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The *Lawrencella* complex (Asteraceae: Gnaphalieae: Angianthinae) of Australia

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Abstract

Wilson, Paul G. The *Lawrencella* complex (Asteraceae:Gnaphalieae:Angianthinae) of Australia. Nuytsia 8(3): 361-377 (1992). The *Lawrencella* complex includes the monotypic genera *Bellida* and *Schoenia*, several species included by Bentham in *Helichrysum* sect. *Lawrencella*, and one species previously placed in both *Helichrysum and Podolepis*. It is considered to be a natural group clearly distinct from other members of the Angianthinae. Three genera are here recognised: *Bellida*, *Lawrencella*, and *Schoenia*. One subspecies is described as new; four new species combinations are made.

Introduction

For many years botanists have recognised that the Australian species placed in *Helichrysum* are not congeneric with the South African and European taxa of that genus (e.g. Merxmüller *et al.* 1977; Hilliard & Burtt, 1981), they have further recognised that the genus as circumscribed in Australia is an artificial assemblage of species and that the closest affinities of these species is frequently to species in other genera rather than to those within the genus (see Haegi 1986). Recently Anderberg (1991) has reviewed the tribe Gnaphalieae. He has removed the Australian species that had previously been included in *Helichrysum* and placed them in *Chrysocephalum* Walp., *Bracteantha* A. Anderb. & L. Haegi, *Ozothamnus* R.Br., *Schoenia* Steetz, and the '*Lawrencella*' complex which, he noted, required further study. The genus *Bellida* he treated as a distinct monotypic taxon possibly related to the *Waitzia* group.

A collaborative comprehensive classification of the *Helichrysum-Helipterum* complex in Australia is in preparation. Prior to this treatment a number of segregate genera are being described or recognised in preparation for a treatment of the family Asteraceae in volume 38 of the Flora of Australia. In view of this forthcoming publication, and in order to save time and avoid repetition, for some of the taxa investigated only brief descriptive details are provided.

For a long time some or all of the species that are here included in the *Lawrencella* complex have been considered to be related. The complex was recognised by Bentham (1867) as a section of *Helichrysum*, with the exclusion of *Schoenia* since its single species he considered to be generically

distinct due to its flattened achenes; he noted, however, that this species was otherwise similar to species in *Helichrysum* sect. *Lawrencella*. Mueller (1889) recognised the relationship between the one species of *Schoenia* and the species included by Bentham in sect. *Lawrencella* for he listed them together as species of *Helichrysum*, as did Black (1929, 1957). Earlier Black (1915) had suggested that if *Schoenia* is to be recognised as a genus distinct from *Helichrysum* then *H. ayersii* F. Muell. must be included in it. Haegi (1986) placed *Schoenia cassiniana* (as *Helichrysum cassinianum*), *Helichrysum ayersii*, *H. davenportii* F. Muell., and *H. semifertile* F. Muell. in sect. *Lawrencella* but noted that this section should have generic rank since the included species were very distinct from other members of *Helichrysum*. In a recent paper Anderberg (1991) indicated the close affinity between *Lawrencella* and *Schoenia* and recognised that further work was required before the status of related taxa could be clarified. In the '*Lawrencella*' complex he placed *Helichrysum ayersii*, *H. davenportii*, *H. lindleyi* Eichler (= *Lawrencella rosea* Lindley), *H. filifolium* (with its close relatives here referred to as the '*Xanthochrysum*' group), *H. spiceri* F. Muell. and *H. obtusifolium* F. Muell. & Sonder. I concur with his suggestions except that I exclude the last two species which I consider to generically distinct.

Tribal classification

The species included in the *Lawrencella* complex have traditionally been placed in the tribe Inuleae. Work on the tribal classification by Anderberg (1989) has indicated that this tribe should be divided into three, the Inuleae, the Gnaphalieae, and the Plucheae. The Gnaphalieae, as defined by Anderberg, comprises the taxa that were included in the two subtribes Gnaphaliinae and Athrixiinae by Merxmüller *et al.* (1977). In a recent comprehensive treatment of the tribe Gnaphalieae Anderberg (1991) has recognised a number of subtribes including the subtribe Angianthinae Benth. in which *Lawrencella* and its relatives are placed. Anderberg expressed uncertainty as to the systematic position of *Bellida* but, as indicated above, I consider that it should be included in the Angianthinae and that it is closely related to *Lawrencella*.

Taxonomy

The Lawrencella complex

Many of the characters that have been examined and used to delimit the genera have been discussed elsewhere (Wilson 1989). There are many morphological and anatomical characters associated with the plants that are of value in determining relationships, however, not all of these characters can be so described that they are readily comprehended. Thus the texture of the corolla, the shape of its constituent cells and the thickening of the cell walls are characters that are of value in suggesting affinity, though sometimes of limited use in formal descriptions because of their cryptic nature. I have expanded below on some of the characters that I consider to be important when assessing affinities.

A number of characters that are found in the achene are useful in serving either to distinguish the *Lawrencella* complex from other taxa that have been included in *Helichrysum*, or to distinguish the putative genera or infrageneric taxa within the group. Those characters that are used in this paper are as follows:

Testa: vascular strand (Figures 2-7). The testa always has a solitary vascular strand that may terminate before the apex of the seed proper, or may terminate at the apex of the seed (particularly in those cases where the apex is in the form of a short sterile apiculum), or may continue around the seed. This character appears to be constant in many sections or genera of the Australian Angianthinae as recently recognised. Thus in the *Helipterum albicans* group (*Leucochrysum* Paul G. Wilson, 1992b) the vascular strand consistently terminates in the short sterile apex of the seed. In *Bracteantha* it passes over the apex to the other side; while in *Waitzia* Wendl., *Chrysocephalum*, *Leptorhynchus* Less., and in the *Helichrysum elatum* group it ceases before reaching the apex. With regard to those taxa here referred to the *Lawrencella* complex it terminates in a sterile apex in *Bellida*, *Helichrysum davenportii*, and *Lawrencella rosea*, while it passes over the apex to the other side in *H. ayersii*, *Schoenia cassiniana*, and in species of the '*Xanthochrysum*' group.

Testa: epidermis. Examination of the cells of the outer layer of the testa in numerous species previously included in *Helipterum* and *Helichrysum* has shown that they in general have the same shape in species that are now recognised as being closely related but may vary in shape between species-groups and between genera. Thus in *Chrysocephalum s.str.* the cells are linear, in *Bracteantha* they are almost square with straight margins, while in *Waitzia* and *Leucochrysum* they are short-oblong with corrugate margins. In the *Lawrencella* complex they are ± equilateral in all taxa except for *H. davenportii* and *Bellida* where they are short-oblong (Figures 2-7).

Corolla. The shape and texture of the tube and lobes, the indumentum, the shape and thickening of the cells of the inner epidermis, the papillosity of the inside of the lobes and throat, and the extent of the vasculature, are all characters that must be assessed for their generic significance. In the *Lawrencella* complex the corolla is regular with cylindrical tube and campanulate limb, the cells of the inner epidermis of the lobes are ± equilateral and of the throat ± straight, the vascular strands reach to the apex of the lobes, while the hairs on corolla tube are biseriate and gland-tipped. In *Bracteantha*, *Chrysocephalum*, *Ozothamnus*, and in the *Helichrysum obtusifolium* group the corolla is narrow-cylindrical and almost glabrous with vascular strands of the last three taxa not passing into the lobes.

Anthers (Figure 1). Of significance in the anther are the shape and length of the collar; the length, texture and branching of the tails; the shape and texture of the anther appendage, and the arrangement, shape, and thickening of its constituent cells. The shape of the anther appendage has frequently been noted but the constituent cells offer further characters that are of value when assessing affinities.

In the *Lawrencella* complex the appendage is acutely cordate or broad-ovate, the proximal cells ± equilateral with thick walls, the distal cells oblong with thinner walls, and the marginal cells small and equilateral, the collar is narrow-oblong and the anther tails very weak and filamentous and extending beyond collar. This situation is similar to that found in *Rhodanthe* Lindley *s.l.* and contrasts with the other genera that have been traditionally included in *Helichrysum*; in these other genera (e.g. *Bracteantha*, *Chrysocephalum*, and *Ozothamnus*) the proximal cells of the appendage are the same as the distal and the tails are firm with the cell walls somewhat thickened.

Style (Figure 1). Of significance are the length and thickness of the arms, the shape and degree of papillosity of the apex, and the thickness and extent of the vascular strand. In the *Lawrencella* complex the arms are long, the apex deltoid with a stout vascular strand extending to its tip. This contrasts with the other taxa of Australian '*Helichrysum*' in which the apex is rounded, truncate, or acuminate, and of the same width as, or only slightly wider than, the style arm.

Pappus (Figures 2-7). In the *Lawrencella* complex the bristles are linear, firm, prominently barbellate, without spreading basal cilia, they are persistent or shed entire. In *Bellida*, *H. lindleyi* and *H. davenportii* the pappus lengthens during anthesis. In other members of '*Helichrysum*' the bristles are filiform or, if broadened at base, eventually break just above the base to leave a persistent corona on the achene.

Achene apex (Figures 2-7). The apex of the achene forms a shallow rim around the base of the pappus in *Helichrysum cassinianum* and in *H. ayersii*, in the other species of the *Lawrencella* complex the achene apex narrows and passes smoothly into the pappus base.

Achenial hairs (Figures 2-7). Normal duplex hairs, when present, are thick-walled; two-celled papillose hairs are absent. The pericarp is velutinous with minute acicular unicellular papillae in *Bellida*, *H. lindleyi*, and *H. davenportii*, in at least some of the achenes. In *H. davenportii* acicular multicellular hairs are sometimes also present. The achenes of *H. cassinianum*, *H. ayersii*, and the '*Xanthochrysum*' group lack these papillae or hairs but bear scattered multicellular gland-tipped hairs in addition to normal duplex hairs.

Vasculature of the achene and seed (Figures 2-7). The position of the two vascular strands in the pericarp in relation to the solitary vascular strand in the testa and to the position of the cotyledons of the embryo was suggested by Short *et al.* (1989) to be of generic significance.

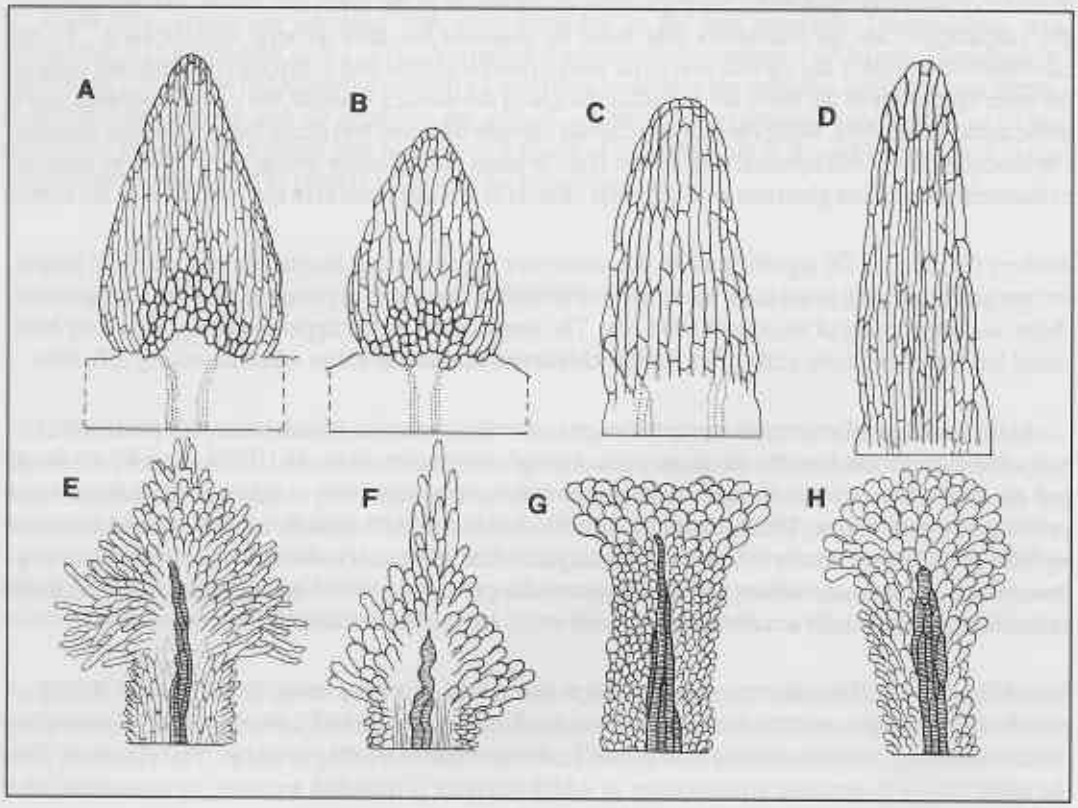

Figure 1. Anther apicula (A-D) and style apices (E-H) of *Lawrencella davenportii* (A & E), *Bellida graminea* (B & F), *Ozothamnus lepidophyllus* (C & G), and *Chrysocephalum semicalvum* (D & H).

The strands of the pericarp and testa are laterally placed (with regard to cotyledons) in *Bellida*, *Helichrysum lindleyi*, and *H. davenportii*, while in *H. cassinianum*, *H. ayersii*, and in the *'Xanthochrysum'* group they are medially placed.

Carpopodium. The carpopodium is small or insignificant in all species of the *Lawrencella* complex; however, in *Bellida*, *H. lindleyi*, and *H. davenportii* the achene has a prominent hollow base while in *H. cassinianum*, *H. ayersii*, and in the *'Xanthochrysum'* group the base is not excavated.

Receptacle. The receptacle is smooth and glabrous in all the taxa of the *Lawrencella* complex except for the *'Xanthochrysum'* group in which it is glandular papillose.

A summary of some of these characters for the taxa of the *Lawrencella* complex is listed in Table1.

	B	L	D	C	A	X
Pericarp v.s.						
lateral	+	+	+			
medial				+	+	+
Testa v.s.						
to apex	+	+	+			
circum.				+	+	+
Achene base						
minute				+	+	+
excav.	+	+				
Achene apex						
rimmed				+	+	
not rimmed	+	+	+			+
Pericarp						
thick	+	+	+			
thin				+	+	+
velutinous	+	+	+			
not vel.				+	+	+
Gland. hairs						
present				+	+	+
absent	+	+	+			
Pappus						
elongating	+	+	+			
not elong.				+	+	+
Receptacle						
papillose						+
smooth	+	+	+	+	+	

Table 1. Comparison of some characters of the achene and capitulum in *Bellida* (B), *Helichrysum lindleyi* (L), *H. davenportii* (D), *H. cassinianum* (C), *H. ayersii* (A), and the *'Xanthochrysum'* group (X).

Chemical data

Few Australian species of *Helichrysum* have been chemically investigated and the taxonomic significance of the results of those that have is not very informative. However, in a paper by Jakupovic *et al.* (1989) the results of an analysis of *Helichrysum davenportii*, *H. lindleyi*, and *Bellida graminea* were presented along with analyses of *H. ambiguum* Turcz. (= *Chrysocephalum*), *H. bilobum* Wakef. (= *Ozothamnus*), and *H. leucopsideum* DC. From this investigation some tentative conclusions were drawn.

In *Helichrysum davenportii* was found isokaurenic acid and a thiophene derivative numbered 37. In *H. lindleyi* the thiophenes numbered 37 and 38 and some triterpenes were found, while in *Bellida graminea* were found thiophene acetylenes and the desoxy derivative of isokaurenic acid numbered 37a and the thiophene numbered 38. These compounds were not found in the three other species of Australian '*Helichrysum*'.

The chemical analyses therefore suggests that the three '*Lawrencella*' species are more closely related to each other than they are to the remaining '*Helichrysum*' species This lends support to the opinion, based on morphological considerations, that the '*Lawrencella*' complex is a natural assemblage of taxa.

Mycorrhizal data

It has been demonstrated by Warcup (1990) that Australian species in the tribe Inuleae can be almost equally divided into those that form only vesicular-arbuscular mycorrhiza (VAM species) and those that form both ectomycorrhiza and vesicular-arbuscular mycorrhiza (Ecto species). The Australian taxa placed in '*Helichrysum*' can also be separated into Ecto and VAM species. The presence of both VAM and Ecto species in the same genus is unusual since normally genera have been found to contain species that are either all ectomycorrhizal or all non-ectomycorrhizal. When the '*Helichrysum*' species are segregated into those genera recognised by Anderberg (1991) and by myself the situation changes, for then each of the segregate genera contains, as far as is known, only ectomycorrhizal or only non-ectomycorrhizal species.

Warcup (1990) examined the mycorrhiza of the following species in the *Lawrencella* complex: *Helichrysum ayersii*, *H. cassinianum*, *H. lindleyi*, *H. davenportii*, *H. subulifolium*, and *Bellida graminea*; he found them all to be non-ectomycorrhizal. This is also the situation in *Rhodanthe s.l.* (Wilson 1992a) and *Helichrysum* subg. *Ozothamnus* (*Ozothamnus* R.Br.); it contrasts with the situation in the *Helichrysum bracteatum* group (*Bracteantha*), the *H. apiculatum* group (*Chrysocephalum*), and in the *H. leucopsideum* group all of which are ectomycorrhizal.

Generic circumscription

On the basis of the characters that are found in the achene (see above) a close relationship is suggested between *H. cassinianum*, *H. ayersii*, and the species of the '*Xanthochrysum*' group on the one hand, and between *Bellida*, *H. lindleyi* and *H. davenportii* on the other. This correlates with the nature of the pappus which in *H. lindleyi*, *H. davenportii*, and *Bellida* elongates during anthesis to extend beyond the corolla while in the other genera it remains more or less equal to the corolla.

The number of genera that should be recognised in the *Lawrencella* complex is difficult to assess, partly because of the few species involved and their morphological diversity (apart from those in the '*Xanthochrysum*' group). Of the taxa represented, *Bellida* appears to be morphologically distinct and I am continuing to recognise it as a monotypic genus. However, the morphology of the epidermal cells of its testa suggests that *Bellida* and *H. davenportii* are more closely related to each other than either is to *H. lindleyi*. With the exclusion of *Bellida* I am dividing the taxa into two genera based on characters observed in the achene and pappus. These two genera consist of 1) *Helichrysum lindleyi* and *H. davenportii*, and 2) *H. ayersii*, *H. cassinianum*, and species of the '*Xanthochrysum*' group.

Key to genera and species of the *Lawrencella* complex

1. Vascular strands of pericarp in lateral position in relation to cotyledons; base of achene excavated
   2. Apex of achene extended to form a pair of cup-shaped protuberances; ray bracts absent ..... *Bellida*
   2. Apex of achene truncate; ray bracts present (*Lawrencella*)
      3. Leaves terete, cauline ..... *Lawrencella lindleyi*
      3. Leaves flat, sub-basal ..... *Lawrencella davenportii*
1. Vascular strands of pericarp in medial position in relation to coytledons; base of achene not excavated (*Schoenia*)
   4. Leaves flat (*Schoenia* subgroup)
      5. Ray bracts present, pink or white ..... *Schoenia cassiniana*
      5. Ray bracts absent ..... *Schoenia ayersii*
   4. Leaves terete (*Xanthochrysum* subgroup)
      6. Terminal barbs of pappus bristles densely clustered, clavate
         7. Involucre narrow-cylindrical or narrow-turbinate; lamina of ray bracts 3-4 mm long; plant cottony ..... *Schoenia ramosissima*
         7. Involucre hemispherical; plant shortly hirsute ..... *Schoenia macivorii*
      6. Terminal barbs of pappus bristles distinct, acute ..... *Schoenia filifolia*

Bellida Ewart, Proc. Roy. Soc. Victoria 19:34(1907).

Type: Bellida graminea Ewart

Annual erect herb to 12 cm high with several leafless scapes arising from base, glabrous except for white villi at base of stems. Leaves basal, filiform. Capitula solitary, terminal. Involucre turbinate, not radiant; bracts 3-seriate, hyaline with a narrow brown stereome reaching to apex, central nerve continuing as a piliferous tip. Receptacle hemispherical, glabrous. Florets numerous, actinomorphic, outer bisexual, inner male. Corolla: tube shortly cylindrical, pilose; limb barrel-shaped, glabrous; lobes 5, papillose within, sparsely pilose outside, vascular strands extending to apex, cells of inner epidermis ± equilateral. Anthers: appendage narrow-cordate, proximal cells ± equilateral and thick-walled, medial and distal cells oblong and thin-walled, marginal cells small; collar narrow-oblong; tails extremely fine and exceeding collar. Style apex deltoid, acute to acuminate, vascular strand stout, extending to apex. Achene compressed clavate, stipitate with

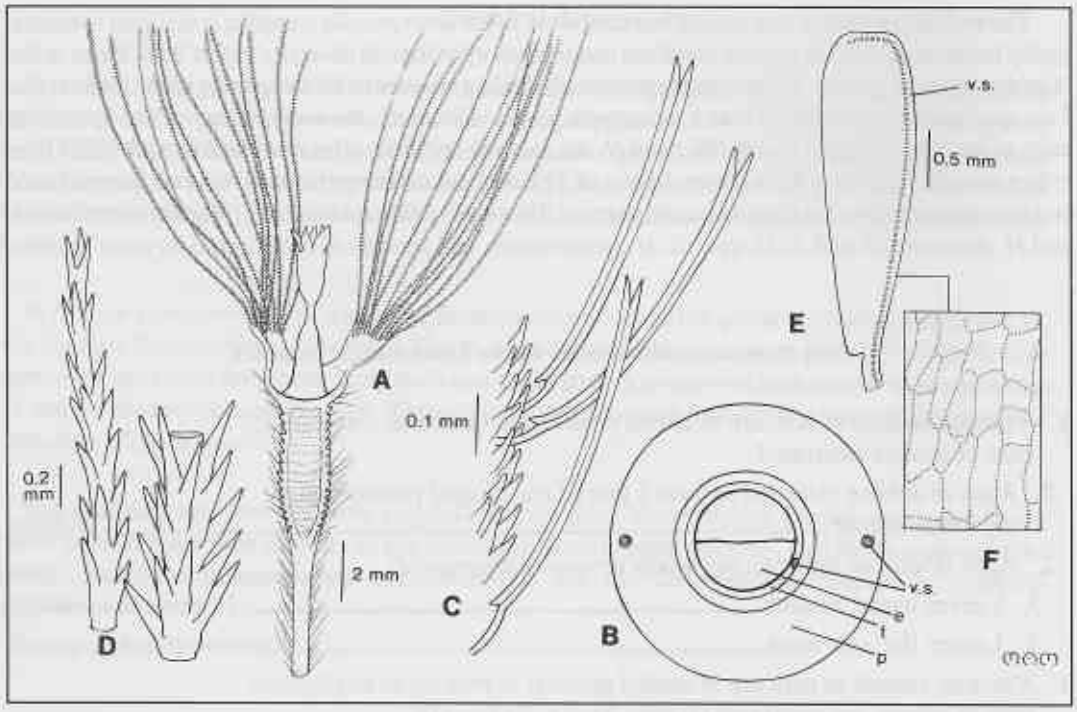

Figure 2. *Bellida graminea*. A - achene with pappus and corolla. B - T.S. achene (semidiagramatic). C - achenial single celled papillae and duplex hairs. D - portion of pappus bristles. E - seed (i.e. testa). F - epidermal cells of testa. (v.s. - vascular strand, p - pericarp, t - testa, e - embryo.) From *Kings Park* 793/86.

excentric hollow base, moderately to sparsely hirsute with duplex hairs and densely and minutely velutinous with acute single-celled papillae (in smooth achenes these absent), not myxogenic, at apex expanded into two cup-shaped extensions that bear the pappus; pericarp deeply and transversely rugose (or occasionally smooth), thick and cartilaginous, a vascular strand in each margin of achene. Seed compressed turbinate, free from pericarp; testa thin, vascular strand extending to apex in medial position and at right-angles to vascular strands of pericarp. Pappus at anthesis about half as long as the corolla, in fruit almost twice as long; bristles filiform, prominently dentate, reddish towards apex, united into groups that are firmly fixed to each of the extensions of the achene, persistent.

A monotypic genus.

Bellida graminea Ewart, Proc. Roy. Soc. Victoria 19:35(1907). *Type:* Jibberding, Western Australia, 1905, *M. Koch s.n.* (iso: PERTH). (Figures 1 & 2)

Distribution. Found only in southern Western Australia.

Moore (1917) indicated a relationship of *Bellida* to *Helichrysum davenportii* and treated them as being congeneric, while Anderberg (1989) has suggested that *Bellida* may not even be a member of the Gnaphalieae. I consider that the similarity of floral and fruit morphology between *Bellida* and *Lawrencella* indicate that its position here is correct. The similarity is strongest to *Lawrencella davenportii* which, if a true reflection of phylogeny, indicates that *Lawrencella* as treated here is paraphyletic.

Lawrencella Lindley, Sketch Veg. Swan R. Col. 23(1839).

Helichrysum sect. *Lawrencella* (Lindley) Benth., Fl. Austral. 3:613(1867). *Type: Lawrencella rosea* Lindley

Annual herbs, glandular puberulous or pilose. Stem single, erect, branched above. Leaves cauline or sub-basal, opposite or alternate, terete or flattened. Capitula terminal to branches or leafless scapes, radiant. Involucre hemispherical; bracts 3-6-seriate. Outer and intermediate bracts narrow-triangular to narrow-oblong, chartaceous, ciliate; stereome narrow-triangular, thin; innermost bracts: claw oblong, hyaline with an oblong flat stereome; lamina elliptic, pink. Receptacle cushion shaped, smooth, glabrous. Florets numerous, outer bisexual, inner male. Corolla actinomorphic, tubular below, narrowly campanulate above, glandular hispidulous; cells of throat with straight walls; lobes 5, papillose within, vascular strands extending to tip. Anther appendage broad-ovate; proximal cells equilateral, thick-walled, distal cells oblong, thin-walled, marginal cells small; collar narrow-oblong; anther tails filamentous exceeding collar. Style apex deltoid, vascular strand, extending to tip. Achenes polymorphic; base excavated forming a hollow extension of the pericarp, pericarp hard and thick, smooth or rugose, glabrous or velutinous with minute aciforme 1-celled papillae or scabrous with flattened acuminate multicelled trichomes or sparsely hispid with stiff duplex hairs; seed narrow-fusiform with a short flattened sterile tip, free from pericarp; testa membranous, vascular strand laterally placed with reference to cotyledons, terminating in the flattened tip. Pappus persistent, colourless or pink, shorter than corolla at anthesis but lengthening in fruit; bristles firm, linear-acuminate, prominently dentate, united in groups towards base.

Two species endemic to Australia.

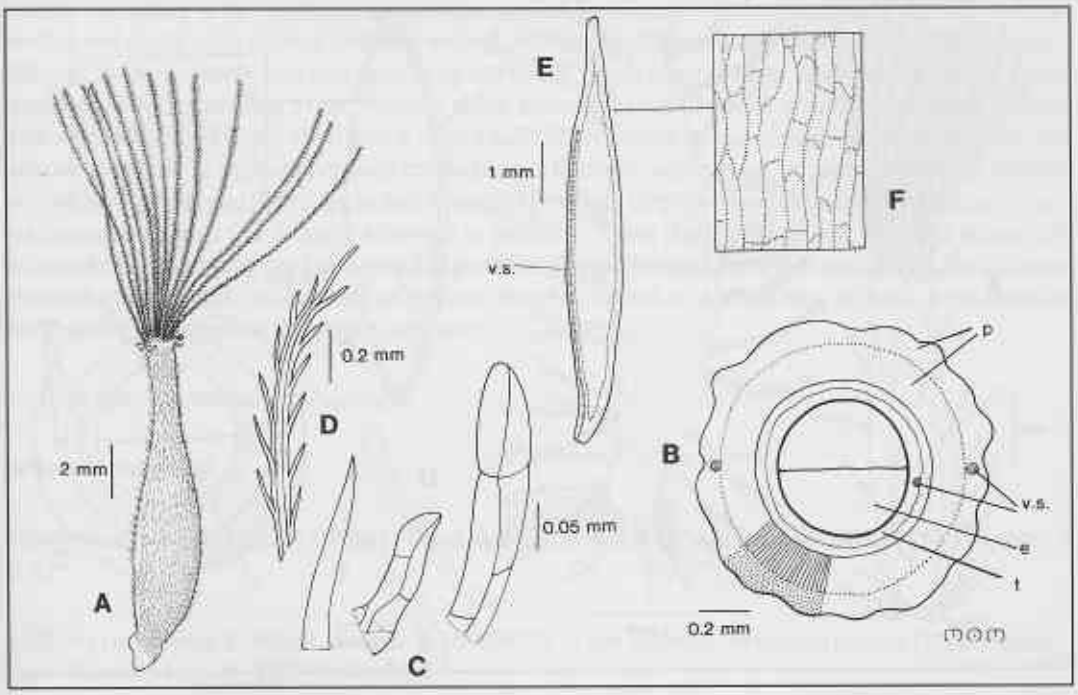

Figure 3. *Lawrencella davenportii*. A - achene with pappus. B - T.S. achene (semidiagramatic). C - trichomes from achene (left papilla from surface of achene, centre and right from near apex of achene). D - Apex of pappus bristle. E - seed (i.e. testa). F - epidermal cells of testa. (v.s. - vascular strand, p - pericarp, t - testa, e - embryo.) From *A.S. George* 3924.

Lawrencella davenportii (F.Muell.) Paul G. Wilson, comb. nov. (Figures 1 & 3)

Helichrysum davenportii F.Muell., Fragm. 3:32(1862). - *Helichrysum lawrencella* var. *davenportii* (F.Muell.) Benth., Fl. Austral. 3:616(1867). - *Helichrysum roseum* (Lindley) Druce var. *davenportii* (F.Muell.) Domin, Vestn. Kral. Ceske Spolecn. Nauk. Tr. Mat.-Pir. 2:120(1923). Type citation: 'In Australia centrali ad flumen Neales. J.Macd. Stuart.' *Lectotype* (here chosen): Neales River (MEL 579934; *isolecto:* MEL *s.n.*).

Bellida major S.Moore, J. Bot. 55:100(1917). Type citation: 'Western Australia, Mulline; *J.E.C. Maryon*, 1916.' *Type n.v.*

Distribution. Found in Western Australia, Northern Territory, and South Australia.

Lawrencella rosea Lindley, *loc.cit.* (Figures 1 & 4)

Helichrysum lawrencella Benth., Fl. Austral. 3:616(1867) *nom.illeg.* - *Helichrysum roseum* (Lindley) Druce, Bot. Soc. Exch. Club Brit. Isles 4:626(1917); Domin, Vestn. Kral. Ceske Spolecn. Nauk. Tr. Mat.-Prir. 2:120(1923) *comb.illeg. non* (Hook.) Baillon (1886). - *Helichrysum lindleyi* H. Eichler, Taxon 12:295(1963). *Type:* Vasse River, on the South West coast of New Holland, 1839, *Mrs Molloy* (holo: CGE photo seen).

Distribution. Southern Western Australia.

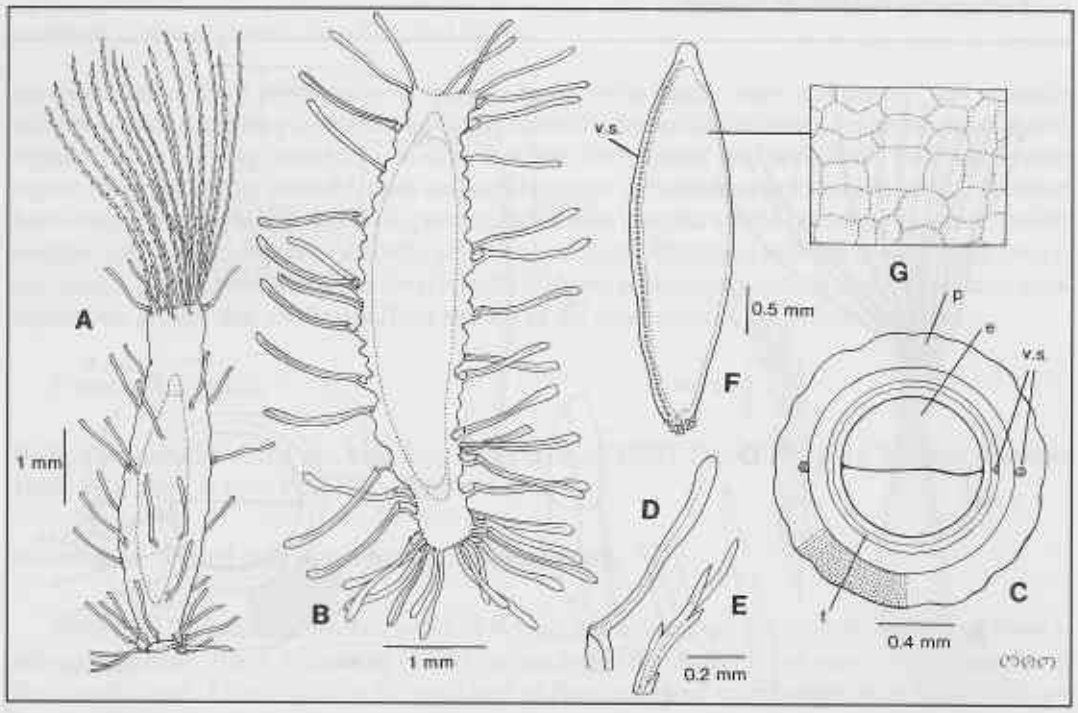

Figure 4. *Lawrencella lindleyi*. A - achene with pappus. B - L.S. achene. C - T.S. achene (semidiagramatic). D - achenial duplex hair. E - Apex of pappus bristle. F - seed (i.e. testa). G - epidermal cells of testa. (v.s. - vascular strand, p - pericarp, t - testa, e - embryo.) From *P.G. Wilson* 12353.

Schoenia Steetz in Lehm., Pl.Preiss. 1:480(1845).

Pteropogon sect. *Schoenia* (Steetz) F.Muell., Linnaea 25:415(1853). - *Helichrysum* sect. *Schoenia* (Steetz) Baillon, Hist.Pl. 8:175(1882). *Lectotype* (here chosen): *Schoenia oppositifolia* Steetz [= *S. cassiniana* (Gaudich.) Steetz].

Xanthochrysum Turcz., Bull. Soc. Imp. Naturalistes Moscou 24/1:199(1851). *Type: Xanthochrysum filifolium* Turcz.

Helipterum sect. *Geniosperma* A.Gray, Hooker's J. Bot. Kew Gard. Misc. 4:230(1852). *Type: Helipterum tenellum* A.Gray

Pteropogon sect. *Helipteropsis* F. Muell., Linnaea 25:415(1853). *Lectotype* (here chosen): *Pteropogon ramosissimus* F. Muell.

Annual erect herbs, hirtellous with short uniseriate hairs that, when young, bear a curled filamentous apiculum producing a woolly cover, or shortly hirsute, or glandular puberulous. Leaves opposite or alternate, oblong or terete. Capitula solitary or corymbiform. Involucre hemispherical to narrow-cylindrical, radiant or not; bracts c. 5-seriate, sometimes woolly ciliate, otherwise glabrous or puberulous on the stereome of the outer bracts; outer bracts scarious-ovate, glossy with a triangular green flat stereome. Inner bracts present or absent: claw oblong, scarious with an oblong stereome; lamina elliptic, pink or yellow (or white). Receptacle convex, glabrous or glandular papillose. Florets actinomorphic, the outer bisexual and the inner male. Corolla narrow-cylindrical with narrow-turbinate limb, 5-lobed, sparsely glandular-puberulous; lobes papillose or colliculate within, vascular strands extending to tip. Anthers: appendage cordate, proximal cells ± equilateral and thick-walled, medial and distal cells oblong and thin-walled, marginal cells small and equilateral; collar narrow-oblong; tails extremely fine and exceeding the collar. Style apex deltoid, acute, papillose, vascular strand stout and extending to tip. Achene terete to compressed-obovoid, sparsely to densely hirsute with somewhat rigid hairs, short gland-tipped hairs also present; apical margin sometimes raised and surrounding base of pappus; pericarp cartilaginous, thin and crustaceous, or papery, vascular strands in centre of ventral and dorsal faces and in medial position; carpopodium annular, insignificant; base not excavated; seed free from or adherent to pericarp. Testa thinly coriaceous, vascular strand 2/3 or completely encircling seed in the medial position. Pappus bristles narrow-linear at base and filiform towards apex, dentate, colourless or yellow, free but united in a short ring at base, persistent or deciduous (persistent on the sterile achenes).

Five species endemic to Australia.

Schoenia subgroup

Schoenia ayersii (F.Muell.) J. Black, Trans. & Proc. Roy. Soc. S. Australia 39:840(1915). (Figures 1 & 5)

Helichrysum ayersii F. Muell., Fragm. 8:167(1874). Type citation: 'In vicinia montis Olgae; Gosse'. *Type:* Gosse's Exped., 1873 (holo: MEL).

Podolepis georgei Diels, Bot. Jahrb. Syst. 35:619(1905). Type citation: 'Hab. in distr. Austin pr. Murrinmurrin, unde misit cl. W.J. George (Hb. Berol.!)'. *Type non vidi.*

Distribution. Found in southern Western Australia, Northern Territory, and South Australia.

A species readily distinguished from *Podolepis*, in which genus it was placed by both Diels (1905) and Davis (1957), by its triangular style apex and its turbinate rugose achenes with coarse hairs.

Schoenia cassiniana (Gaudich.) Steetz in Lehm., Pl. Preiss. 1:481(1845). - *Helichrysum cassinianum* Gaudich. in Freyc., Voy. Uranie 466 t.87(1830). - *Helipterum cassinianum* (Gaudich.) DC., Prod. 6:216(1838). - *Pteropogon cassinianus* (Gaudich.) F. Muell., Linnaea 25:415(1853). *Lectotype* (here chosen): Baie des Chiens-Marins, *C.Gaudichaud* (P photo seen, isolecto G-DC photo seen). (Figures 1 & 6)

Schoenia oppositifolia Steetz in Lehm., Pl. Preiss. 1:480(1845). - *Pteropogon oppositifolius* (Steetz) F.Muell., Linnaea 25:415(1853). Type citation: 'Specimina integra leg. cl. Roë in Australasia australi-occidentali inter flumen Swan-river et sinum regis Georgii III. (V.s. in herb. aulico Vindobonnensi!)', *non vidi*.

Distribution. Found in Western Australia, Northern Territory, and South Australia.

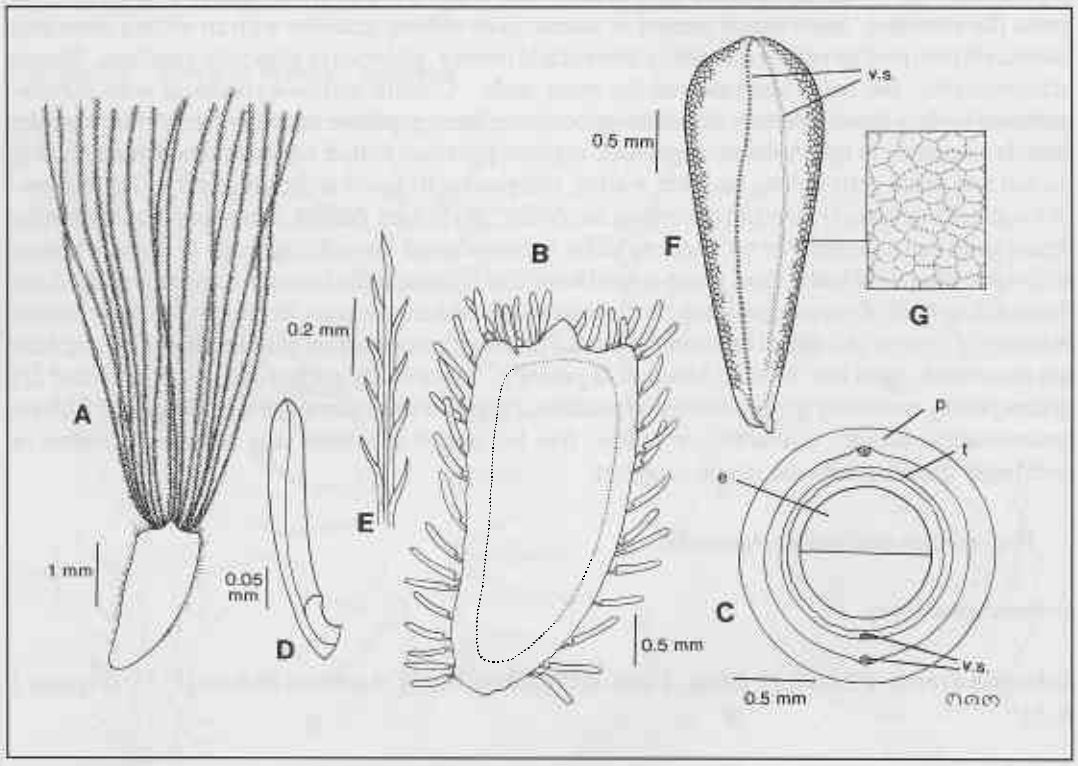

Figure 5. *Schoenia ayersii*. A - achene with pappus. B - L.S. - achene. C - T.S. achene (semidiagramatic). D - achenial duplex hair. E - apex of pappus bristle. F - seed (i.e. testa). G - epidermal cells of testa. (v.s. - vascular strand, p - pericarp, t - testa, e - embryo.) From *H. Demarz* 6588.

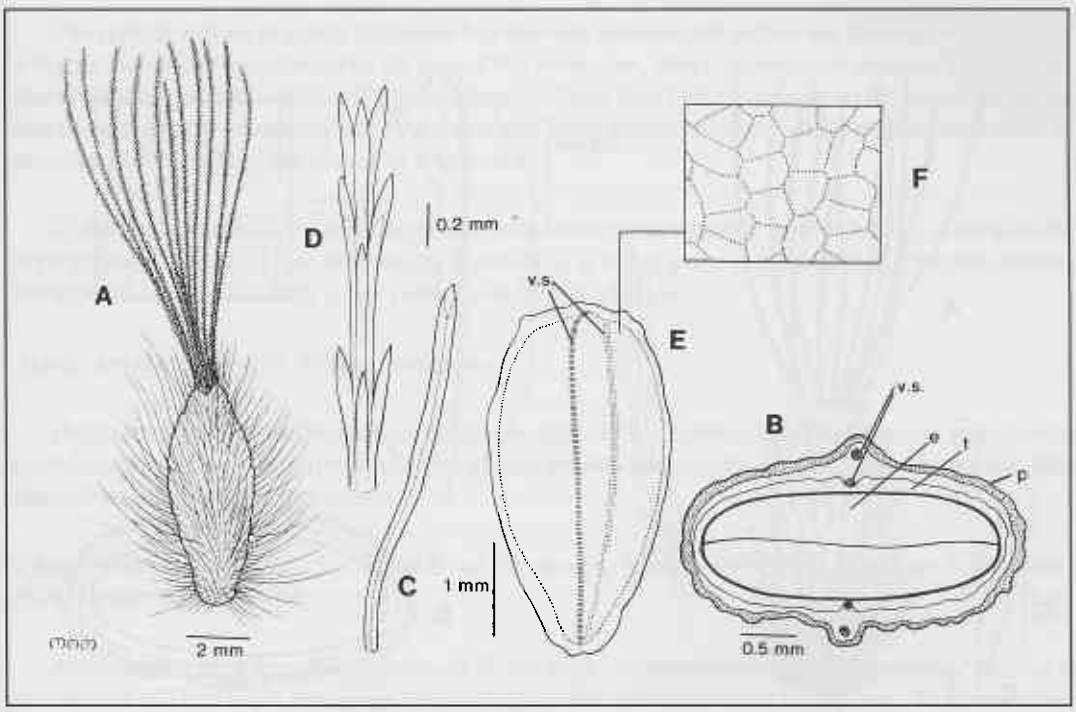

Figure 6. *Schoenia cassiniana*. A - achene with pappus. B - T.S. achene (semidiagramatic). C - achenial duplex hair. D - apex of pappus bristle. E - seed (i.e. testa). F - epidermal cells of testa. (v.s. - vascular strand, p - pericarp, t - testa, e - embryo.) From *P.G. Wilson* 12600.

Xanthochrysum subgroup

Schoenia filifolia (Turcz.) Paul G. Wilson, comb. nov. (Figures 1 & 7)

Xanthochrysum filifolium Turcz., Bull. Soc. Imp. Naturalistes Moscou 24/1:199 t.4(1851). - *Helichrysum filifolium* (Turcz.) F. Muell., Fragm. 3:134(1863). - *Type:* Western Australia, *J. Drummond* 3rd coll. no. 119 (holo: KW photo seen; iso: K, MEL, NSW).

Helipterum tenellum A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:231(1852) *nom. illeg. non* Turcz. (1851). *Type:* 'Swan River, Drummond' (holo: K).

Helichrysum subulifolium F. Muell., Fragm. 3:134(1863). Type citation: 'Ad sinum Champion Bay Australiae occidentalis. P. Walcott.' *Type:* Champion Bay, *P. Walcott* (holo: MEL; iso: K).

Helichrysum turbinatum W. Fitzg., J. W. Austral. Nat. Hist. Soc. No.1:23(May 1904). - *Helichrysum pseudoturbinatum* C. Gardner, Enum. Pl. Austral. Occ. 133(1931) *nom. illeg. Type:* Nannine, Sept. 1903, *W.V. Fitzgerald* (iso: PERTH).

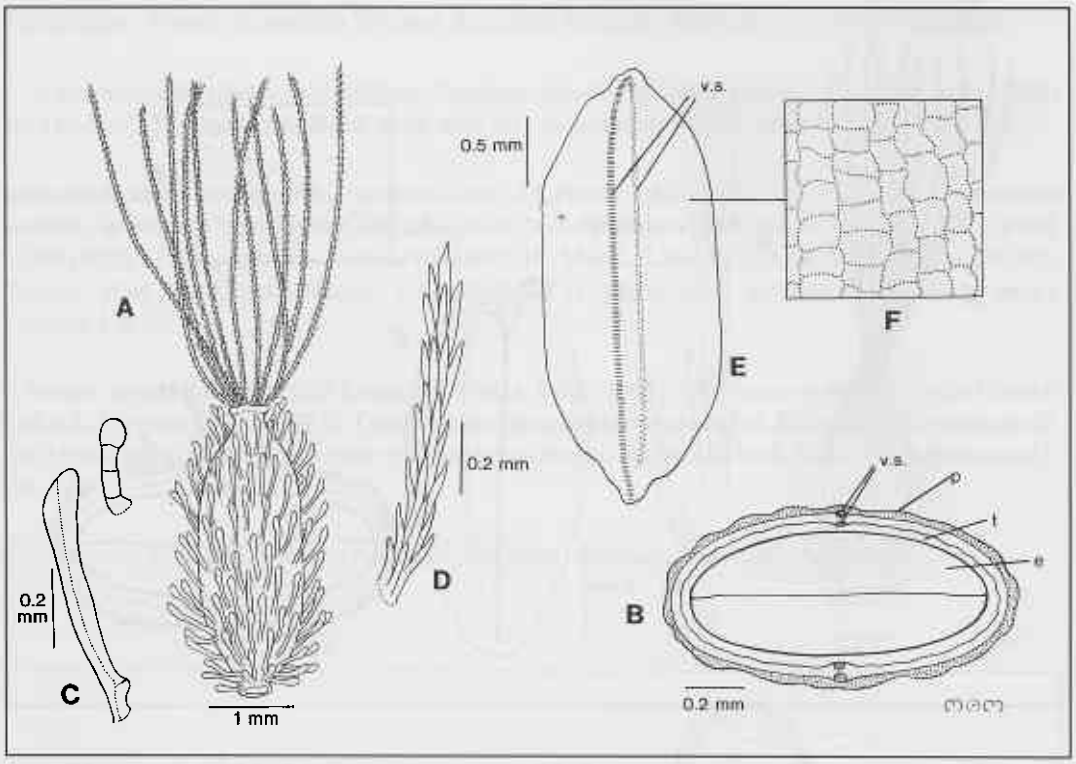

Figure 7. *Schoenia filifolia* subsp. *subulifolia*. A - achene with pappus. B - T.S. achene (semidiagramatic). C - achenial duplex hair. D - apex of pappus bristle. E - seed (i.e. testa). F - epidermal cells of testa. (v.s. - vascular strand, p - pericarp, t - testa, e - embryo.) From *A. Morrison*, 30.ix.1904.

Key to subspecies

1. Involucre turbinate to cylindrical; ray 3-6 mm long
   2. Plant single-stemmed; involucre turbinate ..... subsp. *filifolia*
   2. Plant multi-stemmed; involucre cylindrical ..... subsp. *arenicola*
1. Involucre hemispherical; ray 7-10 mm long ..... subsp. *subulifolia*

subsp. **filifolium**

Helipterum tenellum A. Gray, *l.c.*

Helichrysum turbinatum W. Fitzg., *l.c.* - *Helichrysum pseudoturbinatum* C. Gardner, *l.c.*, *nom. illeg.*

Distribution and habitat. Inland south-west Western Australia from Mullewa to Kalgoorlie and Lake Barker in saline areas.

The typical variant of subsp. *filifolium* has obovoid achenes and yellow ray laminae 4-6 mm long whereas the variant represented by the type of *H. turbinatum*, which is immature and only known from that collection, possibly differs in having short (c. 3 mm long) white laminae to the inner involucral bracts, and narrow, quadrangular, very sparsely hispidulous achenes. Its type was collected 'in crevices of rocks along the shores of a salt lake'.

In the above taxonomy subsp. *filifolia* remains somewhat variable in morphology even with the segregation of the other two subspecies, however, it is not at present reasonable to describe further infraspecific taxa since only a few collections have been made.

subsp. **arenicola** Paul G. Wilson, subsp. nov.

Herba erecta supra basim ramosa ad 30 cm alta. Inflorescentia laxe corymbosa. Involucrum cylindraceum c. 7 mm altum; bractea intima laminis ovatis luteis c. 5 x 2.5 mm. Achenium teres, pilis duplicibus crassis c. 0.2 mm longis.

Typus: Western Australia, 5 miles S.E. of Carnarvon, 4 Sept. 1959, *N.T. Burbidge* 6502 (holo: PERTH; iso: BRI, CANB).

Annual erect herb branching above, to 30 cm high. Inflorescence of open corymbs. Involucre cylindrical, c. 7 mm high; innermost bracts a with yellow ovate lamina c. 5 x 2.5 mm. Achenes terete; duplex hairs thick, c. 0.2 mm long.

Additional collections seen. WESTERN AUSTRALIA: Champion Bay, 1889, *Mrs Forrest* (MEL 110575); Carnarvon, Sept./October 1964, *T.Nysen* (PERTH).

Distribution and habitat. Evidently confined to sandhills in the Carnarvon area of Western Australia. The collection from Champion Bay, if the locality data is correct, indicates that it was once found as far south as Geraldton.

Derivation of epithet. The epithet *arenicola* (sand dweller) refers to the plant's habitat preference.

This subspecies differs from subsp. *filifolia* in being single-stemmed (not with several major branches), in having a cylindrical involucre (not turbinate or hemispherical), and in having terete achenes with short (c. 0.2 mm long) duplex hairs (not obovoid and with hairs c. 0.4 mm long).

subsp. **subulifolia** (F. Muell.) Paul G.Wilson, comb. et stat. nov.

Helichrysum subulifolium F. Muell., Fragm. 3:134(1863). Type citation: 'Ad sinum Champion Bay Australiae occidentalis. P.Walcott.' *Type:* Champion Bay, *P. Walcott* (holo: MEL; iso: K).

Distribution. Western Australia, Geraldton district.

The typical variant of this subspecies differs from subsp. *filifolia* in having much larger capitula and larger achenes with longer and more dense hairs, but some collections suggest that the two subspecies grade into each other.

Schoenia macivorii (F. Muell.) Paul G. Wilson, comb nov.

Helichrysum macivorii F. Muell., S. Sci. Rec.3:99(1883). *Type:* Gascoyne River, 1882, *J. Forrest* (iso: MEL two sheets, PERTH).

Distribution and habitat. Gascoyne River area on sand or loam.

Schoenia ramosissima (F. Muell.) Paul G. Wilson, comb. nov.

Pteropogon ramosissimus F. Muell., Linnaea 25:412(1853). - *Helichrysum semifertile* F.Muell., Rep. Pl. Babbage Exped. 14(1859) - *Helichrysum ramosissimum* (F. Muell.) Druce, Bot. Exch. Club Brit. Isles 4:626(1917) *nom. illeg. non Helichrysum ramosissimum* Hook.(1848). Type citation: 'In planitiebus arenoso-argillaceis inter montes Flinders-range et sinum Spencers-gulph etiam non procol a rupe Cudnaka.' *Lectotype* (here chosen): In planitiebus valibusque sterilibus prope Cudnaka et Wallendunga, Oct. [18]51, Dr M[ueller] (MEL 604822). *Paralectotypes:* Cudnaka, Nov. Holl. austr. inter., *F. Mueller* (MEL); Inter montis Flinder's & Sinum Spenceri, Oct. [18]51, *F.Mueller* (MEL).

Helichrysum semifertile var. *xanthoglossum* F. Muell., Rep. Pl. Babbage Exped. 14(1859). Type citation: 'Wonnomulla, Elizabeth Creek'. *Type*: Smith's Waterhole, *anon.* (holo: MEL).

Distribution. Found in Northern Territory, Queensland, New South Wales and South Australia.

This species has a variant with white and a variant with yellow bract ray laminae. All of the syntypes of *Pteropogon ramosissimus* have white laminae and evidently for this reason Mueller described as a variety a yellow-rayed plant collected on the 'Babbage' expedition.

The presumed holotype of *H. semifertile* var. *xanthoglossum* is a small specimen mounted in a blue packet that is labelled '*Pteropogon ramosissimus ß flavisimus*, Smith's Waterhole'; it bears no other information. Smith's Waterhole is one of the localities visited by B. H. Babbage on his expedition in 1858. The locality is also referred to in the 'Report' by the Aboriginal name Wirra-Wirralu which is stated to be near Elizabeth Creek, the place name mentioned by Mueller in his protologue to var. *xanthoglossum*. Since the specimen agrees with Mueller's description, and is the only collection in herb MEL of that species from the 'Babbage' expedition, I am confident that it is the type.

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