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 ± 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, ± 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, ? Yanchep) .... **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 Reyment 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 synonomy 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.

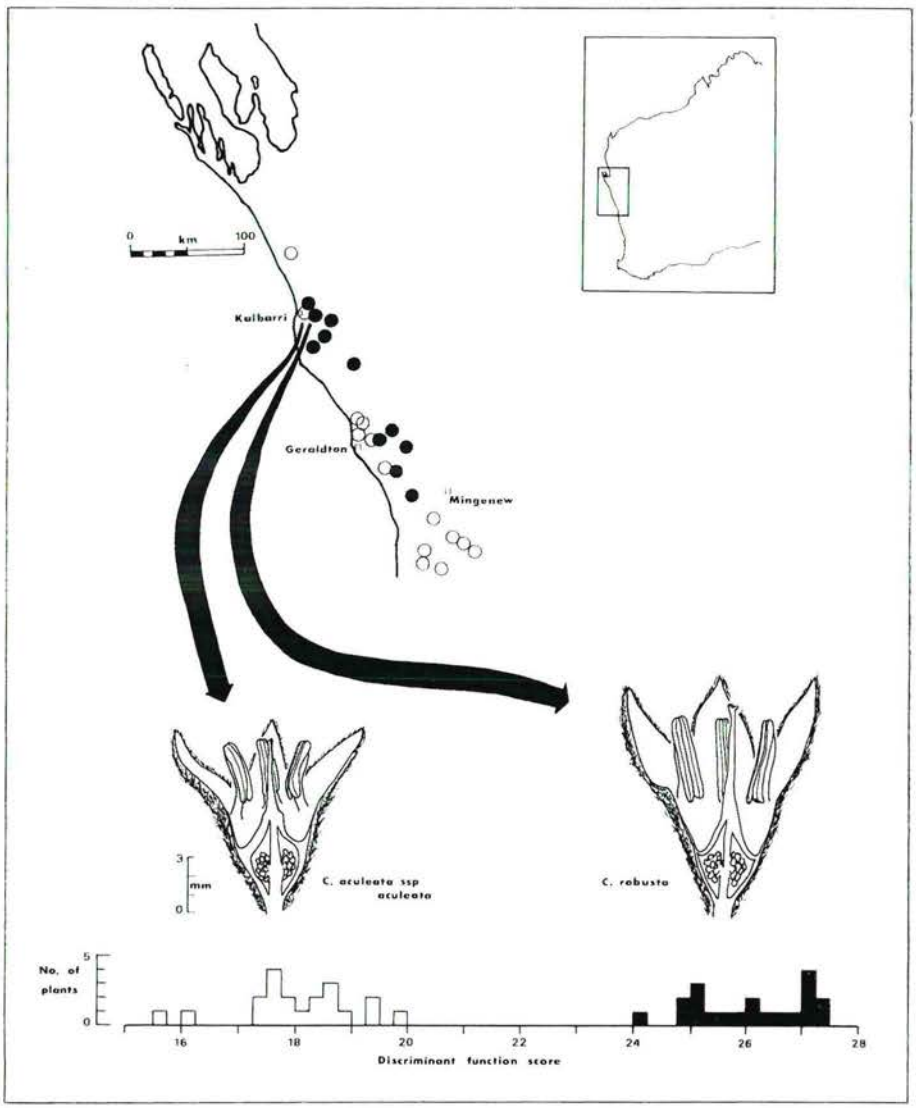

Figure 1. Geographical distribution of *Conostylis robusta* (black circles) and *C. aculeata* (open circles) in the Mingenew—Shark Bay area and results of a discriminant function analysis of 10 floral measurements taken on samples of the two species from near Kalbarri. Camera lucida drawings of representative 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 synonomy 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 ± 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 ± 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. ± 25° 52′ S, 113° 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 Binnu 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 Binnu, 22 August 1975, *S. D. Hopper* 560; ± 1 km S of Greenough River floodway on Yuna-Tenindewa road, 22 August 1975, *S. D. Hopper* 558; 4 km NE of Binnu, 22 August 1975, *S. D. Hopper* 557; 9·2 km W of Binnu 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, < 2 mm longis; foliis < 2 mm latis, < 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 ± 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.

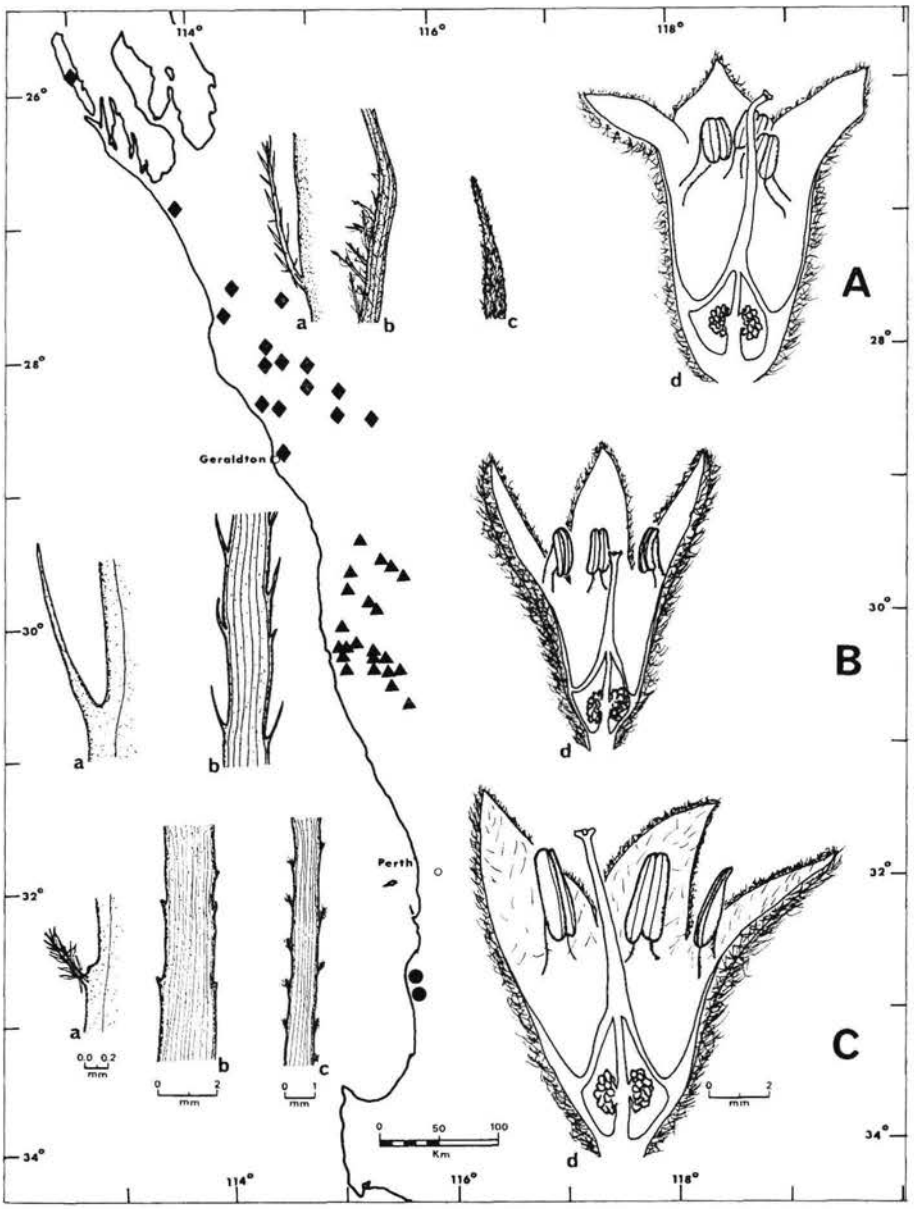

Figure 2. Geographical distributions, half flowers and leaf morphology of (A) *Conostylis stylidioides* F. Muell., (B) *C. aculeata* ssp. *breviflora* ssp. nov., and (C) *C. pauciflora* sp. nov. Camera lucida drawings of fresh material. Comparable organs of the three taxa are at the same scale. *a*, 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 ± 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.

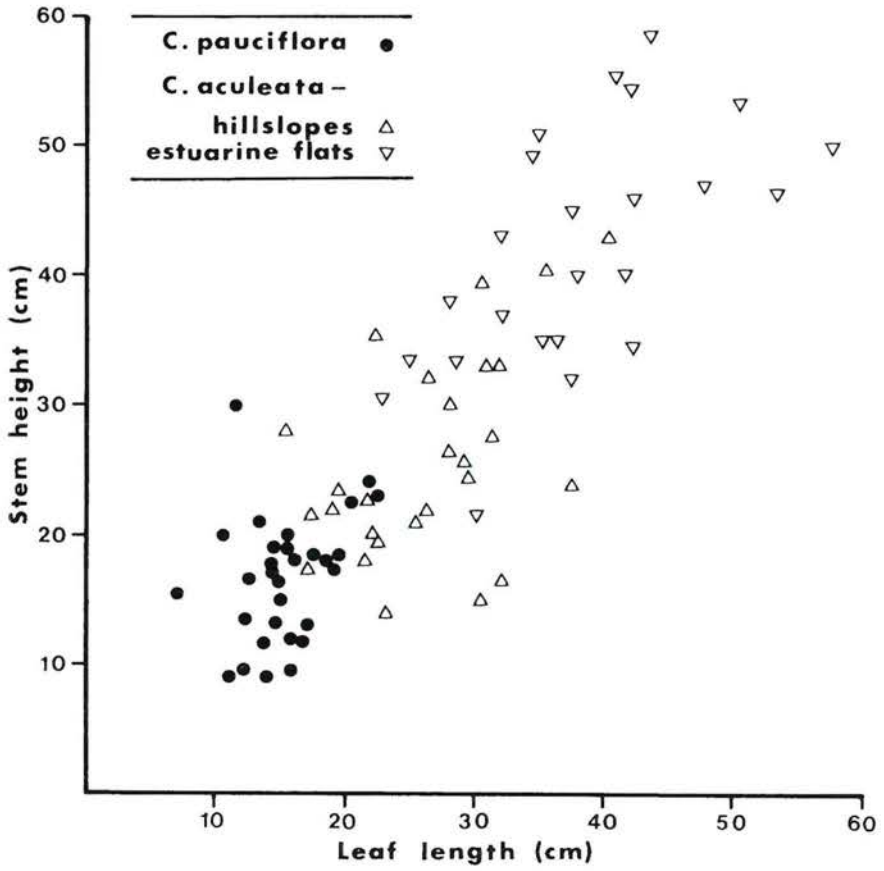

Figure 4. Maximum leaf length and stem height of a population sample of *C. pauciflora* sp. nov. and two of *C. aculeata* ssp. *aculeata* (Spearwood Dune hillslopes and Harvey Estuary flats) from the Dawesville region of the Swan Coastal Plain. Data from Hopper (1977).

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.

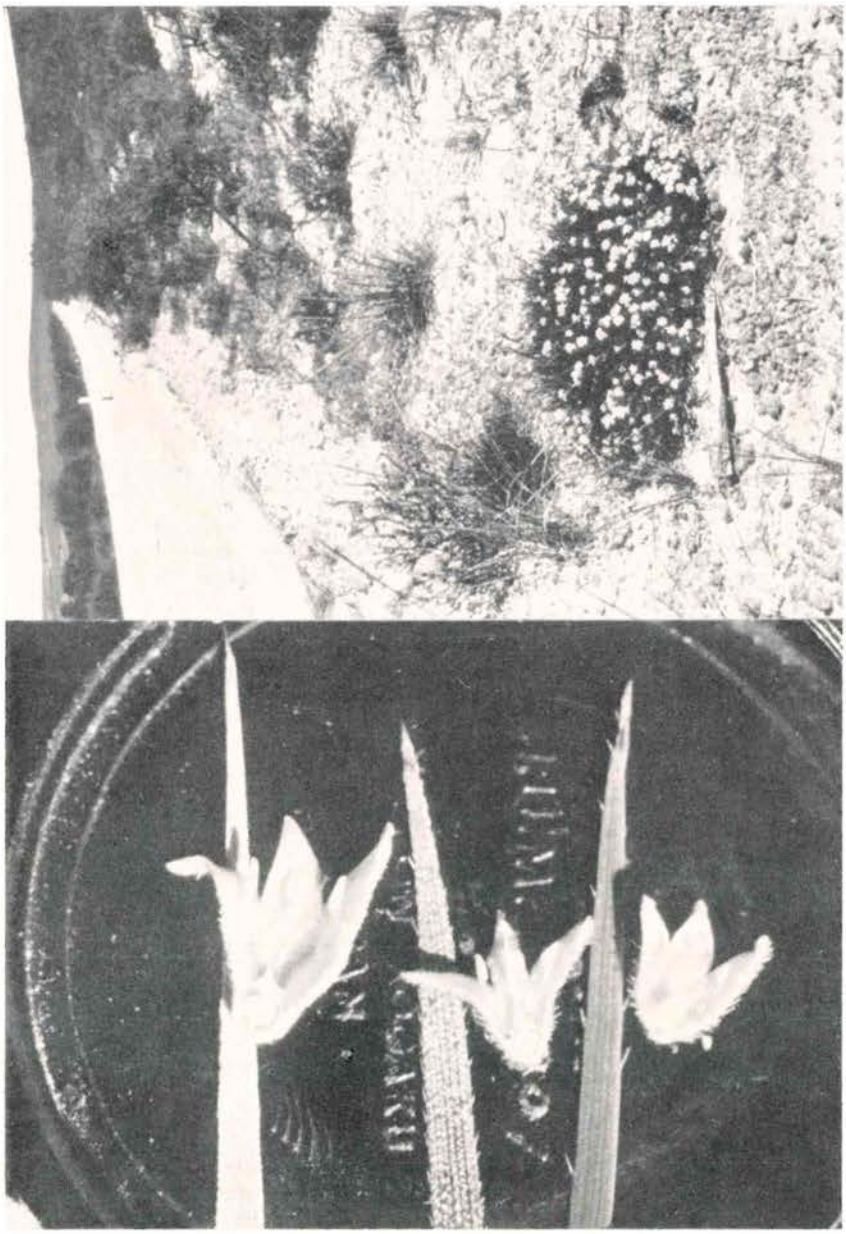

Figure 5. Top—*C. aculeata* ssp. *breviflora* ssp. nov. growing in a roadside ditch on Brand Highway near the Hill River. Bottom—leaves and half flowers of (left to right) *C. candicans*, a hybrid and *C. aculeata* ssp. *breviflora* from the Hill River bridge on the Jurien Bay—Cervantes road.

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