

Reinstatement of *Goodenia pritzelii* Domin (Goodeniaceae) from the north Kimberley and description of *G. oenpelliensis* as a new species from the Northern Territory

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Abstract

Two species of annual *Goodenia* from Tropical Australia are investigated. Based on re-examination of types in conjunction with recently collected material, *Goodenia pritzelii* Domin is reinstated as a poorly known species from the north Kimberley region of Western Australia. *Goodenia pritzelii* is known only from four collections, one of which is the type, and is clearly allied to *G. arachnoidea* Carolin, which grows sympatrically with *G. pritzelii* in one location. The new species *G. oenpelliensis* R.L.Barrett belonging to sect. *Amphichila* is described, and is known from a single collection near Oenpelli in the Northern Territory.

Introduction

The flora of northern Australia remains relatively poorly known and undescribed species, particularly herbaceous annuals, are discovered on a regular basis (e.g. Barrett and Barrett 2015a). This largely relates to the remote nature of tropical Australia and difficulties with access during the summer monsoon when many annual species are fertile (Barrett 2015). In a paper describing three new *Goodenia* Sm. species from the Kimberley region of Western Australia, Barrett and Barrett (2015b) drew attention to two names of uncertain application, *G. heterochila* var. *racemosa* Benth. and *G. pritzelii* Domin. While they suggested both are homotypic synonyms and that *G. pritzelii* be reinstated, they left its status unresolved until a type specimen could be examined.

Goodenia heterochila var. *racemosa* was described by Bentham (1869), who cited the type from Camden Harbour in the Kimberley region (MEL0023798). Domin (1929) later recognised this taxon at specific rank, introducing the epithet *G. pritzelii* to avoid the preoccupied name *G. racemosa* F.Muell. Although *G. heterochila* var. *racemosa* and *G. pritzelii* are one and the same, during his recognition of the latter, Domin, having not examined the type specimen himself, inadvertently introduced confusion in the concept of the species by citing a specimen from the Pilbara region, collected between the Ashburton and Yule Rivers (*Clement s.n.*). Several Clement collections from this expedition are held at K, and images were seen for this study, however it is difficult to be certain which specimen(s) Domin based his decision on, given the broad collection locality and lack of a unique collection number.

The Clement collection may refer to *G. microptera* F.Muell. based on the silvery indumentum described by Domin (1929). A collection by *W.V.Fitzgerald* 93 from Port Hedland (K000215972), was initially identified as *G. heterochila* var. *racemosa* by C.A.Gardner (who probably matched it to the Clement specimen while visiting K), and was subsequently redetermined as *G. microptera* by R.Carolin. Another possibility is that Domin (1929) was identifying *G. pritzelii* with the type collection of *G. lasiophylla* K.Krauss (K000216037, K000216038; now treated as a synonym of *G. forrestii* F.Muell.); although both species bear a superficial resemblance, *G. lasiophylla* is readily distinguished from *G. pritzelii* by its prominent glandular hairs on the calyx and more prominently lobed leaves. No *Goodenia* specimens matching MEL0023798 are known from the Pilbara region, therefore it is unlikely that any Clement collection matches MEL0023798. The inclusion of the Clement specimen under *G. pritzelii* by Domin was probably based on Diels & Pritzel's (1905) concept of *G. heterochila* var. *racemosa* who applied the name to a different specimen from the Pilbara, near Roebourne in April 1901 (*Diels* 2793, cited by Krause (1912) at B but the specimen cannot be located, and is therefore possibly destroyed). It is unlikely that Diels or Pritzel saw the type specimen of *G. heterochila* var. *racemosa* and more likely that they based their concepts on its original description by Bentham (1869).

Following the description of *G. pritzelii*, Roger Carolin initially determined the MEL0023798 specimen as *G. odonnellii* F.Muell. in 1970, and later, he synonymized *G. pritzelii* with *G. microptera* (Carolin 1992), but without justification. We find that this specimen is neither *G. odonnellii* nor *G. microptera* based on differences in corolla shape and indumentum. Compared to *G. odonnellii*, the MEL0023798 specimen has sepals that are broader and an indumentum over most of the plant that is more dense; furthermore, the flowers are axillary in appearance since most bracts are large and scarcely differentiated from the leaves (though the leaves become bract-like towards the inflorescence apex), whereas *G. odonnellii* has a racemose inflorescence with leaf-shaped bracts. The MEL0023798 specimen has equally-winged upper corolla lobes whereas *G. microptera* (as well as *G. maretensis*) has inner wings of the upper corolla lobes reduced relative to the outer wing.

As MEL0023798 does not resemble any other specimens of *Goodenia*, we conclude that *G. heterochila* var. *racemosa* represents a species-level taxon distinct from all other currently-recognised *Goodenia* species, and consequently, we reinstate *G. pritzelii* and provide a detailed description that differs from Domin's (1929) original concept of *G. pritzelii*. In addition, we also provide a description of *G. oenpelliensis* R.L.Barrett, which is based on a collection originally incorporated under *G. pumilio* R.Br. While only known from a single collection, this taxon is considered sufficiently distinct from all other species of *Goodenia* sect. *Amphichila* DC. It is hoped that the descriptions of both species will encourage further collection of small annual *Goodenia* species in Northern Australia.

Materials and Methods

Measurements were made with digital callipers certified accurate to 3/100th mm. MEL0023798 was compared to collections of all aforementioned taxa and other possibly related *Goodenia* species at MEL, and macro images of the type were compared with collections at CANB and PERTH. Three recent collections at PERTH from the vicinity of the type collection are a good match for the type specimen of *G. heterochila* var. *racemosa*, and corroborate our interpretation of character states. The description of *G. pritzelii* presented here is based on examination of the type specimen MEL0023798 (consisting of two young plants and two portions of a stem from another plant) and three more recent PERTH collections. The type specimen appears to have mostly young leaves, and while it possesses flowers, no fruit has developed, making a comprehensive description of reproductive characters impossible from this specimen alone. Fruiting material is described from more recent collections, as well as increasing the size range for other characteristics relative to the type collection. The description of *G. oenpelliensis* is based on the type collection, with sheets at CANB, MEL, NSW and PERTH measured to form the description.

Taxonomy

Goodenia pritzelii Domin, *Biblioth. Bot.* 22(89): 1196 (1929); *Goodenia heterochila* F.Muell. var. *racemosa* Benth., *Fl. Austral.* 4: 71 (1869).

Diagnosis: Distinguished from other north-western Australian *Goodenia* species by the following combination of characters: Annual herb. Indumentum essentially monomorphic, hirsute (long unicellular, appressed to spreading to erect, tubercle-based, eglandular hairs), very dense on new growth, sparse to moderately dense on older growth, 0.25–1.25(–1.6) mm long on stems. Sepals linear to lanceolate, 2.6–5.3 mm long, 0.2–0.8 mm wide, distinctly flattened. Indusium base sunken adaxially, with scattered, appressed pubescent hairs 0.2–0.3 mm long in the depressed area, abaxial surface with a patch of short hairs 0.2–0.3 mm long below the orifice.

Type: Camden Harbour, Western Australia, [1860s, *J. Martin*], herb. *F. Mueller* (holo: MEL0023798!).

Spreading to prostrate (erect when young), annual to 0.15 m high, to 0.8 m wide. *Indumentum* monomorphic (except for a small patch of crisped hairs on the corolla spur), hirsute, (long unicellular, appressed to spreading to erect, tubercle-based, eglandular hairs), very dense on new growth, sparse to moderately dense on older growth, 0.25–1.25(–1.6) mm long, 0.03 mm wide on stems. *Leaves* all cauline, ovate, broadly oblanceolate or narrowly obovate (narrowly ovate when young); lamina 21–45 mm long, 8.5–18 mm wide, flat, margins dentate except near the base (a single leaf with four prominent lobes towards the base), not recurved, midrib obscure adaxially, prominent abaxially, apex acute to obtuse, dried brownish green, weakly discolorous, paler abaxially, adaxial and abaxial surfaces sparsely to moderately densely hispid, slightly denser abaxially, very gradually tapered at the base (not auriculate); petiole 11–23 mm long on seedling (basal) leaves, only 1–3 mm long on mature (upper cauline) leaves; leaves becoming smaller and petioles shorter distally, eventually bract-like along the inflorescence. *Inflorescence* a terminal (or occasionally lateral) leafy raceme >22 cm long, most flowers solitary in axils of leaf-like bracts, but sometimes a few terminal flowers in bract axils, axis straight rather than zigzag; ultimate bracts leaf-like, ±sessile, entire, 7–10 mm long, 0.9–3.8 mm wide; *pedicels* 12–28 mm long, not articulate, ebracteolate, densely strigose, hairs finer than on stems. *Calyx* 1.4–2.6 mm long, densely hirsute; sepals linear to lanceolate, 2.6–5.3 mm long, 0.2–0.8 mm wide, distinctly flattened, with moderately dense, stiffly spreading hairs on all surfaces (c. 0.01 mm wide). *Corolla* yellow, 6.1–9.1 mm long, veins prominently purple outside (when dry), with simple, spreading hairs 0.3–0.6 mm long outside; appearing glabrous in throat (a few short hairs inside at the base of the tube); tube 1.3–2.5 mm long, enations absent, corolla pouch shallow, with dense crisped hairs 0.15–0.25 mm long outside; lobes narrowly to broadly winged, the 2 adaxial (upper) lobes separated lower than the abaxial lobes and ±equally winged, lobes 2.2–2.9 mm long including auricles, inside wing broadly triangular, 0.5–0.7 mm wide, 0.7–1.2 mm long (to top of auricle), outside wing 0.45–0.5 mm wide, 0.8–1.0 mm long; abaxial (lower) lobes 3.6–5.7 mm long (including fused base above tube; individual lobes 1.1–2.9 mm long excluding wings), wings 0.6–0.8 mm wide, 0.7–1.8 mm long. *Stamen* filaments 2.1–2.7 mm long; anthers 0.8–1.24 mm long. *Style* 3.4–5.1 mm long, sparsely hairy, hairs 0.2–0.3 mm long; indusium longer than broad, broadly ovate, entire, 1.2–1.6 mm long, 1.0–1.2 mm wide, not notched, base sunken adaxially, with scattered, appressed pubescent hairs 0.2–0.3 mm long in the depressed area, abaxial surface with a patch of short hairs 0.2–0.3 mm long below the orifice, the orifice densely ciliate, hairs uniform in length 0.12–0.24 mm long. *Ovules* 4, very compressed in bud. *Capsule* obovoid, 4.1–5.8 mm long, hirsute. *Seeds* elliptic, 4.0–4.9 mm long, 2.3–3.0 mm wide, 0.6 mm thick, obscurely verrucose, shining, brownish yellow, wing obsolete or to 0.2 mm wide. **Figs 1, 2a, c, e.**

Distribution and habitat: The type location is ‘Camden Harbour’. Also known from the Sale River, Artesian Range and southern Prince Regent National Park, from sand over sandstone or sandstone pavements, often under or near rock overhangs, or in open shrubland with *Buchanania oblongifolia*, *B.* sp. West Kimberley (*R.L. Barrett 1099*), *Calytrix* aff. *exstipulata*, *Arivela* aff. *tetrandra*, Cyperaceae, *Goodenia psammophila*, *Heliotropium* sp., *Mitrasacme nidulifera*, *Owenia vernicosa*, *Spermacoce* sp., *Terminalia* sp. and *Zornia prostrata*.

Phenology: Flowering and fruiting recorded for January and May.

Conservation status: *Goodenia pritzelii* is to be listed as Priority Two under Conservation Codes for Western Australian Flora (A. Jones, DBCA, pers. comm.). Known only from four locations, one on the edge of the Prince Regent National Park. It must be regarded as Data Deficient as the area in which it is known remains poorly surveyed (IUCN 2001).

Etymology: The species epithet recognises the contribution of Ernst Georg Pritzel to the systematics of Western Australian Goodeniaceae (in Diels and Pritzel 1905).

Additional specimens examined: WESTERN AUSTRALIA: Upper Sale River, 29 Jan 1999, *M.D. Barrett* MDB656 (CANB, DNA, K, MEL, NSW, PERTH); South arm of Bachsten Creek Gorge, 31 Jan 1999, *M.D. Barrett* MDB696 (PERTH); Grasswren Gully, Artesian Range, 28 May 2013, *H. Dauncey* H686 (PERTH).

Notes: Morphological similarities suggest a relationship between *G. pritzelii* and *G. arachnoidea* Carolin for which comparative photos are presented (Fig. 2b, d, f). The two taxa share a dense hirsute indumentum of eglandular hairs, dentate to lobed and non-auriculate leaves, leafy inflorescences, long ebracteolate peduncles, linear hispid sepals, yellow corolla and thick seeds. *Goodenia pritzelii* has an appressed to spreading to erect indumentum of stiff hairs (vs appressed to spreading indumentum of crisped, recurved or contorted tangled hairs in *G. arachnoidea*); sepals distinctly flattened (vs sepals filiform to slightly flattened); indusium with a patch of short hairs on the adaxial surface (vs usually glabrous, occasionally a few hairs); indusium with a patch of short hairs on the abaxial surface (vs a long tuft of beard-like hairs on the abaxial surface).

A number of other species, such as *G. brachypoda* (F.Muell. ex Benth) Carolin, *G. forrestii*, *G. hispida* R.Br., *G. muelleriana* Carolin, *G. odonnellii*, and *G. stellata* Carolin are superficially similar, and have potentially been confused with *G. pritzelii* by earlier authors, but based on our studies, they are not closely related. *G. odonnellii* is ± glabrous or has a sparse (vs dense) indumentum, pedicels to 40 mm long (vs to 28 mm long), sepals 1–2 mm long (vs 2.6–5.3 mm long) and dense hairs (vs ± glabrous) in the throat of the corolla, and a characteristic indusium notched at the apex when viewed from above (vs not notched). The leaves of *G. odonnellii* are only dentate towards the apex, or if lobed, then more deeply lobed throughout (vs a few lobes at the base). *Goodenia forrestii* has more deeply-lobed leaves (vs few lobes), and glandular (vs only simple) hairs on the calyx and corolla. *Goodenia muelleriana* is very distinctly glandular hairy (vs only simple), has basal and cauline leaves (vs only cauline), pedicels 38–100 mm long (vs to 40 mm long), lanceolate (vs ovate to narrowly obovate) leaves, a bracteate (vs leafy) inflorescence and flowers 12–15 mm long (vs 6–9 mm long). *Goodenia heterochila* F.Muell. is very similar in general indumentum and form, but differs by having shorter sepals and the indumentum on the outside of the corolla is much shorter (c. 0.1 vs 0.3–0.6 mm long) and the wings on the upper corolla lobes are very narrow (0.1–0.3 vs 0.45–0.7 mm wide) and unequally placed. *G. stellata* is superficially similar, but the indumentum is stellate (vs simple). Several species related to *G. hispida* and *G. brachypoda* are also similar, but have auriculate leaves.

The non-auriculate leaves, simple, dense indumentum, relatively equal (though asymmetrical) wings on the upper corolla lobes can lead to *G. odonnellii* in the key provided by Carolin (1992). If the wings on the adaxial corolla lobes are interpreted as unequal (the inner wings are shorter and slightly narrower than the outer), then this species can key to *G. microptera*, and this may be why Carolin (1992) included it under that species. However, there are numerous differences between the type and *G. microptera*, especially the presence of dense glandular hairs in the latter. The vernacular name of Pritzel's *Goodenia* is recommended.

The key by Carolin (1992: Group 7) is modified to include *G. pritzelii*

- | | | |
|------|-------------------------------------|---------------------|
| 27 | Stems glabrous or glabrescent | <i>G. nuda</i> |
| 27: | Stems hairy | 27A |
| 27A | Stems lacking glandular hairs | <i>G. pritzelii</i> |
| 27A: | Stems with glandular hairs | 28 |

Goodenia oenpelliensis R.L.Barrett, *sp. nov.*

Diagnosis: Annual herb. Indumentum of dense hispid hairs on all vegetative parts 0.4–0.7 mm long. Leaf blade ovate to obovate, 9–20 mm long, 4–11 mm wide. Seeds lenticular, 0.45–0.55 mm across, pale brown, shiny, wing very narrow, < 0.05 mm wide, pale.

Type: Northern Territory: Oenpelli, 12°18'S, 133°04'E, 21 Oct. 1948, *R.L. Specht* 1234 (holo: CANB 29385!; iso: AD96141084 *n.v.*, K *n.v.*, MEL23456!, NSW80934!, PERTH2640139!).



Fig. 1. *Goodenia pritzelii*. Holotype [J. Martin] (MEL). Inset a. leaves and inflorescence; Inset b. flower. Images by R.L. Barrett.

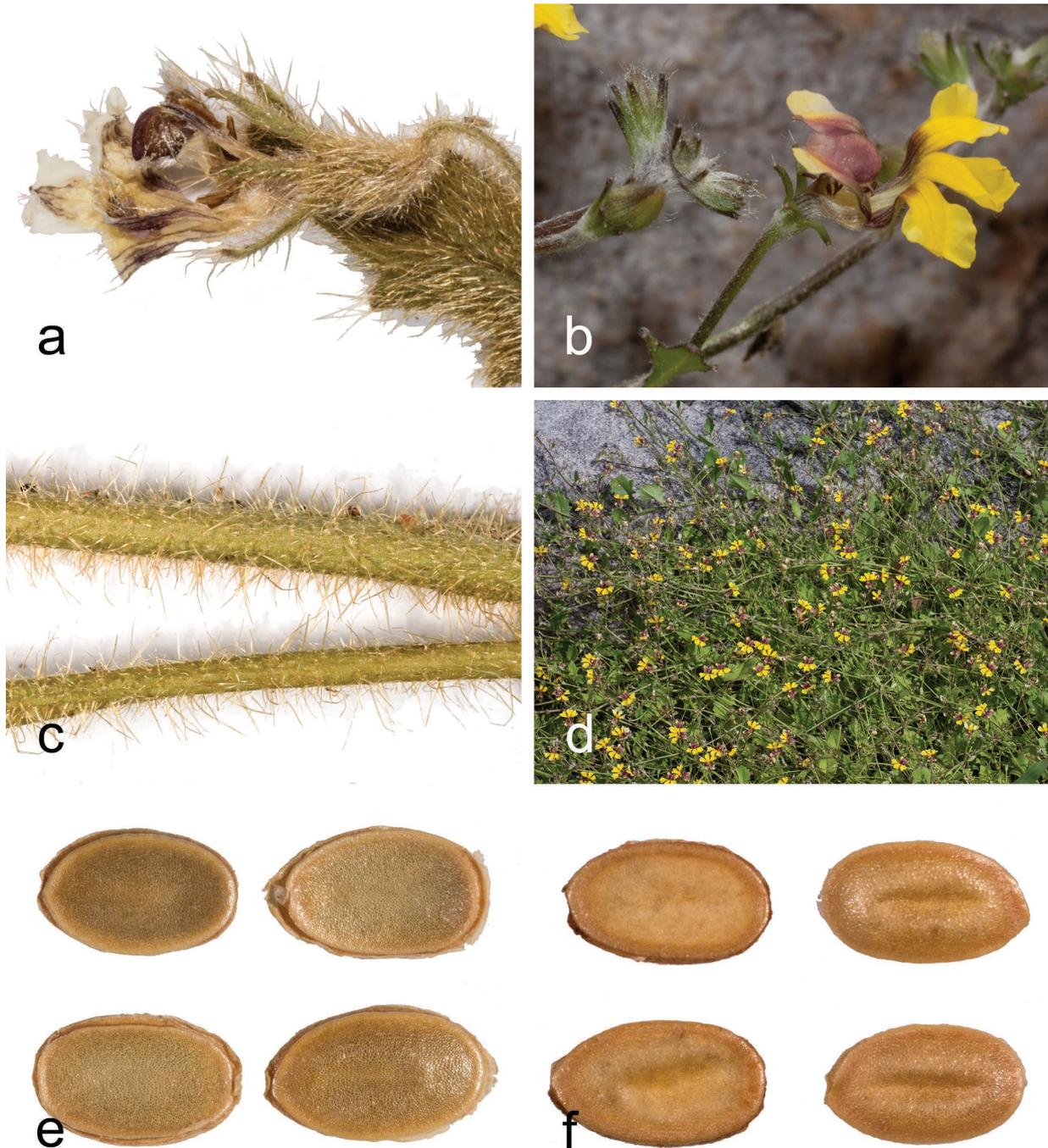


Fig. 2. *Goodenia pritzelii*. M.D.Barrett 656 (PERTH). **a.** flower and calyx; **c.** stem indumentum; **e.** seeds. *Goodenia arachnoidea*. R.L.Barrett 8913 (PERTH). **b.** flower and calyx; **d.** habit; **f.** seeds. Images by R.L. Barrett.

Small, prostrate, annual (or possibly short-lived perennial) *herb* with a small tap-root, up to 2 cm high, 3.5–8 cm across, stolons absent or short, branches when present usually decumbent to spreading. *Indumentum* of erect, simple eglandular hairs 0.4–0.7 mm long on vegetative parts. *Leaves* thin, mostly in a basal rosette, with a few reduced, bract-like leaves on branchlets when present at base of peduncles, blade grading gradually to a long petiole; blade ovate to obovate, 9–22 mm long, 4–12 mm wide, margin entire, apex acute to obtuse, green; with densely distributed hairs on both surfaces of the blades, visible to the naked eye. *Inflorescence* dimorphic with solitary, axillary flowers in leafy rosettes and sometimes in a simple ebracteolate (leaves reduced and often bract-like in cymes) cyme on branches; pedicels (originating in rosettes) 10–17 mm long, elongating during fruiting, pedicels (originating in cymes) only seen immature, >3 mm long, with erect to somewhat antrorse

hispid hairs. *Calyx* tube 0.6–1.1 mm long, densely hispid; sepals narrow-triangular, distinctly unequal, adaxial sepal 1.3–1.5 mm long, lateral and abaxial sepals 0.8–1.2 mm long, with densely hispid hairs. *Corolla* maroon or reddish brown, fan-shaped, 1.5–2.0 mm long, tube 0.3–0.4 mm long, spur obsolete, shortly hispid outside, with erect to appressed hairs 0.15–0.30 mm long, glabrous inside; lobes 1.2–1.4 mm long, equally fused for c. 1/6 their length, wings and auricles absent. *Stamen* filaments linear, 0.6–0.8 mm long; anthers ovate, 0.30–0.35 mm long. *Style* with a few short hairs; indusium 0.35–0.50 mm long, 0.4–0.5 mm wide, minutely papillose (visible at 40× magnification), orifice ciliate, hairs c. 0.05 mm long. *Capsule* ovoid to ellipsoid, 1.8–2.1 mm long, 0.8–1.2 mm in diameter, with dense hispid hairs, dissepiment not seen, ovules numerous (>20). *Seeds* numerous, lenticular, 0.45–0.55 mm across, pale brown, shiny, wing very narrow, < 0.05 mm wide. **Fig. 3.**

Distribution and habitat: The type location is in north-western Arnhem Land in the Northern Territory. The collection was made from sandy soils at the edge of a ‘marsh’ (probably a shallow, ephemeral swamp).

Phenology: Flowering and fruiting recorded for October.

Conservation status: *Goodenia oenpelliensis* is only known from a single location and may be rare. However, since it is so small it may not have been detected elsewhere and so should be listed as Data Deficient (IUCN 2001) until better examination of similar habitats are made.

Etymology: The species epithet recognises the community of Oenpelli, in north-west Arnhem Land, where this species was collected during the National Geographic Society of America and Commonwealth Government of Australia Expedition to the Arnhem Land Aboriginal Reserve (Specht 1958).

Additional specimens examined: Known only from the type collection.

Notes: While preparing the description of *G. cravenii* R.L.Barrett & M.D.Barrett (Barrett and Barrett 2015b) and searching for additional collections of that taxon, an unusual collection incorporated under *G. pumilio* was found. The specimen was cited under *G. pumilio* by Carolin (1992), but is here designated as the type of *G. oenpelliensis*. *Goodenia oenpelliensis* shares with *G. cravenii*, *G. kakadu* Carolin, *G. neogoodenia* Carolin and *G. pumilio* the small, brownish corolla lacking wings (all but *G. neogoodenia* belong to sect. *Amphichila sensu* Carolin 1992). *Goodenia oenpelliensis* and *G. pumilio* have a superficially similar dense leaf indumentum, but *G. oenpelliensis* has simple hairs, while the latter has stellate hairs. *Goodenia oenpelliensis* appears to be morphologically closest to *G. kakadu* and *G. cravenii*, differing in its dense hairs 0.4–0.7 mm long (vs sparse hairs to 0.5 mm long), broad, 4–12 mm wide (vs narrow, 1.0–2.4 mm wide), distinctly petiolate leaves (vs indistinctly petiolate), and larger seeds 0.45–0.55 mm across (vs c. 0.2 mm) with a pale, narrowly-winged margin (vs wingless).

The original key by Carolin (1992), modified by Barrett & Barrett (2015), is here modified further to include *G. oenpelliensis*.

- 12. Leaves sessile 12A
- 12: Leaves petiolate 12B
- 12A. Flowers numerous, 8–32 in the central rosette, and 4–18 in leafy cymes; leaf margins distantly but distinctly toothed, indumentum on lamina 40–80 mm long *G. cravenii*
- 12A: Flowers few, 1–5 in the central rosette and solitary in widely spaced leaf axils along stolons; leaf margins entire, indumentum on lamina 0.32–0.41 mm long *G. kakadu*
- 12B. Hairs on leaves stellate *G. pumilio*
- 12B: Hairs on leaves simple 13
- 13. Ovule solitary *G. neogoodenia*
- 13: Ovules > 20 *G. oenpelliensis*



Fig. 3. *Goodenia oenpelliensis*. R.L. Specht 1234 (CANB). Inset a. leaves and inflorescence; Inset b. calyx; Inset c. inflorescence. Inset d. flower. Images by R.L. Barrett.

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