

## A REVISION OF *BLENNOSPORA* A. Gray (COMPOSITAE: INULEAE: GNAPHALIINAE).

by

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### ABSTRACT

Short, P. S. A revision of *Blennospora* A. Gray (Compositae: Inuleae: Gnaphaliinae). *Muelleria* 6(5): 349-358 (1987). The endemic Australian genus *Blennospora* A. Gray is revised. Two species, *B. drummondii* A. Gray and *B. phlegmatocarpa* (Diels) P. Short are recognised. The genus is compared with *Calocephalus* R. Br. s. str. Lectotypes are chosen for the names *B. drummondii*, *Calocephalus phlegmatocarpus* Diels and *C. stowardii* S. Moore.

### INTRODUCTION

In a previous publication (Short 1981a) I suggested that *Calocephalus* R. Br., as defined by Bentham (1867) is a most unnatural genus and that *Blennospora* A. Gray, considered by Bentham to be synonymous with *Calocephalus*, should be reinstated. It was noted that *Blennospora* differed from *Calocephalus* s. str. "by a number of characters, i.e. pappus type, morphology and arrangement of bracts and cypsela morphology" (Short l.c., p. 401). The reinstatement of *Blennospora* has been accepted by Grieve (1982) and in post-1981 checklists of the plants of Western Australia, South Australia and Victoria. I (Short 1986) have also upheld it in the most recent edition of the 'Flora of South Australia'. The present paper details the reasons why I consider *Blennospora* and *Calocephalus* to be distinct.

*Calocephalus* was described by Brown in 1817. He failed to name any species, this task being left to Lessing (1832) who recognised two species, *C. citreus* Less. and *C. lacteus* Less. Bentham (1867) placed four genera, i.e. *Achrysum* A. Gray, *Blennospora*, *Leucophyta* R. Br. and *Pachysurus* Steetz, in synonymy. My revision of *Calocephalus* s. lat., a genus considered by Bentham to consist of ten species, is still to be finalised. However it is clear that *Calocephalus* s. str. should be considered to be ditypic. Thus the characteristics of *Blennospora* are compared only with *C. citreus* and *C. lacteus*.

### METHODS

The methods used to determine pollen-ovule ratios and the measurements used to determine total anther length, the length of the microsporangia and the terminal anther appendage are the same as those used in a previous publication (Short 1985).

Fruit sections were obtained following the fixation of mature fruit with 5% glutaraldehyde in Pipes buffer and the subsequent infiltration and embedding in Spurr's resin (O'Brien & McCully 1981). Sections were stained in either Toluidine Blue, Aniline Blue Black or Coomassie Brilliant Blue.

To assist in the identification of vascular bundles fruits were cleared and stained in a solution of 1% Basic Fuchsin in 10% KOH (Wilcox 1977).

### RESULTS

Pollen-ovule ratios and anther measurements are summarised in Table 1. Except for the addition of data from *Short 1598* and *Short 1680* for *B. drummondii* all data come from populations previously specified in Short (1981a,b).

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Fruit differences between *Calocephalus* and *Blennospora* are illustrated in Figures 2-4 and are outlined in Table 2. Note that the carpodium, a special structure which develops at the base of the fruit and is believed to facilitate separation of the fruit from the pedicel (Haque and Godward 1984) is only developed in *Blennospora* (Fig. 2b). It is absent from both *C. citreus* (Fig. 2e) and *C. lacteus*. The illustrations (Figs 2c,e) of the fruit of the latter species display part of the pedicel or stipe. All species of *Blennospora* and *Calocephalus* display a layer of endosperm which is one cell wide and all have crystals in the testa.

Table 1. Pollen-ovule ratios and anther characteristics of species of *Blennospora*.

Characteristic	Species	$\bar{x}$	S.D.	S.E. $\bar{x}$	Range	n	Number of Populations
Pollen grains per floret (P/O)	<i>B. phlegmatocarpa</i>	4,119.7	762.4	113.6	2,525-6,119	45	3
	<i>B. drummondii</i>	217	60.1	6.1	64-339	95	7
Total anther length (mm)	<i>B. phlegmatocarpa</i>	1.18	0.099	0.016	0.9-1.33	32	3
	<i>B. drummondii</i>	0.61	0.07	0.007	0.45-0.75	82	7
Length of microsporangia (mm)	<i>B. phlegmatocarpa</i>	0.91	0.084	0.014	0.68-1.06	32	3
	<i>B. drummondii</i>	0.32	0.39	0.004	0.22-0.42	82	7
Length of terminal anther appendage (mm)	<i>B. phlegmatocarpa</i>	0.27	0.04	0.007	0.23-0.38	32	3
	<i>B. drummondii</i>	0.28	0.054	0.006	0.15-0.42	82	7

Table 2. Characteristics of *Blennospora* and *Calocephalus s. str.*

<i>Blennospora</i>	<i>Calocephalus s. str.</i>
Annual herbs.	Perennial herbs.
Leaves mainly alternate but sometimes the lowest pair opposite.	Leaves entirely opposite or sometimes the uppermost alternate.
Compound heads (inflorescence) each with (2)5-25(c. 30) capitula.	Compound heads each with c. 20-300 capitula.
General receptacle ill-defined, with shortly pedunculate capitula scattered along a stem-like axis.	General receptacle cylindrical to narrowly oblong, the capitula $\pm$ evenly distributed along the axis.
Capitular bracts: — some shortly ciliate or with long hairs on the mid to upper margins. — upper part not coloured and opaque. — 8-10, in $\pm$ 2 rows.	Capitular bracts: — all lacking marginal hairs. — upper part opaque, white or yellow. — 8-16, in 2 or $\pm$ 3 rows.
Florets 1-3 per capitulum.	Florets 2-3 per capitulum.
Cypselas: — mucilaginous cells covering entire surface. — pericarp with an inner layer of sclerenchyma. — vascular bundles in pericarp medial to the cotyledons. — carpodium present, annular. — stylophore distinct in mature fruit.	Cypselas: — vesicular trichomes scattered over the surface. — pericarp lacking inner layer of sclerenchyma. — vascular bundles in pericarp oblique to the cotyledons. — carpodium absent. — stylophore absent in mature fruit.
Pappus: — of 7-10 irregularly long-ciliate bristles which are united at the base to form an irregular cup. — bristles $\frac{1}{4}$ to about the length of the corolla tube.	Pappus: — of 4-11 bristles which are plumose in the upper part and united at the base to form a small ring. — bristles about the length of the corolla tube.

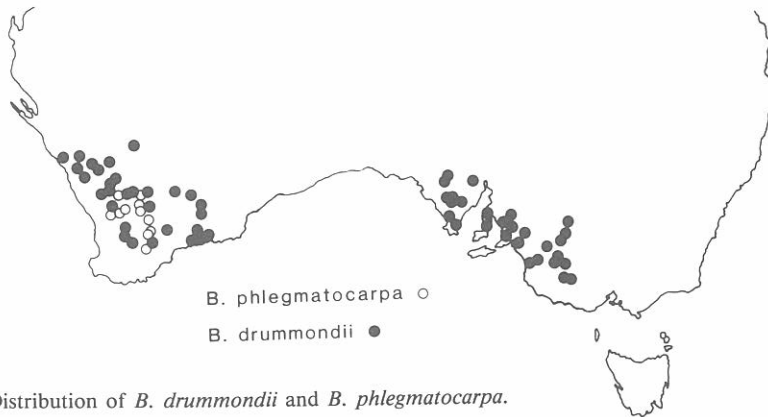


Fig. 1. Distribution of *B. drummondii* and *B. phlegmatocarpa*.

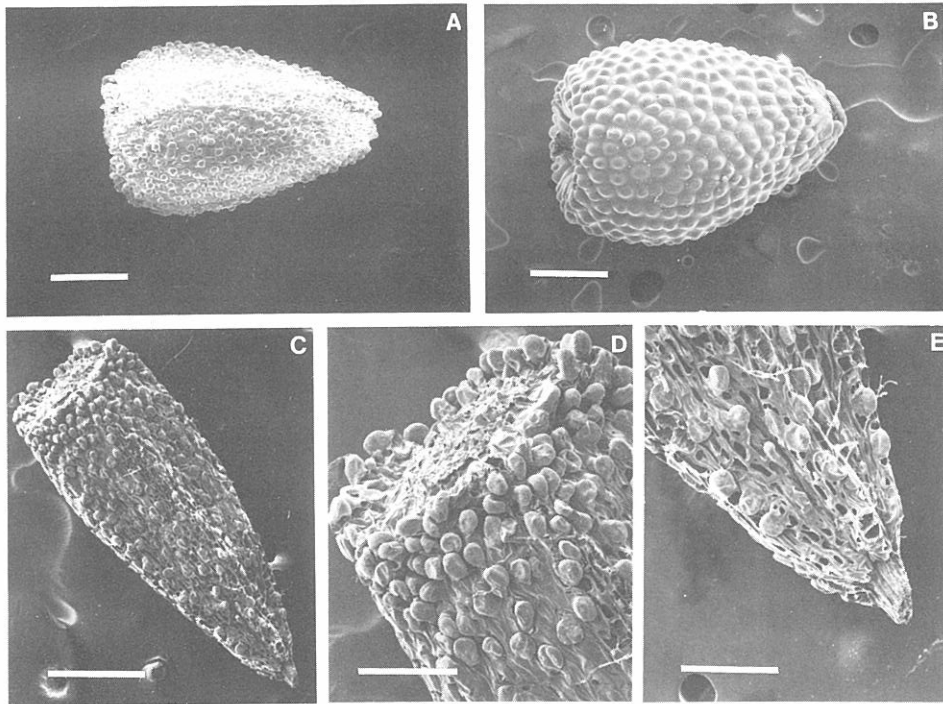


Fig. 2. Surface features of the fruit of *Blennospora* and *Calocephalus*. a — *C. citreus*, general view of entire fruit (Short 855). b — *B. phlegmatocarpa*, general view of entire fruit, note carpopodium & stylophore (Short 1077). c,d,e — *C. lacteus*, general view of entire fruit, apex & base respectively (Opie & van Berkel 29). Scales: a-c, 250  $\mu\text{m}$ ; d & e, 100  $\mu\text{m}$ .

## DISCUSSION

### Generic Characteristics and Affinities

In a future paper I will be outlining my rationale for determining generic limits, emphasising the importance of having a number of complex character differences between species groups. In this respect *Blennospora* differs markedly from *Calocephalus* (see Table 2).

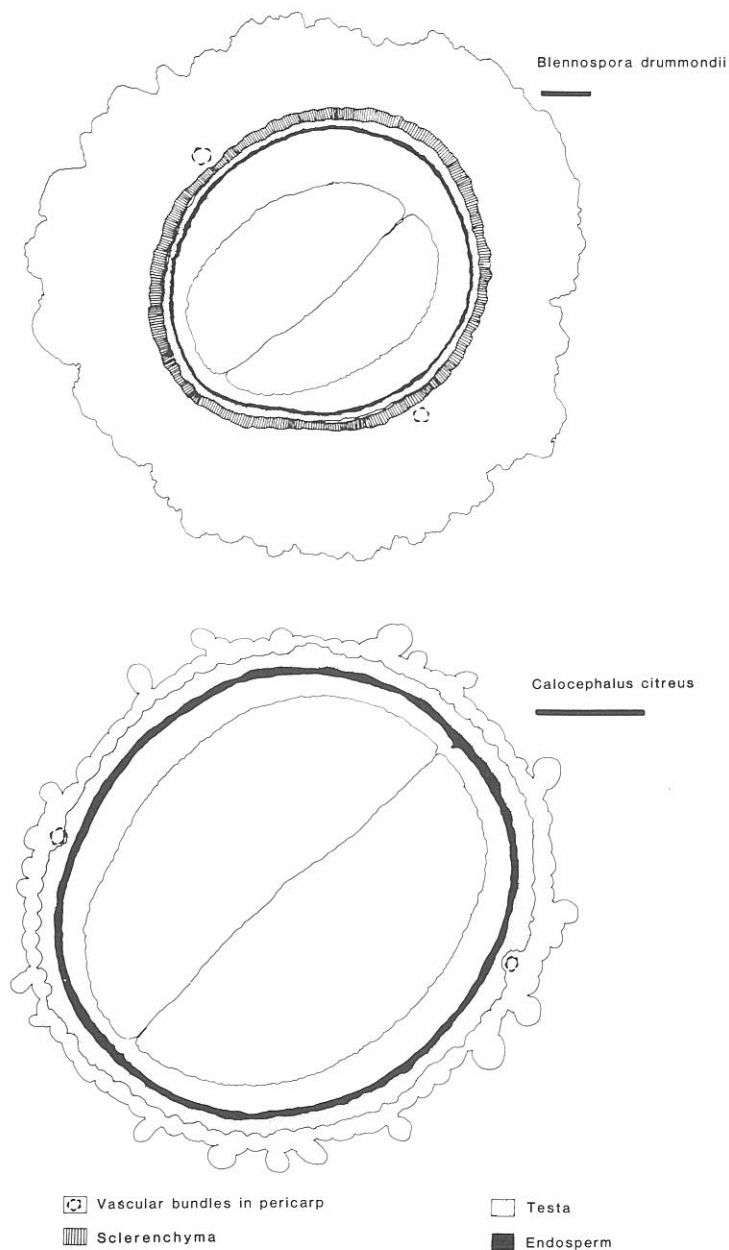


Fig. 3. Transverse sections of fruit of *B. drummondii* (Short 1030) and *C. citreus* (Short 855), diagrammatic. Both scales 100  $\mu\text{m}$ .

Apart from the obvious differences in features such as habit and the morphology and arrangement of the capitular bracts one of the major characteristics by which the genera can be distinguished is fruit anatomy and morphology (Table 2, Figs. 2-4), a feature at this stage rarely used to distinguish genera of Australian Inuleae. The work by Kroner (1980) on *Athrixia* Ker-Gawler *s. lat.*, in which

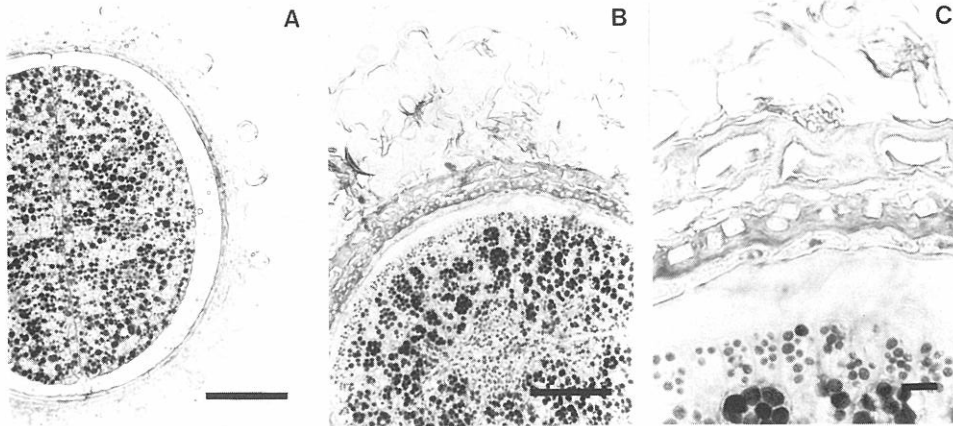


Fig. 4. Transverse sections of fruits. a — *C. citreus* (Short 865). b & c — *B. drummondii* (Short 1030). Scales: a & b, 100  $\mu\text{m}$ ; c, 10  $\mu\text{m}$ .

features of the fruit are highlighted, is exceptional in this regard. Unpublished work on the fruit anatomy of *Angianthus s. lat.* and other members of the “*Angianthus* group” (Merxmüller *et al.* 1977, see Short 1983 for comments on this group) suggest that the fruit characteristics will prove to be of much use for the determination of generic limits in the Australian Inuleae.

The affinities of *Blennospora* are somewhat obscure but if pappus type and fruit morphology are a reliable guide then it would appear that they lie with various species currently included in *Helipterum* DC. Mr Paul G. Wilson (in litt., 1985) has suggested that the genus *Hyalosperma* Steetz, regarded as a synonym of *Helipterum* by Bentham (1867), is closely related.

### Reproductive Biology and Evolution

The use of pollen:ovule ratios (P/Os) in the determination of plant breeding systems has previously been discussed for species of Inuleae, including the two species of *Blennospora* (Short 1981a,b). As noted, the high average P/O value (4,119.7, see Table 1) for *B. phlegmatocarpa* suggests that the species is an outbreeder (i.e. cross-fertilization is common) compared to *B. drummondii* which, with a P/O value of 217 (previously determined as 231 but additional populations have been sampled) is deemed to be an inbreeder (i.e. self-fertilization is predominant). This conclusion is supported by a number of other attributes. Thus *B. phlegmatocarpa* has yellow, pentamerous florets and a strong, somewhat putrid odour. In contrast *B. drummondii* has purplish-black pentamerous or occasionally tetramerous florets which emit a very weak odour. The position of the style arms in relation to dehiscent anthers has also been examined, suggesting that *B. phlegmatocarpa* is protandrous and *B. drummondii* possibly protogynous. Anther length also differs (Table 1) between species and as found for species of *Actinobole* (Short 1985) this primarily reflects a change in the length of the microsporangium, the terminal anther appendage being about the same length in both species. The alignment of pollen grains in the microsporangia also suggests that the anthers are tetrasporangiate in *B. phlegmatocarpa*, bisporangiate in *B. drummondii*.

Both species have a haploid chromosome number of  $n = 11$ .

Given that inbreeding is a derived characteristic then the distribution patterns of related outbreeding and inbreeding species can provide a clue as to the centre of origin and the direction of spread of taxa. Thus as previously argued (Short 1981a, b) it appears that *B. drummondii* may have originated in Western Australia and subsequently spread to the east.

## TAXONOMY

**Blennospora** A. Gray, Hook. J. Bot. Kew Gard. Misc. 3:98, 172 (1851); Short, Muellera 4:401 (1981); Grieve, W. Aust. Wildfls Suppl. 4:72 (1982); Short, Fl. S. Aust. 3:1500 (1986). TYPE: *B. drummondii* A. Gray.

[*Calocephalus* auct. non. R. Br. (1817); Benth., Fl. Austr. 3:573 (1867); Benth. in Benth. & Hook.f., Genera Pl. 2:320 (1873); O. Hoffm. in Engl. & Prantl., Natürl. Pflanzenfam. 4(5):194 (1890); J. M. Black, Fl. S. Aust. 1st ed. 647 (1929), 2nd ed. 927 (1957); Willis, Handb. Pl. Vict. 2:731 (1973); Grieve & Blackall, W. Aust. Wildfls 773, 820 (1975).]

*Annual herbs.* Major axes ascending to erect, cottony hairy; stem often simple but commonly forming major branches at basal and/or upper nodes. *Leaves* mainly alternate but the lowest pair(s) opposite, all leaves sessile, entire, erect, mucronate, cottony hairy, often the uppermost ones with hyaline apices and merging with the bracts of the general involucre. *Inflorescence* a compound head, ellipsoid to broadly ellipsoid or ovoid to broadly ovoid; general involucre inconspicuous, the bracts  $\pm$  leaf-like or  $\pm$  resembling the capitular bracts. *General receptacle* ill-defined, with shortly pedunculate capitula scattered along a stem-like, hairy axis. *Capitula* (2)5-25(30+) per compound head. *Capitular bracts* 8-10, in  $\pm$  2 rows. Outer 4-5 capitular bracts  $\pm$  obovate to oblanceolate or spatulate or  $\pm$  elliptic, each usually predominantly hyaline except for an opaque, green midrib extending for  $\frac{2}{3}$ - $\frac{3}{4}$  of its length but sometimes the hyaline margins poorly developed; bracts flat to conduplicate, glabrous on the inner surface but the outer surface often with long hairs at or about the apex of the midrib, the mid to upper hyaline margins shortly ciliate or with long hairs, the bracts united by the hairs. Inner 4-5 capitular bracts  $\pm$  elliptic or ovate to lanceolate, each flat to conduplicate, predominantly hyaline except for an opaque green midrib extending for c.  $\frac{1}{2}$ - $\frac{2}{3}$  its length, glabrous on the inner surface but the outer surface with long hairs at or about the apex of the midrib; margin entire or the mid to upper portions ciliate or with long hairs, the bracts free or united by the hairs. *Florets* 1-3 per capitulum; corolla tubular, (4)5-lobed, tube yellow, lobes purplish black or yellow. *Style* branches truncate, with short sweeping hairs. *Stamens* (4)5; anthers with a sterile apical appendage which is  $\pm$  narrowly triangular; microsporangia tailed, endothelial tissue polarized; filament collar  $\pm$  straight in outline and composed of  $\pm$  uniform cells and basally not thicker than the filament. *Cypselas* homomorphic,  $\pm$  obovoid; pericarp with mucilaginous cells covering the surface, with an inner layer of sclerenchyma (one cell thick), vascular bundles 2 and lateral to the cotyledons; testa containing crystals; carpodium present, annular. *Pappus* of 7-10, multiseriate, flexible, irregularly long-ciliate bristles; bristles from  $\frac{1}{4}$  to about the length of the corolla tube, forming an irregular cup at the base.

Chromosome number:  $x = 11$  (Short 1981).

## DISTRIBUTION (Fig. 1):

Both species recognised are found in Western Australia but *B. drummondii* extends to South Australia and Victoria.

## KEY TO THE SPECIES OF BLENNOSPORA

1. Lobes of florets yellow..... 1. *B. phlegmatocarpa*  
1. Lobes of florets purplish black..... 2. *B. drummondii*

1. **Blennospora phlegmatocarpa** (Diels) P. Short, Muellera 4:413 (1981); Grieve, W. Aust. Wildfls Suppl. 4:72 (1982). — *Calocephalus phlegmatocarpus* Diels, Bot. Jb. 35:614, fig. 69 o-u (1904); Grieve & Blackall, W. Aust. Wildfls 821 (1975). TYPE: "Hab. in distr. Avon pr. Wyola in lutosus gregaria flor. m. Oct. (D. 5020)". LECTOTYPE (here designated): *Diels 5020*, W. Australien: Wyola, 24.x.1901 (MEL 543205). PROBABLE ISOLECTOTYPE: *Diels s.n.*, East of York, s. dat. (PERTH).

*Calocephalus stowardii* S. Moore, J. Linn. Soc. Bot. 45:182 (1920); Grieve & Blackall, W. Aust. Wildfls 820 (1975). TYPE: "Cowcowing; *Stoward*, 485". LECTOTYPE (here designated): *Stoward* 485, West Australia, Cowcowing, 1916 (BM).

*Annual herbs* c. 1.5-10 cm high. *Leaves* semi-terete to  $\pm$  terete or  $\pm$  linear to narrowly oblanceolate, often  $\pm$  succulent, held erect, 0.5-2.5(2.7) cm long, 0.05-0.15 cm wide, mucronate, cottony hairy, the uppermost ones with hyaline apices and merging with the bracts of the general involucre. *Inflorescence* ellipsoid to broadly ellipsoid or ovoid to broadly ovoid, 0.6-1 cm high, 0.45-1 cm diam.; general involucre inconspicuous, the bracts leaf-like or  $\pm$  resembling the capitular bracts. *Capitula* c. 5-20 per inflorescence. *Capitular bracts* in  $\pm$  2 rows. Outer capitular bracts obovate to oblanceolate or  $\pm$  elliptic, 1.7-2.9(3.2) mm long, 0.4-1.7 mm wide, each bract usually hyaline except for an opaque green midrib extending for  $\frac{2}{3}$ - $\frac{3}{4}$  of its length but sometimes the hyaline margins poorly developed; bracts flat to conduplicate, glabrous on the inner surface but the outer surface often with long hairs at or about the apex of the midrib, the bracts united by long hairs along the mid and upper margins. Inner capitular bracts  $\pm$  elliptic or ovate, flat to conduplicate, 2.3-2.8 mm long, 1-1.5 mm wide, each predominantly hyaline except for an opaque green midrib extending for c.  $\frac{1}{2}$ - $\frac{2}{3}$  its length, glabrous on the inner surface but the outer surface with long hairs at or about the apex of the midrib, the bracts with an entire margin or the mid to upper margin with long hairs which usually unite the bracts. *Florets* 1-3 per capitulum; corolla tube 1.5-2.4 mm long, with 5 yellow lobes. *Stamens* 5; anthers 0.9-1.33 mm long, each with a sterile apical appendage which is  $\pm$  narrowly triangular and 0.23-0.38 mm long; microsporangia 0.68-1.06 mm long. *Cypselas*  $\pm$  obovoid, 0.9-1.1 mm long, 0.6-0.8 mm diam. *Pappus* of 6-10 bristles, from c.  $\frac{1}{4}$  to equal to the length of the corolla tube.  
Chromosome number:  $2n = 22$  (*Short* 633; *Short* 1981b).

#### TYPIIFICATION:

*Stafleu & Cowan* (1976) suggest that the Diels herbarium and types are in B, with Australian duplicates at BM, CANB and MEL. Enquiries reveal that the only extant, definite type material is at MEL, and it has been chosen as the lectotype. A duplicate collection probably exists in PERTH. It lacks a collector's number and date of collection but closely resembles the lectotype and the locality given, i.e. east of York, more or less agrees with the location of Wyola which is about 60 kilometres east-north-east of York.

The only type collection of *C. stowardii* located is at BM. It has been selected as the lectotype because some unlocated duplicates may exist.

#### DISTRIBUTION (Fig. 1):

South-west region of Western Australia.

#### BIOLOGY:

Almost invariably restricted to saline, often sandy soils on the margins of salt lakes which comprise the Avon River System (*Bettenay & Mulcahy* 1972). Commonly associated with *Halosarcia*, *Atriplex* and *Disphyma* but may occur with *Melaleuca*. A few collections have been made from apparently non-saline soils in *Eucalyptus* woodland (e.g. *Short* 654).

#### SELECTED SPECIMENS EXAMINED (Total c. 30):

*Gardner s.n.*, Mortlock River flats, 2 miles E. from Meckering, 22.x.1945 (PERTH); *Haegi* 2639 & *Short*, Kevills Lake, 11.xi.1983 (MEL); *Short* 619, salty flats at base of Hines Hill, 21.ix.1977 (AD); *Short* 633, southern margins of Lake Brown, 22.ix.1977 (AD); *Short* 679, salt depression 1 km E. of Wave Rock, 25.ix.1977 (AD).

2. *Blennospora drummondii* A. Gray, Hook. J. Bot. Kew Gard. Misc. 3:173 (1851); *Short*, *Muelleria* 4:401 (1981); *Grieve*, W. Aust. Wildfls Suppl. 4:72 (1982); *Short*,

Fl. S. Aust. 3:1500 (1986). — *Calocephalus drummondii* (A. Gray) Benth., Fl. Austr. 3:574 (1867); J. M. Black, Fl. S. Aust. 1st ed. 648 (1929), 2nd ed. 928 (1957); J. H. Willis, Handb. Pl. Vict. 2:731 (1973); Grieve & Blackall, W. Aust. Wildfls 821 (1975). TYPE: "Swan River, *Drummond*." LECTOTYPE (here designated): *Drummond s.n.*, Sw. riv., s. dat. (K). POSSIBLE ISOLECTOTYPES: *Drummond 359*, West Australia, s. dat. (BM, GH, MEL 543273, P — 2 sheets). REMAINING SYNTYPE AND ISOSYNTYPE: *Drummond 68*, Swan River, N. Holl., s. dat. (K, mounted with lectotype; E, ex herb. GL).

*Annual herbs* 1-10 cm high. Major axes ascending to erect, cottony hairy; stem often simple but commonly forming major branches at basal and/or upper nodes. *Leaves* semi-terete to  $\pm$  terete or  $\pm$  linear to narrowly oblanceolate, often  $\pm$  succulent, held erect, 0.5-2.5 cm long, 0.05-0.1 cm wide, mucronate, cottony hairy, the uppermost leaves usually overtopping the inflorescence. *Inflorescence* ellipsoid to broadly ellipsoid or ovoid to broadly ovoid, 0.6-1.2 (c. 1.5) cm high, 0.4-1.3 cm diam.; general involucre inconspicuous, the bracts  $\pm$  resembling the capitular bracts, mainly hyaline but with an opaque, green midrib, glabrous to densely hairy on the outer surface. *Capitula* (2)10-25(30+) per inflorescence. *Capitular bracts* in  $\pm$  2 rows. Outer capitular bracts obovate to spatulate, sometimes  $\pm$  elliptic, 1.7-3(3.5) mm long, 0.7-1.2(1.5) mm wide, each usually hyaline except for an opaque green midrib extending for c. 2/3 its length but sometimes the hyaline margins poorly developed; bracts flat to conduplicate, the upper hyaline margins variably ciliate, glabrous on the inner surface but externally usually with long hairs at or about the apex of the midrib and the bracts united by the long hairs. Inner capitular bracts elliptic or ovate to lanceolate, (1.8)2.5-4 mm long, 1.7-3(3.5) mm wide, each predominantly hyaline but with an opaque green midrib extending for c. 2/3 its length, conduplicate, with entire or ciliate upper margins, glabrous on the inner surface but externally with long hairs at or about the apex of the midrib, the bracts free or united by the long hairs. *Florets* 1-3 per capitulum; corolla tube 1.8-2.2 mm long, with (4)5 purplish black lobes. *Stamens* (4)5; anthers 0.45-0.75 mm long, each with a sterile apical appendage which is  $\pm$  narrowly triangular, 0.15-0.42 mm long, microsporangia 0.22-0.42 mm long. *Cypselas*  $\pm$  obovoid, 1.1-1.4 mm long, 0.8-1.1 mm diam. *Pappus* of 7-8 bristles, from c. 1/3 to equal to the length of the corolla tube.

Chromosome number:  $2n = 22$  (*Short 595, 719; Short 1981b*).

#### TYPIFICATION:

Gray (1851) described *B. drummondii* from collections made by James Drummond in Western Australia and forwarded to Gray by Sir William Hooker. At K there is a single sheet containing two apparently different collections made by Drummond, i.e. *Drummond 68* and *Drummond s.n.*. Each collection consists of a single specimen, is accompanied by an envelope containing fragments, and is annotated 'Blennospora Drummondii n. gen.' in Gray's hand. I have chosen the unnumbered collection as the lectotype. The collections in BM, GH and MEL of *Drummond 359*, none of which are annotated by Gray, all bear a strong resemblance to the lectotype.

Of the two sheets of *Drummond 359* in P, one is annotated by Gray as 'Blennospora n. gen.' and consists of two specimens. This sheet was not selected as the lectotype as the lack of a specific epithet suggests to me that Gray may not have closely examined the collection, perhaps only annotating it after general sorting of material when visiting Paris during his journey to Europe from June 1850 to August 1851 (Farlow 1888). As with other specimens of *Drummond 359*, the ones in P closely resemble the lectotype specimen.

#### DISTRIBUTION (Fig. 1):

South west region of Western Australia, southern South Australia and western Victoria.



## ECOLOGY:

Found in an array of habitats. Collectors' notes include "Shallow red-brown sandy loam over limestone. Mallee scrub.", "On sand dune associated with *Eucalyptus incrassata*, *Triodia* & various small annuals.", "Sandy loam at base of granite [rock], with moss.", "Growing in brown loam amongst *Eucalyptus*, *Acacia* shrubs and extending into *Arthrocnemum* [= *Halosarcia*] zone around salt lake.", "In open *Eucalyptus* woodland on brown sandy loam." and "Growing in open areas between low mallee eucalypts and *Melaleuca*. Sand to very sandy loam."

The species probably has a lower tolerance to salinity than *B. phlegmatocarpa* with collections (e.g. *Short 1030*) rarely coming from the upper margins of the sapphire zone surrounding saline depressions. This is the most common habitat of *B. phlegmatocarpa*.

## SELECTED SPECIMENS EXAMINED (Total c. 230):

*Western Australia* — *Short 595*, c. 31 km E. of Dalwallinu, 19.ix.1977 (AD); *Short 683*, Purnta Rock, 26.ix.1977 (AD); *Short 1030*, c. 21 km N. of Wongan Hills, 20.xi.1979 (AD); *Short 1060*, c. 21 km N. of Kojonup, 23.xi.1979 (AD); *Short 1598*, 1.5 km W. of Ajana, 31.viii.1982 (MEL); *Short 1680*, W. edge of Lake King, 11.ix.1982 (MEL); *Wilson 8889*, 65 km SW. of Sandstone, 26.viii.1970 (PERTH).

*South Australia* — *Barker 842*, south side of Mickey Flat road, c. 1.5 miles west of the Ardrossan to Pt Vincent road, 12.x.1970 (AD); *Keane 106*, Rowland Flat, 29.ix.1978 (AD); *Short 719*, c. 6 km SW. of Pt. Julia, 17.xii.1977 (AD).

*Victoria* — *Corrick 6630* & *Short*, c. 6 km east of Underbool Tank, 30.ix. 1980 (MEL); *Short 1219* & *Corrick*, c. 24 km SW. of Nhill, 4.x.1980 (AD).

## ACKNOWLEDGEMENTS

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