VOLUME 25 2007

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Volume 25
Autumn 2007

ISSN 0077-1813

MUELLERIA

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Muelleria **volume 24** was distributed on 22 November, 2006

Muelleria 25: 3-20 (2007)

The lichen genus *Umbilicaria* Hoffm. in Tasmania

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Abstract

The lichen genus *Umbilicaria* Hoffm. in Tasmania comprises six species: *U. cylindrica* (L.) Delise ex Duby, *U. decussata* (Vill.) Zahlbr. (recorded from Tasmania for the first time), *U. nylanderiana* (Zahlbr.) H. Magn. [previously incorrectly referred to as *U. hyperborea* (Ach.) Hoffm.], *U. polyphylla* (L.) Baumg., *U. subglabra* (Nyl.) Harm. and *U. umbilicarioides* (B. Stein) Krog & Swinscow [previously referred to as *U. propagulifera* (Vain.) Llano]. The species are described and illustrated, and their variability, distribution and ecology are discussed.

Introduction

Umbilicaria is a distinctive, easily recognised genus of foliose lichens, widely distributed in areas with cold climates and occurring almost exclusively on siliceous rocks. Characteristics of the genus include a foliose, monophyllous or polyphyllous thallus, attached to the substratum by a central holdfast, termed an umbilicus. The thallus may be smooth, scabrid, pustulate or ridged. Some species develop shaggy, root-like outgrowths termed rhizinomorphs. The black apothecia display a range of morphologies. In most species, they are gyrose, with the disc containing spiral or concentric folds of sterile tissue within the hymenium. The amyloid asci contain eight, mostly hyaline, simple ascospores. Many species reproduce by specialised vegetative diaspores called thalloconidia that are developed on the thallus surface or on the rhizinomorphs; others may develop minute thallus-like propagules called thallyles. Hestmark (2004), Llano (1950) and Purvis (1992) offer excellent summaries of the salient features of the genus.

Estimates of the total number of species of *Umbilicaria* have varied greatly between different authors, although recent workers suggest approximately 70 (Hestmark 2004) to 80 species (Kirk *et al.* 2001). The greatest diversity occurs in the Northern Hemisphere, particularly at intermediate latitudes, whereas in the mid-Southern Hemisphere, *Umbilicaria* appears to be restricted to comparatively small areas in the Andes, New Zealand, Australia and South Africa (Hestmark 1997). It is also relatively diverse in Antarctica (Øvstedal & Lewis Smith 2001). Local endemism is rather uncommon and many species are very widely distributed; this is certainly the case for all the species recorded from Tasmania and Australia. The disjunct distribution reported for some species could be due partly to limited floristic exploration of many high mountain ranges and to difficulties in the identification of some taxa (Codogno 1995).

In the Australasian region, seventeen species of *Umbilicaria* are recognised for New Zealand (Galloway & Sancho 2005; Galloway & Ledingham 2006) whereas seven species are known from mainland Australia (S. Louwhoff in prep.). The first records of *Umbilicaria* from Tasmania were made by the eminent botanist Robert Brown, who accompanied Matthew Flinders in his circumnavigation of the Australian continent in 1801-1803. Brown later visited Tasmania in 1804 and spent several months exploring the environs of Hobart, the Derwent River and Mount Wellington (Moore 2000). He collected two specimens of *Umbilicaria* from Mount Wellington (Crombie 1879), both

now identified as *U. cylindrica* (Groves & Moore 1989). Wilson (1893), in discussing *U. cylindrica*, described the new form *jubata* F. Wilson, also from Mt Wellington. The type of this taxon has never been located (Filson 1984) and subsequently its exact identity remains uncertain. Wilson (1893) also recorded two further taxa: *U. atropurpurea* var. *cinerascens* Ach. and *U. proboscidea* Schrad. The account of the genus in Tasmania by Blackman *et al.* (1974), based mainly on the comprehensive but now dated monograph by Llano (1950) and on extensive field studies by the authors, recognised four species: *U. cylindrica, U. hyperborea, U. polyphylla* and *U. subglabra*. Since these papers, the taxonomic importance of thalloconidia (Poelt 1977; Hestmark 1990), a character overlooked by Llano, has become widely accepted and has led to a major reassessment of the taxonomy of the genus in general (for example, see Krog & Swinscow 1986; Purvis 1992; Sancho *et al.* 1992; Sipman & Topham 1992; Wei 1993; Øvstedal & Lewis Smith 2001; Krzewicka 2004). On that basis, and as a result of further fieldwork, six species are now recognised for Tasmania.

One major problem with *Umbilicaria* taxonomy in Tasmania (and elsewhere) appears to have been not so much the recognition of individual taxa but the definition of their limits and the application of correct names. Indeed there are even serious problems with the typification of the genus itself (Jorgensen & Santesson 1993), and of several of the more common species (see Wei 1993; Jorgensen 1994; Jorgensen *et al.* 1994). Clearly addressing such problems is outside the scope of the present paper. We have confined ourselves solely to reviewing the large holdings of herbarium specimens available and comparing them with published literature and reference material from other regions of the world, bringing the nomenclature of the Tasmanian species in line with modern concepts and elucidating the diagnostic features of the species. In addition, we examine distribution patterns of the species in Tasmania, particularly in relation to geology and rainfall.

Materials and Methods

The morphology and anatomy of several hundred specimens from BM, BRI, CANB, HO, MEL, NSW and PERTH were examined using light microscopy. This included not only Tasmanian and Australian collections but also comparative material from other regions. Thalloconidia were examined by mounting whole rhizinomorphs or thin thallus sections in water, flushed with either 10% KOH or commercial bleach (C). These reagents cause significant swelling of thallus structures and hence measurements were made only on water mounts. Spores and pycnoconidia were examined and measured in hand-cut sections mounted in water, dilute KOH or Lugols Iodine (these structures do not swell noticeably on addition of the reagents used).

Thin layer chromatography (Orange *et al.* 2001) and high performance liquid chromatography (Elix *et al.* 2003) were carried out on a representative selection of specimens. In general, thallus chemistry was not a particularly useful character in the delimitation of Tasmanian *Umbilicaria*, despite the suggestion by Posner *et al.* (1991) that secondary product chemistry of the genus has been overlooked or underestimated (Narui *et al.* 1996). The most common secondary compounds present in Tasmanian *Umbilicaria* are gyrophoric acid, lecanoric acid and umbilicaric acids, or a combination of these, either in major, minor or trace amounts. Some taxa contain no substances.

Key to Species

1. Rhizinomorphs present and typically very abundant on the lower surface and/or margins of the thallus, often forming a shaggy fringe around the lobes 2
   Rhizinomorphs absent 3
2. Rhizinomorphs shrubby and densely dendroid-branched to coralloid, mostly ≤1.5 mm long, sparsely to densely beset with clusters of thalloconidia and appearing uneven and lumpy ..... *U. umbilicarioides*
   Rhizinomorphs elongate and mostly furcate-branched, never coralloid, 1-4 mm long, mostly smooth, glossy and lacking thalloconidia ..... *U. cylindrica*
3. Upper surface extensively folded, wrinkled or puckered 4
   Upper surface predominantly smooth 5
4. Thallus dark brownish, very fragile and brittle; folds and wrinkles with smooth, rounded edges, sometimes whitish and angular only near the centre ..... *U. aylanderiana*
   Thallus black, grey or grey-brown, relatively thick and robust; folds, wrinkles and ridges angular and forming a whitish, reticulate-faveolate pattern across the entire thallus ..... *U. decussata*
5. Thallus polyphyllous, black, epruinose; lobes highly divided and entangled, with margins undulate or ± deflexed; apothecial disc gyrose ..... *U. polyphylla*
   Thallus mostly monophyllous, whitish or greyish pruinose, with margins undulate to upturned; apothecial disc smooth, not gyrose ..... *U. subglabra*

Taxonomy

1. *Umbilicaria cylindrica* (L.) Delise ex Duby

Thallus polyphyllous, 2–10 cm diam., with lobes entire or rather ragged, sometimes fenestrate; upper surface dark brown to dark grey to black, sometimes entirely or in part grey-pruinose, smooth or finely areolate-scabrid; lower surface beige-brown or pinkish, more rarely grey, blackened in the vicinity of the umbilicus, epruinose, mostly smooth but sometimes weakly areolate in older, blacker areas near the umbilicus. *Rhizinomorphs* usually abundant, marginal and laminal on the upper and lower surfaces, 1–4 mm long, usually ± flat at the point of attachment, then cylindrical and gradually tapered to an acute apex, rarely simple, more commonly sparsely to richly furcate-branched, mostly black or ± concolorous with the thallus, smooth and glossy, or sometimes with knob-like projections; thallyles uncommon. *Apothecia* numerous, substipitate; disc gyrose, plane or convex. *Ascospores* ellipsoid to oblong-ellipsoid, rarely somewhat bean-shaped, 12–18 × 5–9 µm. *Thalloconidia* mostly absent (see remarks below). *Pycnidia* scattered, immersed, visible as black dots on the upper surface; conidia bacilliform to fusiform, 3–4 × 0.5–0.7 µm. *Chemistry:* lacking any substances detectable by t.l.c. For further descriptions see Galloway (1985), Krzewicka (2004), Purvis (1992) and Thomson (1984). (Figs 1A–C)

Nomenclatural note: Complex nomenclatural problems surround the typification of the name because it is based in part on a specimen of *Parmelia perforata* (Hale 1965). The implications of this have been discussed by Wei (1993) and Wei & Jiang (1993) who proposed a new name, *U. neocylindrica*, for the entity that has generally been regarded by lichenologists as *U. cylindrica*. However, Jørgensen *et al.* (1994) observed that several

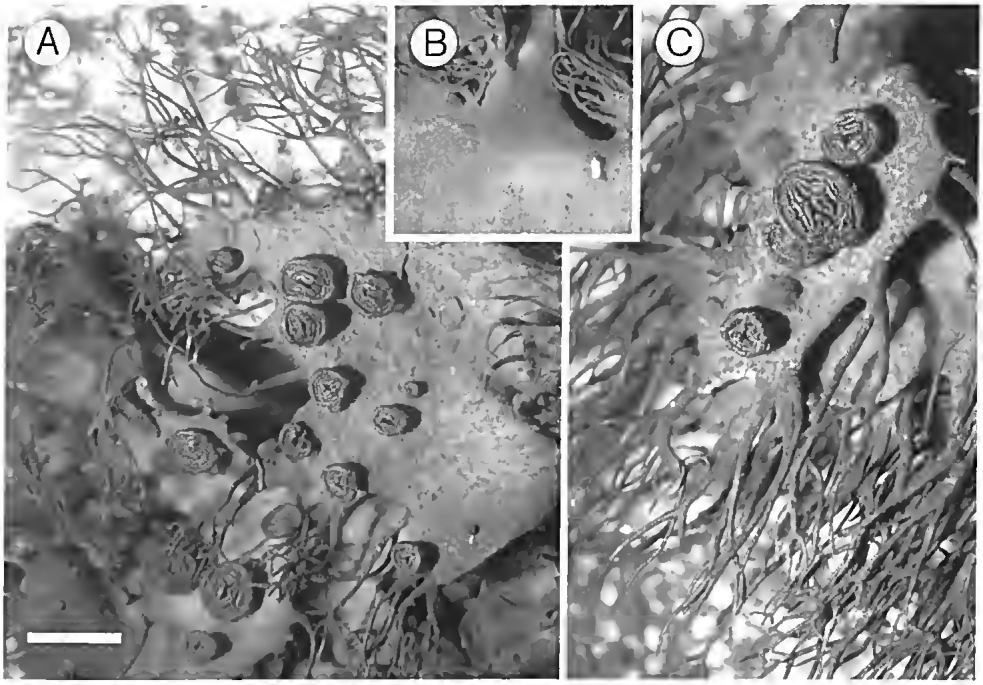

Figure 1. *Umbilicaria cylindrica (Kantvilas & Jarman 294/00)*: A- habit (scale = 5 mm); B- detail of lower surface and rhizinomorphs; C- detail of upper surface, rhizinomorphs and gyrose apothecia.

older alternative names were available for this taxon and instead conserved the name *U. cylindrica* with a new type that agreed with its 200-year-long application, thus avoiding an undesirable name change.

Remarks: In Tasmania and mainland Australia, the name *U. cylindrica* has been widely applied (and misapplied) to all specimens of the genus with a polyphyllous thallus, gyrose apothecia and abundant rhizinomorphs. This view derives in part from the monograph of Llano (1950) and was reinforced by Blaekman *et al.* (1974). By the 1980s, the presence of thalloconidia and their significance for species-level taxonomy in *Umbilicaria* became broadly accepted, following in part from the work of Poelt (1977) and other workers. For the Australasian region, an additional taxon, subsumed within what had been called *U. cylindrica*, was recognised, at the time called *U. propagulifera* (Vain.) Llano in herbaria (Topham *et al.* 1982), and problems in identifying *U. cylindrica* in the study area became evident.

In this account, the taxon with abundant thalloconidia, developed in irregular clumps on the rhizinomorphs, is referred to as *U. umbilicarioides*. The name *U. cylindrica sens. str.* is applied exclusively to a closely related, superficially similar taxon that mostly lacks thalloconidia and hence the rhizinomorphs appear generally smooth. *Umbilicaria cylindrica* differs further in the form of its rhizinomorphs: these are usually relatively long, in part ± flattened, tapered extensions of rather lacerate, incised lobed margins, and resemble the tassles that may fringe a rug (Figs 1A–C). In contrast, the rhizinomorphs of *U. umbilicarioides* are shorter (mostly ≤1.5 mm), densely dendroid or ± squarrosely branched and ± coralloid, and emerge rather abruptly from the lobes like a shrubby fringe (Figs 8A–B). Further discussion is provided under *U. umbilicarioides* (see below).

Tasmanian material of *U. cylindrica sens. str.* falls well within the broad range of variation exhibited by the species elsewhere in the world. The problem in its delineation derives from the apparent presence of sparse, multi-cellular thalloconidia in some specimens, and their taxonomic significance. Recently published descriptions of *U. cylindrica* (e.g. as referred to above) do not mention this character, and indeed Hestmark (1990) specifically states that *U. cylindrica* lacks thalloconidia. On the other hand, Krog & Swinscow (1986) in their discussion of African species imply that, in their concept, the *U. cylindrica* aggregate, at least in Australia, can have thalloconidia. In addition, Poelt & Vězda (1981) include a form of *U. cylindrica* amongst the European species that may have thalloconidia (which they term 'Brutkörnern').

An examination of large numbers of specimens of *U. cylindrica* from many parts of the world (housed mainly in BM, HO and MEL) confirmed that thalloconidia generally do not occur in this species. However, a very small fraction of specimens, mainly Australasian but also from other regions, have occasional, lump-like protuberances on the rhizinomorphs that are easily detected under low-power magnification and at first glance look very much like thalloconidia. When viewed under high-power, these lumps may be gall-like outgrowths or superficial colonies of unidentified algal cells. However, they may also be composed of scattered or clumped, brown-pigmented, globose cells of the mycobiont. Some may simply be bulges in the cortex (which is likewise composed of globose, brown-walled cells), perhaps incipient branches or thallyles, and do not form discrete, easily dislodged clusters. However, instances of what seem to be unequivocally clumped, multicellular thalloconidia have also been observed.

Thus the delineation of *U. cylindrica* and *U. umbilicarioides* in the study area remains problematical. We are convinced that two closely related taxa are involved. To apply only one name would be a regression to the past when thalloconidia were not generally regarded as significant or were not even noticed. However, recognising two species requires that we reluctantly include occasional specimens with sparse thalloconidia within *U. cylindrica*, a view that is not generally supported by other authors.

At a practical level, the problem is compounded by the fact that at some locations (mainly on the higher, dolerite peaks of Tasmania's Central Plateau), the two taxa co-occur in closely intermixed colonies. Thus their separation in the field may be tricky, and most sizeable herbarium specimens are mixtures of the two, leading to problems of identification and curation.

Umbilicaria cylindrica is one of the most widespread species of the genus in the world. It is also one of the most variable morphologically and chemically, as indicated by the many infra-specific taxa that have been described (see Llano 1950). For example, Wei & Jiang (1993), Brodo *et al.* (2001) and Thomson (1984) all report that it contains no lichen substances, whereas Krzewicka (2004) reports the presence of lecanoric and gyrophoric acids, and Purvis (1992) and Hestmark (2004) report that it sometimes contains norstictic acid. This chemical variation, as well as the morphological findings discussed above, suggest that the taxonomy of the species world-wide requires further study. Three varieties have been reported for Australia: *U. cylindrica* var. *delisei* (Despr.) Nyl., *U. cylindrica* var. *fimbriata* (Ach.) Nyl. and *U. cylindrica* var. *tornata* (Ach.) Nyl. (McCarthy 2003). None of these is from Tasmania, but at this stage they are considered to fall within our concept of *U. cylindrica sens. str.* (S. Louwhoff, in prep.).

Distribution and Ecology: Umbilicaria cylindrica is the most widespread species of the genus in Tasmania (Figs 2A, 3A), and is typically part of a rich assemblage of macrolichens that includes *Usnea torulosa* (Müll. Arg.) Zahlbr., *Parmelia signifera* Nyl.,

species of *Xanthoparmelia* (including *Neofuscelia*) and additional species of *Umbilicaria*. It occurs on a wide variety of rock types including Jurassic dolerite, Precambrian metamorphosed sediments, Triassic sandstone, Ordovician conglomerate and Devonian granite (Fig. 3A). It also has a very broad altitudinal range, occurring on exposed summits as low as 300 m a.s.l. (Mt Amos, on Tasmania's East Coast) to the highest peaks and plateaux above 1400 m. Its localities at lower altitudes are invariably on very hard, pre-Carboniferous, siliceous rock types, such as predominate in Tasmania's South-West; there it may be common on rock outcrops in lowland, exposed, windswept buttongrass (*Gymnoschoenus*) moorland, as well as in more alpine or subalpine habitats. On the relatively higher, dolerite peaks of the central and north-eastern highlands, it tends to be

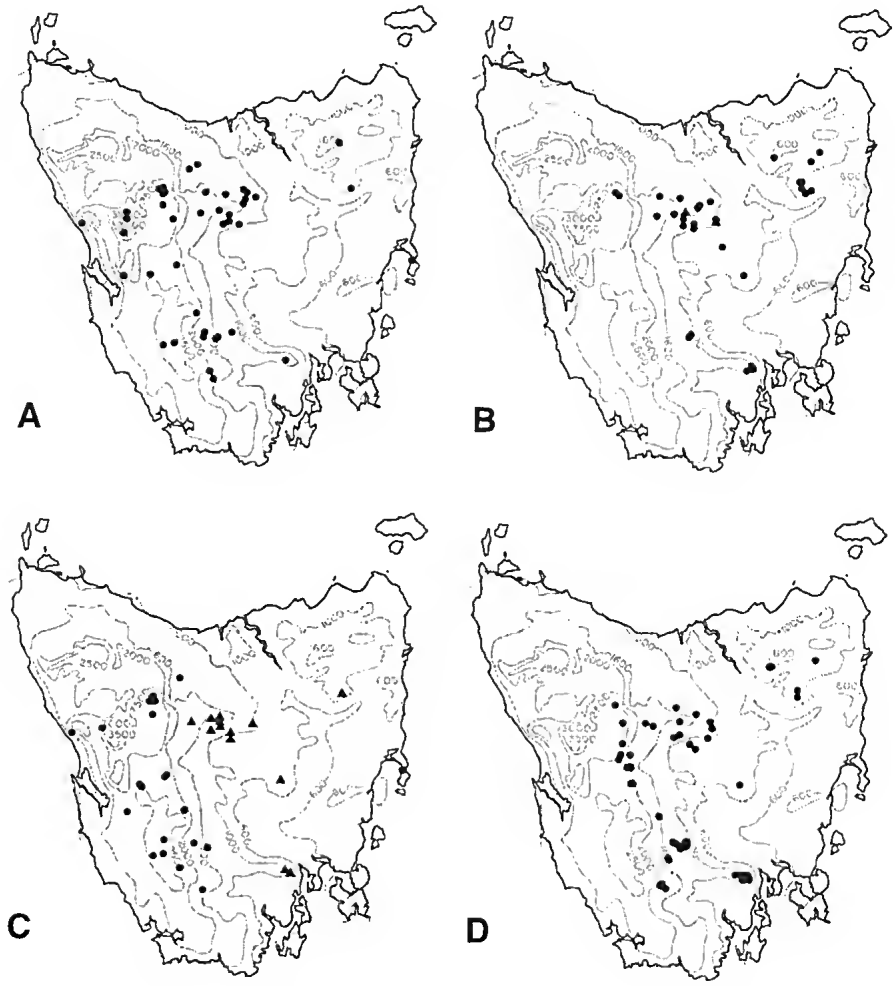

Figure 2. Distribution of *Umbilicaria* species in Tasmania: correlation with mean annual rainfall (mm). A- *U. cylindrica*; B- *U. decussata* (▲) and *U. subglabra* (●); C- *U. nylanderiana* (▲) and *U. polyphylla* (●); D- *U. umbilicarioides*.

exclusively alpine. There it is less abundant and grows together with *U. umbilicarioides*. It is in such habitats that the enigmatic forms with lumpy protuberances and incipient thalloconidia on the rhizinomorphs occur. *Umbilicaria cylindrica* is a cosmopolitan species that in Australia is also known from New South Wales, the A.C.T. and Victoria.

Representative specimens examined: **TASMANIA**: Hansons Peak, 41°40'S, 145°39'E, 24.ii.1968, *R.B. Filson 10715* (MEL); Mt Amos summit, 42°09'S 148°17'E, 300 m alt., 19.ix.1968, *G.C. Bratt & J.A. Cashin 68/1249* (HO); *c.* 2 km S of Lake Augusta, 41°54'S 146°31'E, 1140 m alt.,

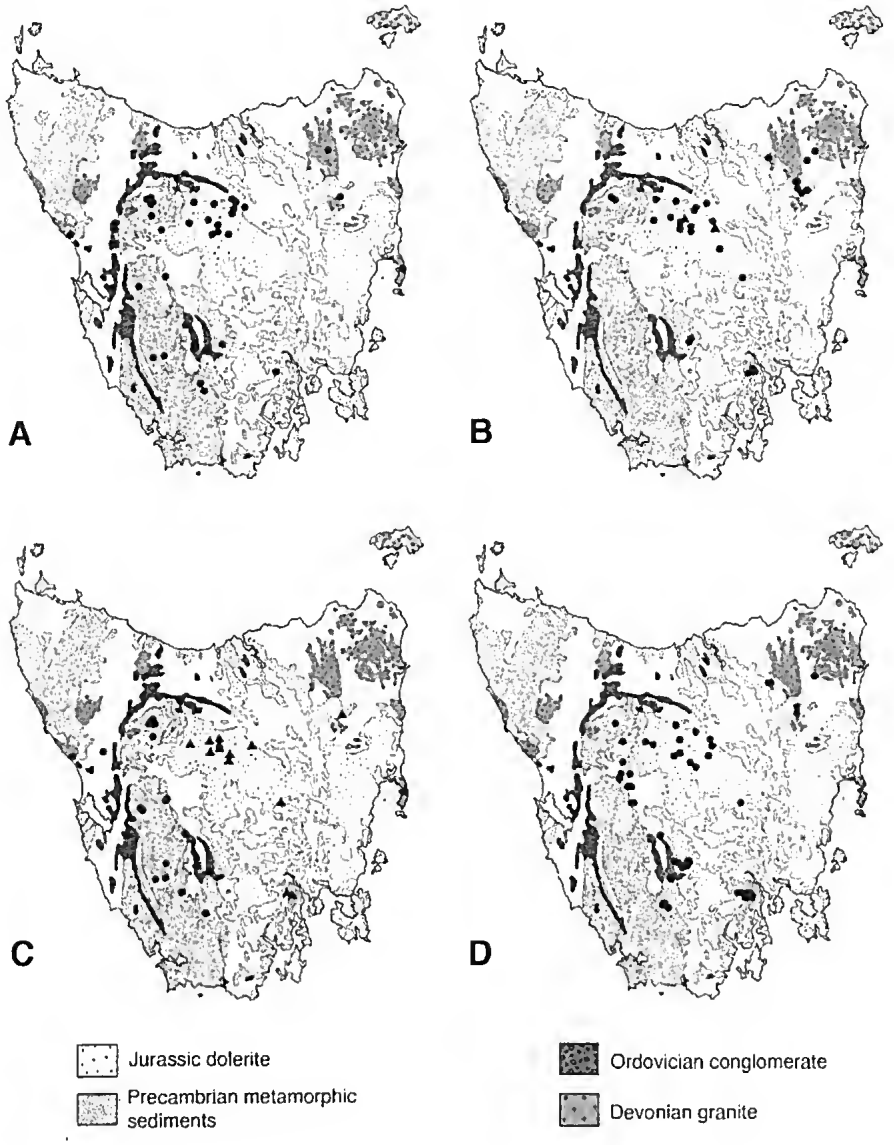

Figure 3. Distribution of *Umbilicaria* species in Tasmania: correlation with geology. A- *U. cylindrica*; B- *U. decussata* (▲) and *U. subglabra* (●); C- *U. nylanderiana* (▲) and *U. polyphylla* (●); D- *U. umbilicarioides*.

14.xii.1999, *G. Kantvilas 448/99* (HO); Schnells Ridge, 43°01'S 146°26'E, 29.vii.1973, *G.C. Bratt 73/881* (HO); Murchison Highway, Hellyer Gorge, 50 m N of Hellyer River, 41°16'S 145°37'E, 300 m alt., 21.i.1989, *F.E. Davies 1101* (CANB); summit of Mt Tim Shea, 42°42'S 145°20'E, 940 m alt., 26.iv.1992, *J.A. Elix 27052* (CANB); Twelvetrees Range, 42°46'S 146°04'E, 640 m alt., 20.i.1984, G. *Kantvilas 37/84* (HO); Cradle Mountain, 41°41'S 145°57'E, 1080 m alt., 1915, *L. Rodway s.n.* (HO); Frenchmans Cap, 42°16'S 145°50'E, 1400 m alt., 4.i.1981, *G. Kantvilas 17/81* (HO); Lake Cumberland Dam, 41°54'S 145°12'E, 360 m alt., 28.iii.1967, *G.C. Bratt 4011* (HO); Anthony Road, 41°52'S 145°37'E, 640 m alt., 22.v.2000, *G. Kantvilas & J. Jarman 294/00* (HO).

2. *Umbilicaria decussata* (Vill.) Zahlbr.

Thallus monophyllous or rarely polyphyllous, 1–8 cm diam., rather tough and rigid, with lobe margins entire, incised or somewhat torn, often upturned; upper surface dull, pale to dark grey or brownish grey, seabrid, markedly faveolate-reticulate with sharp ridges radiating from an elevated umbo and decreasing in size towards the margins, with a whitish, coarsely granular cortical layer centrally or extending onto the ridges; lower surface grey to pale brown, smooth to bullate, sometimes radially ridged, ± continuously covered with sooty, black thalloconidia except for a narrow peripheral zone. *Rhizinomorphs* absent. *Thalloconidia* single-celled, spherical to ovoid, 6–8 µm diam. *Apothecia* unknown in Tasmanian material, scattered, 1–3 mm diam., initially adnate, becoming substipitate; disc plane, not gyrose, with a central column of sterile tissue (omphalodisc), becoming convex and distorted with age. *Pycnidia* not found. *Chemistry:* gyrophoric acid (major), lecanoric acid (minor). For further descriptions see Filson (1987), Galloway (1985), Hestmark (2004), Krog & Swinscow (1986) and Wei & Jiang (1993). (Figs 4A–B)

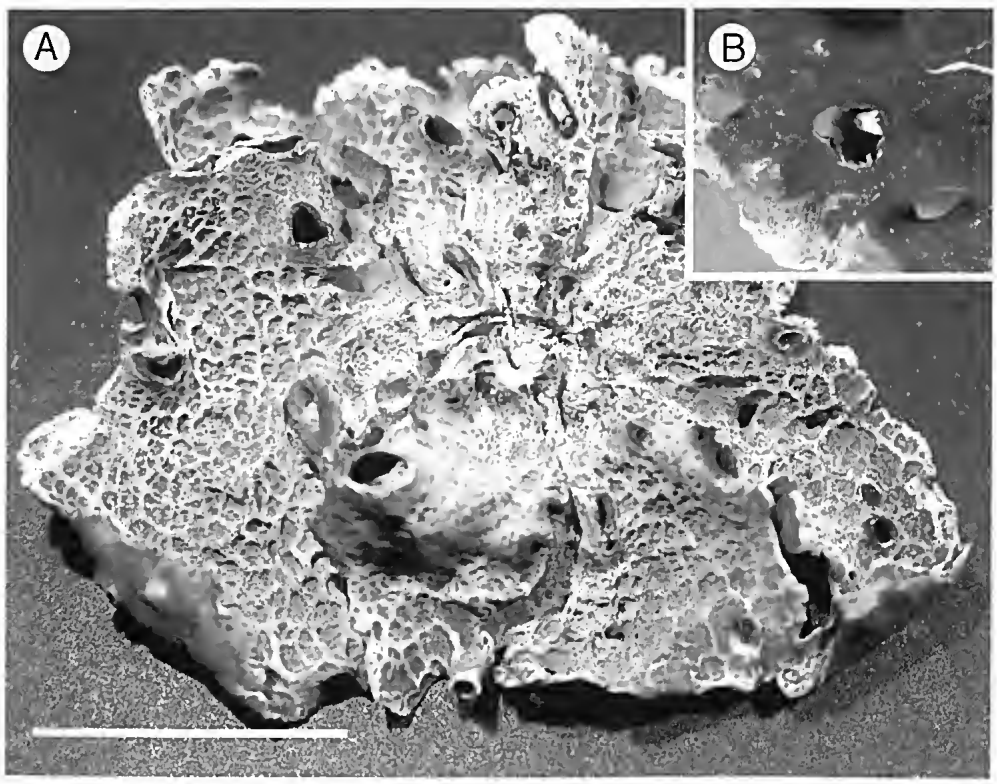

Figure 4. *Umbilicaria decussata (Kantvilas 329/00)*: A- habit (scale = 10 mm); B- detail of lower surface showing a ± continuous layer of black thalloconidia.

Remarks: *Umbilicaria decussata* is readily recognisable by the deeply faveolate-reticulate upper surface with sharp ridges, covered by a white, coarsely granular necral layer. It has no confusing species in the Tasmanian flora. *Umbilicaria nylanderiana* also has a puckered and wrinkled upper surface, but its thallus is very fragile, thin and brittle, the wrinkles are rounded rather than ridged, nor are they covered by a whitish layer, except sometimes near the umbo (compare Figs 4A and 5B). The morphological variation that this species displays elsewhere in the world (Filson 1987; Llano 1950; Sancho *et al.* 1992) is not evident in Tasmania.

Distribution and Ecology: *Umbilicaria decussata* is reported here for Tasmania for the first time. It is known from only two localities, from dolerite summits *c.* 1400 m a.s.l. (Fig 3B), where the mean annual rainfall is approximately 1000-1200 mm (Fig. 2B). This is a comparatively dry and cold regime for Tasmania where alpine areas generally experience rainfalls in the order of 1200-3500 mm per annum. It is possible that higher fire frequencies in such drier areas have severely reduced the range of this species. At both sites it is very rare and represented by only a few small thalli on the uppermost parts of rock tors, habitats that are both fire-protected and serve as bird perch sites. This is a cosmopolitan species that in Australia is also known from New South Wales, the A.C.T. and Victoria.

Specimens examined: **TASMANIA**: Summit of Sandbanks Tier, 41°51'S 146°52'E, 1400 m alt., 24.vi.2000, *G.Kantvilas 329/00* (HO); summit of Wild Dog Tier, 41°47'S 146°35'E, 1390 m alt., 11.iii.2001, *G. Kantvilas 369/01* (HO).

3. *Umbilicaria nylanderiana* (Zahlbr.) H.Magn.

Thallus mainly monophyllous, 3–5(–15) cm diam., with lobes very brittle, irregularly incised, becoming ragged and often fenestrate; upper surface unevenly ridged, folded, puckered, warty to verruculose, dull grey-brown to brown-black, but usually white-pruinose with an irregular pattern of radiating, ± sharp-edged ridges in the vicinity of the central umbo; lower surface dull pale brown to grey-brown, mostly smooth, covered continuously or in patches with black, sooty thalloconidia. *Rhizinomorphs* absent. *Thalloconidia* single-celled, brown, ± roundish, 5–8.5(–10) µm wide. *Apothecia* frequent, 0.5–1.2 mm diam., sessile to subpedicellate; disc gyrose, plane to convex. *Ascospores* ellipsoid to oblong-ellipsoid, 9–14(–16) × 5–8 µm. *Pycnidia* marginal and laminal, visible as minute, glossy, black dots; conidia fusiform (2.5–)3–4 × 0.8–1.3 µm. *Chemistry:* gyrophoric acid (major), lecanoric acid (minor/trace), ± umbilicaric acid (minor/trace). For further descriptions see Galloway (1985), Krzewicka (2004) and Sipman & Topham (1992). (Figs 5A–C)

Remarks: This species is very distinctive, being recognised by the ridged, puckered and folded upper surface, and the smooth undersurface covered with black, sooty thalloconidia. Although the thalloconidia typically form a continuous covering, in some specimens this may be interrupted or very patchy, revealing a pale brown lower surface, perhaps due to the age of the thallus or abrasion by the elements. In the Tasmanian flora, it is easily distinguished from other species of the genus: *Umbilicaria polyphylla* differs by the mostly smooth and black upper surface, whereas *U. decussata* differs by having a reticulate-faveolate pattern of angular ridges across the entire thallus, with the edges of the ridges eroded whitish. *Umbilicaria polyphylla* differs further by having larger (to 16.5 µm wide), multicellular thalloconidia (Hestmark 1990).

In earlier literature on Tasmanian lichens (Wilson 1893; Wetmore 1963), this species was referred to as *U. proboscidea* (L.) Schrad., a species now recognised as having no thalloconidia, occasional rhizinomorphs and white, central reticulate ridges (Purvis 1992). More recently, it was referred to by most Australian authors (e.g. Blackman *et al.* 1974) as *U. hyperborea* (Ach.) Hoffm., largely as a result of the work of Llano (1950) who considered the two taxa conspecific. However, although *U. hyperborea* has a similarly puckered and folded, essentially dark brown upper surface, it differs chiefly by lacking thalloconidia. Thus whereas the underside of *U. hyperborea* is pale to dark brownish, that of *U. nylanderiana* is typically jet black. The two species are also distinguished by their general morphology, with *U. hyperborea* having a rather more delicate, paler, more olive-coloured thallus with smaller ridges and broader folds, and apothecia that tend to be ± embedded among the folds and warts.

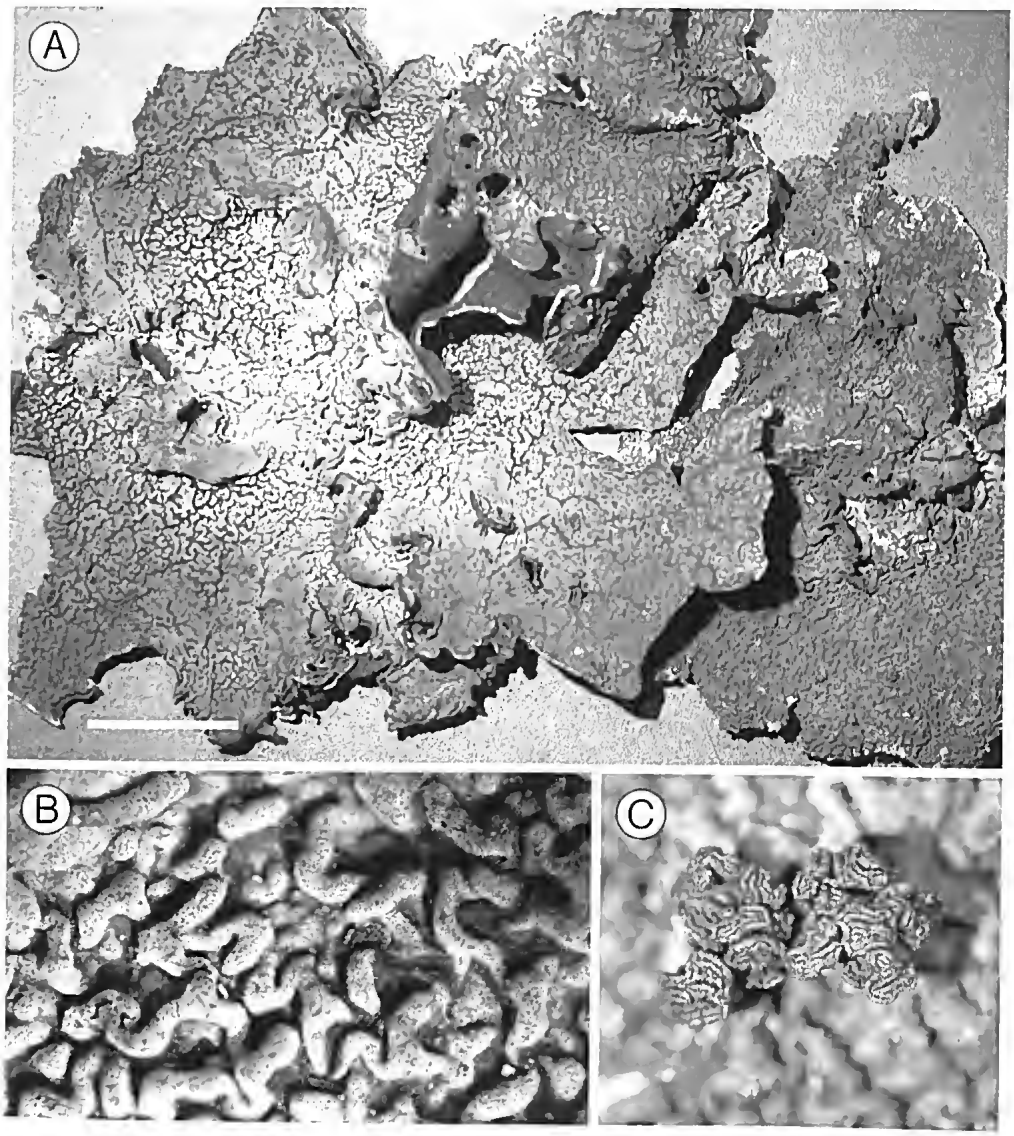

Figure 5. *Umbilicaria nylanderiana (Kantvilas & Jarman 428/99)*: A- habit (scale = 10 mm); B- detail of upper surface; C- gyrose apothecia.

Distribution and Ecology: In Tasmania, *Umbilicaria nylanderiana* is restricted to alpine dolerite on the highest peaks and plateaux (above 1000 m) (Fig. 3C). Like *U. decussata*, it is also found mostly in lower rainfall areas (annual rainfall ≤1600 mm) (Fig. 2C). Within these areas it is locally common and typically associated with other species of the genus, notably *U. umbilicarioides* and *U. subglabra*, and with tufts of *Usnea torulosa* (Müll. Arg.) Zahlbr. This is a bipolar species, common in the mountains and subpolar regions of the Northern Hemisphere (Sancho *et al.* 1992), and recorded in the Southern Hemisphere from New Zealand (Galloway 1985), South America (Hestmark 1990) and Antarctica (Sancho *et al.* 1992). In Australia, it also occurs in Victoria, New South Wales and the A.C.T.

Representative specimens examined: **TASMANIA**: Pulpit Rock, 42°53'S 147°11'E, 3.vi.1967, *G.C. Bratt, M.H. Bratt & J.A. Cashin 4053* (HO); Lake Augusta Quarry, 41°51'S 146°34'E, 20.x.1973, *G.C. Bratt 73/1036* (HO); Walls of Jerusalem, 41°49'S 146°18'E, 1967, *T. & J. Scott 3975* (HO); S end of Ben Lomond Plateau, 41°37'S 147°42'E, 1360 m alt., 9.iv.1996, *G. Kantvilas 19/96* (HO); Table Mountain, 42°14'S 147°08'E, 1095 m alt., 18.vi.1972, *G.C. Bratt & J.A. Cashin 72/409* (HO); *c.* 0.5 km SE of Lake Ada, 41°53'11"S 146°29'16"E, 1150 m alt., 14.xii.1999, G. *Kantvilas & J. Jarman 428/99* (HO); Wild Dog Tier, 41°47'S 146°34'E, 1340 m alt., 11.iii.2001, *G. Kantvilas 378/01* (HO); Sandbanks Tier, 41°50'S 146°52'E, 5.iv.1969, *G.C. Bratt 69/199* (HO); Ouse River, Julian Lakes, 41°48'S 146°29'E, 1.1975, *D. & M. Cook 75/159* (HO).

4. *Umbilicaria polyphylla* (L.) Baumg.

Thallus polyphyllous, 2–6 cm diam., with lobes rather elongate and strap-like, ragged, highly divided, overlapping and entangled, sometimes lobulate, forming ± pulvinate clumps; apices ascending or deflexed, often rather coralloid and very brittle; upper surface dark brown to black, epruinose, smooth to weakly puckered; lower surface black, smooth, ± continuously covered with a fine layer of black, sooty thalloconidia. *Rhizinomorphs* absent. *Thalloconidia* single-celled or in irregular clusters 10–22.5(–25) µm wide, mostly comprising up to 5 cells; individual cells (5–)6–12 µm diam. *Apothecia* not seen in Tasmanian material; disc gyrose. *Pycnidia* uncommon, immersed, visible as minute black dots in the upper surface; conidia bacilliform, 3–5 × 0.6 µm. *Chemistry:* containing gyrophoric acid. For additional descriptions see Galloway (1985), Hestmark (1990), Krog & Swinscow (1986), Krzewicka (2004) and Sipman & Topham (1992). (Figs 6A–B)

Remarks: Umbilicaria polyphylla is easily recognised in the Tasmanian flora by the mostly black, very lacerate, divided and overlapping lobes that form entangled clumps, and by the absence of rhizinomorphs. The underside is usually uniformly black and covered with sooty thalloconidia. The most typical form of the species in Tasmania comprises short, crowded, ascending lobes with rather rounded, deflexed apices; thalli with ragged, elongate lobes are less common (compare Figs 6A and 6B). The most similar species morphologically is *U. nylanderiana*, although in practice, there are very few instances where these species may be confused. Whereas the thallus of *U. nylanderiana* is predominantly monophyllous, with intensely puckered and verruculose, very thin, flattish, broad and brittle lobes, that of *U. polyphylla* is very clearly polyphyllous, with only slightly puckered, narrow, overlapping lobes in clumps. Hestmark (1990) also describes differences in thalloconidia between the two species, with the former having single-celled and the latter multi-celled thalloconidia. However, in the Tasmanian specimens of *U. polyphylla* studied, the thalloconidia occur in mixtures of few-celled clusters and single cells.

Figure 6. *Umbilicaria polyphylla*: A- typical form with rounded, deflexed lobes (*Kantvilas s.n.*) (scale = 5 mm); B- form with elongate, ragged lobes (*Kantvilas 38/84*).

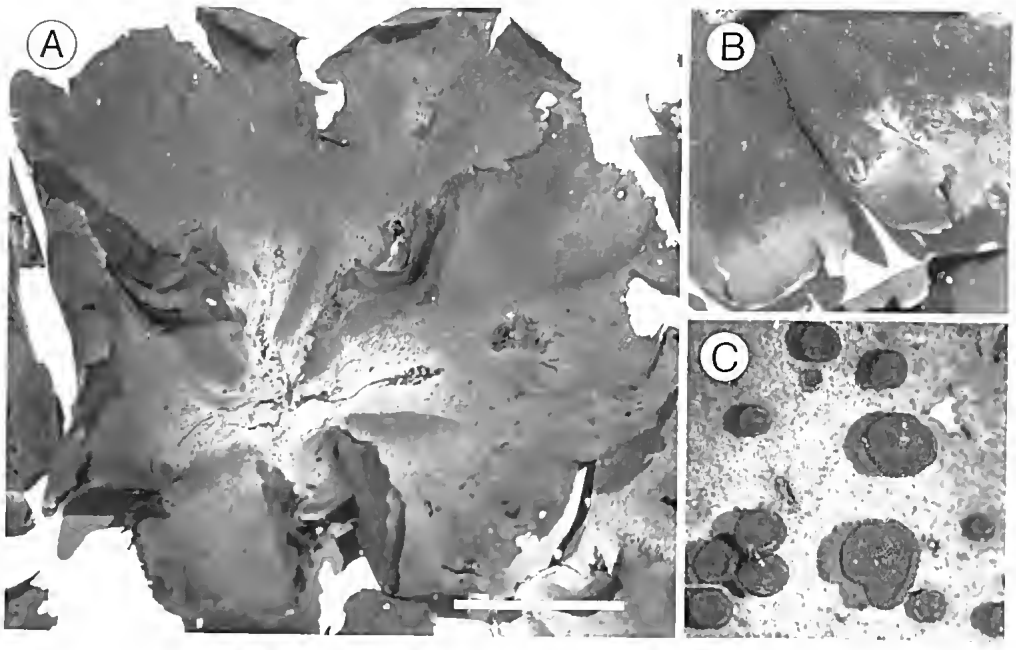

Figure 7. *Umbilicaria subglabra (G.C. Bratt 69/36)*: A- habit (scale = 10 mm); B- detail of lower surface with patchy thalloconidia; C- leiodise apothecia.

Distribution and ecology: Umbilicaria polyphylla is part of the 'south-western' element of Tasmania's lichen flora (Kantvilas 1995) and is restricted to the highly siliceous, pre-Carboniferous rock types such as Precambrian quartzite and Ordovician conglomerate that dominate the western half of the island (Fig. 3C). The outlying record from Devonian granite on Tasmania's East Coast is not unusual in that this area, which is subject to coastal mists, supports many other, mainly 'south-western' plants. Unlike several other species of the genus, for example *U. decussata, U. nylanderiana* and *U. subglabra*, *U. polyphylla* is also found in the wettest areas, where the annual rainfall exceeds 2000 mm (Fig. 2C). Like *U. cylindrica*, with which it typically occurs, *U. polyphylla* has a broad altitudinal range (*c.* 400-1370 m), extending from low elevation buttongrass moorlands to alpine and subalpine heathlands. This is a cosmopolitan species that in Australia also occurs in New South Wales, the A.C.T., Victoria and Western Australia.

Representative specimens examined: **TASMANIA:** Cradle Plateau, 41°40'S 145°55'E, 1040 m alt., 8.i.1972, *G.C. Bratt 72/37* (HO); Sentinel Ridge, northern slopes, 42°52'S 146°13'E, 900 m alt., 16.iii.1968, *G.C. Bratt & J.A. Cashin 68/202* (HO); Hansons Peak, 41°40'S 145°39'E, 24.ii.1968, *R.B. Filson 10707* (MEL); summit of Mt Tim Shea, 42°42'S 145°20'E, 940 m alt., 26.iv.1992, *J.A. Elix 27053* (CANB); Moores Pimple summit, 41°52'S 145°29'E, 880 m alt., 3.i.1974, *G.C. Bratt 74/55* (HO); Crater Peak, 41°39'S 145°56'E, 1200 m alt., 16.ii.1984, *G. Kantvilas & P. James 411/84* (BM, HO); N foothills of Denison Range, 42°27'S 146°15'E, 750 m alt., 13.x.1981, *J. Jarman 842/81* (HO); The Thumbs, 42°39'S 146°18'E, 1080 m alt., 3.ii.1973, *G.C. Bratt & K.M. Mackay 73/44* (HO); Elliot Range, 42°28'S 145°43'E, 880 m alt., 12.i.1985, *G. Kantvilas s.n.* (HO); Schnells Ridge, 43°01'S 146°26'E, 29.vi.1973, *G.C. Bratt 73/882* (HO); Ben Lomond National Park, 41°32'S 147°30'E, ii.1967, *D. McVean 6775* (HO).

5. *Umbilicaria subglabra* (Nyl.) Harm.

Thallus monophyllous or, less commonly, polyphyllous, 2–6(–10) cm diam., thin and fragile to rather tough, occasionally with scattered, irregular perforations and with margins ± torn, often white-crisped, inrolled or ascending, occasionally becoming laciniate; upper surface dull, smooth or minutely scabrid, pale to dark grey or brown-grey, with a white necral layer often extending over the entire thallus, minutely radially or reticulately cracked to striate at the umbo; lower surface smooth, dull, pale or dark grey, continuously or patchily covered with sooty, black thalloconidia. *Rhizinomorphs* absent. *Thalloconidia* single-celled, roundish, (5–)6–8(–10) µm diam. *Apothecia* occasional, 0.5–2.5(–4.5) mm diam., black, substipitate to stipitate; disc not gyrose, smooth (leiodise), plane, becoming convex with age; margin persistent, elevated above the level of the disc. *Ascospores* hyaline, ellipsoid, 10–16(–20) × (3–)5–9 µm. *Pycnidia* laminal, mostly towards the lobe margins; conidia fusiform, 2.5– 3.5(–5) × 0.8–1 µm. *Chemistry:* gyrophoric acid (major), lecanoric acid (minor), ± umbilicaric acid (minor). For further descriptions see Galloway (1985), Hestmark (2004), Krog & Swinscow (1986) and Krzewicka (2004). (Figs 7A–C)

Remarks: This species is characterised by the pale to dark grey upper surface that commonly has a white necral layer centrally or extending over the entire thallus, and fine, thin cracks radiating from the central umbo. The lobe margins are frequently torn, ragged and eroded whitish. This is the only Tasmanian species of the genus with leiodise apothecia (Fig. 7C); the others are gyrose (Figs 1C, 5C and 8C) or, in the case of *U. decussata*, omphalodise. However, some apothecia may rarely have a contorted, flexuose margin that may appear almost gyrose. Of the other *Umbilicaria* species that lack rhizinomorphs, *U. nylanderiana* and *U. decussata* differ from *U. subglabra* by their ridged and/or puckered upper surface, whereas *U. polyphylla* differs by its ± uniformly dark thallus of

overlapping lobes; furthermore, in this species, the single-celled thalloconidia frequently coalesce into roundish clusters. Earlier records of *U. atropruinosa* var. *cinerascens* Ach. from Tasmania (Wilson 1893) refer to *U. subglabra* (Blackman *et al.* 1974).

Distribution and Ecology: This is a locally common alpine species, mostly found on dolerite and only very rarely on Precambrian quartzite (Fig. 3B). Its known altitudinal range is *c.* 1000-1470 m, and although some records are from wetter, western areas of Tasmania, most are from lower rainfall regions (< 2000 mm per annum) (Fig. 2B). This species is best developed on steeply inclined or vertical rock surfaces, mostly with a sunny, exposed aspect, where competition from other macrolichens and from bryophytes is minimal. *Umbilicaria subglabra* is a bipolar species, also reported from Europe, Asia and North America (Hestmark 2004) and New Zealand (Galloway 1985). In Australia, it also occurs in New South Wales, the A.C.T. and Victoria.

Representative specimens examined: **TASMANIA**: Mt Jerusalem, 41°49'S 146°19'E, 8.xii.1987, *G. Kantvilas 109/87* (HO); summit of Drys Bluff, 41°42'S 146°49'E, 1290 m alt., 23.vi.2002, *G. Kantvilas 356/02* (HO); Windy Moor, 42°40'S 146°39'E, 1180 m alt., 30.xii.2001, *G. Kantvilas 1346/01* (HO); summit of Bent Bluff, Ben Lomond Plateau, 41°37'S 147°45'E, 25.v.1997, *P. Buchanan s.n.* (HO); Liawenee, 41°54'S 146°40'E, 1020 m alt., 2.v.1980, *G. Kantvilas 159/80A* (BM, HO); Split Rock, 41°52'S 146°40'E, 1280 m alt., 6.xii.1991, *G. Kantvilas 423/91* (HO); Devil's Gullet, *c.* 54 km S of Devonport, 41°40'S 146°21'E, 1148 m alt., 14.xi.1971, *G.C. Bratt & J.A. Cashin 71/1557* (HO); Coalmine Crag, 41°33'S 147°39'E, 1470 m alt., 28.iv.1998, *G. Kantvilas 89/98* (HO); Lake Augusta, 41°50'S 146°34'E, 840 m alt., 1970, *G.C. & M.H. Bratt 70/250* (HO); summit of Mt Victoria, 41°20'S 147°50'E, 1200 m alt., 8.i.1997, *G. Kantvilas 11/97* (HO); Mt Penny West, 42°02'S 146°56'E, 1150 m alt., 4.iv.1969, *G.C. Bratt & K.M. Mackay 69/159* (HO).

6. *Umbilicaria umbilicarioides* (B. Stein) Krog & Swinscow

Thallus polyphyllous, 3–10(–20) cm diam.; upper surface grey to black, often patchily or continuously pale grey-pruinose, typically finely areolate-scabrid; lower surface pinkish to beige-brown to black (especially near the umbilicus), epruinose or occasionally with patchy, sparse, grey pruina, mostly smooth but sometimes weakly areolate, especially in blackened areas near the umbilicus. *Rhizinomorphs* very abundant, laminal on the upper and lower surfaces, and marginal where they frequently form a dense fringe, 0.5–1.5(–3) mm long, black, mostly terete, richly branched, shrubby to ± coralloid; thallyles frequent. *Thalloconidia* abundant to sparse, occurring near the apices of rhizinomorphs, multicellular, roundish, (15–)20–40(–60) µm wide; individual cells 5–10 µm wide. *Apothecia* occasional to frequent, substipitate; disc gyrose, plane to convex. *Ascospores* ellipsoid to oblong-ellipsoid, 12–18 × 6–9 µm. *Pycnidia* scattered, immersed, visible as black dots on the upper surface; conidia bacilliform to fusiform, 3–4 × 0.5–0.7 µm. *Chemistry:* lacking any substances detectable by t.l.c. For additional descriptions, see Hestmark (1990), Krog & Swinscow (1986) and Krzewicka & Smykla (2004); also Galloway (1985) as *U. propagulifera*. (Figs 8A–C)

Remarks: This species is very similar to *U. cylindrica*, sharing with that species a polyphyllous thallus, abundant rhizinomorphs, gyrose apothecia and the absence of lichen substances. *Umbilicaria umbilicarioides* differs chiefly in developing thalloconidia in irregular clumps on the rhizinomorphs. However, in some thalli, the number of thalloconidia becomes very few and the species appears to grade into *U. cylindrica* (see under that species). The problem is further complicated by the fact that these two species frequently co-occur and are intermixed in large numbers of herbarium collections. The morphology of the rhizinomorphs also aids in the separation of the two species. Whereas

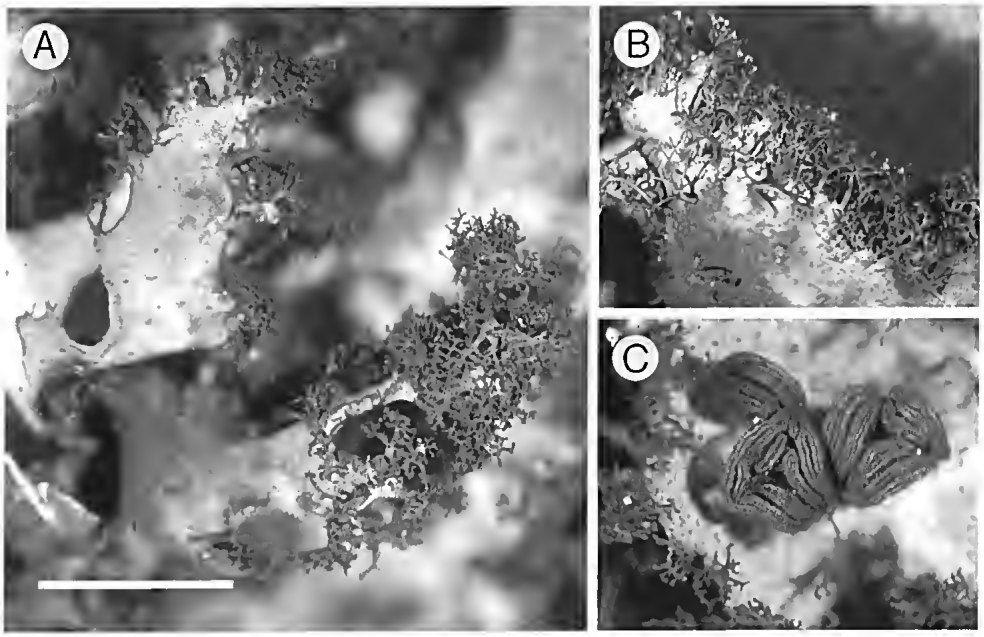

Figure 8. *Umbilicaria umbilicarioides (Kantvilas 83/05)*: A- detail of upper surface with shrubby rhizinomorphs (scale = 5 mm); B- detail of lower surface and rhizinomorphs; C- gyrose apothecia.

in *U. cylindrica*, these occur as tapered, smooth, fureate extensions of rather laecrate, ineised lobes margins (Fig. 1C), in *U. umbilicarioides* they tend to form shrubby, densely ± squarrosely branched, ± coralloid, diserete outgrowths from the thallus lobes (Fig. 8A). In addition, thallyles are abundant in *U. umbilicarioides* but less so in *U. cylindrica*.

Tasmanian and Australian speeimens of *U. umbilicarioides* in BM were named *U. propagulifera* by P. Topham in the early 1980s (P. James *in litt.*) and this name has persisted in various Tasmanian and Australian eheeklists (e.g. Kantvilas 1994; MeCarthy 2003). Krog & Swinseow (1986) synonymised *U. propagulifera* under *U. umbilicarioides*, described from the East Afriean highlands, but eautioned against the widespread extrapolation of all world records of *U. propagulifera* to *U. umbilicarioides*. They specifieally cite Australasian material, which they inelude within *U. cylindrica*. However, as diseussed under *U. cylindrica* above, it is a poor option to broaden the coneept of a widespread, well-defined taxon like *U. cylindrica* to inelude speeimens with abundant thalloeonidia. European speeimens of *U. propagulifera* (Topham *et al.* 1982) are now referable to a related, exelusively Northern Hemisphere taxon. *U. deudrophora* (Hestmark 1993).

Examination of a wide range of herbarium material of *U. umbilicarioides sens. str.* revealed some differenees with Tasmanian material. Thalloeonidia on speeimens from Afriea and Antaretica tend to be more abundant and prominent. Likewise, the rhizinomorphs on the lower surfaee are often very abundant and form a rather shaggy 'tomentum'. The thallus of Antaretic material is also often markedly grey-pruinose, eontrasting sharply with the black rhizinomorphs, whereas Tasmanian specimens, even when partly pruinose, appear uniformly grey to blaek. In African material, the lower surface is also quite markedly seabrid-areolate (a eharaeter highlighted by Krog & Swinscow 1986), whereas Tasmanian material has a mostly smooth underside, exeept in the vieinity of the umbilieus. This particular eharacter, whilst helping to distinguish *U. cylindrica*

and *U. umbilicarioides* in New Zealand (D.J. Galloway *in litt.*) appears to be of limited use in Tasmanian specimens. Although some African specimens of *U. umbilicarioides* are ± identical with Tasmanian specimens, in general the species in Africa exhibits a far wider range of variation, grading from robust thalli with dense rhizinomorphs to rather thin thalli with few rhizinomorphs. Thus further study of Tasmanian (and Australian) populations, and of their relationship with *U. cylindrica sens. str.*, is required and our determinations of this species at this stage are tentative.

Topham *et al.* (1982) suggested that there is an inverse link between the production of apothecia and of thalloconidia, but this is not generally evident in Tasmanian specimens of *U. umbilicarioides*. Apothecia with well-developed asci and spores are common and, if anything, well-developed ascospores appear to be less common in the exclusively sexually reproducing *U. cylindrica*. Krog & Swinscow (1986) also did not observe any suppression of apothecial production in abundantly thalloconidiate specimens.

Distribution and Ecology: In Tasmania, *U. umbilicarioides* is a very common species on the dolerite peaks of the central and north-eastern highlands, ranging from subalpine to alpine elevations (Fig. 3D). Its distribution appears to be determined by altitude and rock type rather than rainfall (Fig. 2D). It typically grows on the apices of large boulders and rock outcrops where it forms extensive associations with *Usnea torulosa* (Müll. Arg.) Zahlbr., *Parmelia signifera* Nyl. *Pseudephebe pubescens* (L.) M. Choisy, *Protoparmelia badia* (Hoffm.) Hafellner, species of *Xanthoparmelia* (incl. *Neofuscelia*), and other species of *Umbilicaria*. On peaks where fires have occurred frequently, it tends to be confined to more sheltered, fire-protected niches. As with other species of *Umbilicaria*, its post-fire recovery appears to be very limited; for example, on Mt Wellington, even nearly 40 years after a severe fire, no signs of recovery of this species have been observed (see also Blackman *et al.* 1974). This species appears to be confined to the Southern Hemisphere and has been reported from Africa, South America and the Antarctic region (Krog & Swinscow 1986), as well as from New Zealand (D.J. Galloway *in litt.*). In Australia, *U. umbilicarioides* also occurs in Victoria, New South Wales and the A.C.T.

Representative specimens examined: **TASMANIA**: summit plateau, Mother Cummings peak, 41°41'S 146° 32'E, 1250 m alt., 3.iii.2002, *G. Kantvilas 154/02* (HO); Table Mountain, 42°14'S 147°08'E, 1095 m alt., 18.vi.1972, *G.C. Bratt & J.A. Cashin 72/410* (HO); Pine Lake, 41°45'S 146°42'E, 1050 m alt., 14.vi.1965, *G.C. Bratt & J.A. Cashin 2339* (HO); Mt Mueller, western peak, 42°46'S 146°28'E, 1150 m alt., 16.xii.1998, *G. Kantvilas 259/98* (HO); Wylds Craig summit, 42°28'S 146°23'E, 1330 m alt., 28.xii.1998, *G. Kantvilas 276/98* (HO); Mt Marian near Tresile Mountain, 42°53'S 147°06'E, 5.ix.1967, *G.C. Bratt & F.N. Lakin 67/74* (HO); Great Lake Plateau, 41°57'S 146°40'E, 1000 m alt., 18.i.1969, *G.C. & M.H. Bratt & K.M. Mackay 69/28* (HO); Wild Dog Tier, 41°47'S 146°34'E, 1340 m alt., 11.iii.2001, *G. Kantvilas 279/01* (HO); Hansons Peak, Cradle Mountain, 41°40'S 145°58'E, 1150 m alt., *G.C. Bratt & J.A. Cashin 3625* (HO); Mt Field East moor, 42°39'S 146°38'E, 30.v.1970, *G.C. Bratt & F.N. Lakin 70/708* (HO).

Acknowledgements

We thank Jean Jarman for her diligent and patient preparation of the figures, Dalia Howe for curatorial assistance and preparing base distribution maps, Jack Elix for confirmation of some of the chemical analyses, and the curators of herbaria cited for loan of material. David Galloway is also thanked for many helpful comments on the manuscripts in the capacity of a referee. SL acknowledges financial support from the Australian Biological Resources Study and the provision of work facilities at the Royal Botanic Gardens, Melbourne.

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Muelleria 25: 21-58 (2007)

A taxonomic treatment of tribe Anthemideae (Asteraceae) in Australia

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Abstract

A concise taxonomic treatment of tribe Anthemideae (Asteraceae) in Australia is presented, with descriptions of all 43 species in the 19 genera in Australia. Keys to genera and species are presented. The South African species *Pentzia globosa* Less. is recognised for the first time as naturalised in Australia.

Introduction

Tribe Anthemideae is a large tribe of 1741 species in the Asteraceae (Bremer & Humphries 1993). It is widely distributed in Eurasia and Africa and to a lesser extent in North America. Australia, however, is rather poorly represented in terms of native species. Nineteen genera in the Anthemideae are represented in Australia, with 17 of these entirely of introduced species. *Cotula* is represented by both native and introduced species, and *Leptinella* is represented by only native species. No genera are endemic. Genera in Australia come from a broad range of subtribes. There are single generic representatives from eight of the 12 subtribes recognised in Bremer & Humphries (1993). Conversely, seven genera are from subtribe Matricariinae.

All species occurring in Australia have their entire or major part of their Australian distribution in temperate latitudes. Many species in tribe Anthemideae have become naturalised in Australia through escape from gardens, and most of these species are only found close to human habitation. They can be considered to be weakly naturalised. Five genera, *Centipeda*, *Ceratogyne*, *Dimorphocoma*, *Elachanthus* and *Isoetopsis*, that until recently had been included in tribe Anthemideae, are now been placed elsewhere and are not described here.

The taxonomic review presented here is drawn from a *Flora of Australia* account of the Anthemideae recently prepared by the author. As it is likely to be several years before the *Flora* account is published, it is considered desirable to present the findings of my research at this time.

The Anthemideae are herbs or shrubs that are often glandular and aromatic and they typically possess truncate-penicillate style-branches. The following features, although not defining for the tribe, are frequently seen in species in Australia: leaves are often much-divided; the disc and receptacle often becomes conical as flowering progresses, and if the capitula are radiate, e.g. species in *Chamaemelum* and *Anthemis*, the ray florets tend to persist and rays become deflexed to form an apron below this conical disc; involucral bracts often have a prolonged hyaline apex; and the pappus of achenes is generally either corona-like or lacking. The glands of the many glandular species appear as minute golden or orange globular structures located on the surface of various structures, including stems, leaves, bracts, corollas and achenes.

Three genera of the Matricariinae, *Leptinella*, *Cotula* and *Soliva*, are closely related. They comprise dwarf herbs with compressed, unribbed achenes, and often with sheathing leaf-bases. The involucral bracts of the species are more or less uniform in length. In the

latter two genera, the outer florets mostly lack a corolla, and in *Cotula*, the florets are sometimes pedicellate.

Individual species in two genera, *Anacyclus* and *Santolina*, have been collected in Australia but are not considered naturalised at this time. Nonetheless, they are included in the key to genera. *Anacyclus radiatus* Lois., native to southern Europe and north-western Africa, was collected from a rubbish dump in Adelaide in 1918 and has been described in South Australian floras. *Santolina chamaecyparissus* L., native to southern Europe, was collected from the Stanthorpe district in far south-eastern Queensland in 1971, but it is unknown whether the plant was from a naturalised population. Species in *Achillea*, *Santolina*, and *Tanacetum* that have been collected but not considered naturalised are discussed under their respective generic treatments.

Tribe ANTHEMIDEAE

Herbs, subshrubs or shrubs, often aromatic and glandular, not spinescent, taprooted or not; latex lacking. Hairs simple. Leaves alternate, occasionally opposite or rosulate, pinnate-veined, not spiny. Capitula radiate, disciform or discoid, pedunculate, or ± sessile in *Artemisia* and *Soliva*; involucre generally 2–multiseriate with bracts imbricate, all of similar size or more often grading to longer inwards, free, without outgrowths; receptacle commonly convex to conical, epaleate or paleate. Florets of radiate capitula: disc florets actinomorphic, bisexual; ray florets zygomorphic, female, with tube glabrous; ligules mostly yellow or white, with apex obtuse, hardly lobed or weakly 2- or 3-lobed. Florets of disciform capitula: central florets actinomorphic, bisexual or functionally male; outer florets actinomorphic or lacking a corolla, female, in *Cotula turbinata* zygomorphic florets present between central and outer florets. Florets of discoid capitula all actinomorphic, bisexual. Anthers mostly ecalcarate, ecaudate, or caudate in *Achillea*, with apical appendage rounded to acute, peracute to subulate in *Artemisia*. Style glabrous; style-branches short to long, not tapering, often penicillate apically, with hairs obtuse, with two stigmatic lines. Achenes homomorphic or dimorphic, terete, angular or compressed, not beaked, with ribs mostly smooth or unribbed. Pappus small, membranous, or of showy scales in *Ursinia*, or absent.

Notes: The terms female, male and bisexual for florets indicates the functional sex of the florets, e.g. a female floret will be both pistillate and fertile. All central or disc florets have both pistils and stamens.

Key to genera

1 Capitula radiate, with ligules 1–50 mm long (if < 4 mm long then ≥ 2 mm wide)

2 Receptacle paleate

3 Leaves entire or 1-pinnatisect with a few entire segments, sericeous; involucral bracts 8 or 9, with inner bracts fused and copiously villous..... **14. *Eriocephalus***

3: Leaves 1–3-pinnatisect, not sericeous; involucral bracts > 10, with inner bracts free, glabrous or nearly so

4 Plants rhizomatous; mid-stem leaves with l:w ratio 4–7 and mostly with 15–25 primary segments per side; inflorescences dense, corymbiform, of numerous capitula; ligules c. 5 per capitulum, 1–3 mm long ..... **4. *Achillea***

4: Plants not rhizomatous or if so capitula 1 or few per inflorescence; mid-stem leaves not entirely as above; inflorescences various; ligules > 5 per capitulum, > 3 mm long

5 Involucral bracts of outer and middle series ovate, conspicuously delineated by a darker margin; palcae forming a cylinder around disc florets; achene with a pappus of ovate white scales c. 4 mm long..... **1. *Ursinia***

5: Involucral bracts of outer and middle series variously shaped, not delineated by a darker margin; palcae not forming a cylinder around disc florets; achene with pappus not as above or absent

6 Receptacular palcae c. 2–4 mm wide; ligules yellow..... ***Anacyclus*** **(see Introduction)**

6: Receptacular palcae c. 0.3–1 mm wide; ligules white or yellow

7 Peduncle commonly > 10 cm long; stereome of involucral bracts 1.5–2 mm wide; palea with a red longitudinal resin duct; achenes copiously woolly..... **5. *Lasiospermum***

7: Peduncle < 10 cm long; stereome of involucral bracts 0.5–1 mm wide; palea lacking a red longitudinal resin duct; achenes glabrous

8 ± Erect annuals or biennials; involucre dull to slightly lustrous, variably hairy; receptacular paleae with apex peracute to spine-like; achenes c. 8–10-ribbed. ..... **7. *Anthemis***

8: Rhizomatous, ascending perennials; involucre somewhat lustrous, sparsely haired; receptacular palcae with apex subacute to obtuse; achenes 3-ribbed..... **6. *Chamaemelum***

2: Receptacle epaleate

9 Leaves 2- or 3-pinnatisect, with rachides and segments < 1 mm wide

10 Involucre 5–7 mm long; mature receptacle hemispherical; achenes 1.8–2.2 mm long, prominently 3-ribbed on one face, with a prominent pair of large glands distally..... **12. *Tripleurospermum***

10: Involucre 2–3 mm long; mature receptacle narrow-conical to ovoid; achene c. 1 mm long, 4- or 5-ribbed on one face, without prominent glands..... **13. *Matricaria***

9: Leaves undivided, lobate or if 1- or 2-pinnatisect then at least the rachis > 1 mm wide

11 Plants to c. 0.3 m tall; ray florets sterile, with a white ligule and a corona c. 2 mm long..... **10. *Mauranthemum***

11: Plants to c. 1.0 m tall; ray florets fertile, with a white or yellow ligule, but no corona

12 Involucre 3–5 mm long with bracts keeled; inner series of bracts with hyaline extension c. 0.2 mm long..... **2. *Tanacetum***

12: Involucre 7–12 mm long, with bracts not keeled; inner series of bracts with hyaline extension 1–5 mm long

13 Ligules white; leaves undivided or lobate; ray achenes ± terete, c. 1 mm diam ..... **11. *Leucanthemum***

13: Ligules yellow, or if white then leaves pinnatisect; ray achenes with lateral wings, 1.2–4 mm diam.

14 Shrubs; base of leaves ≤ diam. of adjacent stem; ligules white ..... **8. *Argyranthemum***

14: Perennial herbs; at least the upper-stem leaves with base > diam. of adjacent stem; ligules yellow ..... **9. *Chrysanthemum***

1: Capitula discoid or disciform (if any ligules/ligule-like processes evident then these < 1 mm long or not from outer series of florets)

15 Plants mostly > 50 cm high; capitula disciform

16 Leaves silvery or grey on one or both surfaces, with up to 5 primary segments per side; inflorescences pyramidal to spiciform; capitula sessile or nearly so and/or grey-tomentose ..... **3. *Artemisia***

16: Leaves ± green on both sides, with 10 or more primary segments per side; inflorescences corymbiform; capitula clearly pedunculate, not grey-tomentose ..... **2. *Tanacetum***

15: Plants < 50 cm high; capitula discoid or disciform; if ever slightly higher than 50 cm then capitula discoid

17 Plants herbaceous, prostrate or if erect then at least outer florets pedicellate; involucral bracts all ± equal in length; capitula disciform

18 Capitula sessile; style persisting as a spine in fruit ..... **19. *Soliva***

18: Capitula pedunculate; style not persisting as a spine in fruit

19 Plants erect, sprawling or prostrate, not truly rhizomatous; leaves eglandular; disc florets fertile ..... **17. *Cotula***

19: Plants prostrate, rhizomatous; leaves glandular; disc florets sterile

20 Plants glabrous; outer florets lacking a corolla ..... **17. *Cotula***

20: Plants with hairs sparse to dense, but sometimes early glabrescent; outer florets with a corolla (corolla persisting in fruit) ..... **18. *Leptinella***

17: Plants woody or herbaceous, erect or sprawling; florets not pedicellate; involucral bracts gradational or all ± equal in length; capitula discoid

21 Woody sub-shrubs; leaves often greyish, 1- or 2-pinnatisect; primary segments of leaves 0.5–2 (–4) mm long

22 Leaves < 1 cm long; receptacle epaleate; corolla 1.5–2 mm long ..... **16. *Pentzia***

22: Leaves > 1 cm long; receptacle paleate; corolla 3–4 mm long ..... ***Santolina* (see Introduction)**

21: Annual herbs; leaves green, 2- or 3-pinnatisect; primary segments of at least larger leaves > 4 mm long

23 Plants glabrous; capitula ovoid, with disc greenish-yellow; corolla c. 1 mm long ..... **13. *Matricaria***

23: Plants with scattered hairs; capitula globose or sub-globose, with disc yellow; corolla c. 2 mm long ..... **15. *Oncosiphon***

1. URSINIA Gaertn., *Fruct. Sem. Pl.* 2: 462 (1791)

Annual or perennial herbs or subshrubs, erect or sprawling. Leaves 1- or 2-pinnatisect. Capitula 1 to several per stem, radiate (in Australia) or discoid; involucre multiseriate, with bracts gradational in length; receptacle paleate. Ray florets neuter or female, sterile or fertile; disc florets bisexual, with corolla 5-lobed. Achenes ± homomorphic, ± terete, 5-ribbed. Pappus present.

A genus of 38 species mainly from South Africa, but also from Namibia, Botswana and Ethiopia. Features unique to this genus compared to other Anthemideae in Australia include the cylindrical receptacular paleae, the long hairs arising from the base of the achenes, and the pappus morphology. The margin of the outer and middle series of involucral bracts is conspicuously pigmented.

Key to species

Annuals; apex of outermost involucral bracts with hyaline extension not or hardly developed, usually hairy; paleae truncate, without any extension; achenes narrow-obloid, 5–8 mm long with a pappus of 5 broad scales only, with a basal tuft of capillary hairs.....**1. *U. anthemoides***

Perennials; apex of outermost involucral bracts with a hyaline extension c. 2 mm long, ± glabrous; paleae with a rotund apical extension; achenes obconical, c. 3 mm long, with a pappus of 5 broad scales and 5 setaceous scales, without a basal tuft of capillary hairs.....**2. *U. speciosa***

1. *_Ursinia anthemoides_ (L.) Poir., *in* J.B.A.P. de Monnet de Lamarck, *Encycl.* 8: 257 (1808)

Arctotis anthemoides L., *Amoen. Acad.* 4: 330 (1763).

Type: Locality unknown, Herb. Linn. 1036.22; holo: LINN *n.v.*, *fide* M.Prassler, *op. cit.* 429.

Annuals to c. 0.5 m high, sparsely or sometimes moderately hairy on stems and leaves. Leaves to c. 5 cm long; rachides and ultimate segments < 1 mm wide, with acicular tips if present c. 0.1 mm long; primary segments up to 10 per side. Capitulum 1 per stem, 12–25 mm diam.; peduncle 5–15 cm long, sparsely hairy or glabrous at anthesis. Involucre 5–8 mm long, patchily cobwebby; outer series of bracts c. 2 mm long, without a hyaline extension, hairy distally; inner series of bracts with hyaline extension 1–2 mm long; paleae narrow-oblong, c. 10 mm long, 0.5–1 mm wide, truncate apically, golden-brown. Ray florets 7–12, neuter; ligule c. 5–15 mm long, orange or yellow adaxially (pale when dried). Disc florets: corolla c. 3 mm long, with tube longer and much narrower than limb; lobes c. 0.3 mm long, usually purplish. Achenes narrow-obloid, 5–8 mm long, glabrous, pale or dark, with a basal tuft of capillary hairs. Pappus comprising 5 ovate spreading scales, c. 4 mm long, white with a triangular brown or purple patch baso-medially.

Notes: Native to South Africa. Occurs in south-western Western Australia. Grows in disturbed sites such as roadsides and wasteland on a variety of soils. Flowers Aug.–Sept.

The subsp. in Western Australia. is subsp. *anthemoides*. Subsp. *versicolor* (DC.) Prassler has capitula with ligules that are longer and with a dark basal patch.

Representative specimens: WESTERN AUSTRALIA: Graham Rock, c. 18 km E of Hyden, *E.N.S.Jackson 3393* (AD, PERTH); 26 km S of Yalingup on Caves Rd, *N.S.Lander 1192* (PERTH); NE foot of Peak Charles, Fizgerald Peaks, Roe district, *J.Taylor 702*, *M.D.Crisp & R.Jackson* (CANB, MEL).

2. *_Ursinia speciosa_ DC., *Prodr.* 5: 690 (1836)

Type: Locality unknown, Southern Africa, *Drege 6368*; lecto: G, *fide* M.Prassler, *Mitt. Bot. Staatssammt. Munchen* 6: 462 (1967).

[*U. chrysanthemoides auct. non* (Less.) Harv. (1865): J.R.Tovey, *Proc. Roy. Soc. Victoria* 22(1): 25 (1907); S.W.L.Jacobs & J.Pickard, *Pl. New South Wales* 87 (1981)]

Perennials to c. 40 cm high, ± glabrous. Leaves to c. 4 cm long; rachides and ultimate segments < 1 mm wide, with acicular tips commonly 0.3–0.5 mm long; primary segments up to 5 per side. Capitulum 1 per stem, 25–40 mm diam.; pedunele 5–15 cm long. Involucre 7–9 mm long, glabrous; outer series of bracts 2–4 mm long, with a hyaline extension 2–4 mm long, glabrous; inner series of bracts with a hyaline extension; paleae narrow-oblong, c. 5 mm long, 0.5–1 mm wide, with a rotund hyaline apical extension, pale to golden. Ray florets 15–25, neuter; ligule c. 15 mm long, orange adaxially (drying yellow). Disc florets: corolla c. 3 mm long, with tube longer and narrower than limb; lobes c. 0.6 mm long, purplish. Achenes obovoid, c. 3 mm long, glabrous, pale or reddish, without a basal tuft of capillary hairs. Pappus comprising an outer series of 5 ovate spreading scales c. 4 mm long white with a pale baso-medial patch and an inner series of 5 filiform scales.

Notes: Native to southern Africa. Occurs predominantly in south-western Western Australia, but also established in Stockton, eastern New South Wales. There are old records from Melbourne, Victoria, but populations do not appear to have persisted. Grows in grey or white sand, and has been recorded from woodland. Flowers spring. The name *U. chrysanthemoides* was incorrectly applied to specimens of *U. speciosa* collected in New South Wales.

Representative specimens: WESTERN AUSTRALIA: 2 km E of Hamelin Bay, *G.J.Keighery 9201* (PERTH); East Katanning, 21 Sept. 1958, *A.Browne* (PERTH). NEW SOUTH WALES: alongside "Stanley Park', Fullerton Cove Rd, *J.R.Hosking 2531 & G.C.Pritchard* (CANB, MEL, NSW). VICTORIA: Coode Is., Oct. 1908, *J.R.Tovey & C.French Jr* (MEL).

2. TANACETUM L., *Sp. Pl.* 2: 843 (1753)

Perennial herbs, erect. Leaves lobate or 1- or 2-pinnatisect. Capitula several to numerous per stem, radiate or discifonn; involucre multiseriate, with bracts gradational in length; receptacle epaleate. Outer florets female; disc florets bisexual, with corolla 5-lobed. Achenes ± homomorphic, ± quadrangular, regularly 5–12-ribbed, glabrous. Pappus present.

Species in Australia are rhizomatous, odorous on crushing, with weakly keeled involucral bracts, with linear peduncular bracts, and with achenes bearing a minute corona. *Tanacetum ptarmiciflorum* (Webb & Berthel.) Sch.Bip., a popular horticultural species from the Canary Is. with distinctive lacy foliage and white ligules, has been recorded from a roadside near Rhynie in far south-eastern Australia (*R.Bates 14151* AD), and *T. cinerariifolium* (Trevir.) Sch.Bip. has been recorded from a roadside in north-eastern Tasmania. Neither are considered naturalised. The latter is cultivated in some parts of the world to obtain pyrethrum, a natural insecticide.

Key to species

1 Leaves grey

2 Capitula several per inflorescence ..... ***T. ptarmiciflorum*** **(see notes above)**
2: Capitula solitary ..... ***T. cinerariifolium*** **(see notes above)**

1: Leaves green

3 Leaves with 10–20 primary segments per side; ligules lacking ..... **2. *T. vulgare***
3: Leaves with 3–7 primary lobes/segments per side; ligules present ..... **1. *T. parthenium***

1. *_Tanacetum parthenium_ (L.) Sch.Bip., *Tanaceteen* 55 (1844)

Matricaria parthenium L., *Sp. Pl.* 2: 890 (1753); *Chrysanthemum parthenium* (L.) Bernh., *Syst. Verz.* 145 (1800).

Type: Europe; *n.v.*

Plants to c. 70 cm high, hairy on stems and leaves. Leaves to c. 9 cm long, 1- or 2-pinnatisect; primary segments 3–7; major rachides usually 3–8 mm wide. Capitula a few to numerous per stem, generally not congested, radiate, 12–20 mm diam.; peduncle to c. 5 cm long. Involucre 3–5 mm long, cobwebby or glabrous; inner series of bracts with hyaline extension c. 0.2 mm long. Ray florets 10 to numerous, fertile; ligule 4–8 mm long, white. Disc florets: corolla 1.5–2 mm long, with tube ± as broad as and as long as the yellow limb. Achenes of disc florets obovoid, 1–1.5 mm long, 5–8-ribbed, pale brown. *Feverfew.*

Notes: Native to Europe. Occurs in south-eastern South Australia, eastern New South Wales, southern Victoria, and eastern Tasmania. Grows in disturbed sites such as roadsides. Flowers spring–autumn.

A garden escape that is weakly naturalised. Horticultural variants include plants with increased numbers of ligulate florets. Plants without non-radiate capitula also occur but these have not been recorded in Australia.

Representative specimens: SOUTH AUSTRALIA: along Torrens at St. Peters, *R.J.Bates 35629* (AD, MEL). NEW SOUTH WALES: Moss Vale, 28 Feb. 1971, *E.J.McBarron* (NSW). VICTORIA: E side of Yarrowee R., Ballarat, *V.Stajsic 1168* (CANB, MEL); near the Chalet, Mt Buffalo, *A.R.Bean 9459* (BRI, MEL). TASMANIA: Russell Falls, Mt Field National Park, 13 Jan. 1943, W.M.Curtis (HO).

2. *_Tanacetum vulgare_ L., *Sp. Pl.* 2: 844 (1753)

Chrysanthemum vulgare (L.) Bernh., *Syst. Verz.* 144 (1800).

Type: Herb. Clifford 398, Tanacetum no. 3; lecto: BM, *fide* C.J.Humphries, *Regnum Veg.* 127: 92 (1993)

T. boreale Fischer ex DC., *Prodr.* 6: 128 (1838). Type: Ukraine and Russian Federation; *n.v.*

[*T. huronense auct. non* Nutt. (1818): J.M.Black, *Nat. Fl. S. Australia* 83 (1909); The author also erroneously ascribed the authority to Fischer]

Plants to c. 150 cm high, transiently pubescent on stems and leaves. Leaves to c. 25 cm long, 1–sub-3-pinnatisect; rachides and ultimate segments c. 1–3 mm wide; primary segments 10–20 per side, variously dissected. Capitula several to numerous per stem, moderately congested, disciform, 5–9 mm diam.; peduncle to c. 5 cm long. Involucre 3–5 mm long, slightly cobwebby or glabrous; inner series of bracts with hyaline extension c. 1 mm long. Outer florets with corolla 3-lobed, yellow. Central florets: corolla 1.5 mm long, with tube as broad as and as long as the yellow limb. Achenes of disc florets obovoid, 1.2–1.8 mm long, 5-ribbed, pale brown. *Common Tansy.*

Notes: Native to Europe, northern Asia and northern North America. Occurs in south-eastern South Australia, south-eastern Queensland, eastern New South Wales, southern Victoria, and eastern Tasmania. Flowers summer–autumn. An occasional garden escape. In South Australia there appears to be a distinctive form with leaves that are more deeply dissected, often moderately hairy, and with ultimate teeth/segments that are strongly infolded on pressing. This may be referable to *T. boreale*, a taxon more recently subsumed in *T. vulgare* or treated as a subspecies of it.

Representative specimens: SOUTH AUSTRALIA: Port MacDonnell, c. 25 km S of Mt Gambier, 14 Feb. 1948, *J.B.Cleland* (AD). QUEENSLAND: c. 6 km W of Mudgeeraba, 22 Jan. 1969, *M.Sampe* (BRI). NEW SOUTH WALES: c. 1 km E of East Kangaloon, c. 3.5 km due NNW of Robertson, *P.G.Kodela 141, T.A.James & M.Westmacott* (CANB, MEL, NE, NSW). AUSTRALIAN CAPITAL TERRITORY: Victoria St, near Hall, *E.M.Canning 6858* (AD, CANB, MEL, NSW). VICTORIA: Genoa, E Gippsland, *R.V.Smith 68/73* (MEL). TASMANIA: crossing of Clyde R., Bothwell, *A.E.Orchard 5349* (HO, MEL).

3. ARTEMISIA L., *Sp. Pl.* 2: 845 (1753)

Annual or perennial herbs, subshrubs or shrubs, erect. Leaves entire, lobed or variously pinnatisect. Capitula commonly numerous per stem, disciform, pedunculate or sessile; involucre 2- or 3-seriate, gradational in length or not; receptacle epaleate. Outer florets female, 2–4-lobed; disc florets bisexual (in Australia), sometimes functionally male, with corolla 5-lobed. Achenes ± homomorphic, quadrangular, ± smooth or 2-ribbed, glabrous. Pappus absent.

A genus of 388 species predominantly from the Northern Hemisphere. Species in Australia are all rhizomatous perennial herbs. Inflorescences are leafy panicles and even peduncular bracts are often leaf-like and exceed the involucre. Capitula are small and the female florets of the outer series have an obliquely tubular corolla not exceeding the involucre. Also distinctive in this genus is the apical appendage of the anthers which is peracute to subulate rather than acute to rounded. *Artemisia ludoviciana* Nutt. subsp. *albula* (Wooton) D.D.Keck was briefly naturalised in Oxley Park, Tamworth in north-eastern New South Wales. (*J.R.Hosking 728* CANB, MEL, NE, NSW); however, the only known population has now been removed.

Key to species

1 Leaves densely hairy on lower surface only ..... **2. *A. verlotiorum***
1: Leaves densely hairy on both surfaces

2 Capitula 1.5–2 mm diam., subsessile; uppermost leaves and panicle-bracts entire ..... ***A. ludoviciana*** (see notes above)
2: Capitula 3–6 mm diam., many distinctly pedunculate; uppermost leaves and panicle-bracts pinnatisect ..... **1. *A. arborescens***

1. *_Artemisia arborescens_ L., *Sp. Pl.* 2nd edn, 1188 (1763)

Type: 'Italia, Oriente' [Italy, Asia]; Herb. Linn. No. 988.10; lecto: LINN, *fide* Y.Ling, *Taxon* 47: 353 (1998).

Plants to c. 200 (–300) cm high, with a dense appressed wool on stems and branches. Leaves to c. 10 cm long, 1- or 2-pinnatisect, petiole-like basally, ± concolorous, with margin entire; rachides and ultimate segments usually 1–2 mm wide; primary segments commonly 2 or 3 per side; both surfaces completely obscured by appressed hairs. Capitula 4–7 mm diam.; peduncle subsessile or to c. 2 cm long. Involucre 3–5 mm long, densely woolly; most bracts of similar length; receptacle densely hairy. Outer florets c. 10, with corolla c. 1.2 mm long. Central florets numerous; corolla c. 1.5 mm long, with tube becoming firm, creamy-white, as broad as and as long as the yellow limb. Achenes of disc florets obovoid, c. 0.7 mm long. *Silver Wormwood.*

Notes: Native to the Mediterranean region and Middle East. Isolated occurrences in south-western Western Australia, south-eastern South Australia, southern New South

Wales, and Victoria. Grows in disturbed sites and often persists as a hedge near abandoned farmhouses. Flowers spring–summer.

A species that in the past was often grown to form hedges around rural properties. It is only weakly naturalised and has a scattered distribution. *Artemisia absinthium* L., is used horticulturally in Australia but is not considered naturalised. It resembles *A. arborescens* but is lower-growing (generally less than 100 cm high) and tends to sprawl, and is less densely sericeous so that plants look slightly greener. Furthermore, the leaves have relatively broader segments, panicles are laxer, and capitula are smaller (3–5 mm diam.) and with a greenish-yellow disc.

Representative specimens: WESTERN AUSTRALIA: Layman Bloek, Tuart Forest, *G.J.Keighery 14034* (PERTH). SOUTH AUSTRALIA: Clayton Rd, road to Kangarilla from Blewitt Springs, *H.P.Vonow 542* (AD, NSW). NEW SOUTH WALES: 10 km SE of Deniliquin, *W.E.Mulham 1453* (CANB). VICTORIA: near Sturgess Point on public land, Port Campbell, *G.W.Carr 0207-86* (AD, CANB, HO, MEL).

2. *_Artemisia verlotiorum_ Lamotte, *Mem. Acad. Sci. Belles-Lett. Clermont-Ferrand* 511 (1876)

Type: *n.v.*

Plants to c. 200 cm high, with a short pubescence on stems and branches. Leaves to c. 8 cm long, mostly 1- or 2-pinnatisect, petiole-like basally except for small pinnatisect auricles, strongly discolorous, with margin entire; rachides and ultimate segments usually 2–6 mm wide; primary segments 1–5 per side; upper surface glabrous or nearly so; lower surface appressed woolly. Capitula c. 2 mm diam.; sessile or peduncle to c. 2 mm long. Involucre 2.5–4 mm long, cobwebby; bracts gradational in length; receptacle glabrous. Outer florets c. 8–12, with corolla c. 1.2 mm long. Central florets c. 8–12; corolla c. 2.5 mm long, with tube narrower than and as long as the purple limb. Achenes of disc florets ellipsoid, c. 0.8 mm long. *Chinese Wormwood.*

Notes: Native to south-western China, the Himalayas and Malaysia. Occurs in south-eastern Australia in south-eastern Queensland, New South Wales and in Melbourne in south-central Victoria. Also naturalised in Europe, northern Africa and South America. Grows adjacent to watercourses, mostly in disturbed environments. Flowers summer–early winter.

There appears to be a few forms of this species in Australia. Plants collected in Canberra (e.g. *M.Gray & E.D'Arnay 6486* CANB) have inflorescences that have a high number of relatively narrow capitula that are extremely congested along branchlets. Plants in southern Queensland, e.g. a collection (e.g. *A.R.Bean 19043* BRI, CANB, MEL, NSW) have relatively few, less congested and smaller capitula and the disc is yellow-green. The indumentum of the branchlets differs in being spreading and curly. In Victoria, the capitula are largest, with the involucre 3–3.5 mm long, and c. 2 mm diam. Plants collected in the early 1900s from Melbourne, Victoria, are similar to *A. verlotiorum* but may be *A. vulgaris* L. Definitive separation of *A. verlotiorum* from *A. vulgaris* requires evidence of an extensive rhizomatous habit and overwintering rosettes. These early Melbourne collections lack this evidence but they differ from specimens determined as *A. verlotiorum* in having smaller and slightly more intricately dissected leaves, inflorescences with fewer capitula, and involucres larger (c. 4 mm long).

Representative specimens: QUEENSLAND: Zealey Rd, Nambour, *A.R.Bean 19043* (BRI, CANB, MEL). NEW SOUTH WALES: alongside Dumaresq Ck, upstream of Marsh St bridge,

J.R.Hosking 1575 & E.L.Cottage (CANB, MEL, NSW). AUSTRALIAN CAPITAL TERRITORY: Farrer, Canberra, *M.Gray & E.D'Arnay 6486* (CANB, NSW). VICTORIA: quarry on Myers Ck Rd, Healesville district, *M.G.Corrick 2718* (MEL).

4. ACHILLEA L., *Sp. Pl.* 2: 896 (1753)

Perennial herbs, subshrubs or shrubs, erect. Leaves 1–3-pinnatisect. Capitula commonly numerous per stem, radiate (in Australia) or discoid; involucre c. 3-seriate, with bracts gradational in length; receptacle paleate. Ray florets female; disc florets bisexual, sometimes functionally male, with corolla 5-lobed. Anthers caudate. Achenes ± homomorphic, compressed, 2-ribbed, glabrous. Pappus absent.

A genus of c. 85 species from Europe and Asia. Species in Australia all rhizomatous perennial herbs. Readily recognised by their dense corymbiform inflorescences, small capitula with involucre longer than broad and with keeled bracts, short c. orbicular ligules. The pinnatisect leaves are also distinctive in the combination of a relatively high length:width ratio (mostly 4–7) and a high number of primary segments 15–25 that arise throughout the length of the leaf. All three species in Australia are moderately pubescent throughout. *Achillea filipendulina* Lam. has been collected on Scholeroft Rd Uraidla near Adelaide in south-eastern South Australia (*R.Bates 9234* AD) and from Island Bend dam viewpoint in the Snowy Mts, far south-eastern New South Wales (*M.E.Phillips s.n.* CANB, NSW), but is not considered naturalised.

Key to species

1 Ligules white or purple

2 Leaves ± planar in fresh state; leaf-rachis mostly 1.3–2.5 mm wide; ligules purple ..... **1. *A. distans***

2: Leaves with a 3-dimensional arrangement of segments in fresh state; leaf-rachis mostly 0.6–1.2 mm wide; ligules commonly white, occasionally purplish ..... **2. *A. millefolium***

1: Ligules yellow

3 Leaves planar in fresh state, 1- or sub-2-pinnatisect; involucre c. 1.8 mm diam.; ligules c. 1 mm long ..... ***A. filipendulina* (see notes above)**

3: Leaves with a 3-dimensional arrangement of segments in fresh state; 2- or 3-pinnatisect; involucre c. 2.5 mm diam.; ligules 1–2 mm long ..... **3. *A. tomentosa***

1. **Achillea distans* Waldst. & Kit. ex Willd., *Sp. Pl.* 4th edn, 3: 2207 (1803)

Type: *n.v.*

Achillea tanacetifolia All., *Fl. Pedem.* 1: 183 (1785); *A. distans* subsp. *tanacetifolia* (All.) Janch., *Oesterr. Bot. Z.* 91: 292 (1942). Type: northern Italy; *n.v.*;

Plants to c. 60 cm high. Leaves to c. 8 cm long, 1- or 2-pinnatisect, ± planar in fresh state; rachis of mid-stem leaves 1.3–2.5 mm wide, often dentate between primary segments. Capitula 6–9 mm diam.; peduncle to c. 0.7 cm long, moderately hairy. Involucre 4.0–5.5 mm long; outer and middle series of bracts with margin unpigmented or brown; inner series of bracts with hyaline extension c. 0.3 mm long; paleae c. 5 mm long. Ray florets c. 5, with a purple ligule 1.5–3 mm long. Disc florets 8–20; corolla c. 2.5 mm long, with tube narrower than and c. as long as purple limb. Achenes c. 2 mm long.

Notes: Native to Europe. Occurs in far south-eastern South Australia, south-eastern Queensland, eastern New South Wales, southern Victoria, and eastern Tasmania. Grows in disturbed sites such as roadsides, often at moderate altitudes. Flowers spring–summer.

An occasional garden escape. In recent Australian floras Australian material has been recognised as subsp. *tanacetifolia*. Plants are uniform in morphology but it is not clear whether they are referable to this or the type subspecies. Based on the length of ligules and the presence of teeth on the winged rachis between primary segments, they are referable to subsp. *distans*; however, this subspecies is considered to have white florets normally.

Representative specimens: SOUTH AUSTRALIA: roadside, Stirling East, 6 May 1944, *J.B.Cleland* (AD). QUEENSLAND: Killarney, 25 Nov. 1917, *C.T.White* (BRI). NEW SOUTH WALES: Eucumbene Dam, Snowy Mtns, 13 Jan. 1965, *M.E.Phillips* (CANB). AUSTRALIAN CAPITAL TERRITORY: Uriarra Ck, N of Uriarra Stn, on road to Brookvale Stn, Jan. 1966, *M.Gray* (CANB). VICTORIA: roadside S of Aberfeldy, *J.R.Hosking 1070* (CANB, MEL, NE, NSW). TASMANIA: Hayes, Jan. 1944, *W.M.Curtis* (HO, MEL).

2. ***Achillea millefolium*** L., *Sp. Pl.* 2: 899 (1753)

Type: Europe; *n.v.*

Plants to c. 60 cm high. Leaves to c. 8 cm long, 2- or 3-pinnatisect, with segments arranged 3-dimensionally in fresh state; rachis of mid-stem leaves 0.6–1.2 mm wide, mostly entire between primary segments, sometimes dentate. Capitula 4–8 mm diam.; peduncle to c. 1.0 cm long, slightly to moderately hairy. Involucre 3.0–4.5 mm long; outer and middle series of bracts with margin light or often dark brown; inner series of bracts with hyaline extension c. 0.3 mm long; paleae 3–4 mm long. Ray florets c. 5, ligule 2–3 mm long, white or less often pink to purple. Disc florets c. 8; corolla c. 2 mm long, with tube narrower than and c. as long as white limb. Achenes c. 2 mm long. *Milfoil, Yarrow.*

Notes: Native to Europe. Occurs in south-eastern South Australia, south-eastern New South Wales, southern Victoria, and in northern and eastern Tasmania. Isolated records from Perth in south-western Western Australia, Stanthorpe in far south-eastern Queensland, and from far north-western Victoria. Grows in disturbed sites such as roadsides, often at moderate to high altitudes. Flowers late spring–autumn.

Pink-flowered forms of *A. millefolium* can be difficult to distinguish from *A. distans*, especially some that are intermediate in leaf morphology. The two species probably co-occur at a number of localities and hybridisation and introgression is the likely reason for these difficult specimens.

Representative specimens: WESTERN AUSTRALIA: Vincent St, Leederville, *G.J.Keighery 11445* (PERTH). SOUTH AUSTRALIA: on road to Nelson, c. 5 km S of Mt Gambier, *R.J.Bates 40461* (AD). QUEENSLAND: Stanthorpe, 14 Dec. 1986, *P.S.Crew* (BRI). NEW SOUTH WALES: Cabramurra township, *P.C.Jobson 4621*, *R.G.Coveny & P.G.Kodela* (AD, BRI, CANB). AUSTRALIAN CAPITAL TERRITORY: 3.5 km N of Piccadilly Circus, Brindabella Ra., *B.J.Lepschi 112* (CANB). VICTORIA: Howmans Gap, c. 3 km direct line NW of Falls Ck Village, *I.C.Clarke 3042* (CANB, MEL). TASMANIA: W side of Ridgley Rd, 6 km S of Burnie, *P.C.Jobson 3453* (HO, MEL, NSW).

3. ***Achillea tomentosa*** L., *Sp. Pl.* 2: 897 (1753)

Type: 'G.Narbonensi, Vallesia, Tataria' [France, Switzerland, Russia to central Asia]; *n.v.*

Plants to c. 40 cm high. Leaves to c. 8 cm long, 2- or 3-pinnatisect, with segments arranged 3-dimensionally in fresh state; rachis c. 1 mm wide, entire between primary segments. Capitula 4–6 mm diam.; peduncle to 0.5 cm long, hairy. Involucre c. 4 mm

long, outer and middle series of bracts not pigmented on margin; inner series of braets with hyaline extension c. 0.5 mm long; paleae 2–3 mm long. Ray florets 5, with ligule 1–2 mm long, yellow. Disc florets c. 20; corolla c. 2.5 mm long, with tube narrower than and c. as long as the yellow limb. Achenes c. 3 mm long. *Woolly Yarrow.*

Notes: Native to south-western Europe. Occurs in south-eastern South Australia. Grows in disturbed sites such as roadsides. Flowers late spring–summer.

An occasional garden escape that is only weakly naturalised. Apart from the colour of the ligules, *A. tomentosa* can be distinguished from the other two species of *Achillea* in Australia by the more numerous disc florets and the entirely stramineous involucral braets with an unpigmented hyaline margin.

Representative specimens: SOUTH AUSTRALIA: Rly line between Owen and Mallala, *H.E.Orchard 6169* (AD); roadside, Hope Valley, 6 Dec. 1947, *J.B.Cleland* (AD).

5. LASIOSPERMUM Lagasea, *Gen. Sp. Pl.* 31 (1816)

Annual to perennial herbs, ascending to erect. Leaves 1- or 2-pinnatisect. Capitula 1 per stem or branch, radiate (in Australia) or discoid; involucre 2- or 3-seriate, with braets mostly of similar length, a few outer ones shorter; receptacle paleate. Ray florets female; disc florets bisexual, with corolla 5-lobed. Achenes ± homomorphic, terete, 8–10-ribbed, hairy. Pappus absent.

A genus of four species from South Africa, Namibia and Egypt.

****Lasiospermum bipinnatum*** (Thunb.) Druce, *Bot. Exch. Club. Brit. Isles Rep.* 631 (1917)

Lidbeckia bipinnata Thunb., *Prodr. Pl. Cap.* 161 (1800).

Type: not designated.

Lasiospermum radiatum Trevir., *Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur.* 13(1): 205 (1824). Type: *n.v.*

Perennials to c. 40 cm high, glabrous, with eglandular stems and leaves. Leaves to c. 5 cm long, fleshy; primary segments up to c. 10 per side; rachides and ultimate segments 0.8–1.5 mm wide. Capitula 1 per stem, 20–25 mm diam.; peduncle 10–30 cm long; peduncular bracteoles several, ovate–lanceolate; disc c. 7–10 mm diam. Involucre 4–5 mm long; braets not keeled or with pigmented margin; inner series of bracts with hyaline extension 1–2 mm long; mature receptacle convex; paleae c. narrow-oblong c. 2.5 mm long, c. 1 mm wide, hyaline, with a red resin duct medially, acute at apex. Ray florets 15–20; ligule c. 10–15 mm long, white. Disc florets: corolla c. 3 mm long, with tube narrower and slightly shorter than the yellow limb. Achenes narrow-obloid, c. 4 mm long, completely hidden by a dense long tan-coloured wool. Pappus absent.

Notes: Native to South Africa. Occurs in south-eastern Tasmania in and around Hobart. Flowers spring. Readily distinguished in fruit by the woolly achenes. The involucral bracts are distinctive compared with other radiate species in Australia. They are c. oblong and have a relatively broad green stereome and this helps distinguish this species from similar-sized white ligulate species such as *Chamaemelum nobile*, *Anthemis cotula and A. arvensis*.

Representative specimens: TASMANIA: Municipal Tip, Campania, *D.I.Morris 8441* (AD, HO, MEL, NSW); Hayes, *W.M.Curtis* (HO).

6. CHAMAEMELUM Mill., *Gard. Dict.* abr. edn 4 (1754)

Annual or perennial herbs or sub-shrubs, erect, ascending or decumbent. Leaves 1- or 2-pinnatisect. Capitula radiate (in Australia), disciform or discoid, solitary or few; involucre 2–4-seriate, with bracts gradational in length; receptacle paleate. Ray florets female or sterile; disc florets bisexual, with corolla 5-lobed. Achenes slightly dimorphic in length, slightly compressed, with inner face ribbed, glabrous. Pappus absent.

A genus of 6 species from the Canary Is., Mediterranean, and Middle East. Like in *Anthemis*, the corolla of species in this genus becomes saccate basally and surrounds the distal portion of the achene.

****Chamaemelum nobile*** (L.) All., *Fl. Pedem.* 1: 185 (1785)

Anthemis nobilis L., *Sp. Pl.* 2: 894 (1753).

Type: Europe; *n.v.*

Ascending perennial herbs to c. 30 cm high, rhizomatous, odorous on crushing, usually sparsely hairy on stems and leaves. Leaves to c. 5 cm long; primary segments mostly 6–10 per side, arising along entire length of leaf, markedly larger in distal half; rachis < 1 mm wide; secondary rachides and ultimate segments < 0.5 mm wide. Capitulum 20–25 mm diam.; peduncle moderately hairy distally. Involucre 4–5 mm long, cobwebby; bracts not keeled or with a pigmented margin; inner series of bracts with hyaline extension 1–1.5 mm long; mature receptacle obovoid; paleae narrow-obovate or oblong-elliptic, c. 0.8 mm wide, subacute to obtuse, sometimes lobed. Ray florets 10–20, fertile; ligule 8–12 mm long, white. Disc florets: corolla 2.5–3 mm long, with tube longer than and as broad as the yellow limb. Achenes obovoid, 1–1.5 mm long, with 3 slender pale ribs, grey-brown.

Notes: Native to south-western Europe. Occurs near Adelaide in south-eastern South Australia, in southern Victoria, and in eastern Tasmania. Grows in roadsides, waste areas and lawns. Flowers late spring–autumn.

Similar to species of *Anthemis* in having hairy stems and leaves, denser on the peduncle, gland-dotted leaves and a paleate receptacle. Used horticulturally as a herb and in lawns and used medicinally and in beverages. The involucre is generally moderately lustrous due to the relatively well-developed hyaline margins. Ray florets persist and the ligules become deflexed post-anthesis. This feature is also evident in the genera *Anthemis*, *Matricaria*, *Tripleurospermum* and *Argyranthemum*.

Representative specimens: SOUTH AUSTRALIA: Bridgewater, c. 20 km SE of Adelaide, 27 Nov. 1937, *E.H.Ising* (AD). VICTORIA: roadside between Trentham and East Trentham, 9 Apr. 1990, *K.Dormouse* (MEL). TASMANIA: Westbury, 20 Feb. 1948, *W.M.Curtis* (HO).

7. ANTHEMIS L., *Sp. Pl.* 2: 893 (1753)

Annual to perennial herbs or subshrubs, erect. Leaves 1–3-pinnatisect. Capitula radiate (in Australia) or discoid, solitary or not; involucre 2- or 3-seriate, with bracts gradational in length; receptacle paleate (in Australia). Ray florets female or sterile; disc florets bisexual, with corolla mostly 5-lobed. Achenes ± homomorphic, sometimes compressed, 4 or 5-angled and/or 10-ribbed. Pappus present or absent.

A genus of 211 species, from Europe, Asia and northern Africa. Characterised by obconical, thick-walled fruits and a basally swollen corolla-tube. The indumentum is frequently of dolabriform (axe-shaped) hairs. In species in Australia the disc is much broader than the length of the generally hairy involucre, the mature receptacle is narrow-

conical and the paleae have a peracute or spine-like apex. Involucral bracts are not keeled as in species of *Oncosiphon* and *Tanacetum*, and the margin is not pigmented brown as in species of *Tripleurospermum* and *Matricaria*.

Key to species

1 Ligules yellow; pappus a small corona ..... **1. *A. tinctoria***

1: Ligules white; pappus absent

2 Plant hardly odorous when crushed; capitula (15–) 20–35 mm diam.; peduncle with hairs largely appressed; involucre 4–6.5 mm long, with hyaline extension 1–2 mm long; receptacular paleae 0.5–1 mm wide, arising throughout; achenes 1–2 mm diam., with ribs smooth; ray florets fertile. ..... **2. *A. arvensis***

2: Plant strongly odorous when crushed; capitula 15–25 mm diam.; peduncle with hairs somewhat untidily arranged; involucre c. 4 mm long, with hyaline extension 0.5–1 mm long; receptacular paleae 0.3–0.7 mm wide, only associated with inner group of disc florets and arising only from upper half of receptacular cone; achene of disc florets c. 0.8 mm diam., with ribs tuberculate; ray florets sterile. ..... **3. *A. cotula***

1. *_Anthemis tinctoria_ L., *Sp. Pl.* 2: 894 (1753)

Type: 'Sueciae, Germaniae' [approximately modern Sweden and Germany]; *n.v.*

Biennial to perennial herbs to c. 60 cm high, with odour not known, moderately hairy. Leaves to c. 7 cm long, 1- or sub-2-pinnatisect. Capitulum 20–40 mm diam.; peduncle with appressed hairs at anthesis. Involucre 5–6 mm long, densely hairy; inner bracts with hyaline extension c. 1 mm long; paleae subtending all florets, narrow-lanceolate, c. 1 mm wide. Ray florets c. 15, female; ligule c. 10 mm long, golden-yellow. Disc florets: corolla c. 3 mm long. Achenes obovoid, c. 2 mm long. Pappus a membranous corona. *Yellow Chamomile.*

Notes: Native to Europe and western to central Asia. Isolated records from south-eastern South Australia and northern Tasmania. Also naturalised in North America. Flowers summer–autumn.

A popular species in horticulture that appears to be only weakly naturalised. The source of Chamomile tea and used as a source of yellow dye. There are several subspecies of *A. tinctoria*. Collections in Australia may be referrable to subsp. *australis* R.R.Fern., but this requires further investigation.

Representative specimens: SOUTH AUSTRALIA: E of Tanunda, *R.J.Bates 29571* (AD). TASMANIA: Launceston, Mar. 1961, *J.Somerville* (HO).

2. *_Anthemis arvensis_ L., *Sp. Pl.* 2: 894 (1753)

Type: Europe; *n.v.*

Annual herbs to c. 60 cm high, hardly odorous on crushing, sparsely to moderately hairy. Leaves to c. 5 cm long, sub-2 to 3-pinnatisect. Capitulum 25–35 mm diam.; peduncle with largely appressed hairs distally at anthesis, ± sericeous when dense. Involucre 4–6.5 mm long, hairy; inner bracts with hyaline extension 1–2 mm long; paleae associated with all disc florets, narrow-elliptic, to 0.5–1 mm wide. Ray florets 15–20, fertile; ligules 8–16 mm long, white. Disc florets: corolla 2.5–3 mm long. Achenes of disc florets obovoid, c. 2 mm long, commonly c. 1 mm diam., sometimes c. 2 mm diam., slightly 4-angled, smooth along ribs. Pappus absent or a vestigial ring. *Field Chamomile.*

Notes: Native to Europe, northern Africa and western Asia. Occurs in eastern New South Wales and Tasmania. A widespread weed in North America, South Africa and New Zealand. Grows in disturbed areas near human habitation. Flowers summer.

The paleae are distinctly broader than those of *A. cotula* and compared to *Chamaemelum nobile* the palcae have a more acute apex and are relatively longer. The variation in achene diameter is unusual. In the absence of fruit and odour characters, *A. arvensis* and *A. cotula* are best distinguished by size of florets, indumentum of peduncles and the length of hyaline extensions of the inner involucral bracts.

Representative specimens: NEW SOUTH WALES: Bannaby Travelling Stock Reserve, 12.5 km directly ESE of Taralga, *I.Crawford 5228* (CANB, NSW). TASMANIA: Tarraleah, 7 Feb. 1945, *W.M.Curtis* (HO).

3. *_Anthemis cotula_ L., *Sp. Pl.* 2: 894 (1753)

Type: Europe; *n.v.*

Annual herbs to c. 60 cm high, strongly odorous on crushing, usually sparsely to moderately hairy. Leaves to c. 5 cm long, 2- or 3-pinnatisect. Capitulum 15–25 mm diam.; peduncle with an untidy indumentum of mainly divergent to spreading hairs distally at anthesis. Involucre 4–5 mm long, hairy; inner bracts with hyaline extension 0.5–1 mm long; paleae arising only from distal half of receptacle, linear to linear lanceolate, 0.3–0.7 mm wide. Ray florets 10–15, sterile; ligule 5–9 mm long, white. Disc florets: corolla 2–3 mm long. Achenes obovoid, 1.2–1.5 mm long, c. 0.8 mm wide, ± terete, usually tuberculate along ribs, sometimes nearly smooth. Pappus absent. *Stinking Mayweed.*

Notes: Native to Europe, northern Africa and western Asia. Occurs in south-eastern South Australia, south-eastern Queensland, eastern New South Wales, southern Victoria, and Tasmania. There is also a single old record from Western Australia. Grows in disturbed environments such as agricultural land and wasteland. Flowers late spring–summer.

Anthemis cotula has been confused with *Triptilrospermum maritimum* subsp. *inodorum q.v.* which, apart from its distinctive fruits, differs in having a broader and more gently convex disc, longer involucral bracts, more sparsely haired peduncle, and in being epaleate. *Chamaemelum nobile* has similar-looking capitula to *A. cotula* but the former is a rhizomatous perennial, its leaves have a higher length:width ratio, its involucral bracts are more lustrous and less hairy, and its achenes have three fine ribs rather than c. 10 tuberculate ribs. A specimen from Woolnorth in far north-western Tasmania. (*A.C.Rozefelds 1307* HO) resembling *A. cotula* has achenes that are not tuberculate and the corolla is differently shaped, and with longer lobes. It is uncertainly identified as *A. litlmanica* Bess ex DC., native to Russia. It is unknown whether it persists at this location.

Representative specimens: WESTERN AUSTRALIA: Mumballup, 21 Jan. 1933, *K.Wilson* (PERTH). SOUTH AUSTRALIA: Hundred of Comaum. Coonawarra area, *M.Gartner 7754* (AD). QUEENSLAND: Gatton, Nov. 1916, *E.W.Burch* (BRI). NEW SOUTH WALES: 'Tawarri', 12 km from Orange on Pinnacle Rd, *R.Medd 160383* (NSW). VICTORIA: between Wodonga and Albury, 1.3 km SSW of Murray R., *I.C.Clarke 3038* (CANB, MEL). TASMANIA: Gilbertson's abattoirs, Longford, *D.I.Morris 8516* (HO, MEL).

8. ARGYRANTHEMUM Webb ex Sch.Bip., *in* Webb & Berth., *Phyt. Canar.* 2: 245 (1844)

Shrubs and subshrubs, with stems and leaves eglandular. Leaves 1- or 2-pinnatisect. Capitula solitary or few, radiate; involucre multiseriate, with bracts gradational in length;

receptacle epalcate. Ray florets female; disc florets bisexual, with corolla 5-lobed. Achenes dimorphic; ray achenes trigonous, incurved with lateral wings and a posterior keel; disc achenes obconical compressed, 1-winged. Pappus present.

A genus of 22 species endemic to Macaronesia (Canary Is., Madeira and the Salvage Is. in the North Atlantic Ocean).

Argyranthemum frutescens (L.) Webb ex Sch.Bip., *in* P.B.Webb & S.Berthelot, *Hist. Nat. Iles Canaries 2*: 264 (1844)

Chrysanthemum frutescens L., *Sp. Pl.* 2: 887 (1753).

Type: Locality unknown, Hort. Cliff.; holo: BM *n.v.*, *fide* C.J.Humphries *op. cit.* 181 (1976).

Plants to c. 1.0 m high, glabrous or nearly so, often glaucous, eglandular. Leaves 1- or 2-pinnatisect, with rachides and segments 0.5–4 mm wide; primary segments 1–5 per side, with average position distal to halfway, entire or with secondary lobes or segments; base narrow. Capitula few; 3–6 cm diam., with peduncle 4–12 cm long. Involucre 7–10 mm long; outer series of bracts 2–5 mm long, with margin brown; inner series of bracts with hyaline extension 3–4 mm long; mature receptacle conical, slightly taller than wide. Ray florets c. 15–20; ligule 8–35 mm long, white. Disc florets numerous; corolla 2.5–3 mm long. Achenes dimorphic, 3–7 mm long; ray achenes 2–5 mm wide, with broad firm lateral wings and an adaxial wing; disc achenes of disc 2.5–4 mm long, 1–2 mm wide, inner series c. quadrangular, ribbed, outer series with a moderate adaxial wing. Pappus an oblique adaxially longer corona to 2 mm long, of similar texture to achenes.

There are two forms naturalised in Australia, both probably horticulturally modified. These are referred with some uncertainty to two subspecies.

Key to subspecies

Plants green, not glaucous; mid-branch leaves with rachis 2–4 mm wide; ligules 15–30 mm long.....**a.** subsp. ***frutescens***

Plants usually bluish-green, slightly to moderately glaucous; mid-branch leaves with rachis 1–2 mm wide; ligules 8–15 mm long.....**b.** subsp. ***foeniculaceum***

a. ***Argyranthemum frutescens*** (L.) Webb ex Sch.Bip. subsp. ***frutescens***

Plants green, not glaucous. Leaves: rachis of mid-branch leaves 2–4 mm wide; primary segments commonly 3 or 4 per side. Ligules > 15 mm long.

Notes: Probably only weakly naturalised. Occurs in southern South Australia and eastern Victoria. Grows in various soils including sand dunes and over limestone, mostly on or near the coast. Flowers spring–autumn.

Representative specimens: SOUTH AUSTRALIA: 10 km S of Port Lincoln, *R.J.Bates 37126* (AD). VICTORIA: Gabo Is., 6 Oct. 1993, *K.Twyford s.n.* (MEL).

b. ***Argyranthemum frutescens*** subsp. ***foeniculaceum*** (Pit. & Proust) C.Humphries, *Bull. Brit. Mus.* (*Nat. Hist.*), *Bot.* 5: 187 (1976).

Argyranthemum frutescens var. *foeniculaceum* Pit. & Proust, *Iles Canaries* 230 (1909).

Type: Agulo, La Gomera, Canary Is., 13 Apr. 1905, *C.-J.M.Pitard 195*; holo: G, iso; L, Z all *n.v.*, *fide* C.J.Humphries, *loc. cit.*

[*Chrysanthemum anethifolium auct. non* Brouss. ex Willd. (1809): J.M.Black, *Fl. S. Australia* 2nd edn, 4: 878 (1957)]

[*C. foeniculaceum auct. non* Willd.: Hj.Eichler, *Fl. S. Australia* 2nd edn, suppl. 303 (1965)]

[*A. foeniculaceum auct. non* (Willd.) Webb ex Sch.Bip. (1908): N.S.Lander *in* N.G.Marchant *et al.* (eds), *Fl. Perth Region* 2: 659 (1987)]

Plants usually slightly to moderately glaucous. Leaves: rachis 1–2.5 mm wide; primary segments 1 or 2 (or 3) per side. Ligules 8–12 mm long.

Notes: Occurs in south-western Western Australia and southern South Australia. Grows in various soils including sand dunes and over limestone, mostly on or near the coast. Flowers spring–autumn.

This subspecies is far more common than subsp. *frutescens*. Ligules are longer than described for plants in their native habitat. Naturalised plants in Australia are likely to be of garden origin and have larger capitula because of plant breeding. There are numerous horticultural forms but only one appears to be naturalised.

Representative specimens: WESTERN AUSTRALIA: Peppermint Grove, *A.S.George 14839* (PERTH). SOUTH AUSTRALIA: Coffin Bay to Port Lincoln tramway track, c. 10 km SW of Coffin Bay, *H.P.Vonow 889* (AD, BRI, CANB).

9. CHRYSANTHEMUM L., *Sp. Pl.* 2: 887 (1753)

Annual herbs, erect. Leaves undivided, lobate or 1- or 2-pinnatisect. Capitula solitary or few, radiate; involucre c. 3-seriate, with bracts gradational in length; receptacle epaleate. Ray florets female; disc florets bisexual, with corolla 5-lobed. Achenes slightly dimorphic; ray achenes winged-trigonous; disc achenes terete or slightly trigonous. Pappus absent.

A genus of two species native to Europe, Asia and North Africa. Both species weakly naturalised in Australia. Species of *Chrysanthemum* have been widely cultivated and plant breeding has produced numerous varieties with modified floral features. Formerly a very large genus of species with radiate, epaleate capitula but, by degrees, several segregate genera including *Leucanthemum*, *Argyranthemum* and *Mauranthemum* have been created or resurrected. Australian representatives of this group of genera are eglandular.

Key to species

Leaves 1- or 2-pinnatisect; all achenes with at least an adaxial wing ..... ***1. C. coronarium***

Leaves dentate, lobate or entire; disc achenes cylindrical; ray achenes only with lateral wings ..... ***2. C. segetum***

1. ****Chrysanthemum coronarium*** L., *Sp. Pl.* 2: 890 (1753)

Type: Crete, Sicily; *n.v.*

[*C. segetum auct. non* L. (1753): S.W.L.Jacobs & J.Pickard, *Pl. New South Wales* 75 (1981)]

Plants to c. 90 cm high, glabrous apart from transient hairs on newer growth. Leaves obovate to ovate in outline, to c. 12 cm long, 1- or 2-pinnatisect, with up to 10 primary divisions per side; base half-clasping; margin entire or with occasional teeth; uppermost leaves similar. Capitula few; 4–6 cm diam., with peduncle c. 3–8 cm long. Involucre 8–10 mm long; outer series of bracts 4–5 mm long, with margin light brown; inner series of bracts with hyaline extension c. 4 mm long; mature receptacle convex. Ray florets: ligule

c. 15–25 mm long. Disc florets numerous; corolla 4–5 mm long, with tube narrower and slightly shorter than limb. Achenes c. 3 mm long, with body hardly compressed, c. 8-ribbed, but with some ribs expanded into wings, brown, glandular; ray achenes 3–4 mm wide, with prominent lateral and adaxial wings; disc achenes c. 2 mm diam. with only adaxial wing prominent. *Summer Chrysanthemum*.

Notes: Native to the Mediterranean region and north-western Iran. Occurs in south-western Western Australia, south-eastern South Australia, and far north-western New South Wales. Grows in disturbed sites. Flowers spring–summer.

A garden escape that is only weakly naturalised. The adaxial wing of the achenes is broadest apically and often forms an acute point.

Representative specimens: WESTERN AUSTRALIA: Vincent St, Leederville, Perth, *G.J.Keighery 11459* (MEL, PERTH); near beach, town limits of Dongara, *R.M.King 9530 & R.M.Garvey* (CANB, PERTH). SOUTH AUSTRALIA: Prospect, 29 Sept. 1907, *S.A.White ex South Australia. museum* (AD). NEW SOUTH WALES: Paldrumatta Bore, Oct. 1901, *P.Corbett* (NSW).

2. *_Chrysanthemum segetum_ L., *Sp. Pl.* 2: 889 (1753)

Type: Europe; *n.v.*

Plants to c. 80 cm tall, glabrous. Leaves oblong or obovate in outline, to c. 7 cm long, acutely dentate to deeply lobate, with up to 4 primary divisions per side, concentrated distally; base hardly or half-clasping; margin entire or with occasional teeth; uppermost leaves often entire. Capitula few; 3–5 cm diam., with peduncle c. 3–8 cm long. Involucre 8–12 mm long; outer series of bracts c. 4 mm long, with margin light brown; inner series of bracts with hyaline extension 3–5 mm long; mature receptacle convex. Ray florets: ligule c. 10–20 mm long. Disc florets numerous; corolla 4 mm long, with tube narrower and slightly shorter than limb. Achenes 2–3 mm long, with body hardly compressed, several-ribbed, without adaxial wings, pale, eglandular; ray achenes 1.2–2.5 mm wide, with lateral wings; disc achenes c. 1 mm diam., regularly ribbed, without wings. *Corn Marigold*.

Notes: Occurs in south-western Western Australia. Grows as a garden escape near human habitation. Flowers late winter–spring.

Representative specimens: WESTERN AUSTRALIA: New Norcia, Nov. 1963, *F.T.Hardy* (PERTH); Bunbury, *C.V.Cahill 1* (PERTH).

10. MAURANTHEMUM Vogt & Oberprieler, *Taxon* 44(3): 377 (1995)

Annual herbs, erect. Leaves lobate. Capitula solitary, radiate; involucre multiseriate, with bracts gradational in length; receptacle epaleate. Ray florets sterile (in Australia) or female; disc florets bisexual, with corolla 5-lobed. Achenes homomorphic, ± terete, 7–10-ribbed. Pappus present on ray florets.

A genus of 4 species from Europe and northern Africa. One species naturalised in Australia. In fruit the corolla-tube is basally swollen. Achenes have dark-red secretory canals.

*Mauranthemum paludosum (Poir.) Vogt & Oberprieler, *Taxon* 44(3): 377 (1995)

Chrysanthemum paludosum Poir., *Voy. Barbarie* 2: 241 (1789); *Leucoglossum paludosum* (Poir.) B.H.Wilcox, K.Bremer & Humphries, *Bull. Nat. Hist. Mus., Ser. Bot.* 23: 142 (1993).

Type: *n.v.*

Plants to c. 30 cm tall, glabrous, eglandular. Leaves to c. 6 cm long, laeerately lobate; base developing lobes above mid-stem; margin serrate with apex peraeute. Capitulum solitary, 2–3 em diam. Involuere 4–6 mm long; outer series of bracts 2–3 mm long, not keeled, with margin darkly pigmented; inner series of bracts with blaekish hyaline extension 0.5–1 mm long; mature receptacle conieal. Ray florets sterile; ligule c. 10 mm long, white with a green base. Disc florets numerous; eorolla 2–2.5 mm long, 5-lobed. Achencs obovoid, c. 2 mm long, red between very prominent pale ribs. Pappus of ray florets a corona to c. 2 mm long.

Notes: Native to Spain and northern Africa. Oeeurs in south-westem Western Australia, south-eastern South Australia, south-eastern New South Wales, and south-eentral Victoria. Grows in disturbed sites such as roadsides. Flowers summer.

A garden eseape that relatively reeently has beeome weakly naturalised. Similar to *Leucanthemum vulgare* but an annual with lighter green leaves with peracute lobes and teeth, and with outer involueral bracts cordate-based, smaller capitula, ray florets sterile, and a eorona well-developed on ray florets.

Representative specimens: WESTERN AUSTRALIA: Cargill St, Victoria Park, Perth, *B.J.Lepschi 2090* (CANB, PERTH). SOUTH AUSTRALIA: track into Chambers Gully, c. 400 m from Waterfall Gully Rd, *A.G.Spooner 15409* (AD); Burra and Burra North, *R.J.Bates 34152* (AD). NEW SOUTH WALES: Princes Hwy N of Milton, 3 July 1998, *K.Mills s.n.* (NSW). VICTORIA: Yan Yean, 45 km N of Melbourne, *D.Senyschyn 27* (MEL); paddock at end of Neale Rd c. 50 m down Opie Rd, Deer Park, 25 Aug. 1986, *C. Le Breton* (MEL).

11. LEUCANTHEMUM Mill., *Gard. Dict.* abr. edn 4 (1754)

Perennial herbs, ereet. Leaves undivided or lobate. Capitula solitary or several, radiate (in Australia) or diseoid; involuere multiseriate, with braets gradational in length; reeeptaele epaleate. Ray florets female; disc florets bisexual, with corolla 5-lobed. Aehenes sometimes dimorphie, ± terete, 10-ribbed. Pappus present on ray florets.

A genus of 33 speeies from Europe and northern Afriea. A key defining eharacter for this genus is the anthoeyanin red coloration of the root tips. Plants have eglandular stems and leaves, the corolla-tube is basally swollen and spongy at maturity, and the achenes have red secretory eanals.

Key to speeies

Leaves variably toothed or crenulate, sometimes also lobed; margin of involueral braets delineated by pigment throughout; eapitula 4–6 cm diam. including rays; outer involucral bracts 3–5 mm long; achene of ray florets 1.5–2.5 mm long with corona e. 0.5 mm long ..... **1. *L. vulgare***

Leaves ± evenly serrulate; margin of involueral braets not delineated by pigment throughout; eapitula 6–10 em diam. ineluding rays; outer involueral braets 5–8 mm long; achene of ray florets 3–4 mm long with corona c. 2 mm long ..... **2. *L.* ×*superbum***

1. *_Leucanthemum vulgare_ Lam., *Fl. Franç.* 2: 137 (1779)

Chrysanthemum leucanthemum L., *Sp. Pl.* 2: 888 (1753).

Type: Europe; *n.v.*

Plants to c. 100 cm high, with seattered coarse hairs on lower parts of stems and on lower-stem leaves, glabreseent. Leaves with few–several lobes or undivided; base

developing basal lobes above mid-stem; margin dentate to crenulate, with up to c. 15 teeth/crenulations per side; mid-stem leaves oblanceolate to narrow-oblong, to c. 4 cm long. Capitula 1–3, 3–6 cm diam.; peduncle glabrous. Involucre 7–10 mm long, glabrous; outer series of bracts lanceolate, 2.5–7 mm long, not keeled, with margin brown; inner series of bracts with hyaline extension c. 1 mm long; mature receptacle convex. Ray florets: ligule c. 10–15 mm long, white. Disc florets numerous; corolla 2–2.5 mm long, with tube as long as and becoming as wide as the yellow limb. Achenes obovoid, c. 1.5–2 mm long, mid to dark red between raised pale ribs. Pappus absent. *Ox-eye daisy*.

Notes: Native to Europe. Occurs in far south-eastern South Australia, eastern New South Wales, southern Victoria, and northern Tasmania. A widespread weed in other parts of the world. Grows in disturbed sites such as roadsides. Flowers spring–summer.

One of the most widespread weeds in tribe Anthemideae. A noxious weed in Victoria, excluding the Melbourne metropolitan area.

Representative specimens: SOUTH AUSTRALIA: Mt Lofty township, *F.M.Hilton 1223A* (AD). NEW SOUTH WALES: alongside New England Hwy, 2 km S of the intersection with Duri Dungowan Rd, S of Timbumburi, *J.R.Hosking 1826* (CANB, NSW). VICTORIA: summit of Mt Skene, 48 km from Jamieson on road to Licola, *D.E.Albrecht 120* (CANB, MEL). TASMANIA: Leven Gorge, *L.Richley 163* (HO); Longley, Dec. 1943, *W.M.Curtis* (HO).

2. **Leucanthemum ×superbum* (Bergmans ex J.W.Ingram) D.H.Kent, *Watsonia* 18(1): 89 (1990)

Chrysanthemum ×superbum Bergmans ex J.W.Ingram, *Baileya* 19: 167 (1975).

Type: cult. at Ithaca, New York, grown from seed, Dreer 1948, 26 June 1921, *L.H.Bailey s.n.*; *n.v.*

[*Chrysanthemum lacustre* non Brot. (1804): J.H.Willis, *Handb. Pl. Victoria* 2: 741 (1972)]

[*Leucanthemum maximum* non (Ramond) DC. (1838): J.A.Jeanes *in* N.G.Walsh & T.J.Entwisle (eds), *Fl. Victoria* 4: 929; E.A.Brown *in* G.J.Hardin (ed.), *Fl. New South Wales* 3: 288 (1992); D.A.Cooke *in* J.P.Jessop & H.R.Toelken (eds), *Fl. S. Australia* 4th edn, 3: 1618 (1986)]

Plants to c. 150 cm high, nearly glabrous or with occasional coarse hairs on stems and leaves. Leaves undivided; base not developing basal lobes; margin strongly serrulate, with 15–30 serrulations per side; mid-stem leaves narrow-elliptic, to c. 14 cm long. Capitula 1 (–3), 5–10 (–13) cm diam.; peduncle glabrous. Involucre 9–12 mm long; outer series of bracts narrow-ovate to lanceolate, 4–7 mm long, not keeled, with margin pale or tinged brown; inner series of bracts with hyaline extension 3–4 mm long, pale or tinged brown; mature receptacle convex. Ray florets: ligule c. 20–45 mm long, white. Disc florets numerous; corolla 4–4.5 mm long, with tube as long as and becoming as wide as the yellow limb. Achenes obovoid, c. 2–4 mm long, with thick raised pale ribs, with red coloration sometimes seen between ribs. Pappus present on ray florets, coronate, c. 2 mm long. *Shasta Daisy*.

Notes: Occurs in Busselton in far south-western Western Australia, far south-eastern South Australia, south-eastern New South Wales and southern and eastern Victoria. Grows in disturbed sites associated with human habitation or activity. Flowers summer–autumn.

Naturalised in areas of moderate to high rainfall. Much cultivated, this species is considered to be a hybrid between *Leucanthemum laestre* (Brot.) Samp. and *L. maximum* (Ramond) DC. A cultivar with deeply dissected ligules has been recorded from far eastern Victoria.

Representative specimens: WESTERN AUSTRALIA: N margin of Broadwater, near Busselton, *G.J.Keighery 8030* (PERTH). SOUTH AUSTRALIA: Mt Compass, Feb. 1967, *T.Smith* (AD). NEW SOUTH WALES: Mt Boyce, 3.4 km SE of Mt Victoria, *R.Coveny 7363*, *R.Barry & K.Wilson* (NSW). VICTORIA: Upper Kiewa Rd, 3.8 km NW of Falls Creek Village, *R.J.Adair 981* (MEL).

12. TRIPLEUROSPERMUM Sch.Bip., *Tanaceteen* 31 (1844)

Annual or perennial herbs, erect. Leaves commonly 3-pinnatisect. Capitula solitary or few, radiate (in Australia) or discoid; involucre multiseriate, with bracts gradational in length; receptacle epaleate. Ray florets female; disc florets bisexual, with corolla 4- or 5-lobed. Achenes ± homomorphic, c. 4-angled, 3-ribbed, with prominent apical glands. Pappus present.

A genus of c. 30 species from Europe, Asia and northern Africa. A genus with distinctive achenial features.

Tripleurospermum maritimum (L.) Koch. subsp. ***inodorum*** (L.) Applequist, *Taxon* 51: 760 (2002)

Matricaria inodora L., *Fl. Suec.* 2nd edn, 297 (1755); *T. maritimum* (L.) Koch. subsp. *inodorum* (L.) Hyl. ex Vaar., *Proc. 7th Int. Bot. Congr.* 1950, 279 (1953), *comb. inval.*; *T inodorum* (L.) Sch.Bip., *Tanaeeteen* 32 (1844)

Type: Locality unknown, Herb. Linn. 1012.12; lecto: LINN, *fide* C.J.Humphries, *Taxon* 47: 364 (1998).

Matricaria perforata Mérat, *Nouv. Fl. Env. Paris* 332 (1812); *T. perforatum* (Mérat) Lainz, *An. Jard. Bot. Madrid* 39(2): 412 (1983). Type: *n.v.*

Erect herbs to c. 100 cm high, glabrous except for transient scattered hairs, with stems and leaves eglandular. Leaves to c. 15 cm long, 3-pinnatisect, with rachides and ultimate segments generally < 1 mm wide. Capitula solitary or few, 3–5 cm diam.; peduncle sparsely hairy. Involucre 5–7 mm long; outer and middle series of bracts not keeled, sometimes with margin brown; inner series of bracts with hyaline extension c. 0.5 mm long; receptacle hemispherical. Ray florets c. 12; ligule 8–18 mm long, white. Disc florets: corolla c. 2 mm long, with tube c. as long as and narrower than the yellow 5-lobed limb. Achenes obovoid, 1.8–2.2 mm long, with 3 prominent pale ribs on one face, generally dark and minutely wrinkled between ribs, with 2 large glands distally. Pappus a scarious rim c. 0.2 mm long. *Scentless Mayweed*, *Scentless False Chamomile*.

Notes: Native to Europe and temperate Asia. Occurs in north-eastern New South Wales with isolated records from southern Victoria and north-western Tasmania. A widespread weed around the world. Grows in disturbed environments such as roadsides. Flowers mostly spring–summer.

A pair of large glands embedded in the achene are visible from both the unribbed face and from above. Although the achene has three thick ribs, the achene appears somewhat quadrangular when viewed from above. The corolla-lobes are yellow but have an oval gland (orange-red on dried specimens) near the apex. This character, and the relative

lack of hairs on branches and leaves, further distinguishes this species from vegetatively similar white-rayed species such as *Matricaria recutita*, *Anthemis cotula*, *A. arvensis* and *Chamaemelum nobile*.

The correct name and rank for this taxon has been the subject of considerable debate overseas and is possibly still not settled. In New South Wales it had until recently been referred to as *T. inodorum*, and in Victoria as *Matricaria perforata*.

Representative specimens: NEW SOUTH WALES: c. 40 km S of Glen Innes on Guyra–Glen Innes Rd, *N.S.Lander 519* (BRI, NSW). VICTORIA: NE corner of intersection of Punt Rd & Swan St, Richmond, *J.C.Reid 2470* (MEL). TASMANIA: Brittons Swamp, May 1975, *B.J.Collins* (CANB).

13. MATRICARIA L., *Sp. Pl.* 2: 891 (1753)

Annual herbs, erect. Leaves 2- or 3-pinnatisect. Capitula solitary or few, rarely subsessile, radiate or discoid; involucre c. 3-seriate, with all or nearly all bracts ± equal in length; receptacle epaleate. Ray florets female; disc florets bisexual, with corolla 4- or 5-lobed. Achenes ± homomorphic, terete or slightly compressed, with 4 or 5 ribs concentrated adaxially. Pappus present.

A genus of seven species widespread in the northern hemisphere, with some species widely distributed in the southern hemisphere as weeds. Species in Australia have eglandular stems and leaves, have at least 2-pinnatisect leaves with rachides and ultimate segments < 1 mm wide, capitula with a prominently domed disc, and an ovoid mature receptacle. Red longitudinal resin canals are often evident in the midline of involucral bracts and in achenes.

Key to species

Capitula radiate; peduncle usually > 2 cm long.....**1. *M. recutita***
Capitula discoid; peduncle mostly < 2 cm long..... **2. *M. matricarioides***

1. *Matricaria recutita L., *Sp. Pl.* 2: 891 (1753)

Chamomilla recutita (L.) Rauschert, *Folia Geobot. Phytotax.* 9: 255 (1974).

Type: Locality unknown, *J.Podpera in Fl. Exsicc. Reip. Boh.-Slov.* 946.II; neo: K, *fide* C.Jeffrey, *Taxon* 41: 566 (1992).

Plants to c. 60 cm high, glabrous. Leaves to c. 7 cm long. Capitula solitary or few, radiate, 10–25 mm diam.; peduncle 3–9 cm long. Involucre 2–3 mm long; inner series of bracts with hyaline extension c. 0.5 mm long; mature receptacle ovoid. Ray florets 9–15; ligule 6–10 mm long, white. Disc florets: corolla c. 1.5 mm long, with tube c. as long as and slightly narrower than the 5-lobed yellow limb. Achenes obovoid, 1.0 mm long, c. 0.8 mm wide. Pappus of ray achenes an oblong scale c. 1 mm long; pappus of disc achenes a minute scarious rim. *Wild Chamomile*.

Notes: Native to Europe. Isolated occurrences in south-western Western Australia, south-eastern South Australia, eastern New South Wales, and Tasmania. Grows in disturbed sites, usually on roadsides. Flowers spring–summer.

Representative specimens: WESTERN AUSTRALIA: Coorow, 23 Sept. 1998, *P.Stubbs* (PERTH). SOUTH AUSTRALIA: roadside, Grange, 14 Jan. 1964, *J.B.Cleland* (AD). NEW SOUTH WALES: E of Forbes on Eugowra Rd, 28 Oct. 1959, *C.K.Ingram* (NSW). AUSTRALIAN CAPITAL TERRITORY: Canberra, *H.S.McKee 8855* (NSW). TASMANIA: Scotts Rd, Risdon Vale, *D.I.Morris 86494* (CANB, HO).

2. **Matricaria matricarioides* (Less.) Porter, *Mem. Torrey Bot. Club* 5: 341 (1894).

Artemisia matricarioides Less., *Linnaea* 6: 210 (1831).

Type: 'Unalaschca', *Chamisso*; syn: *n.v.*; 'Kamtschatca', [former U.S.S.R.], *I.Redowski*; syn: *n.v.*

Santolina suaveolens Pursh, *Fl. Amer. Sept.* 2: 520 (1814); *Chamomilla suaveolens* (Pursh) Rydb., *N. Amer. Fl.* 34: 232 (1916). Type: *n.v.*

Matricaria discoidea DC., *Prodr.* 6: 50 (1838). Type: California, U.S.A, *Douglas*; *n.v.*

Plants to c. 45 cm high but mostly 5–20 cm high, glabrous. Leaves to c. 4.5 cm long. Capitula solitary or few, discoid, 5–9 mm diam.; peduncle to c. 1 cm long. Involucre 3–4.5 mm long; inner series of bracts with hyaline extension c. 1 mm long. Florets: corolla c. 1 mm long, with tube usually slightly longer and broader than the 4-lobed, greenish limb. Achenes obovoid, 1.2–1.5 mm long. Pappus a minute scarious rim. *Rounded Chamomile, Rayless Chamomile, Pineapple Weed.*

Notes: Native to Europe, Asia and possibly North America. Occurs in eastern New South Wales, southern and central Victoria, and eastern Tasmania. Also naturalised in New Zealand. Grows in waste areas in urban environments. Flowers spring–summer.

Generally compact, much-branched plants, with distinctive greenish, domed capitula on short peduncles. Recorded as pineapple-scented.

Representative specimens: NEW SOUTH WALES: C.I.G. footpath, Orange, *R.Medd 161187* (NSW). VICTORIA: outside Melbourne Cricket Ground, Jolimont, *D.E.Albrecht 4599* (AD, CANB, MEL). TASMANIA: St Helens, *T.Shea 10* (HO).

14. ERIOCEPHALUS L., *Sp. Pl.* 2: 926 (1753)

Shrubs, erect. Leaves entire or 1-pinnatisect. Capitula solitary or few, radiate (in Australia) or disciform; involucre 2-seriate, with bracts similar in length, with the densely villous inner series often connate; receptacle paleate. Ray florets female; disc florets bisexual or functionally male, with corolla 5-lobed. Achenes homomorphic, dorsiventrally compressed, with 2 lateral ribs, hairy. Pappus absent.

A genus of 26 species from South Africa and Namibia. Leaves of axillary shoots are commonly crowded together with the subtending leaf, giving the foliage a fasciculate appearance.

****Eriocephalus africanus*** L., *Sp. Pl.* 2: 926 (1753)

Type: 'Aethiopia' [central-eastern Africa]; *n.v.*

Plants to c. 60 cm high, sericeous. Leaves to c. 2 cm long, entire and linear or 1-pinnatisect with segments few. Capitula radiate, solitary but grouped to appear corymbiform, 6–8 mm diam. Involucre c. 3 mm long, silky-hairy; outer series of bracts 4 or 5, free, ovate, with margin brown; inner bracts 3, fused; paleae 3–4 mm long, 0.8 mm wide, hairy; mature receptacle not seen. Florets: ray florets 3 or 4, with ligule c. orbicular, 3–4 mm long, white. Disc florets: corolla c. 2.5 mm long, with tube c. equal limb and much narrower; limb deep purple, 5-lobed. Achenes obovate in profile, c. 3 mm long, pale, woolly.

Notes: Native to South Africa. Occurs in south-central New South Wales. Ecological preferences not known. Flowers winter.

It is unknown whether the Condobolin population has persisted.

Representative specimens: NEW SOUTH WALES: Nerathong area, Condobolin, *G.M.Cunningham & P.L.Milthorp 2600* (NSW).

15. ONCOSIPHON Källersjö, *Bot. J. Linn. Soc.* 96: 310 (1988)

Annual herbs, erect. Leaves 2- or 3-pinnatisect. Capitula 1 to numerous per stem, discoid (in Australia) or radiate; involucre 3-seriate, with bracts gradational in length; receptacle epaleate. Ray florets female; disc florets bisexual, with corolla 4-lobed. Achenes ± homomorphic, ± terete, regularly 4-ribbed, glabrous. Pappus present.

A genus of c. eight species from South Africa and Namibia. Features of these species include the globose capitula and the inflated and brittle corolla-tube. The two Australian species formerly placed in *Pentzia*.

Key to species

Capitula 3–5 mm diam. at anthesis; receptacle conical to obloid at maturity, c.1 mm diam ..... **1. *O. suffruticosum***

Capitula 5–8 mm diam. at anthesis; receptacle ellipsoid at maturity, 2–2.5 mm diam ..... **2. *O. pilulifernm***

1. *_Oncosiphon suffruticosum_ (L.) Källersjö, *Bot. J. Linn. Soc.* 96: 313 (1988)

Tanacetum suffruticosum L., *Sp. Pl.* 2: 843 (1753); *Matricaria multiflora* Fenzl ex Harv., *in* W.H.Harvey & O.W.Sonder, *Fl. Cap.* 3: 166 (1865); *Matricaria suffruticosa* (L.) Druce, *Bot. Exch. Club Soc. Brit. Isles 1913*: 421 (1914); *Pentzia suffruticosa* (L.) Hutch. & Merxm., *Mitt. Bot. Staatssamml. München* 6: 486 (1967).

Type: 'Aethiopia' [central-eastern Africa], Herb. Linn. 987: 11; holo: LINN *n.v.*, *fide* M.Källersjö, *loc. cit.*

Erect annuals to c. 60 cm high, with stems and leaves glandular, pubescent. Leaves to c. 4 cm long, 2- or 3-pinnatisect, with rachis and ultimate segments < 1 mm wide; segments 4–6 per side. Capitula numerous to 100s per stem, congested, 3–5 mm diam.; peduncle with scattered flattened hairs distally at anthesis. Involucre 2–3 mm long, ± glabrous; bracts of outer and middle series keeled; inner bracts with hyaline extension up to 1 mm long; mature receptacle conical, c. 1 mm diam. Florets: corolla c. 2 mm long, with tube longer than and c. as wide as the yellow limb. Achenes obovoid, c. 1 mm long, c. 3-angled, gland-dotted between ribs, grey-brown. Pappus a corona to c. 0.3 mm long, with margin usually lobed. *Calomba Daisy*.

Notes: Native to South Africa. Occurs in south-western Western Australia, southern South Australia, and far north-western Victoria. Grows in disturbed sites. Flowers summer.

A class 2 noxious weed in South Australia. The common name is derived from the town of Calomba in south-eastern South Australia where, presumably, it was first recorded in Australia.

Representative specimens: WESTERN AUSTRALIA: 21.5 km SSW of Nanambinia HS, Parmango Track, Coolgardie Botanical District, *W.R.Archer 1011907* (MEL). SOUTH AUSTRALIA: 1 km SE of Dublin on the Adelaide Rd, *S.W.L.Jacobs 6633* (MEL, NSW). VICTORIA: SW of L. Walla Walla, 13 Nov. 1986, *D.C.Cheal* (MEL).

2. *_Oncosiphon pilulifernm_ (L.f.) Källersjö, *Bot. J. Linn. Soc.* 96: 314 (1988)

Cotula pilulifera L.f., *Suppl. Pl.* 378 (1781); *Matricaria pilulifera* (L.f.) Druce, *Bot. Exch. Club Soc. Brit. Isles* 1916: 635 (1917).

Type: Locality not given, *Nordenstam 161*; neo: S, *fide* M.Källersjö, *loc. cit.*

Cotula globifera Thunb., *Prodr. Pl. Cap.* 2: 162 (1800); *Matricaria globifera* (Thunb.) Fenzl ex Harv., *in* W.H.Harvey & O.W.Sonder, *Fl. Cap.* 3: 165 (1865); *Pentzia globifera* (Thunb.) Hutch., *Bull. Misc. Inform. 1916*: 251 (1917). Type: *n.v.*

Similar to *O. suffruticosum* but differing in the following respects: plants to c. 40 cm high; leaves to c. 2 cm long, 2-pinnatisect; capitula several to numerous per stem, 5–8 mm diam.; receptacle ellipsoidal at maturity, 2–2.5 mm diam.; achenes 3- or 4-angled. *Globe Chamomile.*

Notes: Native to South Africa. Occurs in south-western Western Australia. There are old collections from Port Philip Bay in Victoria and Stockton in eastern New South Wales, but populations are presumed not to have become established at these localities. Grows on rocky rises in woodland and in farmland. Flowers spring.

The capitula of this species are globose, with the involucre confined to the proximal quarter. The capitula of *O. suffruticosum*, although similar, are smaller and subglobose, i.e. with the distal half somewhat flattened.

Representative specimens: WESTERN AUSTRALIA: 12 km SSE of Trayning, *J.Dodd 487* (BRI, PERTH); North Miling, *J.Dodd 519* (BRI, PERTH).

16. PENTZIA Thunb., *Prodr. Pl. Cap.* 2: 145 (1800)

Shrubs, erect. Leaves 1- or 2-pinnatisect. Capitula 1 per branch (in Australia), discoid; involucre c. 3-seriate; gradational in length; receptacle epaleate. Florets bisexual, with corolla 4- or 5-lobed. Achenes ± homomorphic, quadrangular, regularly 5-ribbed, glabrous. Pappus present.

A genus of 23 species mostly from South Africa, but also from Namibia, Morocco and Algeria. Species in Australia are readily recognisable by their small leaves.

Key to species

Leaves commonly greyish, with 1 or 2 (or 3) primary segments per side, commonly confined to distal half; outer series of involucral bracts ovate ..... **1. *P. incana***

Leaves green, with 3–5 primary segments per side, arising ± evenly throughout length; outer series of involucral bracts linear-lanceolate ..... **2. *P. globosa***

1. *_Pentzia incana_ (Thunb.) Kuntze, *Revis. Gen. Pl.* 3: 166 (1898)

Chrysanthemum incanum Thunb., *Prodr. Pl. Cap.* 2: 161 (1800).

Type: not designated.

Pentzia virgata Less., *Syn. Gen. Compos.* 266 (1832), *nom. illeg.* Type: *n.v.*

Low shrub to c. 40 cm high, with younger stems and leaves usually tomentose. Leaves to c. 1 cm long, 1-pinnatisect, with rachis and ultimate segments < 1 mm wide; segments 1 or 2 per side, confined to distal half of leaf (excluding auricles if present). Capitula 1 or few per branch, 4–7 mm diam.; peduncle appressed-tomentose distally at anthesis. Involucre 2.5–3 mm long; bracts of outer and middle series ovate, keeled, with margin usually brown, slightly cobwebby or glabrous; inner series of bracts with hyaline extension 0.5–1 mm long; mature receptacle shallowly domed. Florets: corolla 1.5–2 mm long, with tube ± equal in length but slightly narrower than the 5-lobed, yellow or purplish limb. Achenes of disc florets obovoid, 1–1.5 mm long, 5-ribbed, grey-brown. Pappus an oblique white corona c. 1 mm long. *African Sheep Bush.*

Notes: Occurs in central-eastern South Australia, with an old record from Nyngan in central New South Wales. Grows in arid saltbush shrublands. Flowers at various times.

Introduced by the CSIR, now CSIRO, at Koonamore in South Australia in the 1930s. The single old record from Nyngan differs from the South Australian records in having leaf-segments less consistently concentrated distally.

Representative specimens: SOUTH AUSTRALIA: c. 60 km N of Yunta, Koonamore Stn, *M.D.Crisp 307* (CANB). NEW SOUTH WALES: Nyngan, Nov. 1913, *J.H.Maiden* (NSW).

2. *_Pentzia globosa_ Less., *Syn. Gen. Compos.* 266 (1832)

Type: *n.v.*

Similar to *P. incana* but differing in the following: leaves ± glabrous, sometimes 2-pinnatisect; primary segments of leaves 3–5 per side, arising regularly throughout length; involucre bracts of outer and middle series linear-lanceolate, without a hyaline margin; inner series of bracts with hyaline extension c. 0.2 mm long; mature receptacle conical; corolla-tube much narrower than the limb; corona c. 0.3 mm long.

Notes: Occurs near Jamestown in south-eastern South Australia, with an old record from Gosford on the central coast of New South Wales. Ecological preferences unknown. Flowers recorded in autumn.

The South Australian population has persisted since at least 1897 when it was first collected (*J.H.Maiden* NSW). The tiny secondary segments of the 2-pinnatisect leaves arise at or near the base of the primary segment.

Representative specimens: SOUTH AUSTRALIA: near Bundaleer Picnic Ground, near Jamestown, *R.Bates 14272* (AD). NEW SOUTH WALES: Gosford, Feb. 1894, *coll. unknown* (NSW).

17. COTULA L., *Sp. Pl.* 2: 891 (1753)

Annual to perennial herbs, erect to sprawling. Leaves entire, lobate or 1- or 2-pinnatisect. Capitula solitary, disciform (in Australia) or discoid, with zygomorphic florets present in *C. turbinata*; involucre 2- or 3-seriate, with bracts all of similar length; receptacle epalcate. Florets often pedicellate; outer florets 1–several-seriate, female; central florets bisexual or functionally male, with corolla mostly 4-lobed. Achenes usually dimorphic, dorsally compressed, unribbed, hairy or not. Pappus absent.

A genus of c. 50 species, mostly from the southern hemisphere, with four species native to Australia and three of these endemic. Of the total of seven species in Australia, all are eglandular except for *C. alpina*, and all have stem-sheathing leaves. The involucral bracts are often tinged purple and do not have an elongate hyaline apex, and the outer florets are in some species prominently pedicellate. Central florets, if pedicellate, have much shorter pedicels. The outer florets are female and lack a corolla except for a weakly developed one in *C. bipinnata*.

Key to species

1 All leaves entire, filiform, to c. 1 mm wide, with hairs on basal sheath

2 Outer florets in a single series on slender pedicels, or outer florets absent; central florets numerous, with corolla lobes purple, producing achenes (south-eastern Australia) ..... **1. *C. vulgaris***

2: Outer florets in several series, none on slender pedicels; central florets several, with corolla lobes yellow, not producing achenes (Western Australia) ..... **2. *C. cotuloides***

1: Some or all leaves divided, or if all entire then not filiform, > 1 mm wide and/or entirely glabrous

3 Peduncle stout, arising from a rosette of leaves; leaves dotted with minute glands; outer florets in several series, not pedicellate ..... ***7. C. alpina***

3: Peduncle slender, not arising from a rosette of leaves; leaves without glands; outer florets in a single series, pedicellate, or female florets not developed

4 Peduncle becoming obconical in distalmost 3–8 mm following anthesis; intermediate series of florets zygomorphic, with ligules white or pink ..... **4. *C. turbinata***

4: Peduncle not becoming obconical or at least not as above; all florets actinomorphic or lacking a corolla

5 Stems and leaves usually moderately hairy; achenes of outer florets in several series, papillose on both faces ..... **3. *C. australis***

5: Stems and leaves glabrous or with hairs rather sparse; achenes of outer florets in 1 series or undeveloped, papillose only on inner face

6 Largest leaves usually 1- or 2-pinnatisect, occasionally entire if plants depauperate; peduncle mostly < 2 cm long, with scattered hairs at anthesis; outer florets absent or up to c. 10, with corolla present, with pedicel not tapering ..... **6. *C. bipinnata***

6: Largest leaves entire, lobate, or 1-pinnatisect; peduncle mostly > 2 cm long, glabrous; outer florets numerous, with corolla absent, with pedicel tapering distally ..... **5. *C. coronopifolia***

1. *Cotula vulgaris* Levyns var. ***australasica*** J.H.Willis, *Victorian Naturalist* 73: 201 (1957).

Type: Swamps, Shire of Dimboola, Victoria, 25 Sept. 1892, *F.M.Reader*; holo: MEL; iso: AD, NSW.

[*Cotula filifolia auct. non* Thunb. (1800): J.M.Black, *Fl. S. Australia* 606 (1929); A.Ewart, *Fl. Victoria* 1167 (1931)]

Annuals to c. 20 cm high. Stems sparsely hairy, glabrescent, with hairs antrorse. Leaves to c. 4 cm long, entire and narrow-linear, glabrous except for hairs on sheath. Capitula 3–5 mm diam.; peduncle mostly 2–6 cm long, c. 0.3 mm broad (pressed specimens), with distalmost 1–2 mm sometimes obconical at maturity, usually sparsely to moderately hirsute at anthesis, with hairs antrorse to divergent. Involucral bracts 5–8; outer bracts broad-ovate, 2–3 mm long, with apex rounded. Outer florets up to c. 8, 1-seriate, sometimes absent, with pedicels 0.3–0.6 mm long. Central florets numerous, with pedicels hardly longer than broad; corolla c. 1 mm long, with limb usually purplish. Achenes of outer florets c. 1.5 mm long; faces broad-elliptic, glabrous, with papyraceous wings as broad as or broader than body; achenes of central florets 1.2–1.5 mm long; faces elliptic, glabrous. *Slender Cotula.*

Notes: Occurs in southern Australia from south-central South Australia east to western Victoria, and in eastern Tasmania. Grows in damp saline areas such as the margin of salt lakes and coastal marshes. Flowers late winter–summer.

Differs from the type variety from South Africa which has glabrous peduncles and longer corollas. The achenes of the female florets are both cordate-based and apically-notched due to the large but thin wings.

Representative specimens: SOUTH AUSTRALIA: Butchers Gap, South Kingston, *P.Gibbons 219* (AD). VICTORIA: Murtnagurt Lagoon, L. Connewarre Game reserve, 15 Sept. 1983, *J.Z.Yugovic* (MEL). TASMANIA: Croppies Point, *A.M.Buchanan 1609* (HO).

2. *Cotula cotuloides* (Steetz) Druce, *Bot. Exch. Club Soc. Brit. Isles for 1916, suppl.* 2: 617 (1917)

Gymnogyne cotuloides Steetz, *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 432 (1845); *Cotula gymnogyne* F.Muell. ex Benth., *Fl. Austral.* 3: 549 (1867), *nom. illeg.*

Type: Perth, Western Australia, 1839, *J.A.L.Preiss 101*; holo: MEL; iso: MEL.

Annuals to c. 20 cm high. Stems with scattered long hairs. Leaves to c. 6 cm long, entire and narrow-linear, glabrous except for hairs on sheath. Capitulum 4–12 mm diam.; peduncle 2–10 cm long, 0.3–0.5 mm broad (pressed specimens), not obconical distally at maturity, hirsute at anthesis with hairs antrorse to almost spreading. Involucral bracts c. 10; outer bracts broad-ovate, 2–3 mm long, with apex rounded. Outer florets numerous, multi-seriate, attached to tubercles. Central florets several, ?functionally male, sessile; corolla c. 1 mm long, with limb pale yellow. Achenes of outer florets c. 1.5 mm long; faces c. orbicular, glabrous, with papyraceous wings much broader than body. *Smooth Cotula.*

Notes: Occurs in south-western Western Australia. Grows in a variety of soils in swampy areas, the margin of salt lakes and around granitic outcrops. Flowers spring to early summer.

Similar vegetatively to *C. vulgaris* var. *australasica* but having the proportions of outer female to disc florets reversed. The disc florets of *C. cotuloides* do not appear to produce achenes and they become hidden below the achenes of outer florets as they develop. A single collection containing numerous plants, *P.S.Short 2240 & L.R.Haegi* (AD, MEL, PERTH) from near Australind has relatively small capitula with significantly narrower involucral bracts than typical *C. cotuloides* and may warrant taxonomic recognition.

Representative specimens: WESTERN AUSTRALIA: 19.5 km ESE of Mt Newmont, *W.R.Archer 14119213* (MEL); c. 54 km from Paynes find along road to Cleary, eastern edge of L. Moore, *P.S.Short 2590, N.S.Lander & B.A.Fuhrer* (AD, MEL, PERTH).

3. *Cotula australis* (Sieber ex Spreng.) Hook.f., *Fl. Nov.-Zel.* 1: 128 (1853)

Anacyclus australis Sieber ex Spreng., *Syst. Veg.* 3: 497 (1826); *Strongylosperma australe* (Sieber ex Spreng.) Less., *Syn. Gen. Comp.* 261 (1832); *Pleiogyne australis* (Sieber ex Spreng.) K.Koch, *in* D.F.L.Schlechtendal & H.Mohl (eds), *Bot. Zeitung (Berlin)* 40 (1843); *Lancisia australis* (Sieber ex Spreng.) Rydb., *N. Amer. Fl.* 34: 286 (1916)

Type: Precise locality unknown, [Sydney area], New South Wales, 1823, *F.W.Sieber 331*; *n.v.*

Annuals or short-lived perennials to c. 10 cm high. Stems moderately hairy with hairs antrorse-divergent to spreading. Leaves to c. 4 cm long, 1- or 2-pinnatisect, moderately hairy. Capitulum 2–8 mm diam.; peduncle mostly 2–8 cm long, c. 0.1–0.6 mm broad (pressed specimens), hardly obconical at maturity, moderately hirsute at anthesis, with hairs antrorse, appressed to divergent. Involucral bracts 5–20, oblong to oblong-ovate, 1.5–3 mm long, with apex rounded. Outer florets numerous, multi-seriate, with pedicels

0.5–1 mm long. Central florets 15–25, with pedicels hardly longer than broad; corolla c. 0.5 mm long, with limb pale yellow to white. Achenes of outer florets c. 1–1.5 mm long; faces oblong, minutely papillose, with fleshy wings slightly narrower than face; achenes of central florets c. 1 mm long; faces oblong, glabrous. *Common Cotula, Carrot Weed.*

Notes: Widespread in southern Australia and occurs in all states and territories. Also native to New Zealand. A weed in North and South America, India, Portugal and Southern Africa. Grows in moist environments; and a common weed of urban environments. Flowers at most times of the year. Leaves of *C. australis* often have small near-basal lobes. This species is also distinctive among species in Australia in having a single prominent resin canal in the midline of the involucral bracts (other species have indistinct resin canals or 3 or 4 ± equally distinct) and in having greenish outer achenes. The involucral bracts sometimes have scattered hairs, whereas in other species of *Cotula* in Australia the bracts are glabrous.

Representative specimens: WESTERN AUSTRALIA: Road bore, Yoothapinna Stn, E block, *R.J.Cranfield 5667* (CANB, PERTH). NORTHERN TERRITORY: Desert Springs Motel, Alice Springs, *P.K.Latz 12975* (MEL). SOUTH AUSTRALIA: Ravine des Casoars, 8 km E of Cape Borda, Kangaroo Is., *P.G.Wilson 686* (AD). QUEENSLAND: Warren point Stn, Mitchell, 22 Aug. 1968, *P.Martensz s.n.* (BRI, CANB). NEW SOUTH WALES: Joe's tank, Bundella Stn near Elura mining lease, 42.5 km NNW of Cobar, *M.D.Crisp 4222* (AD, CANB, NSW). AUSTRALIAN CAPITAL TERRITORY: Black Mtn, Canberra, *F.Davies 20 & I.R.Telford* (CANB, MEL, NSW). VICTORIA: near Long Forest Rd, 6 km ENE of Bacchus Marsh and 1.2 km N of Western Hwy, *T.B.Muir 6227* (CANB, MEL). TASMANIA: Andersons Creek, N of Broadmarsh, *P.Collier 3461* (HO).

4. *_Cotula turbinata_ L., *Sp. Pl.* 2: 892 (1753)

Type: 'Aethiopia' [central-eastern Africa]; Herb. Clifford: 417, *Cotula* No. 1; lecto: BM, *fide* C.J.Humphries, *Taxon* 47: 359 (1998).

Annuals to c. 40 cm high. Stems moderately hairy, with hairs spreading. Leaves to c. 5 cm long, 1- or 2-pinnatisect, with spreading hairs. Capitula 5–10 mm diam.; peduncle mostly 4–10 cm long, c. 0.5 mm broad (pressed specimens), with distalmost 3–8 mm obconical at maturity, hirsute at anthesis with hairs antrorse-divergent, glabrous distally. Involucral bracts c. 10, broad-ovate, 2–3 mm long, with apex acute to obtuse. Outer florets numerous, c. 1-seriate, with pedicels to c. 1 mm long. Intermediate florets numerous, c. 1-seriate, bisexual, with a white and usually abaxially purple ligule c. 2 mm long. Central florets very numerous, with pedicels hardly longer than broad; corolla tubular, c. 1 mm long, with limb yellow. Achenes of female florets c. 1.5–2 mm long; faces broad-elliptic, glabrous or papillose, with fleshy wings c. as broad as body; achenes of central florets 1.0–1.3 mm long; faces obovate-oblong, glabrous. *Ferny Cotula.*

Notes: Occurs in far south-western Western Australia, with a single record from coastal New South Wales. Grows in sandy and loamy soils, in disturbed sites and including roadsides and lawns. Flowers winter to mid-spring.

A readily recognisable species in flower with its series of ligulate florets and turbinate distal peduncle. Similar to *C. vulgaris* var. *australasica* in that the involucre and peduncle are sometimes glaucous. The margin of the achenes of the female florets is often minutely papillose.

Representative specimens: WESTERN AUSTRALIA: c. 1 km N of Australind on Mandurah Rd, *P.S.Short 2245 & L.Haegi* (AD, CANB, MEL, PERTH); roadside (along the ocean road) just

N of Bunbury, *B.L.Turner 5485* (MEL). NEW SOUTH WALES: top of cliffed dune terrace, near playschool, Stockton, *P.C.Heyligers 98010* (MEL, NSW).

5. *_Cotula coronopifolia_ L., *Sp. Pl.* 2: 892 (1753)

Type: 'Aethiopia' [central-eastern Africa]; *n.v.*

Cotula integrifolia Hook.f., *Fl. Tasman.* 1: 192 (1856), *nom. illeg. non* Burch (1822). Type: Locality unknown, *R.C.Gunn 1153*; *n.v.*

Perennials to c. 30 cm high, glabrous. Leaves to c. 8 cm long, acutely lobate or 1-pinnatisect, rarely entire with l:w ratio up to 8, or sub-2-pinnatisect. Capitulum 5–12 mm diam.; peduncle mostly 2–8 cm long, 0.3–1.0 mm broad (pressed specimens), not obconical distally. Involucral bracts numerous; outer bracts narrow-ovate or oblong, 3–5 mm long, with apex rounded. Outer florets numerous, c. 1-seriate, with pedicels 1–1.8 mm long. Central florets numerous, with pedicels longer than broad; corolla c. 1 mm long, with limb bright yellow. Achenes of outer florets 1.5–2 mm long; faces broad-oblong, papillose on inner face, with spongy wing c. as broad as body; achenes of central florets c. 1.3 mm long, c. oblong, papillose on inner face. *Water-buttons*.

Notes: Native to South Africa. Widespread in southern Australia and occurring in all states. Also naturalised in New Zealand. Grows in damp or wet places in both saline and fresh water. Flowers mainly winter–spring.

More succulent than other species of *Cotula* in Australia. Grows in shallow water or mud and stems readily take root at nodes. There has been some conjecture about whether this species is native based on the number and extent of early records in Australia. Rarely, depauperate specimens may have entire leaves less than 1 mm wide. These plants can be distinguished from *C. vulgaris* and *C. cotuloides* vegetatively because they are glabrous. A dwarf form occurs on islands in southern Western Australia with smaller leaves with more crowded lobation. Further investigation may be warranted to determine whether these differences are purely ecological. A probable hybrid between *C. coronopifolia* and *C. australis* has been recorded from Mt Chappell Is., in Bass Strait (*J.S.Whinray 223* CANB).

Representative specimens: WESTERN AUSTRALIA: small un-named lake/swamp 0.5 km N of Ledge Point, *A.E.Orchard 5929* (HO, PERTH). SOUTH AUSTRALIA: The Big Point, Bool Lagoon, *J.Z.Weber 7553* (AD, CANB). QUEENSLAND: Claverton Stn, 20 km S of Wyandra, 3 Sept. 1996, *S.Moffat* (BRI). NEW SOUTH WALES: Jerseyville, Trial Bay, near Arakoon, *P.Martensz Q185* (NSW). VICTORIA: Point Wilson, Sperm Whale Head, *T.B.Muir 2273* (MEL). TASMANIA: Ocean Beach, 5 km W of Strahan, *A.E.Orchard 5929* (AD, CANB, HO, MEL, NSW); Whites Valley, Hamilton, *A.M.Buchanan 13679* (HO).

6. *_Cotula bipinnata_ Thunb., *Prodr. Pl. Cap.* 162 (1800)

Type: not designated.

Annuals to c. 40 cm high. Stems glabrous or with occasional appressed to spreading hairs. Leaves to c. 6 cm long, 1- or 2-pinnatisect, or uppermost leaves sometimes entire, sparsely hairy or glabrous. Capitulum 6–8 mm diam.; peduncle 0.5–2 (–3) cm long, c. 0.3 mm broad (pressed specimens), hardly obconical at maturity, sparsely hirsute at anthesis, with hairs antrorse to spreading. Involucral bracts numerous; outer bracts oblong-ovate or oblong, 2–3 mm long, with apex rounded to truncate. Outer florets up to c. 10, 1-seriate, or absent, with pedicels c. 1 mm long. Central florets numerous, with pedicels much longer than broad; corolla c. 1 mm long, with limb pale yellow. Achenes of outer florets

1–1.5 mm long, broad-oblong, with inner face papillose, with thin to slightly spongy wings as broad as body. Achenes of central florets c. 1–1.5 mm long, oblong, glabrous or inner face sparsely papillose. *Ferny Cotula.*

Notes: Native to South Africa. Occurs in south-western Western Australia, southern South Australia, western New South Wales, and western and northern Victoria. Also recorded from the Northern Territory. Grows mostly in seasonally moist saline areas. Flowers late winter–summer.

Although depauperate specimens of *C. coronopifolia* can look similar, *C. bipinnata* has a shorter and more often purplish peduncle bearing scattered hairs at anthesis, a differently coloured disc, and fewer female florets. The involucral bracts are also more frequently purple in *C. bipinnata*. Unlike other species of *Cotula* in Australia, outer florets develop a small corolla.

Representative specimens: WESTERN AUSTRALIA: W of Northern Inland Hwy on Perenjori Rd, *A.M.Ashby 5218* (CANB, PERTH). NORTHERN TERRITORY: roadside, c. 200 km N of Tennant Ck (between Elliot and Renner Springs), *C.R.Alcock 7210* (AD, BRI, DNA). SOUTH AUSTRALIA: 10 km NW of Nuriootpa, Northern Lofty, *R.J.Bates 29155* (AD). NEW SOUTH WALES: 1 km NW along Oxley Rd from the Hay–Maude Rd, *R.G.Coveny 18676*, *G.Chapple, P.G.Kodela & H.McPherson* (AD, BRI, MEL, NSW). VICTORIA: E side of Hume Freeway, 100 km N of Melbourne, *I.C.Clarke 3062* (CANB, MEL).

7. *Cotula alpina* (Hook.f.) Hook.f., *Fl. Tasman.* 1: 192 (1856)

Ctenosperma alpinum Hook.f., *in* W.J.Hooker, *London J. Bot.* 6: 115 (1847).

Type: Marlborough, Tasmania, *R.C.Gunn*; *n.v.*

Scapose, annuals or short-lived perennials to c. 10 cm high, stoloniferous, glabrous. Rosette leaves to c. 4 cm long, 1-pinnatisect, minutely glandular. Capitula 3–7 mm diam.; peduncle to 5 cm long, 1–3 mm broad (pressed specimens), not obconical distally at maturity. Involucral bracts numerous; outer bracts broad-oblong or ovate, 2–3 mm long, with apex rounded. Outer florets numerous, 3- or 4-seriate, sessile. Central florets few, functionally male, sessile; corolla c. 1.0 mm long, with limb yellow-green. Achenes of outer florets 1.5–2 mm long; faces ± obovate, glabrous or papillose, with fleshy wings nearly as broad as body. *Alpine Cotula.*

Notes: Occurs in far south-eastern New South Wales, eastern Victoria, and Tasmania. Grows mostly at high altitudes in various soils including basalt-derived loam, in grassland, sedgeland and forest. Flowers summer to autumn.

Sits uncomfortably between *Cotula* and *Leptinella* as it has functionally male central florets, multiseriate female florets, glandular leaves, and a stoloniferous habit as in the latter genus, but without a corolla on the female florets as in the former. Often confused with *Leptinella filicula* which occupies similar habitats, but hairs are always evident in the latter on close inspection. The hyaline margin of *C. alpina* is often pigmented purple or brown apically; this is a feature of a number of species of *Leptinella* from New Zealand, but is not generally evident in Australian species.

Representative specimens: NEW SOUTH WALES: S along internal road, c. 2 km S of Kydra Reefs, *R.G.Coveny 19004 & A.E.Orme* (MEL, NSW). VICTORIA: 1.25 km SE of Mt Jim, Bogong High Plains, *R.J.Adair 1613* (MEL). TASMANIA: Bluff R., *A.Moscal 8215* (HO); Junction Boat Ramp & Central Plateau roads, E side of Great Lake, *A.Brown 189* (HO).

18. LEPTINELLA Cass., *Bull. Sci. Soc. Philom. Paris* 127 (1822)

Perennial herbs, prostrate. Leaves 1–3-pinnatisect. Capitula solitary, disciform; involucre 2- or 3-seriate, with bracts all of similar length; receptacle epaleate. Outer florets 2–4-seriate, female; central florets functionally male, with corolla mostly 4-lobed. Achenes compressed, unribbed, glabrous. Pappus absent.

A genus of c. 33 species, mostly from New Guinea, Australia, New Zealand and South America. A genus characterised by stoloniferous growth, outer florets in a few series, more numerous than the disc florets and with an inflated macroscopic corolla, and by functionally male disc florets with an unbranched style. There are four species in Australia, all endemic. Roots are fleshy and outer florets are female. *Leptinella maniototo*, native to NZ, has been recorded from a bowling green in Parndana, Kangaroo Is., South Australia, but is not considered naturalised. It has entire leaves or 1-pinnatisect leaves with very short pinnae. Two further collections from southern Tasmania, from Turua Beach in far south-east Tasmania (*A.M.Buchanan 9721* HO) and from Ummarrah Ck (*A.M.Buchanan 7910* HO) in the far south, may represent two further species of *Leptinella* from New Zealand. The identity of these collections requires further investigation.

Key to species

1 Leaves 1-pinnatisect, dilating gradually to form basal sheath; peduncle relatively short and stout at anthesis (length: diam. ratio < 40); achenes oblong-elliptic, with persistent corolla taller than broad ..... **1. *L. filicula***

1: Leaves 1–3-pinnatisect, dilating abruptly to form basal sheath; peduncle relatively long and slender at anthesis (length: diam. ratio > 40); achenes obovate, with persistent corolla broader than tall

2 Leaves once-pinnatisect to sub-bipinnatisect with secondary segments usually only arising in middle to distal third; achenes 2–3 mm long ..... **4. *L. longipes***

2: Leaves bi- or tripinnatisect, with secondary pinnae arising in proximal thirds as well as middle and distal thirds; achenes 1.5–2 mm long

3 Stems transiently villous, soon glabrescent ..... **2. *L. reptans***

3: Stems persistently densely villous ..... **3. *L. drummondii***

1. *Leptinella filicula* (Hook.f.) Hook.f., *Fl. Tasman.* 1: 194 (1856)

Symphyomera filicula Hook.f., *in* W.J.Hooker, *London J. Bot.* 6: 116 (1847); *Cotula filicula* (Hook.f.) Benth., *Fl. Austral.* 3: 551 (1867).

Type: *n.v.*

Plants with stems villous. Leaves to c. 6 cm long, with l:w ratio c. 2–4, 1-pinnatisect, gradually dilating basally to form sheath, with scattered or sparse hairs; primary segments ± restricted to distal half, mostly c. elliptic, sometimes lobed. Capitula 3–6 mm diam.; peduncle to 3 cm long at anthesis, c. 0.8 mm diam., villous. Involucral bracts c. 10–20, broad-elliptic or slightly obovate, 2.0–2.5 mm long, with apex rounded, usually hairy. Outer florets with corolla longer than broad. Central florets several; corolla c. 1 mm long. Achenes (excl. corolla) 1.5–2 mm long, 0.7–1.0 mm wide, with faces oblong-elliptic, brown with a pale margin. *Mountain Cotula.*

Notes: Occurs in far south-eastern Australia from Barrington Tops in central-eastern New South Wales SSW to eastern Victoria, and in central Tasmania. Grows in wet forest. Flowers summer–autumn.

Similar to *Cotula alpina* but hairy, densely so at growing points, and with conical glandular corollas present on outer florets and persisting on fruit. The leaf is commonly infected with the fungus *Febraea rhytismoides* resulting in a conspicuous black mark on each pinna. This is illustrated in Corrick and Fuhrer (2000). The basal leaf-sheath is sometimes lobed.

Representative specimens: NEW SOUTH WALES: eastern side of Barrington Trail, Barrington Tops National Park, *J.R.Hosking 2315 & J.M.Bakonji* (CANB, MEL, NE, NSW). AUSTRALIAN CAPITAL TERRITORY: between Blaekfellows Gap & Upper Cotter R., *N.Burbidge 6354* (CANB, MEL). VICTORIA: Blue Rag Ra., c. 15 km SE of Mt St. Bernard on Hotham to Dargo road, *L.Haegi 1640* (MEL, NSW). TASMANIA: Tarraleah, Central Plateau, 7 Feb. 1945, *W.M.Curtis* (HO).

2. *Leptinella reptans* (Benth.) D.G.Lloyd & C.J.Webb, *New Zealand J. Bot.* 25: 103 (1987)

Strongylosperma reptans Benth., *in* S.L.Endlicher *et al.*, *Enum. Pl.* 60 (1837), as *Strongylospermum*; *Pleiogyne reptans* (Benth.) K.Koch, *in* D.F.L.Schlechtendal & H.Mohl (eds), *Bot. Zeitung (Berlin)* 40 (1843); *Cotula reptans* (Benth.) Benth., *Fl. Austral.* 3: 551 (1867).

Type: Locality unknown, '*Ferd. Bauer*'; *n.v.*

Leptinella intricata Hook.f., *in* W.J.Hooker, *London J. Bot.* 6: 117 (1847). Type: South Cape, Tasmania, *R.C.Gunn*; *n.v.*

Leptinella multifida Hook.f., *in* W.J.Hooker, *London J. Bot.* 6: 118 (1847); *Pleiogyne multifida* (Hook.f.) Sond., *Linnaea* 25: 484 (1852); *Leptinella intricata* var. *multifida* (Hook.f.) Hook.f., *Fl. Tasman.* 1: 194 (1856). Type: 'Kangaroo Point', Tas.; *n.v.*

Plants with sparse to scattered hairs c. 0.5–1 mm long but often soon glabrescent. Leaves to c. 10 cm long, with l:w ratio c. 3–5, 2- or 3-pinnatisect, abruptly dilated basally to form sheath, with scattered hairs or glabrous; primary segments restricted to distal 1/3–1/2, ovate, elliptic or sub-orbicular in outline; secondary segments arising from proximal, middle and distal thirds. Capitula 2–4 mm diam.; peduncle to c. 7 cm long at anthesis, c. 0.5 mm diam., sparsely to moderately hairy, glabrescent. Involucral bracts c. 6–12, broad-elliptic or orbicular, 1.5–2 mm long, with apex rounded, glabrous or hairy. Outer florets with corolla broader than long. Central florets with corolla c. 1 mm long. Achenes (excl. corolla) 1–2 mm long; faces obovate, pale tan to brown, usually with a paler margin.

Notes: Occurs in south-eastern South Australia, southern Victoria, and Tasmania, with an isolated record from north-eastern New South Wales. Grows beside water typically, sometimes in saline environments such as seashores, in grassland, sedgeland and forest. Flowers spring–summer.

Representative specimens: SOUTH AUSTRALIA: south-western banks, southern arm of L. Bonney, *N.N.Donner 9640* (AD, HO). NEW SOUTH WALES: Werrikimbe National Park, 6 Dec. 1987, *J.R.Hosking s.n.* (NSW). VICTORIA: Gunyah Gunyah Rainforest Reserve, Grand Ridge Rd, *J.Yngovic 460* (MEL). TASMANIA: Granville Harbour, *A.E.Orchard 5628* (AD, HO, MEL, NSW, PERTH).

3. *Leptinella drummondii* (Benth.) D.G.Lloyd & C.J.Webb, *New Zealand J. Bot.* 25: 103 (1987)

Cotula drummondii Benth., *Fl. Austral.* 3: 550 (1867).

Type: Locality unknown, Western Australia, *Drummond 3rd collection, 113*; *syn*: MEL; Don R., Western Australia, *A.F.Oldfield*; syn: MEL.

Plants with stems villous. Leaves to c. 7 cm long, with l:w ratio c. 3–5, 2- or 3-pinnatisect, abruptly dilated basally to form sheath, with scattered or sparse hairs; segments in distal 1/3–1/2, elliptic to sub-orbicular in outline. Capitula 2–4 mm diam.; peduncle to 7 cm long at anthesis, c. 0.5 mm diam., sparsely to densely villous. Involucral bracts c. 6–12, broad-elliptic or orbicular, 1.5–2 mm long, with apex rounded, glabrous or sparsely haired. Outer florets with corolla broader than long. Central florets with corolla c. 1.5 mm long. Achenes not seen.

Notes: Occurs in south-western Western Australia. Grows in red clay-loam on river banks in woodland. Flowers late spring–autumn.

A poorly known species very similar to *C. reptans*.

Representative specimens: WESTERN AUSTRALIA: Willgarup R. crossing with Tick Rd, *C.Day & A.Annels MJ 75.1* (PERTH); Blackwood R. near bridge, Sue's Rd, Nillup, E of Karridale, *R.D.Royce 10498* (PERTH).

4. *Leptinella longipes* Hook.f., *in* W.J.Hooker, *London J. Bot.* 6: 117 (1847)

Cotula longipes (Hook.f.) W.M.Curtis, *Stud. Fl. Tasmania* 2: 463 (1963); *Cotula reptans* var. *major* Benth., *Fl. Austral.* 3: 551 (1867).

Type: Circular Head, Tasmania, *R.C.Gunn*; *n.v.*

Plants glabrous or with transient hairs mostly 0.1–0.5 mm long. Leaves to c. 30 cm long, with l:w ratio c. 3–6, 1- or sub-2-pinnatisect, abruptly dilated basally to form sheath, glabrous apart from inconspicuous mostly early caducous hairs; primary segments restricted to distal 1/2–1/3 (–1/4), elliptic to sub-orbicular or obovate in outline; secondary segments if present usually only arising from middle to distal third. Capitula c. 3–5 mm diam.; peduncle to 10 cm long at anthesis, c. 0.5 mm diam., with transient hairs sometimes present distally. Involucral bracts c. 6–8, broad-elliptic or orbicular, 2.0–2.5 mm long, with apex rounded, glabrous or sparsely haired. Outer florets with corolla broader than long. Central florets several to numerous, with corolla c. 1 mm long. Achenes (excl. corolla) 2–3 mm long, 1.0–1.5 mm wide; faces obovate, pale throughout.

Notes: Occurs in far south-eastern Queensland, eastern New South Wales, southern Victoria, far south-eastern South Australia, and eastern Tasmania. Grows on margin of wet often saline areas. Flowers spring–autumn.

The fruits of this species are relatively large, somewhat trigonous and pale throughout, and pressed specimens usually have a wrinkled surface, probably due to the drying out of a fleshy pericarp. Very similar to and occupying similar habitats to *L. reptans*. Without mature fruit *L. longipes* can be distinguished from *L. reptans* by a combination of being earlier glabrescent with shorter hairs, having longer leaves with a relatively longer petiolar portion, and by having less dissected leaves. Leaves of both species are variably elongate depending on environmental conditions.

Representative specimens: QUEENSLAND: Currumbin, *C.T.White 8729* (BRI). SOUTH AUSTRALIA: across Glenelg R. from Donovan's Landing, c. 30 km SE of Mt Gambier, *B.Copley 3015* (AD). NEW SOUTH WALES: near the mouth of Little Ck, Nadgee Nature Reserve, South Coast, *D.E.Albrecht 1472* (MEL). VICTORIA: W bank of Wallagaraugh R., c. 1 km downstream from Gipsy Point settlement, East Gippsland, *N.G.Walsh 3136* (BRI, CANB, HO, MEL); near mouth of Seal Ck, Croajingolong National Park, *D.E.Albrecht 4849* (HO, MEL, NSW). TASMANIA: mouth of Curries R., Beechford, *A.M.Buchanan 10589* (HO).

19. SOLIVA Ruiz & Pav., *Fl. Perm. Prodr.* 113, t. 24 (1794)

Annual herbs, ± prostrate. Leaves 1–3-pinnatiseet. Capitula solitary, sessile, diseiform; involuere 1- or 2-seriate, with braets all of similar length; receptaele epaleate. Outer florets multiseriate, female; central florets functionally male, with eorolla 3- or 4-lobed. Aehenes eompressed, unribbed, glabrous or hairy. Pappus absent.

A genus of c. 9 speeies from South Ameriea. Speeies are low-growing, rosetted, and developing prostrate stems after an initial flowering. They are eglandular and are readily reeognised by the strongly flattened fruits with the style persisting and developing into a prominent spine. The outer florets do not develop a eorolla. The eentral florets are relatively few in number and their styles are unbraneheđ.

Key to speeies

1 Aehenes e. 2.5–4 mm wide, with broad searious wings, not villous apieally ..... **1. *S. sessilis***

1: Aehenes 1–1.5 mm wide, without broad searious wings, villous apically or not

2 Aehenes glabrous, smooth with no distinet marginal region ..... **2. *S. valdiviana***

2: Aehenes villous apieally, with a distinet, transversely corrugated marginal region

3 Leaves to e. 13 em long, 2- or 3-pinnatiseet; aehenes obtuse to rounded apieolaterally (i.e. at shoulders) ..... **3. *S. anthemifolia***

3: Leaves to e. 4 em long, 1- or 2-pinnatiseet; aehenes aeute apieolaterally (i.e. at shoulders)..... **4. *S. stolonifera***

1. *_Soliva sessilis_ Ruiz & Pav., *Syst. Veg. Fl. Perm. Chil.* 113, t. 24 (1794)

Type: *n.v.*

Gymnostyles pterosperma Juss., *Ann. Mns. National Hist. Nat.* 4: 262, t. 61 fig. 3 (1804); *S. pterosperma* (Juss.) Less., *Syn. Gen. Compos.* 268 (1832). Type: *n.v.*

Plants with seattered hairs e. 0.5–1 mm long. Leaves to c. 5 em long, 2-pinnatiseet, with primary segments elliptic to orbieular in outline, with hairs largely abaxial. Capitulum 3–6 mm diam. Involuere 3–6 mm long; bracts 5–8, ovate to laneeolate, aeute, with hyaline margin laeking. Outer florets 12–30. Central florets: eorolla c. 2 mm long, e. 0.5 mm diam. Mature reeeptaele narrow conieal. Aehenes (exel. spine) e. rotund to oblate in profile, 2–2.5 mm long, 2.5–4 mm wide, not woolly apieally; body c. 1 mm wide, with seattered tubercle-based papillose hairs on both sides; wings 0.7–1.5 mm wide, incurved, entire or more often slightly to deeply notehed towards base, forming an aeute spine-like proeess apieally, scarious, smooth; stylar spine 1.8–2.6 mm long. *Jo-Jo*, *Onehunga*, *Bindyi*.

Notes: Oeeurs in far south-western Western Australia, south-eastern South Australia, southern Queensland, New South Wales, Vietoria, and south-eastern Tasmania. Grows in lawns and other disturbed sites. Flowers most times of the year.

A noxious weed (in pest plant eategory) in the Shire of Melville in Western Australia. Webb (1986) has suggested that beeause of their ability to interbreed, that members of subgenus *Soliva*, ineluding *S. pterosperma*, *S. sessilis* and *S. valdiviana* be treated as one species. This was based on a study of populations introdueed to and oeeurring around Auekland, New Zealand. Although taxonomie interpretations perhaps should more desirably be derived from studies earried out within speeies' native distributions, in this treatment the eonelusions of Webb are followed in that *Soliva pterosperma* is regarded

as conspecific with *S. sessilis*. The close similarities in achene morphology suggest that typical *S. pterosperma* (deeply notched wings) and typical *S. sessilis* (unnotched wings) are merely extremes in a continuum of variation of one species. However, all specimens of *S. sessilis* collected in Australia with the exception of a few from Melbourne, Victoria, have deeply notched wings near the base. A different opinion is formed regarding *S. valdiviana* which, on the basis of specimens seen from Australia, has a fundamentally different achene morphology. Plants with achene morphology intermediate between this species and *S. sessilis* were identified by Webb, but these might reasonably be interpreted as hybrids between two species that have come unnaturally together.

Representative specimens: WESTERN AUSTRALIA: Cargill St, Victoria Park, Perth, *B.J.Lepschi 2089* (CANB, MEL, PERTH). SOUTH AUSTRALIA: Upper Waterfall Gully, c. 11.5 km ESE of Adelaide, *Hj.Eichler 18905* (AD). QUEENSLAND: Tozer Gully, Cootharaba Rd, Gympie, *A.R.Bean 17041* (BRI). NEW SOUTH WALES: Barraba, Sept. 1929, *F.A.Rodway* (NSW). VICTORIA: Strathmerton, *H.I.Aston 2354* (HO, MEL). TASMANIA: Cloudy Bay Lagoon, South Bruny Is., *A.M.Buchanan 4547* (HO).

2. *_Soliva valdiviana_ Phil., *Linnaea* 33: 168 (1864)

Type: province of Valdivia, Chile; *n.v.*

Vegetatively similar to *S. sessilis*; achenes glabrous, without wings, often purple at maturity.

Notes: Occurs in Melbourne in south-central Victoria, and Hobart in south-eastern Tasmania. Recorded from lawns. Flowers most times of year.

This species is uncertainly naturalised. Its achene morphology is quite distinct from that of *S. sessilis q.v.*, and this treatment follows the view of Aston (1982) who recognised this species as distinct. Further collections are desirable to help characterise any further morphological differences between this species and *S. sessilis*. According to Aston (per voucher *H.I.Aston 2150* MEL), the leaves of this species are a deeper green than in *S. sessilis*.

Representative specimens: VICTORIA: Queen Victoria Gardens, between St Kilda Rd and the Floral Clock, *H.I.Aston 2150* (CANB, HO, MEL); beside Camberwell Town Hall, Camberwell, *H.I.Aston 2231* (MEL). TASMANIA: Rose Bay, 21 Dec. 1981, *R.B.Pears* (MEL).

3. *_Soliva anthemifolia_ (Juss.) Sweet, *Hort. Brit.* 243 (1827)

Gymnostyles anthemifolia Juss., *Ann. Mus. National Hist. Nat.* 4: 262, t. 61, fig. 1 (1804).

Type: *n.v.*

Plants with scattered hairs c. 0.5–1.5 mm long. Leaves to c. 13 cm long, 2- or 3-pinnatisect, with primary segments elliptic to orbicular in outline. Capitulum 5–12 mm diam. Involucre 2.5–3 mm long; bracts numerous, narrow-oblong to narrow oblong-elliptic, rounded, with a narrow pale or purplish hyaline margin. Outer florets up to c. 100. Central florets: corolla c. 2 mm long, c. 0.3 mm diam. Achenes (excl. spine) obovate in profile, c. 1.8–2.2 mm long, woolly apically; body 0.5 mm wide; wings/margins c. 0.6 mm wide, plane, entire, obtuse to rounded apically, thick, prominently transversely ridged; stylar spine c. 2–3.5 mm long.

Notes: Occurs inland, from Didcot in south-eastern Queensland SSW to northern Victoria, and further west to far south-eastern South Australia. Grows in loam and sandy-loam in lawns and on margins of watercourses in woodland. Flowers winter–spring.

This species and *S. stolonifera* are members of subgenus *Gymnostyles*, and these two species differ most obviously from the two species of subgenus *Soliva* (*S. sessilis* and *S. valdiviana*) in having achenes with thickened transversely wrinkled margins and with long apical hairs.

Representative specimens: SOUTH AUSTRALIA: c. 3.5 km downstream from Lock 6, Murray R., environs of Chowilla, *C.R.Alcock 10313* (AD). QUEENSLAND: 28 km W of Bollon, *H.I.Aston 2421* (BRI, MEL). NEW SOUTH WALES: Salt Caves Dam, Denbollie State Forest, *J.R.Hosking 1894* (CANB, MEL, NSW); O'Briens Ck where crossed by Newell Hwy, c. 2.5 km SW of Narrabri, *H.I.Aston 2414* (AD, BRI, MEL, NSW). VICTORIA: near Murray R. 3 km S of Tocumwal P.O., *A.C.Beauglehole 63962* (MEL).

4. *_Soliva stolonifera_ (Brot.) R.Br. ex G.Don, *in* J.C.Loudon, *Hort. Brit.* 364 (1830)

Hippia stolonifera Brot., *Fl. Lusit.* 1: 72 (1804).

Type: *n.v.*

Plants with few to scattered hairs to c. 0.3 mm long or ± glabrous. Leaves to c. 4 cm long, 1-pinnatisect, with segments oblong or elliptic, entire or with 1 or 2 lobes. Capitulum 4–7 mm diam. Involucre 2.5–3 mm long; bracts 15–20, narrow-oblong to narrowly oblong-elliptic, rounded, with a narrow pale or purplish hyaline margin. Outer florets numerous. Central florets: corolla c. 1.2 mm long, c. 0.2 mm diam. Achenes (excl. spine) obovate in profile, c. 1.8–2.2 mm long, woolly apically; body 0.1–0.2 mm wide; wings/margins c. 0.6 mm wide, acute apically, thick, prominently transversely ridged; stylar spine 1–2 mm long.

Notes: Occurs inland, from south-eastern Queensland, SSW through New South Wales to central Victoria. Grows in woodland, shrubland and *E. camaldulensis* forest. Flowers winter–spring.

Representative specimens: QUEENSLAND: Texas Lagoon, southern outskirts of Texas township, *A.R.Bean 17919* (BRI). NEW SOUTH WALES: Peak Hill, between Dubbo and Parkes, *H.I.Aston 2389* (HO, MEL, NSW). VICTORIA: S of Glenluce Springs and Loddon R., 4 Nov. 1989, *E.Perkins s.n.* (MEL).

Acknowledgements

I would like to thank the Royal Botanic Gardens, Melbourne (MEL) for the use of their herbarium and library facilities, and the scientific and technical staff at MEL for their assistance with loans and other matters. I would also like to thank the directors of AD, BRI, CANB, HO, NSW and PERTH for the loan of specimens. This study was funded by Australian Biological Resources Study (ABRS grant no: 2000/3192).

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Index to genera

Muelleria 25: 59-100 (2007)

A taxonomic treatment of tribe Lactuceae (Asteraceae) in Australia

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Abstract

A concise taxonomic treatment of tribe Lactuceae (Asteraceae) in Australia is presented, with descriptions of 35 species in 20 of the 23 genera in Australia. Keys to all genera and to species in 20 genera are presented. In this paper *Tolpis virgata* (Desf.) Bertol., *Reichardia picroides* (L.) Roth, and *Lactuca serriola* f. *integrifolia* (Gray) S.D.Prince & R.N.Carter are newly recognised as introduced taxa, and two subspecies of *Hedypnois rhagadioloides* (L.) F.W.Schmidt are recognised for the first time in Australia.

Introduction

Tribe Lactuceae is a large tribe in the Asteraceae with well over 1500 species predominantly in the northern hemisphere. Australia is poorly represented, having only six genera with native representatives and a total of only c. 18 native species. Seventeen further genera have introduced representatives in Australia. The vast majority of species in Australia have their entire or major part of their distribution south of tropical latitudes. Many species are widespread and common weeds of urban environments, wasteland and agricultural land. *Sonchus* and *Taraxacum* are represented by a mixture of native and introduced species, whereas *Launaea*, *Picris*, *Microseris*, *Youngia*, and *Actites* are represented by only native species. No genera are endemic to Australia.

The taxonomic review presented here is drawn from a *Flora of Australia* account of the Lactuceae recently prepared by the author. As it is likely to be several years before the *Flora* account is published, it is considered desirable to present the findings of my research at this time.

The Lactuceae is a relatively easily recognisable tribe of mostly non-spiny herbs, characterised by ligulate capitula (all florets zygomorphic), 5-lobed ligules, and abundant latex. A pappus is usually present and typically is composed of scales or bristles. Bristles are sometimes plumose. Achenial dimorphism, where the generally small proportion of achenes located peripherally on the receptacle differ from those located centrally, occurs in several genera. Sometimes these outer achenes are concealed within the concavity of the adjacent hardened involucral bract. The ligules of members of the Lactuceae are rather thin and have a truncate, distinctly 5-lobed apex. The ligule is most often yellow at least adaxially; the abaxial surface sometimes has a contrasting longitudinal stripe of various colours. Another common feature is the way in which withered corollas clump post-anthesis. These clumps commonly fall away from the capitulum en masse.

Species are described for 20 of the 23 genera occurring in Australia. The genera *Picris*, *Microseris*, *Taraxacum* did not come under the author's purview; however, generic descriptions are presented and taxonomic issues regarding these genera are discussed. For *Picris* a list of species is presented. Several species collected once or twice in Australia but not considered naturalised have been included in keys and discussed under their respective genera. Such species are from the genera *Cichorium*, *Crepis*, *Hieracium*, *Sonchus*, and *Tragopogon*.

Tribe LACTUCEAE

Herbs, mostly taprooted, with latex abundant. Hairs glandular or eglandular, sometimes 2–5-furcate, rarely stellate. Not stoloniferous or rhizomatous except in *Launaea sarmentosa* and *Hieracium aurantiacum* (stoloniferous) and *Actites megalocarpus* (rhizomatous). Leaves alternate and/or rosulate, pinnate-veined, or parallel-veined in *Tragopogon*, spiny and decurrent down stems in *Scolymus*, not glandular. Inflorescences terminal. Capitula ligulate, pedunculate, or less often sessile to sub-sessile; involucral bracts uni-, bi- or multiseriate, free or nearly so, sometimes with outgrowths; receptacle epaleate except in *Hypochaeris* and *Scolymus*, usually ± flat. Florets all zygomorphic, bisexual, with tube generally pilose at least at summit; ligule commonly yellow especially adaxially, but also of other colours, with apex truncate, 5-lobed; anthers calcarate and caudate, with apical appendage thin, obtuse to rounded; style with acute hairs, ± evenly distributed; style-branches generally long, tapering, with a single stigmatic area. Achenes homomorphic or dimorphic, terete or compressed, beaked* or not, with ribs ornamented or smooth; papillose hairs lacking. Pappus sometimes dimorphic, rarely absent, comprising bristles or scales; bristles/scales sometimes of two types within a pappus, smooth, scabridulous, barbellate, or plumose.

Notes: *The term beak refers to the cylindrical, much-narrowed section evident distally in some achenes. To qualify as a beak in this treatment this section must extend for 1 millimetre or more before dilating to receive the pappus. The diameter of beaks in Australian material varies from 0.1 to c. 0.5 mm.

In all descriptions below, the diameter of the involucre is the diameter in unpressed specimens measured c. mid-involucre.

Key to Genera

1 Stem leaves ± rigid, spiny, decurrent as prominent wings down stems; capitula subsessile surrounded and exceeded by large foliaceous bracts; receptacular paleae c. 6 mm long, enclosing achene ..... **1. *Scolymus***

1: Stem leaves absent or soft to firm, sometimes weakly spiny, not decurrent down stem; capitula not both subsessile and surrounded and exceeded by large foliaceous bracts; receptacular paleae absent or > 10 mm long, not enclosing achene

2 Pappus of at least central florets with plumose bristles (i.e. bristles with long, extremely fine branches)

3 Involucral bracts uniseriate (rarely an isolated outer bract present); achenes 10–50 mm long

4 Leaves grass-like, parallel-veined, glabrous; peduncle not setose; ligule pale to dark purplish, or if yellow much shorter than involucre; achenes with a smooth transition into beak ..... **23. *Tragopogon***

4: Leaves not grass-like, pinnate-veined, with scattered hairs on both surfaces; peduncle setose, sometimes minutely so; ligule yellow, exceeding involucre; achenes with an abrupt junction between body and beak s ections ..... **17. *Urospermum***

3: Involucral bracts bi- or multiseriate; achenes 3–15 mm long

5 Receptacular paleae attending each floret ..... **18. *Hypochaeris***

5: Receptacular paleae absent

6 Spreading hairs absent; achenes pale, without transverse ridges, distal two-thirds not tapering, c. 1 mm diam ..... **22.** ***Scorzonera***

6: Spreading furcate hairs present; all or most achenes orange-brown with transverse scale-like ridges and tapering in distal half and/or beaked (narrowest region < 0.5 mm diam.)

7 Plants scapose; hairs on stems and leaves bifurcate, with prongs not recurved; pappus of marginal achenes a corona of bristles to 1 mm long ..... **19.** ***Leontodon***

7: Plants usually with cauline leaves; hairs on stems and leaves 2–5-furcate with prongs recurved; pappus of marginal achenes not as above

8 Capitula surrounded by a conspicuous whorl of 5 bracteal leaves 5–22 mm long and more than 4 mm wide; inner involucral bracts bearing a long setose sub-apical spur ..... **20.** ***Helminthotheca***

8: Capitula not surrounded by a whorl of bracteal leaves as described above; inner involucral bracts without a sub-apical spur ..... **21.** ***Picris***

2: Pappus never with plumose bristles (bristles either scabrid-barbellate or ± smooth) or pappus absent

9 Achenes beaked (see definition above)

10 Plants scapose; capitulum solitary ..... **5.** ***Taraxacum***

10: Plants with stem leaves and/or branches; capitula few to numerous

11 Achenes strongly compressed ..... **8.** ***Lactuca***

11: Achenes not or only slightly compressed

12 Stem leaves present at anthesis; all capitula distinctly pedunculate; bracts with spreading setose or glandular hairs; achenes ± gradually tapering, with ring of scales absent ..... **4.** ***Crepis***

12: Stems often leafless at anthesis; capitula in ± sessile clusters along branches; bracts lacking setose or glandular hairs; achenes with a prominent ring of scales at the abrupt transition from body to beak ..... **3.** ***Chondrilla***

9: Achenes not beaked (see definition above)

13 Stem leaves generally no more than 4; inner involucral bracts firm, strongly convex, at maturity; marginal and central achenes markedly different and/or their pappus very different in length

14 Leaf hairs simple; outer involucral bracts shorter or longer than inner bracts; achenes 1.3–2.0 mm long ..... **15.** ***Tolpis***

14: Leaf hairs furcate; outer and intermediate involucral bracts shorter than inner bracts; achenes 4.5–9 mm long ..... **16.** ***Hedypnois***

13: Stem leaves few to many; inner involucral bracts not firm or convex at maturity; achenes and/or pappus all similar

15 Ligule of florets entirely blue, rarely white or pink; pappus of minute scales ..... **2.** ***Cichorium***

15: Ligule of florets yellow; pappus of bristles or hairs or pappus absent

16 Leaves divided with terminal lobe/segment markedly larger than lateral lobes; outer bracts ovate, 0.5–1 mm long; inner bracts 4–8 mm long, glabrous; pappus absent or c. 3 mm long

17 Stem leaves > 3; inner involucral bracts 5–8 mm long, becoming firm, keeled along its length; pappus absent ..... **7. *Lapsana***

17: Stem leaves 0–3; inner bracts 4–5 mm long, remaining thin, only keeled near base; pappus present ..... **6. *Youngia***

16: Leaves various; outer bracts variously shaped, > 1 mm long; inner bracts 2.5–20 mm long, glabrous or hairy; pappus > 3 mm long

18 Achenes all moderately to strongly compressed; pappus of somewhat persistent fine hairs and an inner series of early caducous bristles

19 Non-rhizomatous annuals or biennials; involucre to c. 12 mm long; achenes < 4 mm long ..... **9. *Sonchus***

19: Rhizomatous perennials; involucre mostly > 12 mm long; achenes > 4 mm long ..... **10. *Actites***

18: Achenes not or hardly compressed; pappus not of two types of bristles as above

20 Plants scapose; pappus of long scales or of bristles that broaden basally ..... **13. *Microseris***

20: Plants with stem leaves; pappus of bristles that do not broaden basally

21 Plants glabrous; outer involucral bracts broad-ovate to ovate, with a hyaline margin 0.3–2 mm wide

22 Prostrate plants to 0.05 m high, with runners bearing a single capitulum at few-leaved nodes; outer involucral bracts not cordate-based ..... **11. *Lapsanaea***

22: Erect plants to c. 0.7 m high, without runners; outer involucral bracts strongly cordate-based ..... **12. *Reichardia***

21: Plants hairy; outer involucral bracts lanceolate to linear, with a hyaline margin hardly developed

23 Plants sometimes stoloniferous; leaves entire, with those on stem much reduced, narrowing to base, not stem-clasping; fine stellate hairs present; achenes not tapering distally ..... **14. *Hieracium***

23: Plants not stoloniferous; at least some leaves usually toothed or divided; cauline leaves not narrowing to base, with stem-clasping auricles; stellate hairs absent; achenes tapering distally ..... **4. *Crepis***

1. SCOLYMUS L., *Sp. Pl.* 2: 813 (1753)

Annual, biennial or perennial herbs, branching. Hairs simple, non-glandular. Leaves predominantly cauline, rigid, spiny, decurrent down stems as green spiny wings. Inflorescences solitary or capitula few. Capitula sessile or sub-sessile; involucral bracts multiseriate; inner bracts not hardened, ± erect at maturity; receptacular paleae broadly oblong-elliptic or ovate in profile with apex obtuse to rounded, broadly-winged, enclosing and falling with achene. Florets: ligule golden-yellow. Achenes homomorphic, strongly compressed, unbeaked. Pappus homomorphic, of minute scales and sometimes bristles, with bristles not persistent; bristles scabrid-barbellate, uniform within a pappus.

A genus of three species from the Mediterranean region. A somewhat atypical member of tribe Lactuceae placed in a subtribe of its own by Bremer (1994). Leaves of *Scolymus* appear variegated due to the paler venation and marginal spines. Its fleshy roots have historically been eaten.

Key to species

Biennials or perennials; leaves decurrent for c. 1–4 cm but mostly not extending to leaf below; stems moderately coarse-woolly; hairs on ligule drying pale; long pappus bristles 2 or 3 ..... **1. *S. hispanicus***

Annuals; most leaves decurrent for > 4 cm and typically extending to or beyond the leaf below; stems ± glabrous; hairs on ligule drying dark; long pappus bristles absent ..... **2. *S. maculatus***

1. *_Scolymus hispanicus_ L., *Sp. Pl.* 2: 813 (1753)

Type: Italy; *n.v.*

Biennials or perennials to c. 0.9 m high, somewhat woolly on stems. Stem leaves deeply divided with segments spreading to antrorse, spiny; decurrent leaf-bases extending 1–4 cm down stem, mostly not extending to the leaf below, spiny; margin with scattered spinules. Capitula surrounded and exceeded by 3 or 4 foliaceous bracts 3–5 cm long, arising at base; involucre 10–15 mm long, c. 5–8 mm diam.; bracts with apex spinose and hyaline margin narrow; outer series 6–8 mm long; inner bracts 10–15 mm long; receptacular paleae ovate, c. 7 mm long, 5 mm wide, with apex erose. Florets: ligule 10–15 mm long; tube with pale hairs; style pubescence pale. Achenes 3–5 mm long, with faces obovate, yellowish-brown. Pappus a corona of minute scales and 2 or 3 long seabrid-barbellate bristles. *Golden Thistle.*

Notes: Native to the Mediterranean region. Occurs in central-eastern New South Wales in the Mudgee district, in far south-central New South Wales, and in central Victoria. A troublesome weed in Argentina, Chile and California, U.S.A. Grows in disturbed sites such as pastures and wasteland. Flowers late spring–summer.

A noxious weed in Victoria.

Representative specimens: NEW SOUTH WALES: Hill Plain, south Deniliquin, *W.E.Mulham W822* (NSW). VICTORIA: c. 2–3 km NW from Werribee township, at Lollypop Ck, *V.Stajsic 1302* (CANB, MEL, NSW); Terrick Terrick State Park, *A.C.Beauglehole 82589* (MEL).

2. *_Scolymus maculatus_ L., *Sp. Pl.* 2: 813 (1753)

Type: Italy, Herb. Linn. 963.1; lecto: LINN, *fide* C.Jeffrey, *Regnum Veg.* 127: 86 (1993).

Annuals to c. 1.0 m high, ± glabrous. Stem leaves deeply divided with segments spreading to antrorse, spiny; decurrent leaf-bases extending several to many cm down stem, extending to or beyond the leaf below, spiny; margin with scattered spinules. Capitula surrounded and exceeded by 3 or 4 foliaceous bracts 3–4 cm long arising at base; involucre c. 15 mm long, c. 5–8 mm diam.; bracts with apex spinose and hyaline margin narrow; outer series 5–10 mm long; receptacular paleae obovate, c. 6 mm long, 4 mm wide, with apex entire. Florets: ligule 10–15 mm long; tube with dark hairs; style pubescence pale. Achenes 2.5–4 mm long, with faces obovate, yellowish-brown. Pappus a corona of minute scales, with long bristles absent. *Spotted Golden Thistle.*

Notes: Native to the Mediterranean region. Occurs in south-eastern Queensland and northern New South Wales as far south as Merriwa in the central-east of the state. Grows in heavier soils in disturbed sites such as pastures and wasteland. Flowers early summer.

A declared noxious weed in some shires in north-eastern New South Wales. The basal leaves are much softer and less spiny than cauline leaves and may be seen in younger plants.

Representative specimens: QUEENSLAND: 9 km south of Dirranbandi on road to Hebel, Maranoa, *G.N.Batianoff 2112181 & D.Halford* (BRI, MEL). NEW SOUTH WALES: 66 km north of Moree, towards Goondiwindi, *A.R.Bean 15836* (BRI, NSW); Wallangra, 19 Dec. 1983, *J.Black s.n.* (NSW).

2. CICHORIUM L., *Sp. Pl.* 2: 813 (1753)

Annual, biennial or perennial herbs, branching. Hairs simple, glandular and eglandular. Leaves basal and cauline. Inflorescences paniculate. Capitula pedunculate or sub-sessile; involucral bracts biseriate; basal portion of inner bracts hardened and erect at maturity. Florets: ligule violet-blue or blue, rarely white or pink. Achenes homomorphic, not compressed, beakless. Pappus of scales, persistent; scales uniform within a pappus.

A genus of about nine species from Europe, northern Africa and Asia. *Cichorium endivia*, Endive, is cultivated as a leaf vegetable in Australia but does not appear to be naturalised. It has been recorded from the Parkes and Wallendbeen areas of New South Wales and from Swan Hill in Victoria Its frilly leaf margin, purplish florets, and longer pappus scales distinguish it from *C. intybus*.

Key to species

Ligules blue, or rarely white; pappus scales 0.2–0.3 mm long ..... ***C. intybus***
Ligules purplish; pappus scales 0.6–1.0 mm long ..... ***C. endivia***

Cichorium intybus* L., *Sp. Pl.* 2: 813 (1753)

Type: Europe, Herb. Linn. 962.1; lecto: LINN *n.v.*, *fide* H.W.Lack, *Fl. Iranica* 122: 6 (1977).

Perennials to c. 2 m tall, becoming much-branched, with short spreading eglandular hairs on stems and leaves, glabrescent. Basal leaves with l:w ratio (1–)3–8, divided or not; margin entire, denticulate or dentate; divided leaves with up to 6 retrorse segments per side; cauline leaves several, mostly undivided; base becoming slightly stem-clasping. Capitula numerous, with single capitula on a stout peduncle, or groups of 2 or 3 ± sessile capitula; involucre 9–12 mm long, 2–4 mm diam.; bracts glabrous, or with a few gland-tipped hairs or setae; outer bracts c. 6, ovate–narrow-ovate, 4–6 mm long, with a pale oval region proximally; inner bracts erect and firm at maturity; receptacle c. 3–4 mm diam. Florets: ligule c. 15–25 mm long, blue or rarely white; style pubescence pale. Achenes angular-obconical, 2–3 mm long, with ribs undeveloped, brown, sometimes mottled. Pappus 0.2–0.3 mm long, white. *Chicory*.

Notes: Native to Europe, northern Africa and Asia. Occurs in far south-western Western Australia, mostly south from Perth, in south-eastern Australia from Bundaberg in south-eastern Queensland SSW to Victoria and further west to far south-eastern South Australia, and in eastern Tasmania. Grows in disturbed environments, particularly on roadsides. Flowers spring–summer.

Cichorium intybus has been cultivated in Australia for its large tap-root which can be roasted and ground for mixing with coffee.

Representative specimens: SOUTH AUSTRALIA: Port Rd, Woodville near Woodville Rd interseetion, *R.J.Chinnock 3362* (AD). QUEENSLAND: Carneys Ck Rd, near Croftby, SW of Boonah, *P.I.Forster 28063 & G.Leiper* (AD, BRI, MEL, NSW). NEW SOUTH WALES: 19 km west of Glen Innes on road to Inverell, *J.J.Plat 9, R.G.Coveny & C.J.Dunn* (MEL, NSW). VICTORIA: c. 8 km NNW of Peechelba, along the Wangaratta to Yarrawonga Hwy, *H.I.Aston 2171* (HO, MEL). TASMANIA: Hollow Tree Rd (Bothwell–Hamilton), 4.4. km from Lyell Hwy, *E.A.Brown 94/173 & K.L.Radford* (HO, NSW).

3. CHONDRILLA L., *Sp. Pl.* 2: 796 (1753)

Annual or perennial herbs, branching. Hairs simple, eglandular. Leaves basal and cauline. Inflorescences paniculate. Capitula ± sessile; involucral bracts biseriate; not hardened, reflexed at maturity. Florets yellow. Achenes homomorphic, not or hardly compressed, beaked. Pappus of bristles, persistent; bristles scabridulous, uniform within a pappus.

A genus of approximately 25 species, from Europe, northern Africa and Asia.

**Chondrilla juncea* L., *Sp. Pl.* 2: 796 (1753)

Type: Europe, Herb. Clifford 383, *Chondrilla* no. 1; lecto: BM, *fide* H.W.Lack, *Fl. Iranica* 122: 285 (1977).

Perennials to c. 1.3 m high, becoming much-branched, with spreading to retrorse bristles 2–3 mm long and a close fine wool basally on stems. Basal leaves with l:w ratio c. 5–8, runcinately divided; margin dentate or denticulate; cauline leaves much smaller than basal leaves, narrow-linear, entire, not stem-clasping. Capitula many, with lateral capitula sub-sessile, single or in groups of 2 or 3; involucre 7–13 mm long, c. 2 mm diam.; bracts somewhat appressed woolly; outer bracts c. 6, ovate, c. 1 mm long; inner bracts c. 7–9, with hyaline margin slender and vestigial. Florets 9–12; ligule 7–10 mm long; style pubescence pale. Achenes 8–10 mm long; body c. oblong-ellipsoid, with ribs prominent, scaly distally, terminating in a ring of 5 scales surrounding base of beak, cream to brown; beak capillary, c. 50% longer than body, generally caducous with pappus. Pappus 6–7 mm long, white; bristles minutely scabridulous. *Skeleton Weed.*

Notes: Native to western Asia, Europe and northern Africa. Occurs in south-western Western Australia from Geraldton SE to Esperance, in south-eastern Australia from Bundaberg south to Victoria and extending further west from Victoria into far south-eastern South Australia. Grows in disturbed sites including roadsides and on agricultural land. Flowers late spring–autumn.

A declared noxious weed in Western Australia, South Australia, New South Wales, Victoria and Tasmania. Its ability to regrow from underground parts has made it difficult to eradicate by mechanical means. Hull & Groves (1973) identified three variants, but these have not been recognised taxonomically. Variation was greatest in the shape of the basal leaves, but also occurred in inflorescence and fruit morphology. The less common variants were largely restricted to central-eastern New South Wales. Narrow-leaf and broad-leaf forms have been recognised in South Australia.

Representative specimens: WESTERN AUSTRALIA: Eastern part of Curtin University Campus, Bentley, Perth, *B.J.Lepschi 2532* (AD, CANB, MEL, PERTH). SOUTH AUSTRALIA: Abutting south boundary of the Hineks Natl Park sec. 40, Hd of Moody, *C.R.Alcock 2563* (AD). QUEENSLAND: Thane Ck, near Warwick, 22 Dec. 1958, *J.Mitchell* (BRI). NEW SOUTH WALES: c. 8.5 km from Blakney Ck toward Bevendale, at Handy's Ck crossing, Southern Tablelands, *E.M.Canning 6372* (AD, CANB, MEL, NSW). VICTORIA: c. 10 km east of Yarrawonga, along the Murray Valley Hwy, *H.I.Aston 2173* (MEL).

4. CREPIS L., *Sp. Pl.* 2: 805 (1753)

Annual or biennial herbs, branching, or stemless in *C. pusilla*. Hairs simple, glandular and eglandular. Leaves predominantly basal. Inflorescences cymose or paniculate, Capitula pedunculate, sessile in *C. pusilla*; involucral bracts biseriate; inner bracts mostly hardened, strongly convex and erect at maturity. Florets: ligule yellow. Achenes homomorphic or slightly dimorphic; sometimes slightly compressed, beaked or not. Pappus of bristles, persistent or not; bristles minutely scabridulous, uniform within a pappus.

A genus of approximately 200 species from the northern hemisphere, tropics and South Africa. The inner series of involucral bracts of most species of this genus become firm and strongly convex as fruits develop. Often achenes adjacent to these bracts are shorter and with a more curved body than more central achenes and tend to be housed within the convexity of the bract at maturity. Achenes have c. 10 prominent ribs.

Crepis dioscoridis L. from south-eastern Europe has been recorded once in Australia, from Meadows in the Southern Lofty Ranges, but there is no indication that it is naturalised. It is vegetatively similar to *C. capillaris* but with a larger more densely tomentose capitulum and longer achenes.

Key to species

1 Plants stemless; capitula sessile at base of plant ..... **5. *C. pusilla***
1: Plants developing aerial stems, to 1 m high; capitula pedunculate

2 Peduncles and involucral bracts with robust pale spreading eglandular bristles 1–2 mm long, the indumentum neither cobwebby nor with glandular hairs ..... **2. *C. setosa***
2: Peduncles and involucral bracts without bristles as above, the indumentum cobwebby and often also with spreading gland-tipped hairs to c. 1.5 mm long

3 Stem leaves moderately hairy, entire to lobate; involucral bracts lacking black hairs; capitular buds nodding; central achenes 12–17 mm long, exceeding bracts at maturity ..... **4. *C. foetida***
3: Stem leaves glabrous or nearly so, or if moderately hairy then usually mostly pinnatisect; involucral bracts often with black midline hairs; capitular buds erect; central achenes 1.5–9 mm long, shorter than bracts at maturity

4 Outer bracts lanceolate, 1.0–1.3 mm wide; achenes 6–9 mm long, beaked; pappus clearly overtopping bracts ..... **3. *C. vesicaria***
4: Outer bracts narrow-lanceolate to linear, 0.3–0.6 mm wide; achenes 1.5–6 mm long, not or hardly beaked; pappus not or hardly overtopping bracts

5 Involucre not densely white-woolly, achenes 1.5–2.5 mm long ..... **1. *C. capillaris***
5: Involucre densely white-woolly, achenes 4–6 mm long ..... ***C. dioscoridis*** **(see notes above)**

1. *_Crepis capillaris_ (L.) Wallr., *Erst. Beitr. Fl. Hercyn.* 287 (1840)

Lapsana capillaris L., *Sp. Pl.* 2: 812 (1753).

Type: not designated.

Crepis virens L., *Sp. Pl.* 2nd edn, 1134 (1763), *nom. illeg.* Type: not designated.

[*Crepis tectorum auct. non* L.: A.J.Ewart, *Fl. Victoria* 1197 (1931)]

Plants to c. 1.2 m high, glabrous except for spreading weak hairs on lower stem and leaf midrib. Basal leaves undivided, lobed or lyrate-pinnatisect, with l:w ratio c. 5–8, with segments c. spreading; margin entire or nearly so. Stem leaves few, undivided or lobate above mid-stem; base becoming sagittate, stem-clasping upwards. Capitula few to several; involucre 5–8 mm long, c. 1.5–3 mm diam.; outer bracts 8–10, 2–4 mm long, 0.3–0.6 mm wide, hairy or nearly glabrous; inner bracts usually cobwebby, with emergent usually blackish and broad-based gland-tipped hairs, hardened and convex at maturity or not; receptacle 1.5–4 mm diam. Florets: ligule 5–9 mm long; style pubescence sometimes slightly darkened. Achenes fusiform, 1.5–2.5 mm long, unbeaked, with ribs well-spaced, without ornamentation. Pappus caducous, 3–4 mm long, white. *Smooth Hawksbeard.*

Notes: Native to Europe. Occurs in far south-western Western Australia from Augusta east to Albany, in south-eastern Australia from Glen Innes SSW to southern Victoria and further west to Adelaide in far south-eastern South Australia, and in Tasmania. Grows in mesic environments, mostly in disturbed sites such as urban habitats and roadsides, in plains, forests and woodland, from sea-level to c. 1300 m. Flowers spring–autumn.

Prior to fruit development, the less divided leaves, smaller capitula and narrower outer bracts distinguishes *C. capillaris* from the otherwise similar *C. vesicaria* subsp. *taraxacifolia*. The inner involucral bracts of *C. capillaris* are glabrous adaxially, unlike those of *C. foetida*, *C. vesicaria* and *C. setosa*.

Representative specimens: WESTERN AUSTRALIA: c. 3.2 km east of Nannup, *R.D.Royce 8400* (MEL, PERTH). SOUTH AUSTRALIA: Onkaparinga R. near Mylor, 9 Dec. 1944, *J.B.Cleland* (AD). NEW SOUTH WALES: Adaminaby Cemetery, *I.Crawford 3782* (CANB, MEL, NSW). VICTORIA: Terang, *R.V.Smith 75/16* (AD, BRI, CANB, HO, MEL, NSW). TASMANIA: Franklin, *D.I.Morris 86491* (HO).

2. *_Crepis setosa_ Haller.f., *in* J.J.Roemer, *Arch. Bot. (Leipzig)* 1: 1 (1797)

Type: Peru, 1855–56, *Spruce 4191*; syn: B, E, C all *n.v.*, *fide* J.Solomon (2006a)

Plants to c. 1.0 m high, with spreading hairs on stems and leaves, long-setose on stems. Basal leaves undivided, lobed or lyrate-pinnatisect, with l:w ratio c. 4–8; margin entire or with scattered denticulations; cauline leaves few, undivided or lobate above mid-stem; base becoming auriculate, stem-clasping upwards. Capitula few or several; involucre 6–10 mm long, c. 3–4 mm diam.; outer bracts 8–10, 2–4 mm long, 0.7–1.0 mm wide, with long pale non-glandular hairs; inner bracts with similar indumentum, also slightly cobwebby, hardened and convex at maturity; receptacle c. 3 mm diam. Florets: ligule 5–9 mm long; style pubescence dark. Achenes 4–7 mm long, tapered into a beak; body fusiform, 2.5–4.5 mm long, with ribs well-spaced, scabridulous; marginal achenes shorter. Pappus persistent, 4–5 mm long, white. *Bristly Hawksbeard.*

Notes: Native to the Mediterranean region and south-western Asia. Occurs in north-eastern and south-central Victoria, and around Hobart in south-eastern Tasmania. There is an old record from Hornsby in central-eastern New South Wales. Grows mostly in disturbed sites such as roadsides and river flats but also extending into forest. Flowers summer–autumn.

Similar to *C. capillaris* except for the setose indumentum and the longer, beaked achenes.

Representative specimens: NEW SOUTH WALES: Hornsby, Feb. 1918, *W.H.Blakely* (NSW). VICTORIA: Porepunkah, next to Ovens R., *J.R.Hosking 1414* (CANB, MEL, NE, NSW). TASMANIA: Mt Nelson Rd, Hobart, 19 Jan. 1947, *W.M.Curtis* (HO).

3. *_Crepis vesicaria_ subsp. ***taraxacifolia*** (Thuill.) Thell., *in* Schinz & R.Keller, *Fl. Schweiz*, 3rd edn, 2: 361 (1914)

Crepis taraxacifolia Thuill., *Fl. Env. Paris* 409 (1799).

Type: France; *n.v.*

Barkhausia haenseleri Boiss. ex DC., *Prodr.* 7: 153 (1838), as *Haenseleri*; *Crepis vesicaria* subsp. *haenseleri* (Boiss. ex DC.) Sell, *Bot. J. Linn. Soc.* 71: 254 (1975). Type: Southern Spain, *E.Boissier*; *n.v.*

Plants to c. 1.2 m high, with spreading hairs on stem and leaves, sometimes rather sparse. Basal leaves lyrately 1- or 2-pinnatisect, with l:w ratio c. 5–8, with segments c. spreading; margin entire or with scattered teeth or denticulations; cauline leaves few, usually pinnatisect above mid-stem; base becoming dilated and stem-clasping upwards. Capitula few to many; involucre 8–12 mm long, c. 3–5 mm diam.; outer bracts 8–12, 3–5 mm long, 1.0–1.3 mm wide, nearly glabrous; inner bracts cobwebby, with emergent usually blackish and broad-based gland-tipped hairs, ?not hardened, slightly convex at maturity; receptacle 3–6 mm diam. Florets: ligule 5–9 mm long; style pubescence dark. Achenes 6–9 mm long, beaked; body c. fusiform, 3–4.5 mm long, with ribs well-spaced, scabridulous. Pappus persistent, c. 5 mm long, white. *Dandelion Hawksbeard.*

Notes: Native to Europe. Occurs in far south-eastern Australia from the Adelaide region in far south-eastern South Australia east to Ballarat in south-central Victoria. Also naturalised in New Zealand. Grows in waste land. Flowers spring–early summer.

A very common weed of roadsides between Warrnambool and Portland in Victoria. It has a similar indumentum to *C. capillaris* but its leaves are more divided, inflorescences more congested and with larger capitula, the outer involucral bracts are broader, and achenes much longer and beaked.

Representative specimens: SOUTH AUSTRALIA: Mt Watch Quarry area, c. 1 km from Millicent–Glencoe Rd, *A.A.Munir 5341* (AD). VICTORIA: roadside near Drive-In Theatre, outskirts of Portland, *R.V.Smith 67/130* (AD, CANB, MEL, NSW); Nigretta Falls on Wannon R., c. 7.5 km (direct line) ENE of Wannon, *I.C.Clarke 2527* (AD, CANB, MEL, NSW).

4. *_Crepis foetida_ L., *Sp. Pl.* 2: 807 (1753) subsp. ***foetida***

Type: France; *n.v.*

Crepis foetida a. *vulgaris* Bisch., *Beitr.* 252 (1851); *Crepis foetida* subsp. *vulgaris* (Bisch.) Babc., *J. Bot.* 76: 205 (1938). Type: *n.v.*

Plants to c. 0.8 m high, with spreading hairs on lower stem and leaves. Basal leaves divided or not, with l:w ratio c. 5–8; margin entire dentate or denticulate; cauline leaves few or several, entire or lobate above mid-stem; base becoming sagittate, stem-clasping upwards. Capitula few to several; involucre 9–12 mm long, c. 3–4 mm diam.; outer bracts 12–14, 4–6 mm long, 0.4–1.0 mm wide, hairy; inner bracts cobwebby, with numerous emergent pale slender-based gland-tipped hairs, hardened and convex at maturity; receptacle c. 2–4 mm diam. Florets: ligule 5–9 mm long; style pubescence mostly pale. Achenes 7–17 mm long, beaked, dimorphic; central achenes 12–17 mm long; body narrow fusiform, c. 4 mm long, with ribs crowded, scabridulous; marginal achenes 7–10 mm long. Pappus persistent, 5–8 mm long, white. *Stinking Hawksbeard.*

Notes: Native to Europe and south-western Asia. Occurs in far south-western Western Australia from Moore R. south to Kingston forest, in south-eastern Australia from the Yorke Peninsula in South Australia east to Tumut in south-eastern New South Wales and

SE to Wangaratta in north-central Victoria, with an isolated record from Buchan in far eastern Victoria. Grows in disturbed sites, often in poor soils, in urban environments, forest and woodland. Flowers most of year.

Readily identified in fruit by the extremely long beaks of the central achenes. These exceed the involucral bracts at maturity. The somewhat shorter marginal achenes are housed within the convexity of the involucral bract at maturity. At flowering, the nodding capitular buds and paler indumentum of the involucre distinguishes it from *C. capillaris* and *C. vesicaria* subsp. *taraxacifolia*. Specimens in Australia mostly conform to subsp. *foetida* as defined by Sell (1976), but some specimens have outer involucral bracts broader than 0.75 mm.

Representative specimens: WESTERN AUSTRALIA: Landers Rd, Lesmurdie, *A.A.Mitchell 4134* (PERTH). SOUTH AUSTRALIA: Northern Yorke Peninsula, Hundred of Wiltunga, *B.Copley 3308* (AD); on roadside, west end of Torrens Gorge, *A.G.Spooner 294* (AD). NEW SOUTH WALES: near Wee Jasper Caves, *M.Gray 5363* (BRI, CANB); Brocklesby, Dec. 1921, *J.Hunter* (NSW). VICTORIA: Green Rd, Upper Lurg, *J.Strudwick 770* (MEL).

5. *_Crepis pusilla_ (Sommier) Merxm., *Mitt. Bot. Munchen* 7: 275 (1968)

Melitella pusilla Sommier, *Nuov. Giorn. Bot. Ital.* 14: 497 (1907).

Type: *n.v.*

Plants to 0.02 m high, acaulescent, nearly glabrous. Leaves divided or not, with l: w ratio c. 5–12; margin entire or denticulate. Capitula few to several, sessile; involucre 2.5–4 mm long, c. 1 mm diam.; outer bracts 2–4, c. 1 mm long, glabrous, 0.5 mm wide; inner bracts glabrous, but hairs at base of involucre, morphology not known at maturity; receptacle c. 2 mm diam. Florets: ligule c. 1 mm long; style pubescence black. Achenes ellipsoid, c. 2 mm long, not or hardly beaked, with ribs crowded, ?smooth. Pappus persistent, 1–1.5 mm long, white. *Dandelion Crepis.*

Notes: Native to Portugal, Malta, Greece and Crete. Recorded from the Eyre Peninsula around Bascombe Well and Port Lincoln in South Australia, although its persistence is uncertain. Grows on agricultural land. Flowers spring.

Representative specimens: SOUTH AUSTRALIA: Eyre Peninsula, Hundred of Blesing, near Bascombe Well HS, c. 25 km WSW of Lock, *H.Eichler 19345* (AD, MEL); Proper Bay, Port Lincoln, *C.R.Alcock 2167* (CANB).

5. TARAXACUM Weber ex Wiggers, *Prim. Fl. Holsat.* 56 (1780)

Perennial herbs, scapose. Hairs simple, eglandular. Leaves all basal. Inflorescences solitary. Capitula pedunculate; involucral bracts multiseriate, soft and reflexed at maturity. Florets: ligule yellow. Achenes homomorphic, not compressed, beaked. Pappus of bristles, persistent, homomorphic; bristles scabridulous, uniform within a pappus.

About 2500 species worldwide, predominantly from Eurasia. This genus was not assessed in detail by the author. It is currently undergoing revision in Australia. The treatment of Scarlett (1999) represents some initial findings which has greatly diverged from the previously conservative assessments presented in state floras. Two native species and seven introduced taxa are recognised in Scarlett's treatment.

6. YOUNGIA Cass., *Ann. Sci. Nat. (Paris)* 23: 88 (1831)

Annual, biennial or perennial herbs, branching. Hairs simple, eglandular. Leaves all or mostly basal. Inflorescences cymose or paniculate. Capitula pedunculate; involucral bracts biseriate; soft and reflexed at maturity. Florets: ligule yellow. Achenes homomorphic,

not compressed or outer ones slightly compressed, unbeaked. Pappus of bristles, usually persistent, bristles scabrid-barbellate, uniform within a pappus.

A genus of c. 40 species predominantly from Asia.

Youngia japonica (L.) DC., *Prodr.* 7: 194 (1838)

Prenanthes japonica L., *Mant. Pl.* 1: 107 (1767); *Crepis japonica* (L.) Benth., *Fl. Hongk.* 194 (1861).

Type: Japan; *n.v.*

[*Youngia thunbergiana auct. non* DC. (1838), *nom. illeg.*: J.D.Hooker, *Fl. Tasman.* 1: lxv (1859)]

Scapose or scapiform annuals to c. 0.6 m high, with spreading coarse hairs scattered or sparse on stems and leaves. Basal leaves to c. 20 cm long, with l:w ratio 3–8, often lyrately divided, petiole-like basally; margin entire, denticulate or dentate; cauline leaves few, similar to basal leaves or much reduced, undivided. Capitula several to many; involucre 4–5 mm long, c. 1.5–2 mm diam.; outer bracts 3–5, ovate, 0.5–1.0 mm long, with hyaline margin broad; inner bracts 7–10, with a prominent pale keel developing basally, with hyaline margin alternately distinct and vestigial. Florets: ligule c. 3 mm long, yellow, possibly rarely white; style pubescence pale. Achenes narrow-ellipsoid, 1.5–2 mm long, slightly to moderately compressed, tapering to a neck c. 0.2 mm long, with ribs crowded, unequally prominent, ciliate, with cilia longer distally, reddish-brown or mid-brown. Pappus c. 3 mm long, white; bristles barbellate proximally.

Notes: Occurs in eastern Australia from Mt Windsor in far north Queensland south to Sydney in central New South Wales. Widely distributed in eastern Asia, including New Guinea. Grows in forests; also a weed of lawns and roadsides. Flowers most of year.

A form recorded from disturbed and urban localities has leaves with fewer sessile lateral segments, denser stem indumentum, and achenes that are mid-brown rather than darker reddish-brown. This form possibly has come from outside Australia and further investigation into this variation is warranted.

Representative specimens: QUEENSLAND: Palm Tree Ck, 22 km SE of Toowoomba, *D.Halford Q634* (BRI, MEL). NEW SOUTH WALES: Torrington–Silent Grove Rd, *N.S.Lander 535a* (BRI, CANB, HO, MEL, NSW); Alum Mtn, Buladelah, July 1923, *H.M.R.Rupp* (MEL); Gloucester, Sept. 1965, *R.G.Coveny s.n.*, (NSW).

7. LAPSANA L., *Sp. Pl.* 2: 811 (1753)

Annual, biennial or perennial herbs, branching. Hairs simple, glandular and eglandular. Leaves predominantly cauline. Inflorescences paniculate. Capitula pedunculate; involucral bracts biseriate; inner bracts somewhat firm and erect at maturity. Florets: ligule yellow. Achenes homomorphic, mildly compressed, beakless. Epappate.

A genus of c. ten species from Europe, Asia and north-western Africa.

****Lapsana communis*** L., *Sp. Pl.* 2: 811 (1753) subsp. ***communis***

Type: Locality unknown, Herb. Clifford 389, *Lapsana* no. 1A; lecto: BM, *fide* P.D.Sell, *Watsonia* 13: 301 (1981).

Annuals or biennials to c. 1.2 m high, with gland-tipped hairs on lower stem and sometimes upper stem, and short eglandular hairs on or near leaf margins. Basal leaves variably persistent; cauline leaves to 16 cm long, with l:w ratio 1–4, undivided or lyrately divided, petiole-like basally, with 1 or 2 spreading or slightly retrorse lobes per side;

margin denticulate or dentate; blade or terminal segment ovate, with base truncate or cordate; upper-stem leaves tending to be undivided, narrow-elliptic, with base narrow-cuneate. Capitula few to many; involucre 5–8 mm long, c. 2–2.5 mm diam., with margin of bracts glabrous or inconspicuously ciliate; outer bracts 4–6, ovate, c. 1 mm long, with hyaline margin vestigial; inner bracts 6–10, keeled basally, slightly incurved, with hyaline margin vestigial. Florets: ligule 5–10 mm long; style pubescence black. Achenes narrow-ellipsoid to obconical, 3–5 mm long, slightly compressed, briefly tapering distally, with ribs crowded, not prominent, glabrous, pale brown or greenish. *Nipplewort.*

Notes: Native to Europe. Occurs in far south-eastern South Australia, south-central Victoria, and eastern Tasmania, central eastern and north-eastern New South Wales, and Killarney in south-eastern Queensland. Grows in or near sites of human habitation, in shady, damp environments, including forest. Flowers mainly summer.

Predominantly a weed of sites around human habitation. The glandular portion of the stem hairs is often lost early and hairs will appear eglandular.

Representative specimens: SOUTH AUSTRALIA: Lobethal, c. 25 km east of Adelaide, 13 Feb. 1965, *M.Tregus* (AD). QUEENSLAND: Moss Gardens, c. 15 km east of Killarney, *A.R.Bean 18321* (BRI, MEL, NSW). NEW SOUTH WALES: alongside Macdonald R., Bendemeer, *J.R.Hosking 1694, G.R.Hosking & T.L.Hosking* (CANB, MEL, NE, NSW). VICTORIA: south side of Yarra R., immediately NW of intersection of Don Rd with Warburton Hwy, Launching Place, *I.C.Clarke 3086* (CANB, HO, MEL). TASMANIA: Nicholls Rivulet, *A.M.Buchanan 15034* (HO).

8. LACTUCA L., *Sp. Pl.* 2: 795 (1753)

Annual, biennial or perennial herbs, branching. Hairs simple, eglandular. Leaves predominantly cauline. Inflorescences paniculate. Capitula ± sessile, sometimes clustered; involucral bracts multiseriate, soft and erect or reflexed at maturity. Florets yellow (in Australia), drying whitish or bluish. Achenes homomorphic, strongly compressed, beaked. Pappus of bristles, persistent (in Australia); bristles minutely scabridulous, uniform within a pappus.

A genus of c. 100 species from Europe, Asia, Africa and North America. The two species in Australia have complex panicles with a proportion of capitula sessile or short-pedunculate, slender capitula with relatively few florets, achenes that taper abruptly from the body to a long capillary beak, and often silvery stems.

Key to species

Plants to c. 2 m high; lower stems prickly-setose or glabrous; upper-stem leaves (or the rachis if divided) narrow-linear; margin of at least larger stem leaves crowded-spinulose; involucral bracts typically ± reflexed at maturity; body of achene bearing minute whitish cilia distally; beak < 30% longer than body ..... **1. *L. serriola***

Plants to c. 1 m high; stems glabrous; upperstem leaves (or the rachis if divided) c. oblong to narrow-oblong; margin of all leaves without spinules; involucral bracts typically erect at maturity; body of achene scabridulous distally but with whitish cilia absent; beak > 30% longer than body ..... **2. *L. saligna***

1. **Lactuca serriola* L., *Cent. Pl.* 2: 29 (1756)

Type: southern Europe, Herb. Linn. 950.3; lecto: LINN, *fide* S.D.Prince & R.N.Carter, *Watsonia* 11: 331–338 (1977).

Lactuca scariola L., *Amoen. Acad.* 4: 489 (1759). Type: the Bauhin plate in *Hist. Pl.* 2: 1003 (1656); lecto, *fide* I.M. de Vries & C.E.Jarvis, *Taxon* 36: 151–153 (1987).

Annuals or biennials to c. 2.0 m high, with lower stems and abaxial midrib of leaves prickly-setose, or less often stem glabrous, sometimes glaucous. Stem leaves to c. 20 cm long, with l:w ratio c. 4–8, divided or not; margin spinulose-denticulate, often becoming ± smooth nearer summit; undivided leaves narrow-oblong; divided leaves with 1–3 broad retrorsely arching lobes or segments per side; base above mid-stem sagittate, stem-clasping. Capitula many to c. 100; involucre 6–10 mm long elongating to c. 15 mm long at maturity, c. 2 mm diam., with bracts reflexed at maturity; outer bracts 3–6, ovate, 1–2 mm long, with hyaline margin absent; longer intermediate bracts subequal to inner bracts at anthesis; inner bracts 4 or 5, with hyaline margin distinct. Florets: ligule 7–10 mm long; style pubescence pale. Achenes 6–8 mm long; body c. 3 mm long; faces narrow-obovate, mid-brown, with minute whitish cilia distally; beak as long as or up to c. 30% longer than body. Pappus persistent, c. 6 mm long, white; bristles extremely fine, minutely scabridulous. *Prickly Lettuce.*

Notes: Native to Europe and western Asia. The panicles of this species are typically pyramidal with capitula of primary branches tending not to diverge greatly from the branch. Leaves are typically twisted at the base so that the lamina is in a vertical plane and alternate leaves point in opposite directions. *Lactuca sativa*, from which edible lettuce varieties was derived, has more or less identical fruits to *L. serriola* but has involucral bracts that are finally erect. There is no clear evidence that it is naturalised in Australia. Another species sometimes confused with *L. serriola* is *L. virosa*; however, it has larger, darker achenes and leaves always undivided. Recorded by Everist (1981) as possibly poisonous to stock but nothing is known about the nature of the poisonous principle.

Two forms of *L. serriola* were recognised by Prince and Carter (1977) and both of these occur in Australia.

Key to forms

Stem-leaves, in middle third at least, lobate to subpinnatisect .....**a.** forma ***serriola***
Stem-leaves all entire or at the most with a few shallow broad teeth .....**b.** forma ***integrifolia***

a. *_Lactuca serriola_ L. forma ***serriola***

Mid-stem leaves lobate to subpinnatisect, with 1–3 spreading or retrorsely arched lobes/segments per side; upper-stem leaves lobate, or sometimes reducing to entire upwards; branch leaves lobed or entire.

Notes: Occurs in far south-western Western Australia, south from Geraldton, with an outlier west of Wiluna, and in southern and central Australia. Grows in disturbed sites including roadsides, wasteland and agricultural land. Flowers spring–autumn.

In more arid regions of Australia, including the Northern Territory, this form has relatively few prickles. Mid-stem leaves must be examined to distinguish this form from forma *integrifolia*.

Representative specimens: WESTERN AUSTRALIA: 17.5 km south of Goodwood Rd on Upper Capel Rd, c. 7 km WSW of Kirup, *B.J.Lepschi & T.R.Lally BJL3342* (AD, CANB, PERTH). NORTHERN TERRITORY: Ormiston Gorge, Heavitree Ra., *G.W.Carr 1479 & A.C.Beauglehole 45258* (CANB, DNA, MEL). SOUTH AUSTRALIA: section 16, 35°11'S, 138°37'E, Southern Lofty region, *A.W.Bell 135* (AD, MEL). QUEENSLAND: 'The Hermitage', Biggenden, *P.I.Forster 7660* (AD, BRI, MEL). NEW SOUTH WALES: north side of Oberne Rd, 5.7 km east of Tareutta,

P.C.Jobson 4576, R.G.Coveny & P.G.Kodela (BRI, MEL, NSW). VICTORIA: Terrick Terrick State Park, *A.C.Beauglehole 82660* (MEL). TASMANIA: Pass Rd, Rokeby, *A.M.Buchanan 15149* (HO).

b. *_Lactuca serriola_ forma ***iutegrifolia*** (Gray) S.D.Prince & R.N.Carter, *Watsonia* 11: 337 (1977)

L. virosa var. *integrifolia* Gray, *Nat. Arr. Brit. Pl.* 2: 417 (1821).

Type: [presumably Great Britain], *A.Buddle*, H.S. 118 folio 2; lecto: BM, fide S.D.Prince & R.N.Carter, *op. cit.* 338.

Mid-stem leaves entire or sometimes some with a few shallow broad teeth; upper-stem leaves entire; branch leaves entire.

Notes: Occurs in south-eastern Australia from Adelaide in far south-eastern South Australia ESE to Omeo in the eastern Victoria, with isolated records from north-eastern New South Wales, south-eastern New South Wales and from around Alice Springs in central Australia. Grows in disturbed sites including urban environments and agricultural land. Flowers spring–autumn.

Although the two forms are readily distinguished in the field, herbarium material commonly lacks sufficient evidence of the stem leaves to make a determination. Forma *integrifolia* appears to be less common than forma *serriola* but in Melbourne, Victoria at least forma *integrifolia* is common.

Representative specimens: SOUTH AUSTRALIA: Fullarton, *Hj.Eichler 14607* (AD). NEW SOUTH WALES: Traffic Education Centre, Armidale, *R.G.Coveny 16371* (AD, BRI, CANB, HO, MEL, NE, NSW). VICTORIA: Baranduda Ra. Regional Park, *A.C.Beauglehole 88474* (MEL).

2. *_Lactuca saligna_ L., *Sp. Pl.* 2: 796 (1753)

Type: Habitat in Gallia, Lipsiae' [western Europe], Herb. Burser VI: 11; lecto: UPS, *fide* I.M. de Vries & C.E.Jarvis, *Taxon* 36: 153 (1987).

Annuals or biennials to c. 1 m high, glabrous except for sparse bristles on abaxial midrib of leaves, not glaucous. Stem leaves to c. 20 cm long, with l:w ratio c. 3–30; divided or not, undivided leaves linear to narrow-linear; divided leaves with 1–3 narrow retrorsely arching segments per side; base above mid-stem stem-clasping, narrowly sagittate; margin entire or remotely toothed. Capitula many; involucre 6–10 mm long, elongating to c. 15 mm long at maturity, c. 1–1.5 mm diam., with bracts ± erect at maturity; outer bracts 2 or 3, ovate, c. 2 mm long; longer intermediate bracts subequal to inner bracts at anthesis; inner bracts 4 or 5. Florets: ligule 7–10 mm long; style pubescence pale. Achenes 7–10 mm long; body 3–4 mm long; faces elliptic, dark-brown, commonly mottled blackish, scabridulous distally, tapering somewhat abruptly to a capillary beak; beak c. 40–90% longer than body. Pappus persistent, 4–5 mm long, white; bristles extremely fine, ± smooth. *Willow-leaf Lettuce*.

Notes: Native to Europe and western Asia. Occurs in far south-western Western Australia mostly around Perth but also further east, in south-eastern Australia from Gympie in far south-eastern Queensland SSW through eastern New South Wales to Victoria and from Victoria west to Kangaroo Island in south-eastern South Australia, and in Hobart in far south-eastern Tasmania. Grows in disturbed sites such as urban environments and agricultural land. Flowers spring–autumn.

Representative specimens: WESTERN AUSTRALIA: Benger Swamp, c. 12 km south of Harvey, *J.J.Alford 1664* (PERTH). SOUTH AUSTRALIA: Zadows landing, c. 6 km south of

Mannum, *C.R.Alcock 11104* (AD). QUEENSLAND: Coolmunda dam, 16 km west of Inglewood, *G.N.Batianoff 2010400 & C.Appelman* (BRI, CANB, DNA, NSW). NEW SOUTH WALES: Sinclairs Lookout, 14.4 km west of Glen Innes, *C.J.Dunn 41, J.Plat, & R.Coveny* (BRI, MEL, NSW). AUSTRALIAN CAPITAL TERRITORY: Coffins Crossing of Molonglo R., 3.6 km SSW of Cook P.O., *R.Coveny 11581 & P.Hind* (CANB, NSW). VICTORIA: Murray R. 3 km SW of Tocumwal P.O., *A.C.Beauglehole 63986* (MEL). TASMANIA: roadside, Sandy Bay, 2 May 1958, *W.M.Curtis* (HO).

9. SONCHUS L., *Sp. Pl.* 2: 793 (1753)

Annual, biennial or perennial herbs, branching, sometimes glaucous. Hairs simple, glandular and eglandular. Leaves basal and cauline. Inflorescences cymose. Capitula pedunculate; involucral bracts multiseriate, not hardening, reflexed at maturity. Florets: ligules yellow (in Australia). Achenes homomorphic, moderately to strongly compressed, unbeaked. Pappus of bristles, partially persistent; bristles nearly smooth or scabridulous, of two types within a pappus.

A genus of c. 55 species mainly from Africa, but virtually cosmopolitan. Species in Australia have succulent hollow stems and are nearly glabrous or they develop distinctive spreading gland-tipped hairs on upper stems, branches, peduncles and the involucre. A fine caducous wool is sometimes also present on the receptacle. Denticulations and teeth on leaf margins are spine-tipped and sometimes prickly. The multiseriate involucre comprises 25–45 bracts in several gradational series with the longer intermediate bracts almost as long as the inner bracts. Before and at the onset of anthesis the involucre is cylindrical but it soon becomes markedly conical as the receptacle expands and achenes enlarge proximally and the involucre closes on the withered corollas distally. Pappus bristles in Australian species are white and of two types within a pappus, comprising an inner series of several caducous scabridulous bristles and an outer series of numerous persistent downy hair-like bristles.

Sonchus arvensis, a native of Europe, is a rhizomatous perennial with elliptic, transversely rugose achenes. It was collected at Clare in the northern Mt Lofty Ranges, South Australia in 1960, but there is no evidence to suggest that it has become naturalised.

Key to species

1 Perennial, rhizomatous; achenes elliptic and transversely rugose .....***S. arvensis*** (see notes above)

1: Annuals or biennial, not rhizomatous; achenes not both elliptic and transversely rugose

2 Achenes ± oblanceolate, 0.5–1 mm wide, with l:w ratio > 3, weakly to strongly tranversely wrinkled; leaf-margin with few to numerous denticulations or teeth with spiny tips to c. 1 mm long, or margin entire, generally not prickly; auricles commonly sagittate, sometimes downcurved but not rotated .....**1. *S. oleraceus***

2: Achenes elliptic or slightly obovate, 0.8–2.0 mm wide, with l:w ratio < 3, without transverse wrinkles; leaf-margin with numerous denticulations or teeth with spiny tips to c. 5 mm long, prickly or not; auricles rounded, generally strongly rotated

3 Mid-stem leaves with l:w ratio 1.5–5(–8); achenes ± elliptic 2.0–3.2 mm long, central ones orange-brown and marginal ones pale yellow.....**2. *S. asper***

3: Mid-stem leaves with l:w ratio 3–10; achenes oblong-elliptic, 2.8–4.2 mm long, usually all mid to dark chocolate-brown .....**3. *S. hydrophilus***

1. *_Sonchus oleraceus_ L., *Sp. Pl.* 2: 794 (1753)

Type: Europe, Herb. Linn. 949.6; lecto: LINN, *fide* L.Boulos, *Bot. Not.* 126: 155 (1973).

[*Sonchus tenerrimus auct. non* L.: D.A.Cooke *in* J.P.Jessop & H.R.Toelken (eds), *Fl. S. Australia* 4th edn, 3: 1653 (1986), *p.p.*; J.A.Jeanes *in* N.G.Walsh & T.J.Entwisle (eds), *Fl. Victoria* 4: 684 (1999), *p.p.*]

Annuals or biennials to c. 1.8 m high, with rosette variously developed. Leaves to c. 25 cm long, with l:w ratio commonly c. 2–10, divided or not, thin or slightly coriaceous, always ± pliant along margin; base above mid-stem strongly stem-clasping with auricles usually sagittate, sometimes slightly to strongly downturned, but not arching back toward apex; margin variably denticulate, with spiny tips 0.5–1 mm long, generally not prickly, or margin entire; divided leaves pinnatisect, occasionally almost bipinnatisect, with up to 5 spreading to retrorse primary lateral segments per side; terminal segment often much larger than lateral segments; uppermost leaves variously shaped. Capitula mostly several; involucre 8–13 mm long, 3–6 mm diam.; outer and intermediate bracts ovate-lanceolate. Florets: ligule 5–8 mm long, ± equal to tube; style pubescence dark. Achenes oblanceolate, 2.2–3.2 mm long, 0.5–1.0 mm wide, moderately compressed, not obviously winged, transversely wrinkled; central achenes reddish-brown and marginal ones pale yellow; margin minutely scabridulous. Pappus 5–8 mm long. *Sow Thistle.*

Notes: Native to Europe. Occurs throughout Australia, but more common in the southern half corresponding to the degree of human activity. A widespread weed in many parts of the world. Grows in a wide variety of soils predominantly in disturbed environments. Flowers most of the year, particularly spring to autumn.

This species is extremely variable in leaf shape and its shape may resemble that of *S. asper*. However, unlike in *S. asper*, the auricles are not strongly rotated and are commonly sagittate rather than rounded, and the uppermost leaves sometimes have an entire or nearly entire margin. Some forms of *S. asper* have prickly leaves, whereas *S. oleraceus* is generally not prickly. Forms with lateral leaf-segments somewhat constricted proximally or with linear segments have in recent state floras been identified as *S. tenerrimus* L., a species native to the Mediterranean, but *S. tenerrimus* is a generally more delicate plant with leaves that become abruptly petiole-like distal to the amplexicaul base and with more numerous lateral leaf-segments that are more strongly constricted proximally. Furthermore, the ligules of *S. tenerrimus* are clearly longer than the corolla-tube unlike in *S. oleraceus*, and the receptacle has a more persistent wool.

Sonchus oleraceus commonly occurs with *S. asper* and is likely to hybridise with it.

Representative specimens: WESTERN AUSTRALIA: Mt Lawley Golf Course, Inglewood, *B.J.Lepschi & T.R.Lally 1774* (CANB, PERTH). NORTHERN TERRITORY: Muranji Rockhole, Mt Winter, *B.G.Thomson 1565* (DNA). SOUTH AUSTRALIA: c. Mortlock Expt. Stn, Mintaro, *D.E.Symon 6704* (AD, CANB). QUEENSLAND: side road 6.5 km north of Goondiwindi, *A.R.Bean 17800* (BRI). NEW SOUTH WALES: 53 km west of Nyngan on Cobar road, *G.M.Cunningham 902* (NSW). VICTORIA: Ulupna Is., Murray R., 29 km north of Numurkah P.O., *A.C.Beauglehole 64251* (MEL). TASMANIA: Waterhouse Is., 17 Dec. 2002, *S.Harris & A.Connolly* (HO, MEL).

2. *_Sonchus asper_ (L.) Hill, *Brit. Herb.* 1: 47 (1769)

Sonchus oleraceus var. *asper* L., *Sp. Pl.* 2: 794 (1753).

Type: Europe;Herb. Burser VI: 14; lecto: UPS, *fide* L.Boulos, *Taxon* 47: 368 (1998)

[*S. asper* subsp. *glaucescens auct. non* (Jord.) Ball (1878): D.A.Cooke *in* J.P.Jessop & H.R.Toelken (eds), *Fl. S. Australia* 4th edn, 3: 1654 (1986), *p.p.*; J.A.Jeanes *in* N.G.Walsh & T.J.Entwisle (eds), *Fl. Victoria* 4: 698 (1999), *p.p.*]

Annuals to c. 1.2(–2) m high, with rosette variously developed. Leaves to c. 30 cm long, with l:w ratio 1–5 (–8), divided or not, thin to coriaceous, sometimes semi-rigid at margin; base above mid-stem strongly stem-clasping, with auricles rounded basally, strongly downturned and arching back toward apex; margin with frequent denticulations or teeth, with spiny tips 0.5–5 mm long, somewhat prickly or not; divided leaves lobate to subpinnatisect, with up to 8 usually spreading or slightly retrorse lobes or segments per side; terminal segment usually not or hardly larger than lateral segments; uppermost leaves mostly ovate–narrow-ovate. Capitula few to many; involucre 8–13 mm long, 3–8 mm diam.; outer and intermediate bracts ovate–lanceolate. Florets: ligule 4–5 mm long, shorter than tube; style pubescence dark. Achenes elliptic or slightly obovate, 2.0–3.2 mm long, 0.8–1.8 mm wide, strongly compressed, distinctly winged, without transverse wrinkles; central achenes orange-brown and marginal ones pale yellow; margin usually minutely scabridulous. Pappus 7–9 mm long.

Notes: Native to Europe. Occurs in far south-western Western Australia, south-eastern Australia from Brisbane south through eastern New South Wales to Victoria, and from Victoria west to south-eastern South Australia, and in Tasmania. A widespread weed in other parts of the world. Grows mostly in disturbed environments, in urban areas, woodland and forest. Flowers all year, mostly spring–autumn.

Sonchus asper is highly variable in leaf dissection, prickliness and degree of rosette development, with an apparent continuum of variation evident in these characters. At one extreme, there is a form with little or no rosette development and thin, undivided or shallowly divided, non-prickly leaves. At the other extreme there is a robust form with stouter thicker-walled stems, a better developed rosette, and coriaceous prickly leaves. Prickly-leaved forms of *S. asper*, including the form described above, have in recent years been referred to subsp. *glaucescens* (Jord.) Ball. However, according to Boulos (1976), subsp. *glaucescens* is a biennial with dense, recurved spinules on the margins and ribs of the achenes. All Australian plants appear to be annuals, albeit with different degrees of rosette development, and no significant variation in achene morphology has been identified.

Representative specimens: WESTERN AUSTRALIA: c. 50 km SSE of Kojonup on road to Mt Barker township, *B.J.Lepschi & T.R.Lally 2289* (CANB, PERTH). SOUTH AUSTRALIA: Myponga Conservation Park, *D.E.Murfet 394* (AD); Cherry Gardens, Frith St, *D.E.Symon 13387* (AD, CANB). QUEENSLAND: 9 km along Spring Ck Rd towards Killarney from Teviot Falls Lookout, *G.N.Batianoff 20011123 & D.Halford* (BRI). NEW SOUTH WALES: Perisher Valley, Kosciuszko area, Aug. 1985, *J.Mallen s.n.* (CANB). AUSTRALIAN CAPITAL TERRITORY: corner of Haydon Drive and Belconnen Way, Bruce, *L.G.Adams 3313* (CANB). VICTORIA: Yarrawonga Regional Park, *A.C.Beauglehole 81843* (MEL). TASMANIA: Clarkes Is., Bass Strait, Dec. 1966, *J.Whinray s.n.* (MEL).

3. *Sonchus hydrophilus* Boulos, *in* Hj.Eichler, *Fl. South Australia*, suppl. 331 (1965)

S. asper f. *hydrophilus* (Boulos) J.Kost., *Blumea* 23(1): 165 (1976).

Type: Fleurieu Peninsula, in watercourse three miles (ca 5 km) north of Victor Harbor, South Australia, 8 Jan. 1945, *J.B.Cleland s.n.*; holo: AD *n.v.*, *fide* L.Boulos, *loc. cit.*

Annuals or ?biennials to c. 1.8 m high, with rosette well-developed. Leaves to c. 40 cm long; stem leaves with l:w ratio c. 3–10, undivided or lobate to deeply lobate, thin to mildly coriaceous; base above mid-stem strongly stem-clasping, with auricles rounded basally, strongly downturned and arching back toward apex; margin usually with frequent denticulations with spiny tips 1–3 mm long, not or slightly prickly; lobate leaves with up to 6 spreading to retrorse lobes per side; uppermost leaves ± lanceolate. Capitula several to many; involucre 8–12 mm long, c. 4–9 mm diam.; outer and intermediate bracts narrow-ovate or more often lanceolate. Florets: ligule c. 5–7 mm long, shorter than tube; style pubescence dark. Achenes elliptic or oblong-elliptic, 2.8–4.2 mm long, 1.3–2.0 mm wide, strongly compressed, distinctly winged, without transverse wrinkles, generally all mid to dark chocolate-brown; margin smooth or minutely scabridulous. Pappus 7–9 mm long. *Native Sow-thistle.*

Notes: Occurs in south-western Western Australia from south of Geraldton SE to Esperance, in central Australia south to southern South Australia, and in south-eastern Australia from the Carnarvon Ranges in south-eastern Queensland SSW through eastern New South Wales to Victoria, and in Tasmania. Also occurs in New Zealand and New Guinea. Usually associated with streams and lakes in herbfields, woodland, or forest. Flowers mostly spring to autumn.

Similar to *Sonchus asper* in leaf and achene morphology. It can usually be distinguished from this taxon by the leaves which generally have a higher length to width ratio, and by the achenes which are larger, usually all chocolate brown, with broader wings and with shorter asperities on ribs and margins. *Sonchus hydrophilus* is also similar to the coastal species *Actites megalocarpus* in leaf and achenial morphology, but the latter is rhizomatous, its capitula and achenes are longer, and the achenes usually paler and more tapered distally.

Representative specimens: WESTERN AUSTRALIA: 2.3 km south of Reagans Ford on road to Muchea (Brand Hwy), *B.J.Lepschi & T.R.Lally 1713* (CANB, MEL, PERTH). NORTHERN TERRITORY: Churnside Ck Crossing, Petermann Ra., *C.R.Dunlop 1966* (DNA). SOUTH AUSTRALIA: Dalhousie Springs, Far North, *D.E.Symon 13159* (AD, CANB, DNA). QUEENSLAND: c. 4.8 km SE of The Gums, *R.W.Johnson 552* (BRI, CANB). AUSTRALIAN CAPITAL TERRITORY: shores of Lake Burley Griffin, Canberra, *M.Gray 6742* (CANB, NSW). NEW SOUTH WALES: Gerringong, *F.A.Rodway 5209* (NSW). VICTORIA: 1–1.5 km downstream from Kirks Bridge Rd crossing of Little R., *V.Stajsic 871* (MEL). TASMANIA: Hogan Is., Jan. 1968, *per N.Scarlett, McCoy Society* (MEL).

10. ACTITES Lander, *Telopea* 1: 130 (1976)

Perennial herbs, rhizomatous, branching. Hairs simple, glandular and eglandular. Leaves all cauline after first season; marginal teeth spinulose, hardly prickly. Inflorescences cymose. Capitula pedunculate; involucral bracts multiseriate, soft and reflexed at maturity. Florets: ligule narrow-oblong, yellow, sometimes purplish towards base. Achenes homomorphic, strongly compressed, unbeaked. Pappus of bristles, partially persistent; bristles nearly smooth or scabridulous, of two types within a pappus.

A monotypic genus occurring in coastal regions of southern Australia. Closely related to *Sonchus*, but its achene morphology, perennial life history, rhizomatous habit and larger capitula distinguishes it from species of *Sonchus* in Australia. Anecdotally, however, some are dissatisfied with the placement of this species in *Actites*. Cooke (1986) treated it as a *Sonchus* in *Flora of South Australia*; however, more recent floras have retained the genus *Actites*. This issue is further discussed in the notes for the species.

Actites megalocarpus (Hook.f.) Lander, *Telopea* 1: 129 (1976)

Sonchus asper var. *megalocarpus* Hook.f., *Fl. Tasman.* 1: 227 (1856); *S. megalocarpus* (Hook.f.) J.M.Black, *Fl. S. Australia* 661 (1929); *Embergeria megalocarpa* (Hook.f.) Boulos, *in* Hj.Eichler, *Fl. S. Australia* 2nd edn, suppl. 333 (1965).

Type: 'near the sea on the north shore of the island', Tasmania, *R.C.Gunn 845*; holo: K *n.v.*

S. asper var. *littoralis* J.M.Black, *Naturalised Fl. S. Australia* 104 (1909), *nom. illeg. non* Kirk (1895). Type: Precise locality unknown, South Australia, *J.M.Black*; neo: NSW; isoneo AD, *fide* N.S.Lander, *op. cit.* 130.

Perennials to c. 0.6 m high. Leaves often crowded, to 26 cm long, with l:w ratio 3–7, undivided or lobate, somewhat coriaceous; base above mid-stem cordate or sagittate; margin entire, denticulate or dentate; lobate leaves with 3–6 spreading to slightly retrorse lobes per side. Capitula few to several; involucre 12–20 mm long, c. 6–12 mm diam.; outer and intermediate braets narrow-ovate to lanceolate, with hyaline margin very slender, often bearing spine-like hairs along midrib; inner braets with distinct hyaline margin; receptacle glabrous or pit margin fimbriate. Florets: ligule 6–10 mm long, slightly shorter than tube; style pubescence often dark. Achenes 4.0–8.0 mm long, compressed, pale to dark brown, smooth, except for 3 longitudinal ribs, with these ribs often inflated; margin smooth, rounded. Pappus 7–13 mm long, white. *Dune Thistle.*

Notes: Occurs on the eastern and southern coastlines of mainland Australia from Toorbul in southern Queensland south and then west to Middleton beach in south-western Western Australia, and on the south-eastern coast of Tasmania. Grows on coastal sand dunes and cliffs. Flowers most of year.

Although the best classification for this species is perhaps still a moot point, it is considered best to retain it in *Actites* at this point. Further phylogenetic studies will hopefully elucidate relationships between *Actites*, *Sonchus* and other related genera. Molecular studies by Kim, Lu & Lepschi (2004), although not conclusive, placed *A. megalocarpus* in a separate clade to a clade containing the three Australian species *S. hydrophilus*, *S. asper* and *S. oleraceus*.

Apart from features given in the key, *Actites megalocarpus* tends to have leaf-bases that are less stem-clasping, hairs when developed on the peduncle and outer and intermediate braets that are always spine-like and more robust, and the margin of the achenes rounded and smooth rather than with a sharp edge and scabridulous. The longitudinal ribs of the achenes often become inflated in this species and this was one of the achenial features Lander (1976) used to distinguish the new genus from *Sonchus*. This inflation of ribs has, however, been seen in *S. hydrophilus*, although to a lesser extent. The pappus of dimorphic bristles corresponds to the morphology seen in *Sonchus*. The distinctive glandular hairs seen in species of *Sonchus* in Australia, particularly on the peduncle, have not been seen in *Actites megalocarpus*.

The epithet has changed from *megalocarpa* due to a recent ICBN decision to treat all genera ending in "ites" as masculine.

Representative specimens: WESTERN AUSTRALIA: west of Dempster Hill, Esperance, 16 Nov. 1950, *J.H.Willis* (MEL). SOUTH AUSTRALIA: Kangaroo Is., West Bay, *R.J.Bates 30273* (AD, MEL). QUEENSLAND: 0.5 km south of Eurong, Fraser Is., *A.R.Bean 8066* (BRI). NEW SOUTH WALES: Kioloa Beach, c. 1 km north of Kioloa, South Coast, *I.R.Telford 10159* (AD, CANB, MEL). VICTORIA: Point Nepean, 27 Nov. 1963, *J.D.M.Pearson* (MEL). TASMANIA: Sanctuary Bay, *A.Moscal 5631* (AD, HO, MEL).

11. LAUNAEA Cass., *Dict. Sci. Nat.* 2nd edn, 25: 321 (1822)

Annual to perennial, sometimes stoloniferous herbs, branching or not. Hairs ± lacking. Leaves predominantly basal. Inflorescences solitary or cymose. Capitula pedunculate; involucral bracts multiseriate. Florets: ligule yellow. Achenes homomorphic, not or hardly compressed, unbeaked. Pappus of bristles, ?persistent; bristles, scabridulous, uniform within a pappus.

A genus of 54 species, principally from Africa and south-western Asia, but also in the Mediterranean region. The style-branches in this genus have relatively long hairs, a feature it shares with *Reichardia* according to Bremer (1994).

Launaea sarmentosa (Willd.) Kuntze, *Revis. Gen. Pl.* 1: 350 (1891)

Prenanthes sarmentosa Willd., *Phyt.* 10, t. 6(2) (1794).

Type: India, 1793, *Klein*; holo: B-W 14595.

Herb to c. 0.1 m high, developing stolons to c. 1 m long, rooting at nodes. Leaves all basal, undivided, to 10 cm long, with l:w ratio c. 3–4: margin entire or denticulate; secondary rosettes with much smaller leaves; base attenuate. Capitula solitary at nodes; involucre 4–6 mm diam.; outer bracts c. 8, ovate, c. 3 mm long, with hyaline margin distinct; intermediate bracts c. 6, reaching c. halfway along involucre; inner bracts c. 8, 10–15 mm long. Florets: ligule c. 5 mm long; style pubescence pale or darkened. Achenes narrow-obloid, 4–5 mm long, with ribs prominent, brown, glabrous. Pappus caducous, c. 7 mm long, white; bristles scabridulous.

Notes: Occurs in far western Western Australia predominantly between Exmouth and Karratha and on adjacent islands. Also native to areas abutting the Indian Ocean and South China Sea including countries in Africa and southern Asia. Grows on coastal sands. Flowers most of the year.

A distinctive species with its stoloniferous habit. According to Kilian (1997), who produced a monograph on the genus *Launaea*, the species has been used as a salad vegetable in several countries.

Representative specimens: WESTERN AUSTRALIA: Monte Bello Is., 13 Nov. 1953, *Hill* (CANB); Thevenard Is., *M.White MRW028* (CANB, PERTH).

12. REICHARDIA Roth, *Bot. Abh. Beobacht.* 35 (1787)

Annual or perennial herbs, branching. Hairs ± lacking. Leaves basal and cauline. Inflorescences solitary or cymose. Capitula pedunculate; involucral bracts multiseriate, soft, not convex, infolded at maturity. Florets: ligule yellow. Achenes homomorphic or inner ones abortive, not compressed, unbeaked. Pappus of bristles, not persistent; bristles ± smooth, uniform within a pappus.

A genus of 8 species from the Mediterranean region. A feature of the two species in Australia is the relatively broad outer and intermediate involucral bracts that are cordate-based and with a conspicuous hyaline margin.

Key to species

Leaf-margin crowded-denticulate; outer bracts 5–7 mm long; outer and intermediate bracts overlapping, with hyaline margin 1–2 mm wide; ligules purple-red basally ..... **1. *R. tingitana***

Leaf-margin entire or nearly so; outer braets e. 3 mm long; outer and intermediate braets not or hardly overlapping, with hyaline margin 0.3–0.5 mm wide; ligules not purple-red basally ..... **2. *R. picroides***

1. **Reichardia tingitana* (L.) Roth, *Bot. Abh. Beobacht.* 35 (1787)

Scorzonera tingitana L., *Sp. Pl.* 2: 791 (1753); *Picridium tingitanum* (L.) Desf., *Fl. Atlant.* 2: 220 (1799).

Type: 'Habitat in Tingide', [north-western Afriea]; *n.v.*

[*Reichardia picroides anct. non* (L.) Roth: J.M.Black, *Fl. S. Australia* 2nd edn, 4: 944 (1957)]

Annuals or biennials to e. 0.7 m high, branehing, glabrous, often glaucous. Leaves forming a rosette, to 17 em long, with l:w ratio 3–5, divided or not; margin erowded-dentieulate often minutely, also eommonly remotely dentate, sometimes weakly spinulose; divided leaves with 2–5 slightly antrorse segments per side; cauline leaves few to several, beeoming laneeolate upwards; base beeoming eordate-aurieulate upwards, somewhat stem-elasping. Capitula solitary or few; pedunele dilating distally; involucre 10–14 mm long, e. 7–10 mm diam.; outer braets e. 8, broad-ovate, 5–7 mm long, with hyaline margin 1–2 mm wide, with a short black sub-apieal spur; longer intermediate braets extending over half way; inner bracts with hyaline margin distinet but narrower than in outer braets. Florets: ligule 16–20 mm long, purple-red at base; style pubeseenee pale or slightly darkened. Aehenes broad-obloid, 1.5–4 mm long, not tapering apieally, sometimes squarish in transverse seetion, deeply verrueose or transversely ridged; inner ones pale, outer ones light or dark brown, glabrous. Pappus e. 7–9 mm long, white, detaehing as a unit; bristles fine, smooth. *False Sow-thistle, Reichardia.*

Notes: Native to the Mediterranean region. Oeeurs on the west eoast of Western Australia from Shark Bay SSE to Perth, in southern Western Australia NE of Esperanee, and in south-eastern Australia from south-eentral South Australia east to Deniliquin in south-eentral New South Wales. Grows in various environments, predominantly semi-arid or eoastal, partieularly in disturbed sites sueh as roadsides, ineluding eoastal dunes, in sand, loams, elays and gypsum, in herbfields, shrubland and woodland. Flowers mostly late winter–early summer, also other times.

Readily recognised by its large eapitula, long ligules, and overlapping, broad-margined outer braets. A very eommon weed in south-eastern South Australia.

Representative specimens: WESTERN AUSTRALIA: Near Seven Mile Beach north of Dongara, *N.S.Lander 1299* (MEL, PERTH). SOUTH AUSTRALIA: c. 45 m west of upper part of beach, above south side of Dry Ck,, Pine Point Foreshore Reserve, *R.V.Smith 86/07* (AD, CANB, HO, MEL, NSW). NEW SOUTH WALES: Near Tori HS remnant, just north of Tori Lake, c. 6 km NE of 'Tylden', c. 35 km NNE of Balranald, *P.G.Kodela 461*, *G.Chapple*, *R.G.Coveny & H.McPherson* (AD, BRI, CANB, MEL, NSW). VICTORIA: e. 0.4 km west of Boinka between Underbool & Murrayville, west of Ouyen, *R.V.Smith 69/32* (AD, CANB, HO, MEL, NSW).

2. **Reichardia picroides* (L.) Roth, *Bot. Abh. Beobacht.* 35 (1787)

Scorzonera picroides L., *Sp. Pl.* 1: 792 (1753).

Type: eult., loeality unknown, Herb. Linn. 947.11; LINN *n.v.*, *fide* S.A.Alavi *in* S.M.H.Jafri & A.El-Gadi, *Fl. Libya* 107: 376 (1983).

Similar to *R. tingitana* but differing most markedly in the following (based on limited Australian material): Leaf-margin entire or nearly so. Involuere e. 10 mm long, e. 5–6 mm

diam.; outer bracts c. 3 mm long, with hyaline margin 0.3–0.5 mm wide, with subapical spur very small. Florets: ligule not purple-red basally. Achenes 2–3 mm long, with central ones smooth.

Notes: Native to southern Europe. Recorded once from Mt Melville in far south-western Western Australia where common. Growing on slope in grey gravelly sand over granite in forest. Flowers summer.

This species appears likely to be well established at Mt Melville. A newly recognised naturalised species in Australia.

Representative specimens: WESTERN AUSTRALIA: Mt Melville, *P.Foreman 161* (PERTH).

13. MICROSERIS D.Don, *Philos. Mag. Ann. Chem.* 11: 388 (1832)

Perennial herbs, scapose, largely glabrous. Hairs simple, eglandular. Leaves all basal. Inflorescences of solitary capitula. Capitula pedunculate; involucral bracts multiseriate; soft and reflexed at maturity. Florets: ligule yellow. Achenes homomorphic, not compressed, unbeaked. Pappus of scales (sometimes scales hardly widened at base), bristle-like distally, persistent, homomorphic; scales barbellate (bristle part), uniform within a pappus.

Notes: A feature of this genus, in at least Australia taxa, not mentioned in recent state floras is the presence on the scapes and sometimes leaves of minute translucent cupular discs variably elevated on filamentous stalks. Although usually inconspicuous, close inspection usually reveals the presence of at least some of these distinctive structures. There is still uncertainty regarding the taxonomy of *Microseris* in Australia. This genus was not assessed in detail by the author and the reader is referred to recent workers and publications indicated below. Historically a single species has been recognised for Australia, *M. lanceolata* (Walp.) Sch.Bip. However, Sneddon (pers. comm.), who studied the genus in Australia and New Zealand from the late 1970s has indicated the presence of two species in Australia, *M. scapigera*, based on a type from New Zealand, and *M. lanceolata* based on a type from Tasmania. A recent paper by Vijverberg, Lie, & Bachmann (2002) identified four morphological groups among populations in Australian and New Zealand. Although offering several taxonomic possibilities, the authors did not make any taxonomic decisions. Jeanes (1999) had earlier presented an informal classification in *Flora of Victoria* indicating the occurrence of three species of *Microseris* in Victoria based on distinctions in root, cypsela (achene) and pappus morphology. Unfortunately the treatment of Jeanes was not assessed by Vijverberg, Lie, & Bachmann. It appears clear, however, that the "fine-pappus" form of the latter's study corresponds to *Microseris* sp. 1 *sensu* Jeanes, the "alpine form" corresponds to *Microseris* sp. 2 *sensu* Jeanes, and the "murnong" form corresponds to *Microseris* sp. 3 *sensu* Jeanes. Costin *et al.* (2000) reached the same conclusions regarding the latter two forms. Vijverberg, Lie, & Bachmann collected only four populations of their fourth form "coastal", all of these from New Zealand.

14. HIERACIUM L., *Sp. Pl.* 2: 799 (1753)

Perennial herbs, often with long leafy stolons, branching. Hairs usually of two or more types including glandular, eglandular, stellate, and plumose. Leaves all or mostly basal. Inflorescences solitary, cymose or paniculate. Capitula pedunculate; involucral bracts multiseriate or approaching biseriate, soft and reflexed at maturity. Florets: ligule yellow, rarely orange, green or white. Achenes homomorphic, not compressed, unbeaked. Pappus

of bristles, somewhat persistent, bristles seabrid-barbellate, ± uniform within a pappus, or length variable.

A complex genus of hundreds of species or up to 5000 taxa if apomictic microspecies are counted. Mostly from temperate regions and mostly Europe. Although four species have been recorded in Australia, all of these also naturalised in New Zealand, only one is considered naturalised at this time.

Hieracium praealtum Vill. ex Gochnat subsp. *bauhinii* (Besser) Petunnikov is known from a single population near Falls Creek in north-eastern Victoria (*N.G.Walsh 5962* MEL). *Hieracium pilosella* L. has been recorded from the Brindabella Ra. in the Australian Capital Territory (1992, *SGAP s.n.* CANB), and from near Oatlands in south-eastern Tasmania *A.Woolley* HO). *Hieracium murorum* L. has been recorded from the Blue Mountains in central-eastern New South Wales (*M.Sherring s.n.* 1998 MEL, NSW). Another population of plants, of uncertain identity but probably allied to *H. murorum* has also been recorded from the Blue Mountains (*C.H.Barker 8 & J.R.Hosking* CANB, MEL, NSW).

Key to species

1 Stolons absent; basal leaves with an abrupt transition from petiole to blade; upper stem and peduncles lacking long non-glandular hairs; achenes > 2.5 mm long, the ribs apically confluent in an obscure ring; pappus-bristles in two rows, the hairs unequal ..... ***H. murorum*** **(see notes above)**

1: Leafy stolons present; basal leaves with tapering gradually to base; achenes < 2.5 mm long, the ribs projecting distally to form a crenulate apex; pappus hairs in 1 row with a few shorter than the rest

2 Capitula solitary; stems to 15 cm high, naked or with scale-like bracts; lower surface of leaves with a moderate to dense tomentum of stellate hairs ..... ***H. pilosella*** **(see notes above)**

2: Capitula several per stem; stems to 50 cm high, typically with 1 or more leaves; lower surface of leaves not tomentose, stellate hairs absent or rare

3 Leaves green; ligule deep orangish turning purple when dry; spreading hairs on upper stem 4–5 mm long, dark, emerging from a dense tomentum of stellate hairs ..... ***H. aurantiacum***

3: Leaves slightly glaucous; ligule yellow, remaining yellow when dry; spreading hairs on upper stem c. 3 mm long, pale except for base, emerging from a sparse to scattered indumentum of stellate hairs ..... ***H. praealtum*** **(see notes above)**

****Hieracium aurantiacum*** L. subsp. ***carpathicola*** Nägeli & Peter, *Hierac. Mitt.-Eur.* 1: 290 (1885)

Type: *n.v.*

Hieracium brunneo-croceum Pugsley, *J. Bot.* 59: 67 (1921). Type: Exsicc. Hier. Naegel. nos 17, 80, 122; *E.S.Marshall 4190*; *n.v.*, *fide* P.D.Sell & C.West, *in* T.G.Tutin *et al.* (eds), *Fl. Europaea* 4: 374 (1976).

Stoloniferous perennials to c. 0.4 m high. Basal leaves with l:w ratio c. 3–6, not petiolate, not divided; margin entire or denticulate; very long eglandular hairs scattered on both surfaces; cauline leaves 1–3, strongly reducing upwards; base not dilated or stem-clasping. Capitula several; peduncle densely hairy with dark eglandular hairs c. 4–5 mm long and short glandular hairs emerging from an indumentum of whitish stellate hairs;

involucre 5–8 mm long; bracts with eglandular hairs and glandular hairs, with stellate hairs few or absent; outer bracts 6–8, narrow-lanceolate, c. 2 mm long. Florets: ligule 5–10 mm long, orange, drying purplish; style pubescence dark. Achenes obloid–obovoid, 1.5–2 mm long, with prominent ribs terminating distally as a projection, purplish. Pappus uniseriate, 4–6 mm long, white; bristles brittle, mostly of similar length. *Orange Hawkweed.*

Notes: Native to northern and central Europe. Occurs in eastern Victoria around Falls Creek and in southern Tasmania. Grows in disturbed environments at alpine and lower altitudes. Flowers summer.

The type subspecies has a longer involucre and does not develop the long, leafy stolons of subsp. *carpathicola.*

Representative specimens: VICTORIA: c. 50 m east of P.O., Falls Ck, *J.R.Hosking 1829* (CANB, MEL, NSW). TASMANIA: Old Village, Butlers Gorge, 23 Jan. 1963, *P.A.Tyler* (HO); Waddamana Rd near Shannon R. Bridge, 18 Dec. 1989, *R.J.Fensham* (HO).

15. TOLPIS Adans., *Fam. Pl.* 2: 112 (1763)

Annual or perennial herbs, branching. Hairs simple, eglandular. Leaves mostly basal. Inflorescences cymose or paniculate. Capitula pedunculate; involucral bracts ± biseriate; inner bracts hardened, strongly convex and erect at maturity. Florets: ligule yellow or purplish-brown. Achenes dimorphic, not compressed, unbeaked. Pappus of bristles and scales, persistent, dimorphic; bristles and scales scabridulous, sometimes of two types within a pappus.

A genus of c. 20 species from the Mediterranean region, South Africa and America. Apart from characters given in the key to genera, the two species of *Tolpis* in Australia are characterised by being much taller than broad, and with inflorescences where the overtopping of the primary or medial capitulum by the lateral capitula is very marked.

Key to species

Outer involucral bracts longer than the inner bracts, divergent; ligules at least partly purple; pappus with 0 (marginal achenes), 2 or 4 bristles ..... **1. *T. barbata***

Outer involucral bracts shorter than the inner bracts, appressed; ligules all yellow (drying greenish); pappus with c. 8 bristles in all achenes ..... **2. *T. virgata***

1. *_Tolpis barbata_ (L.) Gaertn., *Fruct. Sem. Pl.* 2: 372 (1791)

Crepis barbata L., *Sp. Pl.* 2: 805 (1753).

Type: 'Habitat in Monspelii, Vesuvii, Siciliae, Messanae', western Europe; *n.v.*

Tolpis umbellata Bertol., *Rar. Lig. [Ital.] Pl.* 1: 13 (1803). Type: 'Repitur Sarzanae ad viarum margines circa S. Francisci coenobium; tum in collibus dictis sarzanello, & Montedarmd.', Italy, *coll. unknown*; *n.v.*

Annuals to c. 0.6 m high, with appressed-cobwebby or woolly indumentum on stems and capitula, glabrescent, with sparse to dense septate hairs on leaves, or leaves ± glabrous. Basal leaves often persistent at anthesis, to c. 11 cm long, with l:w ratio c. 4, undivided or lobate with lobes antrorse; base attenuate; margin entire, denticulate or dentate; cauline leaves 1–4, becoming somewhat narrower upwards, with base attenuate. Capitula 2–7; peduncle of primary capitulum to c. 3 cm long, c. 1 mm diam.; peduncle of lateral capitula to 12 cm long, mostly c. 0.3–0.6 mm diam.; involucre 8–10 mm long, c. 2–4 mm diam.; outer bracts 15–25, linear, 8–10 mm long, setaceous; inner bracts c. 16–22, c. 5 mm long, with midrib often developing tubercles, with hyaline margin distinct

and vestigial in alternate bracts. Florets: ligule c. 2–5 mm long, yellow with a purple band or central-most florets entirely purple; style pubescence pale. Achenes c. obloid, 1.3–1.7 mm long, not tapering distally; marginal achenes housed within concavity of hardened inner bract at maturity, densely brown-hairy; central achenes with numerous close-spaced ribs, glabrous. Pappus white; bristles scabridulous; pappus of marginal achenes c. 0.4 mm long, of scales of varying length; pappus of central achenes 3–5 mm long; bristles 2–4, wider at base; intervening shorter scales more numerous, c. 0.3 mm long. *Yellow Hawkweed.*

Notes: Native to southern Europe. Occurs in far south-western Western Australia mostly south from Perth, far south-eastern Queensland, eastern New South Wales, Victoria, the Mount Lofty Ra. of south-eastern South Australia, and eastern Tasmania. Also recorded once in Alice Springs, Northern Territory. Grows on roadsides and other disturbed sites in woodland and forest. Flowers mid-spring–summer.

The name *Tolpis umbellata* has in the past been applied to Australian collections. Tutin (1976) refers to *T. umbellata* as a variant of *T. barbata* with relatively small capitula and all the florets pale yellow. Australian specimens all appear to have small capitula as in *T. umbellata*, but with pigmentation of the corolla typical of *T. barbata sensu lato* (outer florets yellow with a purple band at the base of the ligule, and the percentage of purple progressively increasing towards the centre of the capitulum).

Representative specimens: WESTERN AUSTRALIA: Bokerup Nature Reserve, *G.J.Keighery & N.Gibson 2433* (PERTH). NORTHERN TERRITORY: Alice Springs, 15 Oct. 1950, *E.Gauba* (CANB). SOUTH AUSTRALIA: Mt Lofty Ra., Crafers, 20 Jan. 1971, *E.H.Ising s.n.* (AD). QUEENSLAND: main picnic area, Girraween Natl Park, 22 km south of Stanthorpe (BRI). NEW SOUTH WALES: Traffic Education Centre, Armidale, *R.G.Coveny 16367 & A.Whalen* (BRI, CANB, NE, NSW). VICTORIA: 9.7 km west from Whitfield on the Mansfield Rd, *I.C.Clarke 2808* (AD, CANB, HO, MEL); Wonnangatta Stn, *E.A.Chesterfield 3593* (BRI, CANB, MEL). TASMANIA: Hill to east of Bonneys Plains Rd, *A.M.Gray 783* (HO, MEL).

2. *_Tolpis virgata_ (Desf.) Bertol., *Rar. Lig. Pl.* 1: 15 (1803)

Crepis virgata Desf., *Actes Soc. Hist. Nat. Paris* 1: 37, t. 8 (1792).

Type: Tunisia; syn: *n.v.*; Algeria; syn: *n.v.*

Tolpis altissima Pers., *Syn. Pl.* 2: 377 (1807). Type: *n.v.*

Similar to *T. barbata* but differing most markedly in the following: Biennials or perennials to c. 1.0 m high. Involucre 5–8 mm long; outer bracts 1.5–3.5 mm long; inner bracts with midrib not developing tubercles. Florets: ligules not purple basally or throughout. Achenes homomorphic, 1.5–2 mm long, all glabrous. Pappus: bristles c. 8, present in all achenes.

Notes: Native to the Mediterranean region. Occurs in far south-western Western Australia between Jarrahwood and Boyup Brook, SE of Bunbury. Grows in various soils in woodland and forest. Flowers summer–early autumn.

First recorded in 1963, and currently recorded from five different localities. Infraspecific taxa have been described for this species based on the number of pappus bristles. Specimens in Australia appear uniform in this respect and conform to the typical variety or subspecies.

Representative specimens: WESTERN AUSTRALIA: Vasse Hwy, Nannup to Jarrahwood, *G.J.Keighery 14363* (PERTH); KC4, Kingston Forest Block, *E.D.Middleton K339* (PERTH).

16. HEDYPNOIS Mill., *Gard. Dict. Abr.* 4th edn (1754)

Annual herbs, mostly branching. Hairs furcate or simple. Leaves predominantly basal. Inflorescences solitary or cymose. Capitula pedunculate; involucral bracts biseriate; inner bracts hardened, strongly convex and erect at maturity. Florets: ligule slightly oblanceolate, yellow. Achenes ± homomorphic, not compressed, unbeaked. Pappus of scales and bristles, somewhat persistent, dimorphic; bristles and scales scabridulous, sometimes of two types within a pappus.

A genus of two species from the Mediterranean region and south-western Asia.

Hedypnois rhagadioloides (L.) F.W.Schmidt, *Samml. Phys.-ökon. Aufs.* 1: 279 (1795).

Hyoseris rhagadioloides L., *Sp. Pl.* 2: 809 (1753).

Type: Southern Europe, Herb. Linn. 957.9; holo: LINN *n.v.*, *fide* B.Nordenstam, *op. cit.* 139.

Annuals to c. 0.4 m high, often < 0.2 m high. Scattered hairs on leaves, distal peduncle and involucral bracts, non-glandular, with those of leaves and stems minutely bifurcate. Basal leaves variably persistent, to c. 20 cm long, with l:w ratio 3–12, entire, lobate or pinnatisect, with segments somewhat antrorse; margin entire or dentate; cauline leaves (0–)1–4, undivided, with base becoming broad-cuneate, hardly stem-clasping. Capitula solitary or few; involucre c. 3 mm diam.; outer bracts 6–10, linear-lanceolate or lanceolate, 2–3 mm long; inner bracts 10–12, 5–9 mm long, variously bristly, or glabrous, hardened and incurved or erect at maturity; hyaline margin narrow or broad in alternate bracts. Florets: ligule c. 3–6 mm long; style pubescence pale. Achenes narrow-obloid, curved, 4.5–9.0 mm long, with ribs inconspicuous, minutely scaly in lines; marginal achenes housed within concavity of bract at maturity. Pappus of marginal achenes a corona of largely-fused scales, 0.5–1 mm long; pappus of central achenes: bristles usually 5, 3–6 mm long, dilated at base; intervening scales to 0.5 mm long.

Notes: Plants are variable in habit from erect to prostrate, and often become multi-stemmed from the base. The peduncle dilates to a variable extent distally, and the achenes become firmly attached to the receptacle at maturity and are somewhat enclosed by hardened incurved bracts. Two largely sympatric species occur in Australia.

Key to subspecies

Distal peduncle and lateral parts of inner involucral bracts bearing numerous sometimes minute spreading hairs at anthesis; fruiting peduncle to 7 mm diam., 2–4 times its diam. near base ..... subsp. ***rhagadioloides***

Distal peduncle and lateral parts of inner involucral bracts glabrous at anthesis (robust spreading hairs sometimes present medially on inner involucral bracts and/or on upper stem in a line below peduncular bracts); fruiting peduncle to 5 mm diam., 1.5–2.5 times its diam. near base ..... subsp. ***cretica***

Hedypnois rhagadioloides (L.) F.W.Schmidt subsp. *rhagadioloides*

Peduncle with spreading hairs distally at anthesis, sometimes minute; fruiting peduncle to 7 mm diam., 2–4 times its diam. near base; sometimes with hairs lost at this stage. Involucre 6–9 mm long, with numerous small hairs distributed over much of the stereome surface, with coarser hairs also present in midline; mature involucre often globular, with

only narrow slits between bracts. Florets: ligule 4–6 mm long, usually exceeding involucre by c. 1–2 mm. Achenes 4.5–7.0 mm long. Pappus bristles of the central achenes mostly 3–5 mm long.

Notes: Native to the Mediterranean region, the Middle East and south-western Asia. Occurs predominantly in south-eastern Australia from far south-eastern Queensland south to south-central Victoria and SW to south-central South Australia; a few occurrences in south-eastern Tasmania, far south-western Western Australia, and central Australia around Alice Springs. Grows predominantly in drier regions in sandy loam or clay soils in grassland and woodland. Flowers spring to summer.

Although sympatric with subsp. *cretica*, there is little evidence of hybridisation between the two forms. At fruiting, the shape of the involucre and degree of dilation of the peduncle helps to identify the subspecies when indumentum characters have been lost.

Representative specimens: WESTERN AUSTRALIA: Cape Leeuwin, south of Augusta, *G.J.Keighery 9200* (CANB, PERTH). NORTHERN TERRITORY: A.I.B. farm, c. 9 km south of Alice Springs, *D.J.Nelson 1968* (DNA, MEL). SOUTH AUSTRALIA: Near Bosanquet Hill, Eyre Penin., *E.N.S.Jackson 5019* (AD, MEL). QUEENSLAND: 2.2 km east of Allora along Forest Plain Rd, *A.R.Bean 10848* (BRI, MEL). NEW SOUTH WALES: Near Tori HS remnant, just north of Tori Lake, c. 6 km NE of 'Tylden', c. 35 km NNE of Balranald, *P.G.Kodela 462*, *G.Chapple*, *R.G.Coveny* & *H.McPherson* (BRI, CANB, MEL, NE, NSW). VICTORIA: c. 4 km south of Sunset Tank, 'Sunset Country', far north-west. *M.G.Corrick 6659* & *P.S.Short* (MEL). TASMANIA: bank of R. Derwent, c. 3 km west of Plenty R. Bridge, *A.M.Gray 1068* (HO).

Hedypnois rhagadioloides subsp. ***cretica*** (L.) Hayek, *in* F.K.G.Fedde, *Rep. Sp. Nov. Beihefte* 2: 807 (1931)

Hyoseris cretica L., *Sp. Pl.* 2: 810 (1753); *Hedypnois cretica* (L.) Dum.Cours., *Bot. Cult.* 2: 339 (1802).

Type: Crete, Herb. Linn. 957.11; holo: LINN *n.v.*, *fide* B.Nordenstam, *op. cit.* 139 (1977).

Peduncle without spreading hairs (occasionally spreading hairs may be present on stem in a line below peduncular bracts); fruiting peduncle to 5 mm diam., 1.5–2.5 times its diam. near base. Involucre 7–11 mm long, glabrous or more often with robust hairs confined to medial zone; mature involucre hardly globular, with bracts well-spaced. Florets: ligule 5–8 mm long, usually exceeding involucre by c. 2–4 mm. Achenes (5.0–) 6.0–9.0 mm long. Pappus bristles of the central achenes 4–6 mm long.

Notes: Native to the Mediterranean region, the Middle East and south-western Asia. Occurs in western Western Australia south from the Murchison River area, and in south-eastern Australia from far south-eastern Queensland south to south-central Victoria and SE to south-central South Australia; also recorded from south-eastern Tasmania around Hobart. Grows predominantly in drier regions in sandy loam or clay soils in grassland and woodland. Flowers spring–summer.

The involucral bracts of subsp. *cretica* have robust hairs confined to the midline in one or two rows, or are glabrous. The distal peduncle may be transiently cobwebby prior to anthesis. Although less reliable for discriminating subspecies, the ligules, achenes and pappus bristles are generally longer in this subspecies and the peduncle generally does not dilate distally to the same extent. Nordenstam (1977) indicates that subsp. *rhagadioloides* is characterised by a chromosome number of $2n = 16$, whereas subsp. *cretica* has a number of $2n = 13$. A few specimens from north-western Victoria are atypical in having more viscid involucral bracts with hairs slightly more diffuse.

Representative specimens: WESTERN AUSTRALIA: Murchison R., *H.Demarz 11437* (CANB, PERTH). SOUTH AUSTRALIA: Gawler Ras, Yardea Stn, c. 1.6 km east of the HS, *C.R.Alcock 3989* (AD, CANB). QUEENSLAND: 2.2. km east along Allora along Forest Plain Rd, *A.R.Bean 10848* (BRI, MEL). NEW SOUTH WALES: Hillston, bank of Lachlan R., near sewerage treatment works, *R.Medd 161177* (NSW). VICTORIA: Yarrara forest, adjacent to Millewa main channel, ± 15 km south of Werrimull, *S.J.Forbes 3136, D.E.Albrecht & J.H.Browne* (MEL). TASMANIA: Henry St Cemetery, Sorell, *A.M.Buchanan 13511* (HO).

17. UROSPERMUM Scop., *Intr. Hist. Nat.* 122 (1777)

Annual or perennial herbs, branching. Hairs simple, eglandular. Leaves basal and cauline. Inflorescences solitary or cymose. Capitula pedunculate; involucral bracts uniseriate, soft and reflexed at maturity. Florets: ligule yellow. Achenes homomorphic, not compressed, beaked. Pappus of bristles, not persistent; bristles plumose, uniform within a pappus.

A genus of two species from the Mediterranean region. Capitula are moderately large and are borne on a long peduncle that gradually dilates distally. Spreading hairs are numerous and variable in size; on or near the margin of leaves they are minute and very densely packed, whereas on lower stems and leaf-midribs they are often larger. A distinctive feature of the mature receptacle is the ciliate pit margins.

Key to species

Involucral bracts with spreading setose hairs ..... **1. *U. picroides***
Involucral bracts with appressed silky hairs ..... **2. *U. dalechampii***

1. *Urospermum picroides (L.) Scop. ex F.W.Schmidt, *Samml. Phys.-ökon. Aufs.* 1: 275 (1795)

Tragopogon picroides L., *Sp. Pl.* 2: 790 (1753); *Arnopogon picroides* (L.) Willd., *Sp. Pl.* 3: 1496 (1803).

Type: Crete, Southern France; *n.v.*

Annuals to c. 0.5 m high, with spreading to retrorse setose hairs scattered on all parts, with minute hairs on margin of leaves. Basal leaves few to several, variably persistent; cauline leaves few to several, to c. 25 cm long, with l:w ratio 3–6; undivided, or lobate to pinnatisect; base becoming truncate, cordate or sagittate, somewhat stem-clasping upwards; margin dentate or denticulate. Capitula solitary or 2; involucre 12–22 mm long, c. 5–8 mm diam.; bracts 7–10, with long setose hairs, with hyaline margin slender and usually grey or broad and pale on alternate bracts, finally reflexed. Florets: ligule c. 15 mm long; style pubescence pale. Achenes 10–15 mm long, somewhat sigmoidal overall, brown, comprising two distinct portions: basal portion flattened-obloid, 3–5 mm long with numerous long tubercles on faces; apical portion c. 7–10 mm long, comprising a dilated part 3.5–5 mm long bearing transverse wrinkles, tapering gradually into beak; beak c. as long as dilated part of apical portion. Pappus 8–12 mm long, detaching as a unit, white. *False Hawkbit.*

Notes: Native to the Mediterranean region. Occurs in western Western Australia mostly south from Carnarvon, and southern South Australia east from Eyre Peninsula, with isolated occurrences in north-western and south-central New South Wales and western Victoria. Grows in a range of soils, often on rocky slopes and outcrops, in shrubland, including chenopod shrublands. Flowers late winter to spring.

A distinctive species with its bristly involucre lacking outer bracts, and its peculiar achenial morphology.

Representative specimens: SOUTH AUSTRALIA: Moralana Stn, northern end where powerline crosses 'Little Brachina Ck', *D.E.Symon 14931* (AD, BRI); 6 km NNW of Mongolata on Whitehill Rd, *N.N.Donner 8353* (AD, MEL). QUEENSLAND: Lake Perseverance NNE of Toowoomba, 15 Oct. 1995, *M.E.Ballingall s.n.* (BRI). NEW SOUTH WALES: Mootwingee Natl Park, 4.5 km SE of 'Mootwingee' HS, *A.N.Rodd 5804, P.G.Wilson & J.Gentle* (AD, MEL, NSW). VICTORIA: west of PMG tower, Callistemon Gorge, Mt Arapiles, *A.C.Beauglehole 29647* (MEL).

2. **Urospermum dalechampii* (L.) Scop. ex F.W.Schmidt, *Samml. Phys.-ökon. Aufs.* 1: 275 (1795)

Tragopogon dalechampii L., *Sp. Pl.* 2: 790 (1753).

Type: Spain; *n.v.*

Annuals to c. 0.5 m high. Spreading to slightly retrorse setose hairs scattered on stems and leaves. Unbranched or branches few. Basal leaves several, persistent at anthesis, to c. 16 cm long, with l:w ratio 3–6; lyrate-pinnatifid; margin entire or denticulate; cauline leaves few–several, becoming undivided; base truncate to cordate, stem-clasping. Capitula solitary or 2; involucre 12–15 mm long, c. 8–10 mm diam.; bracts 7–10, with appressed silky hair scattered on surface, with hyaline margin slender and grey or broad and pale on alternate bracts. Florets: ligule c. 15 mm long; style pubescence pale. Achenes c. 15 mm long, curved; basal portion flattened-obovoid, c. 4 mm long, verrucose; apical portion plumper than basal portion at base, obscurely wrinkled, tapering into a long, ciliolate beak c. 10 mm long. Pappus c. 10 mm long, cream, falling as a unit.

Notes: Occurs in Hobart in south-eastern Tasmania. Flowers spring–summer.

Representative specimens: TASMANIA: northern edge of Queens Domain, Cornelian Bay, *A.M.Buchanan 14338* (HO).

18. HYPOCHAERIS L., *Sp. Pl.* 2: 810 (1753)

Annuals, biennial or perennial herbs, usually branching. Hairs simple, eglandular. Leaves all or mostly basal. Inflorescences solitary or cymose. Capitula pedunculate; involucral bracts multiseriate, soft and reflexed at maturity; receptacular paleae linear, membranous, with apex filamentous, not enclosing or falling with achene. Florets: ligule yellow or white. Achenes homomorphic or dimorphic, not compressed, beaked or not. Pappus of bristles, persistent (in Australia), homomorphic or slightly dimorphic; bristles plumose or scabridulous; sometimes of two types within a pappus.

A genus of c. 60 species mostly from temperate South America or from the Mediterranean region, but also from other parts of Europe and Asia. The involucral bracts of species occurring in Australia have a slender hyaline margin becoming broader in inner series. The longest intermediate bracts are more than half the length of the inner bracts. Achenes are brown with ribs ornamented with transverse sometimes scale-like ridges and taper into a scabridulous beak.

This genus has been spelt *Hypochoeris* in many Australian references. According to article 13.4 of the ICBN, St Louis 2000, *Hypochaeris* is the correct spelling.

Key to species

1 Stems usually with 2 or more leaves (defined as more than 1/4 of length of basal leaves); longest peduncular bracts commonly > 5 mm long; ligule white or cream; pappus uniseriate, all bristles plumose, of similar length ..... **3. *H. microcephala***

1: Stems leafless or occasionally with 1 leaf (defined as more than 1/4 of length of basal leaves); longest peduncular bracts < 5 mm long; ligule yellow; pappus biseriate, the outer series scabridulous, finer and much shorter than inner series

2 Marginal florets not exceeding involucre or only by up to 2 mm; inner involucral bracts elongating by 60–100% post anthesis, equal to or longer than receptacular paleae in fruit; outer achenes not beaked, sometimes briefly tapering distally ..... **1. *H. glabra***

2: Marginal florets usually exceeding involucre by more than 5 mm; inner involucral bracts elongating by < 50% post anthesis, markedly shorter than receptacular paleae in fruit; outer achenes beaked..... **2. *H. radicata***

1. *_Hypochaeris glabra_ L., *Sp. Pl.* 2: 811 (1753)

Type: Belgium, Herb. Linn. 959.4; lecto: LINN, *fide* S.A.Alavi *in* S.M.H.Jafri & A.El-Gadi (eds), *Fl. Libya* 107: 347 (1983).

Annuals to c. 0.4 m high, with spreading hairs often on leaves and occasionally on stems. Basal leaves with l:w ratio (1–)2–6, undivided or with spreading lobes; cauline leaves absent. Capitula solitary or few to several, not cobwebby; involucre 7–10 mm long at anthesis, subsequently lengthening by 60–100%, c. 1–3 mm diam.; bracts mostly smooth, occasionally with a few spine-like hairs, with those of outer series narrow-ovate, 2–3 mm long; receptacular paleae to 17 mm long, shorter than mature inner bracts. Florets: ligule c. 2–5 mm long, not or shortly exceeding involucre, yellow; style pubescence pale. Achenes dimorphic, 3–12 mm long; body 3–5 mm long, with numerous ribs; marginal achenes mostly few to several, rarely lacking, with body narrow-obconical or occasionally fusiform, dark red-brown, unbeaked or less often with beak to 2 mm long; central achenes with body narrow-fusiform, red-brown, with glaucous grooves with beak longer than body. Pappus biseriate, 6–10 mm long, cream; bristles of inner series plumose, with those on marginal achenes more densely plumose proximally; bristles of outer series much shorter, scabridulous. *Smooth Cats-ear.*

Notes: Native to Europe and western Asia. Occurs in south-western Western Australia mostly south and SE from Carnarvon, in South Australia, from far south-eastern Queensland SSW through New South Wales to Victoria, and in eastern Tasmania. Isolated occurrences in central Queensland and southern Northern Territory. Naturalised in New Zealand. Grows in disturbed or relatively intact sites, often in rocky and/or poor soils. Flowers mostly winter to summer.

Occasional specimens, e.g. from the Wimmera in north-western Victoria and the Deniliquin area in south-central New South Wales, are unusual in having setose stems and peduncles. When in flower the narrower capitula with fewer bracts and shorter ligules which barely exceed the bracts readily distinguishes *H. glabra* from *H. radicata*. Post-anthesis, the involucre of *H. glabra* elongates markedly post-anthesis and the longer inner bracts typically exceed the receptacular paleae. In contrast, the involucre of *H. radicata* elongates less markedly post-anthesis and its inner bracts are much exceeded by the often pigment-tipped receptacular paleae. The unbeaked marginal achenes of *H. glabra* also usually distinguishes it from *H. radicata*, although in occasional specimens the marginal achenes are short-beaked or absent. Beaked achenes differ from short-beaked achenes of *H. radicata* in the absence of bristles on the beak. Depauperate specimens are fairly common and these have very narrow capitula.

Representative specimens: WESTERN AUSTRALIA: 5 km south of Tamala Stn HS, Tamala, 1993, *G.J.Keighery & J.J.Alford* (CANB, DNA, PERTH). NORTHERN TERRITORY: Maggie Springs, Ayers Rock, *P.K.Latz 8485* (DNA). SOUTH AUSTRALIA: Kolendo, Dawes Dam, 30 km west of HS, *H.R.Toelken 7490* (AD, HO). QUEENSLAND: 2 km north of Killarney, road to Warwick, *G.N.Batianoff 2010330 & C.Appelman* (BRI, DNA, NSW). NEW SOUTH WALES:

Park Beach, Coffs Harbour, *R.G.Coveny 12763, Z.Donabaner & C.Dunn* (BRI, MEL, NSW). VICTORIA: Three Jacks Reserve, Stawell, *A.C.Beauglehole 22143* (MEL). TASMANIA: Little Musselroe Bay, *A.Moscal 2925* (HO).

2. *_Hypochaeris radicata_ L., *Sp. Pl.* 2: 811 (1753)

Type: Europe, Herb. Clifford; ?LINN, *fide* S.A.Alavi *in* S.M.H.Jafri & A.El-Gadi (eds), *Fl. Libya* 107: 348 (1983).

Perennials to c. 1 m high. Spreading hairs usually present on leaves. Basal leaves with l:w ratio 3–6, undivided or with spreading to retrorse lobes; cauline leaves absent or occasionally solitary, with small bracts subtending branches. Capitula usually few to several, not cobwebby; involucre at anthesis 10–15 mm long subsequently lengthening by c. 20%, c. 3–7 mm diam.; bracts with midrib setose distally or throughout, occasionally ± smooth, with those of outer series narrow-ovate to lanceolate, 2–3 mm long; receptacular palcae to 26 mm long, exceeding mature inner bracts. Florets: ligule c. 8–16 mm long, usually exceeding involucre by c. 5–10 mm, yellow; style pubescence pale. Achenes homomorphic or dimorphic, 7–14 mm long; body fusiform, 4–5 mm long, with numerous ribs; marginal achenes several or absent, red-brown, with beak shorter than body; central achenes red-brown, with glaucous grooves, with beak longer than body. Pappus biseriate, 9–15 mm long, cream; bristles of inner series plumose, with those on marginal achenes not or hardly more densely plumose proximally; bristles of outer series much shorter, scabridulous. *Cats-ear, Flat-weed.*

Notes: Native to Europe. Occurs in far south-western Western Australia, in far eastern Australia from Cairns in northern Queensland south through eastern New South Wales to Victoria, in south-eastern South Australia, and in Tasmania. Also naturalised in New Zealand. Grows in a wide range of natural and disturbed habitats, mostly in areas of moderate to high rainfall. Flowers all year but mostly spring–autumn.

Extremely common and widespread weed in areas with moderate to high rainfall or in watered sites. Peduncles and inflorescence branches are often long and can arise from below mid-stem. Readily distinguishable in flower from the other two species of *Hypochaeris*. After flowering it can be distinguished in most cases by the marginal achenes and otherwise by the receptacular palcae which greatly exceed the involucre and are more commonly pigmented than in *H. glabra*.

Representative specimens: WESTERN AUSTRALIA: Kings Park, Perth, 1 Aug. 1934, *R.Roe s.n.* (CANB). NORTHERN TERRITORY: 27 km north of Alice Springs, *D.J.Nelson 2371* (CANB, DNA). SOUTH AUSTRALIA: Mt Crawford Forest Reserve, *H.P.Vonow 134* (AD, HO). QUEENSLAND: Kileoy Lane near entrance to Crystal Waters Village, c. 13 km west of Maleny, *G.N.Batianoff 201209, T.P.Boyle, & D.Blewett* (BRI, NSW). NEW SOUTH WALES: Bega Swamp, 30 Jan. 1985, *G.Singh s.n.* (CANB). VICTORIA: Cranbourne, Royal Botanic Gardens Annexe, *J.H.Ross 2648 & M.G.Corrick* (AD, MEL). TASMANIA: Ile du Nord, off Maria Is., 20 Dec. 1983, *N.P.Brothers* (HO).

3. *_Hypochaeris microcephala_ var. ***albiflora*** (Kuntze) Cabrera, *Notas Mus. La Plata, Bot.* 16: 201 (1937)

H. brasiliensis var. *albiflora* Kuntze, *Revis Gen. Pl.* 3(2): 159 (1898)

Type: Bolivia, *s.d., Mandon 219*; holo: B *n.v., fide* J.Solomon (2006b)

Perennials to c. 0.4 m high. Spreading hairs on stems and leaves. Basal leaves with l:w ratio 3–6, undivided or with antrorse to retrorse lobes; cauline leaves 2 or 3, mostly linear to narrow-linear, with l:w ratio to c. 20, not dilated basally, reducing to bracts

upwards. Capitula few to several, transiently cobwebby; involucre at anthesis 8–12 mm long, subsequently lengthening by c. 50–80%, c. 2–4 mm diam.; bracts smooth, with those of outer series lanceolate, c. 3 mm long; receptacular paleae to 15 mm long, slightly shorter than mature inner bracts. Florets: ligule c. 2–3 mm long, white or cream; style pubescence pale. Achenes homomorphic, 6–10 mm long, beaked; body narrow-obloid, 4–7 mm long, with c. 5 broad transversely ridged ribs and narrow non-glaucous grooves, with beak slightly shorter than body. Pappus uniseriate, 5–8 mm long, pale yellow-brown proximally, white distally; bristles all plumose. *White Flatweed*

Notes: Native to South America. Occurs in eastern Australia from Maryborough in south-eastern Queensland south to the Sydney region in central-eastern New South Wales. Also naturalised in South Africa. Grows mostly in distrubed sites, in various soils, in urban environments or in grassland, woodland and forest. Flowers mostly late winter to summer.

Hypochaeris microcephala var. *albiflora* is in section *Achyrophorus*, a section that has its greatest diversity in South America. In contrast, *Hypochaeris glabra* and *H. radicata* are in section *Hypochaeris*, a section that has its greatest diversity in Europe and Asia. A suite of characters distinguish *H. microcephala* var. *albiflora* from the other two species. Apart from differences given in the key, it can be distinguished by its longer peduncular bracts, and the achenes with fewer, much broader ribs, non-glaucous grooves, and with a more gradual taper to a shorter beak. *Hypochaeris microcephala* var. *albiflora* and *H. glabra* are similar in that they both have short ligules and the involucres of the two taxa elongate to a similar extent post-anthesis.

Representative specimens: QUEENSLAND: Bunya Mtns Natl Park, *R.Belcher 809* (BRI, MEL); Indooroopilly, Brisbane, *L.Pedley 4410* (BRI, CANB, NSW). NEW SOUTH WALES: Below Callawajune Mtn, (The Beehive or South Obelisk), c. 5.5 km SSW of Urbenville, *R.G.Coveny 12795, Z.Donabauer & C.Dunn* (AD, BRI, CANB, MEL, NSW, PERTH); Blaekett, *R.Coveny 11299* (BRI, NSW).

19. LEONTODON L., *Sp. Pl.* 2: 798 (1753)

Annual or perennial herbs, not branching. Hairs furcate, with prongs straight. Leaves all basal. Inflorescences solitary. Capitula pedunculate; involucral bracts multiseriate; inner bracts ± soft, strongly convex and reflexed at maturity. Florets: ligule yellow. Achenes dimorphic; not compressed, beaked or unbeaked. Pappus of bristles and scales, persistent, dimorphic; bristles plumose or scabridulous, sometimes of two types within a pappus.

A genus of c. 50 species from Europe, northern Africa and south-western Asia, mainly in the Mediterranean region.

Leontodon taraxacoides (Vill.) Mérat, *Ann. Sci. Nat. (Paris)* 22: 108 (1831) subsp. ***taraxacoides***

Hyoseris taraxacoides Vill., *Prosp. Hist. Pl. Dauphiné* 33 (1779); *Leontodon nudicaulis* subsp. *taraxacoides* (Vill.) Schinz & Thell., *Bull. Herb. Boissier* sér. 2, 7: 389 (1907).

Type: *n.v.*

[*L. leysseri auct. non* (Wallr.) Beck; W.M.Curtis, *Student's Fl. Tasmania* 2: 386 (1963).]

[*L. hirtus auct. non* L.; J.M.Black, *Fl. S. Australia* 659 (1929); A.Ewart, *Fl. Victoria* 1197 (1931).]

Scapose perennials to c. 0.4 m high. Bifurcate hairs c. 1 mm long sparse to scattered on leaves and lower stems and sometimes on involucre. Leaves to c. 30 cm long, with

l:w ratio 4–15, undivided or lobate to subpinnatisect; margin entire or remotely sinuate dentate; divided leaves with 3–6 ± spreading lobes or segments per side. Capitulum solitary, nodding in bud; involucre 6–11 mm long, c. 3–5 mm diam.; bracts glabrous or occasionally moderately hairy; bracts of outer series c. 6–8, narrow-lanceolate, 1–2 mm long; intermediate bracts not reaching to half way; inner bracts with a grey hyaline margin. Florets: ligule c. 7–10 mm long; style pubescence pale. Achenes 3–5 mm long, dimorphic; marginal achenes curved-fusiform, tapering into a short neck, ± smooth, housed within adjacent inner bract at maturity; central achenes short-beaked; body narrow-fusiform, transversely ridged or scaly, with beak 0.5–1 mm long. Pappus cream; pappus of marginal achenes of fused scales 0.5–1 mm long; pappus of central achenes 6–9 mm long, biseriate; inner series c. 10, sparsely plumose, much wider at base; outer series 0.5–3 mm long, scabridulous. *Hairy Hawkbit.*

Notes: Native to Europe. Occurs in far south-western Western Australia, south-eastern Australia from south-eastern Queensland south to Victoria, in south-eastern South Australia, and in Tasmania. Occurs mostly nearer the coast associated with human habitation. Naturalised in New Zealand. Grows in waste land and on nature strips, predominantly in urban environments with moderate rainfall and/or irrigation. Flowers mainly late winter–spring, also other times.

A common weed of disturbed areas and of lawns in southern Australia. The involucre is either glabrous or moderately hairy with little evidence of intermediate forms. However, no correlation has been identified between this and other characters in Australian collections.

Although the involucre is multiseriate, the outer and intermediate bracts are relatively small, and the intermediate bracts generally do not reach halfway along the involucre. This is one of several characters distinguishing *L. taraxacoides* from the superficially similar and often co-occurring *Hypochaeris radicata*. Other characters of *L. taraxacoides* distinguishing it from *H. radicata* include stems unbranched, hairs on leaves minutely bifureate, paleae absent, involucral bracts all smooth, and inner involucral bracts with a grey hyaline margin. The subspecies of *L. taraxacoides* in Australia differs from subsp. *longirostris* Finch & P.D.Sell, of southern Europe, in having a much shorter achenial beak.

Representative specimens: WESTERN AUSTRALIA: 100 m WSW of Albany Hwy on Mondurup Rd, Mt Barker, *B.J.Lepschi 2574 & T.R.Lally* (AD, CANB, PERTH). SOUTH AUSTRALIA: Jupiter Ck, Southern Lofty, *R.J.Bates 26810* (AD). QUEENSLAND: Quarry Rd, Sherwood, *A.R.Bean 17107* (BRI, MEL, NSW). NEW SOUTH WALES: southern end of town, Glen Innes, *R.Coveny 12372, W.Bishop & L.Murray* (BRI, NSW). VICTORIA: arboretum in SW corner of Royal Botanic Gardens Annexe, Cranbourne, *P.C.Johson 3486* (BRI, CANB, MEL, NSW). TASMANIA: Balfour, *A.Moscal 4800* (HO, MEL).

20. HELMINTHOTHECA Zinn, *Cat. Pl. Hort. Gott.* 430 (1757)

Annual, biennial or perennial herbs, branching. Hairs simple, eglandular, or furcate with recurved prongs. Leaves basal and cauline. Inflorescenees cymose or paniculate. Capitula pedunculate; involucral bracts biseriate but also surrounded by a series of large leafy bracts inserted at base of capitulum; inner bracts hardened, strongly convex and erect at maturity. Florets: ligule yellow. Achenes dimorphic, not compressed, transversely ridged. Pappus of bristles, not persistent, dimorphic; bristles plumose or scabridulous, uniform within a pappus.

A genus of four species from Europe, northern Africa and south-western Asia.

Helminthotheca echioides (L.) Holub, *Folia Geobot. Phytotax. Bohemoslov.* 8: 176 (1973)

Picris echioides L., *Sp. Pl.* 2: 792 (1753); *Helminthia echioides* (L.) Gaertn., *Fruct. Sem. Pl.* 2: 368 (1791).

Type: Locality unknown, Herb. Linn. 984.1, lecto: LINN, *fide* H.W.Lack, *op. cit.* 113 (1975).

Annuals to perennials to c. 1.0 m high, with spreading hairs and spines, mostly minutely 2–5-furcate. Leaves with l:w ratio 4–12, usually not divided, usually with some robust tubercle-based hairs. Stem leaves few to several; base cordate, stem-clasping; margin entire or sinuate. Capitula few to several, with 4–6 erect, ovate to lanceolate foliaceous bracts 5–22 mm long arising from base: involucre 8–12 mm long excluding spurs; outer bracts lanceolate, 2–3 mm long; inner bracts with spreading hairs and a branched sub-apical spur 2–8 mm long. Florets: ligule c. 8–10 mm long; style pubescence black. Achenes 5.5–9 mm long, beaked, dimorphic; marginal achenes; body pilose; beak equal to or shorter than body, housed in concavity of hardened inner bracts at maturity; central achenes; body with numerous shallow transverse ridges, glabrous; beak as long as or up to 1.5 times longer than body. Pappus 6–7 mm long, or 2–4 mm long on marginal achenes, white, detaching as a unit; bristles of marginal achenes scabridulous; those of central achenes plumose. *Ox-tongue.*

Notes: Native to Europe, Asia and Africa. Occurs predominantly in south-eastern Australia from Manilla in north-eastern New South Wales south to Victoria, and SW to the Eyre Peninsula in south-central South Australia. Isolated occurrences in south-eastern Queensland, northern and far south-eastern Tasmania, and far south-western Western Australia. Grows on roadsides and wasteland, often beside streams. Flowers most of the year, mostly late spring–summer.

Distinctive features of this readily recognisable species include the tuberculate spines on the leaves and the large foliaceous bracts surrounding capitula. The inflorescence bracts are also relatively large. The dimorphism of the achenes follows the pattern seen in several other genera in this tribe, including *Crepis*, *Hedypnois* and *Tolpis*. Also similar to these genera is the placement of the marginal achenes within the strong concavities of alternating inner bracts.

The hyaline margin of inner bracts are well-developed, and appressed-silky. Similar to *Picris* in which it was once included in terms of the forked hairs with recurved prongs. The beak is capillary and often is crumpled in herbarium specimens. Holzapfel (1994) contrasts the black style-hairs of this species with the pale yellow ones of species of *Picris* in Australia.

Representative specimens: WESTERN AUSTRALIA: Cunderdin, 14 Dec. 1981, *E.H.Harris s.n.* (PERTH). SOUTH AUSTRALIA: Morialta Falls Reserve, *R.L.Correll 65* (AD. MEL). QUEENSLAND: Mulgowie, 6.4 km south of Laidley. 31 Oct. 1974, *I.K.Hughes* (BRI). NEW SOUTH WALES: Barham district, 19 Mar. 1956, *C.A.Hare* (NSW). VICTORIA: Just east of Vinifera, *H.I.Aston 2727* (BRI, CANB, DNA, MEL). TASMANIA: New Town, *L.Rodway 450a* (HO).

21. PICRIS L., *Sp. Pl.* 2: 792 (1753)

Annual, biennial or perennial herbs, branching. Hairs simple, eglandular, or furcate with recurved prongs. Leaves basal and cauline. Inflorescences solitary, cymose or paniculate. Capitula pedunculate; involucral bracts multiseriate; inner bracts hardened, strongly convex and erect at maturity. Florets: ligule yellow. Achenes homomorphic, not

compressed, transversely ridged. Pappus of bristles, not persistent, sometimes dimorphic; bristles plumose or scabridulous, dimorphic within a pappus.

This genus was not examined in detail by the author. The reader is referred to Holzapfel (1994) and recent stated floras for details of species. Below is a list of species in Australia as recognised by Holzapfel; these names are all currently in use. Holzapfel indicated that non-native species *P. altissima* Delile, *and P. hieracioides* L. have been collected in Australia but have not become established.

List of species (alphabetical)

1. ***Picris augustifolia*** DC., *Prodr.* 7:130 (1838)
   a. ***Picris augustifolia*** DC., *Prodr.* 7:130 (1838) subsp. ***augustifolia***
   b. ***Picris augustifolia*** subsp. ***carolorum-henricum*** (Lack) S.Holzapfel, *Willdenowia* 24: 144 (1994)
   c. ***Picris augustifolia*** subsp. ***merxmuelleri*** Lack & S.Holzapfel, *Willdenowia* 23: 190 (1993)
2. ***Picris barbarorum*** Lindl. *in Edwards's, Bot. Reg.* 24:58 (1838)
3. ***Picris burbidgei*** S.Holzapfel, *Willdenowia* 23: 183 (1993)
4. ***Picris compacta*** S.Holzapfel, *Willdenowia* 23: 185 (1993)
5. ***Picris conyzoides*** S.Holzapfel, *Willdenowia* 23: 185 (1993)
6. ***Picris drummondii*** S.Holzapfel, *Willdenowia* 23: 187 (1993)
7. ***Picris eichleri*** Lack & S.Holzapfel, *Willdenowia* 23: 188 (1993)
8. ***Picris evae*** Lack, *Phytologia* 42: 210 (1979)
9. ***Picris squarrosa*** Steetz, in J.G.C.Lehmann, *Pl. Preiss.* 1:488 (1845)
10. ***Picris wageritzii*** Lack, *Bot. Jahrb. Syst.* 108: 189 (1987).

22. SCORZONERA L., *Sp. Pl.* 2: 790 (1753)

Annual, biennial or perennial herbs, branching or not. Hairs simple, eglandular. Leaves mostly basal. Inflorescences solitary, cymose or (not in Australia) paniculate. Capitula pedunculate; involucral bracts multiseriate, soft and reflexed at maturity. Florets: ligule yellow (in Australia), violet, or purple. Achenes homomorphic, hardly compressed, unbeaked. Pappus of bristles, persistent, bristles plumose, uniform within a pappus.

A genus of c. 175 species from Europe, Asia and northern Africa.

Scorzonera laciniata L., *Sp. Pl.* 2: 791 (1753)

Podospermum laciniatum (L.) DC., *Fl. Franç.* 3rd edn, 4: 62 (1805).

Type: 'Habitat in Germania, Gallia', Europe; *n.v.*

Biennials to c. 0.4 m high. Indumentum appressed-woolly, glabrescent or nearly glabrous. Basal leaves many, ± persistent, to c. 18 cm long, with l:w ratio 4–40 undivided or more commonly deeply pinnatisect; base weakly sheathing; margin entire; divided leaves with 1–several segments per side, with shape various; cauline leaves 1–several, similar to basal leaves but smaller, with base not clasping stem. Capitula solitary or few, 8–15 mm long, subsequently elongating to 12–35 mm long, c. 2–7 mm diam.; bracts glabrous or variably appressed woolly; outer bracts 4–8, 3–8 mm long, with or without subapical spur; intermediate bracts extending over halfway at anthesis; inner bracts

alternately long with broad margin, short with narrow margin. Florets: ligule 8–12 mm long; style pubeseenee pale. Aehenes 8–15 mm long, glabrous, eomprising two distinet portions; basal portion elliptie, e. 3–5 mm long, with pale prominent ribs, darker between ribs; apieal portion narrower than basal portion, narrow obloid, e. 6–10 mm long, not tapered apieally, pale purplish. Pappus 8–20 mm long, ream. *Scorzonera.*

Notes: This speeies is included in Seet. *Podospermum* (DC.) Boiss. of *Scorzonera* based on its pinnatiseet leaves and its achenes with a relatively large basal enlargement. A feature of this speeies is the massive taproot.

Key to varieties

Segments of leaves or distal 4 eentimetres of undivided leaves with l:w ratio mostly > 10; involuere 8–12 mm long at onset of anthesis elongating to up to 27 mm long at maturity; outer braets usually unspurred..... var. ***laciniata***

Segments of leaves or distal 4 eentimetres of undivided leaves with l:w ratio mostly < 10; involucre 10–15 mm long at onset of anthesis elongating to up to 35 mm long at maturity; outer braets with a subapieal spur..... **var. *calcitrapifolia***

Scorzonera laciniata L. var. ***laciniata***

Raehis of leaf less than twiee as broad in distal quarter as it is midleaf, 1–4 mm wide; lateral segments with l:w ratio mostly > 10. Involuere 8–12 mm long at onset of anthesis, elongating to up to 27 mm long at maturity; braets glabrous or sparsely appressed-woolly at anthesis, unspurred or spur to 0.8 mm long. Aehenes 8–12 mm long. Pappus c. 8–14 mm long.

Notes: Native to Europe and western Asia. Oecurs in far south-eastern South Australia, with isolated reeords from western Victoria, and south-eastern Tasmania around Tunbridge. Grows in disturbed or semi-intaet native vegetation in heavy soils in grassland and woodland. Flowers spring–summer.

Representative specimens: SOUTH AUSTRALIA: Flinders Ras, Walloway, ea. 10 km north of Orroroo, *C.R.Alcock 8394* (AD, CANB, MEL); Environs of Loxton, *C.R.Alcock 6170* (AD). VICTORIA: Benjeroop State Forest, *A.C.Beauglehole 83169* (MEL). TASMANIA: White Lagoon, *L.Gilfedder 5* (HO).

Scorzonera laciniata var. ***calcitrapifolia*** (Vahl) Biseh. ex Boiss., *Fl. Orient.* 3: 757 (1875)

Scorzonera calcitrapifolia Vahl, *Symb. Bot.* 2: 87 (1791).

Type: 'Legi passim in regno Tunetano', [northern Afriea]; *n.v.*

Podospermum resedifolium DC., *Fl. Franç.* 3rd edn, 4: 61 (1805). Type: *n.v.*, *fide* P.E.Boissier, *loc. cit.*

Rachis of leaves eommonly at least twiee as broad in distal quarter as it is midleaf, 2–15 mm wide; lateral segments with a l:w ratio < 10; Involuere 10–15 mm long at onset of anthesis, elongating to up to 35 mm long at maturity; braets glabrous or sparsely to densely appressed-woolly at anthesis, with outer and usually intermediate involueral bracts bearing a subapical spur to e. 2 mm long. Aehenes 10–15 mm long. Pappus e. 12–20 mm long.

Notes: Native to Europe and Asia. Oeeurs in far south-eastern South Australia, north-western and eentral Vietoria and south-western New South Wales, with an outlying

collection from the Liverpool plains in central-eastern New South Wales. Grows in disturbed or near intact sites, in loam or clay soils in grassland or woodland. Flowers spring.

Distinguished from the typical variety by its broader leaf segments, longer capitula and fruit, and the subapical spur on its involucral bracts.

Representative specimens: SOUTH AUSTRALIA: Wolseley, *R.J.Bates 25997* (AD). NEW SOUTH WALES: Barham, 13 Oct. 1949, *J.W.Vickery* (NSW); alongside road between Premer and Colly Blue, Liverpool Plains, *J.R.Hosking 1929* (CANB, MEL, NSW). VICTORIA: Eynesbury Estate, about 8 km south from Melton P.O., *V.Stajsic 605* (MEL); Cocklin Ave, Red Cliffs, *J.H.Browne 937* (MEL).

23. TRAGOPOGON L., *Sp. Pl.* 2: 789 (1753)

Annual, biennial or perennial herbs, branching or not. Hairs simple, eglandular or lacking. Leaves basal and cauline. Inflorescences solitary. Capitula pedunculate; involucral bracts uniseriate, soft and reflexed at maturity. Florets: ligule yellow or purple. Achenes homomorphic or slightly dimorphic in terms of ornamentation of the body, not compressed, beaked. Pappus of bristles, persistent, homomorphic, or in *T. hybridus* dimorphic, bristles plumose or rarely scabridulous, sometimes slightly dimorphic within a pappus.

A genus of c. 50 species from temperate Europe, Asia and Africa. Distinctive features of this genus include the linear, entire, sheathing leaves with parallel venation and the solitary capitula lacking outer and intermediate involucral bracts borne on long distally dilated peduncles. The pappus is biseriate and the inner series typically comprises longer bristles that are distally non-plumose.

Tragopogon brevirostris subsp. *longifolius* (Heldr. & Sart. ex Boiss.) I.Richardson has been collected from a roadside on the road to Ironbark near Adelaide in south-eastern South Australia (*R.Bates 52318* AD, MEL). There is currently no indication that it has become naturalised. The capitula and achenes of this taxon are considerably smaller than in the three naturalised species.

Key to species

1 Capitula glabrous; ligules pinkish or purplish

2 Biennials to 1.3 m high, not or sparingly branched; ligules as long as bracts or nearly so; pappus of all achenes with numerous plumose bristles ..... **1. *T. porrifolius***

2: Annuals to 0.5 m high, typically branching; ligules much shorter than bracts; pappus of outer achenes comprising 5 unequal rigid non-plumose bristles; pappus of inner achenes with more numerous plumose bristles ..... **2. *T. hybridus***

1: Capitula or base of capitula woolly, sometimes somewhat transiently; ligules yellow

3 Mature involucre > 20 mm long, with wool developed only at very base; ligules much shorter than bracts; achenes > 20 mm long, with beak c. as long as body ..... **3. *T. dubius***

3: Mature involucre < 20 mm long, woolly; ligules longer than bracts; achenes < 20 mm long, with beak shorter than body ..... ***T. brevirostris*** **(see notes above)**

1. *_Tragopogon porrifolius_ L., *Sp. Pl.* 2: 789 (1753) subsp. ***porrifolius***

Type: Europe, Herb. Burser XV(2): 69, central plant; lecto: UPS *n.v.*, *fide* C.D. de la Guardia & G.Blanca, *Taxon* 41: 549 (1992).

Biennials to c. 1.3 m high, glabrous, sometimes glaucous. Capitula: involucre 25–35 mm long, increasing to up to 60 mm long at maturity, c. 5–12 mm diam.; bracts 5–8, with hyaline margin vestigial or distinct proximally in alternate bracts, finally reflexed. Florets: ligule as long as or slightly shorter than bracts, lilac to deep violet; style pubescence pale. Achenes 20–40 mm long, homomorphic except for rib ornamentation; body fusiform, 10–15 mm long, light to mid brown, with crowded scale-like tubercles on ribs, with tubercle size reducing to nearly smooth inwards, with transition into beak fairly abrupt; beak slightly longer than body, with a sub-terminal dilation 1–2 mm long. Pappus 15–25 mm long, cream to golden-brown, homomorphic. *Salsify*, *Oyster Plant*.

Notes: Native to the Mediterranean. Occurs in far south-western Western Australia, in south-eastern mainland Australia from south-eastern Queensland south to Victoria and extending west from Victoria to south-eastern South Australia, and in Tasmania. Widely cultivated and naturalised in other parts of the world. Grows in sandy-loam soils in disturbed environments, particularly roadsides. Flowers spring–summer.

The non-plumose tips of the longer pappus bristles are usually purplish unlike in the other species of *Tragopogon* in Australia. The beak of the achenes is dilated in the distal few millimetres then abruptly constricted below a hairy pappus ring. This beak morphology is also present in *T. dubius* except that the dilated portion is shorter. Flowers of these two species apparently open only in the morning.

Representative specimens: WESTERN AUSTRALIA: c. 40 km NE of Albany on Chester Pass Rd, *B.J.Lepschi & T.R.Lally 2322* (AD, CANB, PERTH). SOUTH AUSTRALIA: Mt Lofty Ra., Angaston, c. 70 km NE of Adelaide, *H.Amtsberg 5* (AD). QUEENSLAND: roadside, Warwick, *G.N.Batianoff 2010349 & C.Appelman* (BRI, CANB, NSW). NEW SOUTH WALES: Moss Vale Unanderra rly crossing, Sheepwash Bridge Rd, c. 10 km due east of Moss Vale, *P.G.Kodela 217 & S.L.Kodela* (CANB, MEL, NSW). VICTORIA: 0.8 km NE of Laverton, c. 20 km WSW of Melbourne, *H.I.Aston 845* (MEL). TASMANIA: Tasman Hwy at 'Ardross', *A.M.Buchanan 15647* (HO).

2. *_Tragopogon hybridus_ L., *Sp. Pl.* 2: 789 (1753)

Type: Italy; *n.v.*

Annuals to c. 0.8 m high, glabrous, not glaucous. Capitula: involucre c. 30 mm long, increasing to c. 50 mm long at maturity, 3–5 mm diam.; bracts 5–8, with hyaline margin vestigial or very slender, not becoming hardened, finally reflexed. Florets: ligule less than half the length of the bracts, pinkish-lilac; style pubescence pale. Achenes slightly dimorphic; marginal achenes 35–50 mm long; body narrow-cylindrical, 25–40 mm long, light brown, smooth except for minutely scabridulous ribs, with transition into beak very gradual; beak shorter than body, not dilated sub-terminally; central achenes with body slightly shorter. Pappus 10–20 mm long, cream, dimorphic; pappus of marginal achenes comprising 5 rigid scabrid bristles of unequal length; pappus of central achenes comprising numerous plumose bristles.

Notes: Native to southern Europe. Occurs in the Mt Lofty Ranges NE of Adelaide in south-eastern South Australia. Ecological preferences unknown. Flowers spring–summer.

Tragopogon hybridus has been recorded from two different localities in the Northern Lofty Ranges and has probably become naturalised. It is readily distinguished post-

anthesis by the pappus of its marginal achenes. It is typically more branched than *T. porrifolius* and *T. dubius*.

Representative specimens: SOUTH AUSTRALIA: P.Smyth's property, Salter Springs, 6 Jan. 1987, *J.Hannay* (AD); northern approach to Wasley, Northern Lofty, 17 Nov. 1994, *D.McQuinn s.n.* (AD).

3. *_Tragopogon dubius_ Scop., *Fl. Carniol.* 2nd edn, 2: 95 (1772)

Type: 'Habitat circa Tergestum, et Schenoschetz' [central Europe]; *n.v.*

Annuals or biennials to c. 0.8 m high, newer growth transiently woolly, not glaucous. Capitula with a region of caducous wool at the very base, with a minute stubble persisting; involucre c. 25–35 mm long, increasing to up to 60 mm long at maturity, c. 6–12 mm diam.; bracts mostly 8–12, with hyaline margin vestigial or distinct proximally in alternate bracts, not becoming hardened, finally reflexed. Florets: ligule c. half as long as bracts, yellow; style pubescence pale. Achenes 25–35 mm long, homomorphic except for rib ornamentation; body fusiform, 10–15 mm long, light to mid brown, with coarse tubercles on ribs, with tubercle size reducing inwards, with transition into beak gradual; beak slightly longer than body, with a sub-terminal dilation 0.5–1 mm long. Pappus 25–35 mm long, cream, or grey-cream, homomorphic.

Notes: Native to Europe. Occurs predominantly in south-eastern New South Wales with isolated records from far north-eastern New South Wales and eastern Victoria near Orbost. Grows in loam or clay soils in disturbed sites such as roadsides. Flowers spring–summer.

Although the distinctive wool at the base of the capitulum tends to be lost after anthesis, close inspection usually reveals a persistent stubble of hair bases.

Representative specimens: NEW SOUTH WALES: North Cooma, Mar. 1963, *M.Gray s.n.* (AD, CANB); Warri Bridge Reserve, Shoalhaven R., c. 12.5 km NNW of Braidwood, *B.J.Lepschi 928* (AD, CANB, MEL, NSW). AUSTRALIAN CAPITAL TERRITORY: Grounds of Australian National Herbarium, CSIRO Black Mtn Site, *B.J.Lepschi 3940* (AD, CANB). VICTORIA: Orbost region, Delegate R., 12 Jan. 1987, *D.Allan* (CANB, MEL).

Acknowledgements

I would like to thank the Royal Botanic Gardens, Melbourne (MEL) for the use of their herbarium and library facilities, and the scientific and technical staff at MEL for their assistance with loans and other matters. I would also like to thank the directors of AD, BRI, CANB, HO, NSW and PERTH for the loan of specimens. This study was funded by Australian Biological Resources Study (ABRS grant no: 2000/3192).

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Muelleria 25: 101-114 (2007)

A Revision of *Eriochlamys* (Asteraceae, Gnaphalieae)

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Abstract

Eriochlamys Sond. & F. Muell., currently with one named species *E. behrii*, is revised and three new species *E. cupularis*, *E. eremaea* and *E. squamata* are described, illustrated and mapped.

Introduction

In the original description of *Eriochlamys* the presence of capitula aggregated into subglobose heads was emphasised as a diagnostic character for the genus (Sonder 1853). The unreliability of employing the presence of compound heads as a key character for the genus was intimated by Bentham (1867, 1873) when he included the genus in the subtribe Helichryseae rather than in the Angiantheae (= Angianthinae) where the genus is currently placed. Bentham's concept of the Helichryseae had the flower heads *distinct*, i.e. *not* aggregated into compound heads that he regarded as characteristic of the Angianthinae. Short (1983) commented on the 'artificiality ... of the use of the compound head as a criterion for subtribal recognition' and cited *Eriochlamys* as an example where the heads may be single or aggregated into compound heads. He further recommended that subtribe Angianthinae be subsumed into a broader Gnaphaliinae. Subsequent authors (e.g. Anderberg 1991, Bremer 1994) have recognised the Angianthinae as distinct and placed *Eriochlamys* therein (as did Black, 1929). In circumscribing the Angianthinae, these authors apparently employed details of the anthers and cypselas rather than merely the aggregation of the capitula into compound heads. In a cladistic analysis using morphological characters, Anderberg (1991) identified the Angianthinae as a basal, well-supported clade of 51 genera, mainly with relatively large, often colourful capitula (e.g. *Schoenia* Steetz, *Xerochrysum* Tzvelev, (syn. *Bracteantha* A. Anderb), *Waitzia* Wendl.), and an 'Angianthus' group, including *Eriochlamys* with 23 other genera of mainly small annuals with reduced, often aggregated capitula. *Eriochlamys* is included in a small clade of three genera, sister to *Hyalochlamys* Gray and *Gnephosis* Cass. all of which share the character of a reduced or missing pappus. However, a more recent assessment of the Australian Gnaphalieae based on chloroplast and nuclear sequences (Bayer et al. 2002) shows that the Angianthinae and Cassiniinae do not form monophyletic groups, supporting Short's assertion. Indeed the cladogram suggests that *Eriochlamys* is sister to *Ammobium* R.Br. and *Argyroglottis* Turez. and belongs in a clade that includes the somewhat woody perennial genera *Apalochlamys* Cass., *Calomeria* Vent., *Odixia* Orchard and *Ozothamnus* R.Br., rather than the reduced annuals that Anderberg's classification suggested. These conflicting and perhaps surprising results make it difficult to speculate on the relationships of *Eriochlamys*. Nonetheless, considering the uniform structure of the individual capitula, the florets and the fruits of the taxa treated below, it seems certain that they are truly congeneric.

While only one species of *Eriochlamys* – *E. behrii* – is currently formally recognised, recent flora treatments (Brown 1992, Jeanes 1999) have indicated that a second, unnamed, species exists. Whereas *Eriochlamys behrii* accords with Sonder's concept of the genus (with capitula aggregated into subglobose heads), the second species does not, being

described as having capitula 'simple' (Brown 1992) or 'solitary or up to 5 in groups, but remaining discrete' (Jeanes 1999). In the process of accumulating specimens to formalise the publication of the unnamed species, it became clear that two further, essentially allopatric, species also occur in central Australia (Western Australia, Northern Territory and South Australia) and an area to the east of this in southern Queensland and northern New South Wales. A revision of the genus is presented below. With the exception of the treatments cited above, all the species here recognised have been previously incorporated under the name *E. behrii* in State and regional floras and checklists.

Taxonomy

Eriochlamys Sond. & F. Muell. in Sond., *Linnaea* 25: 488 (1853)

Type *E. behrii* Sond. & F. Muell.

Small ascending to erect, wiry, aromatic annual herbs. Leaves cauline, sessile, alternate or some opposite toward base, entire. Capitula sessile, terminal, simple or in compound heads, or sometimes initially clustered but elongating and becoming spike-like; involucral bracts 2–several-seriate, unequal, outer ones herbaceous, leaf-like, often cottony, inner ones scarious and glabrous or sparsely cottony; receptacle hemispherical to conical, tuberculate, naked. Florets numerous, bisexual, tubular, yellow; corolla deeply 5-lobed; anthers tailed at base, with acute apical appendages; style bilobed, with linear branches, truncate and papillose at apex. Cypselas more or less obovoid, terete or slightly compressed, brown, epidermis minutely papillose, developing a thinly inflated transparent layer on hydration; carpopodium present, a complete annulus with cells outlines just detectable, the cells much smaller than the adjacent epidermal cells of the cypsela; pappus absent.

Although Anderberg (1991, p. 129) described the receptacle as flat, in all species it is domed to conical.

Four species, endemic to mainland Australia.

Key to species

1. Corolla tube ≤ 1 mm long; capitula initially gathered together, but the inflorescence often elongating and becoming spike-like. Largest leaves usually more than 10 mm long and 1 mm wide, at least some with margins merely recurved (not revolute) and the abaxial lamina exposed to some degree. SA, NT, WA..... **2. *E. eremaea***
1. Corolla tube at least 1.1 mm long; capitula solitary or variously aggregated at tips of branchlets but never growing out into a spike-like inflorescence. Leaves rarely larger than 10 mm long and 1 mm wide and abaxial lamina hidden by the revolute margins **2**
   2. Capitula remaining in subglobose compound heads, individual capitula and/or outer bracts obscured by dense woolly hairs SA, NSW, Vic..... **1. *E. behrii***
   2. Capitula solitary, sometimes in closely contracted few-flowered cymes but always separable at least at fruiting stage, individual capitula and bracts not obscured by woolly hairs..... **3**
      3. Outer bracts rhombic or narrowly ovate (broadest near the middle), the thickened or recurved margins not obscuring abaxial surface, distinctly shorter than the involucre, graduating in size and shape across several series from the leaves to the elliptic inner bracts, imparting a scaly appearance to the capitula. NSW, Vic. ..... **3. *E. squamata***

3. Outer bracts c. linear or narrowly lanceolate, leaf-like, margins revolute, obscuring abaxial surface, subequal to or even shortly exceeding involucre, with a sudden transition in shape to the elliptic inner bracts; heads not appearing scaly. SA, Qld, NSW .....**4. *E. cupularis***

1. *Eriochlamys behrii* Sond. & F. Muell. in Sond., *Linnaea* 25: 488 (1853).

Type: 'In solo argillaceo in planitie inter Saltercek et Pine forest Novemb. Dr. Behr' (lecto (here chosen): MEL 542222; isolecto: MEL 542223. Residual syntypes: Dombey-[=Tumby] bay', *s.d., F. Mueller*: MEL 542220, MEL 542221).

Ascending to erect annual, 4–12(–20) cm high, stems branched at base and/or above; stems white-cottony on new growth, older stems glabrescent. Leaves linear to narrowly clavate, 3–11 mm long and 0.3–1.0 mm wide, narrowly to widely spreading from stem, acute to obtuse, base shortly decurrent, margins revolute, entirely obscuring the abaxial surface, adaxial surface glabrous or with scattered sessile glands, abaxial midrib usually with spreading cottony hairs and sessile glands near base. Capitula (1–)2–5(–8) together in terminal globose heads 4–10 mm diam., the individual capitula embedded in and often obscured by the copious long white cottony hairs of bracts; bracts subtending the compound head leaf-like, in 1–3 series, becoming shorter and broader toward the inner series; bracts of individual capitula in 2 or 3 series, 2–3 mm long, the outer ones obovate to broad-ovate, 2–3 mm long, entirely herbaceous or with a short ruminate membranous apex, abaxially densely white-cottony, adaxially glabrous, inner bracts broad-oblong, with broad hyaline margins and green stereome about half as long and wide as the entire bract, glabrous or with a few cottony hairs, glandular on proximal abaxial surface, apex ruminate, usually sparsely ciliate. Florets 20–40 per capitulum, slightly exceeding involucre at maturity; tubular part of corolla 1.5–2 mm long with scattered glands and cottony hairs concentrated proximally and distally; lobes spreading to recurved, c. 0.4 mm long. Cypselas obovoid, rounded to truncate apically, usually slightly flattened, 0.5–0.6 mm long, 0.3–0.4 mm wide. (Figs 2a, 3).

Representative specimens (94 specimens examined): **SOUTH AUSTRALIA.** Clare Village, xi.1882, *L. Wehl* s.n. (MEL); Tarcoola, 21.ix.1920, *E.H. Ising 1731* (AD); Canegrass, c. 60 km NNE of Morgan, 20.ix.1937, *E.H. Ising s.n.* (AD); Eyre Peninsula, Gawler Range, 14.xi.1958, *R.L. Specht 2 & B.B. Carrodus* (AD); Eyre Peninsula, Hundred of Blessing, 3.x.1967, *J.R. Wheeler 551a* (AD); c. 400 m west of Hesso, 9.xii.1978, *P. Short 833* (AD, MEL); 16 km S of Coorabie 24.x.1983, *H.R. Toelken 7732* (AD); Venus Bay, 19.xi.1979, *P.J. Heyligers 79152* (AD, CANB); Kangaroo Island, Dudley Peninsula, 18.xi.1988, *B.M. Overton 929* (AD); Boomerang Island, Lake Gairdner, 10.iv.1993, *R. Bates 32146* (AD); Yorke Peninsula, s.d. *Tepper* s.n. (MEL); 16.7 km N of Port Augusta, 14.x.1995, *K. Watanabe 316* (AD, MEL, TI); Flinders Ranges, Tarcowie Common, 12.i.1993, *R.J. Bates 30744* (AD, MEL). **NEW SOUTH WALES.** Between the Lachlan and Darling Rivers, 1885, *J. Bruckner* s.n. (MEL); Junction of the Darling and Murray R., x.1887, *J. Minchin* s.n. (MEL). **VICTORIA.** Murrayville, 31.xii.1916, *H.B. Williamson* s.n. (MEL); Hattah Lakes National Park, Lendrook Plain, 3.x.1960, *A.C. Beauglehole 39393* (MEL); Sunset Country, edge of Raak Plain, 12.x.1977, *D.J. Cummings 233* (AD, CANB); 21 km SW of Morkalla, 28.x.1977, *A.C. Beauglehole 56979* (MEL); Edge of Lake Tyrell, 19.viii.1996, *S. Garner 320* (MEL); Neds Corner Station, 10.x.2003, *N.G. Walsh 5803* (MEL).

Distribution and Conservation Status: Occurs in from about Ceduna in South Australia to north-western Victoria and into southern New South Wales as far north as around Bourke, within IBRA regions Eyre York Block, Kanmantoo, Flinders Lofty Block and Murray Darling Depression (Environment Australia 2000). Sometimes co-extensive with *E. squamatus*, but generally occurring to the west of that species. (Fig. 1). Not regarded

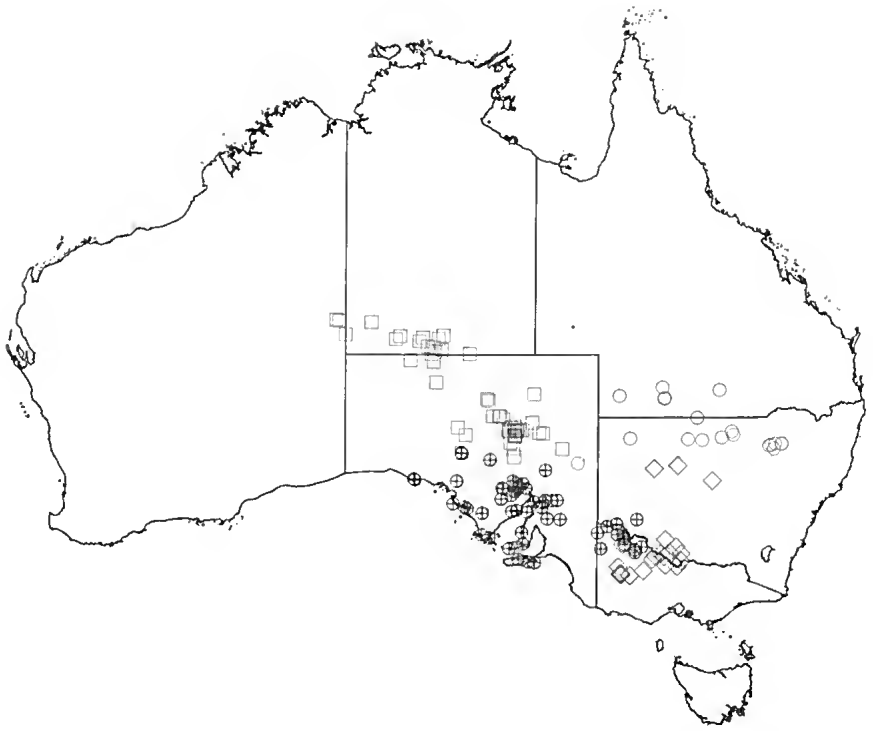

Figure 1. Distribution of *Eriochlamys* based on herbarium records. ⊕ *E. behrii;* □ *E. eremaea;* ◊ *E. squamata;* ○ *E. cupularis*

as rare or threatened *sensu* Briggs & Leigh (1996). Regarded as of 'Least Concern' (LC) *sensu* IUCN (2001).

Habitat: Usually occurring on areas prone to shallow inundation (e.g. ephemeral watercourses, lake margins, run-ons), sometimes slightly to moderately saline. Also occurring on sandy soils, including those of near-coastal areas where sometimes overlying limestone. Collector's notes record associations with chenopod shrublands and low coastal scrubs.

Phenology: Flowers mainly August to January.

Notes: Tupper (1978) noted that *E. behrii* increased under elevated levels of grazing by sheep at the expense of palatable species such as *Austrodanthonia caespitosa* (Gaudich.) H.P. Linder and *Austrostipa scabra* (Lindl.) S.W.L. Jacobs & J. Everett. The work was carried out in the Riverine Plain of southern New South Wales. However it is possible that either *E. behrii* or *E. squamata* was the species observed in the study.

In the protologue, localities for the species are cited 'In solo argillaceo in planitie inter Saltcreek et Pine forest Novemb. Dr. Behr. Dombey-bay'. Although a collector is not given for the Dombey [Tumby] Bay collection, material at MEL suggests this collection (on two sheets, MEL 542220, MEL 542221) is one of Mueller's. It is undated, but other Mueller collections from the same locality at MEL were collected in either December 1851 or January 1852. There are two sheets containing Behr material at MEL (542222, 542223), both mentioning Salt Creek and Pine Forest, and both dated November 1849.

Figure 2. Capitula of *Eriochlamys*. Scale bar = 2 mm throughout. **a**. *E. behrii* from *Toelken 7732* (AD); **b**. *E. eremaea* from *Nordenstam & Anderberg 901* (MEL); **c**. *E. squamata* from *Garner 319* (MEL); **d**. *E. cupularis* from *Bean 14483* (holotype, MEL).

One of these sheets (MEL 542223) includes Behr's label with the site description in German matching that of the Latin in the protologue and a brief generic description in Sonder's hand on which the description in *Linnaea* appears to be based. As well as these labels there is one of Mueller's with '*Eriochlamys pertusa Ferd. Muell*'. with the epithet crossed through and replaced with '*behrii* S & M', the initials undoubtedly standing for Sonder and Mueller (there are occasional specimens at MEL where Mueller's *E. pertusa* determination persists). The other sheet with Behr material (MEL 542222) appears to be

Figure 3. Lectotype of *Eriochlamys behrii*

a mixture: there are two plants and two labels, one of Behr's, the other a Mueller label from the Murray River collected in 1853. It is not indicated which element corresponds with which. The former of the sheets has been chosen as the lectotype, while the latter is regarded *pro parte* as an isolectotype. The Mueller collections from Dombey [Tumbey] Bay (MEL 542220, 542221) are regarded as residual syntypes.

2. *Eriochlamys eremaea* N.G. Walsh sp. nov.

Ab aliis speciebus generis tubo corollae breviore (sub 1 mm longo), foliis majoribus, inflorescentia saepe subspicata et distributione cremico differt.

Type: South Australia. Region 2: Lake Eyre Basin. Edwards Creek. David's Bore, 12.ix.1986, *J.Z. Weber 9460* (holo: AD; iso: MEL, NSW).

Decumbent, ascending or erect annual, 5–12(–17) cm high, often with multiple major axes branching from near base; stems white-cottony on newer growth, usually glabrescent on older parts. Leaves oblong to linear, 6–17 mm long, 0.8–2.5 mm wide, usually slightly dilated at base, narrowly to widely spreading from stem, obtuse or rounded, base shortly decurrent, margins recurved to revolute, obscuring the abaxial surface or slightly exposing the pilose to glabrous lamina, adaxial surface glabrous or with few scattered sessile glands, or rarely, with numerous gland-tipped septate hairs, abaxial midrib usually with spreading cottony hairs near base, sometimes wholly glabrous. Capitula initially aggregated in globose heads c. 5–10 mm diam (c. 5–14 capitula per head), but these usually growing out into subspicate, monochasial occasionally scorpioid cymes to 1.8 cm long. If capitula remaining in head-like infructescences, then not wholly obscured by cottony hairs and the herbaceous bracts quite obvious. Individual capitula cupular, 2.3–3.0 mm long, 2.1–3.1 mm diam.; bracts in 2–3(–4) series, outer bracts flat, elliptic, herbaceous, subequal to or slightly exceeding capitulum; medial bracts obovate or broadly elliptic, 1.3–2 mm long, moderately to densely cottony, eglandular or with very few glands, herbaceous for the greater part but membranous toward the apex; apex truncate-ruminate, ciliate, not recurved; inner bracts obovate, as long as capitula, entirely membranous or with a narrow central stereome, eglandular or sparsely glandular around middle, sparsely pilose or glabrous, apex ciliate. Florets 20–50 per capitulum, slightly exceeding involucre at maturity; tubular part of corolla 0.8–0.95 mm long, with scattered glands and cottony hairs concentrated proximally; lobes spreading or recurved, 0.3–0.45 mm long; anthers 0.05–0.08 mm long. Cypselas obovoid, truncate or slightly depressed at apex with a short apiculum, 0.45–0.55 mm long, c. 0.3 mm diam. (Figs 2b, 4).

Representative specimens (86 specimens examined): **WESTERN AUSTRALIA.** South Lake Hopkins, 9.x.1978, *P.K. Latz 7992* (DNA, PERTH). **NORTHERN TERRITORY.** 3 miles [5 km] E of Victory Downs Homestead, 18.ix.1968, *A. Nicholls 932* (NT); Peterman Range Reserve, 28 km SW from Lingstone Pass, 12.ix.1978, *T.S. Henshall 2213* (AD, CANB, NT); Lake Neale, 28.viii.1973, *P.K. Latz 4249* (NT); Curtin Springs Station, 17.ix.1974, *P.K. Latz 5669* (DNA, NT); Palmer Valley Station, 6.ix.1978, *P.K. Latz 7975* (NT); 3 km SSW of Kulgera, beside Stuart Hwy, 15.ix.1978, *W.R. Barker 3523* (AD); 280 km N of Cadney Homestead, 28.x.1989, *B. Nordenstam & A. Anderberg 901* (AD, MEL, S); 11 km ESE Lyndavale Hmsd., 1.x.1998, *P.K. Latz 15702* (MEL, NT); 15 km SW Idracowra Hmsd, 13.viii.2000, *D.E. Albrecht 9384* (NT); c. 0.3 km N Sputniek Bore, Umbeara Stn, 3.viii.2001, *D.E. Albrecht 9954*, (NT); Murphys Range, 12.viii.2000, *D.E. Albrecht 9351* (NT). **SOUTH AUSTRALIA.** Charlotte Waters, 1889, *W. Schwartz s.n.* (MEL); Warrina, 1890, *Mrs Richards s.n.* (MEL); Ernabella, viii.1944, *L.B. Young s.n.* (MEL); 17 miles [27 km] east of Coward Springs, 27.ix.1960, *R. Filson 3268* (MEL); Edge of Lake Phillipson, 10.ix.1978, *B. Lay 1433* (AD, MEL); Nunns Bore, 25 km E of William Ck, 13.viii.1985, *F.J. Badman 1793* (AD, MEL); Gammon Ranges, toward Lake Callabonna, 11.viii.1989, *R. Bates 20132* (AD); 93 km S of Coober Pedy, 27.x.1989, *B. Nordenstam & A. Arneberg 856* (AD, MEL, S).

Distribution and Conservation Status: Known generally from central Australia (far-eastern central Western Australia, southern Northern Territory and northern South Australia within IBRA regions Central Ranges, Finke, Stony Plains and Simpson Strzelecki Dunefields (Environment Australia 2000). (Fig. 1). Not regarded as rare or threatened *sensu* Briggs & Leigh (1996). Regarded as of 'Least Concern' (LC) *sensu* IUCN (2001).

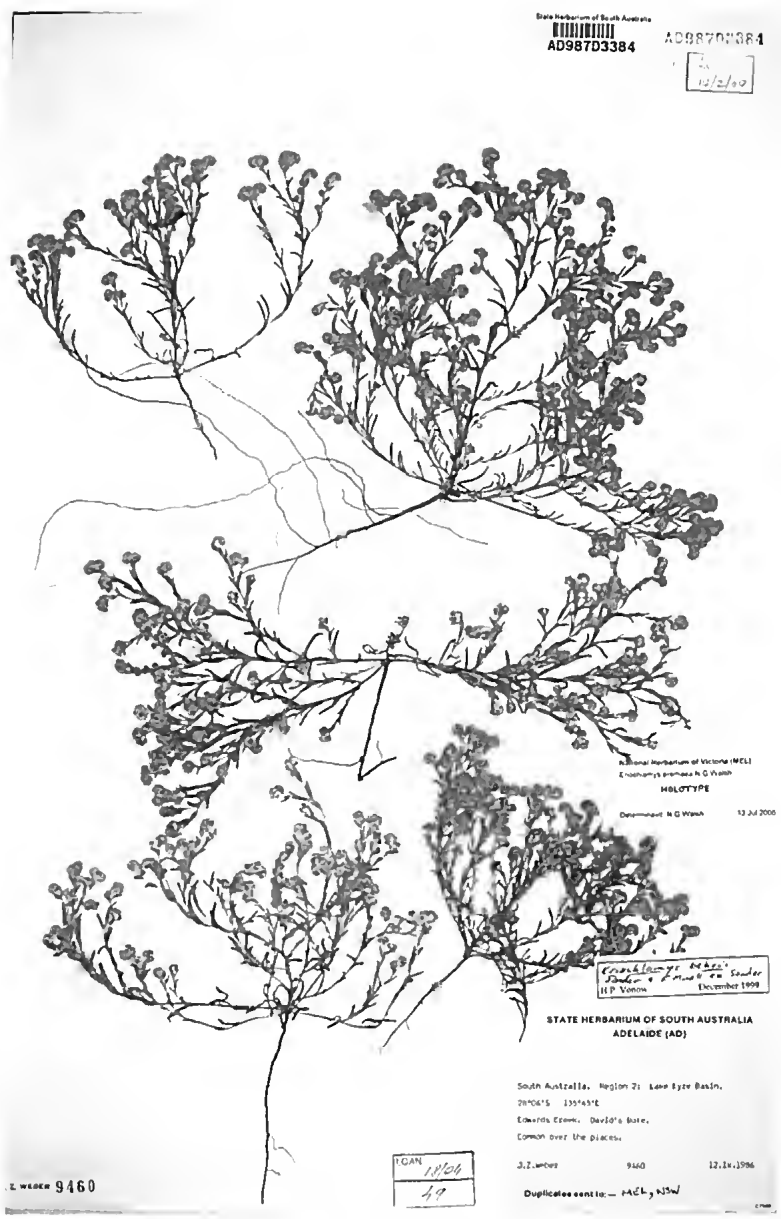

Figure 4. Holotype of *Eriochlamys eremaea*

Habitat: Apparently occurs principally on sandy soils, on dunes, but often also near claypans and along ephemeral watercourses. Also noted from gibber plains. Associated species recorded by collectors include *Zygochloa paradoxa* (R. Br.) S.T. Blake, *Schoenia cassiniana* (Gaudich.) Steetz, *Gnephosis eriocarpa* (F. Muell.) Benth., *Rhodanthe noschata* (A. Cunn. ex DC.) Paul G. Wilson, *Eragrostis dielsii* Pilg., *Sclerolaena* R.Br. spp., *Atriplex* L. spp., *Nitraria billardierei* DC., *Frankenia* L. spp., *Acacia* Mill. spp., *Hakea leucoptera* R. Br.

Phenology: Flowers mainly July to September.

Notes: Distinct from other members of the genus in the smaller corolla tube, the larger leaves and the strong tendency for the inflorescence to elongate so that capitula are arranged spike-like along the stem, and in the strongly eremaean habitat. The latter feature is the source of the epithet (Greek, *eremia* = desert).

3. *Eriochlamys squamata* N.G. Walsh sp. nov.

Eriochlamys sp. A *sensu* E.A. Brown in G.W. Harden (ed.), *Fl. New South Wales* 3: 253 (1992); *Eriochlamys* sp. 1 *sensu* J.A. Jeanes in N.G. Walsh & T.J. Entwisle (eds), *Fl. Victoria* 4: 807 (1999).

Eriochlamys behrii var. *uniceps* F. Mueller *in sched.* (MEL 85358, 'Murray Desert', s.d.)

A *E. behrii* capitulo solitario vel laxe aggregato non in lana incluso, braeteis capitulorum rhombiformibus vel anguste ovatis differt.

Type: 6 miles [10 km] W of Echuca, 5.vii.1953, *R. Melville 3907* (holo: MEL; Iso: K (*n.v.*)).

Procumbent or ascending to erect annual, 4–10(–16) cm high, often extensively branched above base and plant then appearing sub-shrubby; stems white-cottony on newer growth, usually glabrescent with age. Leaves linear, 1.5–4(–7) mm long, 0.3–0.6 mm wide, appressed to narrowly spreading from stem, obtuse or rounded, base shortly decurrent, margins revolute, entirely obscuring the abaxial surface, adaxial surface glabrous or, rarely, with scattered sessile glands, abaxial midrib usually with spreading cottony hairs near base. Capitula terminal, solitary or in clusters of up to c. 5, but remaining discrete, campanulate or cupular, 2.5–3 mm long, 2–3.5 mm diam.; bracts in c. 3–6 series, outer bracts c. rhombic or narrowly ovate, broadest about the middle, 1.3–2.2 mm long, resembling the leaves immediately below capitula, but usually considerably shorter and broader than typical stem leaves, usually shortly woolly toward base; medial bracts broadly obovate or broad elliptic, 2–2.5 mm long, moderately to densely cottony, sparsely glandular near middle, margins narrowly to broadly membranous, apex broadly rounded to truncate, ruminate, sometimes recurved, sometimes ciliate; inner bracts broadly obovate, as long as capitula, largely membranous with a narrow central stereome, or entirely membranous, sparsely glandular around middle, sparsely pilose or glabrous, apex ciliate or glabrous. Florets 20–40 per capitulum, slightly exceeding involucre at maturity; tubular part of corolla 1.2–1.5 mm long, with scattered glands and cottony hairs concentrated proximally and distally or distal hairs sometimes absent; lobes spreading or recurved, 0.3–0.4 mm long. Cypselas obovoid, truncate or slightly depressed at apex with a short apiculum, 0.5–0.6 mm long, 0.3–0.35 mm diam. (Figs 2c, 5).

Representative specimens (43 specimens seen): **NEW SOUTH WALES.** Deniliquin, xii.1915, *A. Sinclair* s.n. (MEL); Murrumbidgee, 1875, *T. Macfarland* s.n. (MEL); Barham, s.d., *A.C.F. Gates* s.n. (MEL); Wanganella via Hay, xii. 1903, *E. Officer s.n.* (NSW); Zara via Hay, iii.1904, *E. Officer* s.n. (NSW); Deniliquin, x.1949, *G.A. Crawford 28* (NSW); 40 km NNE of Moulamein, 18.v.1982, *M. Fox 8205064* (NSW); Wakool, vii.1935, *A.W.S. Moodie* s.n. (NSW); Hill Plain 11 miles south of Deniliquin, 15.xi.1954, *T. & J.Whaite 1700* (NSW). **VICTORIA.** Between Dimboola and Murra Warra, 22.i.1893, *F. Reader* s.n. (MEL, NSW); Jeparit, c. 1916, *S.E. D'Rehor s.n.* (AD); Ouyen, 26.xii.1916, *H.B. Williamson* s.n. (MEL); Galah public watering place, i.1939, *R. Bray* s.n. (NSW); The Range Flora Reserve, 24.x.1979, *A.C. Beauglehole 65391* (MEL); 10 km west of Lake Charm, x.1984, *T. Lowe* s.n. (MEL); Terrick Terrick Flora Reserve, 24.xi.1985, *A.C. Beauglehole 82693* (MEL); Wail State Forest, 15.x.1986, *A.C. Beauglehole 86135* (MEL); West of Sandhill Lake (between Bael Bael and Quambatook), 19.viii.1996, *S. Garner 319* (MEL).

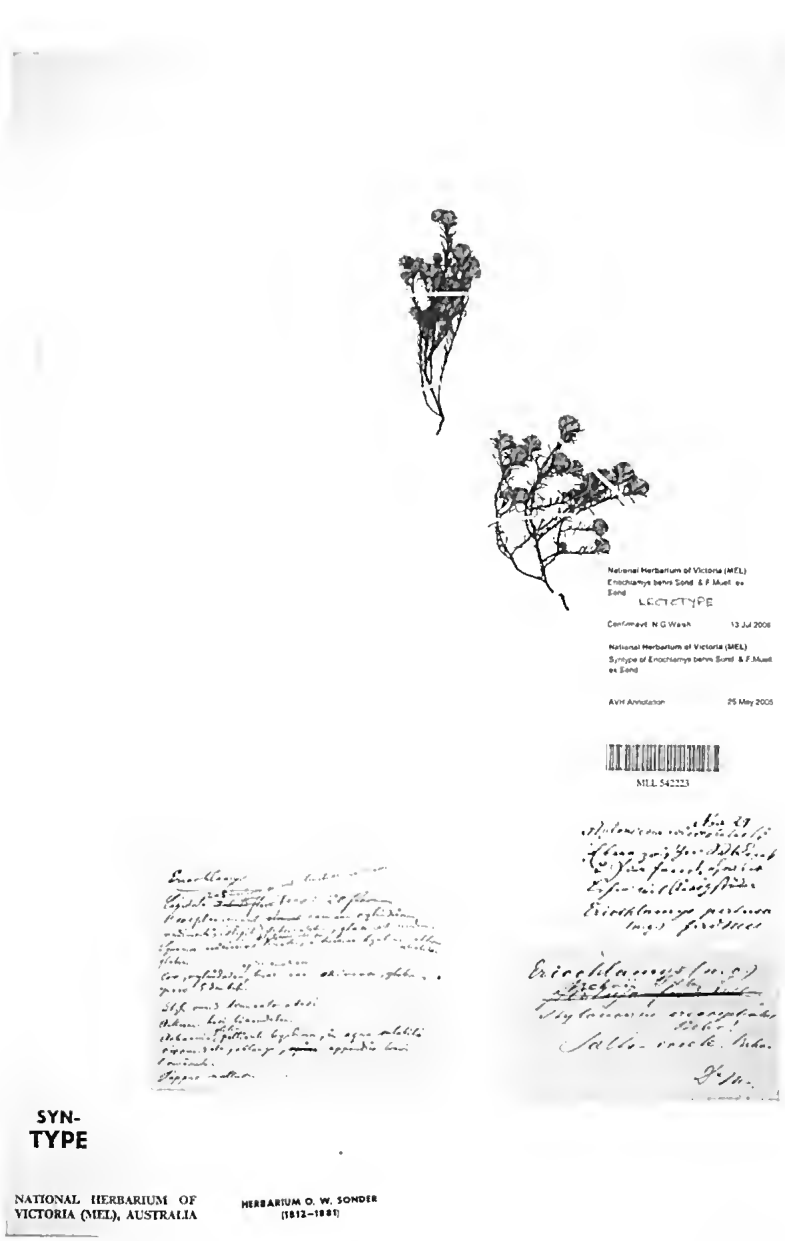

Figure 5. Holotype of *Eriochlamys squamata*

Distribution and Conservation Status: Extends from north-western Victoria through western New South Wales to near Bourke, within IBRA regions Darling Riverine Plain, Cobar Peneplain and Murray Darling Dunefields and Riverina (Environment Australia 2000). No collections have been seed from South Australia, but its presence in that state could be expected. Co-extensive with *E. behrii* through much of its range, but perhaps preferring drier, less saline soils. Partly coextensive with *E. cupularis* in the southern part of that species range, between c. 30° and 31° S. (Fig. 1). Not regarded as rare or threatened *sensu* of Briggs & Leigh (1996). Regarded as of 'Least Concern' (LC) *sensu* IUCN (2001). Note: the map provided for this species in Jeanes (1999) is incorrect.

Habitat: Usually grows in woodland on clay or clayey loam soils, sometimes on raised sandy areas within saline or gypseous flats. Associated species from collectors' notes include *Alectryon oleifolius* (Desf.) S.T. Reynolds, *Casuarina pauper* L.A.S. Johnson, *Rhagodia spinescens* R. Br., 'perennial grasses, low shrubs and prostrate chenopods'. Apparently responsive to disturbance, noted as occurring in an 'overgrazed paddock' (see also note under *E. behrii* relating to the study of Tupper, 1978).

Phenology: Flowers mainly August to January.

Notes: Differs from *E. behrii* in the generally solitary capitula, or these sometimes loosely aggregated in twos and threes but then not embedded in woolly hairs as they are in that species. This species differs from *E. cupularis* in having the outer bracts of the involucre linear and leaf-like and usually as long as or slightly exceeding the capitulum. In *E. squamata* the outer bracts are shorter and relatively broader (decidedly broadest around the midpoint) than the stem leaves, often only c. half as long as the capitulum, and linked to the 'normal' vegetative leaves by a transition sequence along the peduncles. Medial and inner bracts, corollas, receptacles and cypselas are virtually indistinguishable between the two species. Plants of *E. cupularis* are usually more robust and often sub-shrubby. A few collections, mainly around the Pilliga area (here referred to *E. cupularis*) have the outer capitula bracts at the lower end of the range and approach *E. squamata* in this respect. Through the remainder of their ranges though, the distinction between the two species appears to be clear.

Etymology: The epithet (Latin, *squamata* = bearing scales) refers to the series of rhombic or ovate outer bracts that impart a 'scaly' appearance to the capitula.

4. *Eriochlamys cupularis* N.G. Walsh sp. nov.

E. squamatae valde affinis bracteis capitulorum linearibus capitulum subaequantes vel parum superantibus differt.

Type: 9.8 km W of Boatman Road, ENE of Cunnamulla, *A.R.Beau 14483* (holo: MEL; iso: BRI, NSW (*distribuendi*)).

More or less erect annual, 7–20 cm high, often extensively branched above base and plant then appearing sub-shrubby; stems white-cottony on newer growth, usually glabrescent on older parts. Leaves linear, 2–11 mm long, 0.3–0.8 mm wide, narrowly to widely spreading from stem, obtuse or rounded, base shortly decurrent, margins revolute, entirely obscuring the abaxial surface, adaxial surface glabrous or with few scattered sessile glands, abaxial midrib usually with spreading cottony hairs near base. Capitula solitary and terminal, or more often in monochasial or, sometimes dichasial cymes and then individual capitula sometimes appearing axillary, remaining discrete, cupular, 2.5–3.8 mm long, 2.5–3.5 mm diam.; bracts in 2–3(–4) series, outer bracts linear, subequal to or slightly exceeding capitulum, leaf-like; medial bracts broadly elliptic, 1.5–2.8 mm long, moderately to densely cottony, sparsely glandular near middle (but glands often obscured by hairs), entirely herbaceous or with narrow membranous margins, apex truncate, sometimes recurved, ciliate; inner bracts obovate, as long as capitula, entirely membranous or with a narrow central stereome, sparsely glandular around middle, sparsely pilose or glabrous, apex ciliate or glabrous. Florets 20–50 per capitulum, slightly exceeding involucre at maturity; tubular part of corolla 1.3–2.1 mm long, with scattered glands and cottony hairs concentrated proximally and distally or distal hairs sometimes absent; lobes spreading or recurved, 0.3–0.4 mm long. Cypselas obovoid, truncate or slightly depressed at apex with a short apiculum, 0.55–0.65 mm long, 0.3–0.35 mm diam. (Figs 2d, 6).

Representative specimens (23 specimens examined): **SOUTH AUSTRALIA.** Between Stokes Range & Coopers Ck, s.d., *Dr Wheeler s.n.* (MEL); 28 km E of Frome Downs HS, 20.xi.1975, *L.D. Williams 7357* (AD). **QUEENSLAND.** Bowen Downs, 1873, *Birch s.n.* (MEL); c. 39.5 km from Thargomindah toward Cunnamulla, 29.x.1983, *E.M. Canning 6273 & B. Rimes* (BRI, CANB, DNA); Lake Bindegolly, xi.1995, *J. Elsol 24* (BRI). **NEW SOUTH WALES**: Barringum, 1884, *W.A. Foyster* (MEL); Bulloo River, 1887, *L. Morton s.n.* (MEL); Yandarlo [Yandaroo], ix.1887, *W. Baeuerlen, s.n.* (NSW); Namoi, 1890, *Nillsson 9* (MEL); Brigalow Ck, Wee Waa, iii.1937, *S.C.*

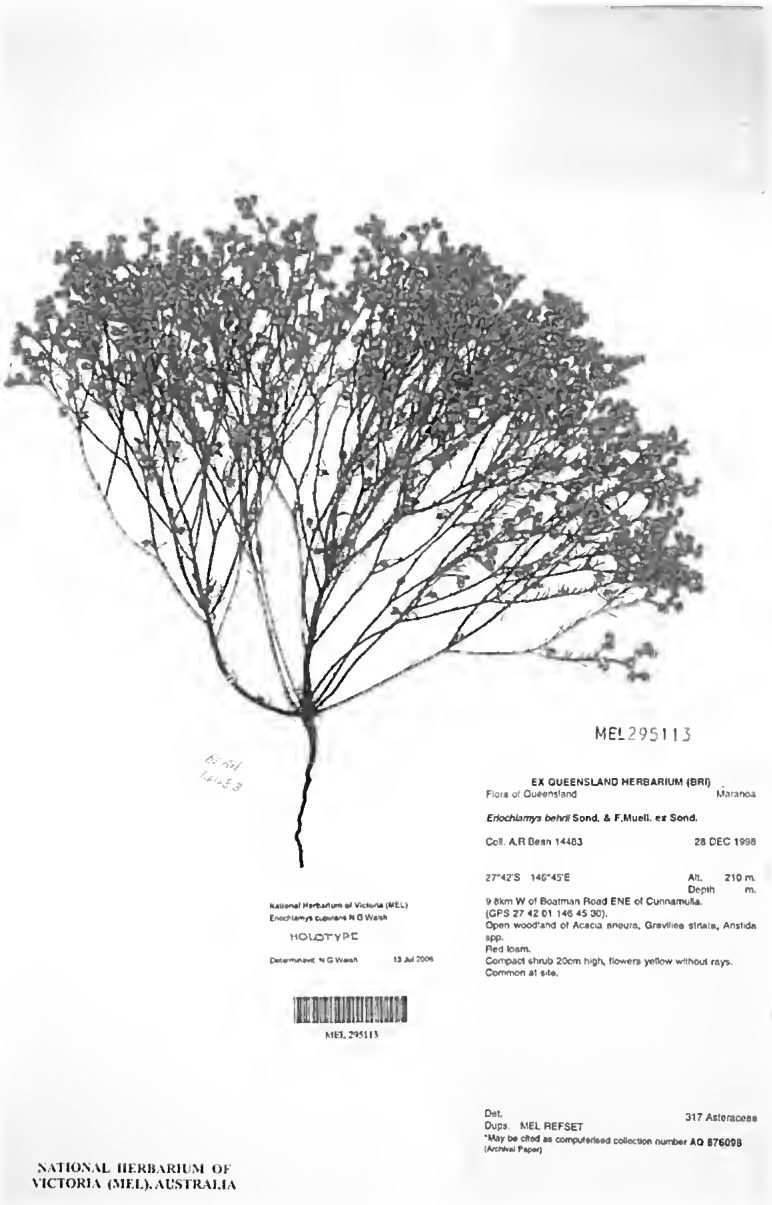

Figure 6. Holotype of *Eriochlamys cupularis*

Sparks s.n. (NSW); Pilliga scrub near Cuttabri, xii.1949, *J.A.O'Reilly s.n.* (NSW); Bourke, i.1951, *W.E.Darley 20* (NSW); Near Brewarrina, 21.xi.1967, *D.J. McGillivray 2872* (NSW); Pratts Hut, Brewarrina, 22.ix.1975, *D.F.Thompson 2559* (MEL); 40 km S of Pilliga, 1.ix.1986, *F. Chalker s.n.* (NSW); 22.2 km ENE of Pilliga on the Wee Waa Rd, 8.ix.1986, *J.M. Dalby 86/60* (BRI, NSW, PRC); Pilliga East S.F., Old Coghill Rd, x.1985, *D.F. Mackay 463* (NSW); Old Coghill Rd, Gilgai Forest Reserve 41, 24.ix.2000, *J.R. Hosking 1903* (CANB, MEL, NE, NSW, TARCH).

Distribution and Conservation Status: Extends from central-eastern South Australia into adjacent areas of Queensland and New South Wales within IBRA regions Broken Hill Complex, Channel Country, Mulga Lands and Darling Riverine Plains (Environment Australia 2000). Its distribution overlaps partly with that of *E. squamatus* between c. 30° and 31° S. (Fig. 1). Although known to date by only 23 herbarium specimens, the notes on herbarium sheets would indicate that it is at least locally abundant. Like the other members of the genus it is likely to be not rare or threatened *sensu* Briggs & Leigh (1996) and likely to be of 'Least Concern' (LC) *sensu* IUCN (2001), but further collecting is encouraged so that an accurate assessment of its conservation status may be made.

Habitat: Occurs principally on sand and sandy loam soils, sometimes in areas prone to inundation. Associated species from collectors' notes include *Acacia aneura* F. Muell. ex Benth., *Acacia* spp., *Aristida* L. spp., *Casuarina* R.Br. spp., *Callitris* Vent. spp., *Eucalyptus populnea* F. Muell., *E. crebra* F. Muell, *Grevillea striata* R. Br. *Muehlenbeckia florulenta* Meisn.. Apparently responsive to disturbance — a note on O'Reilly s.n. (NSW) has "known locally as 'insolvency bush' & takes possession of some areas. It seems to be associated with a 'black alkali' condition in the soil", and on Sparks s.n. (NSW) "... known locally as 'eucalyptus weed' ... becoming a very serious pest on the light sandy soils of the Pilliga Scrub ... in some paddocks it is in full possession".

Phenology: Flowers mainly September to November.

Notes: More closely related to *E. squamata* than other members of the genus. See notes under that species (above). The epithet is Latin, meaning 'cup-shaped', and refers to the shape of the capitula which are more distinctly cup-shaped in this species than other members of the genus.

Acknowledgments

I am grateful to directors and staff of AD, BRI, DNA and NSW for allowing access to and/or loans of specimens, to Philip Short (DNA) and Helen Vonow (AD) for useful comments on a draft of this paper, and to my colleagues, Alison Vaughan and Niels Klazenga, for production of Figure 1.

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Muelleria 25: 115-128 (2007)

Additions to *Epacris* (Epacridoidae, Ericaceae) in Tasmania

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Abstract

Examination of the "*Epacris tasmanica* Complex", indicates that both major clusters identified in the morphometric analysis of Crowden and Menadue (1990), contain taxonomic units additional to those originally published. Two new species, *E. graniticola* R.K. Crowden and *E. moscalianus* R.K. Crowden have been separated from the *E. virgata* group. A morphometric analysis of the designated *E. tasmanica* component of Cluster B, using floral characters only, has resolved two additional taxa. Taxon 1 is the type of *E. squarrosa* Hook. f., subsequently renamed *E. tasmanica* W.M. Curtis. Taxon 2 is identified as a new species *E. cerasicollina* R.K. Crowden. A new diagnostic key has been prepared which differentiates all currently known taxa within the "*E. tasmanica* Complex".

Introduction

The "*Epacris tasmanica* Complex" (Jarman and Crowden 1977; Crowden and Menadue 1990), comprises a group of Tasmanian *Epacris* species which share the common floristic characters of "corolla tube +/- campanulate and about equal in length to the sepals, anthers exserted above the plane of the corolla lobes" and "long styles with varying degrees of basal swelling, which position the stigmas at the top of or above the anthers".

Within the group definitive separation of five species (*E. acuminata* Benth., *E. barbata* Melville, *E exserta* R. Br., *E. glabella* S.J. Jarman and *E. stuartii* Stapf) is relatively straightforward because their respective morphologies feature at least one character which will permit of their unambiguous identification. However, the other two species (*E. tasmanica* W.M. Curtis and *E. virgata* Hook. f.) have long been regarded as problematical because of their variable and partially overlapping morphologies.

Over recent years, the reported range of occurrence of *E. virgata* has expanded from restricted locations around the Asbestos Range (west of the Tamar River in northern Tasmania) to include new sites east of the Tamar River as well as a number of locations in southern Tasmania. Earlier botanists had known of and had commented on the disjunct distribution of *E. virgata*, Hooker (1860) citing the distribution as "Asbestos hills, Yorktown, and "between Hobarton and Huon, *Gunn*". Despite this, the southern populations were included in *E. squarrosa* Hook. f. in the Floras of Rodway (1903) and Curtis (1962). *E. squarrosa* was later determined as an invalid name and emended by Curtis (1969) to *E. tasmanica* W.M. Curtis.

A morphometric study carried out by Crowden and Menadue (1990), involving 37 populations of the "*Epacris tasmanica* Complex" yielded two major clusters. *Epacris tasmanica* Cluster A integrated all northern and southern populations nominated as *E. virgata*, on the basis of which an emended description for *E. virgata* was prepared. Cluster A also contained *E. stuartii* and an unidentified taxon, *E.* aff. *exserta* Mt Cameron, and was bordered by a minor group containing *E. glabella*. *Epacris* aff. *exserta* Mt Cameron is now considered to be a new species and is discussed further below. *E. tasmanica* Cluster B was made up of *E. tasmanica* W.M. Curtis (excepting the southern populations of *E. virgata*), plus *E. barbata* and a minor group containing *E. exserta*.

A later study of pollen exine ornamentation in *Epacris* by Menadue and Crowden (1991) separated populations of the "*E. tasmanica* Complex" into the same two groups, in

that the pollens of all *E. tasmanica* Cluster A and related forms are heavily warted, whilst pollens of *E. tasmanica* Cluster B forms have minimal warting or are entirely without exine ornamentation.

A genetic study involving most of the populations studied by Crowden and Menadue (1990) carried out by Gilmour *et al.* (2000), grouped populations in tight clusters according to their close geographic proximity. Populations identified as *E. virgata* by Crowden and Menadue (*E. tasmanica* Cluster A, in part) were separated into northern (Asbestos Range) and southern (Margate-Kettering) sub-groups. However, this genetic variation is not manifest in any corresponding morphological differences which would enable visual separation of these taxa. Accordingly the suggestion by Crowden and Menadue (1990) that all southern populations be included in *E. virgata* is confirmed and their emended description for *E. virgata* is adhered to.

The study by Gilmour et *al.* (2000) also separated the populations in *E. tasmanica* Cluster B identified as *E. tasmanica* by Crowden and Menadue (1990) into two sub-groups (Taxon 1 and Taxon 2). The more southerly sub-group (Taxon 1), occurs patchily in the Spring Bay area (Fig.4 a). The populations close to Triabunna, Orford and in the foothills of the Thumbs Range are unusual amongst all other members of the *"Epacris tasmanica* Complex" in that they are autumn – early winter flowering. The remaining populations extend south patchily into the Forestier Peninsula and inland into the Prosser River Valley towards Buckland and Hospital Creek. All are morphologically similar, and are indistinguishable from the Spring Bay plants except that they are late winter - spring flowering. Taxon 1 identifies with the collection made by R. Gunn No. 1205 (autumn flowering) which is the type specimen for *E. squarrosa* Hook.f., now *E. tasmanica* W.M. Curtis (in part), an emended description for which is given below.

The second sub-group defined by Gilmour *et al.* (2000) (Taxon 2), includes populations from the central east coast, around Cranbrook and the neighbouring East Coast Range (Fig. 4b). This taxon extends south to Green Hills/Hermitage and to the north of Bicheno almost to St Marys. Inland of the East Coast Range it is found on the western slopes, on the hillsides bordering the valley of the St Pauls River and along the Tooms and Macquarie River valleys. There are also river bank populations along the Swan River and at Harding's Falls (E. Swan River).

Crowden and Menadue (1990) used both leaf and floral variables in their analyses. In both canonical variates and cluster analyses, leaf characters (lamina length, width and length to widest point) were the principal determinants separating the populations into the two major groups, *E. tasmanica* Cluster A (*E. virgata* and related forms) and *E. tasmanica* Cluster B (*E. tasmanica s.str.* and related forms). The same two groups were determined by a discriminant function analysis (DFA) in which lamina length along with two floral characters, filament length and length of the corolla tube, were the main discriminating variables. A second DFA using a suite of floral characters alone, gave a similar result and clearly separated Cluster A from Cluster B, while a DFA using a suite of leaf characters alone misclassified many populations, endorsing the view that non-reproductive plants are difficult to classify. However, none of these analyses indicated a bimodal distribution of populations within *E. tasmanica* Cluster B in accord with Gilmour *et al.* (2000). It is probable that the presence of related taxa in Cluster B additional to Taxon 1 and Taxon 2 obscured any bimodality.

Morphological re-examination and comparison of Taxon 1 and Taxon 2 populations revealed some differences in floral morphology particularly filament length, lobe length, and pedicel length, which although small in scale are nonetheless observable to the unaided eye, and therefore of possible use in identifying the taxa. Accordingly a

new morphometric study using these floral variables has been undertaken, to test their reliability as taxon descriptors and determine their usefulness as characters in a diagnostic key.

Materials and methods

Morphometric examination. A morphometric analysis was undertaken using ten populations of the "E. tasmanica Complex – Cluster B", five each from the Taxon 1 and Taxon 2 sub-groups of Gilmour et al (2000), (Populations 1 – 5 and 6 – 10 respectively from the locations referred to in Appendix 1). A representative specimen from each population is lodged in HO. Six variables were measured using five flowers from each of six plants representing each population (Table 1). All measurements were carried out on freshly opened flowers, before anther dehiscence was completed. Measurements for each plant were averaged and these values used to undertake a one-way analysis of variance and discriminant analysis separating the ten populations. This analysis was undertaken with the DISCRIM procedure of SAS (version 9.1 SAS Institute Inc. Cary, N.C.), 2003. Individual plant scores and population centroids were ordinated on canonical variates 1 and 2. The matrix of Mahalanobis distances amongst the 10 populations derived from this analysis was then subject to UPGMA clustering, using PROC CLUSTER of DAS.

Table 1. Variables determined in the morphometric analysis of components of the "*E. tasmanica* Complex – Cluster B".

PED	Pedicel length measured to the base of the sepals, after dissection of the braets.
STY	Style length from the base after dissection from the ovary, including the stigma.
COR	The length of the corolla "tube" from the base to the geniculation point of the lobes. This measure includes the length of the fused section of the corolla plus the short basal portion of the lobes which continues as an apparent extension of the fused segment.
LOB	Lobe length from the apex to the geniculation.
FIL	The length of the free part of the filament from the point on the corolla where it ceases coherence to the point of attachment of the anther.
ANT	Length of the anther

Determination of anther exsertion. Anther exsertion is best determined using newly opened flowers, preferably before anther dehiscence is completed, by sighting at right angles across the plane of the corolla lobes (Fig. 1 a,b,c). At this stage of flower maturation the anthers are held in a vertical projection. In older flowers, the dehisced anthers reflex into a horizontal orientation and may weigh down on the lobes forcing them to flatten and widen below the normal geniculation (Fig. 1d). In this way the anthers become more exposed and may give an impression of being more fully exserted thus leading to possible misinterpretation. The difference may not be so apparent when dried specimens are examined due to distortion which may occur during the drying. In these cases a direct comparison of the filament and anther lengths is required.

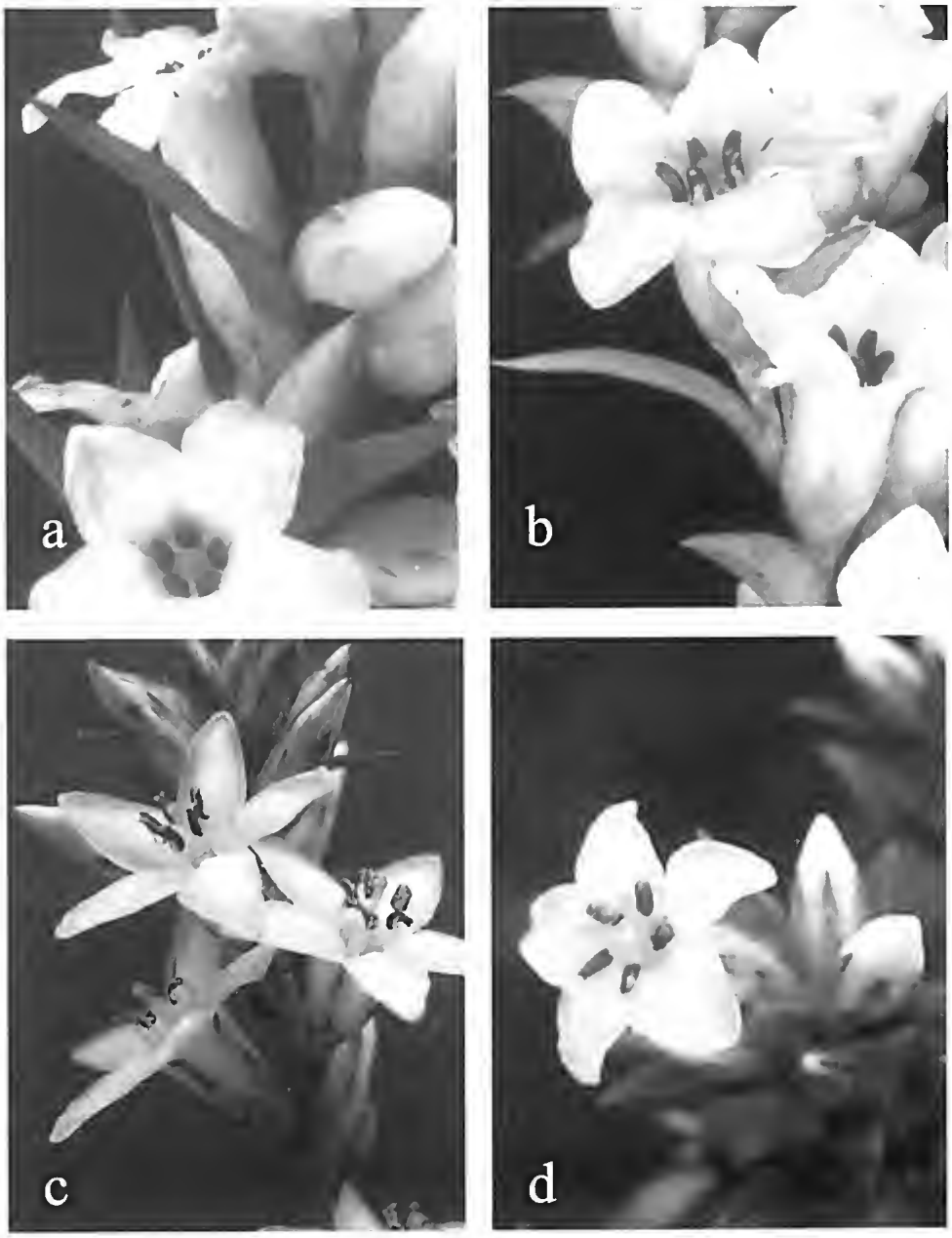

Figure 1. Anther position in *Epacris*. a. included anthers, *E. mucronulata*; b. half-exserted anthers, *E. cerasicollina*; c. anthers wholly exserted, *E. tasmanica*; d. anthers reflexed after dehiscence, *E. cerasicollina*.

Results and discussion

1. *Epacris tasmanica* forms.

Morphometric analysis. Univariate analysis of differences in floral morphology between *E. tasmanica* Cluster B, taxa 1 and 2 is summarised in Table 2. The main differences (and similarities) are highlighted by ratios of the variables and by F values in the ANOVA. The flowers are of comparable size (flower diameter and corolla tube length), although the lobes of *E. tasmanica* are slightly longer and more spreading than Taxon 2. The pedicels (Taxon 2) are longer, almost as long as the subtending leaves (barely longer than the petiole in *E. tasmanica*), and curved (straight in *E. tasmanica*). Most noticeable, however, is the difference in filament length (barely half the size of the anthers in Taxon 2, as long or longer in *E. tasmanica*) in consequence of which in Taxon 2, only the top part of the anthers are exserted above the plane of the corolla lobes, Fig. 1b, (fully exserted in *E tasmanica*, Fig. 1e). Although the differences are of the order of only 1 mm or less and in absolute terms barely discernable to the naked eye, they are nonetheless easy to observe in the comparative context of the morphology of the respective flowers. The difference in anther exsertion especially is readily apparent (Fig. 1b, e) and provides a ready means of identifying Taxon 2 from *E. tasmanica*.

Table 2. Univariate analysis of differences in floral morphology between *E. tasmanica* (Taxon 1) and *E. cerasicollina* (Taxon 2). Means, standard deviations, and ratios (Taxon 1/Taxon 2) of the measured variables are given for the respective combined populations. F and probability values from analysis of variance (ANOVA) are also shown. All measurements in mms.

VARIABLE	TAXON 1 n=30		TAXON 2 n=29		RATIO	ANOVA	
	Mean	SD	Mean	SD	Taxon 1/Taxon 2	F value	Prob.
PED	2.15	0.283	3.31	0.448	0.65	143.5	0.0000
COR	3.24	0.238	3.10	0.423	1.04	2.5	0.1224
LOB	4.17	0.425	3.68	0.358	1.13	22.7	0.0000
FIL	1.34	0.174	0.81	0.096	1.66	208.5	0.0000
ANT	1.21	0.216	1.33	0.257	0.91	4.0	0.0491
STY	3.97	0.262	3.53	0.457	1.13	21.1	0.0000
CV1	-4.68	1.437	4.84	1.131		797.0	0.0000

The dendrogram shown in Fig. 2 is derived from UPGMA cluster analysis based on Mahalanobis distance between populations and Fig. 3 plots population scores on canonical variates 1 (62%) and 2 (16%) derived from the variable discriminant analysis. Both Figs. 2 and 3 clearly show the bimodal grouping of the populations in accordance with their geographical distributions (Fig. 4a, b) as reported by Gilmour *et al.* (2000). Again the two characters, filament and pedicel lengths, predominate in the separation of the groups.

It is proposed to recognise Taxon 2 as a new species given the name *E. cerasicollina.*

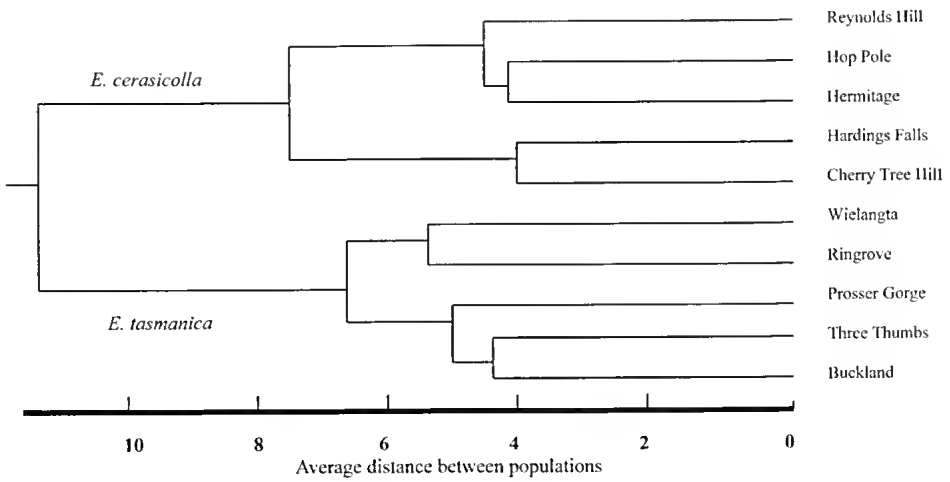

Figure 2. Dendrogram derived from UPGMA eluster analysis based on the Mahalanobis distanee between populations.

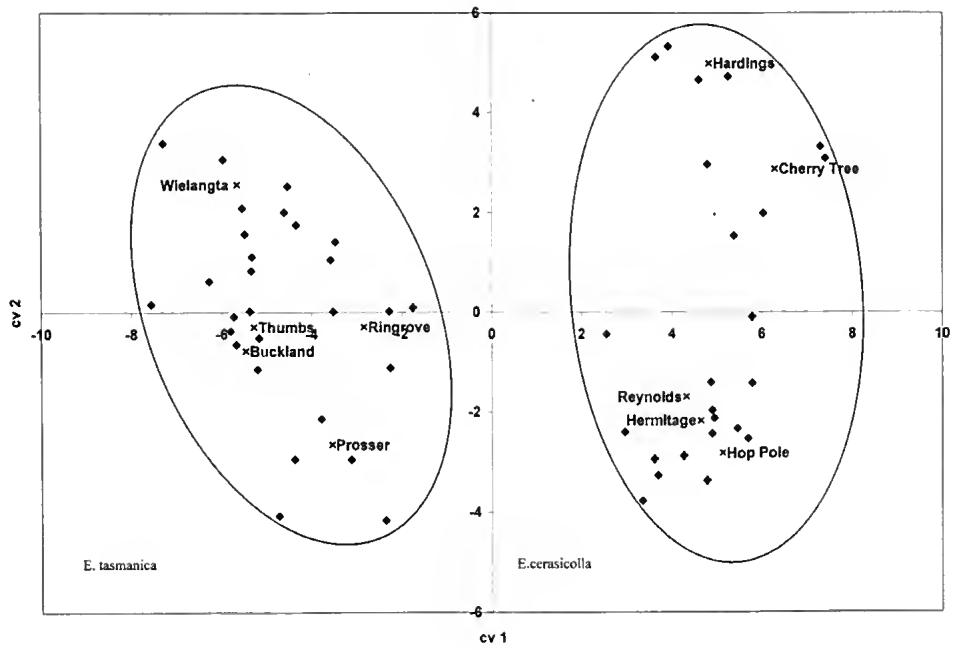

Figure 3. Plot of population seores on eanonieal variates 1 (62%) and 2 (16%) derived from the variable diseriminant analysis. Individual plant seores (♦), population eentroids (x).

2. *Epacris virgata* forms.

a. *E. graniticola* R.K. Crowden sp. nov.

From their study Menadue and Crowden (1990) concluded that specimens collected from Mt Cameron (northeast Tasmania), originally designated *E.* aff. *exserta*, were best regarded as an outlying population of *E. virgata*. They recognised that this taxon warranted more study and accordingly did not include it in their emended description of *E. virgata*. Since then the Mt Cameron taxon has been found at two other locations in northeast Tasmania

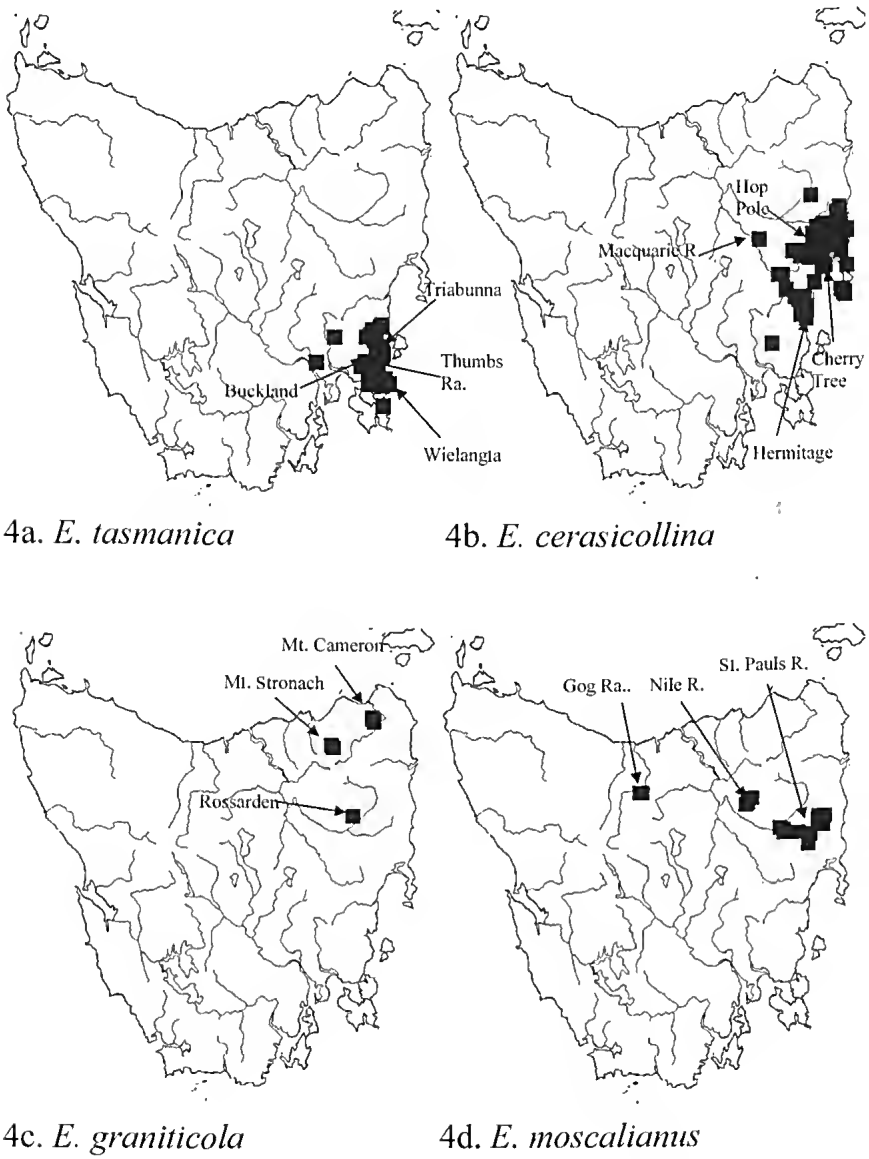

Figure 4. Distribution of *Epacris* species: a. *E. tasmanica*, b. *E. cerasicollina*, c. *E. graniticola*, d. *E. moscalianus*, showing some prime locations.

(Mt Stronach and Rossarden, Fig. 4c). Like Mt Cameron these locations provide granite outcrops, on which the plants are found most frequently growing amongst clumps of moss and lichen in moist depressions and fissures on exposed rock platforms. Gilmour *et al.* (2000) provided genetic evidence that the Mt Cameron plants represented a well-differentiated population. After morphological examination of further specimens from Mt Cameron as well as from the new locations, this taxon is now determined to be a separate species for which the name *E. graniticola* is proposed. It can be distinguished from *E. virgata* by its larger, mostly recurved leaves with a thickened and scabrous margin, and by the flowers which are arranged in short, dense terminal clusters (rarely extending more than a few cms. down the branches) rather than the lengthy, open spicate arrangements typical of *E. virgata*.

b. *E. moscalianus* R.K. Crowden sp. nov.

New forestry roads in eastern and northern Tasmania have facilitated access to areas which previously had been rarely visited, resulting in collections of a novel *Epacris* taxon with obvious affinity to *E. virgata*. This taxon has been collected from amongst moss and lichen in crevices or seepage zones on otherwise exposed rock platforms near marshes which feed into the St Pauls River. It is also found along the margins of the outflow creeks and on flood plains continuing down the St Pauls River (Fig. 4d). Earlier collections from the Nile River, upstream of the Lilyburn Bridge and the lower reaches of the St Pauls River, which previously have been designated as *E. exserta* or as riverine forms of *E. virgata* or *E. tasmanica* are now included in this taxon. It has also been collected on rock platform seepages on the Gog Range (Central North Tasmania), from where it occasionally extends down to become a riverbank species on the Mersey River.

Only two populations were available at the time and included in the morphometric study of Menadue and Crowden (1990). Both were from the lower St Pauls River, and both were resolved in the "*E. tasmanica* A" (*E. virgata*) cluster. Unfortunately no populations were included in the genetic study by Gilmour *et al.* (2000).

The taxon is distinguished from *E. virgata* by the clustering of the flowers at the branch tips and by its generally smaller, thickened leaves, mostly less than 3mm long, with microserrulate margins and a pronounced, almost keeled midrib; from *E. exserta* by its smaller, ovate to rounded, shortly mucronate leaves, (lanceolate to elliptic, usually > 5mm long, apex obtuse and generally inturned in *E. exserta*); and from *E. graniticola* by its smaller, flat leaves (recurved in *E. graniticola*). The name *E. moscalianus* is proposed for this taxon.

Key to species of the "*E. tasmanica* complex"

This group of species is defined as follows: *Corolla tube +/- campanulate, about equal in length with or slighter shorter than the sepals and the lobes. Anthers exserted either in major part or wholly above the plane of the corolla lobes. Style long, swollen near the base, the stigma at the top of the anthers or exserted beyond them.*

1. Leaf apex attenuate, pungent.....2
   Leaf apex acute or rounded or mucronate, blunt.....6
2. Filaments shorter than the anthers, usually only the top half of the anthers exserted above the plane of the corolla lobes.....3
   Filaments longer than the anthers which are wholly exserted above the lobes.....4

3. Sepals and bracts glabrous. ..... ***E. cerasicollina***
   Sepals and bracts hirsute. ..... ***E. barbata***
4. Leaf base broadly obtuse or rarely cordate, lamina concave and stem clasping near the base, straight and +/- spreading above. ..... ***E. acuminata***
   Leaf base narrowly obtuse or truncate, the lamina +/- flat or slightly concave but not stem clasping, spreading. 5
5. Leaves lanceolate, recurved in the upper part. Plant widespread in the south-east..... ***E. tasmanica***
   Leaves elliptic-ovate to obovate, flat, the apex barely pungent. Plant of limited occurrence at Southport Bluff. ..... ***E. stuartii***
6. Leaves elliptic-lanceolate or narrow oblong, 6mm or longer, the apex a blunt, usually inturned mucro. ..... ***E. exserta***
   Leaves lanceolate-ovate, ovate, rounded or obovate, mostly less than 5mm, the apex a short, blunt mucro.....7
7. Flowers typically in long, open, spicate arrangements extending for many cms down the main stems and branches, or more rarely in denser clusters at the ends of the minor branches.....***E. virgata***
   Flowers clustered at the tips of the main stems or on short axillary branches, or sometimes overlapping in short spike like runs of several cms. 8
8. Lamina 3 – 5mm long, recurved, with thickened scabrous margins..... ***E. granitica***
   Lamina usually less than 4mm long, flat, straight, margins +/- entire or mieroserrulate.....9
9. Young stems and branchlets glabrous. Midrib only evident abaxially. Plant of limited occurrence in 3 known locations of the west coast ..... ***E. glabella***
   Young stems and branchlets with sparse hairs or hirsute. 3 – 5 veins evident abaxially, the midrib almost keeled. Distribution restricted in the north and northeast. ..... ***E. moscalianus***

Taxonomy

1. ***Epacris tasmanica*** W.M. Curtis, Taxon 18(2) 244 (1969). emended description.

E. squarrosa Hook. f. non (R. Br.) Poir; *E. serpyllifolia* R. Br. var. *squarrosa* (Hook. f.) Benth.

Lectotype: Chosen by Crowden and Menadue (1990, p. 262). *R. C. Gunn 1209*, Oyster Bay, East Coast (K! NSW!). Residual *syntype R. C. Gunn 1205,* Spring Bay, East Coast, April 1840 (K! NSW!).

Erect sparsely branched *shrub* reaching 2.0m in height, but usually < 1m; young stems and branchlets brown with sparse to dense hairs, older stems mostly bare of leaves. *Leaves* spreading, somewhat crowded on new season's wood, on pubescent, semi-appressed, short petioles < 0.5mm; lamina glabrous or with sparse hairs extending from the petiole, slightly concave, reflexed in upper part, lanceolate to lanceolate-elliptic, 3.0 – 8mm long, 2.0 – 3.5mm wide: apex acute tapering to a pungent mucro; margins entire or irregularly crenulate or scabrid; the midrib keeled, 1, 3 – (5) veins evident abaxially. *Flowers* white on short 1.0 – 2.8mm, straight pedicels, erect, mostly clustered towards the ends or extending a short distance down the branches; bracts creamy white, glabrous, ovate, the lower ones with a rounded apex, the upper ones more acute, margins ciliolate; sepals pale or pink striated, glabrous (rarely hirsute, Bangor and Prosser Gorge), lanceolate-ovate,

3 – 7mm as long as or slightly longer than the corolla tube, the apex acute sometimes almost acuminate, margin ciliolate; corolla tube campanulate, caduccous, 2.5 – 5mm long; lobes spreading, somewhat wavy, longer than the tube 3.5 – 5.5mm long, the bases often cordate, overlapping; anthers red, 0.9 – 1.6mm long wholly exserted above the plane of the corolla lobes on long filaments 1.2 –1.8mm long; ovary smooth, round, glabrous, ca. 1.0mm high; style 3.5 – 6.0mm long, glabrous, distinctly bulbous in the lower half; stigma capitate, exserted; hypogynous scales truncate ea. ¼ depth of ovary. *Capsule* green, usually < ½ length of sepals, the dry sepals and capsule segments open only minimally when the capsules ripen, the style persistent (Fig. 1c, 5)

Selected specimens examined. Ringrove, Mareh 30, 1991, *Y. Menadue* HO 40771. Turnoff to Two Thumbs Lookout, July 14, 1995, *A.C. Rozenfelds* HO 316259. Jacobs Hill, Mt. Walter July 11, 1988, *F. Duncan* HO 326581. Dunbabin property, road to Blackman Bay, Aug. 21, 1996, *M. Howski* HO 321580. Burden Razorback, N. of Kellevie, Oct 31, 1983, *A. Moscal* HO 114943. Hospital Creek Reserve, Nov. 13, 1984, *R.K. Crowden*, HO 111581. Paradise Gorge, Prosser River, Sept. 26, 1996, HO 320343. Tasman Hwy. 8.2km east of Buckland, Sept. 12 1984, HO 111582. Orford, Aug. 20, 1952, *W.M. Curtis* HO 5256. Humper Bluff, Forestier Penin. Sept. 12, 1997, *A. Moscal* HO 327 619. Maelaines Heath, Spring Bay, Triabunna, Sept. 10, 1951, *W.M. Curtis* HO 5259. NE slopes of Isles Tier, 4 km NW of Kellevie, Sept. 5, 1982, *A. Moscal* HO 56163. Brown Mt. Forest Reserve, Dec. 18, 1996. *A.J. North* HO 321948.

Distribution: Southeast Tasmania at low altitudes Forestier Peninsula, Spring Bay and inland to the Meehan Range. Open woodlands (*Eucalyptus ovata* and *E. pulchella*) and scrub on shallow stony soils, Fig. 4a.

2. ***Epacris cerasicollina*** R. K. Crowden. sp. nov.

Epacridi tasmanicae habitu et proprietatibus vegetativis similis sed pedicella longiore recurvatoque antheris partim inclusis differt.

Type: **TASMANIA:** Swan River, Waters Meeting, silty banks below ford. Oct.18, 1987, *R.K. Crowden* and *Y. Menadue* (holotype HO 111579). *Iso.* MEL, CANB, NSW.

Shrub of several stiff, erect stems, 0.5 – 1.5 –(2)m high; old stems mostly bare of leaves; young stems rounded, hirsute; *leaves* semi-erect, generally crowded on new wood at the branch tips; lanceolate to ovate-lanceolate, reflexed in upper part, 3 - 8mm long, 2 – 4mm wide, apex attenuate and pungent, base narrowly obtuse tapering into petiole, margins +/- entire or irregularly erenulate or scabrid, lamina sl. concave near the base, midrib prominent with 3 –(5) veins abaxially, petiole < 1mm, pubescent, the hairs extending onto the base of the lamina. *Flowers* white, in small tight clusters at the branch tips, although rarely extending in tight overlapping spikes a short distance (up to 10em) down some lateral branches; pedieel 2.5 – 4mm, slightly curved; bracts pale, ovate, obtuse apex in lower bracts, the upper ones more acute and sometimes reflexed, glabrous, ciliolate margins; sepals pale or pink striate, laneeolate to lanceolate-ovate, apex acute or acuminate, sometimes reflexed particularly in some southern populations (eg. near Hermitage and Green Hills), margin ciliolate; corolla tube slightly campanulate, 2.9 – 4.1mm long, the lobes slightly longer and overlapping at the base, apex obtuse; corolla eaduecus; anthers red 1.1 -1.7mm long, longer than the subtending filaments, 0.7 – 1.0mm, so that only the upper part is exserted above the plane of the lobes; ovary smooth, style 3.1 – 4.2mm, bulbous near the base, the stigma at or above the top of the anthers; nectary scales truncate, ca. ¼ depth of ovary; capsule greenish brown, < ½ length of the sepals, the sepals and dry capsule segments open only minimally when the capsule ripens; style persistent (fig 1 b,d, 5).

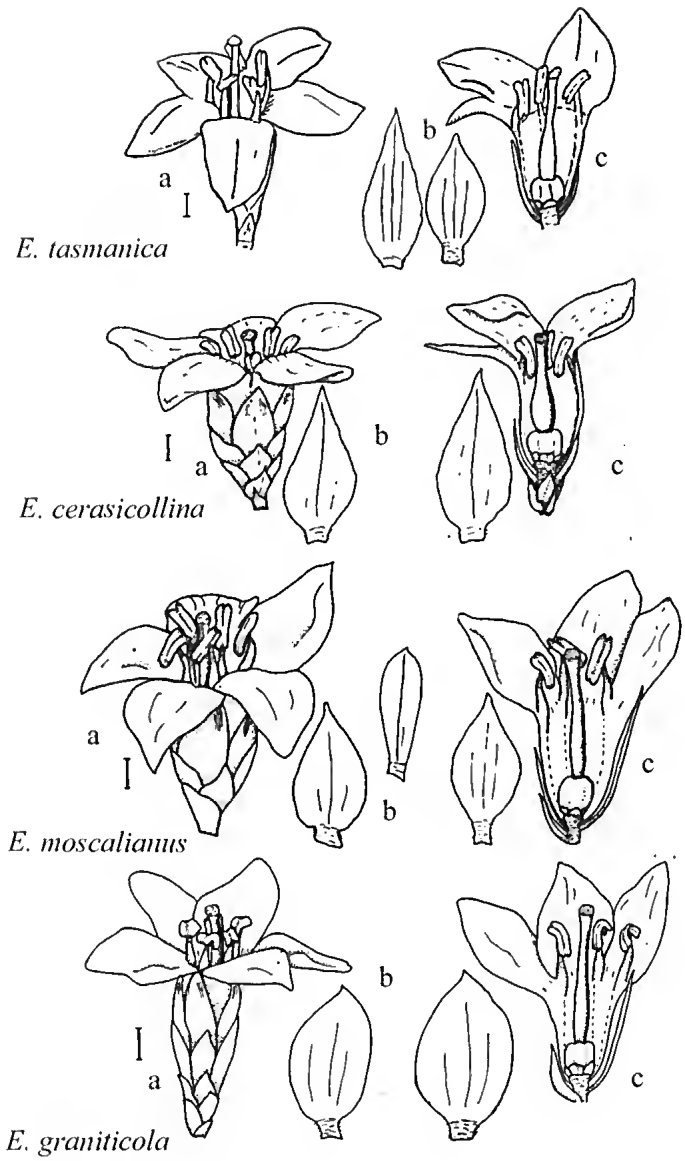

Figure 5. Drawings of *Epacris* species; a. flower, b. leaf variation, c. flower section. Scale bars = 1mm.

Selected specimens examined. Wye River, riverside in rocky site, July 25, 1987, *P. Collier*, HO 120054. Lake leake Rd. 11km from Tasman Hwy. Jn., Nov: 16, 1984, *R.K. Crowden* and *Y. Menadue*, HO 111576. Old Coach Rd. 4.5km NW of Cranbrook, Sept. 12, 1984, *R.K. Crowden* and *Y. Menadue* HO 111567. Old Man Creek, Mayfield Bay, Sept. 12, 1984, *R.K. Crowden* and *Y. Menadue* HO 111574. Lake Leake, Sept. 1, 1983, *W.D. Jackson* HO 68006. Apsley River gorge in river shingle, Nov. 7, 1986, *R.K. Crowden* and *Y. Menadue* HO 407792. Swan R. 6km S of Cranbrook, Sept 4, 1991, *P. Collier* HO 142414. N. of Bicheno, Nov. 18, 1942, *H.D. Gordon* HO 5239. Swansea Oct.15, 1881, *A Simson* HO 5245. Reynolds Hill, Old Coach Road, Oct. 14, 1987, *R.K. Crowden* and *Y. Menadue* HO 111643. Hop Pole Marshes, Sept. 20, 1984, *R.K. Crowden*

and *Y. Menadue* HO 111580. Mt. Peter, east ridge, Dec. 29, 1985, *A.M. Buchanan* HO 98107. Bluemans Creek, Sept.11, 1995, *A. North* HO 316967. Moulting Lagoon game reserve, on track to Apsley marshes, Sept.2, 1996, *D.A. Keith* HO 321579. Schouten Is., S of cabin. Nov. 14, 2000, *A.C. Rozenfelds* HO 509281. Hardings Falls, E. Swan River, Nov. 17, 1985, *R.K. Crowden* and *Y. Menadue* HO 111645. Top of Deep Falls, Green Tier Ridge, SW of Tooms Lake, Oct.14, 1989, *P. Collier* HO 119681. Tasman Hwy 12km N. of Triabunna, Sept. 12, 1984, *R.K. Crowden* HO 407778. Macquarie River, riverbed and terrace, Apr. 30, 2003, A.J. North HO 541045.

Etymology: The specific epithet is from Latin *cerasus*-, cherry, *collis,* hill, named after Cherry Tree Hill, the location of what is possibly its largest extant population.

Distribution: The central east coastal region of Tasmania from Green Hills to about Seymour, on the Freycinet Peninsula and Schouten Island, and inland on the eastern and western slopes of the East Coast range to about 300m altitude, at Lake Leake and down the Valleys of the Tooms and Macquarie Rivers. In grasslands and open woodlands, on shallow stony, often moist soils and in riverbank vegetation. Fig. 4b.

3. ***Epacris graniticola*** R.K. Crowden sp. nov.

Epacride virgata foliis recurvatis marginibus incrassatis scabrisque et floribus in fasciculis terminalibus differt.

Type: **TASMANIA**: Mt. Cameron, southern slopes near eastern end in wet fissures on exposed granite slabs, Oct. 18, 2003, *R.K. Crowden* (holotype: HO 540971). *Iso.* MEL, CANB, NSW.

A generally erect, multistemmed *shrub*, which may reach 1.5m in height in sheltered locations, but often heavily browsed to a low, bushy, almost matlike habit, the old stems mostly bare of leaves. Young stems and branchlets, brown, rounded, hirsute. *Leaves* erect and spreading, reflexed in the upper part; ovate-lanceolate to ovate, 2.0 –5.5mm long, 1.3 – 2.9mm wide; apex acute, mucronate, blunt, the base obtuse and tapering sharply onto the short petiole (< 1mm); lamina glabrous except for sparse hairs extending from the petiole, somewhat thickened; margin thickened, scabrous or minutely denticulate; prominent midrib and 3 – 5 veins evident abaxially. *Flowers* white, in terminal clusters on the main and short lateral branches, or extending a few cms down the major branches; bracts pale, ovate, keeled in the upper part, apex acute, glabrous, margin ciliolate; sepals white or pink striate, lanceolate-ovate, 2.0 – 3.9 mm long, glabrous, apex broadly acute, margin ciliolate; corolla tube barely campanulate, ca. equal to or slightly less than the sepals, glabrous, caducous. anthers red, exserted, 1.0 – 1.45mm long on filaments which are longer; ovary smooth, round, glabrous; style 2.3 -5.8mm long, slender, with a basal swelling, the stigma rounded at the top of or above the anthers; nectary scales rounded triangular, ca. 1/3 the height of the ovary; capsule green, less than ½ sepals length. sepals and dry capsule open widely when the capsules ripen; style persistent (fig 5).

Selected specimens examined. Summit of Mt. Stronach, Aug. 13, 1996, *D.A. Keith* (HO 321358); Mt. Stronach, Oct. 14, 1990, *A. Moscal* (HO 127054); Mt. Cameron, Nov. 19, 1983, *A. Moscal* (HO 110127); Endurance Tin Mine Mt. Cameron, Sept. 05, 1985, *R.K. Crowden* and *Yvonne Menadue* (HO 111595); Cube Rock, Mt. Cameron, Aug. 12, 1996, *D.A. Keith* (HO 321504); Rossarden Sept. 05, 1997, *D.A. Keith* HO 322051).

Etymology: From granite, and Latin *-cola*, dweller. A granite dweller.

Distribution: Known from 3 locations only on granite mountains in northeast Tasmanian; in moist patches on the shaded sides of outcropping boulders or amongst moss and lichen patches in fissures on exposed rock slabs Fig. 4e.

4. ***Epacris moscalianus*** R.K. Crowden sp. nov.

Epacride granuticolae floribus in fasciculis terminalibus similis sed foliis planis rotundatisque, fere carinatis, non nisi costa conspicua abaxialites marginibus serrulatissimis differt.

Type: **TASMANIA:** Dukes River above Dukes Marsh, Nov. 18, 2003, *R.K. Crowden* (holotype HO 541194). *Iso.* MEL, CANB, NSW.

A virgate, sometimes low, bushy *shrub*, rarely more than 50cm high in exposed locations, but reaching up to 1.5m in sheltering scrub; old stems may retain some leaves for several years; young stems greenish-brown, sparsely hairy to pubescent. *Leaves* well spaced on young branches, erect, flat and semi-spreading; 2.1 – 3.5 – (5)mm long, 1.3 – 2.9mm wide, on petioles ca. 1/3 – ½ the length of the leaves, (narrow lanceolate) to oblanceolate to ovate or rounded, the apex broadly acute or obtuse with a short blunt mucro, both surfaces glabrous, the midrib very prominent abaxially, margin +/- entire or microserrulate. *Flowers* white, erect, in small, terminal clusters, or rarely extending a few cms down the stems in tight, overlapping spikes; bracts pale or pink tinged, ovate, apex obtuse, margin ciliolate; sepals pink tinged, ovate-lanceolate, ca. equal or slightly longer than the tube, 2.0 – 5mm long, apex acute, margin ciliolate; corolla tube +/- campanulate, 2.0 – 4.7mm long, glabrous, caduceus; lobes longer than the tube, spreading, overlapping slightly at the base, apex rounded; anthers red 1.0 – 1.5mm long, subtended by filaments which are longer and project the anthers well above the plane of the lobes; ovary rounded, smooth, ca. 1/3 of sepals, style slender with a slight basal swelling, 2.5 – 7mm, the stigma exserted usually above the anthers; nectary scales truncate ¼ - 1/3 ovary. *Capsule* green, ca ½ sepal length. Sepals and dry capsule segments open widely when the capsule ripens; style +/- persistent (fig 5).

Selected specimens examined. Royal George, flood plain at St. Pauls River crossing, Oct. 16, 1987, *R.K. Crowden* HO 111720. St. Pauls River gorge, between Mt. Misery and Mt. Puzzler, June 27, 1981, *A. Moscal* HO 44808. St.Pauls River, flood plain gravels at road crossing SE of Avoca, *R.K. Crowden* and *Y. Menadue*, HO 111730. Avoca, Oct. 18, 1881, *A. Simson* HO 514 924. Horshoe Marsh, St. Pauls River, Apr.9, 1980, *A. Moscal* HO 34949. Nile River at Lilyburn Bridge, Aug. 27, 1996, *M. Ilowski* HO 321506. Dukes River, Nov. 13, 1988, *P. Collier* HO 118675. Gog Range, 2km N of Alum Cliffs, Nov. 9, 2001, *R. Schardinger* HO 526424. St. Pauls River, Jen. With Coal Rivulet, Nov. 22, 1981, *A. Moscal* HO 47233. Coal Rivulet, Nov. 13, 1968, *P. Collier* HO 118683. St. Pauls River, east of Cutoff Hill, May 12, 1985, *P. Collier* HO 98794. West Swan River, Dec. 27, 1980, *A. Moscal* HO 38678. St. Pauls River, riverbed above Meadstone Falls, Nov. 23, 2004, *A.M. Buchanan* HO 530183.

Etymology: Named in honour of Mr Tony Moscal, who first collected this and many other Tasmanian plants during the mid to late 1900's.

Distribution: Marsh edges and outflow creeks to the St Pauls River in eastern Tasmania and as a riverbank and floodplain plant along the St Pauls and upper Nile Rivers; on moist rock outcrops with seepage inflows to some of the above marshes, at Alum Cliffs (Mersey River) on the Gog Range. (Fig 4.d)

Acknowledgements

I thank Prof. B. Potts, School of Plant Science, The University of Tasmania, for running the multivariate programmes; Dr. Y. Menadue for drawings of the *Epacris* species; the staff of the Tasmanian Herbarium for their assistance and encouragement and especially Dr. G. Kantvilas for the Latin.

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Appendix 1.

Locations of populations used in the multivariate analysis.

a. *E. tasmanica.*

1. Wielangta. Roadside scrub at northern edge of Wielangta Forest.
2. Ringrove. Scrubby heath on Sandspit Flats near entrance to Ringrove property.
3. Thumbs. Turnoff to Thumbs Lookout.
4. Prosser. Prosser Gorge below the weir.
5. Buckland. Tasman Highway about 8km east of Buckland.

b. *E. cerasicollina.*

6. Hermitage. Tasman Highway at the turnoff to the Hermitage property.
7. Cherry Tree Hill. Tasman Highway 6km N of Cranbrook, at the entrance to the Forestry Commission's "O" Road.
8. Hardings Falls. In rock crevices and on the riverbank at the head of the falls, Swan River.
9. Reynolds Hill. On the "Old Coach Road, Cranbrook to Avoca, the western slope of the East Coast range about 2km before intersection with the Forestry "M" road.
10. Hop Pole. On the "Old Coach Road", about 5km W of 9, hillside opposite the Hop Pole marshes.

Muelleria 25: 129-133 (2007)

A new subspecies of *Pomaderris pilifera* (Rhamnaceae: Pomaderreae) from eastern Tasmania

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Abstract

Pomaderris pilifera N.A.Wakef. subspecies *talpicutica* A.M.Gray & M.Wapstra is a new endemic subspecies from near Hobart and the north-east of the State. The new subspecies is distinguished by its velvety upper leaf surface (compared to virtually glabrous in subsp. *pilifera*) and an emarginate-retuse leaf apex (compared to acuminate to acute in subsp. *pilifera*). Both subspecies are illustrated with photographs. The new subspecies *talpicutica* is restricted to two very small populations and so far is known only from the type locality, at the East Risdon Nature Reserve, and from an isolated hill top in the north-east of the island.

Introduction

Pomaderris pilifera N.A.Wakef. is a small shrubby species widespread in eastern and north-eastern Tasmania, occurring as well in some parts of eastern Victoria and south-eastern New South Wales. Small populations are common in open woodland and shrubland on most of the drier, low hills of the River Derwent estuary. On a dry stony hillside just above the Derwent shoreline, in the East Risdon Nature Reserve, a small discrete group of between 150 to 200 plants has been identified occurring immediately adjacent to a larger population of *P. pilifera sens. str.* Plants of the former population have a distinctive indumentum on the adaxial leaf surface, all but obscuring the lateral veins and with the leaf apex distinctly emarginate-retuse, whereas plants of typical *P. pilifera* have leaves with the adaxial surface glabrous except near the midrib, distinctive lateral venation and acute-acuminate apices. The two subspecies are otherwise similar. The consistent presence of an adaxial leaf surface indumentum in this small but homogenous population and the absence of any intermediate forms between the two populations in the field warrants recognition at subspecific rank for these plants.

Taxonomy

Pomaderris pilifera N.A.Wakef. subsp. ***talpicutica*** A.M.Gray & M.Wapstra subsp. nov.

A subspecie typica foliis supra trichomatibus brevissimis sessilibus stellatis vestitis et nervis lateralibus fere obscurantibus, apicibus foliorum distincte emarginato-retusis et costa saepe breviter mucronato, pilis hypanthii et calycis et ovarii brevioribus et sparsioribus differt.

Type: Tasmania, East Risdon Nature Reserve, *A.M.Gray 1581*, 3 Oct. 2005 (holotype HO 533348; isotypes AD, CANB, MEL, NSW).

A small diffuse *shrub*, to 1.5 m high with numerous stems arising from a single rootstock. *Leaves* alternate, petiolate, broadly oblong to rarely oblong-ovate, 10–30 mm long, 8–15 mm wide, the widest part usually at the middle; margins very shortly recurved; bases rounded; apices emarginate-retuse and usually with a small mucro at the base of the notch; adaxial surfaces dull grey, velvety, with dense, short, sessile stellate hairs, (the rays 60–75

µm), venation indistinct; abaxial surfaces pale, dull white, velvety, with short, densely matted hairs, the veins prominent and bearing a few well dispersed long, simple white or rusty hairs, particularly nearer the base and onto the petiole and with some scattered, larger stellate hairs interspersed between the simple hairs. *Inflorescences* dense, rounded cymose panicles; flowers subtended at first by broad, brown caducous bracts; *sepals* 1.5–3 mm long, broadly triangular, erect at first then strongly recurved, the outer surfaces with short, dense stellate hairs and scattered, longer simple hairs; *petals* 1.5–2 mm long, erect, clawed, the upper portion slightly hooded and at first enclosing the stamens, then spreading widely and ± flat, often deciduous at or immediately after anthesis; *stamens* 2–3 mm long, longer than the style; *style* 1.5–2 mm long, 3- (rarely 4-) cleft, the lobes 1/3 or less than the length of the style; stigmas capitate; hypanthium and summit of the ovary with short, dense stellate hairs and well dispersed, longer simple hairs; fruit not seen. Flowering period: Sept. –Nov. Figure 1.

Figure 1. Leaf surface detail and detail of leaf apices (inset) of *P. pilifera* subsp. *talpicutica*. Note the distinct *retuse* leaf apex and the velvety upper leaf surface (dull appearance in plates).

Additional specimens examined (all HO plus as indicated): *Pomaderris pilifera* subsp. *talpicutica*: East Risdon Nature Reserve, *F.Coates 407991*, 30 Oct. 1992 (MEL); East Risdon Nature Reserve, above Tommys Bight, *A.M.Gray 1651*, 10 Mar. 2006; The Pimple, E of Evercreech, NE Tas., *A.M.Gray 1656*, 11 Apr. 2006; The Pimple, small dolerite hill in forestry area, near Pimple Road, *A.C.Rozefelds 1443*, 1 Oct. 1999 (right hand specimen of two on sheet); Ridge S of Tommys Bight, East Risdon Nature Reserve, *M.Visoiu 535890*, 4 Oct. 2005; Tommys Bight, East Risdon Nature Reserve, *H. & A.Wapstra 537579*, 4 Oct. 2005; Risdon, just N of Bedlam Walls, *M.Wapstra 532274*, 23 Jul. 2005.

Distribution: This subspeeies is restrieted to two very small populations and so far is known only from the type loeality, at the East Risdon Nature Reserve, and from The Pimple, an isolated hill top in the north-east of the island. A sheet of a eollection by A.C.Rozefelds (HO 500868) bears two speeimens, one assignable to *P. pilifera* subsp. *pilifera*, the other to *P. pilifera* subsp. *talpicutica*. A reeent re-examination of the area of these colleetions brought to light only *two plants* of the speeies. One, a small shrub in reasonable condition whieh was elearly subsp. *pilifera*, the other a browsed and possibly diseased plant, whieh had a few remaining leaves with a diseernible upper leaf indumentum. From the material available, this plant is tentatively assigned to subsp. *talpicutica*, although it differs in the detail of the leaf apex, whieh is rounded to sub-apieulate, not distinetly retuse, a condition whieh is apparent in both the Gray and the Rozefelds eolleetions from The Pimple.

Notes: *P. pilifera* subsp. *talpicutica* is similar to *P. pilifera* subsp. *pilifera* but differs in the indumentum of the upper (adaxial) leaf surfaee (which has a distinct, *densely matted indumentum* of very *short, sessile, stellate trichomes*, giving the surfaee a dull grey velvety appearanee and almost obseuring the lateral veins), the leaf apiees (whieh are distinetly *emarginate-retuse*, with the mid vein often terminating in a very *short, blunt mucro*) and the indumentum of the hypanthium, ealyces and summit of ovary (whieh have *shorter and less dense simple hairs*).

Ecology: At Risdon, the small diserete population of about 200 plants oeeurs on the western slope of a hill overlooking the River Derwent, at an altitude of approx. 35 metres. The soils are skeletal and very well drained, on Permian mudstone, and there are the remains of an Aboriginal midden site a little further uphill with mueh broken and weathered shell debris seattered about. The assoeiated vegetation eonsists of an open, shrubby woodland of *Eucalyptus risdonii* Hook.f. and *E. amygdalina* Labill., both fire damaged and impoverished, and with an open, shrubby mixed understorey of *Dodonaea viscosa* subsp. *spatulata* (Sm.) J.G.West, *Exocarpos cupressiformis* Labill., *Bursaria spinosa* Cav. subsp. *spinosa*, *Allocasuarina littoralis* (Salisb.) L.A.S.Johnson and *Acacia dealbata* Link. ssp. *dealbata*. Smaller assoeiated shrubs inelude *Olearia hookeri* (Sond.) Benth., *Ozothamnus obcordatus* DC., *Correa reflexa* (Labill.) Vent. var. *reflexa*, *Philotheca verrucosa* (A.Rieh.) Paul G.Wilson, *Acacia myrtifolia* (Sm.) Willd., *Acacia genistifolia* Link, *Pultenaea pedunculata* Hook. and *Spyridium eriocephalum* Fenzl var. *eriocephalum*. Grasses and other tussoeks inelude *Austrodanthonia*, *Austrostipa* and *Poa* spp., *Lomandra longifolia* Labill., *Lepidosperma laterale* R.Br. and *Dianella revoluta* R.Br. *Pomaderris pilifera* subsp. *pilifera* is common to seattered on the midden and elsewhere at a marginally higher altitude and extends around the slope, over a wider area than subsp. *talpicutica*.

The Pimple is a small dolerite hill of approx. 470 metres altitude, some 21 km north-east of Fingal, just within the eastern boundary of a large traet of land whieh has, in the past few deeades, been largely eleared of native vegetation and replanted to plantation forest. The vegetation on The Pimple eonsists of remnant and natural regrowth with *Eucalyptus*

obliqua L'Herit. as the major tree species and a very sparse, remnant understorey of *Olearia stellulata* (Labill.) DC., *Notelaea ligustrina* Vent., *Lomatia tinctoria* (Labill.) R.Br., and very scattered *Pomaderris aspera* DC.; the sparse ground-cover consists of *Lomandra longifolia* Labill. and *Pteridium esculentum* (G.Forst.) Cockayne. Despite a thorough search only one plant each of *Pomaderris pilifera* subsp. *pilifera* and *P. pilifera* subsp. *talpicutica* were located, within approx. 50 metres of each other.

Conservation status: As far as is presently understood, this novelty is known only from a single population at the East Risdon Nature Reserve, on Hobart's 'eastern shore' (the type locality), and two collections (Gray and Rozefelds, from the same plant) from a locality in the north-east of the State. Prior to the collection of the latter specimens, the area had been severely alienated and the natural vegetation compromised by forestry operations and it is possible that other populations of *Pomaderris*, once present, may have now been eliminated.

Figure 2. Leaf surface detail and detail of leaf apices (inset) of *P. pilifera* subsp. *pilifera*. Note the distinct *acute* leaf apex and the virtually *glabrous* upper leaf surface (glossy appearance in plates).

Although presently 'protected' within the boundaries of a State Reserve the population of *P. pilifera* subsp. *talpicutica* may be subject to inappropriate management regimes (e.g. too frequent and intense fires, woody weed invasion) and stochastic events (e.g. wildfire, unknown diseases). The East Risdon Nature Reserve also supports two other significant threatened species, namely *Encalyptus risdonii* and *Spyridium erioecphalum* var. *eriocephalum*, both of which co-occur with *P. pilifera* subsp. *talpicutiea*. The *Spyridium* is a shrub of very restricted and disjunct occurrence (listed as 'endangered') in southern Tasmania (at this locality) and formerly near Launceston in the north (not since 1880), providing added impetus to appropriately manage the reserve. It is noted that *S. eriocephalum* is more common and widespread in southern mainland Australia.

Given that the total number of individuals of *P. pilifera* subsp. *talpicutica* is less than 250 and all individuals are restricted to just one population, plus one disjunct, remote, possibly solitary plant, the subspecies qualifies as 'endangered' under both the Tasmanian *Threatened Species Protection Act* 1995 and the *Commonwealth Environment Protection and Biodiversity Conservation Act* 1999.

Etymology: talpicutica - from *talpa*, Latin for the European mole and *entis*, skin (animal). This epithet refers to the soft, dense, very short indumentum on the upper (adaxial) surface of the leaves, rather similar to the fabric termed "moleskin", and a common name of "moleskin dogwood" is suggested.

Key to the subspecies of *Pomaderris pilifera*:

1 Leaf upper surface green, glabrous, (except sometimes along and immediately adjacent to the midrib), lateral veins distinct, impressed; apex of leaf distinctly acuminate or acute (Fig. 2) ..... *P. pilifera* subsp. *pilifera*

1: Leaf upper surface greyish, very shortly felty – tomentose, lateral veins obscure; apex of leaf retuse or emarginate, often with a very short mucro at the base of the notch (Fig. 1)..... *P. pilifera* subsp. *talpieutiea*

Acknowledgements

We thank Mr Neville Walsh (MEL) for his willing encouragement, helpful criticism of the manuscript and the Latin diagnosis and also Dr Marco Duretto (HO) for other useful help and criticism during the preparation of the manuscript. Kim Hill (HO) assisted with the final preparation of the manuscript. An anonymous referee improved the clarity of the manuscript.

Muelleria 25: 134-136 (2007)

Review of EUCLID Eucalypts of Australia (Third Edition)

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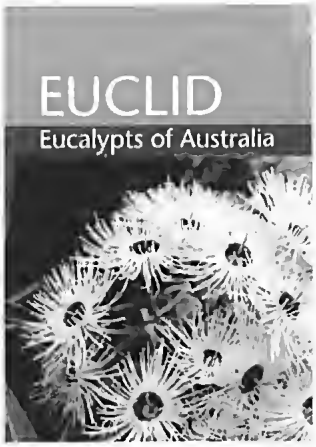

EUCLID Eucalypts of Australia (Third Edition)
Centre for Plant Biodiversity Research
CSIRO Publishing, Collingwood
October 2006
ISBN: 0643093354 (DVD-ROM) AU $120.00
www.publish.csiro.au for ordering, samples and features.

I, and no doubt other botanists, were very excited to hear that finally a version of EUCLID would be available to enable identification of all the eucalypts of Australia. It promises to be, "the definitive electronic identification and information system now covering all 894 eucalypts of Australia in the one publication". Does it live up to the "definitive" claim?

Firstly, a word of warning for those whose computers are more than a few years old; not long after the launch of EUCLID a visiting botanist was looking forward to proudly christening their new copy of EUCLID, but wondered why it wouldn't work on their laptop – they only had a CD drive. This is not an isolated incident either, with several workers expressing disappointment that they would not be able to use it on their current, albeit ageing, machines. Unlike the earlier editions of EUCLID, which were issued on CD-ROM, the third edition has been released on DVD. This has obviously been done to fit the 2.2 Gb of information, including over 9000 colour images, on a single disc, but means that people without DVD drives will be unable to use the program. The software requires a personal computer with a Windows 98/ME/NT/2000/XP operating system; Macintosh and Linux are not supported. An "assumed" limitation I have come across when talking to a couple of people who had an interest in the program, is that they thought it was too expensive, because although the price of $120.00 for EUCLID itself was considered reasonable, they were under the misapprehension that they would also have to spend hundreds of dollars on LUCID software in order to be able to play EUCLID. It must be emphasized that this is not the case. EUCLID comes as a self-contained package including the player software, so assuming you have a modern computer with DVD drive you won't need to buy anything else.

The second edition of EUCLID, released in 2002, covered the area south of 26°S latitude, or, in other words, Queensland, Northern Territory and the northern half of Western Australia were not covered. The second edition included 690 taxa, and the bloodwood eucalypts (*Corymbia*) were included as a subgenus of *Eucalyptus*. This third edition now covers all of Australia, has 894 taxa, and includes 204 Northern taxa to complement the earlier edition. The authors have adopted the consensus view of generic concepts in this third edition, with the recognition of three separate genera, *Eucalyptus*, *Corymbia* and *Angophora*. The reasons behind this decision are explained in the introductory essay on

Evolutionary Relationships of *Eucalyptus sens. lat.* by Dr Judy West, which covers the phylogenetic hypotheses of the past six years. This provides a very useful summary of the issue for non-specialists and a reference list is provided for further reading.

There are two options for installation of EUCLID. The first involves installing the drivers and player to your hard drive. In this case, all of the information and images remain on the DVD, so the DVD must be inserted into your computer to run the program. The second option entails installing all 2.2 Gb of the program onto your computer's hard drive, and in this case the DVD is not needed after installation. Full installation may take an hour or more, but on a new Intel Core 2 Duo laptop it took 19 minutes and was very straightforward.

The interface will be very familiar to users of previous editions of EUCLID, or for users of other Lucid-based interactive keys. A hardcopy User Guide is no longer included, with the information now available on the DVD. To gain a full appreciation of the many features and information available, the potential purchaser should consult the publisher's website and follow the "Sample" link, which provides the introductory essays, list of taxa, several species fact sheets, and a tutorial key in which the identification of *Eucalyptus globulus* subsp. *bicostata* is demonstrated using a subset of the available characters. As with most interactive keys, it is the ability to use the characters available on the specimen, rather than being constrained by the sequential choices offered by couplets of a dichotomous key that makes EUCLID far and away the easiest, most accurate and most useful key to the eucalypts available.

Unfortunately EUCLID does not cover all species of *Eucalyptus*, ie. the four species endemic outside Australia, *E. urophylla*, *E. orophila* and *E. wetarensis* from Timor and adjacent islands, and *E. deglupta* from northern New Guinea, parts of Indonesia and the southern Phillipines. It can be very difficult to access information on these species, and EUCLID would have provided the ideal vehicle for promulgation of information on these little-known species. The omission of *E. deglupta* is a particular drawback, because it is widely grown around the world for pulpwood, and is of horticultural interest, due to its beautifully coloured bark, hence the common name of Rainbow Eucalyptus. To be able to compare our *E. deglupta* growing at the Royal Botanic Gardens Melbourne to the descriptions in EUCLID would have been purely of academic interest, but for foresters and horticulturists there may be more practical implications in not having a reliable identification key to all species of eucalypts. As with many country or state-based floras and revisions, the fact that the scope of this work is limited on the basis of geography, although only missing c. 0.5% of species, prevents me unequivocally applying the "definitive" tag to this edition of EUCLID.

The Index of synonyms, included in the second edition, has been removed, instead being incorporated in the list of "All Eucalypt Names". Browsing through species of *Eucalyptus* is now much easier because a group of taxa can be selected via an individual letter of the alphabet, compared to the index of the 2nd ed. where the user was required to scroll through one continuous list of all taxa to access the taxon of choice. Taxa in *Angophora* and *Corymbia* are presented as lists, but due to the smaller number of taxa this provides a fast route for selection of the taxon of interest. The list of eucalypt names is seemingly complete (including the four non-Australian species!), but there is noticeable unevenness in the reasons given for various taxonomic concepts being adopted, ranging from the clear and well-explained, to the cursory. This may reflect the personal taxonomic views of the authors, but will be frustrating for non-specialists trying to reconcile the taxa and nomenclature adopted in EUCLID with those in other treatments, such as State floras and censuses.

One of the main strengths of EUCLID is that it is not just a compilation of existing knowledge. The authors made many field trips to take measurements of fresh material and to supplement the information available from their herbarium collection at CANB. Thousands of photographs illustrating the main diagnostic features for identification have been taken, and glasshouse trials were undertaken to obtain seedling characters. In this way, the authors have amassed a huge original data matrix of morphological characters that will prove invaluable for many other uses. The authors had obviously resolved to produce an innovative product, rather than rush out a status quo compromise, and the long-term support of their host institutions, CSIRO and the Centre of Plant Biodiversity Research is to be applauded.

The quality and number of images is extremely impressive, and in this respect EUCLID is without peer. However, in some respects the choice of images appears to be opportunistic, with variation in the images included for each taxon, e.g. juvenile leaves and leaf venation are not illustrated for some taxa. Warty stems can be diagnostic for peppermints, but it is depicted in some of the taxa that possess this character, and not in others. The inconsistency in inclusion of photographed features is particularly irritating when the user is relying on the species descriptions and photographs to discriminate between the last few taxa remaining after having run through the key. For some species a photograph of the type specimen is provided with a useful zooming facility that allows the image to be enlarged in certain critical areas, typically the label and where fruits and/or buds are present (with a scale). Flowers are shown in different ways for different taxa, in some they are fresh, in others on herbarium specimens, and for others, not at all. Care would be needed in the interpretation of flower colour from these varied sources, with some white flowers becoming reddish after drying, and so, becoming potentially misleading for casual users of the key. Despite the few deficiencies, the compilation of so many high quality images of eucalypts in the one place is truly a monumental accomplishment.

The real test is trying to key out specimens. In one case I compared the distribution map of an *Angophora* species in EUCLID to that on Australia's Virtual Herbarium (AVH). The distributions from the two sources matched apart from an outlier on the AVH map. This was a MEL specimen, so I was then able to use EUCLID to check the determination. It turned out it was a *Corymbia* species, a fairly scrappy specimen with only leaves and immature buds. Using EUCLID it was possible to get down to two species and have a fair degree of confidence in a final determination to one species by comparing the detailed species descriptions of the two remaining alternatives. Just at random, another example of trying to identify a scrappy specimen that only had a state locality and no notes on bark, habit etc.; using EUCLID it was possible to very quickly get down to two possibilities and then decide between the two by comparison with the descriptions. It is in this sort of work, trying to identify scrappy specimens, with poor locality and habit information, that EUCLID proves invaluable, providing the non-expert with the opportunity to key out incomplete material that would prove virtually impossible even for a seasoned expert.

So, EUCLID is not perfect, but it is by far the most comprehensive and useful aid to the identification and study of the eucalypts available, and for pure "bang for your buck" has to be considered an absolute bargain and an essential item in the library of anyone interested in these icons of the Australian bush.

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