

A REVISION OF ANGIANTHUS WENDL., SENSU LATO (COMPOSITAE: INULEAE: GNAPHALIINAE), 1

by

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ABSTRACT

Angianthus Wendl. (sensu Bentham, 1867) has been revised. Eight genera, *Cephalosorus* A. Gray (monotypic), *Chrysocoryne* Endl. (6 species), *Dithyrostegia* A. Gray (monotypic), *Epitriche* Turcz. (monotypic), *Hyalochlamys* A. Gray (monotypic), *Pleuropappus* F. Muell. (monotypic), *Pogonolepis* Steetz (6 or 7 species) and *Siloxerus* Labill. (3 species) are reinstated. Three species with uncertain affinities, *A. axilliflorus* W. V. Fitzg. ex Ewart & J. White, *A. burkittii* (Benth.) J. M. Black and *A. connatus* W. V. Fitzg. are excluded from the above genera.

Fifteen species are recognised within *Angianthus* s. str. Four of these, *A. cornutus*, *A. cyathifer*, *A. glabratus* and *A. prostratus* are described as new. *A. brachypappus* var. *conocephalus* J. M. Black is raised to specific rank. Three of the 6 species of *Chrysocoryne*, *C. multiflora*, *C. tridens* and *C. trifida* are also described as new.

The following new combinations are made: *Cephalosorus carpesioides* (Turcz.) Short, *Epitriche demissus* (A. Gray) Short and *Pogonolepis lanigera* (Ewart & J. White) Short.

The majority of genera dealt with have no obvious close affinities with one another but all are referred to the subtribe Gnaphaliinae.

CONTENTS

| | |
|-------------------------------------------------------------------------------|-----|
| Generic history | 143 |
| Relationships of <i>Angianthus</i> and segregate genera | 144 |
| Materials and methods | 146 |
| Morphology | 146 |
| Presentation of data | 152 |
| Key to segregate genera and species of <i>Angianthus</i> sensu lato | 153 |
| Genera | |
| <i>Angianthus</i> sensu stricto | 153 |
| <i>Pleuropappus</i> | 179 |
| <i>Epitriche</i> | 181 |
| <i>Cephalosorus</i> | 182 |
| <i>Chrysocoryne</i> | 185 |
| <i>Dithyrostegia</i> | 201 |
| <i>Hyalochlamys</i> | 202 |
| <i>Pogonolepis</i> | 203 |
| <i>Siloxerus</i> | 204 |
| Species of uncertain affinity | 209 |
| Names of uncertain application | 210 |
| Acknowledgements | 210 |
| References | 211 |
| Index to genera and species of Compositae | 212 |

GENERIC HISTORY

Wendland (?1808 or 1809, see Stafleu, 1967), when describing the new genus *Angianthus* recognised a single species, *A. tomentosus*. No further species were attributed to the genus until Mueller described the closely related *A. brachypappus* in 1855. Then in 1867 Bentham, as well as describing several new species of *Angianthus*, placed the following genera in synonymy (arranged chronologically in taxonomic and nomenclatural groups): *Siloxerus* Labill. (1806), including the emendations *Styloncerus* Spreng. (1826) & *Ogcerostylus* Cass. (1827); *Cylindrosorus* Benth. (1837); *Phyllocalymma* Benth. (1837); *Skirrhophorus* DC (1838); *Eriocladium* Lindl. (1839); *Chrysocoryne* Endl. (1843); *Pogonolepis* Steetz (1845); *A. Gray* (April 1851); *Hyalochlamys* A. Gray (April 1851); *Dithyrostegia* A. Gray (April 1851), *Gamozygis* Turcz. (Oct. 1851); *Epitriche* Turcz. (Oct. 1851) and *Pleuropappus* F. Muell. (1855). In justifying this procedure Bentham (l.c., p. 561) stated that the genera had "been established chiefly upon minute distinctions in the pappus which appear to me to afford a much better specific than generic character".

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Muelleria 5(2): 143-183 (1983).

Bentham realised that the same *Siloxerus* had priority over *Angianthus* but because the former name was at complete variance with the etymology given by the author and both Cassini's (1827) and Sprengel's (1826) emendations of *Ogcerostylus* and *Styloncerus* respectively were more recent names than *Angianthus*, he chose the latter name. Ostenfeld (1921) and Ising (1922) made a number of new combinations with *Siloxerus* but in 1940 the International Botanical Committee on Nomenclature approved the conservation of *Angianthus* against *Siloxerus*.

Prior to Bentham (l.c.) the most important work on the group was by Gray (1851). As well as describing a number of new taxa based on collections made by James Drummond in Western Australia Gray produced a conspectus of the Division Angiantheae (= subtribe Gnaphaliinae p.p., see below). He recognised 22 genera within the group. Seven of these, namely *Cephalosorus*, *Chrysocoryne*, *Dithyrostegia*, *Hyalochlamys*, *Phyllocalymma*, *Siloxerus* and *Skirrhophorus* were ultimately referred to *Angianthus* by Bentham (l.c.). Despite Bentham's above-mentioned statement it is clearly evident that Gray did not place undue emphasis on pappus type but also differentiated the genera on characters such as size shape and number of capitular bracts and general involucre bracts, the shape of the compound heads or glomerules and the number of florets per capitulum. Such characters have also been used to a large extent in the current work and indeed in this revision only *Phyllocalymma* and *Skirrhophorus* sect. *Skirrhophorus* (sensu Gray) are retained in *Angianthus* s.str. Although in some cases modified, *Chrysocoryne*, *Cephalosorus*, *Dithyrostegia*, *Hyalochlamys* and *Siloxerus* are reinstated. The genus *Pogonolepis* Steetz, treated by Gray as a section of *Skirrhophorus*, is also reinstated whereas *Skirrhophorus demissus* A. Gray, referred to section *Pseudopappus* A. Gray, is referred to the genus *Epitriche* Turcz.

It is clear from Turczaninow's (1851) work within the group that he too had similar generic concepts to Gray. In fact several genera described by Turczaninow and Gray are nomenclatural synonyms. This is a result of both workers basing many of their descriptions on duplicate collections made by Drummond.

Several workers (e.g. Mueller, 1889; Ostenfeld, 1921) were critical of Bentham's treatment of *Angianthus* but none the less his concepts have been generally followed in current Australian literature. Ewart & White (1909), attributed two further taxa, *A. lanigerus* and *A. axilliflorus* to the genus. Neither species remotely resemble *Angianthus* s.str. as circumscribed in the current work. *A. lanigerus* is a species of *Pogonolepis* while *A. axilliflorus*, like Fitzgerald's (1905) species *A. connatus*, lacks affinity with any of the segregate genera of *Angianthus* s.l. On the other hand the only other species described since Bentham and up to the present time, *A. acrohyalinus* Morrison (1912), undoubtedly belongs to the genus.

A single species, *Gnephosis burkittii* Benth. was transferred to *Angianthus* by Black (1929).

Only Gardner (1931), in a census of Western Australian plants, attempted to divide the genus. He recognised three sections. Two, namely section *Spicatae* Gardn. and section *Pyramidatae* Gardn., are invalid names while the remaining one, section *Skirrhophorus* (DC.) Gardn., is misapplied. Gardner merely listed the various species under each section, placing *A. cunninghamii*, the type species of *Skirrhophorus* DC., under section *Pyramidatae* Gardn.

In this revision the following genera, commonly placed in synonymy with *Angianthus*, have been reinstated: *Cephalosorus*, *Chrysocoryne*, *Dithyrostegia*, *Epitriche*, *Hyalochlamys*, *Pleuropappus*, *Pogonolepis* and *Siloxerus*. Three species, namely *A. axilliflorus*, *A. burkittii* and *A. connatus* are excluded from *Angianthus* s.str. as their relationships are obscure.

RELATIONSHIPS OF ANGIANTHUS AND SEGREGATE GENERA

In his description of the subtribe Angianthinae Bentham (1867, p. 556) wrote: "Flower-heads small, sessile or nearly so on a common receptacle in dense clusters or compound heads, often closely surrounded by imbricate bracts or by a few floral leaves forming a general involucre. Florets all tubular and hermaphrodite." Within Australia he

recognised eight genera within the subtribe, namely *Angianthus* Wendl., *Calocephalus* A. Gray, *Chthonocephalus* Steetz, *Craspedia* Forst.f. (also occurs in New Zealand), *Gnaphalodes* A. Gray (= *Actinobole* Fenzl ex Endl., see Eichler 1963), *Gnephosis* Cass. and *Myriocephalus* Benth.. Subsequently Bentham (1873a) also referred the Indian *Caesulia* Roxb. and the African *Eriosphaera* Less. to the Angianthinae. A similar procedure was also followed by Hoffman (1894) although he excluded *Eriosphaera* and included monotypic *Dimeresia* A. Gray (North America) and *Decazesia* F. Muell. (Australia). Black (1929) also included *Eriochlamys* Sond. & F. Muell. ex Sond. and *Basedowia* Pritzl in the subtribe.

Prior to Bentham (1867, 1873) the majority of the genera listed above were similarly grouped together on the basis of their compound head and usual general involucre in the "Division Angiantheae" of the "Subtribe Gnaphalieae" (De Candolle, 1836, 1838; Gray, 1851).

Recently Merxmuller, Leins and Roessler (1977), making much use of new data derived from investigations of pollen (Besold, 1971; Leins 1971, 1973), the stylar structure of hermaphroditic florets and chromosome numbers, have suggested that only 3 subtribes, i.e. Inulinae, Gnaphaliinae and Athrixiinae be recognised within the tribe. This contrasts sharply with the 9 subtribes recognised by Bentham (1873a) and commonly used in current works. Merxmuller *et al.* (l.c.) have referred the above-mentioned Australasian genera of the Angianthinae to an "*Angianthus* group" within the Gnaphaliinae. They have also tentatively included the Australian genera *Stuartina* Sond. and *Nablonium* Cass. in the group.

Although the alignment of the various genera with others such as *Helichrysum* Miller and *Helipterum* DC. seems reasonable the "*Angianthus* group" is nevertheless artificial. Merxmuller *et al.* (l.c.), like past workers, have, I believe, placed too much emphasis on the presence of pseudocephalia or compound heads. Thus they stated that "their [the pseudocephalia] distribution does not look irregular [within the Inuleae], as most of the taxa concerned can be arranged in well delimited taxonomic groups. This has been accepted for a long time in the *Angianthus* group . . ." (p. 589). Studies of the variation exhibited in the general receptacle, achene and bract morphology of *Angianthus* s.l. alone make it very clear that many of the segregate genera, e.g. *Pogonolepis* and *Siloxerus*, are but distantly related to *Angianthus* s.str. A similar situation appears to occur in the apparent unnatural genera *Calocephalus*, *Chthonocephalus*, *Gnephosis* and *Myriocephalus*, (in the sense of Bentham, 1867). For example *Blennospora* A. Gray, commonly placed in *Calocephalus* but clearly with little affinity with that genus, should be reinstated (Short, 1981a, b).

The artificiality and indeed impracticality of the use of the compound head as a criterion for subtribal recognition may also be seen in the monotypic genera *Eriochlamys* and *Cephalipterum*. *Eriochlamys behrii* Sond. & F. Muell. ex Sond., like the majority of the "*Angianthus* group" has tubular, hermaphroditic florets but the capitula may be single or aggregated into compound heads. Bentham (1867, 1873a) placed the genus in subtribe Gnaphaliinae but Black (1929) referred it to the Angianthinae. The complex species (Short, 1981c) *Cephalipterum drummondii* A. Gray contains capitula with tubular female and male florets. It has obvious affinities with species of *Helipterum*, particularly *H. sterilesceus* F. Muell., but on the basis of the presence of compound heads is placed in the Angianthinae or "*Angianthus* group" thus suggesting only a distant relationship with members of *Helipterum*.

The occurrence of compound heads in so many species is perhaps the result of selection for more efficient pollination or for a shorter life cycle. A reduction in life span is perhaps the most likely factor as perhaps all but four of the c. 80 species in the "*Angianthus* group" (excluding *Craspedia*) are annuals living in semi-arid to arid conditions. Such a hypothesis not only helps to explain the observed aggregation of capitula in the "*Angianthus* group" but may also help to explain the presence of varying degrees of aggregation of capitula in the inflorescences of many closely related species of the ill-defined genera *Gnaphalium* L., *Helichrysum* and *Helipterum*.

Hence, although agreeing with Merxmuller *et al.* (1977) that the subtribe Angianthinae be abolished and that *Angianthus* and other genera included in the

Angianthinae by Bentham (1867) be placed within the Gnaphaliinae, I cannot, at least under current definition, agree with the maintenance of an "Angianthus group". Further revisions within this group are required before the relationships of the many genera can be determined.

MATERIALS AND METHODS

Descriptions of taxa were made from dried herbarium material and to a lesser extent from specimens stored in 70% alcohol. In many cases measurements were made from all available specimens, these usually being fewer than 30 per species. Where more specimens existed collections were selected on a regional basis, care being taken to include the full range of morphological variation. Shapes were defined using the terms given by the Systematics Association Committee for Descriptive Terminology (1962).

Specimens were obtained from the following herbaria: AD, BR1, CANB, CBG, GH, K, KP (Kings Park, Western Australia), KW, MEL, NSW, NT, PERTH, and UWA (abbreviations after Holmgren & Keuken, 1974). Much material was also obtained by the author on field trips to Western Australia in August-September 1977 and November 1979 and on a number of trips in South Australia and Victoria during 1977-1980. A complete set of collections from these trips is housed in AD.

When possible, publication dates of all works have been checked with Stafleu (1967) and Stafleu & Cowan (1976, 1979). Publication dates for the *Bull. Soc. Imp. Naturalistes Moscou* were provided by Dr HJ. Eichler (pers. comm., 1978). Turczaninow (1851) described new species in a paper published in volume 24 of that journal. The volume consists of 2 parts and 4 numbers. Part 1, number 1 contains the first part of the above paper and according to the published records (*Bull. Soc. Imp. Naturalistes Moscou* 24(1):705) was presented to the meeting of the Society on 15 March 1851. This is accepted as the date of publication. Part 2, number 3 contains the second part of the paper and was presented to the Society on 25 October 1851 (*Bull. Soc. Imp. Naturalistes Moscou* 24(2):625). As in the above case this is also accepted as the date of publication. Accurate publication dates had to be obtained as both Turczaninow and Asa Gray (1851) published new species, based on duplicates of the same collections, in the same year. Gray published in three fascicles of *Hook. J. Bot. Kew Gard. Misc.* The fascicles were published in April, May and June of 1851 (Stafleu & Cowan, 1976).

MORPHOLOGY

As pointed out by Heywood (1971) and Heywood *et al.* (1977) the uniformity of inflorescence, floral and fruit structure within natural families such as the Umbelliferae, Cruciferae and Compositae tend to make the recognition of genera difficult. In some cases apparently trivial characteristics have been used to define generic limits. For example various studies (e.g. De Jong, 1965; King & Robinson, 1966) within the Compositae have shown that the pappus type has frequently been given too much weight in the recognition of genera. It is essential to look at a wide range of characters before deciding generic limits. In the current work the segregate genera and species of *Angianthus* s.l. have been recognised on the basis of a combination of a number of morphological characteristics, some of which are unique. For example the oblique scale-like pappus of *Pleuropappus* is, within *Angianthus* s.l., unique to that genus. Furthermore the oblique achene and the number and arrangement of capitula-subtending bracts are also unique to *Pleuropappus* (fig. 1h).

In general a single, unique, generically diagnostic character, or a unique combination of characteristics, is used in the key to the segregate genera and species of *Angianthus* s.l. The characteristics of each genus are also briefly outlined following each generic description.

The use of various characters in Composite taxonomy has been discussed by a large number of workers. Perhaps the most useful and best known study was made by Bentham (1873b). The various features used in delimiting genera and species of *Angianthus* s.l. are discussed below.

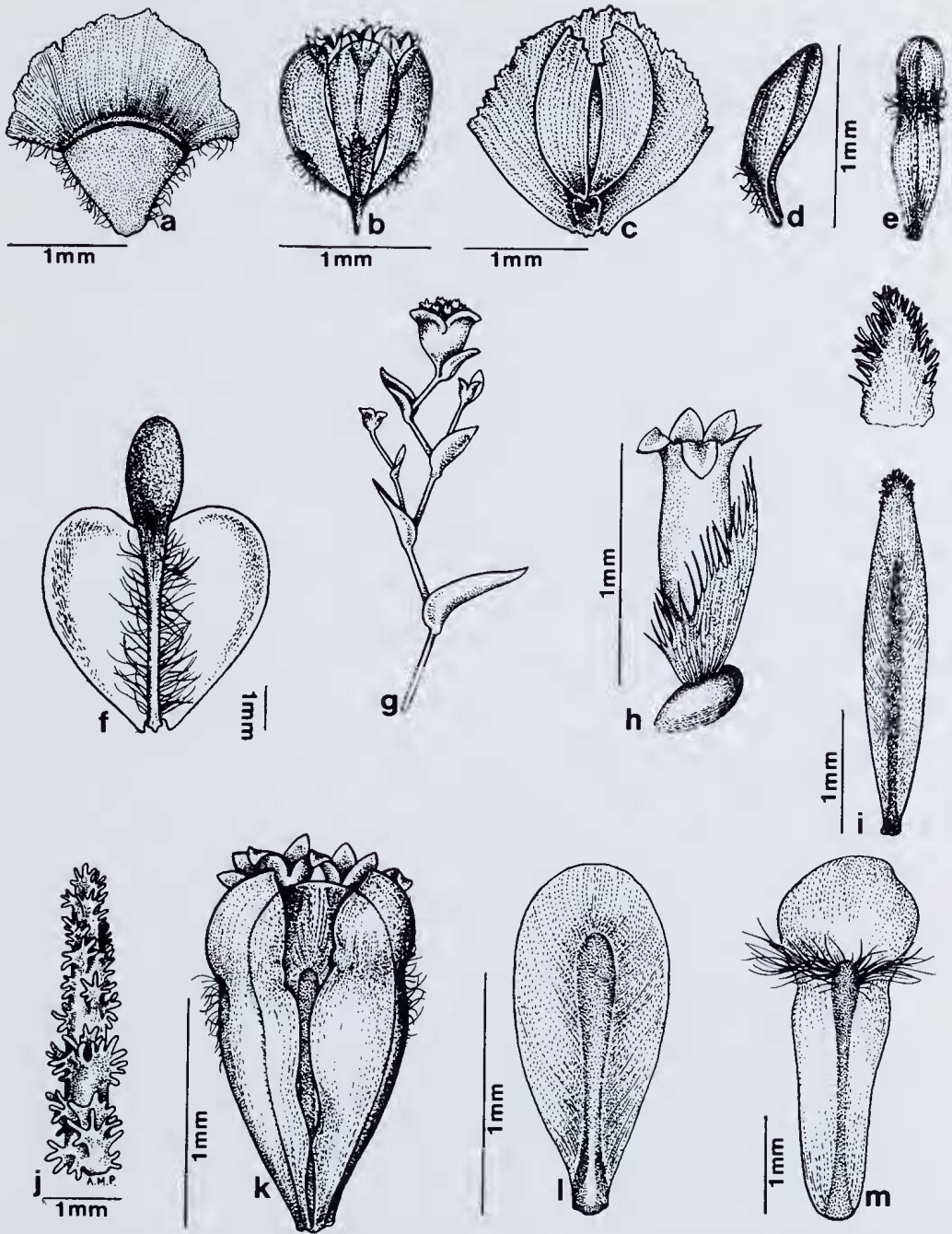


Fig. 1. Characteristics of *Angianthus* and segregate genera. a — capitulum-subtending bracts of *Chrysocoryne pusilla* (Short 902). b — capitulum of *C. pusilla* (Short 902). c — capitulum and capitulum-subtending bract (inner view) of *C. drummondii* (Short 1085). d-e — caputular bracts of *C. pusilla* (Short 902). f — bracts subtending compound head of *Hyalochlamys globifera* (Short 636). g — habit of *Dithyrostegia amplexicaulis*, x 1 (Short 344). h — floret of *Pleuropappus phyllocalymmeus* (Wilhelmi s.n., MEL 541617). i — capitular bract of *Pogonolepis stricta* (Short 1053). j — general receptacle of *Angianthus tomentosus* (Short 1075). k — arrangement of capitular bracts in *A. glabratus* (Short 905). l — capitulum-subtending bract of *A. glabratus* (Short 905). m — capitulum-subtending bract of *A. milnei* (Short 473).

a. HABIT:

With the exception of *Angianthus cunninghamii*, a perennial shrub, all species examined in the current work are annuals. Habit characteristics are useful for distinguishing a number of closely related species. For example within *Chrysocoryne* one species, *C. tridens*, never branches from the upper nodes of major axes but other species commonly do so.

b. LEAVES:

The majority of taxa have alternate leaves but there are exceptions. Within *Angianthus* some species possess a few opposite basal leaves whereas some specimens of *A. preissianus* have entirely opposite leaves. The distinctive *A. connatus* and the monotypic *Cephalosorus* are characterised by possessing some opposite leaves. The latter taxon is also the only genus with petiolate leaves.

Leaf shape is more or less constant within any one genus although specific differences exist, e.g. the conduplicate leaves and hyaline apices of *Angianthus acrohyalinus* are unique within the genus. At the generic level the monotypic *Dithyrostegia* and *Cephalosorus* have unique leaf types.

The nature of the leaf indumentum is of value at both generic and specific levels. For example in all species of *Chrysocoryne* and in monotypic *Hyalochlamys* at least some scale-like glandular hairs are found on the leaves. Such trichomes are absent from other genera. The glabrous or nearly glabrous nature of the leaves of some species of *Angianthus* is also useful for distinguishing some species.

c. COMPOUND HEADS:

All species included by Bentham (1867) in *Angianthus* are said to possess compound heads or glomerules, i.e. the individual capitula are clustered together to form a compact inflorescence usually resembling either a capitulum or a spike. Such inflorescences often possess a general involucre of bracts. Recent workers such as Leppick (1977) have referred to such structures as synflorescences or conflorescences but the term compound head, used in current Australian floras and readily understood, is retained in this work.

The ancestral nature of the inflorescence or compound head in all genera examined is unknown and probably can only be ascertained following anatomical studies at different stages of development. At least in *Angianthus* s.str. the compound heads appear to have been derived from a compound inflorescence, perhaps a compound corymb. This is supported by the fact that in most species of *Angianthus* with oblong to cylindrical heads distinct minor receptacular axes (fig. 1j) are more or less evenly distributed along a single major axis. Two or more capitula are usually attached to each minor receptacular axis and, although difficult to ascertain, it also appears that the outermost capitula of each minor axis commonly possess more than one capitulum-subtending bract.

The arrangement of capitula in the compound head and the nature of the general receptacle furnish very useful, often diagnostic, generic characteristics. For example the general receptacles of *Siloxerus* and *Dithyrostegia* are covered with long silky hairs whereas the receptacle in other genera is glabrous. In *Chrysocoryne* and *Pleuropappus* the capitula are arranged in a regular spike-like fashion along the axis but most species of *Angianthus* have distinct minor receptacular appendages distributed along the major axis. The size and shape of the compound heads provide useful characters for distinguishing many species of *Angianthus*, *Chrysocoryne* and *Siloxerus*.

d. BRACTS:

The bracts of the general involucre, the capitulum-subtending bracts, capitular bracts and the paleae provide some of the best diagnostic characters for distinguishing the genera and to a lesser extent species.

d.1. GENERAL INVOLUCRE (bracts subtending compound heads). The number and shape of the bracts of the general involucre are of much use in distinguishing the genera *Cephalosorus*, *Dithyrostegia*, *Hyalochlamys* and *Pogonolepis*. For example in *Dithyrostegia* the compound head is enclosed by two overlapping or connate leaf-like bracts (fig. 1g), a condition not found in other genera. In contrast all species of

Chrysocoryne lack a conspicuous involucre. In *Angianthus* the bracts provide useful characters for distinguishing species.

d.2. CAPITULUM-SUBTENDING BRACTS. The term capitulum-subtending bract appears to have been applied by Bentham (1867) to a usually singular bract occurring on the adaxial side (relative to the major axis of the general receptacle) of a capitulum of many species of *Angianthus* s.l. It appears that such bracts, under Bentham's definition, could resemble the capitular bracts. For example he recognised such bracts as occurring in both *A. humifusus* (= *Siloxerus humifusus*) and *Angianthus strictus* (= *Pogonolepis stricta*). However the present studies suggest that no such bracts should be recognised. In *Siloxerus* the capitula themselves are difficult to recognise and both receptacular and capitular bracts are similar in appearance. In *Pogonolepis* all bracts within the centre of a compound head have similar morphologies and it would appear that the inner papillose bracts of the general involucre have been interpreted by Bentham as capitulum-subtending bracts. The capitulum-subtending bracts are therefore best defined as a bract or several bracts which occur on one side of a capitulum (usually very obviously the adaxial surface relative to the centre of the general receptacle) only and differ in their appearance from at least some of the capitular bracts. Thus in *Chrysocoryne* (figs. 1a-e; 10c-f, j) the capitulum-subtending bracts are extremely dissimilar to all capitular bracts. In contrast the more or less flat capitulum-subtending bracts in both *Angianthus* and *Pleuropappus* are similar to the inner flat capitular bracts but are quite distinct from the outer pair of concave capitular bracts of these genera (fig. 11-m).

The capitulum-subtending bracts are undoubtedly modified bracts which originally subtended the capitula in ancestral plants with only loosely arranged inflorescences of capitula. Their role in the compound head is presumably one of protection of developing florets and to some extent the attraction of pollinators. The function of protecting developing florets and fruit is perhaps best illustrated in *Chrysocoryne* where the bracts more or less enclose the capitula.

d.3 CAPITULAR BRACTS. The capitular bracts, i.e. the involucre bracts of a capitulum, furnish many characters which are important in distinguishing genera. For example the bracts of *Pogonolepis* are unique in that they possess papillae at their apex (fig. 1i). Similarly the rigid, opaque, thick-cell walled bracts of *Siloxerus* are unique to that genus. In other cases the number and arrangement of the bracts is important in distinguishing genera. With the exception of *Angianthus microcephalus*, all species of *Angianthus* have four capitular bracts arranged so that two outer, variably concave bracts surrounded two inner flat bracts (fig. 1k). The same arrangement occurs in monotypic *Pleuropappus*.

Although the majority of segregate genera have constant and unique features in relation to the capitular bracts the genus *Chrysocoryne* is distinctive in the degree of variation exhibited in the number, arrangement and morphology of the bracts. Three of the six species have similar bracts, i.e. *C. drummondii* (figs. 1c; 9; 10j), *C. tridens* and *C. uniflora* each have two, concave, capitular bracts with shortly ciliate margins. In the remaining species the bracts are quite different. *C. trifida* also has only two capitular bracts but they have long hairs on the upper margins (figs. 9; 10l) and are smaller than those found in the three preceding species. Both *C. multiflora* and *C. pusilla* have from 2 to c. 10 bracts per capitulum. The laminae on the bracts of *C. pusilla* (figs. 1e; 9; 10f) distinguish that species from all others in the genus.

Within *Angianthus* the 4 capitular bracts, particularly the inner flat bracts, frequently exhibit specific differences. For example in several species a wing-like extension extends from the adaxial surface of the midrib of the inner bracts (fig. 3e) while in others the inner bracts are abruptly attenuated in the lower $\frac{1}{2}$ to $\frac{1}{3}$ of the bract (fig. 3d).

It seems reasonable to suggest that the major role of the capitular bracts in all species examined is the protection of the developing florets and achenes. Presumably the colour and number of these bracts, plus the capitulum-subtending bracts, are also important in making the capitula more attractive to likely pollinators. However in *Angianthus* s.l. the general lack of large, coloured laminae, which are found in many species of genera such as *Helipterum*, *Helichrysum* and *Calocephalus*, suggests that in many species this latter

role is only minor. It seems likely that the role of attracting pollinators is more a function of the compound head. Given that protection is probably the major function of the capitular bracts it is not surprising that in many genera the number, morphology and arrangement of bracts is more or less constant. That is, a successful combination of bract characters which ensures floret and achene development has a high selective value and only comparatively minor modifications (such as the degree of development of the wing-like extension in *Angianthus*) have occurred.

The variation found in the capitular bracts of *Chrysocoryne* obviously does not support this argument, at least at first sight. However, this variation is readily explained. Firstly, there is a marked trend in the genus to a reduction in the number of florets per capitulum (see proposed phylogeny in generic treatment). This decreases the need for a large number of capitular bracts and in fact a decrease in bract number is correlated with a decrease in the number of florets per capitulum. Secondly, and perhaps more importantly, the capitulum-subtending bracts are extremely well developed in this genus (figs. 1a, c; 9; 10c; h, j, m). In all species they more or less completely cover the capitula and obviously give great protection to the developing florets, thus decreasing the importance of the capitular bracts in this function.

d.4. PALEAE. Within *Siloxerus* the florets in all species are subtended by a single bract which resembles the capitular bracts. Paleae are not found in other genera.

e. FLORETS:

The florets of all species are more or less morphologically uniform, i.e. they are all tubular, bisexual and yellow. The most important difference occurs in the number of corolla lobes per floret.

Gardner (1977) noted that approximately 80 genera of Compositae include species with tri- and/or tetramerous disc florets. He suggested that a change from a 5 to 3 or 4-lobed state is either related to a change in breeding system, i.e. from chasmogamy to autogamy, or to selective pressure for increased seed production. As previously outlined (Short 1981a, b) in all members of the Australian Gnaphaliinae so far examined species with predominantly or entirely tri- and/or tetramerous florets are inbreeders. Closely related species with pentamerous florets have been classed as outbreeders. Indeed lobe-number is an extremely important character for distinguishing closely related species in *Chrysocoryne* and *Angianthus*.

The length of the corolla tube, i.e. the length from the base of the floret to the base of the lobes, the diameter of the floret tube and the presence or absence of a basal tubular swelling have been recorded for all species but appear to be of little or no taxonomic significance. In many cases the degree of swelling is related to the age of the floret, the swelling becoming pronounced only in mature florets.

f. STAMENS:

The anthers of all members of the Inuleae are said to be tailed and this appears to be the case in all members of *Angianthus* s.l. Various workers (e.g. Robinson & King, 1977) have found that characteristics of the filament collar and the anther appendage provide taxonomically useful characteristics. Such differences have not been closely examined in the current work but the only apparent differences in anther morphology are found between related outbreeding and inbreeding species. Outbreeding species have normal tetrasporangiate anthers whereas related inbreeding species have bisporangiate anthers. Furthermore the anther sacs of inbreeders are about one-half the length of those in outbreeders.

g. POLLEN:

It is clear from the works of Besold (1971), Leins (1971, 1973), Merxmüller *et al.* (1977) and Skvarla *et al.* (1977) that detailed studies of pollen structure will be of considerable use in clarifying generic relationships within the Inuleae. In the current work pollen grains of *Angianthus* s.l. have not been anatomically examined. However it has been found that the number of pollen grains per anther or floret is a very useful character for distinguishing species. As previously pointed out (Short 1981a, b) the pollen-ovule ratio (P/O), which in the hermaphroditic species examined is equal to the number of

pollen grains per floret, reflect a plant's breeding system. In the genera examined there are a number of closely related outbreeding and inbreeding taxa with vastly different P/O values. For example the average P/O of *Chrysocoryne tridens* is 48.6 but that of the closely related *C. uniflora* is 1,775.5. Indeed pollen grain number, along with the number of lobes per floret and the size and morphology of the anthers, provide the best, if not the only characteristics for reliably distinguishing some closely related taxa.

h. PAPPUS:

Pappus characteristics are of much use at both the generic and specific level. For example the oblique scale-like pappus of *Pleuropappus* readily distinguishes it from all other genera included in *Angianthus* by Bentham (1867). In *Siloxerus* the three species have a pappus of jagged scales joined at the base or a jagged ring with more or less indistinct scales. In contrast an array of pappus types occurs in *Angianthus* s.str. Here some species such as *A. milnei*, *A. prostratus* and *A. pygmaeus* completely lack a pappus but others such as the apparently closely related taxa *A. tomentosus*, *A. cyathifer* and *A. acrohyalinus* have very distinctive types.

The pappus is generally regarded as a modified calyx commonly made up of scales or variably plumose bristles which occur at the apex of the achene. Normally, it is not difficult to discern the pappus but difficulties arise in both *Epitriche demissus* and *Angianthus eriocephalus*. In the former case it is difficult to tell from the few specimens available whether in fact a pappus should be recognised. Long hairs appear to occur over much of the apex of the fruit and possibly the lower portion of the floret. The apparent irregular, scattered distribution of the hairs suggests that they are not to be regarded as a pappus but merely as part of the indumentum of the achene. A similar case occurs in *A. eriocephalus* (= *A. preissianus*). Bentham (1867) recorded that a minute pappus occurs in this taxon. However the 'pappus' is nothing more than a cluster of papillae at the apex of the achene. The small papillae are found scattered over much of the fruit.

i. ACHENES:

The majority of Australian works refer to the Composite fruit as an achene. However in recent literature, for example in the various papers included in Heywood, Harborne and Turner (1977), some workers refer to the fruit as a cypsela. Originally the term achene was defined by Necker (1790) to include all dry, indehiscent, one-seeded fruits, irrespective of their derivation from an inferior or superior ovary. De Candolle (1813) redefined the term to include only those fruits derived from an inferior ovary. Subsequently Mirbel (1815) introduced the term cypsela for the same type of fruit. That is an achene is, in the sense of De Candolle's definition, equivalent to a cypsela. Wagenitz (1976) has proposed that De Candolle's definition, which is generally accepted in German texts, be commonly adopted. It is accepted in the present work.

Features of achene morphology promise to be of great value in defining generic limits within the Australian Gnaphaliinae. Detailed anatomical studies have not been made by the present author but examination of achenes at even low magnification (10-40x) clearly shows that at least some genera possess distinctive, often unique fruit. Thus both *Chrysocoryne* and *Siloxerus* are readily distinguished from other segregate genera of *Angianthus* s.l. by the small, more or less obovoid, variably papillate, pink or purple achenes which lack obvious epidermal mucilaginous cells. In contrast others such as *Pogonolepis* and *Cephalosorus* are surrounded by mucilaginous cells. The achene of monotypic *Dithyrostegia* is readily distinguished by its clothing of long papillae or hairs. The monotypic genera *Hyalochlamys* and *Pleuropappus* also have distinctive, unique achenes. In the former genus the carpodium (the point of attachment to the receptacle), is the most distinctive feature, being represented by a distinct white band of cells. In *Pleuropappus* the fruit is obliquely attached to the corolla tube (fig. 1h).

Features such as size and shape, colour, presence or absence of mucilaginous cells and shape of the carpodium are thus useful in distinguishing genera. However detailed anatomical studies of the achenes of *Angianthus* s.l. are highly desirable. Heywood and Humphries (1977), for example, have found in the Anthemideae that characters such as the presence or absence of epicarpic glands and secretory canals, the number of layers and the degree of thickening of the epicarp and mesocarp and the orientation of the

cotyledons are all characteristics which show systematically useful variation. Although anatomical studies in *Angianthus* s.l. may only support the current classification based on more obvious features such studies may be useful in determining relationships of the various genera throughout the Gnaphaliinae. Detailed anatomical studies of achenes will be essential before the many genera of Australian Gnaphaliinae are satisfactorily delimited and their relationships understood.

The function of the mucilaginous cells in the fruit of many species of *Angianthus* s.l. is open to question. Some authors (e.g. Schodde, 1963; Roth 1977) have suggested that the sticky nature of many wet fruits is important in fastening the achenes to the soil particles during germination. This may be so for some species but as Roth (1977) has suggested slime cells may also constitute a water storage tissue. This could be very important in germination, particularly in view of the semi-arid to arid environment inhabited by many of the species of *Angianthus* s.l. Another possibility is that the cells and their degree of water uptake and/or period of hydration are associated with some mechanism in breaking dormancy. That is, the seeds will probably only germinate when sufficient external moisture is available for growth. In such a situation the water retained by the slime cells is of little importance.

PRESENTATION OF DATA

When describing new species a number of workers, particularly F. Mueller, cited locality details which differed to some extent from those occurring on labels accompanying specimens which are (as indicated by notes etc.) obviously type material. When citing type specimens in the current work both the published data and data on original collection labels are usually cited.

Usually type material of most taxa was available and generally when necessary it has been possible to select lectotypes. However this is not the case for material used by Turczaninow. Holmgren and Keuken (1974) list KW, CW and LE as having important Turczaninow collections. A request for type material of seven species from CW has not been acknowledged and none exists in LE. Only four of the required type specimens exist in KW. Although duplicates of all collections cited by Turczaninow exist outside Russia there is no reason to believe that any of these were examined by him. Thus types housed in KW are tentatively referred to as holotypes.

Steetz (1845) described a number of taxa, including *Phyllocalymma filaginoides*, *Skirrhophorus preissianus*, *Styloncerus cylindraceus* and *Styloncerus suberectus*, in Lehmann's "Plantae Preissianae". Type specimens of these taxa occur in GH, LD, MEL and S. The only type collection in GH is *Preiss 37*, the type of *P. filaginoides*. It is in F. W. Klatt's herbarium. Types of all taxa are in MEL, having come from two main sources (possibly the only sources but this is unclear), namely from O. W. Sonder's herbarium purchased toward the end of the nineteenth century (Court, 1972) and from Steetz's herbarium purchased in about 1859 (Mueller, 1888). Specimens in LD and S presumably come from Lehmann's herbarium. The major part of Lehmann's collection was acquired by Andersson for Stockholm in 1860-61 (Nordenstam, 1980). Types of *S. preissianus*, *P. filaginoides* and *S. cylindraceus*, are in S and all have collection labels in Preiss's hand and the name in Steetz's hand. Type collections of all four taxa are housed in LD and are similarly labelled.

When offering Lehmann's herbarium for sale Klatt stated in an advertisement in *Bonplandia* 8(8):143, 15 April 1860 that "the Preiss herbarium contains the originals of the Plantae Preissianae with the labels of the botanists who worked on this flora, as well as the 'unica' of the Preiss collections" (English translation by Mrs D. M. Sinkora). Nordenstam (1980) similarly referred to "the original specimens of *Plantae Preissianae*" (p.282) as being sold to J. Agardh in Lund. Such statements suggest that the principal types of all species are to be found in LD. However it is clear that this is not the case for the above-mentioned taxa described by Steetz. The collections from his herbarium now at MEL undoubtedly should be selected as the lectotypes. Steetz, in his own hand, stated on the sheets that he purchased the specimens of each taxon in 1843. He also recorded Preiss's collection data on the sheets and clearly designated them as new taxa by adding

“nobis!” after each name. Furthermore the sheets from Steetz’s herbarium contain as good, or much better material than those in LD, S, or the collections at MEL obtained with Sonder’s herbarium.

Unless it is otherwise indicated, by reference to microfiche, photographs or the use of the abbreviation ‘n.v.’, it should be assumed that all specimens, types or otherwise, cited in this paper have been seen by the author.

KEY TO SEGREGATE GENERA AND SPECIES OF ANGIANTHUS SENSU LATO

1. General involucre consisting of 2 leaf-like, overlapping or connate bracts which more or less enclose the capitula (fig. 1g) 6. *Dithyrostegia*
1. General involucre absent or inconspicuous or if well developed consisting of more than 2 bracts
 2. Capitular bracts with papillae at the apex (fig. 1i) 8. *Pogonolepis*
 2. Capitular bracts lacking papillae at the apex
 3. Leaves opposite (at least in lower ½ of plant) and distinctly petiolate; laminae 1-2.5 cm long, 0.4-1 cm wide 4. *Cephalosorus*
 3. Leaves alternate or if opposite then lacking petioles and less than 0.3 cm wide
 4. Achene obliquely attached to floret; pappus an oblique scale (fig. 1h) 2. *Pleuropappus*
 4. Achene not obliquely attached to floret; pappus absent or not an oblique scale
 5. Paleae present, the bracts resembling the capitular bracts, whitish, ± opaque and with thick cell walls 9. *Siloxerus*
 5. Paleae absent
 6. Plants prostrate; compound heads woolly; pappus consisting of 8-12 barbed bristles united in a short ring at the base 1. *Gnephosis burkittii*
 6. Plants not with the above combination of characters
 7. Base of floret or apex of achenes with long hairs
 8. Capitular bracts 4-5; capitulum-subtending bract distinct, rigid and opaque 1. *Angianthus connatus*
 8. Capitular bracts 2 or 3; capitulum-subtending bracts absent 3. *Epitriche*
 7. Base of florets or apex of achenes without long hairs
 9. Bracts of general involucre with a leaf-like midrib and broad, hyaline, wing-like margins (fig. 1f), the bracts about the length of the compound heads 7. *Hyalochlamys*
 9. Bracts of general involucre absent or not as above
 10. Compound heads with c. 10 capitula; capitulum-subtending bracts rigid and leaf-like 1. *Angianthus axilliflorus*
 10. Compound heads usually with more than c. 10 capitula (commonly 30-several hundred); capitulum-subtending bracts primarily hyaline
 11. Capitulum-subtending bracts morphologically ± similar, except for the concave nature of some, to the capitular bracts (fig. 1k-m); achenes brown 1. *Angianthus*
 11. Capitulum-subtending bracts totally unlike the capitular bracts (fig. 1a-e); achenes pink or purple 5. *Chrysocoryne*

1. *Angianthus* Wendl., Collect. Pl. 2:31 (?1808); DC., Prodr. 6:150 (1838); Steetz in Lehm. Pl. Preiss. 1:438 (1845); Benth., Fl. Austr. 3:560 (1867) p.p.; Benth. in Benth. & Hook. f., Genera Pl. 2:319 (1873) p.p.; Hoffman in Engler & Prantl, Natürl. Pflanzenfam. IV (5):193 (1890) p.p. TYPE: *A. tomentosus* Wendl.

Cassinia R. Br. in W. & W. T. Aiton, Hort. Kewensis 2nd ed. 5:184 (1813), non *Cassinia* R. Br., Trans. Linn. Soc. London 12:126 (1818) *nom. cons.* TYPE: *C. aurea* R. Br. (= *A. tomentosus* Wendl.)

Cylindrosorus Benth., Enum. Pl. 62 (1837); DC., Prodr. 6:151 (1838). TYPE: *C. flavescens* Benth. (= *A. tomentosus* Wendl.)

Phyllocalymma Benth., Enum. Pl. 61 (1837); DC., Prodr. 6:150 (1838); Steetz in Lehm. Pl. Preiss. 1:436 (1845). TYPE: *P. micropodioides* Benth. (= *A. micropodioides* (Benth.) Benth.)

Skirrhophorus DC. in Lindl. ex DC., Prodr. 6:150 (1838); DC. in Lindl., Nat. Syst. Bot. 2nd ed. 260 (1836) nomen nudum; DC. in Deless., Icon. Select. Pl. 4:22, t. 51 (1840) ('*Skirrhophorus*'); Steetz in Lehm. Pl. Preiss. 1:438 (1845); A. Gray, Hook. J. Bot. Kew

Gard. Misc. 3:147 (1851) p.p. (as to sect. *Skirrhophorus*). TYPE: *S. cunninghamii* DC. (= *A. cunninghamii* (DC.) Benth.)

Eriocladium Lindl., Edwards' Bot. Reg.: Swan River Append. 24 (1839). TYPE: *E. pyramidatum* (= *A. cunninghamii* (DC.) Benth.)

[*Cephalosorus* auct. non A. Gray: see synonymy of *A. microcephalus*.]

[*Siloxerus* auct. non Labill.: see synonymy of *A. brachypappus* & *A. tomentosus*.]

[*Styloncerus* auct. non Spreng., *nom. illeg.*: various species, as to combinations of Kuntze, Rev. Generum Pl. 367 (1891).]

Annual herbs (or perennial shrub, *A. cunninghamii* only). Major axes prostrate, decumbent, ascending or erect, glabrous or hairy; stems simple or forming major branches at basal and/or upper nodes; major axes often developing minor shoots. *Leaves* usually alternate (sometimes opposite), sessile, entire, hairy (sometimes almost glabrous), often with a small hyaline appendage at the apex. *Compound head* ± ellipsoid or lanceoloid to depressed ovoid; bracts subtending compound heads commonly inconspicuous and much less than c. ¼ the length of the head (sometimes the bracts c. the length of the head), the outer ones leaf-like, the inner ones with hyaline apices; *general receptacle* cylindrical to ± oblong or ovoid to broadly depressed ovoid, consisting of a single major axis with minor receptacular axes distributed ± evenly over it. *Capitula* 20-200(c. 1500) per compound head, each capitulum with 1(4) abaxial, hyaline subtending bracts that overlap the capitular bracts. *Capitulum-subtending bracts* narrowly elliptic to elliptic or narrowly oblong to oblong or lanceolate to ovate or oblanceolate to obovate; laminae rarely with a distinct constriction in the upper parts; midrib usually conspicuous, opaque, extending c. ½ to ⅓ the length of the bract, glabrous or variably hairy, sometimes with a few glandular hairs present. *Capitular bracts* 4 (*A. microcephalus* with 2 or 3 only), hyaline, with an opaque midrib, arranged so that 2 outer, variably concave bracts (always present) surround 2 (absent or 1 only in *A. microcephalus*) inner flat bracts. Concave bracts with the lamina variably constricted in the upper half; midrib usually conspicuous and extending c. ⅓ to ½ the length of the bracts, glabrous or variably hairy, sometimes a few glandular hairs present. Inner flat bracts narrow elliptic to elliptic or narrowly oblong or oblanceolate to obovate, tapering gradually to the base or conspicuously attenuated in the lower ½ to ⅓; lamina not or variably constricted in the upper half; midrib usually conspicuous, elongate and extending c. ⅓ to ½ the length of the bract, glabrous or variably hairy, sometimes a few glandular hairs present, sometimes with an entire or dissected wing-like extension from the adaxial surface. *Florets* (1)2(3) per capitulum; corolla (3, 4)5-lobed; style branches truncate; stamens (3, 4) 5, with tailed anthers. *Achenes* ellipsoid or ± obovoid, glabrous or variably papillose or pubescent. Pappus setose, paleaceous, coroniform or absent.

DISTRIBUTION (Fig. 2):

Of the 15 species of *Angianthus* only *A. brachypappus* and *A. glabratus* are absent from Western Australia and 11 are endemic to that state.

ECOLOGY:

Four or five species are restricted to saline depressions but the majority occupy a wider range of habitats.

AFFINITIES/GENERIC CHARACTERISTICS:

The genus is characterised by the usual presence of two inner flat bracts and two outer concave bracts per capitulum (fig. 1k), the presence of one, rarely two or three, capitulum-subtending bracts per capitulum, the usual occurrence of two florets per capitulum and the usual presence of minor receptacular axes on the general receptacle (fig. 1j).

The affinities of the genus appear to be with the monotypic genera *Pleuropappus* and *Epitriche*. Both *Pleuropappus* and *Angianthus* have morphologically similar capitular and capitulum-subtending bracts, but *P. phyllocalymmeus* is readily distinguished by the oblique nature of the pappus and achene. Furthermore the capitula in this species are arranged in a spike-like fashion (i.e. they do not have distinctive minor receptacular appendages) and there are four distinctively arranged capitulum-subtending



Fig. 2. Distribution of species of *Angianthus*.

bracts per capitulum. The capitular bracts of *Epitriche* are also morphologically similar to those of *Angianthus* but *Epitriche* is readily distinguished by the lack of minor receptacular appendages, the apparent absence of capitulum-subtending bracts and the distinctive ring of hairs at the apex of the achene.

EVOLUTION/REPRODUCTIVE BIOLOGY:

Within the genus a number of species are very closely related. The annual species with large, usually more or less oblong compound heads mostly differ from each other only in aspects of the pappus, size and morphology of the capitular bracts and habit. Thus *A. acrohyalinus*, *A. brachypappus*, *A. cornutus*, *A. conocephalus*, *A. cyathifer*, *A. glabratus*, *A. milnei* and *A. tomentosus* appear to form a species cluster. Not far removed are *A. micropodioides*, which has a somewhat reduced compound head and pubescent achenes, and *A. microcephalus*. The latter species also has a somewhat reduced compound head but unlike other taxa the two inner capitular bracts are absent. In all other aspects the species undoubtedly belongs to *Angianthus*. A further species, *A. prostratus*, also has affinities with species such as *A. cornutus* and *A. conocephalus*. The remaining annual species, namely *A. drummondii*, *A. pygmaeus* and *A. preissianus* also form a small species cluster (see under respective species).

The only perennial species, *A. cunninghamii*, is a coastal shrub found in Western Australia. The perennial habit plus the occasional presence of three florets per capitulum suggest that the species may be a rather primitive member of the genus.

With the exception of *A. preissianus* all members of the genus have pollen-ovule ratios of several thousand, i.e. they all appear to be outbreeders. In contrast the average P/O of 119.7 recorded for *A. preissianus* clearly reflects its inbreeding nature (Short 1981a, b).

A number of species, e.g. *A. tomentosus*, *A. milnei* and *A. acrohyalinus*, are capable of producing compound heads containing from 500 to about 2,000 capitula, although under natural conditions they produce relatively few seeds. For example

A. tomentosus, a species known to be self-compatible, may only set about 100 seeds per compound head. Although actual seed set may be dependant upon a number of parameters it is possible that the low actual:potential seed ratio is a result of selection for maintenance of a showy inflorescence, the prime purpose of which is to attract pollinators.

In self-incompatible and partially self-incompatible species it is obviously important to attract potential pollinators. Similarly in predominantly self-pollinated species it is also often advantageous to cross-pollinate. A compact inflorescence may be more conspicuous to insect pollinators than an open inflorescence or very small, compact inflorescences, particularly if plants are sparsely spread throughout a population. Furthermore any increase in the time spent and/or a change in foraging pattern by insects when on large, compact inflorescences as compared to small and/or more open inflorescences may also increase the likelihood of pollination, whether it be self- or cross-pollination. Thus the cost of maintaining a large inflorescence may be off-set by a higher degree of pollination. Alternatively, considering the semi-arid to arid environment inhabited by the above species the actual seed set may be regulated primarily by moisture availability and hence longevity of a plant. Thus it could be expected that actual seed set will only approach potential seed set in years of high rainfall. In dry conditions many seeds and in fact many florets may fail to develop because of water stress.

In contrast to the outbreeding species, *A. preissianus* appears, as expected, to produce a full complement of apparently mature, viable seed.

Keighery (1981) has noted that meat ants (*Iridomyrmex* spp.) are common flower visitors and pollen vectors of *A. conocephalus*. Flies and ants are commonly found on flowering plants of all species and are possibly the main pollen vectors in the genus.

KEY TO SPECIES OF ANGIANTHUS SENSU STRICTO

1. Perennial shrub; major axes 20-50 cm long (west coast of Australia, normally on fore-dunes, sometimes in coastal saline flats) 15. *A. cunninghamii*
1. Annual herb; major axes 5-30(44.5) cm long
 2. Florets 1 per capitulum, flat capitular bracts absent or rarely 1 per capitulum . . . 11. *A. microcephalus*
 2. Florets 2 per capitulum; flat capitular bracts 2 per capitulum
 3. Pappus absent
 4. Midrib of capitular bracts with hairs $\frac{1}{3}$ to $\frac{1}{2}$ the length of the bract 10. *A. prostratus*
 4. Midrib of capitular bracts glabrous or with hairs less than c. $\frac{1}{3}$ the length of the bract
 5. Bracts subtending compound heads inconspicuous or less than c. $\frac{1}{2}$ (rarely to c. $\frac{3}{4}$) the length of the head (if up to c. $\frac{3}{4}$ then the inner capitular bracts with horn-like basal appendages); compound heads \pm ovoid or narrowly ellipsoid to ellipsoid
 6. Flat capitular bracts usually abruptly attenuated in the lower $\frac{1}{3}$ and with horn-like basal appendages (fig. 3f); compound heads ovoid 9. *A. cornutus*
 6. Flat capitular bracts gradually tapering toward the base and lacking basal appendages (fig. 3c); compound heads narrowly ellipsoid to ellipsoid
 7. Capitulum-subtending bracts with the lamina constricted in the upper part and the midrib \pm densely hairy toward the apex (fig. 3b) 2. *A. milnei*
 7. Capitulum-subtending bracts without a constriction in the upper part and with the midrib glabrous or sparsely hairy toward the apex 2. *A. milnei**
 5. Bracts subtending compound heads c. equal to or exceeding the length of the head; compound heads broadly ovoid to broadly depressed-ovoid
 8. Flat capitular bracts lacking an entire wing-like extension from the adaxial surface of the midrib 8. *A. micropodioides**
 8. Flat capitular bracts with an entire wing-like extension from the adaxial surface of the midrib (fig. 3e) or if absent then the florets 3- or 4-lobed
 9. Florets 3- or 4-lobed; pollen grains 16-60 pollen grains per anther 14. *A. preissianus*
 9. Florets (4)5-lobed; pollen grains c.350-500 per anther
 10. Major axes prostrate; compound heads broadly depressed to ovoid 13. *A. pygmaeus*
 10. Major axes erect; compound heads broadly to very broadly ovoid 12. *A. drummondii**

3. Pappus present
11. Bracts subtending compound heads c. equal to, or exceeding, the length of the head †
 12. Pappus of 5 or 6 jagged scales, each scale terminating in a single smooth or minutely barbellate bristle (Fig. 3k) 8. *A. micropodioides*
 12. Pappus a cup of scales or a small ring
 13. Flat capitular bracts with a wing-like extension from the adaxial surface of the midrib (fig. 3e) 12. *A. drummondii*
 13. Flat capitular bracts lacking a wing-like extension from the adaxial surface of the midrib 8. *A. micropodioides**
 11. Bracts subtending the compound heads inconspicuous or less than c. ¼ the length of the head (sometimes reaching c. ¼ the length of the head in *A. brachypappus*)
 14. Leaves (at least the upper ones) conduplicate, often incurved at the apex and with a distinct hyaline appendage; pappus of 4-6 bristles, barbellate in the lower ½, united into a small, slightly toothed ring at the base (fig. 3g) 1. *A. acrohyalinus*
 14. Leaves not conduplicate; pappus not as above
 15. Pappus of 2 or 3 jagged scales, each scale terminating in 1 or 2 terminally subplumose bristles extending the length of the corolla (fig. 3h) 5. *A. tomentosus*
 15. Pappus a jagged cup (of ± distinct scales) or a ring
 16. Leaves almost glabrous, succulent and cylindrical when fresh 4. *A. glabratus*
 16. Leaves conspicuously hairy, usually not succulent
 17. Flat capitular bracts tapering gradually to the base; compound heads ± narrowly ellipsoid to ellipsoid
 18. Pappus a small, jagged ring (Cliff Head — Jurien Bay region, Western Australia) 2. *A. milnei**
 18. Pappus cup-shaped, jagged, often appearing as 2-4 distinct scales (SW. corner Northern Territory and possibly central Western Australia) 3. *A. cyathifer*
 17. Flat capitular bracts abruptly attenuated in lower ⅓-½ (fig. 3d); compound heads usually narrowly ovoid to ovoid, sometimes ± narrowly ellipsoid to ellipsoid
 19. Leaves usually oblanceolate, sometimes linear or narrowly elliptic, 1-3(3.2) cm long, 0.1-0.5 cm wide; pappus a jagged cup, 0.15-0.7 mm long, often with 1 or 2 bristles extending ½-¾ the length of the floret (fig. 3j) (eastern South Australian Queensland, New South Wales, western Victoria) 6. *A. brachypappus*
 19. Leaves ± linear, rarely oblanceolate, 0.5-1.5(1.7) cm long, c.0.1 cm wide; pappus a jagged ring 0.1-0.3 mm long (fig. 3i) (Nullarbor Plain region) 7. *A. conocephalus*

A number of collections, referred to in the key above as *A. milnei**, *A. micropodioides** and *A. drummondii**, are to some extent atypical of the species to which they are referred and under which their diagnostic features are outlined. They possibly represent distinct taxa but further collections are required to substantiate this view.

1. *Angianthus acrohyalinus* Morrison, J. Bot. 50:167 (1912); Grieve & Blackall, W. Aust. Wildfls 812 (1975). TYPE: "Globe Hill Station and Munderoo, Ashburton River, October." LECTOTYPE (here designated): *Morrison s.n.*, Globe Hill, Ashburton River, 6.x.1905 (PERTH). SYNTYPE: *Morrison s.n.*, Munderoo, Ashburton R., 11.x.1905 (K).

Annual herb, (6)10-30 cm high. Major axes erect or ascending, flexuose, hairy; stem often simple in the smaller plants, to c. 7 cm high, but usually forming major branches at basal and/or upper nodes. *Leaves* alternate, lanceolate, flat to conduplicate, apex often incurved, (0.3)1-6(7) cm long, (0.2)0.3-0.6(0.8) cm wide, the lower ones slightly mucronate, the rest usually with a distinctive hyaline appendage at the apex, all leaves

†Since the completion of the manuscript for this revision a collection *Newbey 9154* from c. 72 km NNW. of Bullfinch, Western Australia, has been drawn to my attention. It appears to represent a distinct species of *Angianthus*. It is an annual, has 2 florets per capitulum, a pappus of 2-3 scales, each of which terminates in a single, minutely barbellate awn extending the length of the corolla, and the bracts subtending the compound heads are about equal to or exceeding the length of the compound head. It keys out to lead 12 in the key to species.

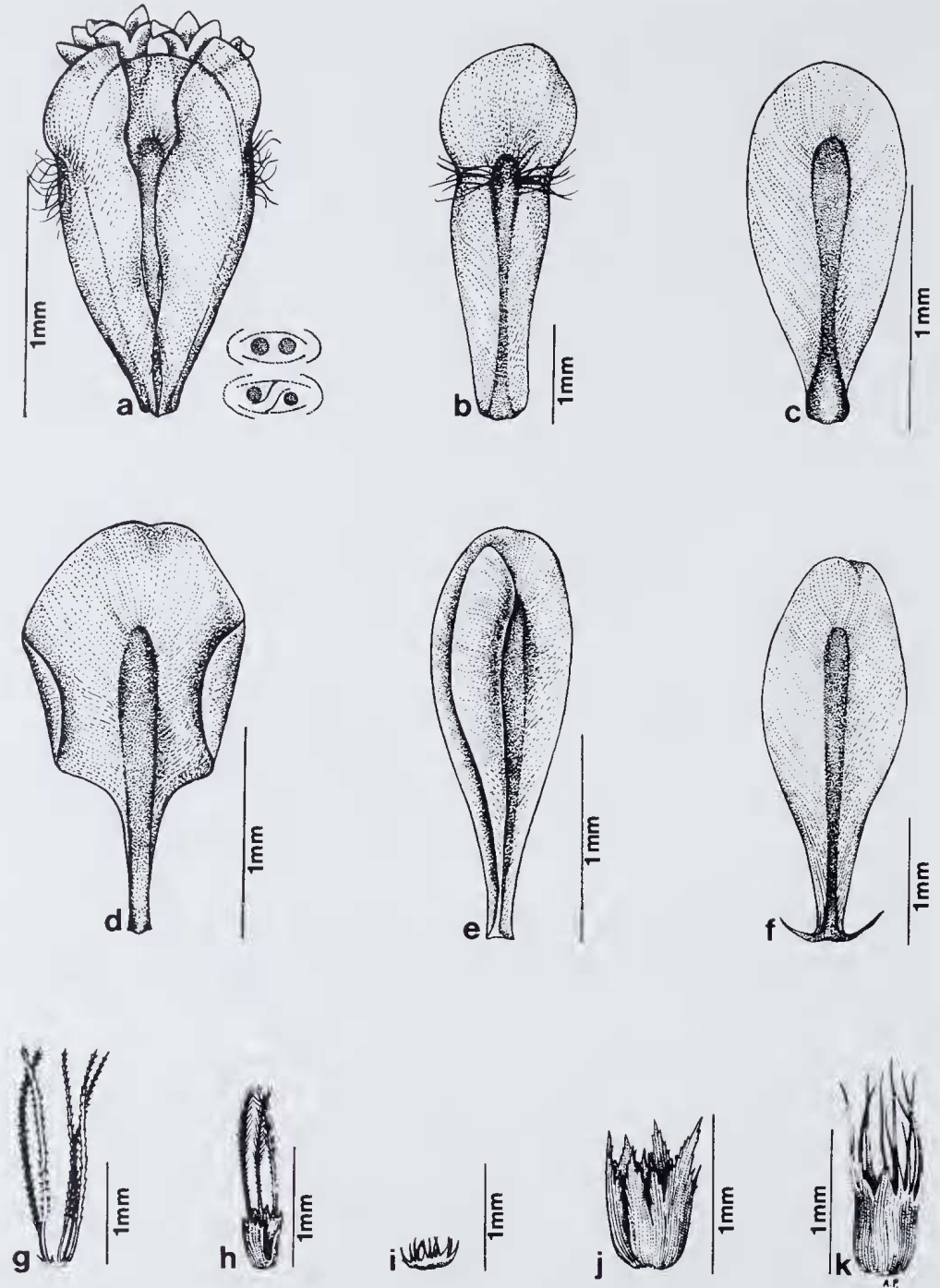


Fig. 3. Characteristics of *Angianthus*. a — general arrangements of capitular bracts (*A. glabratus*, Short 905). b — capitulum-subtending bract with the lamina constricted in the upper part (*A. milnei*, Short 473). c — capitulum-subtending bract lacking constriction (*A. glabratus*, Short 905). d — flat capitular bract abruptly attenuated in lower $\frac{1}{3}$ - $\frac{1}{2}$ (*A. conocephalus*, Ising 1529). e — flat capitular bract with wing-like extension (*A. preissianus*, Short 716). f — flat capitular bract with horn-like basal appendages (*A. cornutus*, Chinnock 4692). g — pappus of *A. acrohyalinus* (Short 484). h — pappus of *A. tomentosus* (Short 1075). i — pappus of *A. conocephalus* (Ising 1529). j — pappus of *A. brachypappus* (Bruchner MEL 84877). k — pappus of *A. micropodioides* (Short 613).

hairy. *Compound heads* ellipsoid or ovoid, 0.8-2.5(2.8) cm long, 0.7-1.1 cm diam.; bracts subtending compound heads not forming a conspicuous involucre but several to c. 10, leaf-like hairy bracts with hyaline apices present, grading into capitulum-subtending bracts; *general receptacle* cylindrical to narrowly oblong. *Capitula* 300-1,000 (c. 1,500) per compound head; capitulum-subtending bracts 1(2, ?3), if more than one then extra one(s) abaxial to, and overlapping, the inner, all bracts narrowly elliptic or obovate, sometimes \pm oblanceolate, 2.2-3.5(3.9) mm long, 0.6-1(1.2) mm wide, the midrib glabrous or variably hairy toward the apex and often some glandular hairs present. *Capitular bracts* with the two concave ones 2.3-3.6(3.9) mm long, the midrib glabrous or sparsely hairy toward the apex and sometimes with some glandular hairs; flat bracts 2, oblanceolate to obovate, \pm gradually tapering toward the base, 2.3-3.5(3.75) mm long, 0.6-0.8 mm wide, the midrib usually glabrous but a few glandular hairs sometimes present. *Florets* 2; corolla 5-lobed, the tube tapering \pm gradually to a variably swollen base, 1.65-2.7(3.2) mm long, c. 0.2-0.3 mm diam. *Achenes* \pm obovoid or ovoid, 0.45-0.85 mm long, c. 0.2 mm diam., papillose. Pappus of 4-6 bristles c. the length of the corolla tube, barbellate in the lower $\frac{1}{2}$, sub-plumose in the upper $\frac{1}{2}$, united into a small slightly toothed ring at the base. Fig. 3g.

DISTRIBUTION (Fig. 2):

North-west Western Australia between latitudes 22°S and 27°S and west of longitude 118°E. Common.

ECOLOGY:

Commonly associated with chenopod dominants in clay soils but also grows in loam or red sand. Collectors' notes include "On red *Triodia* sand-hills", "Reddish loam, with limestone rock. Chenopod, *Acacia* dominants" and "Saline depression . . . growing amongst *Arthrocnemum* [= *Halosarcia*] on powdery white-brown clay loam".

NOTE:

1. *A. acrohyalinus* has obvious affinities with *A. tomentosus* and *A. milnei* and the 3 species all occur in the north-west of Western Australia. However the flexuose axes, conduplicate leaves and the sub-plumose to plumose pappus bristles distinguish *A. acrohyalinus* from all other species.

SELECTED SPECIMENS EXAMINED (8/15):

Western Australia — *Barnett s.n.*, Carnarvon, s. dat. (PERTH); *Beard 2974*, Onslow, 23.viii.1963 (PERTH); *Chadwick 1473*, Cape Range, s. dat. (PERTH, UWA); *Demarz 2468*, Hamersley Station, 19.viii.1970 (PERTH); *Short 435*, 57 km from Denham along Overlander Roadhouse road, 21.viii.1977 (AD); *Short 444*, c. 43 km N. of Overlander Roadhouse, 21.viii.1977 (AD); *Short 483*, c. 3 km N. of Lyndon River on Minilya-Cape Range road, 27.viii.1977 (AD); *Short 1000*, c. 19.3 km SE. of Nanga, 17.xi.1979 (AD).

2. ***Angianthus milnei*** Benth., Fl. Austr. 3:564 (1867). — *Styloncerus milnei* (Benth.) Kuntze, Rev. Generum Pl. 367 (1891). TYPE: "Shark's Bay and Dirk Hartog's Island, abundant, Milne." LECTOTYPE (here designated): *Milne s.n.*, Shark Bay, New Holland, planis, s. dat. (K). ISOLECTOTYPE: PERTH (fragments only). SYNTYPE: *Milne s.n.*, Dirk Hartog Island, planis, plentiful, s. dat. (K, mounted with lectotype).

Annual herb, 6-25(26) cm high. Major axes erect or ascending, hairy; stem often simple in the smaller plants, to c. 10 cm high, but usually forming major branches at basal and/or upper nodes. *Leaves* alternate, narrowly elliptic, lanceolate or oblanceolate, 1-6.5(7.2) cm long, 0.1-0.4(0.9) cm wide, sometimes slightly mucronate, the uppermost ones with a hyaline appendage at the apex, all leaves hairy. *Compound heads* narrowly ellipsoid to ellipsoid, 0.5-2(2.2) cm long, 0.5-0.9 cm diam.; bracts subtending compound heads not forming a conspicuous involucre but several leaf-like, hairy bracts with hyaline apices present, grading into capitulum-subtending bracts; *general receptacle* cylindrical to narrowly oblong. *Capitula* c. 100-400 per compound head; capitulum-subtending bracts 1, \pm elliptic, obovate or ovate, 2.7-3.6 mm long, 0.7-1.2 mm wide, the lamina with a prominent constriction in the upper part, the midrib \pm densely hairy toward the apex, the simple hairs with a length up to c. 1-1.5 times the width of the bract, glandular hairs sometimes present. *Capitular bracts* with the two concave ones 2.4-3.4 mm long,

the midrib sparsely hairy toward the apex and sometimes with a few glandular hairs; flat bracts 2, ± oblanceolate, obovate or narrowly elliptic, gradually tapering toward the base, 2.3-3.5 mm long, 0.6-1.1 mm wide, the midrib usually sparsely hairy toward the apex, glandular hairs sometimes present. *Florets* 2; corolla 5-lobed, the tube tapering gradually into a variably swollen base, sometimes a ± abrupt taper in the lower ½, 1.7-2.3 mm long, 0.3-0.5 mm diam. *Achenes* obovoid, 0.6-0.9 mm long, c. 0.3 mm diam., papillose. *Pappus* absent.

Chromosome number: $n = 13$ (Turner, 1970 — as '*A. tomentosus*', T5382). Fig. 3.

DISTRIBUTION (Fig. 2):

North-west Western Australia between latitudes 21°S and 28°S and west of longitude c.119°E. Common.

ECOLOGY:

Occurs on the margins of saline depressions or in open scrubland, shrubland or tussock grassland formations. Collectors' notes include "Wattle scrub on stony plateau", "In red sand on Spinifex plain" and "Reddish loam, with limestone rock. *Chenopod*, *Acacia* dominants".

NOTES:

1. *A. milnei* in many respects resembles *A. tomentosus* and *A. acrohyalinus* and commonly grows with the latter. However it is readily distinguished from them by the absence of a pappus and by the presence of the distinctive lamina and hairs on the midrib of the capitulum-subtending bract. The conduplicate leaves of *A. acrohyalinus* are distinctly different from those of *A. milnei*.

2. Collections from the Cliff Head-Jurien Bay region (see list below) lack the distinctive lamina and long hairs on the capitulum-subtending bracts and at least one collection, *Burns 128*, contains some florets with a small, jagged, ring-like pappus. Their distribution falls outside that of typical *A. milnei* and collection data suggest that the populations tend to grow in saline regions. It appears that the collections represent a distinct taxon, possibly a subspecies of *A. milnei*. More collections should be examined before any formal status, if any, is conferred upon this taxon.

SELECTED SPECIMENS EXAMINED (8/20):

Western Australia — *Beard 6020*, 10 miles W. of Gascoyne Junction, 18.viii.1970 (NSW, PERTH); *Demarz 4689*, Lake Austin, 23.x.1973 (KP, PERTH); *Gardner 6007*, No. 2 tank between Geraldton and Shark Bay, 17.ix.1941 (PERTH); *Gardner 7836*, Tuckanarra, 13.x.1945 (PERTH); *George 1125*, 20 miles E. of Onslow, 27.viii.1960 (PERTH); *Short 483A*, c. 3 km N. of Lyndon River on Minilya-Cape Range road, 27.viii.1977 (AD); *Speck 678*, 15 miles E. of Berrigarra, 6.ix.1957 (CANB, PERTH); *Turner 5382*, 50 miles SE. of Gascoyne Junction, 22.viii.1965 (PERTH).

SPECIMENS EXAMINED, *A. milnei* VARIANT

Western Australia — *Burns 128*, Cliff Head, S. of Dongarra, 25.x.1967 (PERTH); *Keighery 578*, 3 km E. of Jurien Bay, 20.x.1975 (KP); *Paust 1158*, 3.2 km NE. of Jurien Bay, 3.x.1972 (PERTH); *Short 1012*, c. 2.1 km from Jurien Bay, 19.xi.1979 (AD).

3. *Angianthus cyathifer* Short, sp. nov.

[*Angianthus tomentosus* auct. non Wendl.: Chippendale, Trans. Roy. Soc. S. Aust. 84:103 (1961.)]

Herba annua. Axes maiores plerumque ascendentes decumbentesve, raro erecti, (4)8-18(24) cm longi, varie pilosi; caulis plerumque ramis maioribus vix clarus. *Folia* alterna, sublinearia vel elliptica vel ita anguste, (0.3)0.5-2.5 cm longa, c. 0.1 cm lata, pilosa interdum paulum mucronata, mucrone foliorum superiorum hyalino. *Glomeruli* ellipsoidei vel ita subanguste, 1.2-2.5(2.9) cm longi, c. 0.5 cm diametro; bractee glomerulos subtendentes paulum clare; receptaculum cylindraceum usque subanguste oblongum. *Capitula* c. 100-500; bractee capitulum subtendentes 1(2-7), ± ellipticae, obovatae vel ± oblongae, (1.7)2.1-2.7 mm longae, 0.8-1.3 mm latae; costa plerumque pilosa, interdum pilos glandulosos ferens. *Bractee intra capitulum*: duo concave (1.7)2-2.7 mm longae, costa ad apicem pilosa, interdum pilos glandulosos ferenti; duo planae anguste ellipticae usque ellipticae obovatae, (1.65)2.2-2.6 mm longae, 0.6-1 mm latae, gradatim attenuatae, costa plerumque glabra, interdum pilos glandulosos ferenti. *Flosculi* 2; corolla 5-lobata. *Achenia* subovoidea, 0.5-0.75 mm longa, c. 0.2-0.3 mm diametro, papillosa. *Pappus* subcyathiformis, laceratus saepe 2-4 squamis claris ad basem coniunctis similis, 0.2-0.55 mm longus.

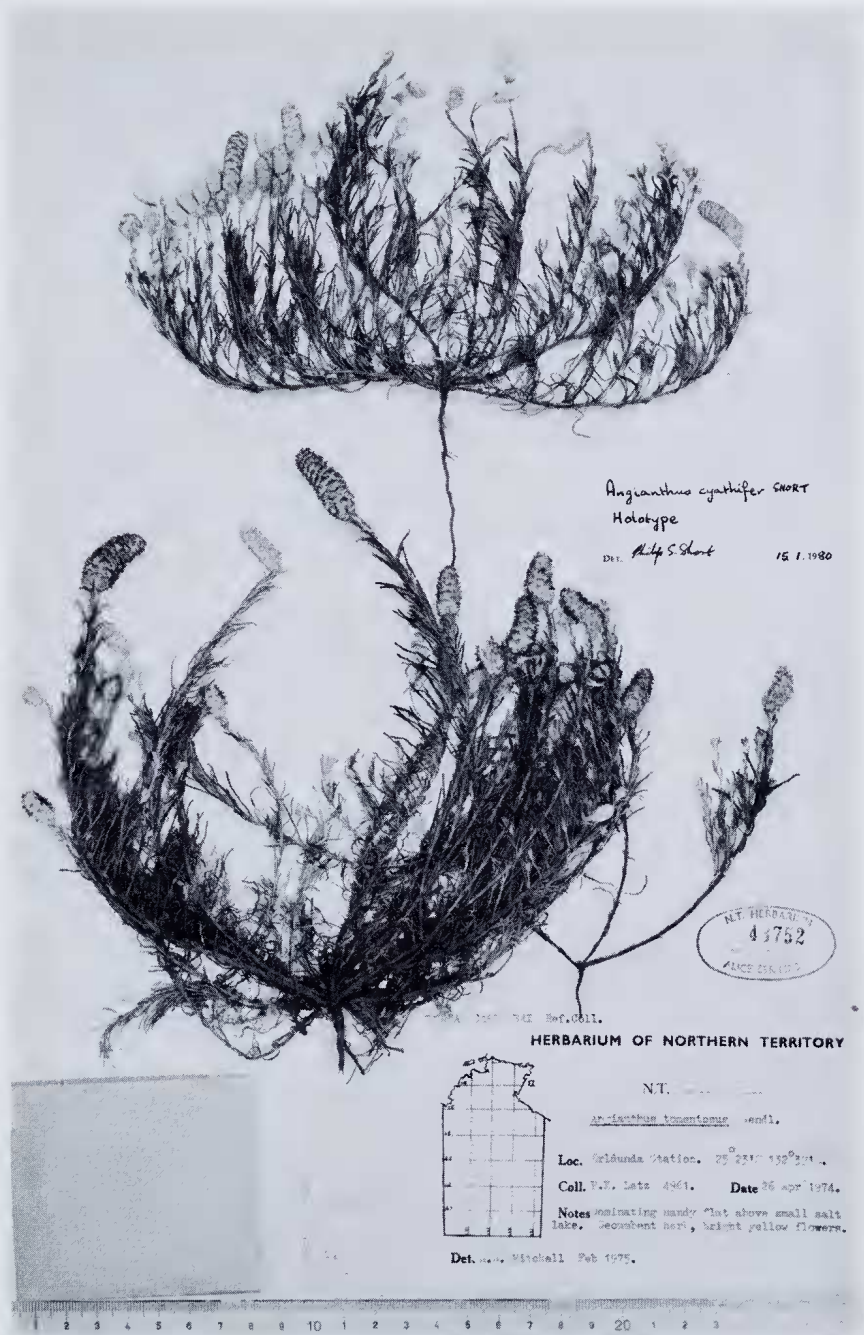


Fig. 4. *A. cyathifer* Short. Holotype (Latz 4961, NT).

HOLOTYPE (fig. 4): *Latz 4961*, Erldunda Station, 25°23'S, 132°39'E. Dominating sandy flat above small salt lake. Decumbent herb, bright yellow flowers, 26.iv.1974 (NT 43752). **ISOTYPUS**: BRI 013705 (NT label indicates that further duplicates occur in CANB, DNA & NT reference coll.).

Annual herb. Major axes usually ascending or decumbent, rarely erect, (4)8-18(24) cm long, hairy; stem usually not distinguishable from major branches. *Leaves* alternate, \pm linear or \pm narrowly elliptic to elliptic, (0.3)0.5-2.5 cm long, c. 0.1 cm wide, sometimes slightly mucronate, the upper most ones with a hyaline appendage at the apex, all leaves hairy. *Compound heads* \pm narrowly ellipsoid to ellipsoid, 1.2-2.5(2.9) cm long, c. 0.5 cm diam.; bracts subtending compound heads not forming a conspicuous involucre but several leaf-like bracts with hyaline apices present, grading into capitulum-subtending bracts; *general receptacle* cylindrical to \pm narrowly oblong. *Capitula* c. 100-500 per compound head; capitulum-subtending bracts 1(2, ?3), if more than one then the extra one(s) abaxial to, and overlapping, the inner, all bracts \pm elliptic, obovate or \pm oblong, (1.7)2.1-2.7 mm long, 0.8-1.3 mm wide, the midrib usually hairy and glandular hairs sometimes present. *Capitular bracts* with the two concave ones (1.7)2-2.7 mm long, the midrib hairy toward the apex and glandular hairs sometimes present; flat bracts 2, gradually tapering to the base, narrowly elliptic to elliptic or obovate, (1.65)2.2-2.6 mm long, 0.6-1 mm wide, the midrib usually glabrous, sometimes glandular hairs present. *Florets* 2; corolla 5-lobed, the tube tapering gradually to the base, (1)1.4-1.9 mm long, c. 0.5 mm diam., a few glandular hairs sometimes present on the tube. *Achenes* \pm obovoid, 0.5-0.75 mm long, c. 0.2-0.3 mm diam., papillose. *Pappus* \pm cup-shaped, jagged, often appearing as 2-4 \pm distinct scales united at the base, 0.2-0.55 mm long. Fig. 4.

DISTRIBUTION (Fig. 2):

South-west corner of the Northern Territory and central Western Australia. Moderately common.

There is a marked disjunction in distribution between the Western Australian collections and those from the Northern Territory but all specimens appear to represent a single taxon. Further collections are required to substantiate this view.

ECOLOGY:

Grows in sandy or clay soils which surround saline depressions. Collectors' notes include "Saltpan area encroached by sand, populated by various annuals, perennial grasses and samphires", "... on margins of salt pan with *Arthrocnemum* [= *Halosarcia*] spp. in deep, white saline sand" and "clayish soil around salt lake".

NOTES:

1. The specific epithet alludes to the cup-like pappus.

2. This species has close affinities with *A. tomentosus*. It is readily distinguished by its pappus and the usually ascending or decumbent major axes.

SPECIMENS EXAMINED:

Western Australia — *Speck 1429*, 10 miles W. of Yelma, 12.ix.1958 (AD, CANB, PERTH); *Tölken 6089*, Lake Miranda, 11.ix.1979 (AD, PERTH); *Wilson 7490*, 30 km NE. of Nambi homestead, 29.viii.1968 (PERTH).

Northern Territory — *Beaglehole 50933*, Tanami Desert, 27 km NW. of the Granites, 20.v.1976 (ACB); *Dunlop 1816*, 77 miles WSW. Granites, 2.vii.1970 (NT); *Latz 4083*, Salt Beef Lake, Tanami Sanctuary, 22.vii.1973 (NT, PERTH); *Latz 4248*, Lake Neale, 28.viii.1973 (NT); *Latz 6547*, south of Mongrel Downs, 4.viii.1976 (MEL); *Lazarides 6088*, 30 miles SSW. of Napperby Station, 28.ix.1956 (AD, BRI, CANB, NSW, NT); *Maconochie 1790*, 3 miles SE. Sangster's Bore, 22.vii.1973 (NT).

4. *Angianthus glabratus* Short, sp. nov.

Herba annua, 6-14(16) cm alta. Axes maiores erecti ascendentesve, glabri parum pilosi; caulis e nodis basalibus superioribusque, ramos maiores efficiens. *Folia* alterna, in vivo sucosa teretia, 0.4-1.6(3) cm longa, c. 0.1 cm lata, mucronem carentia sed interdum folius superioribus ad apicem appendicem hyalinam ferentia, subglabra. *Glomeruli* ellipsoidei vel ita anguste, 1-2.5(3.4) cm longi, 0.4-0.6 cm diametro; bracteae glomerulos subtendentes parum clarae; receptaculum anguste oblongum. *Capitula* c. 100-500; bracteae capitulum subtendentes 1(2-?3), ovatae suboblongaevae, 1.8-2.5 mm longae, 1-1.6 mm latae; costa glabra vel ad apicem varie pilosa. *Bracteae intra capitulum*: duo concave 1.6-2.3 mm longae, costa glabra vel ad apicem varie pilosa; duo planae, subellipticae obovataevae, 1.6-2.2 mm longae, 0.7-1.2 mm latae, attenuatae, costa glabra vel ad apicem varie pilosa. *Flosculi* 2; corolla 5-lobata. *Achenia* subovoidea, c. 0.5-0.8 mm longa, c. 0.3 mm diametro, papillosa. *Pappus* cyathiformis, varie laceratus, interdum c. 5 squamis ad basem coniunctis similis, 0.2-0.4 mm longus.

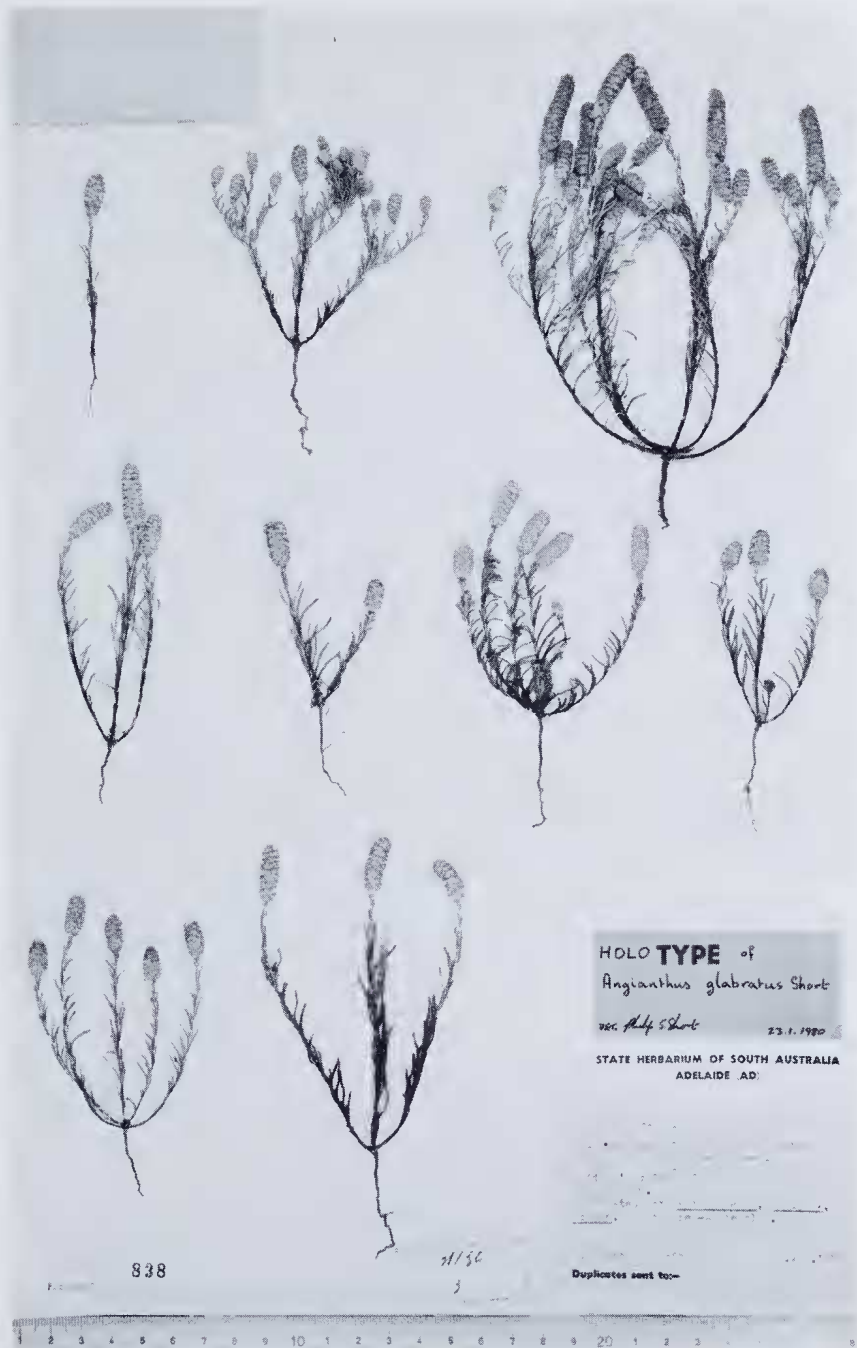


Fig. 5. *A. glabratus* Short. Holotype (Short 838, AD).

HOLOTYPE (fig. 5): Short 838, c. 5.8 km west of Nectar Brook Station along road to Chinamans Creek (34°42'S, 137°54'E). Associated with *Arthrocnemum* [= *Halosarcia*], *Atriplex*, *Aizoon*. Salty grey-white clay. Very common. 9.xii.1978 (AD). ISOTYPUS: CANB, K, MEL, PERTH.

Annual herb, 6-14(16) cm high. Major axes erect or ascending, glabrous or slightly hairy; stem simple or forming major branches at basal and/or upper nodes. *Leaves* alternate, succulent and cylindrical when fresh, 0.4-1.6(3) cm long, c. 0.1 cm wide, not mucronate but sometimes the upper ones with a hyaline appendage at the apex, all leaves \pm glabrous. *Compound heads* narrowly ellipsoid to ellipsoid, 1-2.5(3.4) cm long, 0.4-0.6 cm diam.; bracts subtending compound heads not forming a conspicuous involucre but several leaf-like, hairy bracts with hyaline apices present, grading into capitulum-subtending bracts; *general receptacle* cylindrical to narrowly oblong. *Capitula* c. 100-500 per compound head; capitulum-subtending bracts 1(2, ?3), if more than one then the extra one(s) abaxial to and overlapping the inner, all bracts ovate or \pm oblong, 1.8-2.5 mm long, 1-1.6 mm wide, the midrib glabrous or variably hairy toward the apex. *Capitular bracts* with the two concave ones 1.6-2.3 mm long, the midrib glabrous or variably hairy toward the apex; flat bracts 2, \pm elliptic or obovate, gradually tapering towards the base, 1.6-2.2 mm long, 0.7-1.2 mm wide, the midrib glabrous or variably hairy toward the apex. *Floret* 2; corolla 5-lobed, the tube tapering \pm gradually to the base, 1.1-1.5 mm long, c. 0.4 mm diam. *Achenes* \pm obovoid, c. 0.5-0.8 mm long, c. 0.3 mm diam., papillose. *Pappus* cup-shaped, variably jagged, sometimes appearing to be composed of c. 5 scales joined at the base, 0.2-0.4 mm high. Figs.: 3a, c; 5.

DISTRIBUTION (Fig. 2):

Upper Eyre Peninsula, South Australia between latitudes 31°S and 33°S and longitudes 135°E and 138°E. Moderately common.

ECOLOGY:

Commonly grows on the margins of saline depressions where usually associated with species of *Halosarcia*, *Atriplex* and *Aizoon*, but also occurs on coastal sand-dunes. Also recorded in an *Acacia linophylla* association on red sand dunes.

NOTES:

1. The specific epithet refers to the more or less glabrous nature of the species. This characteristic readily distinguishes it from perhaps its closest relatives, *A. brachypappus* and *A. tomentosus*.

SELECTED SPECIMENS EXAMINED (6/14):

South Australia — Chinnock 2618, 30 km W. of Kingoonya on the Tarcoola road, 27.ix.1975 (AD); Eichler 18817, SW. end of Pernatty Lagoon, 22.x.1966 (AD); Higginson s.n., Port Augusta, 1955 (ACB); Lay 547, Kenella Rocks, Wilgena Station, 1.x.1971 (AD); Short 793, c. 26.7 km S. of Hiltaba homestead, 25.ix.1978 (AD); Specht & Carrodus 96, 40 miles N. of Nonning homestead, 16.xi.1958 (AD).

5. *Angianthus tomentosus* Wendl., Collect. Pl. 2:32; t.48 (?1808); Brown, Trans. Linn. Soc. London 12:103 (1817); Cass., Dict. Sci. Nat. 14:483 (1819); DC., Prod. 6:150 (1838); Sond., Linnaea 25:487 (1853); Benth., Fl. Austr. 3:562 (1867); J. M. Black, Fl. S. Aust. 1st ed. 644 (1926), 2nd ed. 924 (1957); Willis, Handb. Pl. Vict. 2:729 (1973); Grieve & Blackall, W. Aust. Wildfls 811 (1975). — *Stylancerus tomentosus* (Wendl.) Kuntze, Rev. Generum Pl. 367 (1891). — *Siloxerus tomentosus* (Wendl.) Ostenf., Biol. Meddel. Kongel. Danske Vidensk. Selsk. 3:137 (1921). TYPE: "Botany Bay". LECTOTYPE (here designated): GOET (ex herb. Wendl., Herrenhausen; photograph only seen). PROBABLE ISOLECTOTYPES: GOET (ex herb. Bartling; photograph only seen), MEL 543905 (ex herb. Steetz), (see note 2 below).

Cassinia aurea R. Br. in W. T. Aiton, Hort. Kewensis 2nd ed. 5:184 (1813); Spreng., Syst. Veg. 16th ed. 426 (1826). TYPE: "Nat. of the South coast of New Holland. Robert Brown, Esq. Introd. 1803, by Mr. Peter Good". TYPE SPECIMEN: *Brown s.n.*, Bay IV, South Coast, s. dat. (K), (see note 3 below).

Cylindrosorus flavescens Benth., Enum. Pl. Hueg. 62 (1837). — *Angianthus flavescens* (Benth.) Steetz in Lehm., Pl. Preiss. 1:438 (1845). TYPE: "Swan River (Hugel)". LECTOTYPE (here designated): *Hugel s.n.*, Swan River, s. dat. (K, herb. Benth.). ISOLECTOTYPE: W. Probable isolectotype: MEL 84773 (see note 4 below).

Annual herb, (3)5-30(44.5) cm high. Major axes erect or ascending, hairy; stem often simple in the smaller plants, to c. 10(19) cm high, but usually forming major branches at basal and/or upper nodes. *Leaves* alternate, oblanceolate or sometimes a few narrowly elliptic, 0.5-3(5.1) cm long, 0.1-0.3(0.5) cm wide, sometimes slightly mucronate, the upper ones with a small hyaline appendage present at the apex, all leaves hairy. *Compound heads* ellipsoid or lanceoloid to ovoid, 0.7-3(5.3) cm long, 0.4-0.8(1.1) cm in diam.; bracts subtending compound heads not forming a conspicuous involucre but several leaf-like, hairy bracts with hyaline apices present, grading into capitulum-subtending bracts; *general receptacle* \pm cylindrical to narrowly oblong. *Capitula* 150-700(1,000) per compound head; capitulum-subtending bracts 1(2-4), if more than one then the extra one(s) abaxial to, and overlapping, the inner, all usually ovate, sometimes \pm lanceolate, elliptic or \pm obovate, (2.1)2.3-3(3.3) mm long, 0.7-1(1.45) mm wide, the midrib glabrous or variably hairy toward the apex and sometimes with a few glandular hairs. *Capitular bracts* with the two concave ones (1.8)2.1-2.7(3) mm long, the midrib usually glabrous but sometimes a few glandular hairs present; flat bracts 2, \pm obovate, gradually tapering to the base, rarely a more or less abrupt taper in the lower $\frac{1}{2}$, (1.8)2.1-2.8(3) mm long, 0.6-1(1.2) mm wide, the midrib usually glabrous but sometimes a few glandular hairs present. *Florets* 2; corolla 5-lobed, the tube tapering gradually to the base or sometimes an abrupt taper in the lower $\frac{1}{2}$, (1.2)1.3-2(2.2) mm long, c. 0.35-0.4 mm in diam. *Achenes* obconical, 0.5-0.8 mm long, c. 0.3 mm in diam., papillose. *Pappus* of 2-3 jagged scales, 0.25-0.7(0.8) mm long, each scale terminating in 1-2 terminally sub-plumose bristles extending to c. the length of the corolla tube, the total pappus length (1.25)1.35-1.8(2) mm. Figs: 1j, 3h.

Chromosome number: $n=12$ (Turner, 1970, T5565).

DISTRIBUTION (Fig. 2):

South west of New South Wales, western Victoria, South Australia and below latitude c. 26°S in Western Australia. Very common.

ECOLOGY:

Found in both coastal and inland situations around clay pans, saline depressions and granite outcrops or in woodland, scrub and shrubland formations. Collectors' notes include "Red soil near granite outcrop. Assoc. with *Waitzia* sp. & *Sida calyxhymenia*.", "Claypan depression with *Casuarina cristata*, *Heterodendrum* and *Atriplex vesicaria*.", "In *Kochia pyramidata* [= *Maireana pyramidata*] association", "On sandy loam with *Melaleuca* and *Atriplex* on edge of salty flat", "Clay loam in mallee *Eucalyptus*, *Melaleuca*, *Casuarina* scrubland" and "*Eucalyptus* woodland with *Eremophila* spp. & *Cratystylus* as dominant shrubs. Brown clay loam."

NOTES:

1. The publication date of volume 2 of Wendland's *Collectio Plantarum* is usually cited as 1810. Stafleu (1967) has suggested that pages 16-34 and plates 43-48, which include the description of *A. tomentosus*, were published in 1808.

2. The type locality of *A. tomentosus* is cited by Wendland (?1808) as Botany Bay. However the species does not occur in eastern New South Wales. Brown (1817) and Cassini (1819) were both of the opinion that Wendland described it from material acquired from Kew. This material presumably originated from that collected by Brown and/or Good from Petrel Cove (see note 3 below).

Wendland's reference to Botany Bay as the collection site is possibly due to the fact that many of the Australian plants collected by Good and cultivated at Kew were kept in a glasshouse referred to as the "Botany Bay House" (Smith, 1881).

Wendland presumably based his description of *A. tomentosus* on all material available to him. Of the two collections held at GOET the one selected as the lectotype comes from Wendland's own herbarium in Herrenhausen while the other is a collection originally sent by Wendland to the German botanist Bartling in 1842 (Prof. Dr G. Wagenitz, pers. comm., 1981). The MEL collection, which consists of cultivated material, was presented to J. Steetz by Wendland's son in 1844. This information was recorded by Steetz on the herbarium sheet.

3. The only type material of *C. aurea* seen is housed at K. It is clearly marked "Bay IV, South Coast" which indicates that it was collected from Petrel Bay, Isle St. Francis (Stearn, 1962).

4. Bentham (1837) based his description of *Cylindrosorus flavescens* on a collection made by Hügel in Western Australia. According to Stafleu (1967) the Hügel collections were acquired by the Vienna herbarium (W) in 1839. However a specimen was obtained from Vienna by Bentham and is now housed at K (Bentham, 1863). It follows therefore that one should lectotypify. Both the K and W specimens are well preserved and there seems no reason to give preference to either other than that Bentham presumably chose to retain the specimen at K.

The sheet MEL 84773 contains a single specimen designated as *C. flavescens*. It comes from O. W. Sonder's collection but the label indicates that it originally came from Vienna. Although there is no indication that the specimen was collected by Hügel it is nevertheless a good match with the specimens from K and W.

SELECTED SPECIMENS EXAMINED (19/76):

Western Australia — Allan 183, Fitzgerald River, 50 miles W. of Ravensthorpe, 8.xi.1969 (BR1, PERTH); Chinnock 1068, 30 km NE. of Depot Springs homestead, 15.ix.1973 (AD); George 3806, Elder Creek, 21.viii.1962 (PERTH); Kenneally 71/289, 7½ miles W. of Ballidu, 28.ix.1971 (UWA); Short 431, Hamelin Pool, 20.viii.1977 (AD); Short 562, Edge of Mongers Lake, 18.ix.1977 (AD); Short 612, Mt Rupert Station, 20.ix.1977 (AD); Short 620, Hines Hill, 21.ix.1977 (AD); Short 704, Newman Rocks, 29.ix.1977 (AD); Vachell s.n., Kellerberin, .xii.1903 (NSW 138779).

South Australia — Crisp 682, Koonamore Station, 8.xii.1973 (AD, CBG); Lang 994, c. 14.7 km SE. of Hiltaba homestead, 14.x.1977 (AD); Short 708, c. 14.7 km W. of Yalata Mission turn-off on main highway to Perth, 29.viii.1977 (AD); Specht & Carrodus 23, 10 miles N. of Nonning homestead, 14.xi.1958 (AD); Wace 12, Masillon Island, 5.i.1971 (AD).

Victoria — D'Alton s.n., Dimboola, 1901 (NSW 138781); Henshall s.n., Red Cliffs, 21.xi.1968 (NT).
New South Wales — Alchin 332, Wentworth, 28.x.1975 (NSW); Green 182, Pooncarie, .x.1974 (NSW).

6. **Angianthus brachypappus** F. Muell., Trans. Philos. Soc. Vict. 1:44 (1855); F. Muell., J. Bot. (Hooker) 8:149 (1856); Benth., Fl. Austr. 3:563 (1867); F. M. Bail., Qd. Fl. 848 (1900); J. M. Black, Fl. S. Aust. 1st ed. 644 (1929), 2nd ed. 924 (1957), p.p. (excl. *A. conocephalus* (J. M. Black) Short); Willis, Handb. Pl. Vict. 2:729 (1973). — *Stylancerus brachypappus* (F. Muell.) Kuntze, Rev. Generum Pl. 367 (1891). — *Siloxerus brachypappus* (F. Muell.) Ising, Trans & Proc. Roy. Soc. S. Aust. 46:604 (1922). TYPE: "On barren plains near Swanhill." LECTOTYPE (here designated): ?Mueller s.n., Murray plains near Swanhill, s. dat. (MEL 541214). POSSIBLE ISOLECTOTYPES: GH (ex herb. O. W. Sonder, location given as "Murray"); MEL 541222 (no locality details but descriptive notes in Mueller's hand and specimens resemble those of lectotype); MEL 541212 (ex herb. Sond., resembles lectotype but locality given as "Murray"); MEL 541213 (resembles lectotype but locality given as "Murray").

Annual herb, (3)5-13.5 cm high. Major axes erect or ascending, sometimes decumbent, hairy; stem rarely simple, usually forming major branches at basal and upper nodes. *Leaves* alternate, usually oblanceolate, sometimes ± linear or narrowly elliptic, 1-3(3.2) cm long, 0.1-0.5 cm wide, usually very slightly mucronate, the upper most ones with a small hyaline appendage at the apex, all leaves variably hairy. *Compound heads* lanceoloid to ± ovoid or narrowly ellipsoid to ellipsoid, 1-2.5(2.9) cm long, 0.5-0.8 cm diam.; bracts subtending compound heads usually not forming a conspicuous involucre, rarely c. ¼ the length of the head, usually of c. 5-6(10) leaf-like bracts with hyaline apices present, grading into capitulum-subtending bracts; *general receptacle* cylindrical or narrowly oblong. *Capitula* c. 100-300 per compound head; capitulum-subtending bracts 1(2-3), if more than one then the extra one(s) abaxial to and overlapping the inner, all bracts elliptic or obovate, sometimes ± ovate, lamina rarely with a distinct constriction in the upper part, the entire bracts (2)2.3-3(3.25) mm long, 1-1.7(1.9) mm wide, the midrib variably hairy toward the apex. *Capitular* bracts with the 2 concave ones (2.1)2.3-3.2 mm long, the midrib variably hairy toward the apex; flat bracts 2, obovate, abruptly attenuated in the lower ⅓-½, the edge of the bracts often incurved so as to slightly cover the florets, (2)2.2-3(3.3) mm long, 0.8-1.3 mm wide, the midrib variably

hairy toward the apex and often with a dissected wing-like extension from the adaxial surface. *Florets* 2; corolla 5-lobed, the tube tapering \pm gradually to a sometimes variably swollen base, (1.3)1.5-2.2 mm long, c. 0.4 mm diam. *Achenes* \pm obovoid, 0.5-0.8 mm long, c. 0.3 mm diam., papillose. Pappus cup-shaped, variably jagged, often with 1 or 2 bristles extending $\frac{1}{2}$ - $\frac{2}{3}$ the length of the corolla tube, the cup 0.15-0.7 mm high, including the bristles the total pappus length up to 1.6 mm long. Fig. 3j.

DISTRIBUTION (Fig. 2):

North-eastern South Australia, western New South Wales and north-west Victoria. Common.

Two collections, *Blake 10441* and *White BRI 224128*, from Yelarbon, Queensland, represent a disjunct locality. Unfortunately the condition of the specimens is poor but there appears to be no reason to exclude them from *A. brachypappus*.

ECOLOGY:

Commonly occurs on sandy soils in open areas. Collectors' notes include "Open plain, sandy loam", "Sandridge, very common, blue-bush association" and "Very gently undulating gilgaied depressions on brown gibber soils".

SELECTED SPECIMENS EXAMINED (8/66):

South Australia — *Lay 577*, Balta Baltana Block, 7.x.1971 (AD); *Symon 9478*, W. edge of Simpson Desert, NE. of Macumba, 28.ix.1974 (AD); *Weber 1443*, Andamooka Opal Fields, 8.ix.1968 (AD).

Victoria — *Willis s.n.*, C. 1 mile E. of Berribee Tank, 31.viii.1948 (MEL 84413).

New South Wales — *Constable s.n.*, Mundi Mundi Station, 14.x.1947 (NSW 4543); *Leigh S30*, 50 miles NE. of Hay, 26.ix.1963 (NSW); *Richley F97*, Fowler's Gap, 20.ix.1973 (AD).

Queensland — *Blake 10441*, Yelarbon, 22.ii.1936 (BRI, GH).

7. *Angianthus conocephalus* (J. M. Black) Short, comb. et stat. nov.

Angianthus brachypappus var. *conocephalus* J. M. Black, Fl. S. Aust. 1st ed. 645, fig. 300 (1929), 2nd ed. 924, fig. 1224 (1957), basionym. TYPE: "Ooldea; Nullarbor Plain." LECTOTYPE (here designated): ? *J. M. Black s.n.*, Ooldea, 25.ix.1920 (AD 97823002, herb. J. M. Black). SYNTYPE (POSSIBLE ISOLECTOTYPE): *J. M. Black s.n.*, Ooldea, 25.ix.1920 (AD 98103149, herb. J. M. Black). OTHER SYNTYPES: *J. M. Black s.n.*, Ooldea, 24.ix.1920 (AD 98103149, herb. J. M. Black); *J. M. Black s.n.*, Ooldea, growing on edge of Nullarbor Plain, 24.ix.1920 (AD 98103149, herb. J. M. Black); *J. M. Black s.n.*, Ooldea, just W. of siding & near rlyine, 23.ix.1920 (AD 98103149, herb. J. M. Black); *Ising s.n.*, Nullarbor Plain, s. dat (AD 98103149), herb. J. M. Black).

[*Angianthus brachypappus* auct. non. F. Muell.: Grieve & Blackall, W. Aust. Wildfls 812 (1975).]

Annual herb. Major axes usually ascending or decumbent, rarely erect, 3-8 cm long, hairy; stem usually not distinct from the major branches which develop from basal nodes. *Leaves* alternate, \pm linear, rarely oblanceolate, 0.5-1.5(1.7) cm long, c. 0.1 mm wide, nor or very slightly mucronate, the upper most ones with a small hyaline appendage at the apex, all leaves variably hairy. *Compound heads* \pm ovoid, 0.8-1.6 cm long, 0.4-0.6 cm diam.; bracts subtending compound heads not forming a conspicuous involucre but usually several leaf-like, hairy bracts with hyaline apices present, grading into capitulum-subtending bracts; *general receptacle* narrowly oblong, the capitula arranged in a spike-like fashion, the minor receptacular appendages small. *Capitula* c. 30-100 per compound head; capitulum-subtending bracts 1(2-4), if more than one then the extra one(s) abaxial to, and overlapping the inner, all bracts obovate, 2.3-2.8 mm long, 0.8-1.2 mm wide, the midrib glabrous or sparsely hairy toward the apex. *Capitular bracts* with the 2 concave ones 2.3-2.7 mm long, the midrib glabrous; flat bracts 2, obovate, abruptly attenuated in the lower $\frac{1}{3}$, the edge of the bracts incurved so as to slightly cover the florets, 2-2.7 mm long, 0.9-1.4 mm wide, the midrib glabrous or sparsely hairy toward the apex. *Florets* 2; corolla 5-lobed, the tube tapering gradually to the base, 1.4-2.1 mm long, c. 0.4 mm diam. *Achenes* \pm obovoid, 0.4-0.7 mm long, c. 0.3 mm diam., papillose. Pappus a jagged ring, 0.1-0.3 mm long. Figs: 3d, i.

DISTRIBUTION (Fig. 2):

Nullarbor Plain region. Common.

ECOLOGY:

Occurs on both clay and loam soils. Collectors' notes include "Common on clayey soils", "Fine sandy loam over calcrete" and "In loam over limestone".

NOTE:

1. *A. conocephalus* was originally described by Black (1929) as a variety of *A. brachypappus*. The var. *conocephalus* was considered to have a conical compound head and var. *brachypappus* a cylindrical head. However the shape of the compound head is quite variable. On the other hand both species exhibit distinct differences in habit and leaf morphology and usually pappus morphology. They are also allopatric.

SELECTED SPECIMENS EXAMINED (5/23):

Western Australia — *Aplin 1656*, Forrest, 31.viii.1962 (PERTH); *Chinnock 1151*, 30 km S. of Rawlinna, 19.ix.1973 (AD); *George 8495*, 30 miles NW. of Reid, 14.x.1966 (PERTH).

South Australia — *Chinnock 1183*, 15 km E. of Koonalda homestead, 21.ix.1973 (AD); *Ising 1529*, Hughes, 8.ix.1920 (AD).

8. ***Angianthus micropodioides*** (Benth.) Benth., Fl. Austr. 3:565 (1867) ('*micropoides*'); Grieve & Blackall, W. Aust. Wildfls 812 (1975) ('*micropoides*'). — *Phyllocalymma micropodioides* Benth., Enum. Pl. Hueg. 62 (1837); Steetz in Lehm. Pl. Preiss. 1:436 (1845). — *Styloncerus micropodioides* (Benth.) Kuntze, Rev. Generum Pl. 367 (1891) ('*micropodes*'). TYPE: "Swan River. (Hügel.)" LECTOTYPE (here designated): *Hügel s.n.*, Swan River, s. dat. (W). ISOLECTOTYPE: K (see note 1 below).

Phyllocalymma filaginoides Steetz in Lehm. Pl. Preiss. 1:437 (1845); Steetz in Walper's Repert. Bot. Syst. 6:229 (1846). — *Angianthus micropodioides* var. *filaginoides* Ewart & J. White, Proc. Roy. Soc. Vict. 22:92 (1909) ('*micropoides*'). TYPE: "In solo arenoso — turfoso inter frutices ad fluvii Cygnorum ripam prope oppidulum Perth, mense Januario 1839. Herb. Preiss. No. 37." LECTOTYPE (here designated): *Preiss 37*, In Nova Hollandia, (Swan-River Colonia) in solo arenoso turfoso inter frutices ad flumis Cygnorum ripam leg. cl. Preiss, s. dat. (MEL 541603). ISOLECTOTYPES: LD, MEL 541604, MEL 541605 (ex herb. O. W. Sonder), MEL 583143 (ex herb. O. W. Sonder), S, GH (ex herb. Klatt), (see p.152).

Annual herb. Major axes ascending to erect, 4-15 cm long, hairy; stem sometimes simple to c. 10 cm high, but usually forming major branches at basal and/or upper nodes. *Leaves* alternate, ± linear or lanceolate, 0.5-1.5(2.8) cm long, 0.05-0.1 cm wide, distinctly mucronate, variably hairy. *Compound heads* ± depressed ovoid to broadly depressed ovoid, 0.4-0.6 cm long, 0.4-0.5 cm diam., axillary or terminal; bracts subtending compound heads forming a conspicuous involucre exceeding the length of the head, of c. 10 leaf-like bracts, ± lanceolate to ± ovoid, 0.5-1.5 cm long, c. 0.1 cm wide, mucronate, hairy; *general receptacle* a small convex axis. *Capitula* c. 10-30 per compound head; capitulum-subtending bracts 1, ± oblong or ovate, 2.1-2.8 mm long, 0.8-1.3(1.5) mm wide, the midrib variably hairy toward the apex. *Capitular bracts* with the two concave ones 2.4-3.1 mm long, the midrib hairy; flat bracts 2, obovate, ± abruptly attenuated in the lower ½, 2.4-3.1 mm long, (0.75)0.9-1.25 mm wide, the midrib usually variably hairy toward the apex, rarely glabrous. *Florets* 2; corolla 5-lobed, the tube tapering gradually towards the base in immature florets, a more abrupt taper in the lower ⅓ of mature florets which have variably swollen bases, 1.4-1.9 mm long, c. 0.5 mm diam. *Achenes* ± obovoid, 0.8-1 mm long, 0.5-0.6 mm diam., pubescent. Pappus of 5 or 6 jagged scales fused at the base, each scale terminating in a single smooth or minutely barbellate bristle, the total pappus c. ⅓-⅔ the length of the corolla tube. Fig. 3k.

DISTRIBUTION (Fig. 2):

Western Australia, particularly in the South West Drainage Division (Mulcahy & Bettenay, 1972), between latitudes c.28°30'S and 32°S and west of longitude c.122°E. Locally common.

ECOLOGY:

Grows on sand or very sandy loam amongst *Halosarcia* and *Melaleuca* on the edge of saline depressions.

NOTES:

1. Bentham (1837) based his description of *Phyllocalymma micropodioides* on a collection made by Hügel in Western Australia. According to Stafleu (1967) the Hügel collections were acquired by the Vienna herbarium (W) in 1839. However a specimen was obtained by Bentham and is now housed at K (Bentham, 1863). It follows therefore that one should lectotypify. The W sheet of *P. micropodioides* contains three good individual specimens, the K sheet a single specimen. Thus the former sheet has been designated as the lectotype.

2. Pappus characteristics, i.e. the length of the awns and the jagged nature of the scales, were used by Steetz (1845) to distinguish *Phyllocalymma filaginoides* from *P. micropodioides*. Such characteristics are however quite variable, even within a single plant, and Bentham (1867) reduced the former species to synonymy. There are however a number of specimens in which the typical awned scales of *A. micropodioides* are absent. For example the collection *Short 1008* contains individuals with a small, jagged, ring-like pappus while a pappus is absent in specimens of *Short 992* and *Short 946*. One collection contains some individuals which lack a pappus (referred to as *Short 1012A*) and others with a distinct ring-like pappus (referred to as *Short 1012*). Future investigations may show that the latter collections represent a distinct taxon but apart from the variable characteristics of the pappus there appear to be no features by which it can be distinguished from *A. micropodioides*. It may be that the pappus variation is under simple genetic control.

3. *A. micropodioides* and *A. cornutus* exhibit a similar habit but the latter species can be readily distinguished by the presence of horn-like basal appendages on the flat capitular bracts. Furthermore the pubescent nature of the achene appears to be unique to *A. micropodioides*.

SELECTED SPECIMENS EXAMINED (5/19):

Western Australia — Chinnock 4417 & Wilson, Mortlock river just east of Meckering, 22.xi.1978 (AD); Morrison s.n., Banks of Swan Estuary, 28.xii.1898 (CANB 209968, BRI 078604, MEL 84466, PERTH); Preiss 36, Swan River Colonia, 1843 (MEL 583144, ex herb. Sond.; MEL 84467, ex herb. Steetz); *Short 1024*, c. 13.7 km NW. of Ballidu, 20.xi.1979 (AD); *Short 1037*, c. 8 km W. of Kalguddering, 20.xi.1979 (AD).

SPECIMENS EXAMINED, *A. micropodioides* VARIANT:

Western Australia — *Short 946*, 3.4 km N. of Boodarocking, 13.xi.1979 (AD); *Short 954*, Lake Campion, 14.xi.1979 (AD); *Short 968*, 45.1 km N. of Koorda along main road to Mollerin, 14.x.1979 (AD); *Short 987*, 7.9 km N. of Latham, 15.xi.1979 (AD); *Short 992*, c. 30.4 km S. of Pindar along main road to Tardun, 15.xi.1979 (AD); *Short 1008*, Yarra Yarra Lake, c. 12 km N. of Carnamah, 19.xi.1979 (AD); *Short 1021*, *1021A*, c. 54.5 km from Nugadong along main road to Gunyidi, 19.xi.1979 (AD).

9. *Angianthus cornutus* Short, sp. nov.

[*Angianthus milnei* auct. non Benth.: Grieve & Blackall, W. Aust. Wildfls 814 (1975).]

Herba annua. Axes maiores decumbentes ascendentesve, 3-10(16) cm longi. *Folia* alterna, linearia vel lineari-triangularia, 0.5-1(1.2) cm longa, 0.1 cm lata, mucronata, pilosa. *Glomerulus* ovoideus, 0.8-1.2 cm longus, 0.3-0.6 cm diametro; bractee glomerulos subtendentes involucrium conspicuum longitudine c. $\frac{1}{4}$ - $\frac{3}{4}$ glomeruli partes aequante facientes; receptaculum convexum vel oblongum. *Capitula* c. 30-40; bractee capitula subtendentes 1(2), obovatae \pm oblongaeve, 2.4-3 mm longae, 1.2-1.6 mm latae; costa ad apicem variabiliter pilosa. *Bractee intra capitulum*: duo concave 2.4-2.6 mm longae, costa versus apicem variabiliter pilosa; duo planae, ellipticae \pm obovatae, in infima tertia parte attenuatissimae, 2.4-3 mm longae, 0.9-1.2 mm latae, costa versus apicem varie pilosa, ad basin 2 appendicibus propriis cornuatis, c. 0.2-0.4 mm longis. *Flosculi* 2; corolla 5-lobata. *Achenia* \pm ellipsoidea, papillosa. Pappus carens.

HOLOTYPE (fig. 6): *Chinnock 4692*, Saline depression 3.8 km E. of Carnegie (25°47'S, 123°01'E). Prostrate herb growing in sand on edge of *Arthrocnemum* [= *Halosarcia*] zone. Associated with *Aizoon*, *Chrysocoryne* and *Gnephosis*. Abundant, 16.ix.1979 (AD). ISOTYPUS: CANB, PERTH.

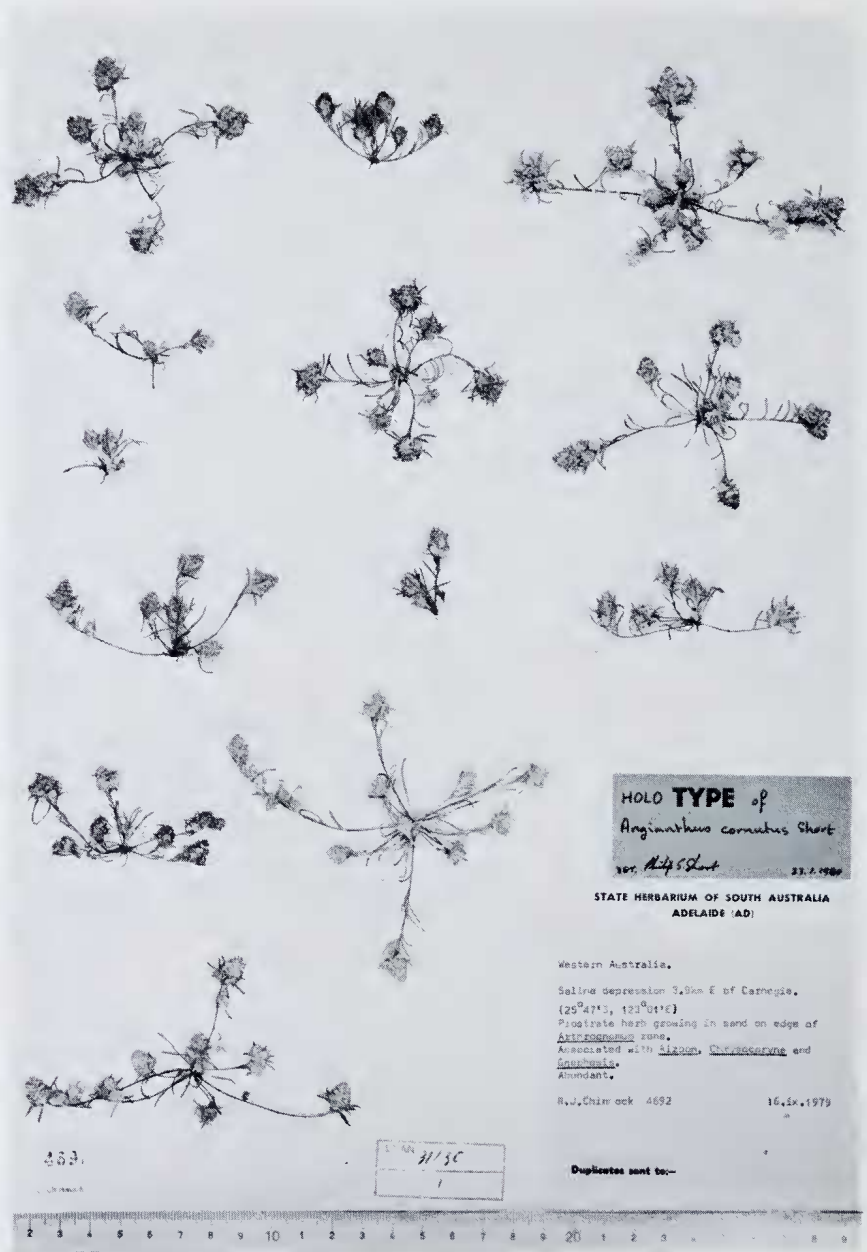


Fig. 6. *A. cornutus* Short. Holotype (Chinnock 4692, AD).

Annual herb. Major axes decumbent or ascending, 3-10(16) cm long, hairy; stem not distinguishable from major branches which develop from basal nodes. *Leaves* alternate, linear or linear-triangular, 0.6-1(1.2) cm long, c. 0.1 cm wide, mucronate, hairy. *Compound heads* ovoid, 0.8-1.2 cm long, 0.3-0.6 cm diam.; bracts subtending compound heads forming a conspicuous involucre extending c. $\frac{1}{4}$ to $\frac{3}{4}$ the length of the head, of c. 10-15 bracts, the outer ones leaf-like, linear-triangular to narrowly triangular, 0.5-0.8 cm long, c. 0.1 cm wide, mucronate, hairy, the inner ones with hyaline apices and grading into capitulum-subtending bracts; *general receptacle* \pm convex or oblong. *Capitula* c. 30-40 per compound head; capitulum-subtending bracts 1(2), if more than

one then the extra one abaxial to and overlapping the inner, all bracts obovate or \pm oblong, 2.4-3 mm long, 1.2-1.6 mm wide, the midrib variably hairy toward the apex. *Capitular bracts* with the two concave ones 2.4-2.6 mm long, the midrib variably hairy toward the apex; flat bracts 2, elliptic or obovate, abruptly attenuated in the lower $\frac{1}{3}$, the edge of the bracts often incurved so as to slightly cover the florets, 2.4-3 mm long, 0.9-1.2 mm wide, the midrib variably hairy toward the apex and with 2 distinct horn-like appendages, c. 0.2-0.4 mm long, at the base. *Florets* 2; corolla 5-lobed, the tube either tapering \pm gradually to a swollen base or with an abrupt taper in the lower $\frac{1}{3}$, the entire tube 1.5-1.8 mm long, 0.5-0.6 mm diam. *Achenes* \pm ellipsoid, c. 0.6 mm long, c. 0.3 mm diam., papillose. *Pappus* absent. Figs.: 3f, 6.

DISTRIBUTION (Fig. 2):

Restricted to a small area in the vicinity of Carnegie, Leonora and Wiluna, Western Australia. A single collection, *Short 1112*, from Dundas Rocks, may be referable to this species. Uncommon.

ECOLOGY:

Apart from the holotype collection the only habitat information is "low rocky ridge in ironstone wash area".

NOTE:

1. The specific epithet alludes to the horn-like basal appendages which are found on the flat capitular bracts. The affinities of this species appear to be with *A. micropodioides* (see note 3 under that species) and possibly *A. conocephalus*. It is readily distinguished from the latter species by the well developed general involucre. The involucre is inconspicuous in *A. conocephalus*.

SPECIMENS EXAMINED:

Western Australia — *Beaglehole 59466* & *Errey 3166*, 19 km S. of Wiluna, 13.ix.1978 (ACB, AD); *Blackall s.n.*, Yandil Station, -.ix.1939 (PERTH); *Blackall s.n.*, near Leonora, -.ix.1939 (PERTH); *Short 1112*, salt lake at base of Dundas Rocks 25.viii.1970 (AD); *Wilson 8940*, 18 km S. of Wiluna, 28.viii.1970 (PERTH).

10. *Angianthus prostratus* Short, sp. nov.

Herba annua. Axes maiores prostrati decumbentesve, 5-20(23) cm longi, pilosi, ramis maioribus e nodis basalibus efficientibus; caulis non clarus. *Folia* alterna, sublinearia oblanceolatae, 0.5-1(2) cm longa, 0.05-0.1(0.2) cm lata, mucronata, pilosa. *Glomeruli* latissime ovoidei usque late depressoque ovoidei, 0.5-1 cm longi, 0.5-1.1 cm diametro; bracteae glomerulos subtendentes involucrem clarum longitudini glomeruli aequales longioresve facientes; receptaculum latissime ovoideum. *Capitula* 20-30; bractea capitulum subtendens 1, elliptica vel ita anguste, 2.5-3(3.3) mm longa, 0.9-1.1 mm lata; costa clare pilosa in dimidio superiore, pilis bractea circa tertia parte longioribus. *Bracteae intra capitulum*: duo concavae 2.6-3.2(3.4) mm longae, costa dense pilosa, pilis bractea circa tertia usque dimidia parte longioribus; planae 2, subobovatae usque oblanceolatae, 2.3-3(3.3) mm longae, 0.7-1 mm latae, \pm gradatim attenuatae, costa in dimidio superiore varie pilosa, pilis bractea circa tertia usque dimidia parte longioribus, raro e pagine adaxiali appendicem aliformem integram efficiens. *Flosculi* 2; corolla 5-lobata. *Achenia* subobovoidea, 0.7-0.9 mm longa, c. 0.5 mm diametro, varie papillosa, ad apicem circulo pilorum parvorum. Pappus carens.

HOLOTYPE (fig. 7): *Aplin 2297*, 10 miles south of Leonora on road to Menzies, 17.viii.1963 (PERTH).

Annual herb. Major axes prostrate or decumbent, 5-20(23) cm long, hairy; stem not distinct from the major branches which develop from basal nodes. *Leaves* alternate, \pm linear or oblanceolate, 0.5-1(2) cm long, 0.05-0.1(0.2) cm wide, mucronate, hairy. *Compound heads* very broadly to broadly depressed ovoid, 0.5-1 cm long, 0.5-1.1 cm diam.; bracts subtending compound heads forming a conspicuous involucre about equal to or exceeding the length of the head, of c. 10 bracts, the outer ones leaf-like, \pm linear or oblanceolate, 0.5-1 cm long, 0.05-0.2 cm wide, mucronate, hairy, sometimes a few inner ones with hyaline apices; *general receptacle* \pm very broadly ovoid. *Capitula* 20-30 per compound head; capitulum-subtending bract 1, narrowly elliptic to \pm elliptic, 2.5-3(3.3) mm long, 0.9-1.1 mm wide, the midrib conspicuously hairy in the upper $\frac{1}{2}$, the single hairs c. $\frac{1}{3}$ the length of the bract. *Capitular bracts* with the two concave ones 2.6-3.2(3.4) mm long, the midrib densely hairy, the single hairs c. $\frac{1}{3}$ - $\frac{1}{2}$ the length of the



Fig. 7. *A. prostratus* Short. Holotype (Aplin 2297, PERTH).

bract; inner flat bracts 2, \pm obovate to oblanceolate, \pm gradually tapering to the base, 2.3-3(3.3) mm long, 0.7-1 mm wide, the midrib variably hairy in the upper $\frac{1}{2}$, the single hairs c. $\frac{1}{3}$ - $\frac{1}{2}$ the length of the bract, rarely with an entire wing-like extension from the adaxial surface. *Florets* 2; corolla 5-lobed, the tube tapering \pm gradually to a variably swollen base, (1.7)2-2.4 mm long, c. 0.8 mm diam. *Achenes* \pm obovoid, 0.7-0.9 mm long, c. 0.5 mm diam., a conspicuous ring of small hairs at the apex, the entire achene variably papillose. Pappus absent.

Fig. 7.

DISTRIBUTION (Fig. 2):

Restricted to Western Australia between latitudes c. 28°S and 31°S and between longitudes 119°E and 122°E.

ECOLOGY:

Frequently grows in saline soils. Collectors' notes include "on gentle slope surrounding salt lake", "clay depression, saline" and "red loamy soil in *Eucalyptus* woodland".

NOTE:

1. The specific epithet alludes to the common prostrate habit of the species. This character plus the long hairs on the capitulum-subtending bracts and capitular bracts readily distinguish it from all other species of *Angianthus*.

SPECIMENS EXAMINED:

Western Australia — *Barker 1909*, Arrow Lake, 12.viii.1977 (AD); *Blackall s.n.*, near Paddington, -ix.1927 (PERTH); *Demarz 5643*, 6 miles N. of Bulga Downs, 24.ix.1975 (KP, PERTH); *Gardner 2081B*, Paddington, 9.ix.1927 (PERTH); *Wilson 8806*, Lake Barlee, 26.viii.1970 (PERTH).

11. *Angianthus microcephalus* (F. Muell.) Benth., Fl. Austr. 3:566 (1867); Grieve & Blackall, W. Aust. Wildfls 813 (1975). — *Cephalosorus microcephalus* F. Muell., Fragm. 3:158 (1863). — *Styloncerus microcephalus* (F. Muell.) Kuntze, Rev. Generum Pl. 367 (1891). TYPE: "Ad flumen Murchison. A. Oldfield." LECTOTYPE (here designated): *Oldfield s.n.*, Salt swamp, Estuary of Murchison, s. dat. (MEL 541602), (see note 1 below). ISOLECTOTYPES: K, PERTH.

Annual herb. Major axes decumbent or ascending, 6-10(21) cm long, variably hairy; stem not distinct from the major branches which develop from basal nodes. *Leaves* alternate or opposite, succulent when fresh, narrowly elliptic or \pm linear, 0.3-1(1.2) cm long, c. 0.1 cm wide, slightly mucronate, hairy. *Compound heads* broadly ovoid to very broadly ovoid, 0.35-0.6(0.8) cm long, 0.35-0.5(0.6) cm diam.; bracts subtending compound heads forming a conspicuous involucre extending c. $\frac{1}{4}$ - $\frac{1}{2}$ the length of the head, of c. 10 bracts, the outer ones leaf-like, narrowly elliptic to elliptic or lanceolate to ovate, 0.3-0.4 cm long, 0.1-0.15 cm wide, mucronate, hairy, the inner ones with hyaline apices and grading into capitula-subtending bracts; *general receptacle* \pm oblong or ovoid. *Capitula* c. 10-40 per compound head; capitulum-subtending bract 1, \pm oblong or ovate or obovate, 1.7-2.4 mm long, 0.45-1.1 mm wide, the midrib usually glabrous but sometimes a few glandular hairs present toward the apex. *Capitular bracts* with the two concave ones 1.7-2 mm long, the midrib glabrous; flat bracts absent or ? 1 only. *Florets* 1; corolla 5-lobed, the tube tapering gradually toward the base, 1-1.4 mm long, c. 0.4 mm diam. *Achenes* \pm obovoid, 0.45-0.6 mm long, c. 0.2 mm diam., papillose. Pappus of 2 or 3 ovate scales, 0.2-0.4 mm long, each scale terminating in a variably barbellate bristle extending to c. $\frac{2}{3}$ the length of the corolla, the total pappus length 0.8-1.1 mm.

DISTRIBUTION Fig. 2:

North west of Western Australia between latitudes 25°S and 27°S and west of longitude 117°E. Locally common.

ECOLOGY:

Commonly grows in saline areas. Collectors' notes include "Clay salt flat. Growing with *Arthrocnemum* [= *Halosarcia*], *Salicornia* [= *Sarcocornia*]" and "On old shell beds and clay".

NOTES:

1. The collection MEL 541602 has been designated the lectotype of *Cephalosorus microcephalus*. It could possibly be regarded as the holotype as it is the only collection labelled in Mueller's hand and it is possible that the K collection, which was acquired from the Oldfield herbarium, was not seen by Mueller. The PERTH collection is a fragment of the lectotype acquired by C. A. Gardner this century.

2. *A. microcephalus* is readily distinguished from other species of *Angianthus* by the presence of only 1 floret per capitulum and the absence of 2 inner flat bracts within each capitulum. In all other respects the species is typical of *Angianthus*.

SPECIMENS EXAMINED:

Western Australia — Cannon 317, Hamelin Pool Station, 24.ix.1974 (PERTH); George 11439, Dirk Hartog Is., 3.ix.1972 (PERTH); Short 442, c. 3 km N. of Eagle Bluff, Peron Peninsula, 21.viii.1977 (AD); D. G. W. M3B23, Roderick River, Boolardy, 28.x.1953 (PERTH).

12. *Angianthus drummondii* (Turcz.) Benth., Fl. Austr. 3:566 (1867); Grieve & Blackall, W. Aust. Wildfls 814 (1975). — *Skirrhophorus drummondii* Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1):188 (1851) ('*Scirrhophorus*'). — *Styloncerus drummondii* (Turcz.) Kuntze, Rev. Generum Pl. 367 (1891). TYPE: "Nova Hollandia. Drum. 111.n.123." POSSIBLE HOLOTYPE: KW (see p.152). ISOTYPES: K, MEL 541210, NSW, PERTH.

Angianthus platycephalus Benth., Fl. Austr. 3:566 (1867); Grieve & Blackall, W. Aust. Wildfls 814 (1975). — *Styloncerus platycephalus* (Benth.) Kuntze, Rev. Generum Pl. 367 (1891). TYPE: "Tone River, Oldfield." HOLOTYPE: Oldfield 85, Wet places, Tone R., W. Aust., s. dat (K), (see note 1 below). ISOTYPES: MEL 541607, PERTH. POSSIBLE ISOTYPE: MEL 541606 (lacks collector's number).

Annual herb. Major axes \pm decumbent or ascending to erect, 2-7 cm long, variably hairy; stem simple or forming major branches at basal nodes. *Leaves* alternate or opposite, \pm linear, c. 0.5-1 cm long, c. 0.1 cm wide, variably mucronate, hairy. Compound heads \pm broadly ovoid, 0.4-0.6 cm long, 0.5-0.7 cm diam.; bracts subtending compound heads forming a conspicuous involucre about the length, or exceeding the length, of the head, of c. 10 bracts, the outer ones leaf-like, \pm linear or oblanceolate or \pm elliptic, 0.5-1 cm long, 0.1-0.3 cm wide, variably mucronate, hairy; *general receptacle* a small convex or slightly elongate axis. *Capitula* c. 20-60 per compound head; capitulum-subtending bracts 1(?2), \pm oblong or obovate, c. 2 mm long, c. 1 mm wide, the midrib glabrous or variably hairy toward the apex. *Capitular bracts* with the two concave ones c. 2 mm long, the midrib variably hairy toward the apex; flat bracts 2, obovate, \pm gradually tapering toward the base, c. 2 mm long, c. 1 mm wide, the midrib glabrous or variably hairy toward the apex and with an entire wing-like extension from the adaxial surface. *Florets* 2; corolla 5-lobed, the tube tapering gradually to the base, c. 1.8 mm long, c. 0.8 mm diam. *Achenes* \pm obovoid, c. 0.8 mm long, c. 0.3 mm diam., papillose. Pappus a very small jagged ring, c. 0.1 mm long.

DISTRIBUTION (Fig. 2):

An uncommon species restricted to the south west of Western Australia. Specimens referred to as a variant of *A. drummondii* are similarly restricted.

ECOLOGY:

The only information available comes from the holotype collection of *A. platycephalus*. The plants on the sheet are growing in clumps of moss and the label records them as growing "in wet places".

Specimens referred to as a variant of *A. drummondii* favour saline regions. Collectors' notes include "sandy loam in *Arthrocnemum* [= *Halosarcia*]/*Melaleuca* zone around salty depression" and "on sandy island . . . Growing with *Arthrocnemum* [= *Halosarcia*] & *Frankenia*".

NOTES:

1. The K collection of Oldfield 85 is regarded as the holotype of *A. platycephalus*. There is no indication that Bentham saw any of the MEL material, usually indicated by the initial 'B' on the herbarium labels, and the PERTH collection is a fragment of the K type material acquired this century by C. A. Gardner.

2. Bentham (1867) regarded *A. platycephalus* and *A. drummondii* as distinct species, the former having a small jagged ring-like pappus, the latter none. However a small, jagged, ring-like pappus is discernible in the type material of *A. drummondii* and apart from minor habit differences (erect axes in *Drummond 123* and more or less

decumbent ones in *Oldfield 85*) no differences are discernible between the type collections.

There is an allied variant of *A. drummondii*. Several collections of immature plants, *Ehrendorfer 181*, *George 7293*, *Short 664* & *Short 694*, and three collections of mature plants, *Demarz 6640*, *Short 1102* & *Wittwer 588*, contain individuals which lack a pappus. All but three of these collections are from the same location, Lake King. The plants possibly represent a distinct taxon, perhaps a subspecies of *A. drummondii*, but further collections are required to substantiate this view.

Both *A. drummondii* and its variant have close affinities to *A. pygmaeus* and *A. preissianus*. Unlike *A. preissianus* they do however have primarily 5-lobed florets and are outbreeders (*Short 1981a*, b). The pappus of *A. drummondii* also readily distinguishes it from both *A. pygmaeus* and *A. preissianus*. The variant of *A. drummondii* and *A. pygmaeus* closely resemble each other. However the latter taxon normally has prostrate or decumbent axes and broadly depressed to depressed ovoid compound heads whereas in the variant of *A. drummondii* the axes are ascending to erect and the compound heads are broadly to very broadly ovoid.

SPECIMENS EXAMINED:

Western Australia — *Morrison s.n.*, Hotham River, 12.xi.1904 (PERTH); *Mueller s.n.*, Harvey River, 5.xii.1877 (MEL 85700); *Mueller s.n.*, Preston River, 5.xii.1877 (MEL 85701).

SPECIMENS EXAMINED, *A. drummondii* VARIANT:

Western Australia — *Demarz 6640*, Lake Muir Swamp, 21.xi.1977 (KP); *Ehrendorfer 181*, south coast area — Walpole/Albany/Stirling Ranges, 14.xii.1966 (PERTH); *George 7293*, Lake King, 3.xi.1965 (PERTH); *Short 664*, c. 20.5 km S. of Lake Grace along road to Pingrup, 24.ix.1977 (AD); *Short 694*, Lake King, 26.ix.1977 (AD); *Short 1102*, Lake King, 26.xi.1979 (AD).

13. ***Angianthus pygmaeus*** (A. Gray) Benth., Fl. Austr. 3:567 (1867); Diels & Pritzel, Bot. Jahrb. Syst. 35:612, fig. 69A-E (1905); Grieve & Blackall, W. Aust. Wildfls 815 (1975). — *Skirrhophorus pygmaeus* A. Gray, Hook. J. Bot. Kew Gard. Misc. 3:148 (May 1851) ('Skirrhophorus'). — *Styloncerus pygmaeus* (A. Gray) Kuntze, Rev. Generum Pl. 367 (1891). TYPE: "South-western Australia, Drummond." LECTOTYPE (here designated): *Drummond 59*, S.W. Australia, s. dat. (K). ISOLECTOTYPES: GH (ex herb. Klatt), MEL 541610, NSW, PERTH (see note 1 below).

Skirrhophorus mucronulatus Turcz., Bull. Soc. Imp. Naturalistes Moscou 24 (2):72 (Oct. 1851). TYPE: "Nova Hollandia. Drum.v.n.59." HOLOTYPE: ?CW, n.v. (see p.152). ISOTYPES: GH, K. MEL 54160, NSW, PERTH.

Annual herb. Major axes usually prostrate or decumbent, rarely ascending or erect, c. 0.5-6(9) cm long, variably hairy; stem sometimes simple and often \pm lacking, but usually forming major branches at basal nodes. *Leaves* alternate or opposite, \pm narrowly elliptic or \pm linear, sometimes semi-succulent, c. 0.3-1 cm long, c. 0.1 cm wide, mucronate, glabrous or slightly hairy. *Compound heads* broadly depressed to depressed ovoid, c. 0.2-0.4 cm long, 0.2-0.6(1) cm diam.; bracts subtending compound heads forming a conspicuous involucre c. $\frac{3}{4}$ or about the length of the head, of c. 5-10 leaf-like bracts, \pm elliptic or ovate, 0.3-0.5 cm long, 0.1-0.3 cm wide, often with a small hyaline margin, mucronate, variably hairy, a few inner ones with hyaline apices and grading into capitula-subtending bracts; *general receptacle* convex. *Capitula* (4)15-50(c.70) per compound head; capitulum-subtending bracts 1, \pm obovate or \pm oblong, 1.7-2.4 mm long, 0.7-1.5 mm wide, \pm white, the midrib glabrous or slightly hairy toward the apex. *Capitular bracts* with the two outer concave ones 1.6-2.2 mm long, \pm white, the midrib glabrous or sparsely hairy toward the apex; flat bracts 2, obovate, \pm gradually tapering toward the base, 1.6-2.2 mm long, 0.6-1 mm wide, \pm white, the midrib glabrous or sparsely hairy toward the apex and with an entire wing-like extension from the adaxial surface. *Florets* 2; corolla (?4)5-lobed, the tube tapering gradually to a sometimes variably swollen base, 0.9-1.3 mm long, c. 0.5 mm diam. *Achenes* \pm obovoid, 0.5-0.7 mm long, c. 0.2-0.3 mm diam., variably papillose and often with a fringe of papillae at the apex. Pappus absent.

DISTRIBUTION (Fig. 2):

Restricted to the salt lakes of the Avon River System, Western Australia (Short 1981a, b). Uncommon.

ECOLOGY:

Appears to grow exclusively in sandy soil on the margins of saline depressions. Commonly associated with species of *Halosarcia* and *Disphyma*.

NOTES:

1. The lectotype sheet of *Skirrhophorus pygmaeus* contains drawings of the species which, according to Gray (1851), were to be illustrated in *Icones Plantarum*. This did not eventuate. The sheet is also clearly inscribed with the words "*Skirrhophorus pygmaeus* n.sp." in Gray's hand. It is possible that the sheet could be regarded as the holotype as there is no clear indication that Gray saw any of the duplicates.

2. As pointed out under the respective species *A. pygmaeus* has close affinities with *A. preissianus* and *A. drummondii* and, in particular, to a variant of *A. drummondii*.

SPECIMENS EXAMINED:

Western Australia — *Chinnock 4158*, c. 3.5 km W. of eastern edge of Lake King, 26.ix.1977 (AD); *Chinnock 4359*, Eclipse Lake, 11.xi.1978 (AD); *Chinnock 4366*, small salt pan 0.7 km beyond western edge of Lake King, 12.xi.1978 (AD, PERTH); *Gardner s.n.*, Mortlock River flats, E. of Meckering, 22.x.1945 (PERTH); *Pritzel 902*, Avon district, -.xi.1901 (NSW); *Short 617*, 3.4 km E. of Meckering in Mortlock River, 20.ix.1977 (AD); *Short 674*, 1 km E. of Wave Rock, 25.ix.1977 (AD); *Wilson 6386a*, 3 km E. of Meckering, 23.xi.1967 (PERTH).

14. *Angianthus preissianus* (Steetz) Benth., Fl. Austr. 3:566 (1867); K. Hoffman in Engler & Prantl., *Naturl. Pflanzenfam.* 1V5:194, fig. 98A (1890); J. M. Black, Fl. S. Aust. 1st ed. 645 (1929), 2nd ed. 924 (1957); W. M. Curtis, Stud. Fl. Tas. 344 (1963); Willis, *Handb. Pl. Vict.* 2:730 (1973); Grieve & Blackall, W. Aust. Wildfls 814 (1975). — *Skirrhophorus preissianus* Steetz in Lehm. Pl. Preiss. 1:439 (1845). — *Styloncerus preissianus* (Steetz) Kuntze, Rev. Generum Pl. 367 (1891). TYPE: "In umbrosis madidis inter frutices prope lacum ad Woodman's point, mense Dec. 1838. Herb. Preiss. No. 38." LECTOTYPE (here designated): *Preiss 38*, In Nova Hollandia, (Swan-River Colonia) in umbrosis madidis inter frutices prope lacum ad Woodman's point, s. dat. (MEL 541608, ex herb. Steetz). ISOLECTOTYPES: LD, MEL 541609, S (see p.152).

Skirrhophorus eriocephalus Hook. f. ex A. Gray, Hook. J. Bot. Kew Gard. Misc. 3:148 (1851) (Hook. f. in MSS); Hook. f., Fl. Tas. 1:198, pl. 53A (1856). — *Angianthus eriocephalus* (Hook. f. ex A. Gray) Benth., Fl. Austr. 3:567 (1867); W. M. Curtis, Stud. Fl. Tas. 344 (1963). — *Styloncerus eriocephalus* (Hook. f. ex A. Gray) Kuntze, Rev. Generum Pl. 367 (1891). TYPE: "Georgetown, Van Diemen's Land, Gunn." LECTOTYPE (here designated): *Gunn 1973*, George Town, 21.xi.1842 (K). ISOLECTOTYPES: HO, NSW, NSW p.p. (lacks collector's no. but cites Georgetown and the dates 21.xi.42 & 10.i.43, i.e. a mixed collection). POSSIBLE ISOLECTOTYPES: GH (several collections ex herb. Hook. f. but each lacks collection date, collector's no. and gives the location only as Tasmania or "VDL").

Annual herb. Major axes erect to prostrate (0.5)4-10(16) cm long, glabrous or variably hairy; stem often simple in the smaller, erect plants, sometimes \pm lacking (less than c. 1 cm high) in the prostrate ones, but usually forming major branches at basal and/or upper nodes. *Leaves* alternate or opposite, usually \pm narrowly elliptic or \pm linear, sometimes semi-succulent to succulent and \pm terete, 0.5-1(1.2) cm long, c. 0.1-0.2 cm wide, mucronate, variably hairy. *Compound heads* broadly ovoid to depressed ovoid, 0.4-0.8(1) cm long, 0.4-0.7(1) cm diam.; bracts subtending compound heads forming a conspicuous involucre about the length of the head, of c. 15 bracts, the outer ones leaf-like, \pm elliptic, or ovate to lanceolate, 0.5-1 cm long, 0.1-0.2 cm wide, variably mucronate, hairy, a few inner ones with hyaline apices and grading into capitulum-subtending bracts; *general receptacle* an expanded, convex axis. *Capitula* c. 5-100 per compound head; capitulum-subtending bracts 1(2), if more than one then the extra one abaxial to and overlapping the inner, all bracts \pm obovate or \pm oblong, 1.7-2.4(2.6) mm long, 0.7-1.5 mm wide, \pm white, the midrib glabrous or variably hairy

toward the apex. *Capitular bracts* with the two concave ones 1.6-2.3 mm long, \pm white, the midrib variably hairy toward the apex; flat bracts 2, obovate, \pm gradually tapering toward the base, (1.5)1.6-2.3 mm long, 0.6-1 mm wide, \pm white, the midrib glabrous or sparsely hairy toward the apex and usually with an entire wing-like extension from the adaxial surface. *Florets* 2; corolla 3(4, 5)-lobed, the tube tapering \pm gradually to a sometimes variably swollen base, 0.9-1.4 mm long, c. 0.4-0.5 mm diam.; anthers 3(4, 5), each with c. 16-44 pollen grains. *Achenes* \pm obovoid, 0.5-0.8 mm long, c. 0.3 mm diam., variably papillose and often with a fringe of glandular hairs at the apex. Pappus absent. Fig. 3e.

DISTRIBUTION (Fig. 2):

Coastal and inland regions of south western Australia, South Australia, Victoria and Tasmania. Very common.

ECOLOGY:

Favours saline habitats and sandy soils. Commonly associated with species of *Halosarcia*, *Sarcocornia* and *Frankenia*.

NOTES:

1. The lectotype sheet of *S. eriocephalus* contains at least two collections. On the lower $\frac{1}{3}$ of the sheet there are drawings, a label and a blue envelope containing specimens which are regarded as the lectotype material. Above this there are some further specimens attached to the sheet. These may possibly belong to Mueller's Brighton collection which is in a further envelope at the top of the sheet although they do match material in the type envelope.

2. *A. preissianus* exhibits a great deal of variation. Commonly collections contain specimens with erect or ascending major axes and variably hairy, non-succulent leaves. However other collections, e.g. *Orchard 1439*, *Royce 9731* and *Short 1013*, are of more or less glabrous specimens with short axes and succulent leaves. Further variation may also be found in the wing-like extension on the adaxial surface of the inner capitular bracts. Usually a single membranous wing extends from the axis but in some cases, e.g. *Royce 9731* and *Tepper s.n.* MEL 84892, two wings are present. In a further collection, *Short 932*, an inner wing is absent. Specimens also exhibit variation in the placement of leaves (opposite or alternate) and the number of papillae at the apex of the mature achenes. Much of the variation exhibited by *A. preissianus* may well be environmentally induced; certainly the habit of the plant is largely dependent on the degree of shading. Some variation may also be a reflection of the ability of inbreeders (Short, 1981a, b) to produce highly adapted biotypes.

3. Bentham (1867) and Curtis (1963), although commenting on the variation exhibited by the taxa, recognised both *A. preissianus* and *A. eriocephalus*. Due to the variation exhibited the latter species is regarded as a synonym of *A. preissianus*. The recognition of an infraspecific taxon is not warranted.

4. A number of authors, e.g. Bentham (l.c.), Curtis (l.c.) and Grieve and Blackall (1975), have described *A. preissianus* as having a small pappus. However the pappus appears to be best interpreted as a cluster of papillae at the apex of the achene. The same papillae are found over much of the fruit.

5. *A. preissianus* is very closely related to *A. pygmaeus*, *A. drummondii* and the variant of *A. drummondii*. Indeed all taxa may, under certain conditions display a similar habit to *A. preissianus* and the taxa can then only be discerned on microscopic characters. *A. preissianus* is best distinguished from all related taxa by its 3- or rarely 4-lobed florets which reflect the inbreeding nature of the species (Short, 1981a, b). *A. drummondii*, the variant of *A. drummondii* and *A. pygmaeus* all have 5-lobed florets.

SELECTED SPECIMENS EXAMINED (14/158):

Western Australia — *Drummond 122*, W.A., s. dat. (MEL, NSW); *Eichler 20305*, c. 30 km NNE of the coast at Stokes Inlet, 18.x.1968 (AD, PERTH); *Orchard 1439*, c. 38 km N. of the coast at Stokes Inlet, 10.x.1968 (AD, PERTH); *Royce 9731*, E. of boundary of Watheroo National Park, 7.x.1971 (PERTH); *Short 932*, c. 47 km E. of Yellowdine, 13.xi.1979 (AD); *Short 1013*, c. 14 km from Jurien along main road to

Badgingarra, 19.xi.1979 (AD); *Short 1052*, saline flat running into Leschenault Inlet, c. 3 km from Bunbury, 22.xi.1979 (AD).

South Australia — *Martinsen 60*, Mambray Creek, 12.ix.1974 (AD); *Short 716*, 8.6 km S. of Corny Point Lighthouse, 9.ix.1977 (AD); *Short 800*, c. 10 km south of Streaky Bay, 26.ix.1978 (AD); *Tepper s.n.*, Kangaroo Island, 1886 (MEL 84892).

Tasmania — *Rodway s.n.*, River Derwent, 3.xii.1899 (NSW 138738); *Whinray 221*, Cape Barren Island, 3.xi.1973 (AD).

Victoria — *Morrison s.n.*, Port Melbourne, 7.xii.1892 (BRI 078641, MEL 225623, PERTH).

15. ***Angianthus cunninghamii*** (DC.) Benth., Fl. Austr. 3:565 (1867); Grieve & Blackall, W. Aust. Wildfls 815, pl. 13 (1975). — *Skirrhophorus cunninghamii* DC., Prod. 6:150 (1838); DC. in Deless., Icon. Select. Pl. 4:22, t.51 (1840); Steetz in Lehm. Pl. Preiss. 1:438 (1845); A. Gray, Hook. J. Bot. Kew Gard. Misc. 3:148 (1851). — *Styloncerus cunninghamii* (DC.) Kuntze, Rev. Generum Pl. 367 (1891). TYPE: "In arenosis insulae anglis dictae Dirk Hartog's ad oram occid. Australiae januario flor. legit cl. A. Cunningham." HOLOTYPE: *Cunningham s.n.*, Sandy downs, Dirk Hartog's Island, West Coast Australia, -i.1822 (G in herb. DC., ex microfiche IDC). ISOTYPES: K (excl. illus., ex herb. Allan Cunningham), MEL 541221 (see note 1 below).

Eriocladium pyramidatum Lindl., Edwards' Bot. Reg.: Swan River Append. 24 (1839). HOLOTYPE: *Toward 15*, Swan River, s. dat. (CGE, herb. J. Lindley), (see note 2 below).

Perennial shrub, 20-50 cm high. Major axes \pm erect and densely hairy. *Leaves* alternate, often recurved, oblanceolate or ovate, 0.5-2(2.6) cm long, 0.2-0.3 cm wide, densely hairy. *Compound heads* broadly to broadly depressed ovoid, 0.5-0.9 cm long, 0.45-0.8 cm diam.; bracts subtending compound heads forming a conspicuous involucre extending c. $\frac{1}{3}$ the length of the head, of c. 20 bracts, the outer ones leaf-like, \pm ovoid, 0.2-0.3 cm long, 0.1-0.15 cm wide, densely hairy, the inner ones with hyaline appendages and grading into capitulum-subtending bracts; *general receptacle* ovoid to very broadly ovoid, c. 2-3 mm long, c. 2 mm diam. *Capitula* c. 25-50 per compound head; capitulum-subtending bract 1, obovate to \pm oblanceolate, sometimes \pm narrowly oblong to oblong, (2.6)3.1-3.8(4.1) mm long, (1)1.2-1.5(1.65) mm wide, with the upper part of the lamina yellow and with a prominent constriction, the midrib usually sparsely hairy toward the apex and some glandular hairs always present. *Capitular bracts* with the two concave ones (2.3)2.9-3.5(3.7) mm long, with the upper part of the lamina yellow and with a prominent constriction, the midrib usually with a few glandular hairs; flat bracts 2, oblanceolate or \pm narrowly oblong, gradually tapering to the base, (2.8)3-3.6(3.75) mm long, (0.6)0.7-1(1.2) mm wide, the lamina with a prominent constriction in the upper part, the midrib usually with a few glandular hairs. *Florets* 2 (3); corolla 5-lobed, the tube tapering \pm gradually to the base which is distinctly swollen in mature florets, 2-2.5 mm long, c. 0.5 mm diam., glandular hairs often present. *Achenes* \pm obconical, 0.9-1.4 mm long, 0.5-0.6 mm diam., papillose. Pappus absent.

DISTRIBUTION (Fig. 2):

Western coastline of Australia between latitudes 20°S and 32°S. Common.

ECOLOGY:

Commonly grows in the unconsolidated calcareous sands of coastal foredunes but also grows in saline flats. Collectors' notes include "Low salt flats with mangrove and *Salicornia*" and "Growing on unconsolidated foredunes".

NOTES:

1. The sheets referred to as isotypes of *S. cunninghamii* have slightly different wording. On the K sheet there is a reference to "sandy plains" rather than "sandy downs" as on the holotype. The MEL sheet has the words "Frequent on desert plains of sand". Despite these discrepancies both probably can be regarded as isotypes although the number "288" which also appears on the MEL label suggests that this may not be correct.

2. Lindley (1839) based his descriptions of new species from the Swan River Colony on specimens he obtained from Drummond, Mangles, Toward and Ward. No particular

collection was specified for *Eriocladium pyramidatum* but *Toward 15* is the only one of the species in Lindley's herbarium and is thus regarded as the holotype. Drummond also collected this species, i.e. *Drummond 125* (MEL, GH), *Drummond ? 159* or *245* (GH ex herb. Klatt) and *Drummond s.n.* (MEL 541216), but there is no reason to believe that Lindley saw any of these collections.

3. *A. cunninghamii* is the only perennial species of *Angianthus* and the only one to occasionally produce 3 florets per capitulum. Both characters suggest that the species is a somewhat primitive member of the genus.

SELECTED SPECIMENS EXAMINED (6/36):

Western Australia — *Allender s.n.*, Shark Bay, 18.ii.1969 (UWA 2493); *Demarz 2890*, Vlaming Head, 4.xi.1970 (PERTH); *Kenneally 1014*, Dorre Island, 15.xii.1973 (PERTH); *Morrison s.n.*, Claremont, 28.iii.1900 (BRI 086974); *Serventy s.n.*, Bernier Island, 5.viii.1947 (PERTH); *Serventy s.n.*, Stewart Island, s. dat. (PERTH).

2. **Pleuropappus** F. Muell., *Trans & Proc. Vict. Inst. Advancem. Sci.* 37 (1855). TYPE: *P. phyllocalymmeus* F. Muell.

[*Angianthus* auct. non Wendl.: see synonymy of *P. phyllocalymmeus*.]

[*Styloncerus* auct. non Spreng., *nom. illeg.*: see synonymy of *P. phyllocalymmeus*.]

Annual herb. Major axes erect or ascending, sometimes decumbent, hairy; stem simple or forming major branches at basal and/or upper nodes. *Leaves* mainly alternate but opposite at the base of the stem, sessile, entire, linear, mucronate, hairy. *Compound heads* narrowly ellipsoid or lanceoloid to ovoid; bracts subtending compound heads forming a conspicuous involucre c. $\frac{1}{4}$ the length of the head, the outer ones leaf-like, the inner ones with hyaline apices; *general receptacle* cylindrical to narrowly oblong, consisting of a single major axis lacking minor receptacular axes, the individual capitula distributed \pm evenly along its entire length. *Capitula* 40-100 per compound head, each capitulum with 4 (5, 6) abaxial, hyaline subtending bracts that overlap the inner capitular bracts. *Capitulum-subtending bracts* arranged so that an outer bract covers 2 middle bracts which in turn cover a single inner bract, sometimes 1-2 additional bracts covering the inner 4, all bracts flat, ovate or elliptic; midrib usually conspicuous, opaque, c. $\frac{1}{3}$ - $\frac{1}{2}$ the length of the bract, variably hairy. *Capitular bracts* 4, hyaline, with an opaque midrib, arranged so that 2 outer concave bracts surround 2 inner flat bracts. Concave bracts with the midrib conspicuous, c. $\frac{1}{2}$ the length of the bract, variably hairy. Inner flat bracts obovate, abruptly attenuated in the lower $\frac{1}{3}$ - $\frac{1}{2}$; the midrib conspicuous, c. $\frac{1}{2}$ the length of the bract, glabrous or hairy. *Florets* 2 per capitulum; corolla 5-lobed; style branches truncate; stamens 5, with tailed anthers. *Achene* obliquely attached to the floret, ellipsoid, papillose. Pappus an oblique jagged scale. Fig. 1h.

DISTRIBUTION (Fig. 8):

A monotypic genus confined to southern Eyre Peninsula and southern Yorke Peninsula. It is poorly collected and Jessop (1977) recorded *P. phyllocalymmeus* as an endangered species. However field observations suggest that the species, although geographically restricted, is locally common.

AFFINITIES/GENERIC CHARACTERISTICS:

Pleuropappus phyllocalymmeus superficially resembles many species of *Angianthus* with similar shaped compound heads. Furthermore, there are 4 capitular bracts which are arranged in the same manner as those in *Angianthus*. However *Pleuropappus* is readily distinguished by the presence and arrangement of 4 or more capitulum-subtending bracts, by the obliquely attached achenes and by the absence of minor receptacular appendages on the general receptacle of the compound head.

EVOLUTION/REPRODUCTIVE BIOLOGY:

Although accurate determinations of pollen-ovule ratios (P/Os) have not been made it is apparent that a P/O value of several thousand will be found in this species. Such a value suggests that the species commonly cross-pollinates (Short, 1981a, b).

Ants have been observed on flowering compound heads and are possibly important pollen vectors.

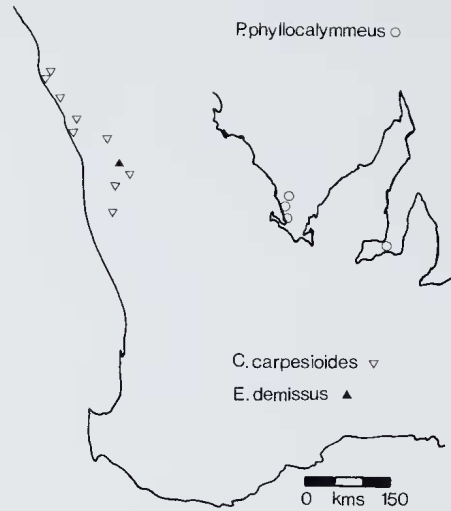


Fig. 8. Distribution of *Pleuropappus phyllocalymmeus* (South Australia), *Cephalosorus carpesioides* and *Epitriche demissus* (Western Australia).

Pleuropappus phyllocalymmeus F. Muell., Trans & Proc. Vict. Inst. Advancem. Sci. 37 (1855). — *Angianthus phyllocalymmeus* (F. Muell.) Druce, Bot. Soc. Exch. Club Brit. Isles 4:604 (1917); Domin, Mem. Soc. Sc. Boheme 2:121 (1923) (*phyllocalymmeus*); J. M. Black, Fl. S. Aust. 1st ed. 645 (1929), 2nd ed. 924 (1957); Hj. Eichl., Suppl. to J. M. Black's Fl. S. Aust. 326 (1965). — *Angianthus pleuropappus* Benth., Fl. Austr. 3:563 (1867) *nom. illeg.* — *Styloncerus phyllocalymmeus* (F. Muell.) Kuntze, Rev. Generum Pl. 367 (1891) (*phyllocalymmeus*). TYPE: "On sterile plains of the Port Lincoln district. — *C. Wilhelmi*." LECTOTYPE (here designated): *Wilhelmi* s.n., Port Lincoln, s. dat. (K). PROBABLE ISOLECTOTYPES: MEL 541617-541619, MEL 84469 (see note 1).

Annual herb, 4-8(15) cm high. *Leaves* 0.7-1(1.3) cm long, c. 0.1 cm wide. *Compound heads* 0.8-1.5(2) cm long, c. 0.3-0.5 cm diam.; *bracts subtending compound heads* c. 10, the outer ones leaf-like, narrowly elliptic or lanceolate, 0.5-1 cm long, 0.1-0.15 cm wide, ± mucronate, hairy, the inner ones with hyaline apices and grading into capitulum-subtending bracts. *Capitula* 40-100 per compound head; capitulum-subtending bracts ovate or elliptic, 1.8-2.2 mm long, 1-1.2 mm wide. *Capitular bracts* with the two outer concave ones c. 2 mm long; flat bracts abruptly attenuated in lower $\frac{1}{3}$ - $\frac{1}{2}$ and the edges sometimes incurved so as to slightly cover the florets, 2-2.3 mm long, 0.9-1.3 mm wide. *Florets* 2; corolla 5-lobed, the tube usually tapering gradually to the base but sometimes an abrupt taper occurring in the lower $\frac{1}{3}$, 1.3-1.7 mm long, c. 0.5 mm diam. *Achene* obliquely attached to the floret, ellipsoid, 0.7-0.8 mm long, 0.3-0.4 mm diam., papillose. Pappus an oblique jagged scale about the length of the corolla tube.

DISTRIBUTION: See generic treatment.

ECOLOGY:

Grows exclusively in sandy or clay loam on the margins of saline depressions. Associated with *Halosarcia*.

NOTE:

1. Following his description of *P. phyllocalymmeus* Mueller (1855, p.37) cited a single collection, "On sterile plains of the Port Lincoln district. — *C. Wilhelmi*." None of the Wilhelmi collections from MEL & K are designated in this manner but a K collection is recorded as coming from "Port Lincoln".

Because of confusion with the labels of the MEL collections (see annotations on the sheets), the K material, which contains 2 individual specimens in good condition, has been designated as the lectotype. The same sheet also contains *Wilhelmi* material designated as coming from "between the Fountain & Long Lake" but this material has been clearly separated from the lectotype. A further label "Victoria, South Australia, July 26/55, Mueller" occurs on the sheet but both the location and the name, "*Chrysocoryne tenella* Muell." (= *C. drummondii* A. Gray) suggests that it has been erroneously placed with this material.

SELECTED SPECIMENS EXAMINED (6/13):

South Australia — *Alcock 2801*, Lower Eyre Peninsula, Hundred of Lake Wangary, 14.x.1969 (AD, CANB); *Cleland s.n.*, Coffin Bay Reserve, 10.xi.1960 (AD 96404182); *Lang 1082*, c. 33.7 km WNW. of Cummins on road to Mt. Hope, 20.x.1977 (AD); *Short 806*, c. 34 km NW. of Cummins on road to Mt. Hope, 26.ix.1978 (AD); *Short 823*, c. 13.5 km W. of Yorketown along main Warooka road, 28.x.1978 (AD); *Wilhelmi s.n.*, Lake Greenly, 1855 (NSW 138697).

3. *Epitriche* Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2):74 (Oct. 1851). TYPE: *E. cuspidata* Turcz. (= *E. demissus* (A. Gray) Short)

Skirrhophorus DC. in Lindl. ex DC. sect. *Psuedopappus* A. Gray, Hook. J. Bot. Kew Gard. Misc. 3:149 (May 1851). TYPE: *S. demissus* A. Gray (= *E. demissus* (A. Gray) Short)

[*Angianthus* auct. non Wendl.: see synonymy of *E. demissus*.]

[*Styloncerus* auct. non Spreng.: see synonymy of *E. demissus*.]

Annual herb. Major axes erect, glabrous or sparsely hairy; stem simple or forming major branches at upper nodes. *Leaves* opposite, sessile, the base ± stem clasping and with hyaline margins, the entire leaf glabrous or sparsely hairy. *Compound heads* broadly depressed ovoid; bracts subtending compound heads forming a conspicuous involucre c. equal to or longer than the head; *general receptacle* an entire, convex, ± smooth axis, the capitula distributed evenly over its surface. *Capitula* c. 10-20 per compound head. *Capitular bracts* 2 or 3, hyaline, ± flat to concave, with a conspicuous, sparsely hairy midrib extending c. ½ the length of the bract, the bracts overlapping one another. *Florets* 1 per capitulum; corolla 5-lobed; style branches truncate; stamens 5, with tailed anthers. *Achenes* ? ± obconical and papillose, the apex beset with long hairs. Pappus absent.

DISTRIBUTION (Fig. 8):

A monotypic genus endemic to the south-west of Western Australia. Known only from the type collection and *Wilson 8314*.

AFFINITIES/GENERIC CHARACTERISTICS:

The lack of collections has made it difficult to ascertain certain characteristics of this genus and the full range of variation exhibited by the species is unknown. For example characteristics of the achene are difficult to ascertain and the number of capitula per compound head has been estimated for only 2 or 3 individuals.

At least superficially the genus appears to be allied to *Angianthus* s.str. However the apparent lack of minor receptacular appendages, the absence of capitulum-subtending bracts and the distinctive ring of hairs at the apex of the achene all suggest that the genus should be reinstated. There is some doubt whether or not the hairs at the apex of the achene should be regarded as a pappus (see morphology section).

Epitriche demissus (A. Gray) Short, comb. nov.

Skirrhophorus demissus A. Gray, Hook. J. Bot. Kew Gard. Misc. 3:149 (May 1851), basionym. — *Angianthus demissus* (A. Gray) Benth., Fl. Austr. 3:567 (1867); Greive & Blackall, W. Aust. Wildfls 815 (1975). — *Styloncerus demissus* (A. Gray) Kuntze, Rev. Generum Pl. 367 (1891). TYPE: "South-western Australia, Drummond, 1850." LECTOTYPE (here designated); *Drummond 58*, S.W. Australia, 1850 (K) (label in Gray's hand, plus drawings). ISOLECTOTYPES: GH (ex herb. Klatt), K (ex herb. Benth.), KW, MEL 541627, MEL 84428, NSW, PERTH (2 sheets).

Epitriche cuspidata Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2):75 (Oct. 1851). TYPE: "Nova Hollandia. Drum.V.n.58." POSSIBLE HOLOTYPE: KW (see p.152). ISOTYPES: GH (ex herb. Klatt), K (2 sheets), MEL 541627, MEL 84428, NSW, PERTH (2 sheets).

Annual herb, 2-5 cm high. *Leaves* ± lanceolate, 0.5-1 cm long, c. 0.3 cm wide. *Compound heads* 0.3-0.5 mm long, 0.4-0.6 cm diam.; bracts subtending compound heads c. 10-15, the outer ones leaf-like, glabrous or sparsely hairy, the inner ones densely hairy. *Capitula* c. 10-20 per compound head. *Capitular bracts* oblanceolate, 2-2.8 mm long, c. 0.5-0.7 mm wide. *Florets* 1; corolla 5-lobed, the tube bulb-like at the base, 1.7-1.9 mm long, c. 0.3 mm diam. *Achenes* ? obconical and papillose, the apex beset with long hairs which are c. ½-⅔ the length of the floret.

DISTRIBUTION: See generic treatment.

ECOLOGY:

Recorded growing in clay soil (*Wilson 8314*). No other information available.

SPECIMENS EXAMINED:

Western Australia — *Wilson 8314*, c. 5 km S. of Three Springs, [c. 29°32'S, 115°46'E], 25.vii.1969 (PERTH).

4. *Cephalosorus* A. Gray, Hook. J. Bot. Kew Gard. Misc. 3:98 (April 1851), 152 (May 1851). LECTOTYPE (here designated): *C. phyllocephalus* A. Gray (= *C. carpesioides* (Turcz.) Short).

Piptostemma Turcz., Bull. Soc. Naturalistes Moscou 24 (1):191 (March 1851) *nom. illeg.*, [later homonym of *Piptostemma* Spach., Hist. Veg. Phan. 10:34 (1841).] TYPE: *P. carpesioides* Turcz. (= *C. carpesioides* (Turcz.) Short)

[*Angianthus* auct. non Wendl.: see synonymy of *C. carpesioides*.]

[*Styloncerus* auct. non Spreng., *nom. illeg.*: see synonymy of *C. carpesioides*.]

Annual herb. Major axes erect, variably hairy; stem distinct, hollow, simple or with opposite branching from upper nodes. *Leaves* opposite or alternate, petiolate or sessile, entire, lamina ± elliptic or oblanceolate to obovate, variably hairy. *Compound heads* broadly depressed to depressed ovoid; bracts subtending compound heads forming a conspicuous involucre ½ to c. the length of the head; the outer ones leaf-like, the inner ones hyaline toward the base, all bracts glabrous to variably hairy; *general receptacle* an entire, broadly depressed ovoid axis, the capitula sessile and distributed evenly over the surface. *Capitula* c. 30-60 per compound head. *Capitular bracts* 3 or 4(5), hyaline, ± flat, or concave, the laminae rarely with a distinct constriction in the upper part, the bracts ± overlapping each other; the midrib ± conspicuous and extending c. ⅔ the length of the bracts, variably hairy at or near the apex. *Florets* 1 per capitulum; corolla 5-lobed; style branches truncate; stamens 5, with tailed anthers. *Achenes* ± obovoid, with a cellular, diaphanous pellicle. Pappus a jagged cup.

DISTRIBUTION (Fig. 8):

A monotypic genus confined to the south-west of Western Australia between latitudes 28°S and c.31°S and west of longitude 116°E.

NOMENCLATURE PROBLEMS:

1. Gray (1851) described two species, namely *C. phyllocephalus* and *C. gymnocephalus*, in his new genus *Cephalosorus*. The generic description supplied covers the major characteristics of both species and there is nothing to suggest that either one should be given preference when selecting a lectotype. *C. gymnocephalus* clearly differs from *C. phyllocephalus* and is allied to species in the genus *Gnephosis* s.l., to which Bentham referred the species in 1867. Thus it is convenient to designate *C. phyllocephalus* as the lectotype species of *Cephalosorus*. *C. gymnocephalus* is excluded from the genus.

AFFINITIES/GENERIC CHARACTERISTICS:

Cephalosorus has no obvious affinities with other segregate genera of *Angianthus*.

It is readily distinguished by the opposite, petiolate leaves which occur in at least the lower half of the plant. Achene morphology and the morphology, number and arrangement of capitular bracts are unique.

***Cephalosorus carpesioides* (Turcz.) Short, comb. nov.**

Piptostemma carpesioides Turcz., Bull. Soc. Naturalistes Moscou 24(1):192 (March 1851), basionym. TYPE: "Nova Hollandia. Drum. coll. IV. n. 200." POSSIBLE HOLOTYPE: KW (see p.152). ISOTYPES: GH (ex herb. Klatt), K, MEL 541595, MEL 541596.

Cephalosorus phyllocephalus A. Gray, Hook. J. Bot. Kew Gard. Misc. 3:152 (May 1851). — *Angianthus phyllocephalus* (A. Gray) Benth., Fl. Austr. 3:565 (1865); Grieve & Blackall, W. Aust. Wildfls 812 (1975). — *Styloncerus phyllocephalus* (A. Gray) Kuntze, Rev. Generum Pl. 367 (1891). TYPE: "Swan River, Drummond, 1846, 1848." LECTOTYPE (here designated): *Drummond 200*, S.W. Australia, 1848 (K). ISOLECTOTYPES: GH (ex herb. Klatt), MEL 541595, MEL 541596 (see note 2 below).

Cephalosorus brevipapposus F. Muell., Fragm. 3:159 (1863). — *Skirrhophorus phyllocephalus* F. Muell., l.c., pro syn., (? as to collections of F. Muell.). TYPE: "Ad flumen Murchison; *Oldfield*. Ad sinum Champion Bay; *Walcott*." LECTOTYPE (here designated): *Oldfield s.n.*, Murchison R., W.A., s. dat. (MEL 541597). PROBABLE ISOLECTOTYPE: PERTH (ex MEL, referred to as *Angianthus phyllocephalus* on label). SYNTYPE: None seen, the only specimens of this species seen from Champion Bay were collected by Oldfield. No Walcott specimens of the species have been seen.

Annual herb, 15-25(29) cm high. Leaves opposite and distinctly petiolate in at least the lower half of the plant, the uppermost ones frequently \pm sessile and alternate; petiole \pm absent to c. 2 cm long, variably hairy; laminae \pm elliptic or oblanceolate to obovate, 1-2.5(3.4) cm long, 0.4-1(1.3) mm wide, sometimes with a very small mucro at the apex, almost glabrous (particularly the lower surface) to densely hairy. *Compound heads* 0.5-1.4 cm high, 0.7-1.5 cm diam.; bracts subtending compound head c. 10-20, the outer ones \pm ovate or \pm obovate, 0.5-1(1.4) cm long, 0.3-0.8 cm wide. *Capitula* c. 30-60 per compound head. *Capitular bracts* 3.3-4.2 mm long, (0.7)1-1.8 mm wide. *Florets* 1; corolla tube with a conspicuously swollen base, the tube 1.5-2 mm long, 0.5-0.8 mm diam. *Achenes* \pm obovoid, 1.9-2.5 mm long, 0.9-1 mm diam. Pappus a jagged cup c. 0.7 mm long.

DISTRIBUTION: See generic treatment.

ECOLOGY:

Little information is available. Collectors' notes include "Common on rocky ironstone knoll" and "Ironstone gravel".

NOTE:

1. The lectotype sheet of *C. phyllocephalus* contains three good, entire specimens, plus drawings of the species. According to Gray (1851) the species was to be illustrated in *Incones Plantarum* but this did not eventuate. A label attached to the sheet has the words "*Cephalosorus phyllocephalus* n. gen." in Gray's hand.

SPECIMENS EXAMINED:

Western Australia — *Alpin 56*, 1-2 miles North of Carnamah, 4.ix.1958 (PERTH); *Burns 24*, Port Gregory road, 20.ix.1970 (PERTH); *Gardner 12831*, Arrino, 27.ix.1960 (PERTH); *?Mueller s.n.*, Port Gregory, -.x.1877 (MEL 84472); *?Mueller s.n.*, upper Irwin River, s. dat. (MEL 84473); *Oldfield s.n.*, Champion Bay, s. dat. (MEL 84471). *Paust 1267*, 1 mile N. of Northampton-Port Gregory road on Yerina Springs road, 6.x.1972 (PERTH); *Wilson 3829*, 15 km N. of Badgingarra, 2.ix.1965 (AD, GH, PERTH).

(To be continued in *Muelleria* 5(3):185)