931, W. E. Blackall 711; between Yuna and Mullewa, 21 September 1940, W. E. Blackall 4858; Utakarra, 4.8 km E of Geraldton, 26 August 1970, R. Coveny 3032; 6 miles W of Northampton, 25 September 1926, C. A. Gardner 1980; 48 km N of Ajana, 28 August 1931, Gardner and Blackall 590; near Herald Bay outcamp, Dirk Hartog Island W.A. $\pm 25^{\circ} 52' S$, $113^{\circ} 06' E$, 3 September 1972, A. S. George 11461; ± 24 km S of Tamala Station (Shark Bay): 25.8 km S of main road along E boundary track, 20

August 1975, *S. D. Hopper* 556; 22.5 km E of Binu on road to Balla and Yuna, 22 August 1975, *S. D. Hopper* 561; 6.9 km E of Yuna, 22 August 1975, *S. D. Hopper* 559; 28 km ESE of Binu, 22 August 1975, *S. D. Hopper* 560; \pm 1 km S of Greenough River floodway on Yuna-Tenindewa road, 22 August 1975, *S. D. Hopper* 558; 4 km NE of Binu, 22 August 1975, *S. D. Hopper* 557; 9.2 km W of Binu along West Road, 19 August 1975, *S. D. Hopper* 555; Bowes, 31 October 1903, *A. Morrison*.

Conostylis stylidioides has affinities with both *C. candicans* and *C. prolifera*. It bears a very close resemblance to diploid hybrids of these species (e.g. *S. D. Hopper* 138, PERTH) and is most probably a stabilized allotetraploid hybrid derivative.

C. stylidioides can be distinguished from *C. candicans* by its short leaves less than 5 cm long and 1 mm wide, while it differs most noticeably from *C. prolifera* in its tomentose leaves and its golden yellow perianth lobes (the latter character is only discernible in fresh material).

C. stylidioides has been found growing sympatrically with *C. prolifera* at The Loop (Kalbarri National Park) and near Yuna. No hybrids were observed in these mixed populations.

New Taxa

Two new taxa belonging to the *C. aculeata* group have been encountered. Both are restricted endemics of the western coastal region of the South West Botanical Province.

All measurements given in the description were taken from Herbarium specimens. Unless stated to the contrary, all collections cited are housed at the Western Australian Herbarium (PERTH).

Conostylis pauciflora Hopper sp. nov. (Figures 2, 3 and 4)

Ab *C. aculeata* R.Br. spinis foliorum flexilibus, membranaceis, dense tomentosis, \leq 2 mm longis; foliis \leq 2 mm latis, \leq 25 cm longis; et floribus per inflorescentiam paucis, differt.

Differs from *C. aculeata* R.Br. in the flexible, membranous and densely tomentose leaf spines less than 2 mm long, in the leaves less than 2 mm wide and 25 cm long, and in the few flowers per inflorescence.

Type: Hacienda, 20 km S of Mandurah on the Old Coast Road, on the eastern slopes of the Spearwood Dunes overlooking Harvey Estuary, in Jarrah-Marri woodland, in sandy soil, 11 August 1976, *S. D. Hopper* 131 (holo: PERTH, iso: PERTH).

Herb, proliferously branched with stolons up to 15 cm long. *Leaves* green, equitant at the base, otherwise flat, ensiform, maximum length 15 cm on average (up to 25 cm); *marginal spines* flexible, membranous and densely tomentose, rarely more than 1 mm long. *Inflorescence* a capitulate cyme, usually of less than 10 flowers, on a simple scape (8) 16 (30) cm high, equal to or longer than the leaves. *Flowers* yellow, 8–15 mm long; *perianth* tomentose outside, slightly hairy within, the lobes 4–7 mm long and usually exceeding the tube; *stamens* uniseriate, filaments 0.5–1.0 mm long, anthers 2–3 mm long; *style* 5–12 mm long, the stigma \pm level with the anthers; *placenta* covered all over with numerous ovules. *Seeds* not seen.

Distribution and habitat: (Figure 2). The south-west of Western Australia; Yalgorup-Dawesville area of the Swan Coastal Plain within 10 km of the coast. The species is known from only a few localities on sandy hillslopes of the Spearwood Dune System, occurring in mixed Jarrah-Marri-Banksia woodland.

Specimen examined. Between Lake Preston and Lake Clifton, Yalgorup National Park, 20 October 1972, *S. Paust* 1361.

Apart from its membranous marginal setae and few-flowered inflorescence, *Conostylis pauciflora* has shorter leaves and scapes than do plants of *C. aculeata* occurring nearby in the Dawesville area (Figure 4). These differences are sufficient I feel to warrant specific status for *C. pauciflora*.

Some hybrids of *C. aculeata* ssp. *aculeata* and the coastal ecotype of *C. candicans* bear a strong resemblance to *C. pauciflora*, and it is proposed elsewhere (Hopper 1977) that the new species is in fact a stabilized hybrid derivative.

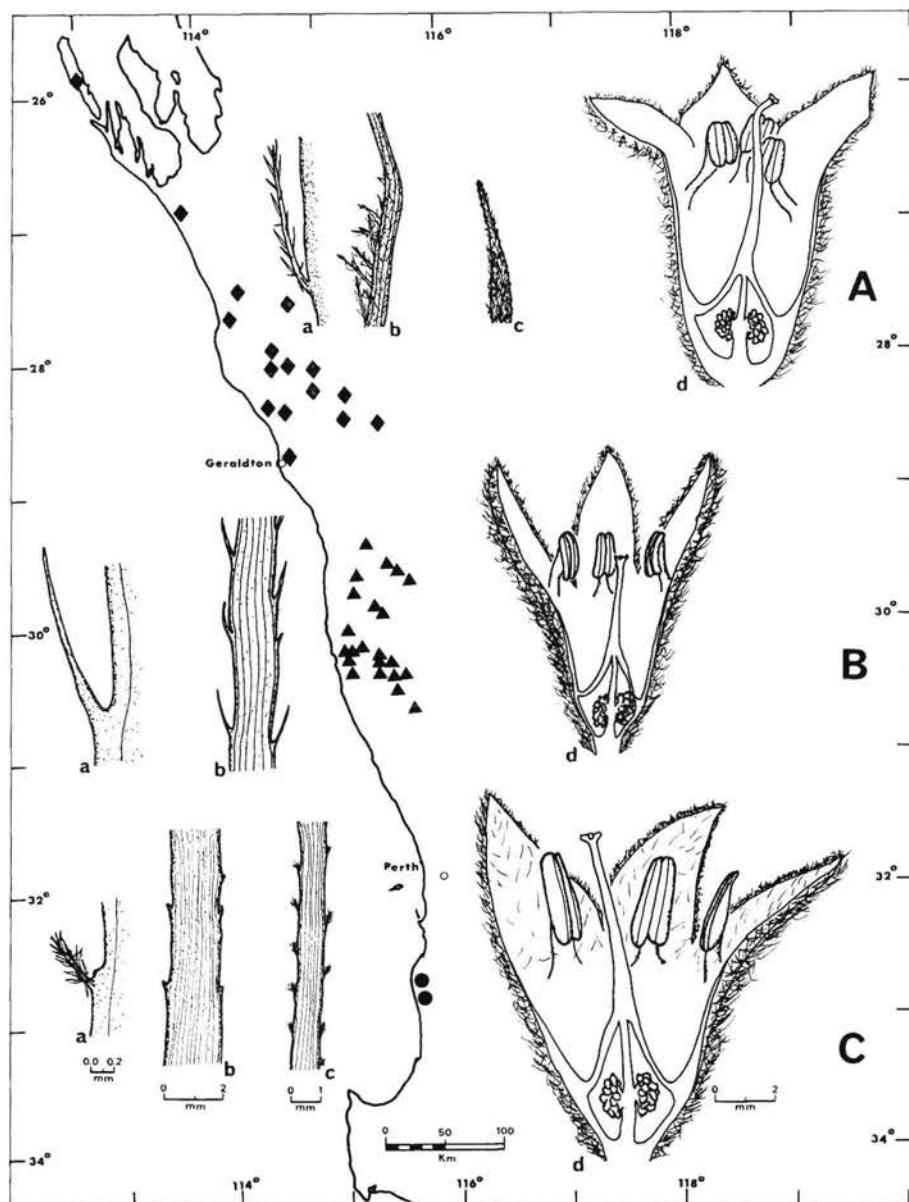


Figure 2. Geographical distributions, half flowers and leaf morphology of (A) *Conostylis stylioides* F. Muell., (B) *C. aculeata* ssp. *breviflora* ssp. nov., and (C) *C. pauciflora* sp. nov. Camera lucida drawings of fresh material. Comparable organs of the three taxa are at the same scale. a, marginal spine; b, mature leaf; c, young leaf; d, half flower.



Figure 3. *Conostylis pauciflora* sp. nov. holotype. Both specimens from the same collection—HA 6 and HA 8 are field numbers.

Natural hybrids between *C. pauciflora* and *C. aculeata* ssp. *aculeata* have been found at one locality (Hopper *loc. cit.*). Hybrids displayed a slight reduction in pollen fertility relative to the parental species, and occupied a habitat intermediate in soil moisture between the dry hillslopes favoured by *C. pauciflora* and the wet flats by *C. aculeata*.

Further field work may extend the known range of *C. pauciflora* southward as far as Busselton, since specimens resembling *C. pauciflora*-*C. aculeata* hybrids have been collected in this region (e.g. *R. D. Royce* 3165). Also, a specimen in the Canberra Botanic Gardens Herbarium (*R. Whittaker* and *W. A. Niering* D70-55) collected in the Yanchep National Park resembles *C. pauciflora*, but may be a hybrid of *C. candicans* and *C. aculeata*. Population studies are needed to clarify the situation.

The specific epithet refers to the few-flowered inflorescence.

Conostylis aculeata R.Br. ssp. **breviflora** Hopper ssp. nov. (Figures 2 and 5)

Ab subspecibus aliis *C. aculeatae* R.Br. floribus minoribus 6-9 mm longis, differt.

Differs from other subspecies of *C. aculeata* R.Br. in the smaller flowers 6-9 mm long.

Type: 11.4 km S of Hill River bridge on Brand Highway, in *Xanthorrhoea* heath and roadside ditches about 500 m S of laterite-capped flat top hill, 15 September 1976, *S. D. Hopper* 222 (holo: PERTH).

Herb growing in tufts up to 50 cm in diameter, proliferously branched with stolons up to 18 cm long. *Leaves* green distichous, equitant, conduplicate at the base, flat and linear for most of their length, maximum length 13 cm on average (up to 18 cm), 1-3 mm broad; *marginal spines* 3-8 mm apart, rigid, pungent, indurate, glabrous, 1-3 mm long. *Inflorescence* a capitulate cyme on a simple or once divided scape up to 20 cm high, equal to or longer than the leaves. *Flowers* yellow, (6) 7.5 (9) mm long; *perianth* tomentose outside, glabrous within, the lobes 3-6 mm long and exceeding the tube; *stamens* uniseriate, filaments 0.5-1.0 mm long, anthers 1-2 mm long; *style* 3-5 mm long, the stigma \pm level with the anthers; *placenta* covered all over with numerous ovules; *ovary* scarcely enlarging in fruit. *Seeds* not seen. *Chromosome number* $n = 8$.

Distribution and habitat: (Figure 2). The south-west of Western Australia, within 70 km of the coast from Dandaragan to the Arrowsmith River. *C. aculeata* ssp. *breviflora* is common in winter-wet flats, swamps, depressions and roadside ditches (Figure 5) in sandy soil throughout the Mt. Lesueur-Eneabba heathlands.

Selected specimens examined. Cockleshell Gully, 24 August 1938, *W. E. Blackall* 3572; 5 miles N of Hill River (Solley's Farm), 27 September 1957, *D. M. Churchill* 691 (UWA); Hill River bridge, Brand Highway, 8 July 1975, *S. D. Hopper* 688; 20 km SSW of Badgingarra, 15 June 1975, *S. D. Hopper* 690; 14.6 km E of Brand Highway along Green Head-Coorow Rd, 17 June 1975, *S. D. Hopper* 691; 26 km W of Arrino, 6 August 1975, *S. D. Hopper* 692; 9.5 km W of Eneabba, 24 June 1976, *S. D. Hopper* 694; 22 km SW of Three Springs, 4 August 1975, *S. D. Hopper* 689; Hill River bridge on Jurien-Cervantes Rd, 15 September 1976, *S. D. Hopper* 225; 2.3 km N of turn-off to Drummond's Crossing on Eneabba-Mingenew Rd, 6 August 1975, *S. D. Hopper* 697; Brand Highway, 19 km N of Eneabba, 6 August 1975, *S. D. Hopper* 693; 52 miles N of Regans Ford, 7 October 1967, *W.A. Loneragan* 67.124 (UWA); 13 miles N of Cockleshell Gully, 8 October 1967, *W.A. Loneragan* 67.125 (UWA); Dandaragan, 3 December 1965, *F. Lullfitz* L4478.

Conostylis aculeata ssp. *breviflora* is closely allied to but occupies a distinct geographical range from other subspecies of *C. aculeata*. It is readily distinguished from these by its smaller flowers, (averaging 7.5 mm long in comparison with 9-11 mm for the other subspecies) and by its shorter leaves.

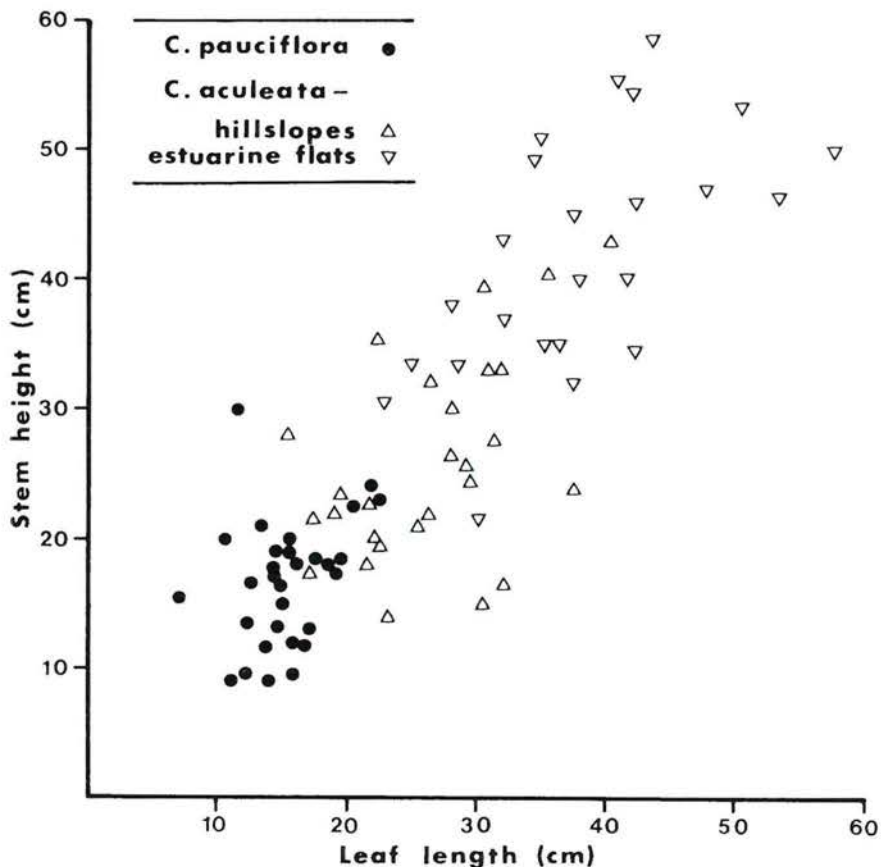


Figure 4. Maximum leaf length and stem height of a population sample of *C. pauciflora* sp. nov. and two of *C. aculeata* ssp. *aculeata* (Spearwood Dune hillslopes and Harvey Estuary flats) from the Dawesville region of the Swan Coastal Plain. Data from Hopper (1977).

Collections of small-flowered, short-leaved plants of *C. aculeata* have been obtained north of the Murchison River (e.g. W of Nerren Nerren, 20 October 1974, *J. S. Beard* 7101), but these differ from *C. aculeata* ssp. *breviflora* in having unusually long marginal spines and narrower leaves. Their status must remain obscure until detailed field studies have been carried out.

Hybrids of *C. aculeata* ssp. *breviflora* and *C. candicans* are known from Cockleshell Gully and the Hill River bridge on the Jurien—Cervantes road (Figure 5). At both localities the new taxon occupies low-lying alluvial flats while *C. candicans* occurs on adjacent drier hill slopes. Hybrids are confined to narrow zones of overlap where the two species grow intermixed.

Specimens collected 13 km S of the Hill River on the Jurien Bay—Cervantes road (*S. D. Hopper* 115) and 18 km SSW of Three Springs (*S. D. Hopper* 221) have features intermediate between *C. aculeata* ssp. *breviflora* and *C. aculeata* ssp. *aculeata*, suggesting that these two taxa hybridize where their distributions overlap.

The subspecific epithet refers to the characteristic short flowers of the new taxon.

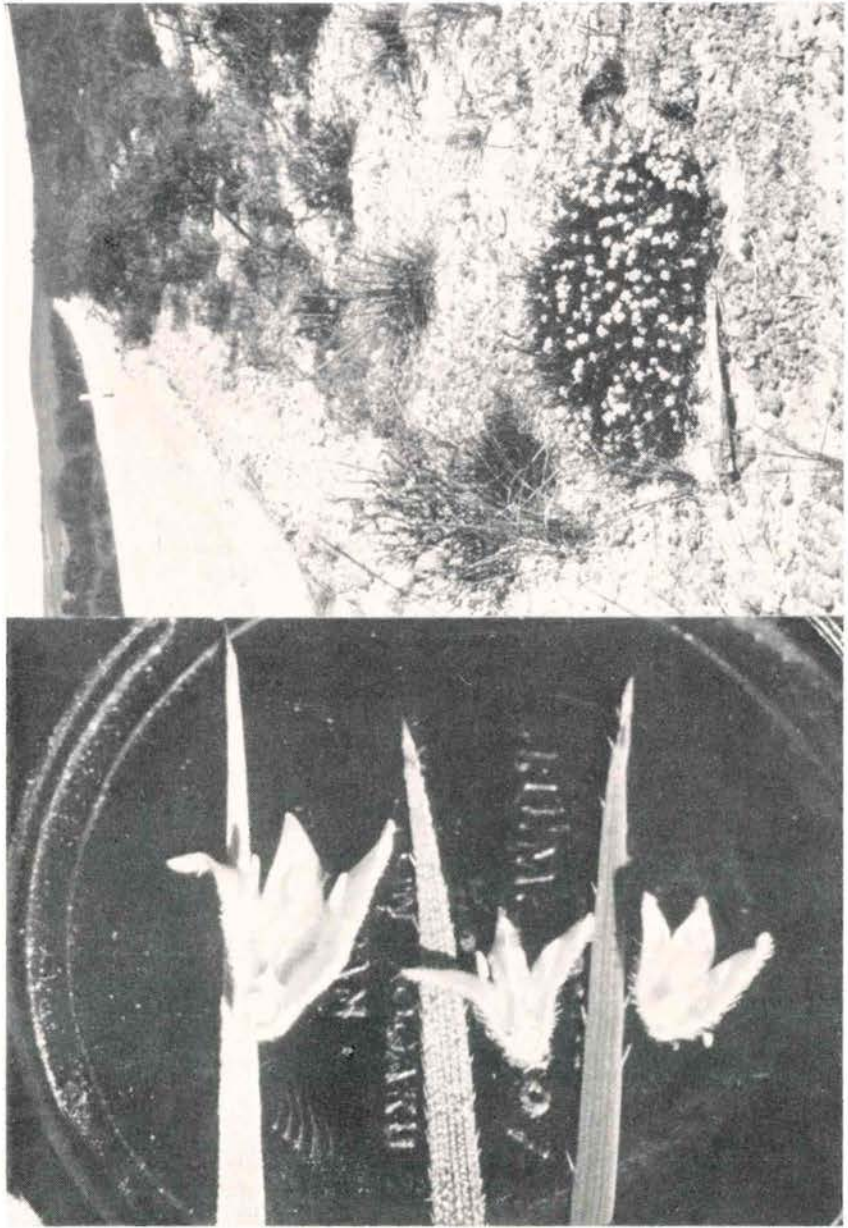


Figure 5. Top—*C. aculeata* ssp. *breviflora* ssp. nov. growing in a roadside ditch on Brand Highway near the Hill River. Bottom—leaves and half flowers of (left to right) *C. candicans*, a hybrid and *C. aculeata* ssp. *breviflora* from the Hill River bridge on the Jurien Bay—Cervantes road.

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