New species of *Olearia* (Asteraceae: Astereae) from Western Australia

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Abstract

Lander, N.S. New species of *Olearia* (Asteraceae: Astereae) from Western Australia. *Nuytsia* 18: 97–106 (2008). Two new species of *Olearia* Moench endemic to the Mallee and Coolgardie Bioregions respectively in the South-West Botanical Province of Western Australia are described: *O. newbeyi* Lander and *O. trifurcata* Lander. *Olearia pimeleoides* subsp. *incana* D.A.Cooke, widely distributed across southern Australia, is formally raised to specific rank. Descriptions, distribution maps, illustrations, and notes on affinities, habitat and conservation status are provided for all three species.

Introduction

Prior to the preparation of an account of *Olearia* Moench (Asteraceae) in the ongoing *Flora of Australia* series it is necessary to formally describe a number of new species. The two taxa newly described here were first collected by farmer and botanist Ken Newbey (1936–1988) of Ongerup. Both are endemic to Western Australia where they are restricted to the Mallee and Coolgardie Bioregions. In addition, the combination *Olearia incana* (D.A.Cooke) Lander, previously published illegitimately (Lander 1992) is formalised.

My taxonomic studies of Australian species currently recognized as *Olearia* are ongoing and it is highly likely that generic and infrageneric concepts will change as a result of molecular-phylogenetic studies (Cross *et al.* 2002).

The descriptive terminology used in this paper follows Radford (1986). In particular, I have used 'texture' to refer to the 'substance' or 'consistency' of an organ rather than its surface configuration. For more specific terms applied to the Asteraceae I have followed Jeffrey (2007).

The descriptions in this paper were prepared using the DELTA suite of programs (Dallwitz, 1980; Dallwitz *et al.* 1993) and lightly edited to improve readability. The maps were prepared using the program *DIVA-GIS* (Hijmans *et al.* 2006). Distributions are summarised in terms of the *Interim Biogeographic Regionalisation for Australia (IBRA) version 6.1*, established by Department of the Environment, Water, Heritage and the Arts (2008).

Olearia incana (D.A.Cooke) Lander, *stat. et comb. nov.* — *Olearia incana* Lander in G.J. Harden, *Fl. New South Wales* 3: 192 & fig. (1992), *nom. inval.* — *Olearia pimeleoides* subsp. *incana* D.A.Cooke, *J. Adelaide Bot. Gard.* 7(3): 281 (1985); D.A. Cooke in J.P. Jessop, *Fl. South Australia* 3: 1483–1484).

Type: '*c.* 5 km S of Maralinga, 30.vii.1969, *B. Copley* 2695 (*holo*: AD 96937169).'

Olearia lanatus auct., non *Olearia lanata* Koster, *Nova Guinea, Bot.* 24: 536–537 (1966) – [W.R.] Phillipson, *in sched.* (1938).

Shrub to 1.5 m high; vegetative surfaces glandular and lanate with multicellular, uniseriate, simple and biseriate, vesicular trichomes. Stems ascending, pale brown or grey; bark slightly rough. *Leaves* alternate, scattered or rarely crowded, ascending, sessile or subsessile. Lamina flat, narrowly elliptic or cuneate, 2–18 mm long × 1–4 mm wide, concolorous, white, green, grey (greenish grey, pale grey or white-lanate), sub-coriaceous, smooth; venation indistinct apart from mid-vein; abaxial vestiture densely hairy with multicellular, uniseriate, simple and biseriate, vesicular trichomes; adaxial vestiture densely hairy, with multicellular, uniseriate, simple and biseriate, vesicular trichomes; base cuneate; margin revolute, entire or irregularly and coarsely dentate; apex broadly acute or rounded, muticous. *Heads* terminal, solitary or in clusters of 2 or 3, subsessile, conspicuously radiate, 20–46 mm in diameter; disc 6–12 mm in diameter; peduncular bracts absent; involucre conic (obconic) or hemispheric. *Involucral bracts* 3–6-seriate, 2.5–7.5 mm long × 1.4–2.0 mm wide. *Outer involucral bracts* strongly cymbiform, ovate; stereome green or brown; abaxial vestiture ± uniform, basally glabrous to densely pubescent, apically sparsely to densely pubescent; trichomes multicellular, uniseriate, simple and biseriate, vesicular; margin membranous, fimbriate; apex broadly acute, the same colour as the stereome. *Inner involucral bracts* somewhat cymbiform, elliptic or narrowly triangular; stereome green and brown (apically); abaxial vestiture ± uniform, basally glabrous, apically sparsely or densely pubescent; trichomes multicellular, uniseriate, simple and biseriate, vesicular; margin membranous, fimbriate; apex broadly acute, the same colour as the stereome. *Receptacle* convex. *Ray florets* 11–21, female, 1-seriate, 9.8–21.3 mm long, white. Staminodes absent. Floral tube abaxially glabrous basally to sparsely pubescent apically with biseriate, simple trichomes. *Ligule* glabrous, narrowly elliptic or obovate, 7–17 mm long × 2.3–3.5 mm wide, glabrous; apex minutely 3-lobed. *Stylar arms* narrowly filiform; 1.5–3.2 mm long. *Disc florets* 20–27, bisexual, pale yellow, infundibular, 6.7–9.2 mm long, glabrous basally to sparsely pubescent apically with biseriate, simple trichomes; lobes 5, 1.0–1.5 mm long; apex acute. *Anthers* 2.5–3.6 mm long; basal lobes acute, shorter than the filament collar; filament collar 0.4–0.6 mm long; sterile appendage triangular. *Stylar arms* 1.8–3.0 mm long; sterile appendage half-conic with botuliform sweeping-hairs. *Achene* narrowly ellipsoid, 1.8–2.3 mm long × 0.6–1.0 mm wide, brown, densely sericeous, with duplex hairs and biseriate, vesicular trichomes; venation indistinct; carpopodium conspicuous; apex truncate. Pappus uniseriate or biseriate with 37–56 minutely barbellate, bristles, equal in length to the tubular florets.

Flowering period. July–October.

Selected specimens examined (from a total of 108). WESTERN AUSTRALIA: Kookadine, *s. dat.*, *A. Forrest s.n.* (MEL); Victoria Desert, Camp 39, 22 Sep. 1891, *R. Helms s.n.* (PERTH); Eucla, 1882, *J. Oliver s.n.* (MEL); 'Albion Downs', 13 miles [20.8 km] NW of Woolshed, 17 Sep. 1958, *N.H. Speck* 1476 (PERTH). SOUTH AUSTRALIA: Italowie Creek, Aug. 1979, *P.E. Conrick* 102, (AD); Maitland, Sep. 1890, *W. Gill* 157 (MEL); Quorn [as 'Flinders Range'], May 1900, *M. Koch* 240 (ED, MEL); Fowlers Bay, 1880, *A.F. Richards s.n.* (MEL). VICTORIA: Swan Hill, Oct.1888, *C. French s.n.* (MEL, P); Lake Albacutya, Sep. 1897, *C. French s.n.* (MEL, P); *s. loc.*, Dec. 1853, *J. Mueller s.n.* (MEL); Wimmera [River], *s. dat.*, *Anonymous* 18 (MEL); Dandenong Range, *s. dat.*, *s. leg.* (MEL). NEW SOUTH WALES: Tooma Rapids, *s. dat.*, *[Miss] Campbell s.n.* (MEL); Barrier Range, June 1889, *J.F. Irvine s.n.* (MEL); Wagga, 1886, *R. Thom s.n.* (MEL); Darling River, 1889, *[Miss] Urquhart s.n.* (MEL); Castlereagh [River], *s. dat. W. Woolls s.n.* (MEL).

Habitat. In open woodlands and forest, on dunes, flats and valley floors, in sandy and loamy soils, often over limestone.

Distribution. Widespread across southern Australia, occurring in the Avon Wheatbelt region in the South-west Botanical Province, and the Murchison, Coolgardie, Great Victoria Desert, Nullarbor and Hampton Bioregions in the Eremaean Botanical Province of Western Australia; the Great Victoria Desert, Nullarbor, Gawler, Eyre York Block, and Flinders Lofty Block Bioregions of South Australia; Broken Hill Complex, Mulga Lands, Darling Riverine Plain, Brigalow Belt South, Cobar Peneplain, Riverina, South Western Slopes, and South Eastern Highlands Bioregions of New South Wales; and the Murray Darling Depression, Victorian Midlands and South Eastern Highlands Bioregions of Victoria (Figure 1).

Affinities. The densely lanate vestiture on the vegetative parts of *Olearia incana* is typical of *Olearia* sect. *Eriotriche* where this species would seem best retained. Its affinities appear to lie with *O. pimeleoides* (DC.) Benth. *sens. str.*, from which it is readily distinguished: the leaves of *O. pimeleoides* are discolorous, subglabrous and green adaxially, grey-woolly hairy abaxially; its heads are solitary or in loose panicles; its achenes are obovoid; and its pappus is comprised of 39–65 bristles.

Typification. The combination *Olearia incana* Lander (1992: 192 & figure) was invalid under ICBN Article 33.3 since there is no direct reference to the author of its basionym and the place of valid publication with page or plate reference and date. This oversight is corrected here.

A single specimen of this taxon collected at Coolgardie by C.A. Gardner (PERTH 0052966) was labelled '*Olearia lanatus* auct.' by [W.R.] Phillipson in 1938, which suggests that the W.A. taxon may have been recognised as a species at that time in Western Australia. Phillipson (a New Zealand professor of botany) appears to have coined a number of species names in this way. The name *Olearia lanata* was published formally by Josephine Koster (1966: 536–537), who applied it to a New Guinea species.

Notes. Cooke (1985: 181) notes that '[*Olearia pimeleoides*] subsp. *incana* appears to be parapatric with the typical subspecies at the south-eastern edge of its range, which is almost entirely through more arid habitats than the range of subsp. *pimeleoides*.' However, mapping the occurrence of the 108 collections of *O. incana* and 815 specimens of *O. pimeleoides sens. str.* examined in the course of this study (Figure 1) shows them in fact to be very broadly overlapping over much of southern Australia. Furthermore, unlike that of *O. incana*, the distribution of *O. pimeleoides sens strict.* is strikingly disjunct for it is absent entirely in the Great Victoria Desert and Nullarbor Plain Bioregions.

Although the morphological differences between *Olearia incana* and *O. pimeleoides* are seemingly not great they are maintained in a wide range of habitats over an enormous geographical area. Thus both taxa are recognised here as species.

Conservation status. This species is very widely distributed and is neither rare nor endangered.

Etymology. From the Latin *incanus*, referring to the greyish foliage of this species.

Figure 1. Distribution of *Olearia incana* (•) and *O. pimeleoides* (o).

Olearia newbeyi Lander, *sp. nov.*

Olearae stuartii affinis sed capitulis flosculis radii 76–85 in 3–4 seriebus, non 21–64 in serie singulari, et 6–11 (non 20–72) flosculis disci, antheris 0.83–0.93 (non 1.6–3.3) mm longis, acheniis 0.6–1.1 (non 2.0–2.3) mm longis, et setis pappi longitudine flosculos disci paulo superantibus (non sub-aequalibus) differt.

Typus: [locality withheld for conservation reasons], 21 January 1985, *K.R. Newbey* 10897 (*holo*: PERTH 06105424 – 3 sheets).

Shrub to 0.3 m high × 0.30–0.35 m wide. Vegetative parts sparsely hairy with biseriate, capitate, glandular trichomes. Stems ascending to erect; bark smooth, minutely multi-ribbed, pale brown to green, otherwise purple. *Leaves* appressed, sessile, clasping, crowded in fascicles, becoming scattered and alternate as the branches extend, slightly conduplicate. Lamina flat, 2–12 mm long × 0.8–4.0 mm wide, broadly linear to narrowly oblong, smooth, concolorous, dull medium-green; midvein distinct; vestiture uniform, sparsely glandular with long thin and short broad, capitate, glandular trichomes; texture fleshy to herbaceous; base shallowly cordate; margin variably serrate; apex acute. *Heads* terminal, in paniculate conflorescences, 5–8 mm in diameter, pedunculate, minutely radiate; peduncle 2–20 mm long × 0.2–0.4 mm wide; bracts several, grading into those of the involucre; involucre cup-shaped; bracts 4-seriate, flat, 1.7–4.7 mm long × 0.4–0.8 mm wide, glandular with long thin and short broad, biseriate, capitate trichomes and occasional biseriate, simple, glandular trichomes; apex narrowly acute; margin membranous, ciliate. *Outer involucral bracts* narrowly triangular, dark to

pale green, purple apically; abaxial surface uniformly sparsely glandular; adaxial surface sparsely glandular apically, otherwise glabrous. *Inner involucral bracts* narrowly linear to triangular, dark yellow or purple, sparsely glandular apically to centrally, subglabrous basally. *Receptacle* slightly concave or flat. *Ray florets* 76–85, female, 3–4-seriate, 1.9–3.7 mm long, dull medium purple. Staminodes absent. Floral tube sparsely hairy apically with biseriate, simple, eglandular trichomes. *Ligule* elliptic, linear or oblong, 1.5–2.0 mm long × 0.16–0.33 mm wide, sparsely hairy basally; apex 2–3-lobed. *Stylar arms* 0.5–1.0 mm long × 0.1 mm wide, narrowly filiform, the stigmatic area limited to the apical region. *Disc florets* 6–11, bisexual, 2.3–2.9 mm long, buccinate, sparsely hairy apically and centrally with biseriate, simple, eglandular trichomes; lobes 5–6, 0.40–0.56 mm long, acute. *Anthers* 0.83–0.93 mm long, narrowly acute; lobes fused to filament collar; sterile appendage narrowly to very narrowly ovate; filament collar 0.16–0.26 mm long. *Stylar arms* 0.50–0.96 mm long × 0.10–0.13 mm wide; sterile appendage half-clavate, with botuliform sweeping-hairs. *Achenes* 0.6–1.1 mm long × 0.2–0.3 mm wide, narrowly to very narrowly ellipsoid to obovoid, pale brown, uniformly densely hairy with duplex and glandular hairs; venation indistinct; base truncate; carpopodium conspicuous, central or oblique; apex truncate. *Pappus* uniseriate with 18–30 barbellate bristles, slightly longer than the tubular florets. (Figure 2)

Flowering period. January.

Habitat. On disturbed roadside in shrubland in loamy sand over a granite apron.

Distribution. Known from a single population in the Mallee Bioregion of the South-west Botanical Province of Western Australia. (Figure 3)

Affinities. The sparsely glandular-hairy vestiture on vegetative surfaces of *Olearia newbeyi* is typical of *Olearia* sect. *Merismotriche* Archer ex Benth., where this species would seem best placed. Its affinities may lie with *O. stuartii* (F.Muell.) F.Muell. ex Benth., from which it is readily distinguished: the capitula of *O. stuartii* have 21–64 ray florets in a single series and 20–72 disc florets, its anthers are 1.6–3.3 mm long, and its achenes are 2.0–2.3 mm long with a pappus of bristles subequal to the disc florets.

Conservation status. Further investigation is required for an accurate assessment of the conservation status of this species; therefore it is currently classified as category 1K of Briggs and Leigh (1996) and as Priority One of the Western Australian Flora Conservation Codes adopted by the Department of Environment and Conservation (DEC).

Etymology. The specific epithet refers to the collector of this species, farmer and botanist Ken Newbey (1936–1988) of Ongerup, Western Australia (Kenneally 1988).

Olearia trifurcata Lander, *sp. nov.*

Olearia passerinoides affinis sed ramificatione trifurcata non divaricata, foliis in sectione transversali anguste triangularibus non teretibus, capitulis flosculi radii 2–4 non 6–16, flosculis disci 3, non 14, et acheniis setis pappi 40–52 non 25–40, differt.

Typus: *c.* 1 km SE of Kau Rock, 33 ° 24' 35" S, 122° 19' 53" E, *c.* 60 km NE of Esperance, 13 January 1990, *W. Archer s.n.* (*holo*: PERTH 1292471; *iso*: AD, CHR, K, MEL).

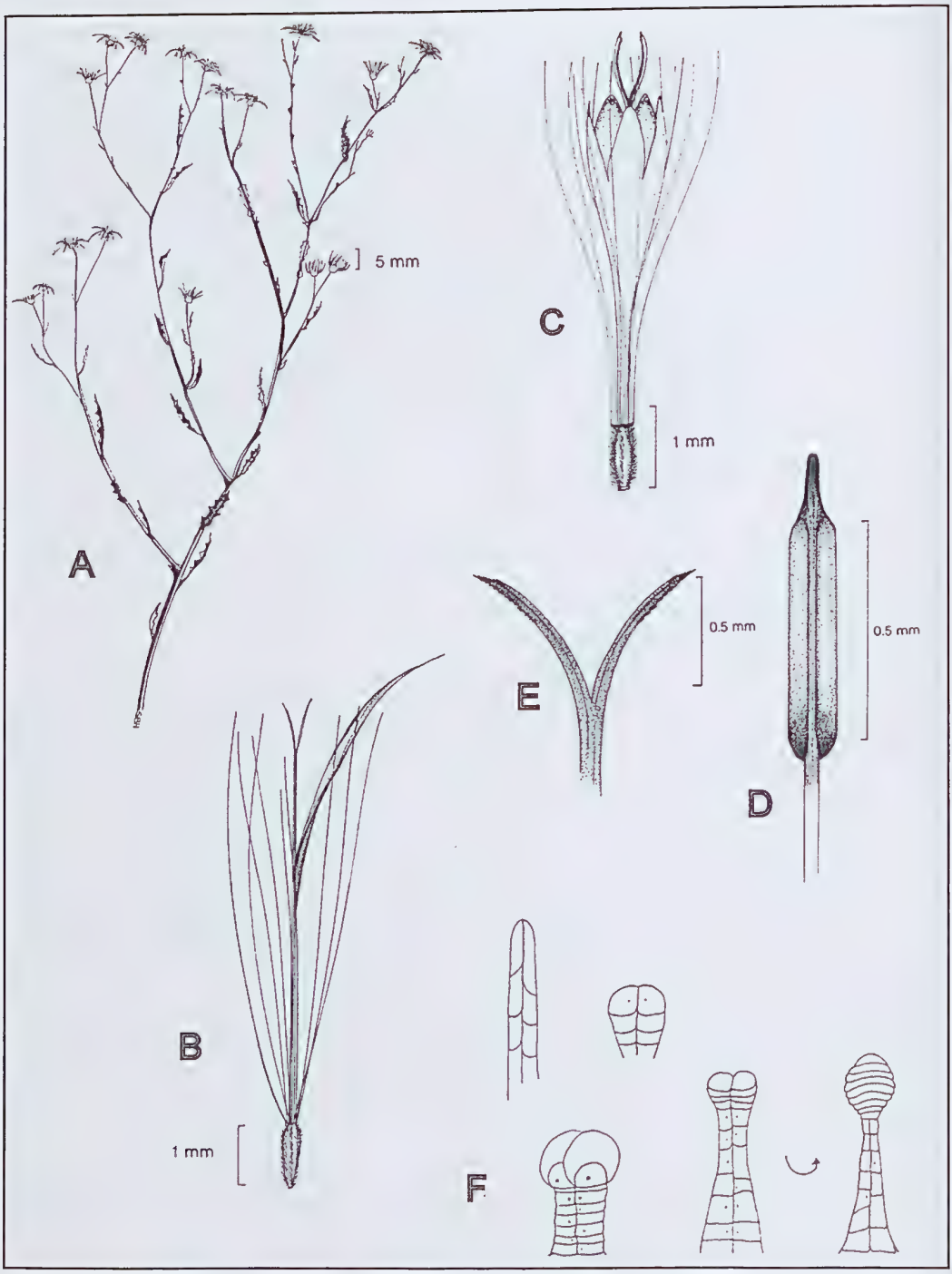

Figure 2. *Olearia newbeyi*. A – habit; B – ray floret; C – disc floret; D – anther; E – stylar arms; F – trichomes. Drawn from *K. Newbey* 10897 (*holo*: PERTH 06105424).

Figure 3. Distribution of *Olearia newbeyi* (o) and *O. trifurcata* (■).

Subshrub, dense, upright, tussock-like, to 0.3 m high × 0.4 mm wide; vegetative surfaces pustulate and viscid, but otherwise glabrous. Stems trifurcate, pale green. *Leaves* opposite, sessile. *Lamina* very narrowly triangular, 1.2–8.0 mm long × 0.8–1.0 mm wide, conduplicate, pale green, pustulate and viscid, indurate; base somewhat dilated; margin entire; apex acuminate, somewhat recurved, mucronulate. *Heads* solitary, terminal, sessile, radiate, 8–12 mm in diameter; disc 2.5–5.0 mm in diameter. Involucre narrowly obconic or ovoid; bracts 4–5-seriate, 0.9–7.7 long × 0.5–2.2 mm wide. *Outer involucral bracts* triangular, carinate; stereome green, pustulate, viscid; margin narrowly membranous, irregularly serrulate; apex acute. *Inner involucral bracts* narrowly elliptic, carinate; stereome pale and smooth basally, green and pustular apically; margin narrowly membranous, irregularly serrulate; apex acute. *Receptacle* slightly convex. *Ray florets* 2–4, uniseriate, radiate, female; corolla 7.5–8.0 mm long, white. Staminodes absent. Floral tube 3.2–3.6 mm long, with scattered biseriate, eglandular hairs. *Ligule* broadly elliptic or obovate, 4.8–5.0 mm long × 2.5–2.6 mm wide, minutely 3-lobed apically. *Stylar arms* filiform, 1.1–1.5 mm long, minutely papillose abaxially. *Disc florets* 3, bisexual; corolla cylindric, 5.0–5.7 mm long, pale yellow; tube 4.1–4.2 mm long, with biseriate, eglandular hairs scattered basally; lobes narrowly triangular, 1.0–1.5 mm long. *Anthers* 1.9–2.0 mm long; apical appendages elliptic; basal lobes acute and shorter than the filament collar; filament collar 0.5–1.0 mm long; filaments attached 1.5 mm from base of tube. *Stylar arms* filiform, 1.9–2.4 mm long × 0.5–0.6 mm wide, with narrowly triangular apical appendages bearing minutely botuliform papillae above the stigmatic lines. *Achene* obovoid, 1.7–2.3 mm long × 1.0–1.3 mm wide, pale brown, sericeous with long, duplex hairs; base acute; carpopodium, inconspicuous, central; apex truncate. *Pappus* uniseriate with 40–52 minutely barbellate bristles, more or less equal to the tubular florets. (Figure 4)

Flowering period. January to February.

Other specimens examined. WESTERN AUSTRALIA: *c.* 1 km SE of Kau Rock, *c.* 60 km NE of Esperance, 3 Feb. 1990, *W. Archer s.n.* (PERTH 1216724); 1 km NE of Kau Rock, *c.* 65 km NE of

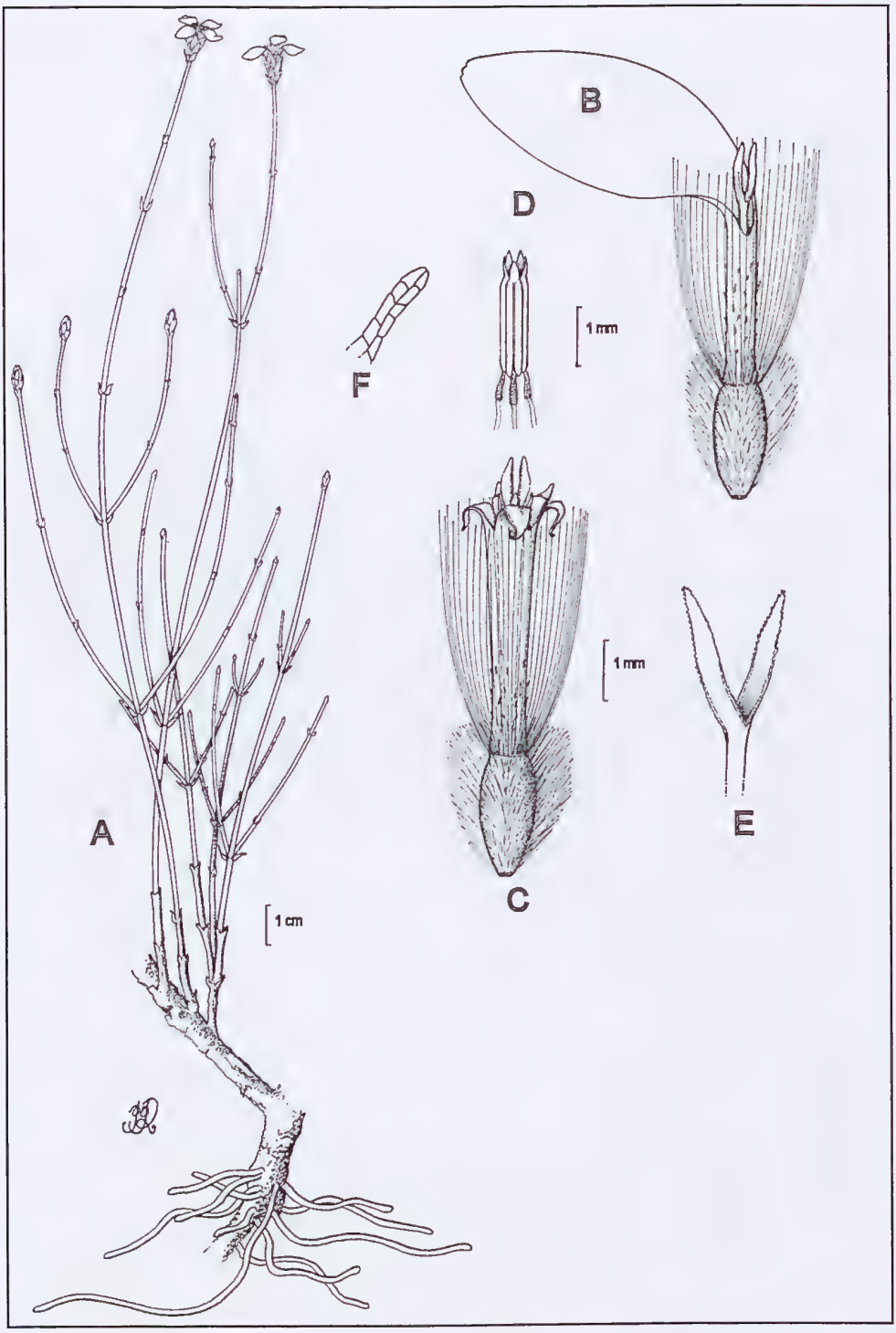

Figure 4. *Olearia trifurcata*. A – habit; B – ray floret; C – disc floret; D – anthers; E – stylar arms; F – trichome. Drawn from *W. Archer s.n.* (*holo*: PERTH 1292471).

Esperance, 7 Jan. 1996, *W. Archer* 701961 (PERTH 05423368); 11 km ENE of Mt Ridley, 10 Feb. 1990, *W. Archer* 1002902 (PERTH 1215752); island in SE portion of Lake Halbert, 17 Feb. 1990, *W. Archer* 1702904 (PERTH 1215760); NW shore of Lake Halbert, 5 km ENE of Mt Ridley, 24 Feb. 1990, *W. Archer* 2402901 (PERTH 1216716); N shore of Lake Halbert, 6.5 km ENE of Mt Ridley, 24 Feb. 1990, *W. Archer* 2402902 (PERTH 1215744); SW shore of Lake Halbert (0.5 km SSW of 2402901), 24 Feb. 1990, *W. Archer* 2402903 (PERTH 1231472); 93 km ESE of Kambalda, 31 Mar. 1997, *W. Archer* 3103971 (PERTH); 2 km SE of Widgiemooltha, 18 Aug. 1981, *K.R. Newbey* 8559 (PERTH 1679341); 2 km SE of Widgiemooltha, 22 Jan. 1985, *K.R. Newbey* 10887 (AD, BRI, HO, MEL, NSW, NT, PERTH 2391503 & 1280031).

Distribution. Known from the Mallee Bioregion of the South-West Botanical Province of Western Australia where it occurs over an area of some six hectares around Lake Halbert and several other salt lakes in the vicinity, and from the Coolgardie Bioregion of the Eremaean Botanical Province of Western Australia where it occurs around a salt lake immediately south-east of Widgiemooltha, and on a rocky alluvial slope from a sandstone outcrop above a playa lake (Figure 3).

Habitat. Playa lake margins in sub-saline, sandy loam amongst halophytic low shrubland in the *Stipa* zone, 0.3–1.0 m above water level.

It has been suggested that the Kau Rock site may be influenced by the presence of gypsum (W. Archer, pers comm.). If so, this species might be added to the list of gypsophiles found in Australia noted by Parsons (1976). The recently described *Olearia arckaringensis* Lang is also gypsophilous (Lang, in press).

Affinities. The pustulate, viscid vegetative surfaces of *Olearia trifurcata* are typical of *Olearia* sect. *Merismotriche* Archer ex Benth., where this species would seem best placed. Its affinities may lie with *O. passerinoides* (Turcz.) Benth., from which it is readily distinguished: the stems of *O. passerinoides* are divaricately branched; its leaves are compressed-terete and slightly concave above; its ray florets are 6–15; its disc florets are 10–14 and are mauve to pink; its pappus bristles are 25–40. *O. passerinoides* is widespread in Victoria, South Australia and Western Australia.

Notes. The underground branching radiates like the spokes of a wheel, equally from the centre of the plant. The unusually thick, unbranching, hairy roots spread horizontally (far in excess of the foliage) and are contained within the top 50 mm of soil where the pH is neutral: the compacted soil beneath is alkaline with a pH of 8.5 (W. Archer, pers. comm.)

The trifurcate branching observed in this taxon is remarkable and has been observed in no other species of *Olearia*.

Conservation status. This species is confined to a single habitat type and has a restricted distribution with a geographic range of less than 250 km. However, it is estimated that there are some 7000 individuals at sites in the Lake Halbert area alone (W. Archer, pers. comm.) and 1000 individuals at the Kambalda site (W. Archer, pers. comm.), and it is also common at the Widgiemooltha site (K.R. Newbey, pers. comm.). Currently, it appears to be neither endangered nor vulnerable.

Etymology. The specific epithet refers to the unusual branching characteristic of this species.

Acknowledgements

I am indebted to the late Mr Kenneth R. Newbey of Ongerup for first drawing two of these species to my attention, and to Mr William Archer of WA Nurseries, Mt Merivale, for his exhaustive search for further populations of *Olearia trifurcata* and for his detailed field observations. I am grateful to Ms Susan Harris for the illustration of *O. newbeyi* and to Mr John J. Rainbird for the illustration of *O. trifurcata.* Mr Paul Wilson provided the Latin diagnoses and offered a number of useful comments on a draft of this paper. I thank the following herbaria for access to and/or the loan of specimens from their collections: AD, AK, BH, BM, BRI, CANB, CBG, CGE, CHR, CO, DBN, ED, FL, G, HO, K KPBG, L, LD, MEL, NSW, P, TCD, and WRSL.

References

Briggs, J. & Leigh, J. (1996). *Rare or threatened Australian plants*. (CSIRO Publishing: Collingwood, Vic.)

Cooke, D.A. (1985). Studies in the tribes Astereae and Inuleae (Compositae). *Journal of the Adelaide Botanic Gardens* 7(3): 273–287.

Cooke, D.A. (1986). *Olearia. In*: Jessop, J.P. & Toelken, H.R. (eds) *Flora of South Australia.* Part III. Polemoniaceae – Compositae. 4th ed. pp. 1475–1486. (South Australian Government Printing Division: Adelaide.)

Cross, E.W., Quinn, C.J. & Wagastaff, S.J. (2002). Molecular evidence for the polyphyly of *Olearia* (Astereae: Asteraceae). *Plant Systematics & Evolution* 235: 99–120.

Dallwitz, M.J. (1980). A general system for coding taxonomic descriptions. *Taxon* 29: 41–46.

Dallwitz, M.J., Paine, T.A., & Zurcher, E.J. (1993–). *User's guide to the DELTA System: a general system for processing taxonomic descriptions.* 4th ed. http://delta-intkey.com

Department of the Environment, Water, Heritage and the Arts (2008). *Interim Biogeographic Regionalisation for Australia (IBRA), Version 6.1.* http://www.environment.gov.au/parks/nrs/science/bioregion-framework/ibra/index.html [accessed 8 May 2008]

Hijmans, R.J., Guarino, L., Jarvis, A. & O'Brien, R. (2006). *DIVA-GIS 5.4.0.1.* http://www.diva-gis.org [accessed June 2008]

Jeffrey, C. (2007). Compositae: introduction with key to tribes. *In:* Kadereit, J.W. & Jeffrey, C. (eds) *The families and genera of vascular plants. VIII. Flowering plants - eudicots: Asterales*. pp. 61–87. (Springer: Berlin.)

Jessop. J.P. (ed.) (1993). *A list of the vascular plants of South Australia.* 4th ed. (Botanic Gardens of Adelaide & State Herbarium: Adelaide.)

Kenneally, K.F. (1988). Obituary: Ken Newbey (1936–1988). *Western Australian Naturalist* 17(6): 126–127.

Lander, N.S. (1992). *Olearia. In*: Harden, G.J. (ed.) *Flora of New South Wales*. Vol. 3, pp. 185–197. (University of New South Wales Press: Kensington, NSW.)

Lang, P.J. (in press). *Olearia arckaringensis* (Asteraceae: Astereae), a new endangered Daisy-bush from northern South Australia. *Journal of the Adelaide Botanic Gardens*.

Parsons, R.F. (1976). Gypsophily in plants – a review. *American Midland Naturalist* 96: 1–20.

Radford, A.E. (1986). *Fundamentals of plant systematics*. (Harper & Row: New York.)