



Taxonomic evaluation of *Ptilotus manglesii* (Amaranthaceae) and recognition of *P. davisii* for two phrase names in south-west Western Australia

Timothy A. Hammer

Western Australian Herbarium, Biodiversity and Conservation Science, Department of Biodiversity, Conservation and Attractions, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983
Email: timhammer09@gmail.com

Abstract: Evaluation of *Ptilotus manglesii* (Lindl.) F.Muell. (Amaranthaceae) and two phrase-named taxa from south-west Western Australia support recognition of the new species *Ptilotus davisii* T.Hammer. The new species is morphologically similar to *P. manglesii*, but clearly differentiated from it in vegetative and floral characters. The differences between *P. manglesii* and *P. davisii* are discussed and a key is provided. The taxonomic and nomenclatural history of *P. manglesii* is also discussed and lectotypifications are made.

Keywords: Amaranthaceae, new species, nomenclature, *Ptilotus*, taxonomy, typification

Introduction

Ptilotus R.Br. (Amaranthaceae) includes approximately 120 species, of which 93 are native to Western Australia (Hammer *et al.* 2018). Most species occur in arid and semi-arid regions of Australia, while smaller numbers are native to mesic climates (see Hammer 2019). *Ptilotus manglesii* (Lindl.) F.Muell., commonly “pom pom” or “rose-tipped mulla mulla”, is endemic to the winter-wet Mediterranean climate of the Southwest Australian Floristic Region, a global biodiversity hotspot (Hopper & Gioia 2004).

Ptilotus manglesii was originally included within *Trichinium* R.Br. as *T. manglesii* Lindl. (Lindley 1839). *Trichinium* and *Ptilotus* were described by Brown (1810), who considered them to be close, but differentiated on the basis of *Trichinium* having more hairs on the exterior surface of the flowers. Poiret (1816) was not convinced that the genera were distinct and therefore chose to unite them as separate sections under the name *Ptilotus*. Despite this early synonymisation, many authors (e.g. Lindley 1839; Fielding & Gardner 1844; Moquin-Tandon 1849; Bentham 1870) continued to recognise *Trichinium* as distinct from *Ptilotus*, while other authors (e.g. Mueller 1868, 1882; Schinz 1893) continued to include *Trichinium* under *Ptilotus*. The genera have remained united since Black (1948). The union of the two genera is supported by recent molecular phylogenies (e.g. Hammer *et al.* 2019b), which indicate that they are not reciprocally monophyletic. See Hammer (2019) for further discussion on the taxonomic history of *Ptilotus* and *Trichinium*.

Fielding and Gardner (1844) included an illustration and description of *Trichinium manglesii* and erected *T. spectabile* Fielding & Gardner, which they differentiated from *T. manglesii* on the basis of its longer linear leaves (as opposed to broader and more spatulate leaves in *T. manglesii*). Moquin-Tandon (1849) included both species in his treatment of *Trichinium* and recognised the new variety *T. manglesii* var. *angustifolium* Moq., distinguishing it from var. *manglesii* on the basis that it had longer and narrower leaves. Although Moquin-Tandon included *T. spectabile* in his treatment, he was not convinced that it was distinct from *T. manglesii* var. *angustifolium*, adding the note “An [or] *T. manglesii* var. *angustifolium*?” under the description of *T. spectabile* (Moquin-Tandon 1849: 289).

Mueller (1868) combined all species of *Trichinium* under *Ptilotus*, and treated *T. spectabile* as a synonym of his new combination *P. manglesii*. Bentham (1870) did not follow Mueller in the synonymisation of the genera, but did, however, follow him in including *T. spectabile* under *T. manglesii*, remarking “the broad and narrow-leaved specimens, distinguished as *T. manglesii* and *T. spectabile*, are so much intermixed and connected by intermediates that they cannot be reckoned as marked varieties” (Bentham 1870: 228). No mention was made by either author of Moquin-Tandon’s *T. manglesii* var. *angustifolium*. Since Mueller and Bentham’s broader circumscriptions of *P. manglesii*, the taxonomy of this species has remained stable.

Several specimens were collected in the southern part of the range of *Ptilotus manglesii* from 1992 to 2005

that were initially included within the morphological variation of *P. manglesii*, or as *P. aff. manglesii*. These specimens varied from the typical *P. manglesii* in being smaller plants with shorter inflorescences and flowers and having narrower basal leaves at the level of or extending above the inflorescences (i.e. having leaves longer than flowering stems). The growing number of specimens with this morphology led to the erection of two phrase-names at the Western Australian Herbarium (PERTH), *Ptilotus* sp. Beaufort River (*G.J. Keighery 16554*) in 2004 and *P. sp.* Porongurup (*R. Davis 10805*) in 2005. *Ptilotus* sp. Beaufort River was differentiated from the earlier phrase-name due to its ovoid inflorescences (subsequent specimens were globose) and a slightly shorter and denser abaxial sepal indumentum (R. Davis, pers. comm.). The present study evaluates the status of these phrase-names with respect to the morphological variability of *P. manglesii* across its geographic range.

Methods

This study was based on examination of dried specimens of *Ptilotus manglesii*, *P. sp.* Beaufort River and *P. sp.* Porongurup housed at PERTH. Specimens were critically evaluated irrespective of current determinations and compared to the protologues and type specimens. Scans of type specimens were accessed through JSTOR Global Plants (<https://plants.jstor.org/>) and the herbarium catalogues of Kew (<https://apps.kew.org/herbcat/gotoHomePage.do>) and Museum National d'Histoire Naturelle (<https://science.mnhn.fr/institution/mnhn/collection/p>). The staff at the National Herbarium of Victoria (MEL) kindly arranged for type specimens to be scanned and made available for use in this study.

Results and discussion

No morphological characters were found that clearly segregate the specimens of *Ptilotus* sp. Beaufort River from those of *P. sp.* Porongurup. Measurements of floral and vegetative characters for the two phrase names overlap considerably. The differentiation of *P. sp.* Porongurup from *P. sp.* Beaufort River on the basis of having a slightly shorter and denser abaxial sepal indumentum was not supported with close examination of the specimens currently available. The density and length of the sepal indumentum was found to vary throughout the range of both phrase names, and no further characters were found with which to segregate them. *Ptilotus* sp. Beaufort River and *P. sp.* Porongurup are therefore recognised here as the same taxonomic entity. For convenience, the combined entity is referred to using the earlier name *P. sp.* Beaufort River in the remainder of this discussion.

The geographic range of *Ptilotus manglesii* overlaps entirely with that of the known distributions of *P. sp.* Beaufort River (Fig. 1). At several locations of *P. sp.* Beaufort River, plants occur in close proximity to, or

co-occur with populations of *P. manglesii* (e.g. *R. Davis 12974* and *R. Davis 12975*; Fig. 2A, C). Examination of specimens in the field and herbarium indicates that *P. manglesii* is morphologically consistently separable from *P. sp.* Beaufort River, with no apparent intermediates, using several easily diagnosable characters.

Plants of *Ptilotus* sp. Beaufort River are conspicuously shorter than *P. manglesii*, have narrower leaves that are often longer than the flowering stems and inflorescences, and often have leaves and flowering stems densely clustered (Fig. 2). As noted by previous authors (e.g. Mueller 1868; Bentham 1870), *P. manglesii* is morphologically diverse in its vegetative characters, yet it never has flowering stems shorter than the long and narrow basal leaves. Leaves of *P. manglesii* range in shape from spatulate (as described in the protologue), to narrowly oblanceolate, as described for *T. spectabile* and *T. manglesii* var. *angustifolium*. Narrow-leaved specimens of *P. manglesii*, previously included within the concepts of *T. spectabile* and *T. manglesii* var. *angustifolium*, can be differentiated from *P. sp.* Beaufort River by being taller plants (to 30 cm high) with flowering stems that are consistently longer than the basal leaves.

In addition, *Ptilotus manglesii* and *P. sp.* Beaufort River can be reliably segregated by the sizes of several floral structures. Bracts, bracteoles and outer sepals in *P. manglesii* are 10–13.5 mm long, 13–15 mm long and 17–28 mm long, respectively, and are disjunctly longer than those of *P. sp.* Beaufort River (6.8–9 mm long, 6.2–11.5 mm long and 9–14.5 mm long, respectively). Sepal length is related to inflorescence width, which is also conspicuously different between *P. manglesii* and *P. sp.* Beaufort River, the former having longer and broader inflorescences (38–50 mm wide) than the latter (20–40 mm wide). Anthers in *P. manglesii* are longer than in *P. sp.* Beaufort River (1.0–1.2 mm long *vs.* 0.5–0.7 mm long), as are staminodes (2.5–5.0 mm *vs.* 1.1–2.3 mm long) and styles (4.0–6.5 mm long *vs.* 1.4–3.5 mm long).

Given the morphological segregation from *P. manglesii*, the new species *Ptilotus davisii* T.Hammer is formally erected here to accommodate the entity previously recognised under the phrase names *P. sp.* Beaufort River (*G.J. Keighery 16554*) and *P. sp.* Porongurup (*R. Davis 10805*).

Key to species

1. Bracts 10–13.5 mm long; bracteoles 13–15 mm long; outer sepals 17–28 mm long; anthers 1.0–1.2 mm long; style 4.0–6.5 mm long *Ptilotus manglesii*
 - 1: Bracts 6.8–9.0 mm long; bracteoles 6.2–11.5 mm long; outer sepals 9.0–14.5 mm long; anthers 0.5–0.7 mm long; style 1.4–3.5 mm long *Ptilotus davisii*
-

Taxonomy

Ptilotus davisii T.Hammer, *sp. nov.*

Holotypus: c. 2.1 km S along Knight Road from the junction with Washpool Road, Woogenellup, Western Australia, 10 Dec. 2018, R. Davis & T. Hammer RD 12985 (PERTH09127933). **Isotypus:** CANB [to be distributed]. Fig. 2D, E.

Ptilotus sp. Beaufort River (G.J. Keighery 16554) Western Australian Herbarium, FloraBase <https://florabase.dpaw.wa.gov.au/> [accessed: 1 Apr. 2020].

Ptilotus sp. Porongurup (R. Davis 10805) Western Australian Herbarium, FloraBase <https://florabase.dpaw.wa.gov.au/> [accessed: 1 Apr. 2020].

Perennial *herbs* 40–150 mm high, 50–200 mm wide; tap root woody. *Stems* multiple, decumbent or erect, 10–60 mm long, terete, ribbed, glabrescent with shortly verticillate hairs. *Basal leaves* linear to oblanceolate, 40–150 mm long, 0.5–7 mm wide, glabrous or glabrescent with shortly verticillate hairs; base sessile, broadened into a persistent sheath 1–4 mm wide; margins entire; apex acute or rounded. *Cauline leaves* linear to narrowly lanceolate, 10–30 mm long, 0.5–4 mm wide, glabrous or with shortly verticillate hairs on the margins; base sessile, attenuate; margins entire; apex acute. *Inflorescences* terminal, spiciform, hemispherical to globular or rarely ovoid, 10–35 mm long, 20–40 mm wide, pink or magenta. *Bracts* ovate, 6.8–9.0 mm long, 2.5–3.5 mm wide, brown or white, with scattered verticillate hairs to 2 mm long; midrib not prominent; apex acute. *Bracteoles* ovate, 6.2–11.5 mm long, 2.6–3.9 mm wide, transparent, glabrous apart from midrib; midrib prominent, with verticillate hairs to 3 mm long; apex brown, acute. *Outer sepals* lanceolate with a dilated apex, \pm straight, 9–14.5 mm long, 1.1–2.1 mm wide; inner surface glabrous; outer surface with verticillate hairs to 5 mm long and a distally glabrous portion to 3 mm long;

apex dilated, truncate, serrate, with \pm in-rolled margins. *Inner sepals* lanceolate with a dilated apex, \pm straight, 8.2–14 mm long, 1.0–1.6 mm wide; inner surface glabrous apart from a fringe of straight verticillate hairs to 1 mm long on the margins half-way up the sepal length, and woolly hairs to 2 mm long at the base; outer surface with verticillate hairs to 1.5 mm long and a distally glabrous portion to 3 mm long; apex dilated, truncate, serrate, with \pm in-rolled margins. *Fertile stamens* 3–5; *filaments* uneven in length, 2.0–5.6 mm long; *anthers* 0.5–0.7 mm long, 0.3–0.5 mm wide, pink. *Staminodes* 0–2, 1.1–2.3 mm long. *Staminal cup* 0.4–0.7 mm long, symmetrical, lacking appendages. *Ovary* obconical, 1.3–1.9 mm long, 0.9–1.5 mm wide, glabrous; *stipe* 1.5–2.5 mm long, tightly enclosed by sepal bases at maturity. *Style* curved, 1.4–3.5 mm long, excentric on the ovary apex. *Stigma* unlobed, capitate. *Seed* not seen. **Fig. 2C–E.**

Diagnostic features. *Ptilotus davisii* may be distinguished from all other members of the genus by the following combination of characters: a small perennial herb to 15 cm high, basal leaves 0.5–7 mm wide and usually longer than the stems, inner and outer sepals less than 15 mm long, outer sepal surface pink or magenta, inner surface of sepals with a basal woolly indumentum, anthers 0.4–0.7 mm long, style excentric on the ovary apex, a glabrous ovary, style curved and 1.4–3.5 mm long.

Phenology. Most flowering and fruiting specimens have been collected in late spring to summer (November to February).

Distribution and habitat. *Ptilotus davisii* occurs in the Avon Wheatbelt, Jarrah Forest and Esperance Plains IBRA (Interim Biogeographical Regionalisation for Australia) regions of south-west Western Australia, from 33.0° S to 34.6° S latitude and 116.4° E to

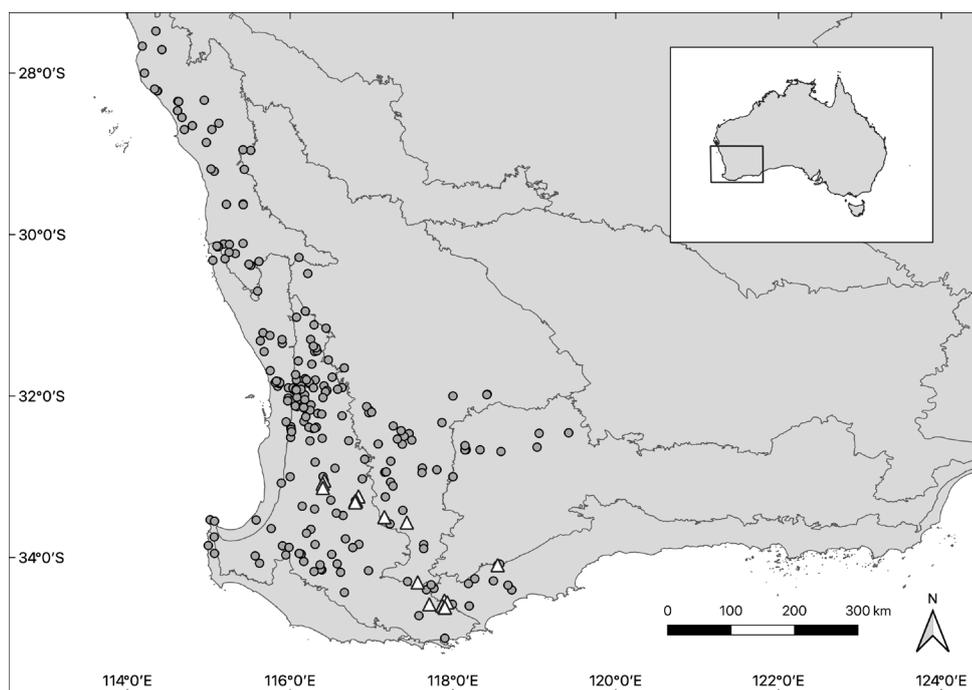


Fig. 1. Locations for the PERTH specimens of *Ptilotus manglesii* (grey circles) and *P. davisii* (white triangles). Boundaries are Interim Biogeographical Regionalisation for Australia (IBRA) regions (Department of the Environment 2018).

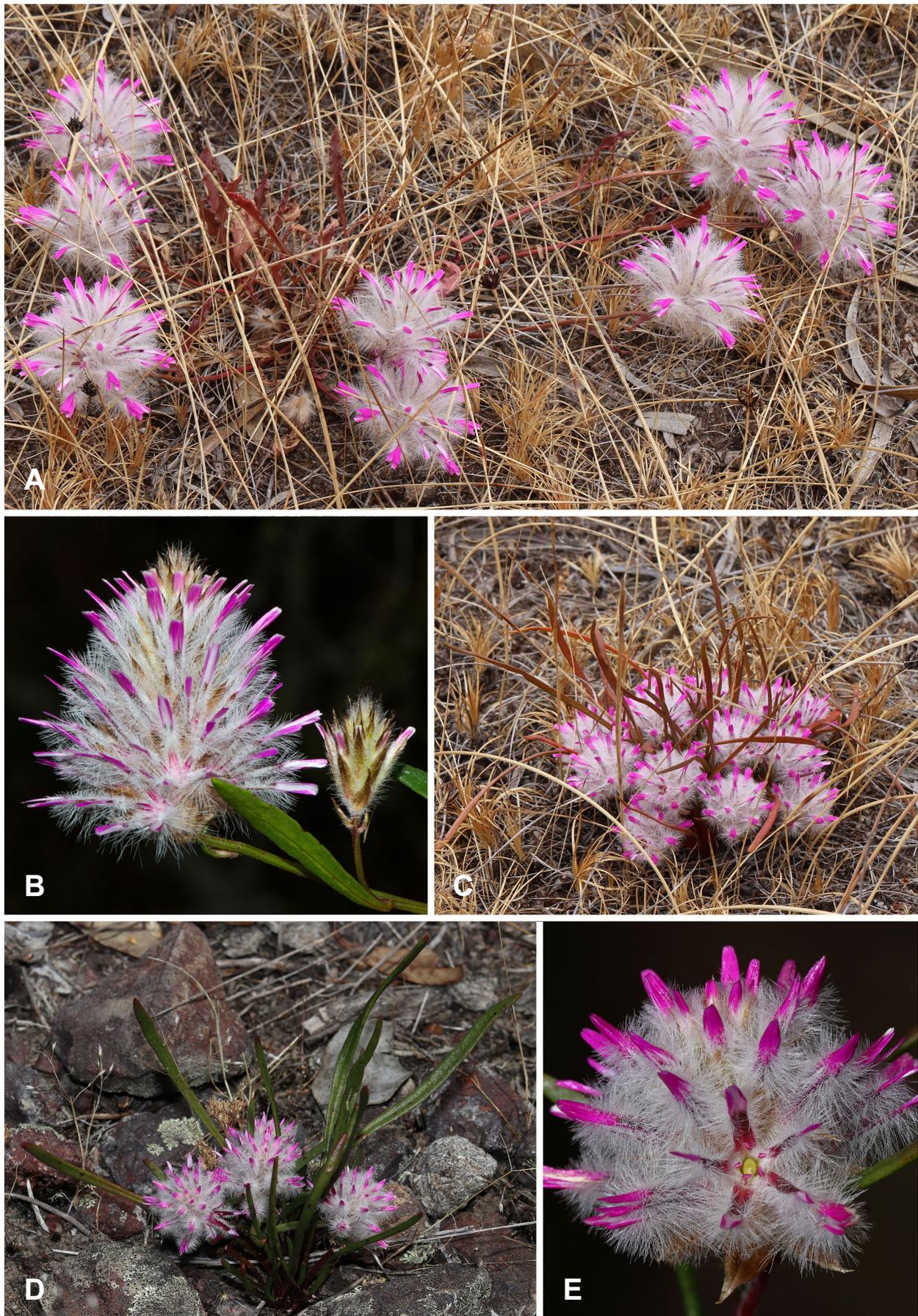


Fig. 2. *Ptilotus manglesii*: **A** habit; **B** inflorescence. *Ptilotus davisii*: **C**, **D** habit; **E** inflorescence. — A R. Davis 12975, B T. Hammer & R. Davis TH 76, C R. Davis 12974, D, E R. Davis & T. Hammer RD 12985. A and C were collected from the same location. Photos: A, C–E R. Davis; B T. Hammer.

118.5° E longitude (Fig. 1). It has been collected growing in seasonally wet plains, creek lines, and roadside drainage lines in grey or brown sandy loam or clay, occasionally with ironstone or laterite. It has been commonly collected in *Eucalyptus wandoo* woodlands and *Melaleuca* shrublands.

Conservation status. *Ptilotus davisii* is not currently listed as of conservation concern in Western Australia.

Proposed Vernacular Name. Davis's mulla mulla.

Etymology. The specific epithet honours the Western Australian botanist Robert W. Davis (1959–), who has made the majority of known collections of the species and was the first to recognise it as potentially being a new taxon (R. Davis, pers. comm.). Davis has made substantial contributions to the taxonomy of many Western Australian plant groups during his long career at the Western Australian Herbarium, including authoring 16 *Ptilotus* taxa and publishing several important taxonomic revisions in the genus.

Other specimens examined

WESTERN AUSTRALIA: Boundary Road, 13 km NW of Quindanning, 5 Aug. 1997, *G. Paull 943A* (PERTH); c. 8 km S along Boundary Road from junction of Harvey-Quindanning Road, 13 Nov. 2015, *R. Davis & A. Brown RD 12587* (PERTH); c. 11 km N along Boundary Road from junction of Williams-Collie Road, c. 33 km NE of Collie, 13 Nov. 2015, *R. Davis & A. Brown RD 12586* (PERTH); 750 m S along Dardadine-Hillman Road from junction with Dardadine West Road, 11 Dec. 2018, *R. Davis & T. Hammer RD 12988* (PERTH); Hillman Townsite, 24 Nov. 1992, *V. Crowley DKN 166* (PERTH); c. 300 m N along Dardadine-Hillman Road from the junction with Howie Road, 1 Dec. 2018, *R. Davis 12974* (PERTH); 3.6 km N along Hillman Road from junction with Coalfields Highway, 11 Dec. 2018, *R. Davis & T. Hammer RD 12986* (PERTH); Hillman Townsite Reserve, Darkan, 14 Dec. 2000, *V. Crowley s.n.* (PERTH06005837); Beaufort River Water Reserve, Arthur River to Kojonup, *G.J. Keighery 16554* (PERTH); 3 km due E on Woodanilling-Robinson Road, Woodanilling, 6 Dec. 2008, *R. Garstone s.n.* (PERTH08472505); 21 km S of Ongerup on Boxwood-Ongerup Road, 20 Jan. 2006, *S. Osborne 125* (PERTH); Cranbrook catchment, 2 km E of Cranbrook, 10 Dec. 1996, *R. Davis 1727* (PERTH); 3.7 km W along Woogenellup Road from junction of Kalgan Plains Road, c. 7.5 km NNW of Kamballup, 31 Dec. 2005, *R. Davis 10961* (PERTH); 0.9 km S along Kalgan Plains Road from Woogenellup, 28 Dec. 2005, *R. Davis 10958* (PERTH); c. 75 m E along Woogenellup Road from the junction with Great Southern Railway Road, 10 Dec. 2018, *R. Davis & T. Hammer RD 12984* (PERTH); Twin Creek Conservation Reserve, Knight Rd, N of Porongurups, 18 Nov. 2005, *E.M. Sandiford 1129* (PERTH); Twin Creeks Nature Reserve, 4 km N of Porongurup, 28 Dec. 2005, *R. Davis 10959* (PERTH); 4 km N of Porongurup, Twin Creeks Reserve, Feb. 2005, *A. Burchell s.n.* (PERTH07395019); 4 km N of Porongurup, Twin Creeks Reserve, Jan. 2005, *A. Burchell s.n.* (PERTH07395027); Twins Creek Reserve, off Knights Road, c. 4 km N of Porongurup, 22 Dec. 2004, *R. Davis 10805* (PERTH).

Ptilotus manglesii (Lindl.) F.Muell.

Fragm. 6: 230 (1868). — *Trichinium manglesii* Lindl., *Edward's Bot. Reg.* 25: sub tab. 28 (1839). — **Type citation:** "Swan River". **Syntype:** Western Australia, *Toward 46* (CGE?, n.v.), *fide* Benl (unpubl.).

Trichinium spectabile Fielding & Gardner, *Sert. Pl.* tab. 53 (1844). — **Type citation:** "Swan River Colony, New Holland. *Drummond n. 436*". **Lectotype (here designated):** Western Australia, 1839, *J. Drummond 436* (K000356849, ex Herb. Hooker; photo seen). **Isolectotypes:** K000356856, MEL2221664, MEL221665, MEL2217630, P04944200, P04944201, P04944250 (photos seen); PERTH 00336645!

Trichinium manglesii var. *angustifolium* Moq. in A.D.C., *Prodromus* 13(2): 289 (1849). — **Type citation:** "Drummond! Preiss! n. 1358.". **Lectotype (here designated):** "Nova Hollandia, Swan River", 1839, *J. Drummond s.n.* (P00609983, ex Herb. Moquin-Tandon; photo seen). **Isolectotype:** K000356855 (photo seen). **Remaining syntypes:** Port Leschenault, [Western Australia,] 28 Dec. 1839, *L. Preiss 1358* (L1695387, LD1213215, MEL2217614, MEL2217615, MEL2217617, P04944193, P04944197; photos seen)

Trichinium macrocephalum auct. non R.Br.: Nees in Lehm., *Pl. Preiss.* 1: 627 (1845).

Perennial *herbs* 100–400 mm high, 150–400 mm wide; tap root woody. *Stems* single or multiple, decumbent, prostrate or rarely erect, 70–300 mm long, terete, ribbed, glabrescent with shortly verticillate hairs. *Basal leaves* spatulate to oblanceolate, 40–150 mm long, 10–60 mm wide, glabrous or glabrescent with shortly verticillate hairs; base sessile, broadened into a persistent sheath 1–4 mm wide; margins entire or often undulating; apex acute or rounded. *Cauline leaves* lanceolate to ovate, 15–70 mm long, 5–15 mm wide, glabrous or with shortly verticillate hairs on the margins; base sessile, attenuate; margins entire or usually undulating; apex acute. *Inflorescences* terminal, spiciform, ovoid to cylindrical, 25–70 mm long, 38–50 mm wide, pink or magenta. *Bracts* ovate to lanceolate, 10–13.5 mm long, 2.8–4.5 mm wide, brown, with scattered verticillate hairs to 2.5 mm long in the basal half; midrib not prominent; apex acute. *Bracteoles* ovate to lanceolate, 13–15 mm long, 4.5–5.5 mm wide, transparent, glabrous apart from midrib; midrib prominent, with verticillate hairs to 3 mm long; apex brown, acute. *Outer sepals* lanceolate with a dilated apex, ± down-curved, 17–28 mm long, 2.0–4.0 mm wide; inner surface glabrous; outer surface with verticillate hairs to 5 mm long and a distally glabrous portion to 7 mm long; apex dilated, truncate, serrate, margins ± in-rolled. *Inner sepals* lanceolate with a dilated apex, ± down-curved, 15–25 mm long, 1.5–3.5 mm wide; inner surface glabrous apart from a fringe of straight verticillate hairs to 1 mm long on the margins half-way up the sepal and woolly hairs to 3 mm long at the base; outer surface with verticillate hairs to 4 mm long and a distally glabrous portion to 5 mm long; apex dilated, truncate, serrate, margins ± in-rolled. *Fertile stamens* 3–5; *filaments* unequal in length, 3.5–6.5 mm long; *anthers* 1.0–1.2 mm long,

0.5–0.6 mm wide, pink. *Staminodes* 0–2, 2.5–5.0 mm long. *Staminal cup* 0.5–1.0 mm long, symmetrical, lacking appendages. *Ovary* obconical, 2.0–2.7 mm long, 1.2–1.7 mm wide, glabrous; stipe 2.0–4.5 mm long, tightly enclosed by sepal bases at maturity. *Style* curved, 4.0–6.5 mm long, excentric on the ovary apex. *Stigma* unlobed, capitate. *Seed* dull brown, c. 3.1 mm long, c. 1.7 mm wide. **Fig. 2A, B.**

Phenology. *Ptilotus manglesii* is typically collected in flower and fruit from September to January, with populations in the north of the range flowering and fruiting earlier than in the south.

Distribution and habitat. *Ptilotus manglesii* occurs in south-west Western Australia from Kalbarri to Albany (i.e. 27.5° S to 35.0° S), and as far east as Hyden (i.e. 119.4° E) (Fig. 1). It can be found in a variety of habitats throughout its range, including open woodlands dominated by jarrah, marri or wandoo and open shrublands (e.g. with *Acacia* spp., *Allocasuarina* spp. or *Banksia* spp.) on slopes, road verges, drainage lines and seasonally wet plains. It grows in a variety of substrates, including red-, brown- or grey-coloured clay, loam or sand, often with gravel or laterite.

Conservation status. *Ptilotus manglesii* is not listed as of conservation concern.

Typification. Fielding & Gardner (1844) cited *Drummond 436* in the protologue of *Trichinium spectabile*. Of the available syntypes, the sheet K000356849 is here designated as the lectotype. The exsiccatum consist of seven inflorescences attached to stems with narrow basal and cauline leaves, which match the description and illustration in the protologue. The sheet is labelled “436. Swan River. Drummond” and “*T. spectabile* Field. Sert. t. 53” and bears the stamp “Herbarium Hookerianum 1867”.

Further annotations were made on the sheet K000356849 by Bentham and Moquin-Tandon, indicating that they viewed this specimen in their treatments of *Trichinium* (see Moquin-Tandon 1849; Bentham 1870). Moquin-Tandon wrote on this specimen “*Trichinium manglesii* Lindl. var. *angustifolium* (an *T. speciosum* [sic] Field?)” and signed it “A. Moq”, identifying the specimen as either *T. manglesii* var. *angustifolium* or *T. spectabile*. Perhaps because of this identification by Moquin-Tandon, the sheet was erroneously labelled “Type *Trichinium manglesii* var. *angustifolium*” at a later date by someone at K. Moquin-Tandon (1849) made it very clear in his treatment that he included this specimen under the concept of *T. spectabile*, as a narrow-leaved specimen of *Drummond 436*. He specified the material *J. Drummond s.n.* and *L. Preiss 1358* in the protologue of *T. manglesii* var. *angustifolium*.

Of the syntypes of *Trichinium manglesii* var. *angustifolium*, the specimen P00609983 of the gathering *J. Drummond s.n.* is here designated as the

lectotype. The exsiccatum consists of a plant with a flowering inflorescence and long, narrow basal leaves attached to a rootstock, which matches the protologue in Moquin-Tandon (1849). The specimen was labelled by Moquin-Tandon as “*Trichinium manglesii* var. β *angustifolium*” and is therefore considered likely to have been used by him for the description of this taxon.

Nomenclatural Notes. Lindley (1839) did not specify a collector in the protologue of *Trichinium manglesii*. Benl (unpubl.), in a manuscript for his treatment of *Ptilotus* for the Flora of Australia, indicated “*Toward 46* (CGE)” as the holotype. Andrew Toward was gardener to HRH the Duchess of Gloucester and was mentioned by Lindley (1839), along with Mangles, as sending him wild specimens of *Trichinium*. *Toward 46* (CGE) should be considered a syntype unless it can be established that it was the only specimen available to Lindley prior to finishing the protologue (ICN Art. 9.4; Turland *et al.* 2018; see also McNeill 2014). For the preparation of the present study, I have been unable to arrange to view this specimen or confirm its existence at CGE and cannot therefore resolve the status of the type for *T. manglesii*.

Other authors (e.g. Fielding & Gardner 1844; Mueller 1868; Bentham 1870) associated Lindley’s concept with the gathering *Drummond 435*, presumably unaware of *Toward 46*. In November 1839, Drummond sent his first numbered collection of 1,300 specimens to Hooker in London (Erickson 1969), and among these were *Drummond 435* and *436*. Lindley completed the description of *Trichinium manglesii* in May 1839 (Lindley 1839), hence cannot have seen any numbered Drummond material (earlier collections of Drummond were un-numbered; Erickson 1969). Lindley may have seen earlier unnumbered specimens sent by Drummond. If the original material is not recovered, then a neotype should be designated for *T. manglesii* (ICN Art. 9.8 & 9.13; Turland *et al.* 2018).

Nees (1845) misapplied the name *Trichinium macrocephalum* R.Br. to the narrow-leaved specimen *L. Preiss 1358*, collected from Port Lechenault in Western Australia, which was later included as original material for *T. manglesii* var. *angustifolium* (Moquin-Tandon 1849). *Ptilotus macrocephalus* (R.Br.) Poir. (= *T. macrocephalum*) only occurs in south-eastern Australia and is not closely related to *P. manglesii* (see Hammer *et al.* 2019a, 2019b).

Selected specimens examined

WESTERN AUSTRALIA: 3 km NNE of Kalbarri, 24 Oct. 2000, *B.J. Lepschi et al. 4334* (PERTH); Over the fence line at the western end of Yuna golf course, 30 Oct. 2003, *K.A. Shepherd & R.Bennett KS 915* (PERTH); 1.3 km S along first north from junction of Skipper, c. 25 km NE of Eneabba, 9 Nov. 2004, *R. Davis 10781* (PERTH); Hi Vallee property (D. & J. Williams) Warradarge, close to creekline near E boundary of property, 7 Dec. 2002, *M. Hislop 2907* (PERTH); 200 m N along Canning Road from junction of Masonmill Road, Carmel, 20 Nov. 2002, *R. Davis 10536*

(PERTH); 19.5 km E along Bindoon-Dewars Pool Road from Great Northern Highway, 9 Nov. 2015, *T. Hammer, R. Davis & K. Thiele TH 78* (PERTH); Site 11, Gorrie Road, 5.5 km SSE of Chidlow, 1 Nov. 1996, *R. Davis 1522* (PERTH); 425 m SW along a trail heading towards Bixton Street from Bickley Road, Kenwick, 25 Oct. 2015, *T. Hammer & R. Davis TH 76* (PERTH); Wadderin Reserve, c. 300 m E of Reservoir, N of Narembeen, 26 Sep. 2003, *M. Hislop & M. Griffiths WW 104.30* (PERTH); 1.3 km S along Kinsella Road from junction of Brookton Highway, 22 Jan. 2017, *T. Hammer & R. Davis TH 99* (PERTH); Site 32, E of Great Southern Highway, c. 8 km SSE of Beverley, 25 Oct. 2000, *R. Davis WW 32-13* (PERTH); North Dandalup Dam, off Hines Rd, on W boundary of State Forest, 15 Nov. 1996, *A. Markey 880* (PERTH); c. 300 m N along Dardadine-Hillman Road from the junction with Howie Road, 1 Dec. 2018, *R. Davis 12975* (PERTH); 4.1 km from Wrights Bridge towards Nannup on Balingup-Nannup Road, 6 Jan. 2000, *T.R. Lally & N.G. Lally TRL 1643* (PERTH); Seaton Ross Road c. 20 km NE of Manjimup, 29 Oct. 1998, *R. Davis 8414* (PERTH); Gravel Pit, Yerriminup Road, E off Albany Highway, 9 Dec. 1985, *E.J. Croxford 4355* (PERTH); 0.5 km along firebreak running SW of Bluff Knoll Road, 0.3 km from Chester Pass Road in Stirling Range National Park, 24 Oct. 2001, *E. Hickman & S. Gilfillan EJH 1751* (PERTH); Pallinup River, 18 km NW of Mount Groper, 15 Jan. 1985, *K.R. Newbey 10912* (PERTH); 0.3 km W along Woogenilup Road from junction of Chester Pass Road, 31 Dec. 2005, *R. Davis 10963* (PERTH); Hay River, 25 Nov. 1994, *G. Janicke JAN 009* (PERTH).

Acknowledgements

The author acknowledges the Curator and staff of the Western Australian Herbarium (PERTH) for their helpful assistance. The curation staff at the National Herbarium of Victoria (MEL) are thanked for arranging scans of specimens. Peter Luscombe is thanked for providing access to his property and providing the locations of new populations for the new species. Robert Davis provided substantial assistance during this study, including providing useful discussions on the taxa, accompanying the author into the field and giving permission to use photographs. Kevin Thiele is thanked for his advice on the manuscript.

References

- Benl, G. (unpubl.). *Ptilotus*. Manuscript for: *Flora of Australia*, Vol. 5; dated 1988. (Australian Biological Resources Study: Canberra).
- Benthams, G. (1870). *Flora Australiensis*, Vol. 5. (L. Reeve & Co.: London).
- Black, J.M. (1948). Amarantaceae. In: *Flora of South Australia*, 2nd edn, 2: 323–332. (Government Printer: Adelaide).

- Brown, R. (1810). *Prodromus florae Novae Hollandiae et insulae Van Diemen*. (R. Taylor et socii: London).
- Department of the Environment (2018). *Australia's bioregions (IBRA)*, IBRA7, Commonwealth of Australia. <https://www.environment.gov.au/land/nrs/science/ibra#ibra> [accessed: 1 Apr. 2020].
- Erickson, R. (1969). *The Drummonds of Hawthornden*. (Lamb Paterson: Osborne Park).
- Fielding, H.B. & Gardner, G. (1844). *Sertum plantarum: or drawings and descriptions of rare and undescribed plants from the author's herbarium*. (Hippolyte Baillièrre: London).
- Hammer, T.A. (2019). *Mulling over the mulla mullas: taxonomy and evolution of the Australian genus Ptilotus and relatives in the aervoid clade (Amaranthaceae)*. PhD Thesis. (The University of Western Australia: Perth).
- Hammer, T.A., Davis, R.W. & Thiele, K.R. (2018). A key to *Ptilotus* (Amaranthaceae) in Western Australia. *Nuytsia* 29: 217–227.
- Hammer, T.A., Davis, R.W. & Thiele, K.R. (2019a). Of a different feather: two new species of featherheads from the *Ptilotus macrocephalus* (Amaranthaceae) complex. *Australian Systematic Botany* 32(1): 61–70.
- Hammer, T.A., Zhong, X., Colas des Francs–Small, C., Nevill, P.G., Small, I.D. & Thiele, K.R. (2019b). Resolving intergeneric relationships in the aervoid clade and the backbone of *Ptilotus* (Amaranthaceae): evidence from whole plastid genomes and morphology. *Taxon* 68(2): 297–314.
- Hopper, S.D. & Gioia, P. (2004). The Southwest Australian Floristic Region: evolution and conservation of a global hot spot of biodiversity. *Annual Review of Ecology, Evolution, and Systematics* 35: 623–650.
- Lindley, J. (1839). *Trichinium alopecuroideum*, Foxtail Trichinium. *Edwards's botanical register* 25: plate 28. (James Ridgway & Sons: London).
- McNeill, J. (2014). Holotype specimens and type citations: General issues. *Taxon*: 63(5): 1112–1113.
- Moquin-Tandon, A. (1849). Amarantaceae. In: de Candolle, A.P. (ed.), *Prodromus systematis naturalis regni vegetabilis* 13: 231–424. (Victor Masson: Paris).
- Mueller, F.J.H. von (1868). *Fragmenta phytographiae Australiae*, Vol. 6. (Government Printer: Melbourne)
- Mueller, F.J.H. von (1882). *Systematic census of Australian plants, with chronologic, literary and geographic annotations*. (M'Carron, Bird & Co.: Melbourne)
- Nees von Esenbeck, C.G.D. (1845). Amarantaceae. In: Lehmann, J.G.C. (ed.), *Plantae Preissianae* 1(4): 626–631.
- Poiret, J.L.M. (1816). *Ptilotus*. In: Lamarck, J.B. (ed.), *Encyclopédie méthodique: Botanique* Suppl. 4: 619–620. (Agasse: Paris)
- Schinz, H. (1893). Amarantaceae. In: Engler, A. & Prantl, K. (eds), *Die natürlichen Pflanzenfamilien* Teil III, Abt. 1a: 91–118. (Wilhelm Engelmann: Leipzig)
- Turland, N.J., Wiersema, J.H., Barrie, F.R., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Kusber, W.-H., Li, D.-Z., Marhold, K., May, T.W., McNeill, J., Monro, A.M., Prado, J., Price, M.J. & Smith, G.F. (2018). *International code of nomenclature for algae, fungi, and plants (Shenzhen Code)*. (Koeltz Botanical Books: Glashütten). [*Regnum Vegetabile* 159].

