



The *Ptilotus murrayi* species group: synonymisation of *P. petiolatus* under *P. murrayi* and description of the new Western Australian species *P. unguiculatus* (Amaranthaceae)

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Abstract: The *Ptilotus murrayi* F.Muell. species group encompasses the morphologically similar *P. murrayi*, *P. gomphrenoides* F.Muell. ex Benth. and *P. petiolatus* Farmar. These three species overlap in distribution in Western Australia, where they are easily confused with one another. A critical examination of specimens shows that there are no consistent morphological characters to justify the separation of *P. murrayi* and *P. petiolatus*, and therefore the latter is formally synonymised under the former. *Ptilotus* sp. Edaggee Station (T.E.H.Aplin 3208) is found to be a distinctive new species and described as *Ptilotus unguiculatus* T.Hammer. Updated descriptions are given for *P. murrayi* and *P. gomphrenoides*.

Keywords: Amaranthaceae, Australia, new species, *Ptilotus*, taxonomy

Introduction

Ptilotus R.Br. (Amaranthaceae) is a genus of c. 120 species native to Australia, mostly occurring in arid or semi-arid regions of Australia, with the highest diversity in Western Australia (Hammer *et al.* 2015). A recent molecular phylogeny by Hammer *et al.* (2015) resolved several molecular clades within the genus, including the large clade informally named ‘clade B’. Within clade B, *Ptilotus murrayi* F.Muell. and *P. gomphrenoides* F.Muell. ex Benth. were resolved as sister species. The morphologically similar *P. petiolatus* Farmar was not included in the phylogeny (Hammer *et al.* 2015). Together these species comprise the *P. murrayi* species group.

Ptilotus murrayi was described by Mueller (1863) based on a type from Will’s Creek (the Diamantina River, incorrectly noted in the protologue as ‘Cooper’s Creek’) near the border of South Australia and Queensland, collected by J. Murray on the Howitt expedition (Fig. 1A). Specimens of *P. murrayi* from Western Australia were not available to Mueller, but he did mention having seen similar specimens from Western Australia that had pedunculate inflorescences:

Vidi etiam specimina manca plantae persimilis ad montes Hamersley Range sub expeditione Francisci Gregorii collecta, spicis pedunculatis praecipue divellenda.

Mueller (1863: 145)

Bentham (1870) formally described *P. gomphrenoides* based on these pedunculate specimens from Gregory’s

expedition in the Hamersley Range (Fig. 1B). Farmar (1905) erected *P. petiolatus* from specimens collected by E. Clement in north-western Western Australia in 1897. He separated *P. petiolatus* from *P. murrayi* on the basis that the former has inflorescences with acute apices, shorter staminal filaments and larger anthers:

[...] *quod flores P. murrayi simillimus sed spicis acutis filamentis brevioribus antheris majoribus differt*
Farmer (1905: 1089)

He went on to say that *P. murrayi* was incompletely known, and that only a few fragments (‘an inch in length’) were available at K, however he felt confident that these differences were sufficient to erect the new species.

Farmer (1905) also erected *P. roseo-albus* Farmar within this species group, differing from *P. gomphrenoides* in having shortly pedunculate spikes (as opposed to long-pedunculate) and a denser abaxial sepal indumentum. Within *P. roseo-albus* he described var. *conglomeratus* Farmar, which differed from the typical variety in having cylindrical inflorescences in clusters, as opposed to conical and loosely arranged inflorescences. The two varieties of *P. roseo-albus* were recombined under *P. gomphrenoides* by Benl (1962) as *P. gomphrenoides* var. *roseo-albus* (Farmer) Benl and var. *conglomeratus* (Farmer) Benl, stating that the characters that Farmar used were common characteristics of *P. gomphrenoides*. Hammer & Davis (2017) recently synonymised these varieties under the typical *P. gomphrenoides*, as these varieties were found to intergrade imperceptibly into one another. Black (1923) described *P. murrayi* var. *major* J.M.Black from the Diamantina River, South



Fig. 1. Comparative morphology of flowering inflorescences. **A** *Ptilotus murrayi*; **B** *P. gomphrenoides*. Photos: A K.R. Thiele; B R. Davis.

Australia, on the basis of its larger leaves, longer stems and inflorescences, and slightly longer sepals. This variety was synonymised by Bean (2008), who recognized that the characters attributed to *P. murrayi* var. *major* were within the typical variability of var. *murrayi*. In a manuscript by Benl (unpubl.), *P. petiolatus* subsp. *limbatus* Benl MS was included as a manuscript name based on a specimen from Edaggee Station, Western Australia (Fig. 2), which he primarily differentiated from subsp. *petiolatus* by the new subspecies having clawed sepals. While the new taxon was never formalised, it was included under the phrase name *Ptilotus* sp. Edaggee Station (T.E.H.Aplin 3208) at the Western Australian Herbarium awaiting evaluation of its taxonomic status.

The geographic distributions of taxa in the *P. murrayi* species group overlap significantly in Western Australia, and this, coupled with the strong morphological similarities, has led to some confusion between them. *Ptilotus murrayi* has a disjunct distribution, occurring in Western Australia from Carnarvon, Gascoyne, Murchison, Pilbara and Dampierland (Interim Biogeographic Regionalisation for Australia, IBRA; Department of the Environment 2018) regions and in south-western Queensland and north-eastern South Australia in the Mitchell Grass Downs and Channel Country IBRA regions. It has not been recorded from the Northern Territory or north-western South Australia (Fig. 3A). *Ptilotus petiolatus* and *P. murrayi* are sympatric throughout the range of the former. *Ptilotus petiolatus* is known from 15 specimens, ten from

Dampierland and five from the Pilbara IBRA regions. *Ptilotus gomphrenoides* is also almost entirely sympatric with *P. murrayi* in Western Australia, occurring in the Carnarvon, Gascoyne, Pilbara, and northern Murchison bioregions (Fig. 3B). *Ptilotus* sp. Edaggee Station (T.E.H.Aplin 3208) is known from a single collection on Edaggee Station, approximately 70 km SSE of Carnarvon, Western Australia and 75 km SW of the southwestern-most record of *P. murrayi*, which occurs near the Gascoyne River (Fig. 3B).

During the construction of an online identification key to all species in *Ptilotus* for the *Flowering Plants of Australia* project on *KeyBase* (available at <http://keybase.rb.gov.au/keys/show/6609>), *P. murrayi*, *P. gomphrenoides* and *P. petiolatus* were found to be difficult to discriminate due to unclear morphological boundaries, which was also noted by Burbidge (unpubl.) in a key constructed for *Ptilotus*. A thorough examination of the morphology of specimens for each species was conducted to critically evaluate the species boundaries within the group. This showed that specimens of *P. murrayi* and *P. petiolatus* could not be reliably separated, including those that Farmar had originally used to erect *P. petiolatus*. As a result, the later name of *P. petiolatus* is here formally synonymised under *P. murrayi*. *Ptilotus* sp. Edaggee Station (T.E.H.Aplin 3208) is also assessed and found to be a very distinctive species. The morphological differences between the two accepted species in the *P. murrayi* species group (i.e. *P. murrayi* and *P. gomphrenoides*) are clarified and descriptions are given for both.

Material and methods

This study was based on the examination of dried specimens of *P. gomphrenoides*, *P. murrayi*, *P. petiolatus* and *P. sp.* Edaggee Station (T.E.H.Aplin 3208) housed at PERTH and specimens of *P. murrayi* on loan from BRI and AD, covering the geographic range of all species. Scans of type specimens were assessed through *JSTOR Global Plants* (<https://plants.jstor.org/>). The specimens were critically evaluated irrespective of current determinations and matched to the protologues and type specimens, and when necessary, specimens were re-determined as a result of this study. Care was taken to evaluate the specimens based on their likely natural posture in the field, and when available, label data were used to infer the natural habit of the specimens. A distribution map of the species was produced using georeferenced records retrieved from the *Australasian Virtual Herbarium* (<https://avh.chah.org.au/>). The terminology used in this paper for the perianth of *Ptilotus* is different from what is conventionally used within Australia. The term 'sepal' is used here in place of 'tepal', as recent studies support the calycine origin of the uniseriate perianth for all Caryophyllales, the corolla having been lost (see Ronse De Craene 2013; Vrijdaghs *et al.* 2014).

Results and discussion

The examination revealed that *P. sp.* Edaggee Station (T.E.H.Aplin 3208) is clearly a distinctive species within the genus. Benl (unpubl.) intended to describe this taxon as a subspecies of *P. petiolatus*. While it is understandable that he believed the two entities were related, given their superficial similarities (e.g. habit, leaf size and shape, inflorescence size and shape; Fig. 2), *P. sp.* Edaggee Station (T.E.H.Aplin 3208) is significantly different from *P. petiolatus* in important floral characters. It may not be closely related to the *P. murrayi* species group. The sepals of *P. sp.* Edaggee Station (T.E.H.Aplin 3208) are conspicuously clawed (i.e. narrow at the base and dilated toward the apex), and more so in the outer sepals, where the dilated apex is 0.7–0.9 mm wider than the base. *Ptilotus petiolatus*, *P. murrayi* and *P. gomphrenoides* do not have clawed sepals. In other *Ptilotus* species, this trait is consistent within a species and is often shared between closely related species. Within clade B, several species groups possess clawed sepals, such as the species group including *P. latifolius* R.Br. and *P. chamaecladus* Diels and the species group including *P. conicus* R.Br. and *P. corymbosus* R.Br. *Ptilotus sp.* Edaggee Station (T.E.H.Aplin 3208) also differs from *P. petiolatus*, by possessing crisped nodose hairs on the inner margins of the sepals, which often become tangled and obscure the ovary and staminal cup. Sepals in *Ptilotus petiolatus*, *P. murrayi* and *P. gomphrenoides* are adaxially glabrous (see Fig. 1). *Ptilotus sp.* Edaggee Station (T.E.H.Aplin 3208) has longer staminal filaments (0.7–0.9 mm) and style (0.6–0.8 mm) than

P. petiolatus (0.3–0.6 and 0.3–0.5 mm, respectively), which ensure the anthers and stigma are raised above these obscuring hairs. Furthermore, the bracteoles of *P. sp.* Edaggee Station are much longer and wider than the bracts (by c. 1 mm), while the bracts and bracteoles of the other species are similar in size. These differences are sufficient to recognise *P. sp.* Edaggee Station (T.E.H.Aplin 3208) as a distinct species, and therefore *P. unguiculatus* T.Hammer is erected to accommodate it (see below).

Ptilotus murrayi and *P. petiolatus* can both be segregated from *P. gomphrenoides* in Western Australia by the latter species having pedunculate inflorescences; peduncles are short but present on some specimens (e.g. those previously included under *P. roseo-albus*). *Ptilotus gomphrenoides* could additionally be segregated from the other two species by examination of the midrib region of the sepals (i.e. the thickened prominent midrib flanked by two lateral veins that is clearly differentiated from the scarious region surrounding it). All *Ptilotus* species have five sepals that are arranged with two outer sepals and three inner sepals. Sometimes the outer and inner sepals are morphologically similar, but in the *P. murrayi* species group they are conspicuously different. The outer sepals in the *P. murrayi* species group are conspicuously different to the inner sepals in that they enclose the inner sepals and possess larger and more conspicuous scarious margin, particularly towards the apex. The midrib region and margin of the sepal usually vary in colour in these species, being either dark pink or green around the midrib and pink on the margin (Fig. 1). The outer sepal has a prominent and concave midrib (thus allowing it to tightly enclose the inner sepals in bud), but the midrib region is much narrower and less starkly coloured. *Ptilotus gomphrenoides* has a much wider sepal midrib region (0.5–0.8 mm), which is usually pink to dark pink, whereas the *P. murrayi* and *P. petiolatus* consistently have a narrow (0.2–0.3 mm) and green sepal midrib region. The outer sepals in *P. gomphrenoides* have a longer scarious margin above the midrib (0.8–1.5 mm) and rounded apices (Fig. 1B), whereas *P. murrayi* and *P. petiolatus* have a shorter scarious margin above the midrib (0.5–1.0 mm) and more acute apices (Fig. 1A). Using the characters outlined above, specimens of *P. gomphrenoides* could be confidently segregated from *P. murrayi* and *P. petiolatus*.

The differences Farmar stated as separating *P. petiolatus* and *P. murrayi* do not withstand scrutiny with the specimens currently available. All collections of *P. petiolatus* have inflorescences with an acute apex, while collections of *P. murrayi* can have either an acute or truncated apex; it is likely that Farmar had only access to specimens of *P. murrayi* with the latter character. Farmar indicated that staminal filament length and anther length were both important in splitting *P. petiolatus* from *P. murrayi*. This study found, however, that throughout the geographic ranges of both species, they overlap in staminal filament length (0.3–0.6 mm) and anther length

(0.3–0.5 mm). Benl (1979) suggested that *P. petiolatus* could be identified based on its unusually short style, but *P. murrayi* and *P. petiolatus* were found to have the same range of style length (0.3–0.5 mm) with the specimens currently available.

Benl (1971) used leaf size to split *P. murrayi* from *P. petiolatus* and *P. gomphrenoides* in his key. Leaf size in these species imperceptibly intergrades, and is not correlated with geography and any other characters, rendering the use of this as a distinguishing character ineffectual. Benl (1971) furthermore noted a difference in phyllotaxis of *P. petiolatus* and *P. gomphrenoides*, considering the former to be subopposite ('annähernd gegenständig', p. 172) and the latter to be alternate. However, leaf arrangement in these species is not consistent across all specimens available. Each of the three species has specimens that have an alternate leaf arrangement, but some specimens can be found to have an apparent opposite or subopposite arrangement.

Bentham (1870) described *P. gomphrenoides* as 'apparently erect' and *P. murrayi* as 'apparently prostrate' (pp. 243–244). All three species were found to have prostrate specimens (this character being more common in *P. murrayi* than the other species), as well as specimens described on labels as ascending or erect. Habit could not be correlated with other characters (e.g. leaf size or the size of floral parts), to reliably discriminate between the species. Several specimens in *P. gomphrenoides* were found to exhibit the characters attributed by Farman (1905) and Benl (1971) to *P. petiolatus*, such as slightly smaller flowers, leaves and an overall more petite habit (e.g. *A.C. Beauglehole 48962*), which may indicate that these characters attributed to *P. petiolatus* by previous authors are within the normal range variation for both *P. gomphrenoides* and *P. murrayi*. Furthermore, no differences between the habitats of the three species could be discerned, all typically occurring on flat floodplains or on the fringes of ephemeral wetlands, creeks or rivers, with clayey red or brown soils.

Given that there are no consistent characters with which to separate *P. petiolatus* from *P. murrayi*, the former encompassing the normal variation from throughout the range of *P. murrayi* (including in specimens available from eastern Australia), *P. petiolatus* is here synonymised under *P. murrayi*. No significant differences were found between the specimens of *P. murrayi* from Western Australia and eastern Australia, leaving the question open as to the significance of the large geographic disjunction in the records between Western Australia and eastern Australia (see Fig. 3A), which may be more appropriately investigated with an in-depth molecular study. Full descriptions for the modern concepts of *P. murrayi* and *P. gomphrenoides* are given below. A key to all accepted species of *Ptilotus* in Western Australia, including those described here, is currently under review by the journal *Nuytsia* and is expected to be forthcoming.

Taxonomy

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

Type: Edaggee Station, Western Australia [precise locality withheld for conservation reasons], 3 July 1970, *T.E.H. Aplin 3208* (holo: PERTH 04073819!, **Fig. 2**; iso: M 0241497 image!).

Ptilotus sp. Edaggee Station (T.E.H. Aplin 3208) Western Australian Herbarium, in FloraBase, <https://florabase.dpaw.wa.gov.au/> [accessed: 9 May 2018].

Decumbent *annual herb* to 8 cm high, 20 cm wide. *Stems* terete, ribbed, with dense nodose hairs on young growth and the hairs becoming sparse with age. *Basal leaves* not seen. *Cauline leaves* alternate, lanceolate to ovate, entire, 8–30 mm long, 5–11 mm wide, glabrous; base narrowly attenuate or petiolate, 5–10 mm long; apex mucronate, mucro c. 0.1 mm long. *Inflorescences* solitary or in clusters of 2–3, terminal, sessile, spiciform, conical, 5–12 mm long, 7–8 mm wide, white, subtended by leaves; apex acute. *Bracts* broadly ovate, 1.8–1.9 mm long, 1.4–1.5 mm wide, translucent, glabrous; midrib obscure; apex acute. *Bracteoles* broadly ovate, 3.0–3.1 mm long, 2.4–2.5 mm wide, translucent, glabrous; midrib obscure; apex acute. *Outer sepals* spatulate, strongly clawed, 3.5–3.6 mm long, 0.4–0.5 mm wide at base, 1.1–1.4 mm wide at dilated apex; midrib region prominent, green, 1.5–2.5 mm long, 0.1–0.3 mm wide; basal outer surface with long, wavy, nodose hairs, not exceeding sepal apex; inner surface glabrous apart from crisped nodose hairs on margins becoming dense and tangled within; apex acute, the scarious margin 1.0–1.2 mm long, glabrous, translucent, serrate, in-rolled. *Inner sepals* narrowly spatulate, clawed, 2.5–3.1 mm long, 0.3–0.4 mm wide at base, 0.6–0.8 mm wide at the dilated apex; midrib region prominent, green, 1.7–2.2 mm long, 0.2–0.3 mm wide; basal outer surface with long, wavy, nodose hairs at base, becoming densely woolly with age, not exceeding sepal apex; inner surface glabrous apart from crisped nodose hairs on margins becoming dense and tangled within; apex acute, the scarious margin 0.3–0.7 mm long, glabrous, translucent, serrate, in-rolled. *Fertile stamens* 5; *filaments* 0.7–0.9 mm long; *anthers* 0.4–0.5 mm long, 0.2–0.3 mm wide, yellow. *Staminal cup* 0.3–0.4 mm long, unlobed. *Ovary* globular, 0.6–0.7 mm long, 0.6–0.8 mm wide, glabrous. *Style* straight, 0.6–0.7 mm long, centrally placed on the ovary apex. *Stigma* unlobed, capitate. *Fruit* not seen. *Seed* not seen.

Diagnostic characters. *Ptilotus unguiculatus* can be distinguished from other members of the genus by the following combination of characters: decumbent habit, dense pubescence on young stems, glabrous and petiolate leaves, sessile and terminal inflorescences (subtended by leaves), bracts that are c. 1 mm shorter and narrower than bracteoles, conspicuously clawed (dilated at the apex) sepals, crisped nodose hairs on the abaxial margin of the sepals that obscure the ovary, base of sepal adaxial surface with long silky nodose hairs that do not exceed the sepal apices, five fertile stamens, staminal cup appendages absent, a central style centrally placed on the ovary apex, and a glabrous ovary.

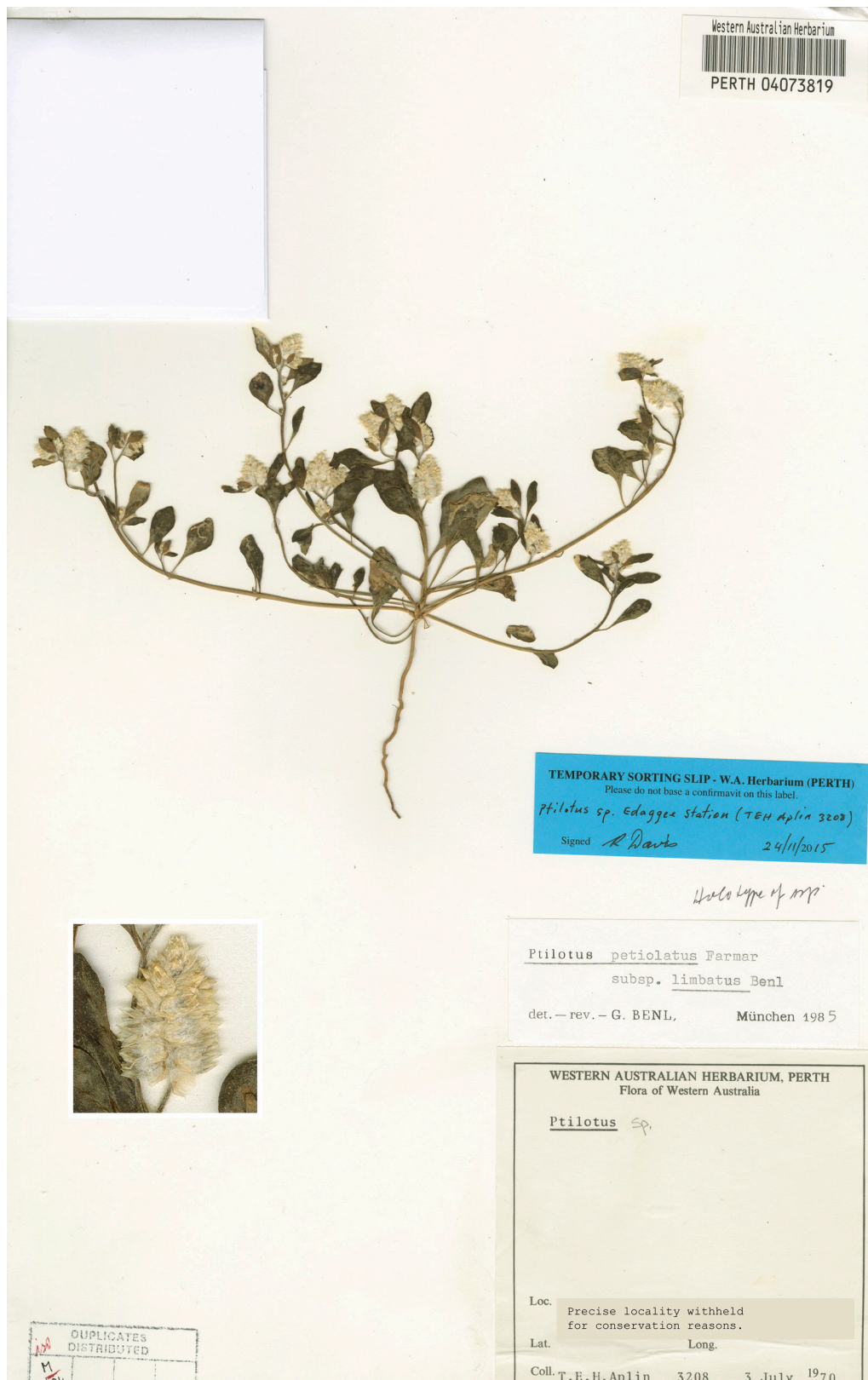


Fig. 2. Scan of *Ptilotus* sp. Edaggee Station (T.E.H. Alpin 3208), the proposed holotype of *P. unguiculatus* (PERTH 04073819). Insert: Close-up of inflorescence.

Phenology. The only examined specimen was collected as flowering, but not fruiting, in early July. It is likely that this species has a similar flowering and fruiting time to other annual *Ptilotus* species in region, which is typically from June to September.

Distribution and habitat. *Ptilotus unguiculatus* is currently known only from Edaggee Station, in the Carnarvon bioregion of Western Australia, where it was collected from a disturbed area. No habitat description was included with the specimen. Inspection of the

locality from aerial satellite images indicates it to be a plain with open shrubs.

Conservation status. *Ptilotus unguiculatus* is listed as Priority 1 under Conservation Codes for Western Australian Flora, under the name *P.* sp. Edaggee Station (Smith & Jones 2018). It is only known from the type specimens, collected in 1970 from a disturbed area on Edaggee Station, Western Australia.

Etymology. The specific epithet is from the Latin *unguiculatus* (having claws), referring to the conspicuously clawed sepals of the new species.

Notes. This new species may be potentially confused with *P. villosiflorus* F.Muell., which is also a small herb with greenish-white flowers, but which differs by typically occurring on coastal dunes, having sepals that are not clawed and abaxial sepal hairs that exceed the sepal apex. *Ptilotus latifolius* and *P. chamaecladus* are species closely related to *P. villosiflorus* that do have clawed sepals. *Ptilotus latifolius* is a large rounded, upright herb or subshrub with tangled branches that has bracteoles that are longer than the sepals. Both *P. chamaecladus* and *P. latifolius* have staminal cup lobes alternating with the stamens, while the new species has an unlobed staminal cup. The fruit of *P. villosiflorus*, *P. chamaecladus* and *P. latifolius* is hard and indehiscent, while those of the *P. murrayi* species group are membranous and irregularly dehiscent. Due to the similarity of the new species to the *P. latifolius* species group and despite Benl (unpubl.) considering the taxon to be closely allied with the *P. murrayi* species group, I could not confidently place the new species in either group. The difference in the fruit between these two groups is an important diagnostic character, but there was no fruit available for *P. unguiculatus*.

***Ptilotus murrayi* F.Muell.**

Fragm. 3: 145 (1863). — **Type:** ‘From the flooded tracts of Will’s Creek [=Diamantina River], beyond desert’ [state unknown], 1861, *J. Murray s.n.* (syn.: BM 000895594 image!, K 000357020 image!, MEL 2235243 image!, MEL 2235244 image!, PERTH 01558226!).

Ptilotus murrayi var. *major* J.M.Black, *Trans. & Proc. Roy. Soc. S. Austral.* 47: 368 (1923). — **Type:** ‘Between Herrgott [=Marree] and Innamincka’, South Australia, Jun. 1916, *R. Cockburn s.n.* (holo.: AD 97747822A image!).

Ptilotus petiolatus Farman, *Bull. Herb. Boissier* ser. 2, 5: 1089 (1905), syn. nov. — **Type:** ‘North West Australia, Between the Ashburton and De Grey rivers’, Western Australia, [purchased] Aug. 1900, *E. Clement s.n.* (syn.: K 000349177 image!, K 000349178 image!, K 000349179 image!).

Prostrate mat-forming or decumbent annual herb 5–20 cm high, 20–100 cm wide. *Stems* terete, ribbed, glabrous. *Basal leaves* not seen. *Cauline leaves* alternate or subopposite, narrowly lanceolate to broadly lanceolate or spatulate, entire, 5–30 mm long, 3–9 mm

wide, glabrous; base narrowly attenuate or petiolate, 5–10 mm long; apex mucronate, mucro c. 0.1 mm long. *Inflorescences* solitary or in clusters, axillary or terminal, sessile, spiciform, cylindrical, 5–30 mm long, 4–8 mm wide, white; apex acute or truncate. *Bracts* ovate, 1.0–1.8 mm long, 0.8–1.1 mm wide, translucent, glabrous; midrib obscure; apex rounded. *Bracteoles* ovate, 1.5–2.1 mm long, 0.7–1.0 mm wide, translucent, glabrous; midrib obscure; apex acute. *Outer sepals* narrowly lanceolate, 2.0–3.3 mm long, 0.4–0.7 mm wide; midrib region prominent, green, 1.5–2.5 mm long, 0.1–0.3 mm wide; basal outer surface with long, wavy, nodose hairs at base, becoming densely woolly with age; inner surface glabrous; apex acute, scarious margin 0.5–1.0 mm long, glabrous, white. *Inner sepals* lanceolate, 1.8–2.8 mm long, 0.3–0.7 mm wide; midrib region prominent, green, 1.7–2.2 mm long, 0.2–0.3 mm wide; basal outer surface with long, wavy, nodose hairs at base, becoming densely woolly with age; inner surface glabrous; apex acute, scarious margin 0.3–0.7 mm long, glabrous, pink. *Fertile stamens* 5; *filaments* 0.3–0.6 mm long; *anthers* 0.3–0.5 mm long, 0.1–0.2 mm wide, yellow. *Staminal cup* 0.3–0.5 mm long, unlobed. *Ovary* globular, 0.7–1 mm long, 0.5–0.9 mm wide, glabrous. *Style* straight, 0.3–0.5 mm long, centrally placed on the ovary apex. *Stigma* unlobed, capitate. *Fruit* smooth, membranous, irregularly dehiscent. *Seed* round, black, glossy, c. 0.9 mm long, c. 0.7 mm wide. **Fig. 1A.**

Diagnostic characters. *Ptilotus murrayi* may be distinguished from all other members of the genus by the following combination of characters: a prostrate or decumbent annual herb with glabrous stems and leaves, sessile axillary inflorescences, sepals not clawed, outer sepals with acute apices, a glabrous adaxial sepal surface, densely woolly hairs on the base of the abaxial sepal surface, 5 fertile stamens, staminal cup appendages absent, a central style centrally placed on the ovary apex, and a glabrous ovary.

Phenology. *Ptilotus murrayi* typically flowers from April to August throughout its range, extending into late October in Queensland and South Australia.

Distribution and habitat. *Ptilotus murrayi* occurs in the Carnarvon, Gascoyne, Murchison, Pilbara and Dampierland IBRA regions in Western Australia, and in south-western Queensland and north-eastern South Australia in Mitchell Grass Downs and Channel Country IBRA regions, with several outlying collections in the Simpson-Strzelecki Dunefields (Fig. 3A). The typical habitat is a flat floodplain or on the fringes of ephemeral wetlands, billabongs or rivers with silty or more commonly clayey red or brown soils.

Conservation status. *Ptilotus murrayi* is not listed as of conservation concern in any state in which it occurs.

Selected specimens examined

QUEENSLAND: 5.6 km W of turnoff to Birdsville along Windorah to Bedourie road, 27 June 2010, *D. Halford QM116* (BRI); Elizabeth Springs Conservation Park,

24 Oct. 2010, *R.Moore 1304* (BRI); Carlo, 16 June 2010, *J.Silcock JLS263* (BRI); 18 km E of Mount Leonard Station Homestead, 9 June 2010, *G.P.Turnpin GPT1333* (BRI).

SOUTH AUSTRALIA: Cordillo Downs on track near S. boundary c. 1 km S of Bluebush Dam, 6 May 2011, *D.C.Bickerton, P.J.Lang & D.J.Duval 76* (AD).

WESTERN AUSTRALIA: Liveringa Station near Fitzroy River, 20 Apr. 1985, *T.E.H.Aplin 179* (PERTH); track behind station to Yanarrie River within 200 m of homestead Yanrey Station, 6 May 2004, *G.Byrne 943* (PERTH); Maitland Road, Bullgarra Cell, Karratha, 20 Aug. 1986, *K.Glennon 239* (PERTH); on the side of North West Coastal Highway on a mound in a recently burnt flood plain, 2 km W of Yule River, 17 Aug. 2015, *T.Hammer, S.Dillon & K.Thiele TH 25* (PERTH); c. 800 m ENE of Balmoral Caravan Park, Balmoral Road, Nickol, Karratha, 14 Apr. 2011, *V.Long VLK tall-11* (PERTH); c. 20 km E of Nanutarra Station homestead, c. 200 km W of Paraburdoo, 15 May 1997, *A.A.Mitchell 4735* (PERTH); 8.7 km NNW of Whim Creek, Mallina Station, Pilbara, 19 Apr. 2006, *S.van Leeuwen PBS 5816* (PERTH).

***Ptilotus gomphrenoides* F.Muell. ex Benth.**

Fl. Austral. 5: 244 (1870). — **Type:** ‘Hamersley Range, N.W. coast, F. Gregory’s Expedition’, *F.Mueller s.n.* (syn: K 000357029 image!, MEL 2281815 image!).

Ptilotus roseo-albus Farmar var. *roseo-albus*, *Bull. Herb. Boissier ser. 2*, 5: 1090 (1905). — *Ptilotus gomphrenoides* var. *roseo-albus* (Farmar) Benl, *Mitt. Bot. Staatssamml. München* 4: 277 (1962). — **Type:** ‘N.-W. Division, W. Australia, E. Clement, 1897’ [between the Ashburton and De Grey rivers, Western Australia, 1897, *E.Clement s.n.*] (syn: K 000357024 image!, K 000357025 image!, K 000357026 image!, K 000357027 image!).

Ptilotus roseo-albus var. *conglomeratus* Farmar, *Bull. Herb. Boissier ser. 2*, 5: 1090 (1905). — *Ptilotus gomphrenoides* var. *conglomeratus* (Farmar) Benl, *Mitt. Bot. Staatssamml. München* 4: 278 (1962). — **Type:** ‘N.-W. Division, W. Australia, E. Clement, 1897’ [between the Ashburton and De Grey rivers, Western Australia, 1897, *E.Clement s.n.*] (holo: K 000357028 image!).

Erect, decumbent or less-commonly prostrate *annual herb* (2–) 10–30 cm high, 35–100 cm wide. *Stems* terete, ribbed, glabrous or with sparse nodose hairs. *Basal leaves* not seen. *Cauline leaves* alternate, narrowly lanceolate to broadly lanceolate, entire, 5–30 mm long, 1–5 mm wide, glabrous; base narrowly attenuate or petiolate, 3–10 mm long; apex mucronate, mucro 0.1–0.2 mm long. *Inflorescences* solitary or in clusters, axillary or terminal, pedunculate (peduncle 1–10 mm long) or rarely sessile, spiciform, cylindrical, 4–20 mm long, 6–7 mm wide, pinkish white; apex acute or truncate. *Bracts* ovate, 1.1–1.4 mm long, 0.8–0.9 mm wide, translucent, glabrous; midrib obscure; apex rounded. *Bracteoles* ovate, 1.2–1.5 mm long, 0.8–0.9 mm wide, translucent, glabrous; midrib faint or obscure; apex acute. *Outer sepals* narrowly lanceolate, 2.0–3.0 mm long, 0.5–0.8 mm wide; midrib region prominent, pink or rarely greenish, 1.2–1.5 mm long, 0.4–0.8 mm wide; basal outer surface with long, wavy, nodose hairs at base, becoming densely woolly with age; inner surface glabrous; apex rounded, scarious

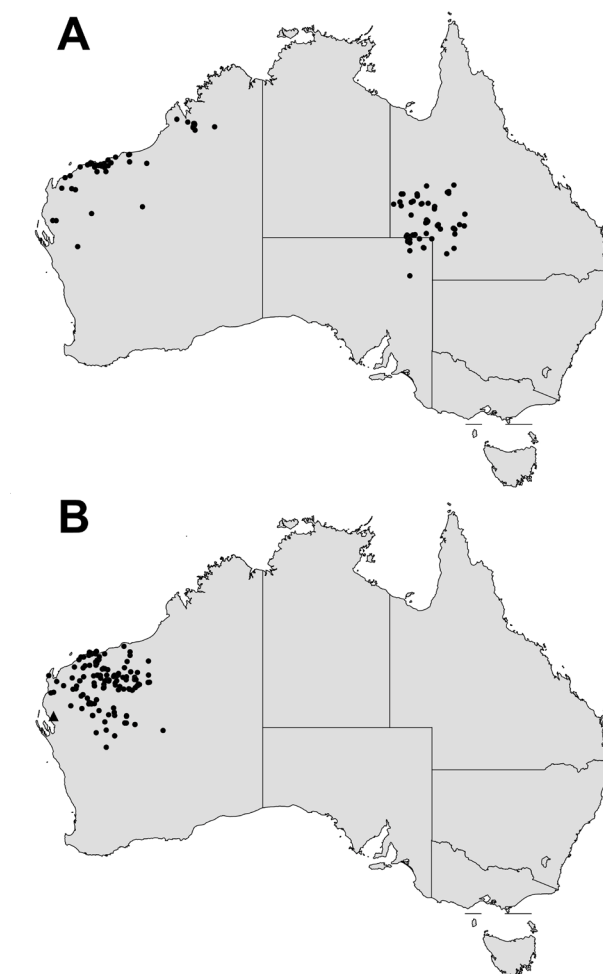


Fig. 3. Occurrence of herbarium records. **A** *Ptilotus murrayi*; **B** *P. gomphrenoides* (circles) and *P. unguiculatus* (triangle).

margins 0.8–1.5 mm long, glabrous, white. *Inner sepals* lanceolate to broadly lanceolate, 1.8–2.5 mm long, 0.7–1.2 mm wide; midrib region prominent, pink or rarely green, 1.0–1.5 mm long, 0.5–0.8 mm wide; basal outer surface with long, wavy, nodose hairs at base, becoming densely woolly with age; inner surface glabrous; apex rounded, scarious margin 0.5–0.8 mm long, glabrous, pink. *Fertile stamens* 5; *filaments* 0.3–0.7 mm long; *anthers* 0.2–0.4 mm long, 0.2–0.3 mm wide, yellow or pink. *Staminal cup* 0.1–0.2 mm long, unlobed. *Ovary* globular, 0.6–0.7 mm long, 0.5–0.7 mm wide, glabrous. *Style* straight, 0.2–0.4 mm long, centrally placed on the ovary apex. *Stigma* unlobed, capitate. *Fruit* smooth, membranous, irregularly dehiscent. *Seed* round, black, glossy, c. 0.8 mm long, c. 0.7 mm wide. **Fig. 1B.**

Diagnostic characters. *Ptilotus gomphrenoides* can be distinguished from other species in the genus by the following combination of characters: an erect or decumbent annual herb with glabrous stems and leaves, pedunculate axillary or terminal inflorescences, sepals not clawed, outer sepals with rounded apices, a glabrous adaxial sepal surface, densely woolly hairs on the base of the abaxial sepal surface, 5 fertile stamens, staminal cup

appendages absent, a central style centrally placed on the ovary apex, and a glabrous ovary.

Phenology. *Ptilotus gomphrenoides* flowers from April to September, with a few outlying specimens having been collected from October to January.

Distribution and habitat. *Ptilotus gomphrenoides* occurs in the Carnarvon, Gascoyne, Pilbara and northern Murchison IBRA regions of Western Australia (Fig. 3B). The typical habitat is flat seasonally-inundated floodplains, riverbanks or creek lines with clayey red or brown soils.

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

Selected specimens examined

WESTERN AUSTRALIA: Callina Creek c. 40 km WSW of Marble Bar, 30 Apr. 2006, *A.Bean* 25214 (PERTH); Chichester Ranges, 20 July 2011, *S.Chalwell* 379 (PERTH); Turn off to Python Pool near Tom Price railway road, 16 July 2013, *R.Davis* 12261 (PERTH); 1.1 km S along fenceline from Mount Brockman road and 22 km W of Hamersley Station homestead, 24 Sep. 2006, *D.Halford* Q9265 (PERTH); Nammuldi/Silvergrass lease area near Mt Brockman, WNW of Tom Price, 28 Aug.–7 Sep. 1998, *M.Maier s.n.* (PERTH 05986389); N of Catho Well mesa, Mount Stuart Station, West Pilbara Iron project area, 7 Aug. 2008, *K.McMaster* LCH 25882 (PERTH); 14 miles S of Nullagine, Sep. 1971, *R.Mirrington* 710919 (PERTH); Gascoyne River crossing at Yinnetharra, Western Australia, 14 Aug. 2002, *S.Patrick* 4291 (PERTH); Karijini National Park, 900 m NNW of the summit of Mt Hyogo and 13.3 km SW of Mt Bruce and 31.1 km NNE of Mt Bennett, Hamersley Range, 24 Aug. 1995, *S.van Leeuwen* 2053 (PERTH); E side of track, 5.3 km N of Ripon Hill Road on track of abandoned Braeside Station Homestead, 10.5 km W of Pulgorah Cone, 119.9 km ESE of Marble Bar, Warrawagine Station, Pilbara, 22 Apr. 2004, *S.van Leeuwen et al.* PBS 7047 (PERTH).

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