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A new species of *Olearia* (Asteraceae: Astereae) from the Australian Capital Territory and adjacent New South Wales

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Abstract

Olearia heloderma Albr. & I.Telford*, sp. nov.*, a distinctive species from the mountainous region near the Australian Capital Territory and New South Wales border is described and illustrated, with notes on distribution, habitat, conservation status, relationships and features distinguishing it from other species of *Olearia*.

Introduction

As currently circumscribed, *Olearia* Moench is the largest genus of tribe Astereae in Australia with ca. 113 species (Schmidt-Lebuhn 2022). Molecular phylogenies have demonstrated its non-monophyly (Cross et al. 2002). Recent work on Astereae in New Zealand centred on *Celmisia* Cass. and relatives has confirmed that the species of *Olearia* are divided into two distantly related clades. The first clade is subtribe Brachyscominae Nesom, a predominantly Australian lineage including ca. 90 species of *Olearia*, the genera *Brachyscome* Cass., *Calotis* R.Br., *Vittadinia* A.Rich., *Minuria* DC., and many smaller genera; the second clade is subtribe Celmisiinae Saldivia comprising *Celmisia*, the remainder of *Olearia*, and a few small island genera (Nesom 2020a; Saldivia & Nicol 2023).

Nesom (2020b) proposed to split ten new genera from the Australian lineage of *Olearia*, several of them to accommodate only one or two species. However, this proposed taxonomy has not yet found broad acceptance. In support of the suggested genera, Nesom cited the results of Cross et al. (2002). Although a major advance at the time, these results were based on only a single sequence region, and sampling of fewer than half the species of *Olearia* and a few species from related genera. Those results also provided little topological resolution to support this level of taxonomic change, with much of the tree forming two large polytomies.

In 1975, amateur botanist Margaret Parris discovered a distinctive species of *Olearia* (*sens.lat.*) in the mountainous region near the Australian Capital Territory and New South Wales border. Further searches by Ian Telford and colleagues in 1980s and 1990s uncovered additional populations in the vicinity. A manuscript name, *Olearia rhizomatica*, was published as a *nomen nudum* by Lander (1992) who was revising *Olearia*. The Australian Plant Census (Council of Heads of Australasian Herbaria 2011) adopted the phrase name *Olearia* sp. Rhizomatica (I.R.Telford 11549) based on Lander's manuscript name, but the species has remained without a formally published name despite being recognised as distinct for over 40 years.

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All Populations of *Olearia* sp. Rhizomatica in the ACT were burnt by the 2019–2020 'Black Summer' bushfires, and many in NSW https://www.bushfirefacts.org/fire-maps.html. Based on the potential post-fire impacts of herbivory, *Olearia* sp. Rhizomatica was identified as one of 486 plant species having a high priority for urgent management intervention to support recovery from the 2019–2020 bushfires (see https://www.dcceew.gov.au/environment/biodiversity/bushfire-recovery/bushfire-impacts/priority-plants).

The Bushfire Recovery project 'Survive and Thrive', which currently has an Australian Capital Territory-focus, was borne out the need to develop *ex-situ* vegetative and seed stocks as insurance against extinction in the wild due the impact of wildfire or climate change. Of the twelve species from the Australian Alps bioregion identified as having a high priority for urgent management intervention, *Olearia* sp. Rhizomatica was selected as one of five species to be initially targeted for the 'Survive and Thrive' project (https://parkstrust.org.au/survive-and-thrive/). The increased focus on *Olearia* sp. Rhizomatica has provided impetus to formally publish this species.

Methods

Preserved specimens housed at the Australian National Herbarium (CANB, including CBG) and live, cultivated material grown under favourable conditions at the Australian National Botanic Gardens (ANBG) were examined when preparing the species description. Capitula on pressed specimens were rehydrated with boiling water prior to assessing floral characters. Capitula length was measured from the base of involucre to tip of the corolla lobes of the disc florets. Involucre diameter was measured at anthesis. Anther length includes the terminal appendages.

Cultivated material of underground structures that give rise to shoots was fixed in 70% ethanol. Hand-cut transverse sections were made with a single-sided razor blade in distilled water, transferred to 0.5% toluidine blue O (Feder & O'Brien 1968) for ca. 20 s, washed twice in distilled water and mounted on a microscope slide in distilled water, covered with a glass slip, and examined under bright field using a Nikon Eclipse 90i motorised compound microscope and Nikon DSRI1 Colour Digital Camera.

Nearly all Australian species of Asteraceae tribe Astereae, including *Olearia* sp. Rhizomatica, were sequenced for Angiosperms 353 target capture data (Johnson et al. 2019). The phylogeny is being prepared for publication (Stephanie Chen et al., unpubl. data) and discussing it in detail is beyond the scope of this paper, so we restrict ourselves to commenting on the placement of *Olearia* sp. Rhizomatica. Laboratory, bioinformatic, and phylogenetic methods followed Schmidt-Lebuhn & Grealy (2024).

Taxonomy

Olearia heloderma Albr. & I.Telford, ***sp. nov.***

Type: New South Wales: Southern Tablelands: Scabby Range, head of Sams Creek, 3 km S of Mt Kelly, 22 Jan 1982, *I.R.Telford 11541, F.E.Davies, A.M.Lyne & S.York* (holo: CBG 9200477!; iso: AD, BRI, HO, MEL, NSW, PERTH).

Olearia rhizomatica Lander, *nom. inval.*, in G.J.Harden (ed.), *Fl. New South Wales* 3: 195 (1992).

Olearia rhizomatica J.D.Briggs & Leigh, *nom. inval., nom. nud.*, J.D.Briggs & J.H.Leigh, *Rare or Threatened Austral. Pl.* 32 (1996).

Olearia sp. Rhizomatica (I.R.Telford 11549) Australian National Herbarium [Council of Heads of Australasian Herbaria (2011), *Australian Plant Census*].

Ascending to spreading low *shrub* to 40 cm high, sometimes spreading vegetatively by root suckers. *Indumentum* on stems, leaves, peduncles and involucral bracts consisting of flagellate hairs (eglandular simple hairs with a wispy terminal extension) and sometimes also shorter gland-tipped hairs (when present most visible on leaf and involucral bract margins). *Stem* internodes with decurrent longitudinal ribs extending downwards from either side of leaf bases; young branchlets with a moderate to dense indumentum dominated by flagellate hairs, distinctly sparser or absent immediately below leaf attachment. *Leaves* alternate, often crowded, spreading to ascending, sessile, mildly aromatic when crushed, stub-like bases persisting on older stems; lamina shallowly conduplicate, narrowly cuneate to spatulate in outline, (3–)5–16 mm long, (1–)2.0–6.2 mm wide at widest point distally, 0.5–1.4 mm wide at narrowest point proximally, concolorous, green, adaxial surface glabrous or with very sparse gland-tipped hairs and/or flagellate hairs along midvein, abaxial surface glabrous or with gland-tipped and/or flagellate hairs along midvein; texture rather thick when fresh, particularly just in from the margins (hereafter submargins) which are glandular verrucose abaxially, the uneven texture becoming more accentuated when dry with sunken and raised regions including a somewhat keeled midvein abaxially; venation indistinct apart from midvein; base gradually narrowing, though sometimes broadening slightly at attachment; margins flat, with scattered gland-tipped and/or flagellate hairs, a distal tooth or lobe sometimes present on one or both sides of the blade below the 3-lobed apex, rarely with both marginal and apical lobes absent; apical lobes acute to obtuse, muticous or rarely with a tiny acute terminal callus. *Capitula* terminating the main axes and lateral shoots, solitary, pedunculate, radiate, 6.0–8.0 mm long, 18–33 mm diameter. *Peduncles* 15–68 mm long, indumentum dense though underlying tissue partly visible, with a few short antrorse bracts (resembling the outer involucral bracts) along their length. *Involucre* hemispherical, 6.6–12 mm diameter; bracts 35–55, 3–4-seriate, all strongly reflexed after fruit shed; outer involucral bracts subulate, 2.0–5.7 mm long, 0.3–0.7 mm wide, sometimes curving outward in the distal half, green, midvein inconspicuously glandular verrucose, glabrous or with scattered marginal gland-tipped and/or flagellate hairs, margins non-membranous, apex long acute; inner involucral bracts narrowly lanceolate, 2.8–6.0 mm long, 0.6–1.1 mm wide, green, midvein inconspicuously glandular verrucose, glabrous, hyaline scarious margins 0.05–0.2 mm wide, serrulate, apex long acute. *Receptacle* convex, 2.0–4.0 mm across, with short irregular projections between the floret scars. *Ray florets* 20–51, 1–2-seriate, female, corolla tube 2.0–4.0 mm long, with very sparse minute antrorse simple hairs externally, especially near apex, rarely virtually glabrous; ligules 6.5–13.0 mm long, 1.2–2.6 (–3.0) mm wide, violet, apex rounded, shortly 3-lobed, occasionally ray florets producing 1–2 shorter and narrower additional ligules; stylar arms linear, 0.7–1.0 mm long. *Disc*

florets 32–88, bisexual, yellow, corolla tube 3.0–5.2 mm long, with very sparse minute antrorse to spreading simple hairs externally, especially near apex, rarely virtually glabrous; corolla lobes 0.7–1.3 mm long, acute; anthers 1.3–2.0 mm long including narrowly triangular sterile terminal appendages c. 0.4 mm long; stylar arms narrowly oblong to linear–oblanceolate, 0.7–1.0 mm long. *Cypsela* oblong-elliptic to oblong-obovoid, elliptical in cross-section, 1.7–2.3 mm long, 0.6–0.8 mm wide, 0.3–0.5 mm thick, light brown, 6–9–ribbed, with appressed or antrorse white duplex hairs throughout, carpopodium slightly oblique. *Pappus* 2-seriate (outer row of bristles usually incomplete); longer bristles 22–36, 3.2–5.3 mm long, outer row of bristles much shorter, white. (Fig. 1)

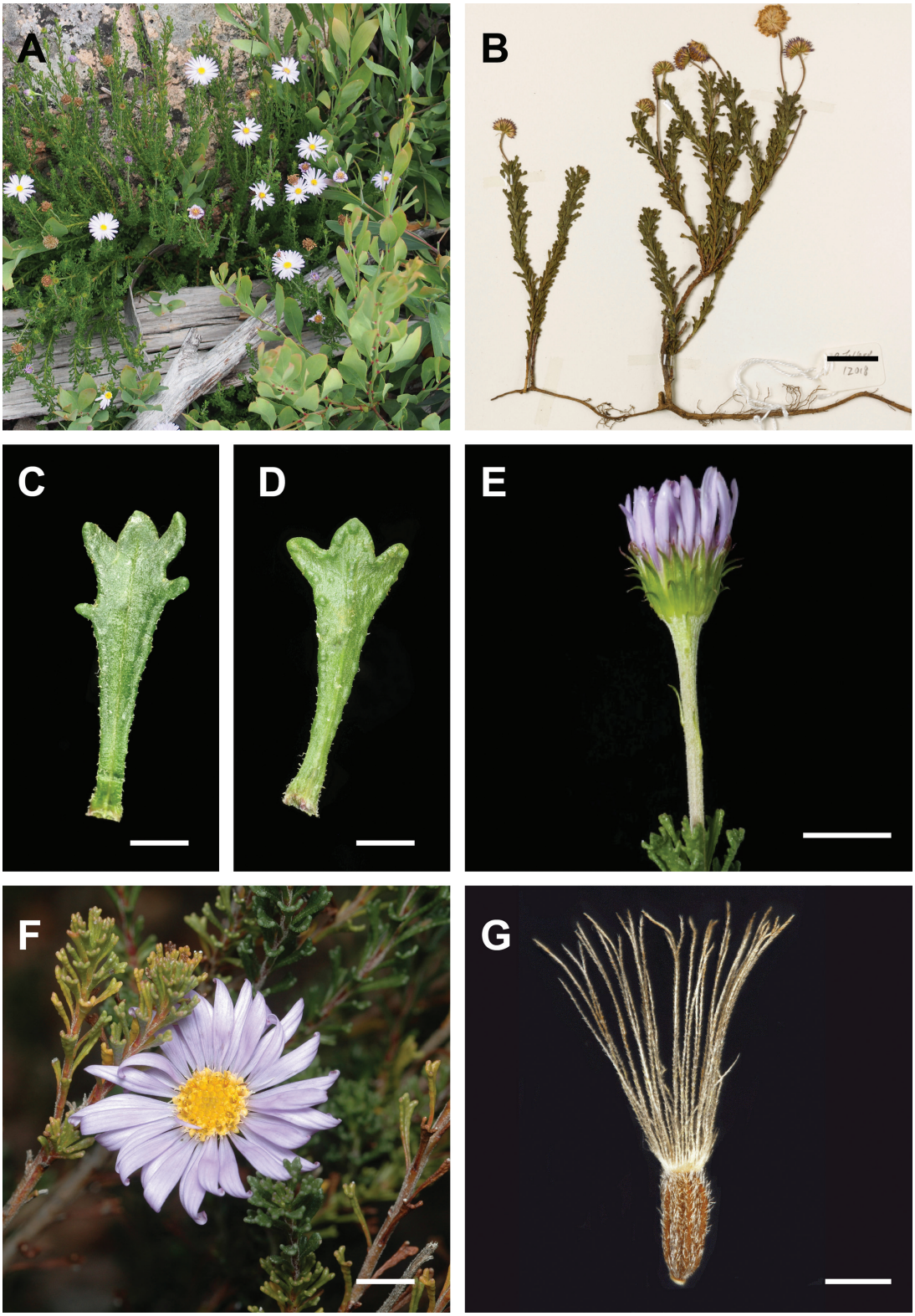

Fig. 1. *Olearia heloderma*: **A,** habit, with broader-leaved *Daviesia mimosoides* at right; **B,** specimen showing root suckering; **C,** detached leaf showing adaxial surface; **D,** detached leaf showing abaxial surface; **E,** capitulum in late bud; **F,** capitulum at anthesis; **G,** cypsela. Scale bars: A = 20 mm; C & D = 2 mm; E & F = 5 mm; G = 1 mm. Images A by A.McLachlan from *T.North 2296*; B by Centre for Australian National Biodiversity Research from *I.R.Telford 12018 & D.J.Mallinson*); C–F by M.Fagg from *I.R.Telford 11541 & F.E.Davies, A.M.Lyne, S.York*; G, by J.FitzGerald from *T.North* 2310.

Diagnostic characters: A distinctive species distinguished from other species of *Olearia* by the following combination of characters: root-suckering low shrub; indumentum densest on stems and peduncles and dominated by flagellate, eglandular hairs; leaves alternate, narrowly cuneate to spatulate, crowded, rather short with distinctive lobing and glandular verrucose submargins; involucral bracts with inconspicuously glandular verrucose midvein; ligules violet, cypsela 1.7–2.3 mm long, 6–9-ribbed and with appressed or antrorse white duplex hairs throughout.

Specimens examined: NEW SOUTH WALES: Southern Tablelands: Scabby Range Nature Reserve, 2.9 km W of Mt Gudgenby, on tributary of Sams Creek, 9 Jan 2003, *I. Crawford 7331* (CANB); Scabby Range, Namadgi National Park, 17 Dec 1987, *P.Gilmour 6328* (CBG); c. 60 km S of Canberra, Yaouk Bill Range, Yaouk Peak. c. 150-200m SE of trig, 9 Jan 1996, *L.Halasz 2* (CANB, NSW, PERTH); Namadgi National Park, Scabby Range, 2.5 km SSW of Mt Kelly, 22 Jan 1992, *I.R.Telford 11542* (CBG); Gurrangorambla Range, Mount Morgan, 12 Jan 1994, *I.R.Telford 12018 & D.J.Mallinson* (CBG, NSW, PERTH). AUSTRALIAN CAPITAL TERRITORY: c. 0.5 km NW of Namadgi Trig, Namadgi National Park, 18 Dec 1987, *P.Gilmour 3353* (CBG); Big Creamy Flat, Namadgi National Park, 3 Feb 1988, *P.Gilmour 6569* (CBG, NSW); Sentry Box, Scabby Range, Namadgi National Park, 17 Jan 2022, *T.North 2296* (CANB); Sentry Box Hill, 3 May 1975, *M.Parris s.n.* (CBG); Sentry Box Hill, 1 km ENE of summit, 14 Jan 1981, *I.R.Telford 8584 & M.Parris* (CBG, NSW, PERTH); Sentry Box Hill, 1 km ENE of summit, 14 Jan 1981, *I.R.Telford 8592 & M.Parris* (CBG); Sentry Box Hill, 1 km ENE of summit, 18 Mar 1981, *I.R.Telford 8626* (CBG); Gudgenby Nature Reserve, c. 1 km SE of Sentry Box Hill, 3 Apr 1984, *I.R.Telford 9668* (CBG); Namadgi National Park, Scabby Range, head of Porcupine Creek, 2.5 km SE of Yaouk Gap, 11 Mar 1992, *I.R.Telford 11549* (CBG, MEL, NSW, PERTH); Namadgi National Park, Scabby Range, Mt Scabby, headwaters of Cotter River, 11 Mar 1992, *I.R.Telford 11555* (CBG, NSW); Namadgi National Park, Scabby Range, ACT-NSW border fence, 2.5 km SE of Yaouk Gap, 11 Mar 1992, *I.R.Telford 11556* (CBG). CULTIVATED: Australia National Botanic Gardens, nursery np1, 11 Nov 2021, *R.Purdie 12895* (CANB).

Distribution: Based on specimens at CANB and CBG, *Olearia heloderma* is currently known from approximately 12 sites dispersed around the border region between the ACT and NSW centred on the Scabby Range Nature Reserve (Fig. 2). Additional populations are likely to be discovered with further targeted survey effort, however much of the area within the species extent of occurrence is time-consuming and challenging to access by foot due to the terrain. Helicopter access is an easier, though more expensive option for facilitating further survey.

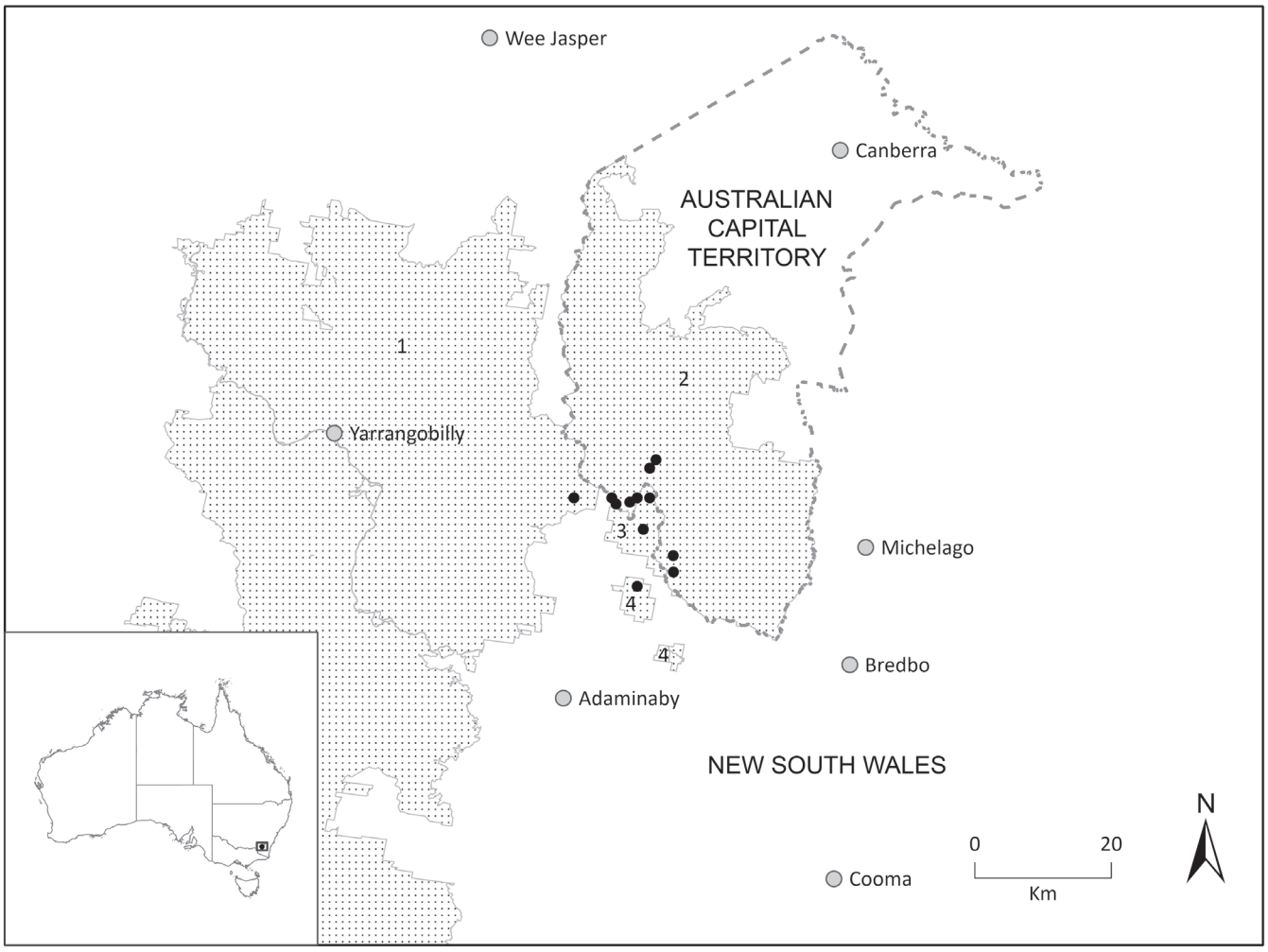

Fig. 2. Distribution of *Olearia heloderma* (solid black circles) based on specimens in Australian herbaria. Conservation reserves shown in stipple: 1 = Kosciuszko National Park, 2 = Namadgi National Park, 3 = Scabby Range Nature Reserve, and 4 = Yaouk Nature Reserve.

Conservation status: All known populations of *Olearia heloderma* occur within conservation reserves. In the ACT it occurs within the Bimberi Wilderness zone of Namadgi National Park. In NSW it occurs within Kosciuszko National Park, Scabby Range Nature Reserve and Yaouk Nature Reserve.

The species is currently not listed as threatened in New South Wales or the Australian Capital Territory, however assessment of its conservation status is hampered by limited knowledge of population sizes and threatening processes. Data associated with herbarium collections indicate that some sites have few plants, whilst it is common at other sites. The species appears to resprout post-fire, however no data are currently available on post-fire seedling recruitment. A limited quantity of seed is currently stored in the ANBG seed bank.

Habitat: *Olearia heloderma* occurs in mountainous granitic terrain at elevations of 1450 to 1800 m. Most occurrences are on gentle to steep slopes of various aspect, but it has also been found on ridge tops. Plants grow in gravelly loam derived from decomposing granite, often amongst outcropping rocks (Fig. 3). Most records are from subalpine vegetation types including *Eucalyptus pauciflora* woodland, shrubland and heathland. There is a solitary record from *Eucalyptus delegatensis*-dominated tall montane open forest. Frequently recorded associated species include *Daviesia* spp., *Eucalyptus pauciflora*, *Kunzea muelleri*, *Leptospermum* spp., *Oxylobium ellipticum*, *Poa* spp., *Podolobium alpestre* and *Veronica perfoliata*.

Fig. 3. Typical habitat of *Olearia heloderma* on Mt Namadgi. Image by E.Cook (no voucher).

Phenology: Flowering specimens have been collected in the field from December to April and fruiting specimens in March and April. As very limited fieldwork has been undertaken in other months, the recorded flowering and fruiting period may be inaccurate. Cultivated plants afforded frost protection have flowered as early as August in the ANBG.

Etymology: The specific epithet is a noun in apposition and derived from the Greek, *helos*- nail, stud or wart (see Brown 1956: 842) and *derma*- skin, in reference to the glandular verrucose leaf submargins, and the resemblance of the leaf submargin texture to the skin of the helodermatid lizard *Heloderma suspectum* Cope, the Gila Monster.

Affinities: *Olearia heloderma* is very distinctive morphologically and unlikely to be confused with any other species of *Olearia sens. lat.*, particularly on account of its short, narrowly cuneate to spatulate leaves with a 3-lobed apex and glandular verrucose submargins.

The evolutionary relationships of *Olearia heloderma* are currently not well resolved except that it is related to the main Australian lineage of *Olearia* as opposed to Celmisiinae (Stephanie Chen et al., unpubl. data). Preliminary phylogenetic analyses using Angiosperms353 target capture data (Johnson et al. 2019) failed to place the species consistently, and sometimes in an isolated position. A possible reason is that relatively limited data were recovered for the sample, with e.g. sequences available for only 91 of the 262 genes that were used in one of the analyses. It can therefore not be said with certainty if *O. heloderma* is part of *Olearia sens. str.* or any of the segregate genera proposed by Nesom (2020b). Because of the absence of firm evidence, and given that the majority of Australian species of *Olearia* in the preliminary analyses formed a large clade including the type species of the genus, we have chosen to describe *O. heloderma* under *Olearia*. Future work should aim to test the phylogenetic relationships of this species, and this may warrant a subsequent transfer to a different genus.

Notes: Initially, it appeared that upright shoots produced away/remote from the parent plant were rhizomes, hence the epithet as originally proposed by Lander, and subsequently adopted as part of the phrase name. Our investigations (Fig. 4) have shown that the underground more-or-less horizontal structures are roots and the vertical growths from them 'root suckers'. The anatomy of these structures in transverse section (Fig. 4B) is typical of eudicot roots without central pith, with central xylem, the vascular tissue surrounded by cortex, and the formation of lateral roots initiated to the outside of the vascular cylinder (cf. Raven et al. 1999).

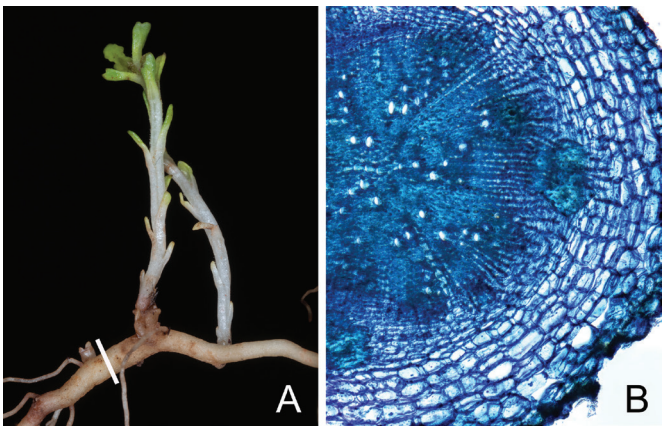

Fig. 4. Underground structures in *Olearia heloderma*: **A.** root with several thin lateral roots and two stem shoots visible. White line indicates location of transverse section; **B.** transverse section of root stained with Toluidine Blue O with primordial lateral roots developing (staining lighter blue) at 3 and 6 o'clock. Scale: A, Root diameter at white line = 1.2 mm; B, Root radius 0.6 mm. Images by J.J. Bruhl from *R.Purdie 12895* (CANB).

The multicellular, flagellate, eglandular hairs found on stems, leaves, peduncles and involucral bracts frequently break off but may retain a persistent base. These persistent hair bases could be confused with short gland-tipped hairs, which are sometimes present and most visible on the leaf and involucral bract margins.

Olearia heloderma (as *Olearia* sp. Rhizomatica) is included in the key to New South Wales species of *Olearia* (PlantNET 2023), however, to arrive at *O. heloderma* a user would have to follow the 'leaves viscid on upper surface' lead in one of the key couplets. This requires correction, because although the leaves have glands embedded in the leaf tissue there is no evidence of the upper surface being viscid.

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