

Argyrotegium, a new genus of Gnaphalieae (Compositae)

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Abstract *Euchiton mackayi* and *E. nitidulus* lack the definitive characters of *Euchiton*, namely stolons and paired papillae on the cypsela epidermis. A morphological comparison of species of *Euchiton* from New Zealand and Australia, supplemented by published data on other species and genera, demonstrates that *E. fordianus*, *E. mackayi*, *E. nitidulus*, and *E. poliochlorus* are morphologically distinct from the remainder of *Euchiton* and from all other genera of Gnaphalieae. This is supported by published evidence from ITS sequences. *Euchiton fordianus*, *E. mackayi*, *E. nitidulus*, and *E. poliochlorus* are transferred to a new genus, *Argyrotegium*, and new combinations are made.

Keywords *Argyrotegium fordianum*; *Argyrotegium mackayi*; *Argyrotegium nitidulum*; *Argyrotegium poliochlorum*; new genus; New Zealand; Australia; Compositae; Asteraceae; Gnaphalieae; *Euchiton fordianus*; *Euchiton mackayi*; *Euchiton nitidulus*; *Euchiton poliochlorus*

INTRODUCTION

Two species stand out as anomalies among the 14 species of *Euchiton* Cass. in New Zealand. Both are mat-forming plants of wet, high-altitude habitats. *Euchiton mackayi* (Buchanan) Anderb. has previously been recorded only from New Zealand, where it is widely distributed, and *E. nitidulus* (Hook.f.) Anderb. only from four very restricted areas, two in New Zealand and two in mainland south-east Australia. The habit of these two species is distinctive, both having prostrate, much-branched stems covered in small leaves with broad, clasping, imbricate petioles. As the plants age the living leaves become restricted to the upturned stem tips. The old stems remain clothed in dead leaf bases and produce long wiry adventitious roots. The capitula, which are solitary at the ends of the stems, are sessile at anthesis but become scapose as the fruits develop.

The first intimation of uncertainty about the generic position of these two species occurs in the original description of *Euchiton mackayi*, when Buchanan (1882) described it under *Raoulia* but suggested that the large foliage might ally it more closely with *Gnaphalium*. Kirk (1899) took up this suggestion and it was followed by Cockayne (1928), Allan (1961), and Drury (1972). Drury (1972) listed all the indigenous New Zealand species of *Gnaphalium* under section *Euchiton* (Cass.) DC. and distinguished *G. mackayi* and *G. nitidulum* from the rest of the New Zealand species on the basis of their imbricate achenial papillae and their chamaephytic life form. Anderberg (1991, p. 167), in his worldwide revision of Gnaphalieae, noted that “The majority of species of *Euchiton* probably form a monophyletic group, defined by their stoloniferous habit, and paired cypsela papillae.” The results of a parsimony analysis based on ITS sequences (Breitwieser et al. 1999) suggested that the separation of the stoloniferous and non-stoloniferous species into two separate genera should be considered.

In view of the above findings, we set out to test the hypothesis that *Euchiton mackayi* and *E. nitidulus* are sufficiently distinct from the stoloniferous species of *Euchiton* to warrant recognition at generic level.

MATERIALS AND METHODS

All material was collected in the field. Vouchers for specimens studied are listed in Appendix 1.

Euchiton mackayi and *E. nitidulus* were compared initially with two stoloniferous species over a wide range of characters. For the two stoloniferous species, we selected *E. involucratus* (G.Forst.) Holub, the type species, and *E. traversii* (Hook.f.) Holub because it is similar to *E. mackayi* and has at times been regarded as conspecific with it.

For characters which differed consistently between these two pairs of species, we extended the comparison to a representative selection of the remaining indigenous New Zealand species (*Euchiton audax* (D.G.Drury) Holub, *E. collinus* Cass., *E. lateralis* (C.J.Webb) Breitw. et J.M.Ward, *E. limosus* (D.G.Drury) Holub, *E. paludosus* (Petrie) Holub, and *E. ruahinicus* (D.G.Drury) Breitw. et J.M.Ward), and a selection of indigenous Australian species (*E. collinus*, *E. fordianus* (M.Gray) P.S.Short, *E. involucratus*, *E. mackayi*, *E. nitidulus*, and *E. umbricola* (J.H.Willis) Anderb.). Beyond this scope we relied on published character information (Drury 1970, 1972; Royen 1983; Webb 1988; Buchanan 1999; Walsh 1999a; Rozefelds 2001).

We then compared *Euchiton mackayi* and *E. nitidulus* with other genera with which they have been linked, either alone or as part of *Euchiton*: *Raoulia* Hook.f. (by Buchanan 1882), *Leucogenes* Beauverd (by Drury 1972), *Ewartia* Beauverd (by Breitwieser et al. 1999), *Stuartina* Sond., *Gnaphalium* L., *Troglophyton* Hilliard et B.L.Burt, and *Vellereophyton* Hilliard et B.L.Burt (by Anderberg 1991). Finally we checked the occurrence of the most distinctive features of *E. mackayi* and *E. nitidulus* in Anderberg's (1991) character matrices for Gnaphalieae and for his five subtribes.

Most characters were examined from rehydrated herbarium material. Stem anatomy was investigated using rehydrated perennial stems cut free-hand with a razor blade and stained with aqueous aniline sulphate. Involucral bracts were transferred from dry herbarium specimens to 100% ethanol then mounted in Euparal (Drury 1970). Cypselae were mounted in lactic acid, covered, and heated (Drury 1970). Papus hairs were mounted directly in Euparal.

RESULTS

Our collections have extended the known range of both *Euchiton mackayi* and *E. nitidulus* to include Tasmania. *Euchiton mackayi* has not been recognised previously from Australia.

Characters which were found to differ consistently between *Euchiton mackayi* and *E. nitidulus* and a representative selection of other New Zealand species of *Euchiton* are shown in the upper part of Table 1.

There are two quite distinct growth forms. In *Euchiton mackayi* and *E. nitidulus* the main stems are prostrate, with short internodes, full-sized leaves, and adventitious roots. The stems branch and rebranch to form a mat. In older plants the living leaves may be bunched at the ends of the branches to give a rosette-like appearance. In the other eight New Zealand species shown in Table 1, leaves are initially produced in a rosette on an upright stem with suppressed internodes. This stem produces adventitious roots from the basal nodes. Prostrate branches, which arise in the axils of the rosette leaves, have long internodes and leaves which are reduced in size. Roots are not produced from the nodes. These specialised branches are termed stolons. Eventually their apices give rise to new, adventitiously rooted rosettes. Illustrations of these habit differences can be found in Drury (1972) and Walsh (1999b).

The prostrate stems of *Euchiton* always form secondary vascular tissues. In *E. mackayi* and *E. nitidulus* there is a substantial cylinder of secondary phloem which is completely lacking in lignified cells. In the other eight New Zealand species examined, irregular cell-clusters or single cells in the phloem are heavily lignified and appear brilliantly yellow in transverse sections stained with aniline sulphate.

The proximal part of the leaf in *E. mackayi* and *E. nitidulus* is broad, colourless, and appressed to the stem, forming a sheath-like petiole which ranges from half as long to as long as the lamina and may equal it in breadth. In the other eight New Zealand species examined the leaves may be imbricate at the extreme base, or when immature, but are otherwise spreading.

In many Gnaphalieae the backs of the style arms are papillose due to the protrusion of the distal ends of epidermal cells. In *Euchiton mackayi* and *E. nitidulus* these protrusions are negligible on the lower part of the arm, whereas in the other eight species they are more or less uniform all along.

The cypselae of *E. mackayi* and *E. nitidulus* are 1.1 to 1.5 mm long and are narrowly obovoid when

the embryo is fully developed, although aborted or immature cypselae are narrowly cylindrical. In the remaining species the cypselae are usually 0.6 to 0.8 mm long, but sometimes exceeding 1 mm in *E. lateralis*, *E. paludosus*, and *E. traversii*; in shape they are usually cylindrical to fusiform, but obovoid in some *E. lateralis* and occasionally obovoid in *E. collinus*, *E. involucratus*, and *E. paludosus*.

Epidermal hairs are usually absent from the cypselae of *E. mackayi* and *E. nitidulus*. Occasionally one or two clavate twin hairs have been observed just below the pappus in *E. mackayi*. Clavate twin hairs are always present over the entire length of the cypselae of the other eight species. In these same eight species the cypselae epidermis is papillose, with a finger-like projection at each end of the cells, the proximal papilla of one cell forming a pair with the distal papilla of the cell below. This condition was termed "paired papillae" by Drury (1970). In contrast, *E. mackayi* and *E. nitidulus* have what Drury termed "imbricate papillae", with a single papilla formed at the distal end of each cell and usually overlapping the base of the cell above.

The pappus in *Euchiton* consists of narrow, scabrid, capillary hairs. In *E. mackayi* and *E. nitidulus* the majority of these hairs have two apical

cells side by side, the shaft of the hair is 0.015 to 0.023 mm wide, and the bases of at least some of the hairs are tangentially fused, so that when the pappus is shed the hairs remain in groups or in a fragile ring. In the other eight species examined all or most pappus hairs have a single apical cell, the shaft of the hair is usually narrower (0.008 to 0.012 mm), and there is no basal fusion, although when the pappus is shed some hairs may remain in small groups, held together by interlocking basal cilia. Broader pappus hairs are sometimes found in three of these eight species: up to 0.015 mm in *E. traversii* and *E. lateralis*, and up to 0.02 mm in *E. paludosus*.

The expression of the above characters in a selection of Australian species of *Euchiton* is shown in the lower part of Table 1. *Euchiton mackayi*, *E. nitidulus*, and *E. fordianus* match the New Zealand material of *E. mackayi* and *E. nitidulus* except that the number of apical cells in the pappus hairs is more commonly one than two in one specimen of *E. mackayi*. *Euchiton involucratus* and *E. collinus* match the New Zealand material of the same species. *Euchiton umbricola* matches these last two species in most of these characters, but not in pappus breadth, and only sometimes in cypselae shape and number of apical cells in the pappus hair.

Table 1 Observed character variation in *Euchiton*. Column numbers: 1, stolons absent; 2, phloem fibres absent; 3, leaves with long, broad, sheathing bases; 4, style arms with dorsal sweeping hairs decreasing downwards; 5, cypselae glabrous; 6, cypselae papillae imbricate (cf. paired); 7, pappus hairs with basal fusion; 8, most pappus apices 2-celled (cf. 1-celled); 9, pappus shafts > 0.015 mm wide (cf. usually 0.008 to 0.012 mm wide); 10, cypselae length > 1 mm; 11, mature cypselae obovoid (cf. cylindrical to ellipsoid). ●, yes; ○, no; ·, variable.

	1	2	3	4	5	6	7	8	9	10	11
New Zealand											
<i>E. mackayi</i>	●	●	●	●	●	●	●	●	●	●	●
<i>E. nitidulus</i>	●	●	●	●	●	●	●	●	●	●	●
<i>E. involucratus</i>	○	○	○	○	○	○	○	○	○	○	·
<i>E. traversii</i>	○	○	○	○	○	○	○	○	○	·	○
<i>E. audax</i>	○	○	○	○	○	○	○	○	○	○	○
<i>E. collinus</i>	○	○	○	○	○	○	○	○	○	○	·
<i>E. lateralis</i>	○	○	○	○	○	○	○	○	○	·	·
<i>E. limosus</i>	○	○	○	○	○	○	○	○	○	○	○
<i>E. paludosus</i>	○	○	○	○	○	○	○	○	·	·	○
<i>E. ruahinicus</i>	○	○	○	○	○	○	○	○	○	○	○
Australia											
<i>E. mackayi</i>	●	●	●	●	●	●	●	·	●	●	●
<i>E. nitidulus</i>	●	●	●	●	●	●	●	●	●	●	●
<i>E. fordianus</i>	●	●	●	●	●	●	●	●	●	●	●
<i>E. involucratus</i>	○	○	○	○	○	○	○	○	○	○	○
<i>E. collinus</i>	○	○	○	○	○	○	○	○	○	○	○
<i>E. umbricola</i>	○	○	○	○	○	○	○	·	●	○	·

DISCUSSION

In view of the general difficulty in finding discriminating characters for genera in Compositae, it is remarkable that the species in Table 1 fall into two groups separated by four clearly defined and unequivocal characters, as well as three in which the states are difficult to define or observe and another four which are subject to some exception. The stoloniferous habit is one of two characters cited by Anderberg (1991) as definitive of *Euchiton* and restricted within the Gnaphalieae to *Euchiton*, *Antennaria*, and *Parantennaria*. Prostrate stems which could be defined as stolons, i.e., with long internodes and leaves which are reduced in size, without roots, and linking rooted leaf-rosettes, are lacking in the *E. mackayi* group (*E. mackayi*, *E. nitidulus*, and *E. fordianus*) but are characteristic of the *E. involucratum* group (*E. involucratum*, *E. traversii*, *E. audax*, *E. collinus*, *E. lateralis*, *E. limosus*, *E. paludosus*, and *E. ruahenicus*). The second character cited by Anderberg (1991) as definitive of *Euchiton* is the presence of both distal and proximal papillae ("paired papillae") on cells of the cypselae epidermis. This curious feature is present in all members of the *E. involucratum* group but is not recorded from any other genera of Gnaphalieae (Anderberg 1991), nor is it present in the *E. mackayi* group. This has distal papillae only, a feature shared with members of a number of other genera in the tribe including *Helichrysum*, *Pseudognaphalium*, *Chiliocephalum*, *Stuartina*, *Vellereophyton*, *Troglophyton*, *Gnaphalium*, and *Achyrocline* (Anderberg 1991), *Ewartia*, *Leucogenes*, and *Raoulia* (Breitwieser & Ward 2003). The distal papillae of the *E. mackayi* group are sometimes imbricate but sometimes project more or less at right angles to the cypselae surface. Both Drury (1970, 1972) and Anderberg (1991, 1994) referred to all of these as "imbricate papillae". We have generally retained this wording because of common usage but have not used it in formal description.

The occurrence of fibres in the secondary phloem (Drury & Watson 1966) is a feature which Anderberg (1991) regarded as characteristic of Gnaphalieae. The states of this character are sometimes difficult to determine. There may be very little secondary phloem formed, and its fibres may be difficult to distinguish from primary bundle caps. If cambial activity has ceased and all cells have matured, it may be impossible to distinguish between secondary phloem fibres and xylem fibres which protrude into the phloem as a result of uneven cambial activity. In addition, the absence of fibres

from the secondary phloem of a stem is not always indicative of their absence from other stems of the same plant. In spite of these limitations, we are confident that phloem fibres occur in the secondary phloem of all members of the *Euchiton involucratum* group in Table 1 and in none of the *E. mackayi* group.

Distinctive epidermal hairs, often termed twin hairs, with a single basal cell and two unequal longer cells, one arising at the distal end of the basal cell and the other arising at the proximal end and running alongside it for the first part of its length, are very commonly found on the cypselae of Compositae. Twin hairs with somewhat clavate terminal cells are common in Gnaphalieae and were present in all stoloniferous species of *Euchiton* we examined. All cypselae of the *E. mackayi* group were glabrous except for occasional clavate hairs at the distal end, just below the pappus in *E. mackayi*.

There are three more characters in Table 1 which are exactly correlated with the preceding four, but which we regard as less useful discriminators. In the stoloniferous species of the *Euchiton involucratum* group, mature leaves ensheath the inner leaves of the rosette only at the extreme base, whereas in the non-stoloniferous *E. mackayi* group the leaves have broad, sheathing bases which may be half the total length of the leaves. However, this difference may be due to the difference in general growth form, with the suppression of internodes in the rosettes of the stoloniferous species making the leaves much more close-set on the stem. Long, broad, sheathing petioles are a common feature of mat and cushion plants in other genera such as *Ewartia*, *Raoulia*, and *Pterygopappus*.

The style arms of Gnaphalieae are shortly papillose on their ventral, stigmatic surface and the distal ends of epidermal cells at the tip and along the dorsal side of the style arms may also project, to assist the removal of pollen as the closed style grows up through the pollen sacs. These projections, which are often termed sweeping hairs, may be long and very obvious, or quite short and difficult to see, as in *Euchiton*. In all members of the *Euchiton involucratum* group, cells project dorsally along the entire length of the style arm, whereas in the *E. mackayi* group the projections are largely confined to the distal half of the arm. This difference is clearly discernable in living material at anthesis but is sometimes difficult to see in herbarium material.

In *Euchiton* the cells in the basal part of the pappus hairs often project. In the *E. involucratum* group these projections are as long or longer than the width of the hair and sometimes interlock with those of

neighbouring hairs, so that when the hairs are shed some remain together in small groups. In the *E. mackayi* group these basal projections may be short or absent but there is always some tangential fusion of the hairs, so that when they are shed they remain in groups or in a fragile ring. The distinction between interlocking and fusion is not always readily seen.

There are four further characters which show different trends rather than absolute differences between the *Euchiton mackayi* and *E. involucratus* groups. The cypselae in *Euchiton* are usually of the “*Helichrysum* type”, i.e., very small and cylindrical in shape. Some, however, show a trend to increasing size and obovoid shape, both most strongly developed in the *E. mackayi* group. Similarly, the pappus hairs in *Euchiton* are usually very narrow, with a single cell at the tip, and a trend to wider hairs with two cells at the tip is most evident in the *E. mackayi* group.

A number of characters which distinguished stoloniferous *Euchiton involucratus* and *E. traversii* from non-stoloniferous *E. mackayi* and *E. nitidulus* in our initial comparison broke down with additional taxa. Among these we mention anther tails, because in this character there does seem to be a definite trend although it is obscured by numerous exceptions. In some Gnaphalieae, including *Euchiton*, the anthers are prolonged into tails of sterile tissue below the pollen sacs, and the upper part of the filament is thickened to form a “collar”. The tails usually extend at least to the end of the collar in the *E. involucratus* group and are usually much shorter in the *E. mackayi* group, but this character can be variable, even within a single capitulum.

Thirteen currently accepted species of *Euchiton* are not included in Table 1. Based on published information, nearly all of these can be assigned to either the *E. involucratus* or the *E. mackayi* group. All four remaining indigenous New Zealand species (*E. delicatus* (D.G.Drury) Holub, *E. ensifer* (D.G.Drury) Holub, *E. polylepis* (D.G.Drury) Breitw. et J.M.Ward, and *E. sphaericus* (Willd.) Holub) clearly belong to the *E. involucratus* group. *Euchiton delicatus*, *E. ensifer*, and *E. polylepis* are recorded as having a stoloniferous habit and small cypselae (Webb 1988). In addition, *E. ensifer* is recorded as having paired papillae and twin hairs on the cypselae (Drury 1970). *Euchiton sphaericus* is a non-stoloniferous, upright annual with small cypselae (Webb 1988) which have paired papillae and twin hairs (Drury 1970).

Of the Australian species not included in Table 1, *Euchiton litticola* A.M.Buchanan is stoloniferous and has fusiform cypselae with clavate hairs

(Buchanan 1999), which clearly places it in the *E. involucratus* group. *Euchiton poliochlorus* N.G.Walsh is described as rhizomatous and sometimes loosely mat-forming, with long, obovate, glabrous cypselae and pappus hairs fused at the base, and with distal, but not proximal, papillae on the epidermal cells of the cypselae (Walsh 1999a; Rozefelds 2001), which places it in the *E. mackayi* group. *Euchiton argentifolius* is part of a species complex in Australia (including material which has been referred to *E. argentifolius* (N.A.Wakef.) Anderb., *E. traversii*, *Gnaphalium collinum* var. *monocephalum* Hook.f., and *G. collinum* var. *radicans* Benth.) which is currently under revision by one of us (CF).

Of the six remaining species referable to *Euchiton*, *E. japonicus* (Thunb.) Holub is a widespread stoloniferous species with twin hairs and paired papillae on the cypselae (Drury 1970) and is clearly a member of the *E. involucratus* group. The other five species are all endemic to New Guinea (Royen 1983). Two (*E. brassii* (Mattf.) Anderb. and *E. breviscapus* (Mattf.) Anderb.) were transferred to *Euchiton* by Anderberg (1991). Three (*Gnaphalium heleios* P.Royen, *G. chiliastrum* (Mattf.) P.Royen, and *G. clemensiae* Mattf.) have not yet been transferred. Royen’s (1983) “The Alpine Flora of New Guinea” was clearly overlooked by Anderberg (1991) who listed *G. chiliastrum* under *Raoulia* (following Mattfeld 1940) and did not mention the other two species. All five endemic New Guinea species were described and figured by Royen (1983) as stoloniferous, and all have twin hairs except *G. heleios* which has, however, very small cypselae. This suggests that these five species belong to the *E. involucratus* group. Although *E. breviscapus* and *G. clemensiae* have cypselae which are uncharacteristically large for this group, this is also true for several species in New Zealand.

It is apparent that *Euchiton mackayi*, *E. nitidulus*, *E. fordianus*, and *E. poliochlorus* (and possibly part of the Australian *E. argentifolius*-*E. traversii* complex) comprise a species group, here referred to as the *Euchiton mackayi* group, which is distinct from the remainder of *Euchiton*. The question remains whether it is distinct from other genera with which one or more of its species have been associated.

The first of these is *Raoulia*, under which *Euchiton mackayi* was originally described (Buchanan 1882). Both *E. mackayi* and *E. nitidulus* resemble *Raoulia* in their mat-forming habit, small leaves with sheathing, imbricate petioles, and solitary, terminal, sessile capitula. However, *Raoulia* lacks many distinctive features of the *E. mackayi*

group including fibreless phloem, dorsal hairs which extend well down the style arms, and glabrous cypselae, as well as capitula which are conical in shape when young and which become stalked as the fruits develop, florets which are predominantly female, and very short corolla lobes.

Drury (1972, p. 174) noted that his group IV, comprising *G. mackayi* and *G. nitidulum*, "comes very near to the ditypic New Zealand genus *Leucogenes*". Moreover, the only postulated natural intergeneric hybrids involving *Euchiton* have *E. mackayi* and *L. leontopodium* (Hook.f.) Beauverd as the putative parents and have been shown to be morphologically intermediate between these two species (Drury 1972, p. 168). However, *Leucogenes* also forms hybrids with several other genera in the New Zealand Gnaphalieae (Allan 1961; Falvey 1996; Ward 1997; McKenzie 2001) and it, like *Raoulia*, lacks the fibreless phloem, dorsal hairs extending well down the style arms, and glabrous cypselae of the *Euchiton mackayi* group, as well as the conical capitula which become stalked with age, predominantly female florets, and very short corolla lobes. It differs also in the possession of a ray of large white-woolly bracts surrounding the capitulum cluster, pappus hairs with clavate cells at the tip, and equifacial rather than dorsi-ventral leaf anatomy.

Phylogenetic analyses based on molecular (Breitwieser et al. 1999) and morphological and anatomical (Breitwieser & Ward 2003) data provide no support for a close relationship between the *Euchiton mackayi* group and either *Raoulia* or *Leucogenes*. Molecular evidence (Breitwieser et al. 1999) does support a close relationship between it and two species of *Ewartia*, *E. catipes* (DC.) Beauverd and *E. nubigena* (F.Muell.) Beauverd. However, these both lack the fibreless phloem, dorsal hairs which decrease down the style arms, and glabrous cypselae of the *E. mackayi* group, as well as the conical capitula, capitula becoming stalked with age, predominantly female florets, and very short corolla lobes. They also differ in their functionally dioecious breeding system, showy white involucre bracts, broad, opaque pappus hair tips, and equifacial leaf anatomy.

Euchiton forms a clade with *Stuartina*, *Gnaphalium*, *Troglophyton*, and *Vellereophyton* in Anderberg's phylogenetic analysis of Gnaphaliinae (1991, p. 34). The *Euchiton mackayi* group lacks the defining characters of *Stuartina*, namely five (cf. two) vascular bundles in the cypselae and hook-shaped involucre bracts. It also lacks truncate style branches with sweeping hairs restricted to the apex,

small, oblong cypselae with clavate twin hairs, and dimorphic pappus hairs with apical cells subclavate in the hermaphrodite florets, all of which are characteristic of *Gnaphalium*. The defining features of *Troglophyton*, capitula on filiform peduncles and an effuse habit, are lacking in the *E. mackayi* group, as are other features shared by *Troglophyton* and *Vellereophyton* such as fibres in the phloem, white-tipped involucre bracts, truncate style branches with sweeping hairs restricted to the apex, small, oblong cypselae with clavate twin hairs, and pappus hairs with clavate apical cells.

Homoplasy is so rife in the Gnaphalieae that hypothesised relationships must be open to question. We therefore checked all genera of Gnaphalieae in Anderberg's (1991) data matrices for the tribe and subtribes for the occurrence of two diagnostic features of the *Euchiton mackayi* group, absence of phloem fibres and presence of imbricate papillae. No genera were recorded as having both of these features.

Evidence has been presented in this paper for the morphological distinctness of the *Euchiton mackayi* group from the stoloniferous species of *Euchiton* and from all other genera of Gnaphalieae. Of particular note is the complete lack in the *E. mackayi* group of the two synapomorphic characters of *Euchiton*, stolons and paired papillae. Monophyly of the *E. mackayi* group is supported by evidence from ITS sequences. In the strict consensus tree of Breitwieser et al. (1999, fig. 2), *E. mackayi* and *E. nitidulum* from New Zealand and *E. mackayi* (as *Euchiton* sp.) and *E. argentifolius* from Australia form a clade, with *Ewartia catipes* and *E. nubigena* as its sister group. It is clear that there is ample support for erecting a new genus to encompass the *Euchiton mackayi* group, which we do formally below. We provide new combinations for *E. fordianus*, *E. mackayi*, *E. nitidulum*, and *E. poliochlorus*. Any new combinations for taxa in the *E. argentifolius*-*E. traversii* complex in Australia await the outcome of the present revision (CF).

TAXONOMY

Argyrotegium J.M.Ward et Breitw., gen. nov.

Herbae perennes, tegetes formantes, non-stoloniferae. Phloema sine fibris. Folia alternata, in superficiebus ambabus tomentosa. Petiolus latus, vaginans. Capitula solitaria vel pauca simul in fasciculis terminalibus. Bractae involucri papyraceae

stramineae vel brunneae dilutae, stereomos non-divisus plerumque. Receptaculum planum epaleatum. Flosculi externi filiformes feminei, flosculi centrales tubulares hermaphrodites. Ramuli styli obtusi pilis dorsalibus et apicalibus induti, pili dorsales decrescentes basin versus. Cypselae obovoideae 1 mm longiores, cellulae epidermidis papilla singulata distali instructae, pili didymi absentes plerumque. Pili pappi capillares, cellulae apicales acutae, duo plerumque singulae interdum, basi turmis vel annulo fragili connati.

Typus: *Argyrotegium mackayi* (Buchanan) J.M.Ward et Breitw.

Perennial herbs, usually forming mats. Stems usually prostrate, much-branched, leafy, rooting from nodes, upturned at tips, phloem without fibres. Leaves alternate, simple, entire; lamina tomentose on both surfaces, usually flat; sheath usually at least half length of lamina. Capitula solitary or few together in terminal clusters, conical and sessile at anthesis, opening and becoming stalked as fruits develop. Involucral bracts spirally arranged, changing gradually from outer to inner bracts; outer bracts shorter, broader; lamina of inner bracts papery, straw-coloured to pale brown, stereome-lamina gap sometimes partly crimson; stereome usually undivided. Receptacle flat, epaleate. Florets all tubular with corolla colourless or entirely crimson or crimson in part only; outer florets filiform, female, usually more numerous than central florets. Central florets broader, hermaphrodite; corolla lobes short, erect; anther apical appendage flat, tails usually not exceeding filament collar; style branches obtuse with hairs dorsally and apically, dorsal hairs decreasing downwards. Mature cypselae usually obovoid, more than 1 mm long; each epidermal cell with microscopic, single, distal papilla; twin hairs usually absent. Pappus hairs slender, capillary, narrowing at apex; apical cells acute, usually two or sometimes single; bases fused in groups or in a fragile ring, sometimes with patent cilia or shorter protrusions.

ETYMOLOGY: The generic name is derived from the Greek words *argyreon*, silver, and *tegium*, a little mat, referring to the predominant leaf colour and mat- or patch-forming growth habit.

ORTHOGRAPHY: The specific epithet *mackayi* is written as *m'kayi* in the original description (Buchanan 1882) but as *mackayi* in the caption to the accompanying figure. Since two forms are used in the protologue, one must be chosen, following Articles 60 and 61 of the International Code of Botanical Nomenclature (Greuter et al. 2000). Article

60.1 states that the original spelling of an epithet is to be retained. Article 61.3 states that if orthographical variants of a name appear in the original publication, the one that conforms to the rules and best suits the recommendations of Article 60 is to be retained. Recommendation 60.4 gives *mac* in preference to *mc* or *m'*. Thus, the variant *mackayi* in the original publication is to be retained. Fortunately this is the variant which has been in use since it was taken up, without comment, by Cheeseman (1906).

DISTRIBUTION: New Zealand, Australia (Tasmania, Victoria, and New South Wales).

HABITAT: Subalpine and alpine, often in wetter areas such as stream, bog, and lake margins, but also in grassland and herbfield.

Argyrotegium fordianum (M.Gray) J.M.Ward et Breitw., comb. nov.

BASIONYM: *Gnaphalium fordianum* M.Gray, *Contrib. Herb. Aust.* 26, 2 (1976).

SYNONYM: *Euchiton fordianus* (M.Gray) P.S.Short in Wilson et al., *Muelleria* 7, 521 (1992).

Argyrotegium mackayi (Buchanan) J.M.Ward et Breitw., comb. nov.

BASIONYM: *Raoulia m'kayi* Buchanan, *Trans. N.Z. Inst.* 14, 354 (1882).

SYNONYMS: *Gnaphalium traversii* var. *mckayi* (Buchanan) Kirk, *Stud. Fl. N.Z.*, 299 (1899).

Gnaphalium mackayi (Buchanan) Cockayne, *Vegetation of N.Z.* (2nd ed.), 439 (1928).

Euchiton mackayi (Buchanan) Anderb., *Op. Bot.* 104, 167 (1991).

Argyrotegium nitidulum (Hook.f.) J.M.Ward et Breitw., comb. nov.

BASIONYM: *Gnaphalium nitidulum* Hook.f., *Handbk. N.Z. Fl.*, 154 (1864).

SYNONYM: *Euchiton nitidulus* (Hook.f.) Anderb., *Op. Bot.* 104, 167 (1991).

Argyrotegium poliochlorum (N.G.Walsh) J.M.Ward et Breitw., comb. nov.

BASIONYM: *Euchiton poliochlorus* N.G.Walsh, *Muelleria* 12, 225 (1999).

ACKNOWLEDGMENTS

We thank John Lovis and Paul Wilson for comments on the draft manuscript, Neville Walsh for the translation of the diagnosis, Dick Brummitt for helpful discussion on

nomenclature, the New Zealand Department of Conservation, the Tasmania Parks and Wildlife Service, the New South Wales National Parks and Wildlife Service, and the Hobart City Council for permission to collect plant material, the staff of the Tasmanian Herbarium and the Centre for Plant Biodiversity, Canberra, for helpful advice and access to herbarium specimens, and Roger Good for sharing so much of his time and knowledge at Kosciuszko. Funds for part of this research were provided to IB by the New Zealand Foundation for Research, Science and Technology.

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Appendix 1 Voucher specimens of material examined.***Euchiton audax***

NEW ZEALAND: Canterbury, Cameron V., *C. J. Burrows*, Dec 1964, CANU 9304; Otago, L. Hawea town, *A. T. Dobson*, 7 Jan 1974, CANU 019530.

E. collinus

NEW ZEALAND: Canterbury, Banks Peninsula, *A. T. Dobson*, 25 Oct 1971, CANU 016980; Marlborough, Tennyson Inlet, *M. C. Barker* 7415, 1 Jan 1974, CANU 019596.

AUSTRALIA: NSW, Kosciuszko N.P., *J. M. Ward* 96058 & *J. D. Lovis*, 29 Jan 1996, CANU 38614; Tasmania, Mt Field N.P., *J. M. Ward* 00023 & *J. D. Lovis*, 14 Apr 2000, CANU 38615.

E. fordianus

AUSTRALIA: NSW, Kosciuszko N.P., *J. M. Ward* 96057 & *J. D. Lovis*, 29 Jan 1996, CANU 38617; Tasmania, Central Highlands, *J. M. Ward* 94063 & *J. D. Lovis*, 4 Feb 1994, CANU 38137; Tasmania, Ben Lomond N.P., *J. M. Ward* 00035 & *J. D. Lovis*, 17 Apr 2000, CANU 38618.

E. involucratus

NEW ZEALAND: Canterbury, Waitaki R. mouth, *J. M. Ward* 91215, 1 Apr 1991, CANU 38609; Canterbury, Waitaki R. mouth, *J. M. Ward* 93099, 29 Nov 1993, CANU 38610; Southland, Clifden, *A. T. Dobson*, 18 Jan 1973, CANU 018790.

AUSTRALIA: Tasmania, Lake Highway near Projection Bluff, *J. M. Ward* 95123/2 & *J. D. Lovis*, 29 Jan 1995, CANU 38210.

E. lateralis

NEW ZEALAND: Nelson, St Arnaud Ra., *J. M. Ward* 93012 & *J. D. Lovis*, 23 Jan 1993, CANU 38612; Canterbury, Mt Hutt, *J. M. Ward* 95059 & *J. D. Lovis*, 1 Apr 1995, CANU 38270; Canterbury, Mt Hutt, *I. Breitwieser* & *J. M. Ward* 00007, 26 Feb 2000, CANU 38613.

E. limosus

NEW ZEALAND: Canterbury, Mt Hutt, *A. T. Dobson*, 11 Mar 1973, CANU 018991; Southland, Te Anau, *A. T. Dobson*, Jan 1975, CANU 20991.

E. mackayi

NEW ZEALAND: Southland, Blue Mtns, *J. M. Ward* 66237, 15 Jan 1966, CANU 34793; Southland, Borland-Grebe Saddle, *D. G. Lloyd* 67197, 20 Jan 1967, CANU 11457; Canterbury, Cass, *R. McKenzie*, Feb 1996, CANU 38602; Otago, Nevis R., *J. M. Ward* 91049, 3 Jan 1991, CANU 38603.

AUSTRALIA: Tasmania, Mt Field N.P., *J. M. Ward* 94038 & *J. D. Lovis*, 30 Jan 1994, CANU 38619; Tasmania, Pine Lake, *J. M. Ward* 94064 & *J. D. Lovis*, 4 Feb 1994, CANU 38138; Tasmania, Ben Lomond N.P., *J. M. Ward* 94099 & *J. D. Lovis*, 6 Feb 1994, CANU 38161; Tasmania, Mt Field N.P., *J. M. Ward* 96208 & *J. D. Lovis*, 16 Dec 1996, CANU 38620; Tasmania, Ben Lomond N.P., *J. M. Ward* 00039 & *J. D. Lovis*, 17 Apr 2000, CANU 38604; Tasmania, Mt Wellington, *J. M. Ward* 00058/2 & *J. D. Lovis*, 24 Apr 2000, CANU 38605.

E. nitidulus

NEW ZEALAND: Canterbury, Cass, *J. M. Ward* 80027/1, 25 Feb 1980, CANU 33811; Nelson, Mt Maling, *J. M. Ward* 89111, 13 Feb 1989, CANU 32790; Nelson, Island Saddle, *J. M. Ward* 65212, 14 Feb 1965, CANU 34799.

AUSTRALIA: Kosciuszko N.P., *J. M. Ward* 96035/2 & *J. D. Lovis*, 28 Jan 1996, CANU 38606; Kosciuszko N.P., *J. M. Ward* 96039/1 & *J. D. Lovis*, 30 Jan 1996, CANU 38607; Tasmania, Ben Lomond N.P., *J. M. Ward* 00037/1 & *J. D. Lovis*, 17 Apr 2000, CANU 38608.

E. paludosus

NEW ZEALAND: Fiordland, L. Monk, *C. J. Burrows*, Jan 1965, CANU 9233; Canterbury, L. Heron, *A. T. Dobson*, 21 Dec 1972, CANU 018819.

E. ruahinicus

NEW ZEALAND: Westland, near Franz Josef, *A. T. Dobson*, 6 Jan 1974, CANU 019527; Nelson, Mt Owen, *D. G. Lloyd* 65337, 1 Apr 1965, CANU 11455.

E. traversii

NEW ZEALAND: Nelson, Red Hills, *J. M. Ward* 671142, 12 Dec 1967, CANU 38623; Canterbury, L. Ohau, *J. M. Ward* 99074, 30 Nov 1999, CANU 38611; Canterbury, Cass, *J. M. Ward* 65214, 28 Jan 1965, CANU 29788.

E. umbricola

AUSTRALIA: *I. Breitwieser* 701 & *R. Vogt*, 29 Jan 1996, CANU 31788; Tasmania, Cradle Mtn N.P., *J. M. Ward* 99058 & *J. D. Lovis*, 16 Jan 1999, CANU 38616.

