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Revision of the connate bract group allied to *Goodenia panduriformis* (Goodeniaceae), including recognition of three new species

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Abstract

Shepherd, K.A. & Lepschi, B.J. Revision of the connate bract group allied to *Goodenia panduriformis* (Goodeniaceae), including recognition of three new species. *Nuytsia* 34: 227–254 (2023). The taxonomy of several species of *Goodenia* with connate bracts allied to *G. panduriformis* (A.Cunn. ex Benth.) K.A.Sheph. was evaluated through morphological assessment of herbarium specimens. Consequently, the circumscriptions of *G. connata* (F.Muell.) K.A.Sheph., *G. discophora* (F.Muell.) K.A.Sheph., *G. daviesii* (F.Muell.) K.A.Sheph. and *G. panduriformis* are revised and new descriptions provided. Three new species, *G. aluta* K.A.Sheph. & Lepschi, *G. crescentiloba* K.A.Sheph. & Lepschi and *G. obscurata* K.A.Sheph. & Lepschi are also recognised, the latter being listed as a species of conservation concern. Further, a replacement lectotype for *Velleia helmsii* K.Krause is designated and a key, distribution maps and figures are included.

Introduction

Following the recent recircumscription of *Goodenia* Sm. to include *Velleia* Sm., *Verreauxia* Benth., *Selliera* Cav. and *Pentaptilon* E.Pritz. (Shepherd *et al.* 2020), a curation effort was undertaken in select Australian herbaria to redetermine specimens of the subsumed taxa. During this process it became apparent that there were novel taxonomic entities within a group from subg. *Monochila* sect. *Velleia* (Sm.) K.A.Sheph. (*sensu* Shepherd *et al.* 2020) allied to *G. panduriformis* (A.Cunn. ex Benth.) K.A.Sheph. This group, comprising *G. panduriformis*, *G. connata* (F.Muell.) K.A.Sheph., *G. discophora* (F.Muell.) K.A.Sheph. and *G. daviesii* (F.Muell.) K.A.Sheph., form a well-supported monophyletic subclade within 'Goodenia Clade C' based on a combined phylogeny of nrDNA + cpDNA sequence data (see Figure 8, Shepherd *et al.* 2020). With the exception of *G. daviesii*, members of this subclade have bracts that are fused to form a distinctive disc or funnel (Figure 1). While *G. daviesii* has free bracts, it is morphologically similar to *G. connata* in other respects. Moreover, bracts subtending some terminal flowers in *G. connata* may be free rather than fused (see under that species for further discussion). Representatives of this group are distributed across mainland Australia, including the arid interior. They are short-lived perennials and disturbance opportunists, frequently appearing post-fire or in disturbed habitats. Some are also poisonous to livestock (Watson 1946; Gardner & Bennetts 1955) and the common name of two species alludes to

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this, as *G. discophora* is sometimes referred to as Cabbage Poison, while *G. panduriformis* is called Pindan Poison. The toxicity is likely due to the presence of a glucoside called 'vellein', named for *V. discophora* F.Muell. (= *G. discophora*), the species from which this compound was first isolated (Bottomley & White 1951).

A significant number of herbarium collections have been made since Roger Carolin's seminal works on *Velleia* (Carolin 1967a, 1992) and, with this increase in material, it has become apparent there is more taxonomic diversity within the *G. panduriformis* group than previously recognised. Our systematic study has revealed diagnostically informative variation in a range of vegetative and floral features, including the size, shape and degree of fusion of the sepals, the size, colour and presence of wing tissue on the corolla lobes, the indumentum on the style, and ovule number. Consequently, we have recircumscribed *G. panduriformis*, *G. connata*, *G. discophora*, and *G. daviesii*, and recognised three new taxa. *Goodenia crescentiloba* K.A.Sheph. & Lepschi, a widespread species found across the arid regions of northern Australia, is shown to be distinct from *G. panduriformis*, which is now largely confined to the Kimberley region of Western Australia. *Goodenia aluta* K.A.Sheph. & Lepschi is recognised from central and Western Australia and is distinct from typical *G. connata* on account of its yellow flowers and usually glabrous style. Finally, *G. obscurata* K.A.Sheph. & Lepschi, a white-flowered species with a yellow throat from the western Pilbara of Western Australia, is distinguished from the yellow-flowered *G. discophora*, which is confined to more southern localities in the Eremaean and South-West provinces of Western Australia.

The discovery of three undescribed, distinctive and conspicuous taxa within an equally distinctive and visible component of the Australian flora (the Goodeniaceae), may seem surprising. However, it may be that their very conspicuousness has led to them being overlooked by previous workers and collectors. Anecdotal evidence suggests that the obvious connate bracts found in this group of taxa has led botanists to uncritically place material in one of the previously recognised taxa without further consideration, including in the botanically well-surveyed Pilbara region where *G. aluta*, *G. obscurata* and *G. connata* all occur. However, we note that *G. aluta* has been informally recognised in the southern Northern Territory by botanists familiar with the flora of that region, where it co-occurs with *G. connata* (D.E. Albrecht pers. comm.). Specimens of the yellow- to orange-yellow-flowered *G. crescentiloba*, a taxon morphologically more similar to *G. panduriformis*, have been frequently referred to *G. connata* by collectors and herbarium workers alike. This is possibly because the morphology of these specimens does not match *G. panduriformis s. str.* and so they were placed in *G. connata* by default. This has resulted in a confused and heterogeneous concept of *G. connata* that has been further compounded by the inclusion of specimens of both the yellow-flowered *G. aluta* and the white-flowered *G. obscurata*.

Even with the recognition of three new taxa, some taxonomic uncertainty remains in this group with respect to the morphological variation exhibited by *G. connata s. str.*, the relationship between *G. daviesii* and *G. connata*, and the distinctiveness or otherwise of *Velleia helmsii* K.Krause, a name previously applied to hairy plants of *G. connata* by some workers (*in sched.*) but considered synonymous with that species by Carolin (1967a, 1992) and herein. Resolution of these taxonomic issues is not possible on the basis of existing collections and data: fieldwork throughout the ranges of *G. daviesii* and *G. connata* is required, preferably supported by molecular data.

Methods

This study was based on the examination of herbarium specimens held at AD, BRI, CANB, DNA, MEL, NSW, NT, and PERTH. Supplementary material including types were viewed online via JSTOR

Global Plants (https://plants.jstor.org/) or the Museum National d'Histoire Naturelle (P) database (https://science.mnhn.fr/institution/mnhn/search). Measurements were coded from dried herbarium specimens, with floral characters scored from material that was rehydrated in boiling water and a drop of detergent. The width of the style was measured at the widest point, while sepal length and width were recorded from flowering material only. Measurements of seed length and width refer to the seed only, excluding the seed wing. Seed wing measurements were recorded at the widest point of that structure.

Distribution maps include specimens observed in the herbaria listed above, with decimal latitude and longitude data downloaded from Florabase (Western Australian Herbarium 1998–) and The Australasian Virtual Herbarium (https://avh.chah.org.au/). Maps were created using QGIS version 2.18.16 and include version 7 of the Interim Biogeographic Regionalisation for Australia (IBRA) bioregions (Australian Government Department of Agriculture, Water and the Environment 2012).

Leaves and inflorescence structure

Many of the specimens available for study are incomplete, lacking the lower portion of the plant including the basal leaves (particularly in the larger and more robust species *G. connata*, *G. crescentiloba*, and *G. panduriformis*). In those specimens where these features are present, there appears to be considerable variation in leaf shape, the degree of dissection of the margins, and glaucousness; however, it is unclear whether this variation is of taxonomic significance. Further field sampling from across the range of each species within this clade would help clarify the potential diagnostic value of these features.

The inflorescence structure in *Goodenia* was described by Carolin (1967b) at its simplest, as an open, polytelic, thyrsoid form where the bracts are leaf-like or reduced. Inflorescence structure is more complicated in sect. *Velleia*, as the above ground enrichment zone is contracted, so the leaves appear basal and most of the plant habit is represented by a series of elongated 'dichotomous axillary cymes' (Carolin 1967a), characterised as 'Form H' in Shepherd *et al.* (2020). Because of this complicated structure, we record the peduncle length as encompassing the whole inflorescence, which effectively is equivalent to the height of the plant.

The total number of flowers in the terminal dichasia (Figure 1) are diagnostic for species in this group. *Goodenia panduriformis* in particular is distinctive, as the lateral branches of each dichasium grow more strongly than the others in the inflorescence, resulting in the superficial appearance of a 'raceme of clusters' (Carolin 1967a) of up to 24 flowers.

The structure of bracteoles in *Goodenia*, if present, is also complicated. Albrecht (2002) observed that axillary buds sometimes subtend flowers (e.g. in *G. halophila* Albr. and *G. cylindrocarpa* Albr.), suggesting they are perhaps better referred to as 'opposite or sub-opposite bracts' following the concepts of Briggs and Johnson (1979). The bracts and bracteoles in the *G. panduriformis* clade form distinctive, disk-like structures around the stem, which may or may not be completely fused (and are completely free in *G. daviesii*); however, it is difficult to pinpoint the exact transition from bracts to bracteoles due to the complicated structure of the inflorescence. For practical reasons, we have decided to not to attempt to distinguish between these structures and refer to all prophylls as bracts. The length of the pedicel is measured from the subtending bract to the terminal flower (Figure 1).

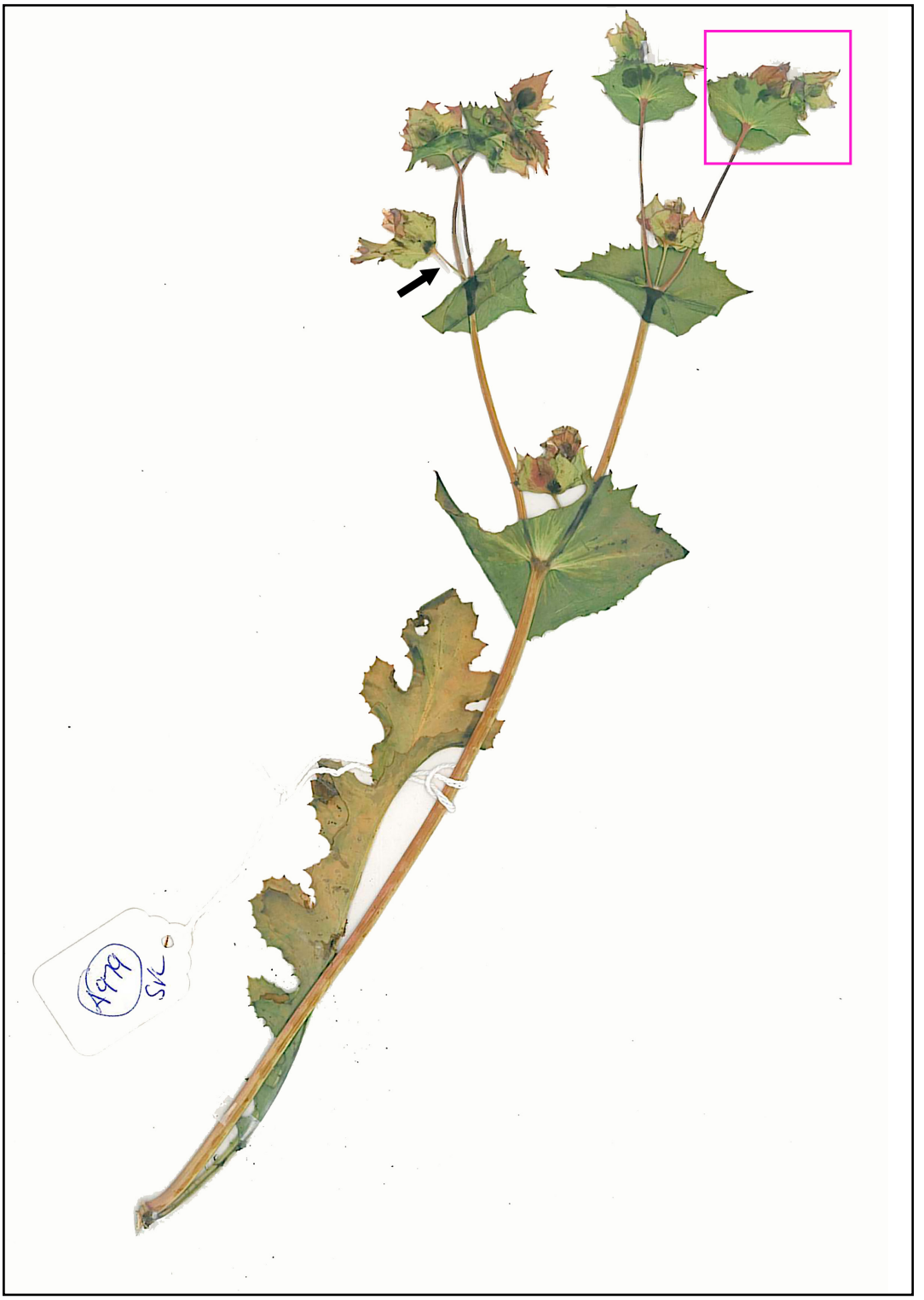

Figure 1. *Goodenia connata* herbarium specimen highlighting the pedicel (black arrow) and one of the terminal dichasia (purple square) as measured in the descriptions. Voucher: *S.L. van Leeuwen* 4979 (PERTH 06765378).

Taxonomy

Key to the connate bract group allied to *Goodenia panduriformis*

1. Bracts free, paired, margins dentate to denticulate; peduncles with scattered to dense hairs 0.2–0.6 mm long (WA: Meekathara–Balladonia)..... **G. daviesii**

1: Bracts usually connate into a funnel or disc (may be split on one side or rarely free and paired in some terminal flowers), margins entire to dentate; peduncles glabrous or with moderately dense hairs 0.1–0.3 mm long basally **2**

2. Robust herb 1–1.5 m high; inflorescence with terminal clusters of (7–)10–24 flowers; connate bracts usually split almost to base on one side; sepals free (or almost so); corolla 25–29 mm long (WA: Kimberley)..... **G. panduriformis**

2: Herb 0.15–1 m high; inflorescence a terminal dichasium of 1–7 flowers; connate bracts rarely split on one side; sepals fused at the base in a tube 1–5.5 mm long; corolla 14–29 mm long **3**

3. Style usually glabrous, rarely with scattered hairs 0.1–0.5 mm long; apex of posterior sepal rounded with an apiculus, margin entire; corolla yellow with brownish or purplish brown markings; abaxial corolla lobe wings obsolete or rarely very narrow, 0.2–0.3 mm wide (WA: Wittenoom–Gibson Desert; NT; SA) ..... **G. aluta**

3: Style with scattered to dense hairs 0.2–2 mm long; apex of posterior sepal acute to acuminate, margin entire to dentate; corolla yellow, orange yellow, cream, white, whitish green to pale violet, very pale pink, pinkish mauve or yellowish pink; abaxial corolla lobe wings 0.3–3.2 mm wide, rarely obsolete **4**

4. Posterior sepal 16.5–25 mm long; margin of bracts crescentic to shallowly crescentic dentate; corolla 22–29 mm long, yellow to orange-yellow (WA, NT: Little Sandy Desert–Tanami) ..... **G. crescentiloba**

4: Posterior sepal 5.5–15 mm long; margin of bracts entire to dentate; corolla 14–25 mm long, cream, white, whitish green to pale violet, very pale pink, pinkish mauve, yellowish pink or yellow **5**

5. Sepals connate into a tube 1.5–2.2 mm long, posterior sepal narrowly ovate, 1.4–5.5 mm wide; corolla yellow with deep orange throat (WA: S of Shark Bay–N of Esperance)..... **G. discophora**

5: Sepals connate into a tube 2.3–5.5 mm long, posterior sepal ovate, 6.2–12.3 mm wide; cream, white, whitish green to pale violet, very pale pink, pinkish mauve or yellowish pink **6**

6. Corolla white or very pale pink with a yellow throat, 14–19 mm long; sepals glabrous, entire, fused at the base 2.3–3.8 mm, posterior sepal ovate, free portion 5.5–7.5 mm long, 6.2–7 mm wide; ovules 11–16 (WA: W Pilbara from W of Fortescue to Karijini NP)..... **G. obscurata**

6: Corolla cream, white, whitish green to pale violet, pinkish mauve or yellowish pink, 16–25 mm long; sepals glabrous or with scattered to moderately dense hairs 0.1–0.5 mm long, entire to dentate, fused at the base 4.5–5.3 mm, posterior sepal broadly ovate, free portion 7.5–8.5 mm long, 8.4–10.5 mm wide; ovules (20–)28–40 (WA, SA, Qld, NSW, Vic) ..... **G. connata**

Goodenia aluta K.A.Sheph. & Lepschi, *sp. nov.*

Type: 60.6 km (by air) N of Kiwirrkurra, Western Australia, 10 September 2015, *P.C. Jobson & R. Davis* J 12078 (*holo*: PERTH 09088830!; *iso*: CANB 834240!; NT D0269563!).

[*Velleia connata auct. non* F.Muell.: R. Carolin, *Proc. Linn. Soc. New South Wales* 92: 36–38 (1967), *p.p.*; R.C. Carolin in J.P. Jessop (ed.), *Fl. Centr. Australia* 352 (1981), *p.p.*; R.C. Carolin in A.S. George (ed.). *Fl. Australia* 35: 287–288 (1992), *p.p.*]

Annual or short-lived perennial *herb*, (0.15–)0.5–0.6 m high. *Leaves* arranged in a basal rosette, obovate, denticulate, petiolate, lamina (including petiole) 37–68 mm long, 15–23 mm wide, glabrous, with a densely hairy axil, apex rounded with a short apiculus, base attenuate. *Inflorescence* an elongated, branched dichasium, with terminal dichasia of 1 or 2 flowers; peduncles 500–600 mm long including inflorescence, glabrous; pedicels 8–19 mm long, glabrous; bracts connate into a disk, not slit to the base, 15–52(–71) mm diam., glabrous, with a densely hairy axil, apex rounded with an apiculus, margin entire or with very shallow, scattered teeth. *Sepals* 5, basally fused for 4.5–5.3 mm, glabrous on both surfaces, apex rounded with an apiculus, margin entire; posterior sepal larger than the remainder, broadly ovate, free portion 7.5–8.5 mm long, 8.4–10.5 mm wide, remainder ovate, 6.2–8.5 mm long, 7–8.1 mm wide. *Corolla* 16–20 mm long, yellow with brownish or purplish brown markings, with a short pouch, glabrous on the outer surface, inner surface with scattered to moderately dense hairs 0.2–0.3 mm long in throat and faint enations; tube 2–3 mm long. *Adaxial corolla lobes* falcate-oblong, 7–10.7 mm long, 2–2.5(–3.5) mm wide, basally fused for a further 3–4 mm; auricle 4.5–5.7(–9.5) mm long, 2–3.5 mm wide, with dense hairs 0.4–0.7 mm long on the inner margin; wing above auricle 1.2–2.7 mm long, 0.8–2 mm wide, inner surface with dense hairs, wing opposite auricle obsolete. *Abaxial corolla lobes* oblong, 4–5.6 mm long, 3.1–3.5 mm wide, basally fused for a further 6.6–9 mm, wing obsolete or rarely very narrow and 2.4–3 mm long, 0.2–0.3 mm wide, not exceeding the length of the lobe. *Stamens* 5, filaments 3.7–5 mm long, 0.3–0.7 mm wide; anthers linear, 2.6–3.3 mm long, 0.8–1.2 mm wide. *Style* 7–8.2 mm long, 1.3–1.5 mm wide, usually glabrous; indusium obovoid, slightly curved inwards, 2.2–2.8 mm long, 4–5 mm wide, abaxial surface glabrous or with scattered hairs 0.1–0.5 mm long, adaxial surface with scattered to moderately dense hairs 0.3–0.5 mm long, upper lip with dense bristles 0.9–1 mm long, lower lip glabrous with bristles 0.4–0.6 mm towards the edges and 0.1 mm long at the centre. *Ovary* elliptic, 2.5–2.9(–3.5) mm long, 2.9–3 mm wide, glabrous, septum obsolete, with (20–)25–30 ovules. *Fruit* a capsule, ovoid, glabrous, *c.* 12 mm long, *c.* 14 mm wide. *Seeds* ovate, flat, brown, 3.6–4.5 mm long, 2.7–3.5 mm wide, with small projections over the surface; wing golden brown, not overlapping seed margin, 1.8–2.3(–2.7) mm wide. (Figure 2)

Diagnostic features. Readily distinguished from allied species by the following features: bracts connate into a disk, not slit to the base, glabrous, apex rounded with an apiculus, margins entire or with very shallow, scattered teeth; terminal dichasia of 1 or 2 flowers; a yellow corolla 16–20 mm long with brownish or purplish brown markings; pedicels glabrous; sepals fused at the base for 4.5–5.3 mm, glabrous, rounded with an apiculus and entire margins, posterior sepal 7.5–8.5 mm long, 8.4–10.5 mm wide; abaxial corolla wings obsolete or very narrow (0.2–0.3 mm wide), not exceeding the length of the lobe; style 7–8.2 mm long, glabrous; and (20–)25–30 ovules per flower.

Selected specimens examined. WESTERN AUSTRALIA: Kiwirrkurra Indigenous Protected Area; 18.3 km by track E of Kiwirrkurra store, along track to Balgo, 12 Sep. 2015, *D.E. Albrecht* DEA 14436 *& R. Butcher, P.C. Jobson, R. Davis* (CANB 887405, NT D0275109 *n.v.*, PERTH 09509445); Eagle Bore Study Site, 16 July 2001, *T.B. Bragg* 2001-8 (MEL 2289271, OMA *n.v.*, PERTH 05663148); Hamersley Range to Marillana Stn, 7 May 1958, *N.T. Burbidge* 6015 (CANB 53757, PERTH 02763583);

Figure 2. *Goodenia aluta*. A – habit; B – young inflorescence showing the connate disk-like bracts; C – flowering stems; D – young bud showing the very broad posterior sepal with an apiculate apex and entire margins; E – side view of flower highlighting the basally fused sepals and short adaxial corolla lobes with an obsolete wing on the outer margin; F – flower from above showing the almost obsolete wings on the abaxial corolla lobes. Vouchers: *M. Goods* DD 1497 (PERTH 09124330) (A, C); *G. Goods* DD468 (B, E); Kiwirrkurra, WA, 2015 (unvouchered) (D, F). Images: M. Goods (A, C), G. Goods (B, E), R. Whyte (D, F).

Patience Well, Gibson Desert, 1 Mar. 2001, *C.P. Campbell* 1154 (CANB 06335802, PERTH 06335802); 50 km NW of Maruwa, 28 July 2016, *M. Goods* DD 1137 (PERTH 08898693); Hamersley Stn, 1 Aug. 1995, *J. Shaw* 02 (PERTH 04268490), Little Sandy Desert, 23 km N of Cooma Well along the No. 1 Vermin Proof Fence (Original fence), 31.3 km E of Old Cundlebar, 13.4 km SSE of Burranbar Pool on Savory Creek, 10.2 km SW of Savory Well on Savory Creek, 14. Aug. 2001, *S. van Leeuwen* 4884 (CANB 570481, MEL 2425487, PERTH 06473067).

NORTHERN TERRITORY: 24.5 km N of Barrow Creek along the Stuart Hwy, 13 Sep. 1983, *L.A. Craven* 8198 (CANB 398951, MEL 0715595, NT D0073796 *n.v.*); 89 miles [143 km] from Yuendumu towards Rabbit Flat, July 1971, *C.H. Gittins* 2265 (BRI AQ 0000355 *n.v.*, CANB 745659, NSW 2400721); 15 km SSE Sangsters Bore, Tanami Desert, 10 July 1983, *P.K. Latz* 13220 (MEL 0725617, NT A0089563); 25 km East of NE corner Lake Mackay, 4 Oct. 2001, *P.K. Latz* 18132 (MEL 2289275, NT A0107307); 18 miles [28.9 km] NE of Barrow Creek Township, 24 Aug. 1956, *M. Lazarides* 5823 (AD 95918102, BRI AQ0225608, CANB 109403, MEL 0009623, NE 14481 *n.v.*, NSW 5612, NT A0082967, PERTH 02763486).

Phenology. Flowering specimens collected in March and from May to October. Fruiting specimens collected from May to October.

Distribution and habitat. *Goodenia aluta* is distributed from the Pilbara region in Western Australia eastwards to the Northern Territory, occurring in the Gascoyne, Great Sandy Desert, Little Sandy Desert, Gibson Desert and Tanami bioregions. It also occurs on the margins of the Central Ranges, Davenport Murchison Ranges and Burt Plain bioregions (Figure 3). It is found on red sandy gravel over sandstone, sandplains between dunes or rarely on lateritic plains, and is associated with low mallee or *Acacia* shrublands over *Triodia*.

Conservation status. This species is widespread across arid Western Australia and the Northern Territory and is not considered to be under threat.

Etymology. From the Latin *aluta* (purse or pouch made of soft leather), in reference to the appearance and texture of the distinctly broad sepals that are fused at the base.

Affinities. *Goodenia aluta* is superficially similar to *G. connata* but is readily distinguished by its sepals, which are entire (vs entire to dentate) and have a rounded apex with an apiculus (vs acuminate). The corolla in *G. aluta* is yellow with brownish or purplish brown markings (vs cream, white, whitish green, pale violet, pinkish mauve or yellowish pink), and the abaxial corolla lobe wings are usually obsolete or rarely 2.4–3 mm long and 0.2–0.3 mm wide (vs 1.5–6 mm long and 0.4–2 mm wide, or rarely obsolete in some plants from western Queensland). It also has a style that is usually glabrous, or more rarely with a few scattered hairs (vs scattered hairs).

Notes. Three Western Australian collections of *G. aluta* from east of Newman and in the Little Sandy Desert (*R.D. Royce* 1655 (PERTH 02763826); *G.J. Morse* 209 (CBG 8504000, PERTH 02763680); *Desert Dreaming Expedition* 78 (PERTH 03170012)) have a few scattered hairs on the style rather than being glabrous as observed in all other specimens. These specimens have yellow flowers and obsolete wings on the abaxial corolla lobes and in all other respects appear to be a match for typical *G. aluta*. Specimens of *G. connata* from Ethabuka Station (Bush Heritage reserve) in western Queensland (*N.G. Walsh* 7163 *& J. Silcock* (MEL 2346274, MEL 2342259)), which also have obsolete wings on the abaxial corolla lobes (Figure 4F [right hand flower]), have denser hairs on the style and the flowers are pale yellowish pink, and are referred to *G. connata*.

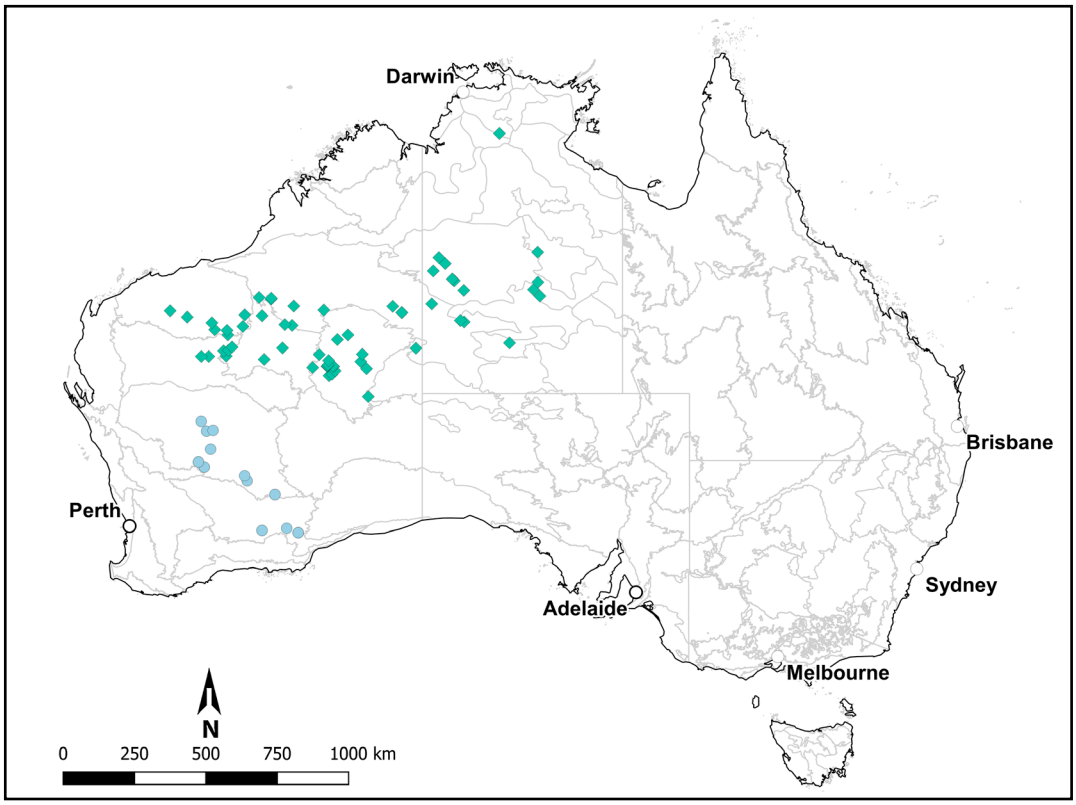

Figure 3. Distribution of *Goodenia aluta* (◆) and *G. daviesii* (●) with IBRA subregions (Australian Government Department of Agriculture, Water and the Environment 2012) in pale grey.

Goodenia connata (F.Muell.) K.A.Sheph., *Phytokeys* 152: 88 (2020). *Velleia connata* F.Muell., *Trans. Philos. Soc. Victoria* 1: 18 (1855). *Type*: Sandhills towards the junction of the Murray & Murrumbidgee [New South Wales/Victoria], December 1853, *F. von Mueller s.n.* (*holo*: MEL 594385!).

Velleia helmsii K.Krause in H.G.A. Engler, *Das Pflanzenreich IV* 54 (277): 33, 35 (1912). *Type citation*: 'Eremaea: Victoria Wüste, Camp 53, unter 29° 20 s. Br. Und 124° 50 ö. L. (Helms – blühend im September 1891 – Herb. Kew, Berlin, Sydney).' *Type*: Victoria desert, Camp 53 [Western Australia], 15 September 1891, *R. Helms s.n.* (*lecto*, inadvertently designated by R.C. Carolin, *Proc. Linn. Soc. New South Wales* 92(1): 37 (1967): B, destroyed; *isolecto*: K, MEL 9628, NSW 75658; replacement *lecto*, here designated: MEL 9628!; *isolecto*: AD 96620116 *n.v.*, AD 207923A *n.v.*, K 000215452 image!, NSW 75658!, NSW 82670!, NSW 2400727!).

Annual or short-lived perennial *herb*, 0.15–0.5 m high. *Leaves* in a basal rosette, obovate to spathulate, entire or denticulate to lyrate, petiolate, lamina (including petiole) 42–325 mm long, 10–85 mm wide, with lobes 2.5–42 mm long, 1–87 mm wide, glabrous or sometimes with scattered hairs 0.1–0.3 mm long on the margins, with a densely hairy axil, apex rounded to acute, base attenuate. *Inflorescence* an elongated, branched dichasium, with terminal dichasia of 2–5 flowers; peduncles 170–500 mm long including inflorescence, glabrous or with scattered hairs 0.1–0.3 mm long; pedicels 3–33 mm long, glabrous or with scattered to moderately dense hairs 0.1–0.5 mm long; bracts connate into a disk (rarely leaf-like and paired towards apex), sometimes slit to the base, (6–)13–82(–110) mm diam., glabrous or with scattered hairs 0.1–0.5 mm long, with a densely hairy axil, apex acuminate to acute, margin

entire to dentate. *Sepals* 5, basally fused for 2.5–5.5 mm, outer surface glabrous or with scattered to moderately dense hairs 0.1–0.5 mm long, inner surface glabrous or with scattered to moderately dense hairs 0.1–0.3 mm long, apex acuminate, margin entire to dentate; posterior sepal larger than the remainder, broadly ovate, free portion 6–15 mm long, (5–)6.2–12.3 mm wide, remainder ovate to broadly ovate, 5.8–14.3 mm long, (3.5–)4.4–10 mm wide. *Corolla* 14–25 mm long, cream, white, whitish green to pale violet, pinkish mauve or yellowish pink, glabrous or with scattered to moderately dense hairs 0.1–0.5 mm long on the outer surface towards the apex, inner surface with moderately dense to dense hairs 0.2–1.1 mm long in throat and at base and faint enations; tube 1–2.5 mm long. *Adaxial corolla lobes* falcate-oblong, 8–12.5 mm long, 1.8–3.4 mm wide, basally fused for a further 1.2–3.6 mm; auricle 4.7–7.3 mm long, 2–3.3 mm wide, with dense hairs 0.6–1.8 mm long on the inner margin; wing above auricle 2–4 mm long, 0.8–2.5 mm wide, wing opposite auricle 1.1–5.2 mm long, 0.3–2.2 mm wide. *Abaxial corolla lobes* oblong, 2.8–6.3 mm long, 1.1–4.1 mm wide, basally fused for a further 8.5–12 mm, wings 1.5–6 mm long, 0.4–2 mm wide (rarely obsolete in some plants from western Queensland), exceeding the length of the lobe by 0.2–1.4 mm. *Stamens* 5, filaments 2.9–4.3 mm long, 0.3–0.6 mm wide; anthers linear, 1.7–3.5 mm long, 0.4–1 mm wide. *Style* 5–6.2 mm long, 1.1–2.5 mm wide, with scattered to moderately dense hairs 0.3–1.8 mm long; indusium broadly obovoid, 2.2–3.2 mm long, 2.1–5.2 mm wide, abaxial surface with scattered hairs to moderately dense hairs 0.1–1.2 mm long, adaxial surface with scattered to moderately dense hairs 0.1–1.3 mm long, upper lip with dense bristles 0.5–1 mm long, lower lip glabrous or with bristles 0.1–0.7 mm long towards the edges. *Ovary* elliptic to obovate, 2.2–5.5 mm long, 2.1–6 mm wide, glabrous, septum with residual tissue, with (20–)28–40 ovules. *Fruit* a capsule, ovoid, glabrous, 8–13 mm long, 9–13 mm wide. *Seeds* ovate, flat, light brown, 3.2–3.8 mm long, 2.3–2.6 mm wide, smooth or with faint pits over the surface; wing golden brown, not overlapping seed margin, 1.3–2.1 mm wide. (Figure 4)

Diagnostic features. *Goodenia connata* is distinguished by the following combination of characters: bracts connate into a disk (rarely leaf-like and paired towards apex), sometimes slit to the base, glabrous or with scattered hairs 0.1–0.5 mm long, apex acuminate to acute, margin entire to dentate; terminal dichasia of 2–5 flowers with a cream, white, whitish green to pale violet, pinkish mauve or yellowish pink corolla 14–25 mm long; pedicels glabrous or with scattered to moderately dense hairs 0.1–0.5 mm long; sepals fused at the base for 2.5–5.5 mm, glabrous or with scattered to moderately dense hairs 0.1–0.5 mm long, apex acuminate with entire to dentate margins, posterior sepal 6–15 mm long, (5–)6.2–12.3 mm wide; abaxial corolla wings 1.5–6 mm long, 0.4–2 mm wide, exceeding the length of the lobe by 0.2–1.4 mm; style 5–6.2 mm long, with scattered hairs 0.3–1.8 mm long; and (20–) 28–40 ovules per flower.

Selected specimens examined. WESTERN AUSTRALIA: *c.* 48 km from Roebourne turnoff to Wittenoom Rd in Gorge of Hammersley Range, 5 Aug. 1971, *A.M. Ashby* 4180 (AD 97418211 *n.v.*, NSW 2400725); 14 miles [22.5 km] NE of Wiluna, 15 Oct. 1947, *G.E. Brockway s.n.* (CANB 26688); 18.8 km W of turnoff to Eagle Rock Falls, on the Great Northern Hwy, 3 Sep. 2004, *R.J. Chinnock* 9713 (AD 170239 *n.v.*, DNA D0287427 *n.v.*, PERTH 07025181); *c*. 126 km N of Balladonia along Zanthus–Balladonia track, 23 Sep. 2003, *R. Davis* 10595 (PERTH 06537715); NE of Tjuntjuntjara, 26 Sep. 2011, *R. Davis & A. Pennington* RD 11928 (PERTH 08325936); Anne Beadell Hwy. 5.2 km W of Ilkurlka roadhouse. Great Victoria Desert, 6 Oct. 2010, *R. Davis, J. Jackson & D. Ferguson* 11635 (MEL 2360955, PERTH 08249016); Red sand plain, 94.9 km NE of homestead, Lake Mason Stn N of Sandstone, in Kaluwirri block, 18 Sep. 2005, *D.J. Edinger* 5489 (PERTH 07284527); W of Cundeelee Mission, 22 Sep. 1963, *A.S. George* 5902 (PERTH 02763699); Lorna Glen Stn, 10 km E of turnoff from Wiluna/Granite Peak Rd, 5 Sep. 2003, *K.F. Kenneally & D.J. Edinger* K 12509 E 3709 (PERTH 06705138); *c*. 124 km E of Balfour Downs HS on Talawanna Track, 9 April 1995, *A.A. Mitchell* PRP 89 (NSW 2400716, PERTH 04249631); Corvette Resources, Plumridge Project, NE

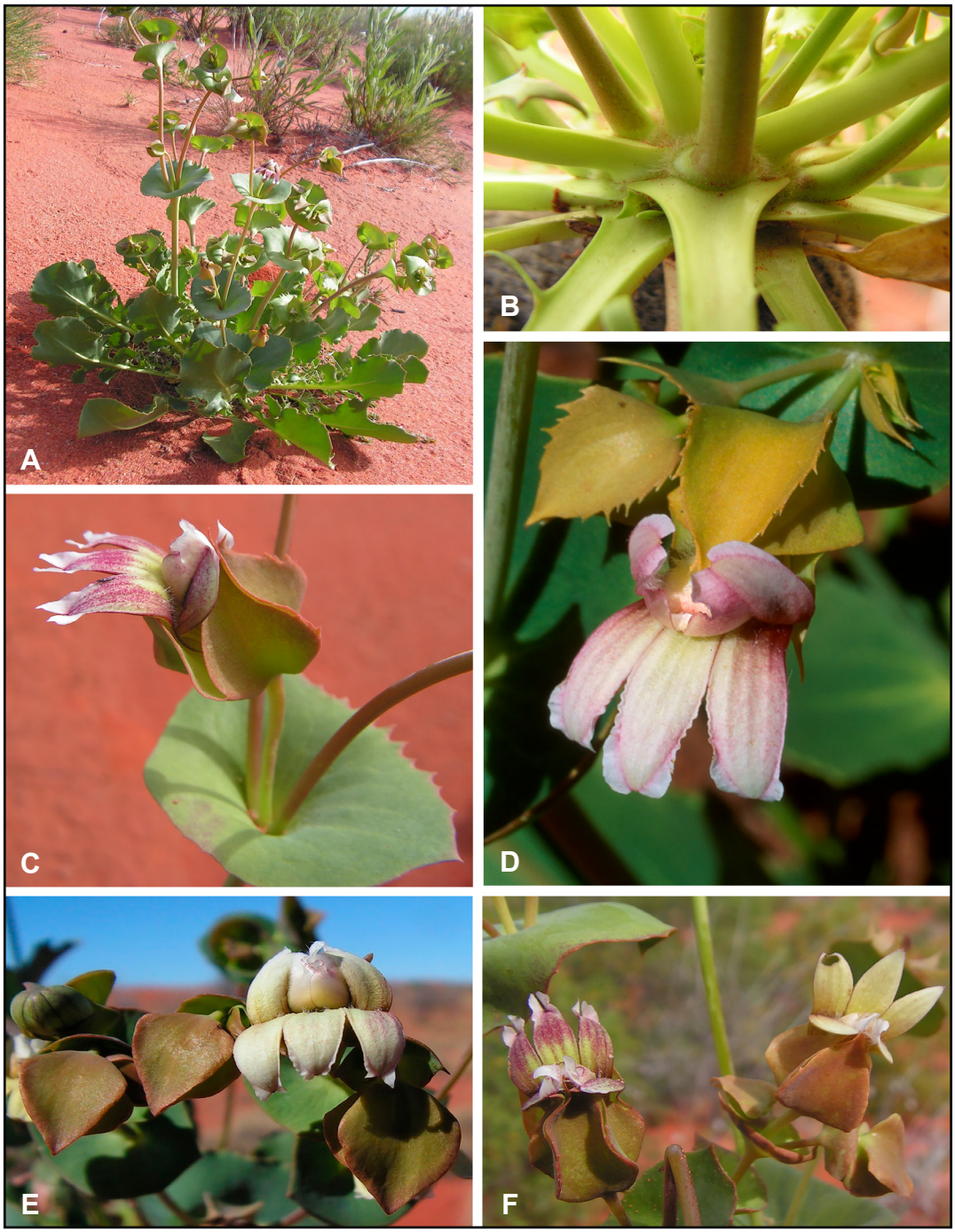

Figure 4. *Goodenia connata*. A – habit; B – glabrous petioles with dense hairs in the leaf axils; C – side view of flower showing connate bracts with the margin almost entire on one side and dentate on the other, and basally fused sepals; D – top view of flower showing dentate sepal margins and a pinkish corolla with obvious wing tissue on the apex of the lobes; E – flower with a yellowish pink corolla that has wing tissue on the lobes, and sepals with entire margins; F – two variable forms, one with a pinkish corolla with short wings on the abaxial lobes (left) and the other with a yellowish pink corolla with obsolete wings (right). Vouchers: Ethabuka Stn, Qld, 2010 (unvouchered) (A–C); *J.E. Wajon* 1169 (PERTH 07325436) (D); *C.J. Nicholson & R.W. Purdie* CJN415 (BRI AQ1004197) (E); *N.G. Walsh* 7163 *& J. Silcock* (MEL 2346274, 2342259) [right hand specimen, left unvouchered] (F). Images by: C.J. Nicholson (A–D, F); J.E. Wajon (E).

of the intersection of the PNC Baseline and Cable Haul Rd, 3 Sep. 2009, *S. Reiffer* SRe 103 (PERTH 08799695); 12 miles [19.3 km] NE of Millrose, Eremean Province, 8 Sep. 1958, *N.H. Speck* 1381 (CANB 109406, PERTH 02763605); 0.5 km N of Coondewanna Bore on track to Packsaddle, 6.8 km S of Packsaddle Hill, 19.9 km E of Mt Meharry, Hamersley Range, 10 Sep. 1991, *S. van Leeuwen* 973 (NSW 363564, PERTH 4003705); Little Sandy Desert, 9.4 km N of Lake Sunshine, 18 km SE of Yanneri Lake, 12.1 km SSW of Terminal Lake, 40.3 km ENE of Kulonoski East Well on Beyondie Stn, 35.2 km N of Bullen Hill, 18 Aug. 2001, *S. van Leeuwen* 4979 (CANB 570480, MEL 2425483, PERTH 06765378); 147 km SW of Warburton towards Laverton on Lasseter Hwy, 9 Apr. 1992, *F.A. Zich* 86 (CANB 433644, NSW 699640, PERTH 03590038).

NORTHERN TERRITORY: Serpentine Gorge, W of Alice Springs, 27 July 1967, *A.C. Beauglehole* ACB 24305 (AD 97533070, CANB 300716, MEL 0623272, NSW 2400723, PERTH 02763435); NW Simpson Desert, 27 Sep. 1972, *P.K. Latz* 4374 (AD 97508160 *n.v.*, CANB 298600, DNA A0049661 *n.v.*); 8 Mile Gap; 10 km E of Ellery Big Hole; West MacDonnell NP, 30 Aug. 2003, *P.K. Latz* 19155 (MEL 2283537, NT A0104567); Desert Grazing Block, 27 miles [43.4 km] NE of Narwietooma Stn, 15 Sep. 1956, *M. Lazarides* 5987 (AD 95918101 *n.v.*, BRI AQ0225607 *n.v.*, CANB 109404, CANB 109405, MEL 0009622, PERTH 02763478); Serpentine Gorge, 29 July 1967, *R. Maconochie* 447 (AD 97049445 *n.v.*, MEL 2193365); 34 miles [54.7 km] NW of Hamilton Downs, 23 Sep. 1955, *R.E. Winkworth* 1378 (MEL 0009629); Above E walls of Serpentine Gorge, 8 June 1974, *J.H. Willis s.n.* (MEL 2116559).

SOUTH AUSTRALIA: Lock, 5 Dec. 1967, *C.R. Alcock* 1697 (AD 98584737 *n.v.*, AD 96807200 *n.v.*, CANB 189836, NSW 88016, NSW 131637); About 38 km N of Cowell; about 3 km directly SE of Microwave Tower, 22 Oct. 1983, *J.D. Briggs* 1409 (AD 98722369 *n.v.*, CBG 8316106); *c.* 40 km NW of Ceduna, *c.* 2.5 km NW of Koonibba Hill, 4 Jan. 1979, *M.D. Crisp* 4764 (AD 98218446 *n.v.*, CBG 7900361); Billiatt CP – E side of main road, *c*. 13 km N of Park S boundary, 16 Nov. 2010, *D.J. Duval & D.E. Murfet* 2017 (AD 242832, K *n.v.*); Cooltong Conservation Park. NW boundary of Park along N-S fenceline track, 21 Oct. 2011, *D.J. Duval, J. White & L. Duffy* 2304 (AD 251542); 50 km N of Cowell on Lincoln Hwy, 3 Nov. 1992, *T. Hall* 443 (AD 99247245); 0.8 km direct NW of Buckleboo, Buckleboo Conservation Reserve (CR50), 20 Oct. 1998, *S.D. Kenny & V.C. Hagan* BS103-3881 (AD 117448); 41.7 km by road S of Pipalyatjara towards Kunytjanu, APY Lands, [9.5 km direct SSE of Ilarunga], 22 Oct. 1996, *P.J. Lang* BS23-26759 (AD 99837056); 11.9 km direct S of Mulyawara No. 1 Well, on Rodinia Track, 21 Sep. 2021, *P.J. Lang, P.D. Canty, J. Kellermann & R. Butcher* BS1137-199 (AD 281617, PERTH 09394281, PERTH 09394303); NW track, *c*. 2 km W of Corrobinnie Hill, off the southern boundary of Pinkawillinie Conservation Park, 15 Oct. 2007, *T.S. Te, D.J. Duval & M.J. Thorpe* 195 (AD 213887); Great Northern Hwy, 55.5 km W of Newman Drive, 31 July 2004, *J.E. Wajon* 1169 (MEL 2311650, PERTH 07325436); *c.* 24 km by road NW of Krewinkel Hill, *c*. 31 km by road SE of air strip at old Mt Davies Camp, on Pipalyatjara – Mt Lindsay Rd, 3 Sep. 1978, *J.Z. Weber* 5362 (AD 97838039 *n.v.*, MEL 0593590, NSW 663396 *n.v.*).

QUEENSLAND: 26.1 km W of St George, 28 Dec. 1998, *A.R. Bean* 14471 (BRI AQ0675280 *n.v.*, MEL 0291279); 0.5 km E of Calabah HS, *c*. 90 km SSE of Charleville, 16 Jan. 2008, *A.R. Bean & J. Wang* 27263 (BRI AQ0786309); 26.2 km from St George towards Bollon, 15 Oct. 1983, *E.M. Canning & B. Rimes* 5991 (BRI AQ0593241 *n.v.*, CBG 8312598, MEL 713686, NSW 66394); 12.7 km from Charleville toward Cunnamulla, by railway line, 19 Oct. 1983, *E.M. Canning & B. Rimes* 6058 (BRI AQ0593252 *n.v.*, CBG 8313271, MEL 0713686, MO *n.v.*, NSW 66393); 30 km W of St George on Barwon Hwy, 24 Sep. 2003, *R.A. Mckenzie* RAM03/174 (BRI AQ0762194); Ethabuka Stn (Bush Heritage reserve), 3 July 2015, *C.J. Nicholson & R.W. Purdie* CJN415 (BRI AQ1004197).

NEW SOUTH WALES: Shuttleton, Oct. 1903, *W. Baeuerlen* 3103 (AD 98831043, CANB 375797, MEL 0304119, PERTH 02763427); Just outside the S boundary of Mallee Cliffs NP, NNE of Euston off the Sturt Hwy, 10 Oct. 2000, *R.G. Coveny, G. Chapple, P.G. Kodela & H. McPherson* 18794 (AD 119106, CANB 549767, MEL 2067860, NSW 449196); H. Norris, Fairview [Fairview Park], [NE of] Burgooney, Nov. 1976, *G.M. Cunningham & P.L. Milthorpe s.n.* (CANB 827589); Griffith, 2 June 1934, *E.B. Farhy s.n.* (NSW 78493); Northern Boundary Track, 100 m W of Coombes Rd (which is in Scotia Sanctuary), Tarawi NR, 25 Nov. 2011, *R.L. Johnstone & G. Errington* 2991 (CANB 579151, MEL 2365597, NSW 888535); 2.5 miles [4 km] E of Euabalong turn-off along road from Lake Cargellico–Mt Hope, 23 May 1969, *P. Martensz* 179 (CANB 325355).

VICTORIA: 3 km ENE of Wonga Hut, Wyperfeld NP. Mallee Study area, 11 April 1977, *A.C. Beauglehole* ACB 55448 (MEL 541879); 8 miles [12.8 km] W of Annuello, 8 Oct. 1972, *A.C. Beauglehole & N. Macfarlane* ACB 40510 (MEL 520229); Murray–Sunset NP. Bambill South Track, 5.8 km S of Settlement Rd, 25 Nov. 2011, *J.L. Birch, N.G. Walsh, C.L. Gallagher & S. Stewart* 453 (MEL 2355909); Hattah–Kulkyne NP, on Murray Valley Hwy c. 5 km E of Hattah township, 12 Nov. 1998, *A.C. Cochrane, N.G. Walsh & R.J. Fletcher* 315 (MEL 2054401); Murray–Sunset National Park. Beside Nowingi Line Track about 10.1 km W of Meridian Rd, 23 Nov. 2010, *J.A. Jeanes & G. Lay* 2476 (CANB 579088, K *n.v.,* MEL 2338137, S *n.v.)*; Murray–Sunset NP. Nowingi Line Track, 100 metres E from Rocket Lake Track, 29 Oct. 2010, *V. Stajsic & J.A. Jeanes* 6181 (MEL 2359101); Nowingi, Oct. 1928, *H.B. Williamson s.n.* (MEL 9620, MEL 9621, MEL 9621, MEL 600905, MEL 600906).

Phenology. Flowers recorded in all months except February and May. Fruits recorded from March to November.

Distribution and habitat. This species is widespread in arid and semi-arid areas of all mainland states and territories (Figure 5). Found growing on stony slopes, ridges, outcrops and sandplains, on or between dunes, or near watercourses, in skeletal soil over granite or quartzite, or brown, orange, white or deep red sand, loam or fine clayey sand. Favours open *Eucalyptus* woodland or mallee, *Acacia* or *Melaleuca* shrubland and *Triodia* communities. Also recorded from open *Angophora* and *Callitris* woodland.

Conservation status. This widespread species is not currently considered to be under threat except in Victoria, where it is listed as Endangered (EN) (The State of Victoria Department of Environment, Land, Water and Planning 2023).

Affinities. See comments under *G. aluta*. *Goodenia connata* is also morphologically similar to *G. obscurata*. The latter differs in having a 14–19 mm long corolla that is white or very pale pink with a yellow throat (vs 14–25 mm and cream, white, whitish green to pale violet, pinkish mauve or yellowish pink), consistently glabrous and entire sepals (vs glabrous or with scattered to moderately dense hairs 0.1–0.5 mm long, and entire or dentate margins), posterior sepal 6.2–7 mm wide (vs (5–)6.2–12.3 mm), fewer ovules (11–16 vs (20–)28–40) and mostly longer seeds (3.6–4.4 mm long vs 3.2–3.8 mm).

Notes. This widespread taxon is morphologically variable. Leaves may be entire with shallowly dentate margins to lyrate and strongly dentate. There is also considerable variation in the presence and density of hairs and the dentation of the sepal margins. Many of the southern populations in Western Australia, and just across the border in South Australia, have hairs 0.1–0.5 mm long on the pedicels, bracts and sepals, with scattered to moderately dense hairs 0.1–0.4 mm long on the outer surface of the corolla; these specimens are a good match for the type of *Velleia helmsii*, a species

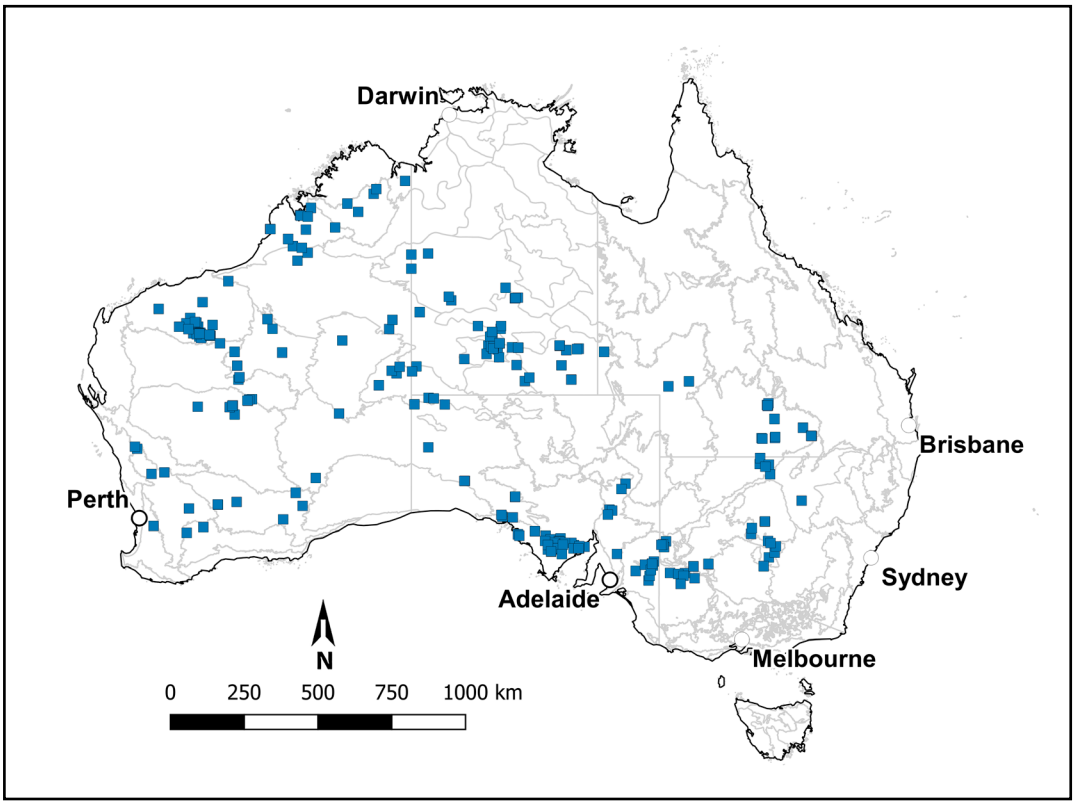

Figure 5. Distribution of *Goodenia connata* (■) with IBRA subregions (Australian Government Department of Agriculture, Water and the Environment 2012) in pale grey.

treated as a synonym of *G. connata* by Carolin (1967a, 1992). These characters appear to be somewhat continuous and both forms have been collected in apparent sympatry from near Cundeelee Mission in Western Australia (*A.S. George* 5902). Similarly, bract margins may be entire to strongly dentate, even on the same plant (Figure 2B). Flower colour is highly variable, as is the length of the wings on the abaxial corolla lobes, with variation apparent even within the same population. A population from far western Queensland (*N.G. Walsh* 7163 & *J. Silcock* (MEL 2346274, MEL 2342259)) that co-occurs with typical *G. connata* (Figure 4F) has a pale yellow corolla tinged with pink, residual to absent abaxial corolla wing tissue, and a hairy style. This population requires further investigation to determine whether taxonomic recognition of this variation is warranted. Finally, an unusual specimen from Western Australia (*A.M. Ashby* 4180 (AD 97418211 *n.v.*, NSW 2400725)), has slightly narrower sepals than is typical and an ovule number of 20 rather than 28–40. In other respects, this specimen is a match for material regarded as *G. connata*.

It is unclear if some of the morphological variation observed in *G. connata* is in any way influenced by environmental or phenological factors. Incomplete collections, particularly those lacking basal leaves, and inconsistent recording of corolla colour further impede investigation of this variation. This species would benefit from a morphological and molecular study that examines plants from across its range to determine if any of the observed variation warrants taxonomic recognition. *Goodenia daviesii* appears morphologically similar to the hairy forms of *G. connata* and therefore should be included in any taxonomic study of this complex.

Carolin (1967a) cited the type of the name *Velleia helmsii* K.Krause as '*Holotype* – Victoria desert, Camp 53. Helms (B. destroyed) – *Isotypes* (K. MEL 9628. NSW 75658).' This is here treated as effective lectotypification by Carolin on material formerly held at B. As Carolin's citation meets the relevant requirements of ICN Art. 7.11 (Turland *et al.* 2018), his use of the term 'holotype' is correctable under ICN Art. 9.10. As original material of this name held at B is no longer extant, having been destroyed during WWII, a replacement lectotype is designated here from among the remaining isolectotypes.

Goodenia crescentiloba K.A.Sheph. & Lepschi, *sp. nov.*

Type: 25 km east of north-east corner of Lake Mackay, Northern Territory, 4 October 2001, *P.K. Latz* 18123 (*holo*: PERTH 06750923!; *iso*: CANB 577333!, NT A0102635 *n.v.*).

[*Velleia panduriformis auct. non* A.Cunn. ex Benth.: R.C. Carolin in J.P. Jessop (ed.), *Fl. Centr. Australia* 352 (1981), *p.p.*; C.R. Dunlop, *Tech. Rep.: Conservation Commission N. Terr.* 26: 40 (1987).]

Annual or short-lived perennial *herb*, 0.5–1 m high. *Leaves* arranged in a basal rosette, obovate to narrowly obovate, dentate to lyrate, petiolate, lamina (including petiole) 53–170 mm long, 25–42 mm wide, with lobes 4–15 mm long, 5–20 mm wide, glabrous, with a densely hairy to floccose axil, apex acute, base attenuate. *Inflorescence* an elongated, branched dichasium, with terminal clusters of (1–)3–7 flowers; peduncles 500–1000 mm long including inflorescence, glabrous; pedicels 13–21 mm long, glabrous. *Bracts* connate into a disk, rarely slit nearly to the base and appearing paired, 5.3–89 mm diam., glabrous, with a densely hairy axil, apex acute to acuminate, margin with a crescentic to shallowly crescentic-shaped sinus between dentate lobes (or rarely entire). *Sepals* 5, basally fused for 3.5–8 mm, outer surface glabrous or with a few hairs only at the margin and towards apex of the sepals, inner surface glabrous, apex acute to acuminate, margin entire to shallowly dentate; posterior sepal larger than the remainder, broadly ovate to elliptic, free portion 16.5–25 mm long, 8.5–13.5 mm wide, remainder narrowly ovate to lanceolate, 10.5–20 mm long, 3.8–10 mm wide. *Corolla* 22–29 mm long, yellow to orange-yellow, glabrous on the outer surface, throat with scattered to moderately dense hairs 0.3–0.5 mm long and faint enations; tube 3.5–5.5 mm long. *Adaxial corolla lobes* falcate-oblong, 10–11.5 mm long, 3.5–4.2 mm wide, basally fused for a further 5–7 mm; auricle 7–8.5 mm long, 3–4.2 mm wide, with dense hairs 0.7–0.9 mm long on the inner margin; wing above auricle 2.4–3.5 mm long, 0.6–1.5 mm wide, with dense hairs, wing opposite auricle 2–3.3 mm long, 0.7–1.3 mm wide. *Abaxial corolla lobes* oblong, 3.9–5.5 mm long, 1–3.6 mm wide, basally fused for a further 10.3–12.6 mm, wing 1.7–3.8 mm long, 0.3–1.5 mm wide, not exceeding the length of the lobe. *Stamens* 5, filaments 4.5–7 mm long, 0.5–0.9 mm wide; anthers linear, 3.2–4.4 mm long, 0.6–1.9 mm wide. *Style* 8.3–10 mm long, 2.5–2.6 mm wide, with dense hairs 1–2 mm long towards the apex; indusium obovoid, sometimes slightly curved inwards, 2.7–4 mm long, 3.7–4.2 mm wide, abaxial surface glabrous or with scattered hairs 0.8–1 mm long, adaxial surface with scattered to moderately dense hairs 0.2–0.6 mm long, upper lip with dense bristles to 0.7–0.8 mm long, lower lip glabrous or with short bristles 0.1–0.4 mm long. *Ovary* elliptic, 3.8–4.5 mm long, 4.3–4.5 mm wide, glabrous, septum incomplete and less than one third length, with 13–18 ovules. *Fruit* a capsule, ovoid, glabrous, *c.* 12.5 mm long, *c.* 11 mm wide. *Seeds* subcircular to ovate, flat, golden brown, 5.5–6 mm long, 4.2–4.7 mm wide, smooth or punctulate with faint pits or projections towards the margin; wing golden brown, not overlapping seed margin, 2.5–3 mm wide, punctulate. (Figure 6)

Diagnostic features. Distinct within the genus by the following combination of characters: bracts connate into a disk (the latter rarely slit nearly to the base), glabrous, acute to acuminate, margins with a crescentic-shaped sinus between each dentate lobe (rarely entire); terminal clusters of (1–)3–7 flowers with a yellow to orange-yellow corolla 22–29 mm long; pedicels glabrous; sepals fused at

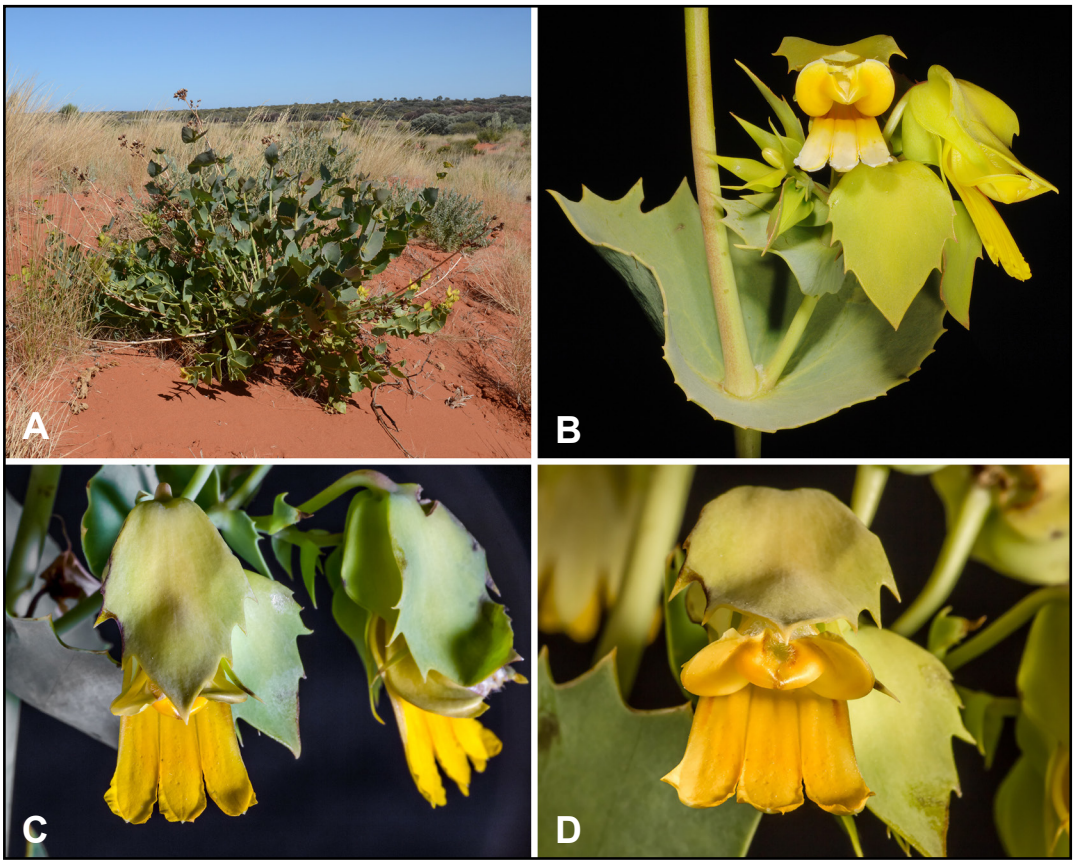

Figure 6. *Goodenia crescentiloba*. A – habit; B – disk-like bracts highlighting the crescentic to shallowly crescentic-shaped sinus between dentate lobes on the far margin; C – yellow flower viewed from above showing the broad posterior sepals fused at the base and with strongly dentate margins; D – flower, showing the long abaxial corolla lobes and auricles cupping the indusium. Vouchers: *M. Goods* DD 460 (PERTH 08749655) (A); *K.R. Thiele* 3623 (PERTH 08332134) (B); Kiwirrkurra, 2015 (unvouchered) (C, D). Images: R. Wait (A); K.R. Thiele (B), R. Whyte (C, D).

the base for 3.5–8 mm, glabrous or with a few hairs only at the margin and towards apex, acute to acuminate, with entire to shallowly dentate margins, posterior sepal 16.5–25 mm long, 8.5–13.5 mm wide; abaxial corolla wing 1.7–3.8 mm long, 0.3–1.5 mm wide, not exceeding the length of the lobe; style 8.3–10 mm long with dense hairs 1–2 mm long; and 13–18 ovules per flower.

Selected specimens examined. WESTERN AUSTRALIA: 93 km W of Kiwirrkurra, 12 Sep. 2015, *R. Davis* 12678 (DNA D0285660 *n.v.*, PERTH 08850380); McLarty Hills, Great Sandy Desert, 5 Aug. 1977, *A.S. George* 14647 (CANB 292059, PERTH 02713306); Canning Stock Route, 4 km N of Well 12, 22 May 2013, *M. Goods* DD 460 (PERTH 08749655); 82 km WNW of Tanami toward Billiluna, 1 July 1971, *C.H. Gittins* 2311 (BRI AQ0000343 *n.v.,* CANB 745490, NSW 2400717); 100 km NNW Docker River, East Gibson Desert, 29 Apr. 2005, *J. Schofield* 20872 (PERTH 07311338); Canning Stock Route near Well 31, 16 Aug. 2008, *K.R. Thiele* 3623 (PERTH 08332134).

NORTHERN TERRITORY: *c.* 84 km WNW Green Swamp Well, Tanami Desert, 16 Aug. 1995, *D.E. Albrecht* 6972 (MEL 279604, NT A0091784 *n.v.*); 78 miles [125.5 km] WNW of Tanami, 13 Sep. 1972, *C.R. Dunlop* 2328 (CANB 237350, DNA A0033494 *n.v.*); on Tanami Track *c.* 472 km NW of Alice Springs (140 km SE of Rabbit Flat), 25 May 1985, *P.A. Fryxell, L.A. Craven & J. McD. Stewart*

4503 (CANB 377115, MEL 305938); Supplejack Stn, 11 km W of Eight Mile Bore, 2 Oct. 1978, *T.S. Henshall* 2375 (CBG 8101107, DNA A0064555, PAUH *n.v.,* TEX *n.v.*); 70 miles [112.6 km] N of Camp 4, 29 June 1911, *G.J. Hill* 400 (MEL 9635); 62 km SSE of Tanami Downs HS, 27 Aug. 2008, *P.K. Latz* 23709 (MEL 2479286); 13 miles [20.9 km] NW of Numagalong HS, 26 Aug. 1965, *D. Nelson & R. Swinbourne s.n.* (AD 96550480 *n.v.*, MEL 2193364, NSW 90871, NT A0011800 *n.v.*).

Phenology. Flowers observed from April to October with peak flowering in late winter. Fruits observed in May to August and in October.

Distribution and habitat. *Goodenia crescentiloba* is widespread in Western Australia and the Northern Territory, occurring in the Little Sandy Desert, Great Sandy Desert and Tanami bioregions (Figure 7). It is found growing in deep red sand with conglomerate rocks and pebbles in swale-sand plains, dune slopes, or between dunes in shallow drainage lines, in low woodland or shrublands and hummock grasslands with *Corymbia deserticola*, *C. setosa*, *Eucalyptus victrix*, *Allocasuarina decaisneana*, *Acacia* and *Triodia*.

Conservation status. This species is widespread and is not considered to be under threat.

Etymology. Formed from the English word ‘crescent’ and the Latin *lobus* (lobe) in reference to its distinctive, crescent-like sinus between the lobes on the margins of the bracts.

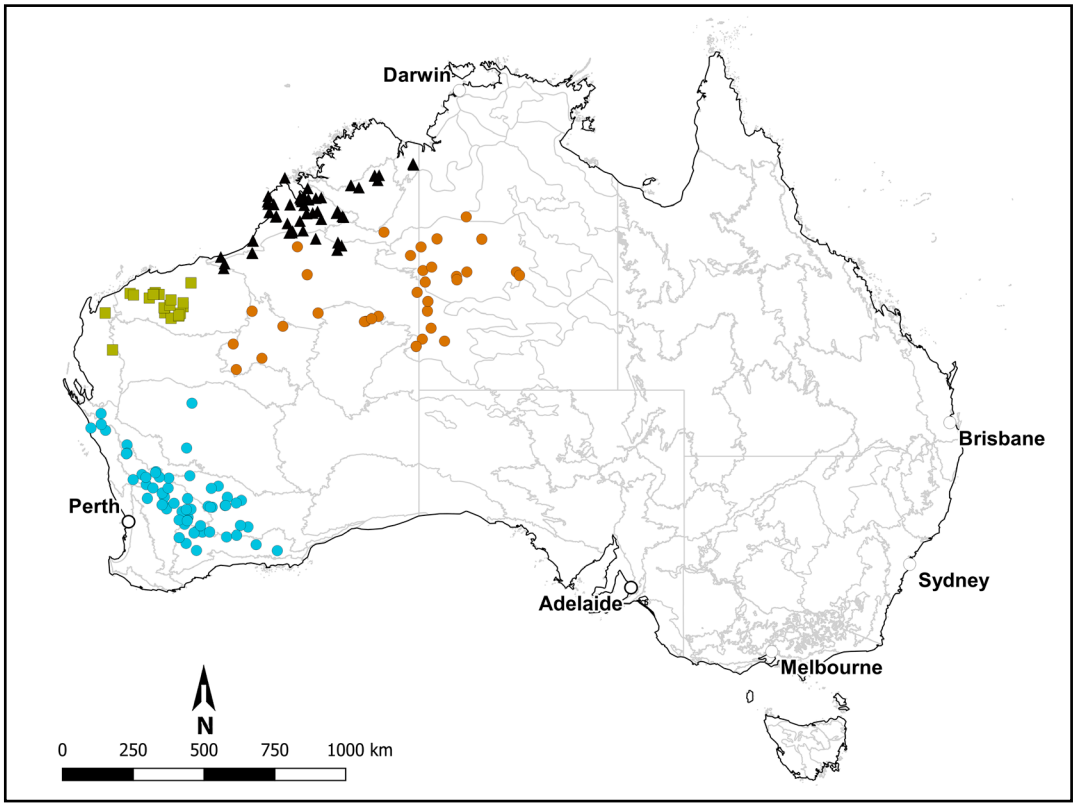

Figure 7. Distribution of *Goodenia crescentiloba* (●), *G. discophora* (●), *G. obscurata* (■) and *G. panduriformis* (▲) with IBRA subregions (Australian Government Department of Agriculture, Water and the Environment 2012) in pale grey.

Affinities. This species is similar to *G. panduriformis* in having large yellow to orange-yellow flowers. *Goodenia crescentiloba* is readily distinguished from *G. panduriformis* in having connate bracts (vs usually split to base on one side), fewer flowers per cluster ((1–)3–7 vs (7–)10–24), sepals that are basally fused for 3.5–8 mm (vs free or connate only at base) and glabrous or with a few hairs at the apex (vs hairs on both surfaces), shorter adaxial corolla lobes 10–11.5 mm long (vs 12–14.5 mm), and smaller abaxial corolla lobe wings 1.7–3.8 mm long (vs 3.8–5.5 mm).

Notes. A chromosome number of *2n* = 16, recorded by Peacock (1963) and repeated in Carolin (1967a, 1992) for *Velleia panduriformis*, may be referable to *G. crescentiloba* rather than *G. panduriformis*. Peacock records the voucher for this count as a 'seed collection' from the Northern Territory, which is within the range of *G. crescentiloba* rather than *G. panduriformis*; however, in the absence of a voucher specimen, the identity of the material used by Peacock remains unconfirmed.

Goodenia daviesii (F.Muell.) K.A.Sheph., *Phytokeys* 152: 88 (2020). *Velleia daviesii* F.Muell., *Fragm*. 10(81): 10–11 (1876). *Type*: Near Ularing, Western Australia, 1875, *Young s.n.* (*holo*: MEL 009647!).

Annual or short-lived perennial *herb*, 0.15–0.6 m high. *Leaves* in a basal rosette, obovate, narrowly ovate to spathulate, denticulate to lyrate, petiolate, lamina (including petiole) 90–135 mm long, 17–30 mm wide, with lobes 5–11.5 mm long, 2.2–6 mm wide, with scattered to dense hairs 0.3–0.5 mm long, with a densely hairy axil, apex acute, base attenuate. *Inflorescence* an elongated, branched dichasium, with terminal dichasia of 1–3(–5) flowers; peduncles 150–600 mm long including inflorescence, peduncle with scattered to dense hairs 0.2–0.6 mm long; pedicels 3–25 mm long, with moderately dense to dense hairs 0.1–0.5 mm long; bracts leaf-like, free and paired, 8–49 mm long, 11–27 mm wide, with scattered to dense hairs 0.2–0.7 mm long, and a densely hairy axil, apex acuminate to acute, margin dentate to denticulate. *Sepals* 5, basally fused for 2.3–4.5 mm, outer surface with dense hairs 0.2–0.5 mm long, inner surface with dense hairs 0.2–0.3 mm long, apex acuminate, margin strongly dentate; posterior sepal larger than the remainder, broadly ovate, free portion 11.8–13.5 mm long, 11–11.4 mm wide, remainder ovate to broadly ovate, 10.2–11.6 mm long, 6–8.5 mm wide. *Corolla* 15–20 mm long, bluish-white, rose white or creamy yellow, with scattered to dense hairs 0.1–0.3 mm long on the outer surface, inner surface with moderately dense hairs 0.3–0.4 mm long in throat and at base and faint enations; tube 2–2.8 mm long. *Adaxial corolla lobes* falcate-oblong, 9.3–11.2 mm long, 2.7–3.1 mm wide, basally fused for a further 2–3.2 mm; auricle 6–7 mm long, 2.5–3 mm wide, with dense hairs 0.6–1.2 mm long on the inner margin; wing above auricle 3.7–4 mm long, 0.8–1.8 mm wide, wing opposite auricle 1.7–2.2 mm long, 0.6–0.8 mm wide. *Abaxial corolla lobes* ovate, 4.8–6 mm long, 3.3–4 mm wide, basally fused for a further 10–10.2 mm, wings 2.5–6.5 mm long, 0.5–1.5 mm wide, exceeding the length of the lobe by 0.3–2.1 mm. *Stamens* 5, filaments 3.2–4 mm long, 0.5–0.7 mm wide; anthers linear, 2.4–3.1 mm long, 0.9–1.4 mm wide. *Style* 5–6.3 mm long, 1.7–2 mm wide, with moderately dense to dense hairs 0.7–1.3 mm long; indusium broadly obovoid, 2.5–3 mm long, 4.3–4.4 mm wide, abaxial surface with moderately dense hairs 0.7–1.2 mm long, adaxial surface with moderately dense to dense hairs 0.3–1.1 mm long, upper lip with dense bristles 0.8–1 mm long, lower lip glabrous or with bristles 0.5–0.6 mm long towards the edges. *Ovary* elliptic to obovate, 2.3–6.2 mm long, 2.3–6 mm wide, glabrous, septum obsolete or with residual tissue, with 30–34 ovules. *Fruit* a capsule, ovoid, glabrous, 7–10 mm long, 7.5–10 mm wide. *Seeds* ovate, flat, light brown, 3–3.8 mm long, 2.1–2.5 mm wide, smooth or with faint pits over the surface; wing golden brown, not overlapping seed margin, 1–1.4 mm wide.

Diagnostic features. Uniquely characterised within the genus by the following features: bracts leaf-like, free and paired, with scattered to dense hairs 0.2–0.7 mm long, acuminate to acute with dentate to denticulate margins; terminal dichasia of 1–3(–5) flowers with a bluish white, rose white or creamy

yellow corolla 15–20 mm long; pedicels with moderately dense to dense hairs 0.1–0.5 mm long; sepals fused at the base for 2.3–4.5 mm, with dense hairs 0.2–0.5 mm long on the outer surface, acuminate with strongly dentate margins, posterior sepal 11.8–13.5 mm long, 11–11.4 mm wide; abaxial corolla wings 2.5–6.5 mm long, 0.5–1.5 mm wide, exceeding the length of the lobe by 0.3–2.1 mm; style 5–6.3 mm long, with moderately dense to dense hairs 0.7–1.3 mm long; and 30–34 ovules per flower.

Selected specimens examined. WESTERN AUSTRALIA: Roe Botanical District, 17 km N of Mt Buraminya, 23 Nov. 1991, *W.R. Archer* 2311912 (MEL 2019307); 1 mile E of Woolgangie, 2 Nov. 1947, *J.H.Calaby s.n.* (CANB 15011); Quadrat LMS8, Lake Mason Stn, N of Sandstone, 14 Sep. 2005, *D.J. Edinger* 5436 (PERTH 07284039); Site ll, Lake Mason, Lake Mason Stn, 56 km NNE of Sandstone, 14 April 2004, *D.J. Edinger & G. Marsh* DJE 4008 (PERTH 06794726); 30 miles [48 km] W of Balladonia towards Fraser Range, 26 Oct. 1931, *C.A. Gardner* 2912 (CANB 00539269‘ PERTH 02569175); near Derby, July 1967, *C. H. Gittins* 1445 (NSW 807648); *c*. 5 km E of Derby, Broome road, 22 May 2008, *S.W.L. Jacobs* 9868 (CANB 726309, NSW 874780); 4 km NE of Comet Vale, 18 Oct. 1987, *G.J. Keighery* 9437 (PERTH 02764164); Coolgardie Goldfields, Oct. 1901, *E. Pritzel* 850 (NSW 75659); 18 miles [28.9 km] W of Old Gidgee HS, N of Sandstone, 16 Oct. 1972, *R.D. Royce* 10445 (PERTH 01875329); 11.9 km N Lake Barlee HS, Lake Barlee, 19 Oct. 2003, *L. Sweedman* 6192 (PERTH 06868215); 25.7 miles SW of Coolgardie on the Great Eastern Hwy, 9 Mar. 1970, *M.D. Tindale & E.M. Bennett* 43 (NSW 105109); 9 miles [14.4 km] E of Kurnalpi, 11 Oct. 1974, *E. Wittwer* 1357 (PERTH 02764237).

Phenology. Flowers recorded from September to November. Fruits recorded in May and October.

Distribution and habitat. Restricted to Western Australia, extending from south-east of Meekatharra to west of Balladonia in the Coolgardie and Murchison bioregions, with a single southernmost population in the Mallee bioregion to the south of Dundas Nature Reserve (Figure 3). It is found growing on plains or salt flats in red sand or sandy loam associated with *Eucalyptus georgei*, or in red clay loam over limestone in open mallee with *Triodia*.

Conservation status. This species is relatively widespread and is not considered to be under threat.

Affinities. *Goodenia daviesii* is morphologically most similar to the hairy southern Western Australian specimens of *G. connata* (see notes under that species) but can be recognised by the presence of free bracts (vs usually connate), peduncles with dense hairs 0.1–0.5 mm long (vs glabrous or with scattered hairs 0.1–0.3 mm long), pedicels with dense hairs 0.1–0.5 mm long (vs glabrous or scattered to moderately dense hairs 0.1–0.5 mm long), and a bluish white to rose white or creamy yellow corolla 15–20 mm long (vs a cream, white, whitish green to pale violet, pinkish mauve or yellowish pink corolla 16–25 mm long).

Goodenia discophora (F.Muell.) K.A.Sheph., *PhytoKeys* 152: 89 (2020). *Velleia discophora* F.Muell., *Fragm*. 10(81): 10 (1876). *Type*: Near Ularing, Western Australia, 10–15 October 1875, *Young s.n.* (*holo*: MEL 009649!).

Annual or short-lived perennial *herb*, 0.3–0.7 m high. *Leaves* arranged in a basal rosette, petiolate, narrowly ovate, spathulate to lyrate, denticulate to dentate, lamina (including petiole) 55–300 mm long, 16–50 mm wide, with lobes 5–30 mm long, 5–14 mm wide, glabrous, with a densely hairy axil, apex acute to rounded, base attenuate. *Inflorescence* an elongated, branched dichasium, with terminal dichasia of 1 or 2 flowers; peduncles 300–700 mm long including inflorescence, glabrous; pedicels

2–30 mm long, glabrous; bracts connate into a disk, not slit to the base, 11.5–80 mm diam., glabrous, with a densely hairy axil, apex rounded or with a small apiculus, margin entire. *Sepals* 5, basally fused for 1.5–2.2 mm, both surfaces glabrous, apex acute, margin entire; posterior sepal slightly larger than the remainder, narrowly ovate, free portion 5.9–6.1 mm long, 1.4–5.5 mm wide, remainder narrowly ovate, 4.1–6 mm long, 2–3 mm wide. *Corolla* 16–19 mm long, yellow with a deep orange throat, glabrous on the outer surface, inner surface with dense hairs in the throat 0.2–0.4 mm long, sometimes with faint enations; tube 3–3.5 mm long. *Adaxial corolla lobes* falcate-oblong, 6.9–7.5 mm long, 2–2.5 mm wide, basally fused for a further 3.2–4 mm; auricle 2.8–3 mm long, 1.4–1.5 mm wide, with dense hairs 0.3–0.6 mm long on the inner margin; wing above auricle 3.3–5 mm long, 1.1–1.8 mm wide, wing opposite auricle 3.2–6 mm long, 0.5–2 mm wide. *Abaxial corolla lobes* oblong, 4.3–8.3 mm long, 1.8–2.7 mm wide, basally fused for a further 5.5–6 mm, wing 2.4–8.2 mm long, 0.8–2.2 mm wide, extending 0.1–1.2 mm beyond the lobe apex. *Stamens* 5, filaments 2.1–3 mm long, 0.3–0.5 mm wide; anthers linear, 1.6–1.8 mm long, 0.6–1.5 mm wide. *Style* 3–3.5 mm long, 0.7–1 mm wide, with scattered to moderately dense hairs 0.2–0.3 mm long; indusium obovoid, 2.1–2.2 mm long, 2.4–2.5 mm wide, abaxial surface with scattered to moderately dense hairs 0.2–0.5 mm long, adaxial surface with moderately dense hairs 0.2–0.4 mm long, upper lip with dense bristles to 0.4–0.6 mm long, lower lip glabrous with bristles to 0.1 mm long. *Ovary* elliptic, 2.7–1.2 mm long, 2–2.5 mm wide, glabrous, septum almost obsolete, with 12–15 ovules. *Fruit* a capsule, elliptic to ovoid, glabrous, 7–12 mm long, 9–14 mm wide. *Seeds* ovate, flat, brown, 2.5–3 mm long, 1.8–2 mm wide, with small projections over the surface; wing golden brown, not overlapping seed margin, 1.3–1.5 mm wide. (Figure 8)

Diagnostic features. Distinguished within *Goodenia* by the following features: bracts connate into a disk, not slit to the base, 11.5–80 mm diam., glabrous, apex rounded or with a small apiculus, margins entire; terminal dichasia of 1 or 2 flowers; a yellow corolla 16–19 mm long with deep orange throat; pedicels glabrous; sepals fused at the base for 1.5–2.2 mm, glabrous, acute with entire margins, posterior sepal 5.9–6.1 mm long, 1.4–5.5 mm wide; abaxial corolla wings 2.4–8.2 mm long, 0.8–2.2 mm wide, extending 0.1–1.2 mm beyond the lobe apex; style 3–3.5 mm long, with scattered to moderately dense hairs 0.2–0.3 mm long; and 12–15 ovules per flower.

Selected specimens examined. WESTERN AUSTRALIA: Roe Botanic District. 10.5 km NNE of Mt Heywood, 14 Dec. 1991, *W.R. Archer* 1412913 (MEL 2019308, PERTH 03590054); Roe Botanic District. 16.5 km NNE of Mt Heywood, 28 Dec. 1991, *W.R. Archer* 28129119 (MEL 2019310); Roe Botanic District. 23 km NE of Mt Heywood, 28 Dec. 1991, *W.R. Archer* 2812919 (MEL 2019309); Yellowdine, 32 km E of Southern Cross along Great Eastern Hwy towards Coolgardie, 30 Jan. 1979, *B.Barnsley* 1007 (CBG 7902345); 13 miles [20.9 km] E of Meekatharra, 8 Dec. 1955, *N.T. Burbidge* 4718 (CANB 34049, PERTH 2692457); Geraldton to Mt Magnet Rd, 14 miles [22.5 km] E of Mullewa, 10 Sep. 1966, *R. Filson* 8702 (MEL 0033377); Gnarlbine, 12 Nov. 1891, *R. Helms s.n.* (MEL 0009650); *c.* 60 km direct NE of Wubin, *c.* 19 km direct SW of Mt Gibson, 1.5 km E of Great Northern Hwy along road to Mt Gibson gold mine, 24 Oct. 1992, *A.M. Lyne, L. Craven & F. Zich* AML 856 (AUA *n.v.,* CBG 9215700, E *n.v.,* MU *n.v.,* PERTH 09159614); Corridors (Koolyanobbing, Windarling, Mt Jackson), 16 Oct. 2000, *E. Mattiske* J 39–156 (MEL 2286925, NSW 536939, PERTH 06351255); *c.*15 km E of Mullewa, 4 Oct. 1966, *E.A. Shaw* 635 (AD 96832258 *n.v.*, CANB 537224); 20.9 km SE of Victoria Rocks Rd on Hyden–Norseman Rd, E of Norseman, 6 Oct. 2011, *K.A. Shepherd, C.F. Wilkins & J.A. Wege* KS 1467 (PERTH 09198334); 3.6 km E of Burgess Rd on Dinnie Rd, 24 Sep. 2013, *K.A. Shepherd & S.R. Willis* KS 1513 (PERTH 08616302); Borrikin Rock, 19 Sep. 1982, *B.H. Smith* 122, (NSW 2400724, MEL 624758); 7.88 miles [12.6 km] E of No. 1 Rabbit fence on track to Clampton, 22 Oct. 1995, *B.H. Smith* 1811 (MEL 2369206, PAL *n.v.*, PERTH 09229302, S *n.v.*); Wilroy, 14 Sep. 1959, *R.F. Thorne* 24495 (RSA *n.v.*, MEL 2476583); Along track to Orchid corner, Eurardy Bush Heritage Reserve, Kalbarri, 19 Aug. 2008, *J.E. Wajon* 1714 (PERTH 08338906).

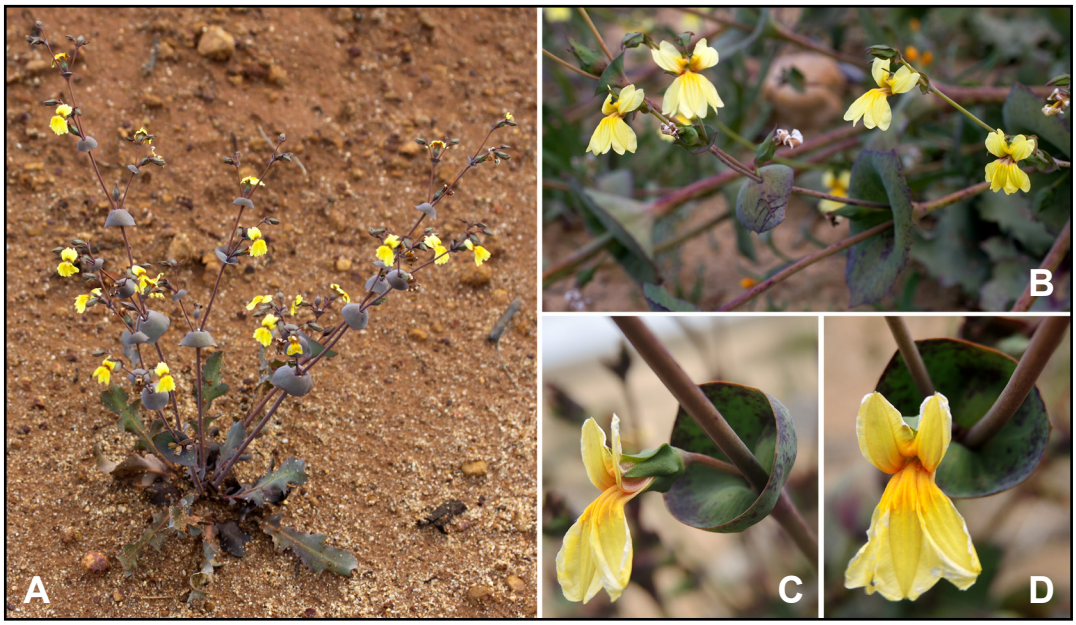

Figure 8. *Goodenia discophora*. A – habit; B – flowering stem; C – solitary yellow flower showing the connate bracts and narrow sepals divided to near the base; D – flower showing the obvious wings on the abaxial corolla lobes. Vouchers: *K.A. Shepherd, C.F. Wilkins & J.A. Wege* KS 1467 (PERTH 09198334) (A); *J.E. Wajon* 1714 (PERTH 08338906) (B); *K.A. Shepherd & S.R. Willis* KS 1513 (PERTH 08616302) (C, D). Images by: K.A. Shepherd (A, C, D); J.E. Wajon (B).

Phenology. Flowers recorded from September to December. Fruits recorded from May to January.

Distribution and habitat. Restricted to Western Australia, occurring in the Avon Wheatbelt, Coolgardie, Geraldton Sandplains, Mallee, Murchison and Yalgoo bioregions (Figure 7). Grows in grey or yellow sand or reddish brown loam over laterite or granite, in open mallee or low woodland over heath with *Acacia*, *Allocasuarina acutivalvis*, *Gyrostemon ramulosus*, *Thryptomene* and *Seringia*.

Conservation status. Widespread and currently not considered to be at risk.

Affinities. This species is morphologically most similar to *G. obscurata* in having generally smaller flowers with less than 20 ovules in each ovary. *Goodenia discophora* is distinguished from *G. obscurata* in having a yellow corolla with a deep orange throat (vs a white corolla with a yellow throat), and narrower sepals (posterior sepal 1.4–5.5 mm wide vs 6.2–7 mm wide) that are more shortly fused at the base (1.5–2.2 mm vs 2.3–3.8 mm).

Goodenia obscurata K.A.Sheph. & Lepschi, *sp. nov.*

Type: Hamersley Range, Chichester-Millstream National Park, 20 km E of Millstream Junction, Western Australia, 4 October 1989, *B. Nordenstam & A. Anderberg* 313 (*holo*: PERTH 01947729!; *iso*: CANB, MEL 2191030!, NSW 2400728!).

Annual or short-lived perennial *herb*, 0.35–0.6 m high. *Leaves* in a basal rosette, obovate, denticulate, petiolate, lamina (including petiole) 54–73 mm long, 24–25 mm wide, glabrous, with a densely hairy axil, apex rounded, base attenuate. *Inflorescence* an elongated, branched dichasium, with terminal dichasia of 1 or 2 flowers, peduncles 350–600 mm long including inflorescence, glabrous; pedicels

4–25 mm long, glabrous; bracts connate into a disk, not slit to the base, 9–63 mm diam., glabrous, with a densely hairy axil, apex rounded with an apiculus to shallowly acute, margin entire to shallowly denticulate. *Sepals* 5, basally fused for 2.3–3.8 mm, both surfaces glabrous, apex acute to acuminate, margin entire; posterior sepal larger than the remainder, ovate, free portion 5.5–7.5 mm long, 6.2–7 mm wide, remainder ovate, 4.4–7.2 mm long, 3–4.8 mm wide. *Corolla* 14–19 mm long, white or very pale pink with a yellow throat, glabrous on the outer surface, inner surface with scattered to moderately dense hairs 0.2–0.5 mm long in the throat and faint enations; tube 1.8–2.6 mm long. *Adaxial corolla lobes* falcate-oblong, 6.5–10.3 mm long, 1.3–3 mm wide, basally fused for a further 1.5–3 mm; auricle 4–7 mm long, 1.4–2.6 mm wide, with dense hairs 0.4–1.2 mm long on the inner margin; wing above auricle 2–3 mm long, 0.7–3 mm wide, with scattered hairs, wing opposite auricle 1.1–5 mm long, 0.4–1.2 mm wide. *Abaxial corolla lobes* oblong, 3.2–5.4 mm long, 3.2–5 mm wide, basally fused for a further 7.1–10.6 mm, wings 2.4–5.7 mm long, 0.6–1.6 mm wide, exceeding the length of the lobe by 0.1–0.4(–0.6) mm. *Stamens* 5, filaments 3–3.6 mm long, 0.5–0.7 mm wide; anthers linear, 1.8–2.7 mm long, 0.5–1.1 mm wide. *Style* 4.7–6 mm long, 0.8–1.3 mm wide, very few to scattered hairs 0.3–1.2 mm long; indusium broadly obovoid, 2–2.7 mm long, 3.2–5 mm wide, abaxial surface with scattered hairs 0.3–0.6 mm long, adaxial surface with scattered hairs 0.3–1 mm long, upper lip with dense bristles 0.6–1.4 mm long, lower lip glabrous or with bristles 0.1–0.3 mm towards the edges. *Ovary* elliptic to obovoid, 1.8–3 mm long, 2–2.7 mm wide, glabrous, septum obsolete, with 11–16 ovules. *Fruit* a capsule, globular to ovoid, glabrous, 9–11 mm long, 8–12 mm wide. *Seeds* ovate, flat, brown, 3.6–4.4 mm long, 2.5–3.3 mm wide, punctulate; wing pale brown, not overlapping seed margin, 0.7–1.8 mm wide. (Figure 9)

Diagnostic features. *Goodenia obscurata* is distinguished by the following characters: bracts connate into a disk, not slit to the base, glabrous, apex rounded with an apiculus or shallowly acute, margins entire to shallowly denticulate; terminal dichasia of 1 or 2 flowers with a white or very pale pink corolla 14–19 mm long; pedicels glabrous; sepals fused for 2.3–3.8 mm, glabrous, acute to acuminate, with entire margins, posterior sepal 5.5–7.5 mm long, 6.2–7 mm wide; abaxial corolla wings 2.4–5.7 mm long, 0.6–1.6 mm wide, exceeding the length of the lobe by 0.1–0.4(–0.6) mm; style 4.7–6 mm long, with very few to scattered hairs 0.3–1.2 mm long; and 11–16 ovules per flower.

Selected specimens examined. WESTERN AUSTRALIA: 2 miles [3.2 km] from Mount Bruce, Fortescue [District], 26 Sep. 1965, *J.V. Blockley* 88 (PERTH 06035264); *c.* 74 km SE of Pannawonica, 5 May 2023, *L.I. Buchan Rivas & J. Alford* K087-02 (PERTH 09575227); Abydos-Woodstock Rd, S of Port Hedland, 26 Apr. 1958, *N.T. Burbidge* 5888 (CANB 53758); Adjacent to homestead airstrip; Yanrey Stn, 9 May 2004, *G. Byrne* 965 (PERTH 07407157); Adjacent to Millstream Chichester NP, W side of road, 18.9 km W of junction with main Millstream Chichester National Park entry road on Millstream–Pannawonica Rd, 10.6 km NNW of Mt Flora, 66.6 km ESE of Pannawonica, 1 Sep. 2015, *S. Caddy-Retalic* WAA 008427 (PERTH 09202927); Near the Lyndon River, 1885, *H.S. Carey s.n.* (MEL 9631); Hood Bore, Coolawanyah Stn, 85 km N of Tom Price, 25 June 2011, *A. Douglas* WB 30824 (PERTH 08673233); Roadside 139.2 km N of Kumarina, 23 Aug. 1985, *Hj. Eichler* 23594 (CANB 364006); Hamersley Range, on summit, 24 Aug. 1932, *C.A. Gardner* 3150 (CANB 00539272, PERTH 02569191); Mt Elvire, 41.8 km NNE of Mt Rica, 22.7 km WSW of Mt Flora, 17.2 km ESE of River Well on the Robe River, Yalleen Stn, Hamersley Range, 14 Oct. 1998, *S. van Leeuwen* 4310 (CANB 538620, MEL 2425488, PERTH 06110819); Pannawonica–Millstream Rd, 11 km W of entrance to Millstream, 18 July 2004, *J.E. Wajon* 1060 (DNA D0276552, PERTH 07349254); NW roadside *c.* 2.5 miles (4 km) W of Gordon Oxer Lookout (onto Red & Hancock Gorges), Hamersley Ra. National Park, 16 Aug. 1974, *J.H. Willis s.n.* (MEL 2193368).

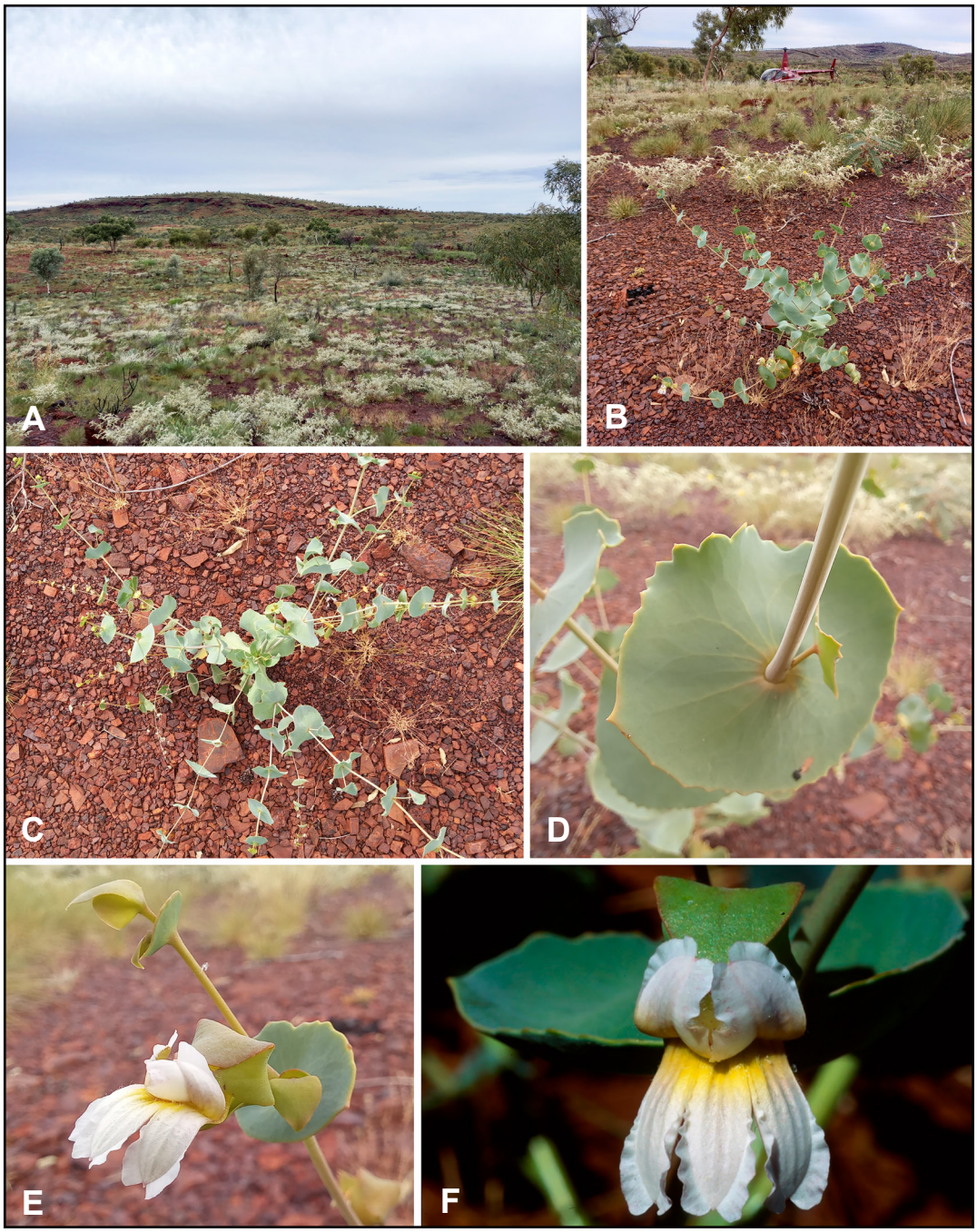

Figure 9. *Goodenia obscurata*. A – habitat; B – habit; C – whole plant comprised of flowering stems; D – connate, disk-like bracts; E – side view of flower showing the broad obovate sepals; F – white and yellow flower highlighting the broad posterior sepal with entire margins and the wings on the adaxial and abaxial corolla lobes that do not extend far beyond the apex of each lobe. Vouchers: *L.I. Buchan Rivas & J. Alford* K087-02 (PERTH 09575227) (A– E); *J.E. Wajon* 1060 (PERTH 07349254) (F). Images by: L.I. Buchan Rivas (A– E); J.E. Wajon.

Phenology. Flowers recorded April, May and August to October. Fruits recorded April to October.

Distribution and habitat. Restricted to Western Australia and extending across the western Pilbara, with a single population recorded from the Carnarvon bioregion, inland from the Exmouth Gulf (Figure 7). Occurs on floodplains or low rocky ridges, growing in red-brown sandy clay or lateritic loam over banded ironstone. Associated with low open woodland of *Acacia* over *Triodia*, or open shrubland with a sparse overstorey of *Corymbia hamersleyana* and *Hakea chordophylla* over *Triodia*.

Conservation status. To be listed as Priority Three under Conservation Codes for Western Australian flora (Tanya Llorens pers. comm.). An under-surveyed species that is mostly known from mining tenements.

Etymology. From the Latin *obscurata* (obscured), in reference to this taxon having been overlooked within the genus. Most material of this species has previously been referred to an expanded and ill-defined *G. connata*.

Affinities. See comments under *G. discophora* and *G. connata*.

Goodenia panduriformis (A.Cunn. ex Benth.) K.A.Sheph., *PhytoKeys* 152: 91 (2020). *Velleia panduriformis* A.Cunn. ex Benth., *Fl. Austral.* 4: 46 (1868). *Lectotype*, first-step designated by Carolin, *Proc. Linn. Soc. New South Wales* 92(1): 36 (1967): 'Goodenough Bay and Point Cunningham, N.W. Coast, A. Cunningham (K)'; second-step designated by K.A. Shepherd *et al.*, *Phytokeys* 152: 91 (2020): 'Australia: Western Australia. Point Cunningham & Carlisle Head, the North Point of Goodenough Bay', *s. dat.*, [*A. Cunningham s.n.*] (K 000215368 image!; *isolecto*: BM 00104382 image!, K 000215367 image!, MEL 0009640!).

Robust annual or short-lived perennial *herb*, 1–1.5 m high. *Leaves* in a basal rosette, obovate, denticulate to shallowly or very shallowly dentate, petiolate, lamina (including petiole) 46–100 mm long, 17–55 mm wide, glabrous, with a densely hairy to floccose axil, apex rounded, base attenuate. *Inflorescence* an elongated, branched dichasium, with lateral branches at each node growing more strongly than the others giving a superficial appearance of a cluster, with terminal dichasia of (7–)10–24 flowers; peduncles 1000–1500 mm long including inflorescence, glabrous or with moderately dense hairs 0.1–0.3 mm long basally; pedicels 5.5–15 mm long, glabrous, or with scattered to moderately dense hairs 0.1–0.3 mm long basally; bracts connate into a disk usually slit nearly to the base on one side, 3.6–140 mm diam., glabrous or with scattered hairs 0.1–0.4 mm long, with a densely hairy axil, apex rounded to acute, margin very shallowly dentate to shallowly dentate. *Sepals* 5, free or barely fused at base, outer surface with scattered to dense hairs 0.1–0.3 mm long, sometimes restricted to margins and apex only, inner surface and margin usually with scattered to moderately dense hairs 0.1–0.2 mm long, apex acute to acuminate, margin entire to shallowly dentate; posterior sepal larger than the remainder, broadly ovate to elliptic, 20–22 mm long, 11–15.8 mm wide, remainder narrowly ovate to lanceolate, 14.6–17.5 mm long, 5.6–7 mm wide. *Corolla* orange yellow, 25–29 mm long, glabrous on the outer surface or with scattered hairs 0.2–0.3 mm long, inner surface with dense hairs 0.3–0.6 mm long in throat and faint enations; tube 1.5–3 mm long. *Adaxial corolla lobes* falcate-oblong, 12–14.5 mm long, 2.5–4 mm wide, basally fused for a further 4.2–6 mm; auricle 5–6.5 mm long, 2–3.5 mm wide, with dense hairs 1.3–1.5 mm long on the inner margin; wing above auricle 2.4–3.5 mm long, 0.6–2 mm wide, with dense hairs, wing opposite auricle 3.3 mm long, 1–1.9 mm wide. *Abaxial corolla lobes* oblong, 4.8–5.2 mm long, 3–3.5 mm wide, basally fused for a further 13–15 mm, wing 3.8–5.5 mm long, 1.2–1.7 mm wide, not exceeding the length of the lobe. *Stamens* 5, filaments 4.6–5.2 mm

long, 0.7–0.8 mm wide; anthers linear, 3.3–3.8 mm long, 0.7–0.9 mm wide. *Style* 9.2–10 mm long, 1.1–1.5 mm wide, with scattered hairs 0.6–1.5 mm long; indusium obovoid, sometimes slightly curved inwards, 3.3–4 mm long, 3.2–4 mm wide, abaxial surface glabrous or with moderately dense hairs 0.6–1.5 mm long, adaxial surface with scattered to moderately dense hairs to 2 mm long, upper lip with dense bristles 1–1.1 mm long, lower lip with short bristles 0.1 mm long. *Ovary* elliptic, 4–5 mm long, 3–3.2 mm wide, glabrous, septum incomplete and less than one third length, with 14 ovules. *Fruit* a capsule ovoid, glabrous, *c.* 10.6 mm long, *c.* 9 mm wide. *Seeds* ovate, flat, pale brown, 5.2–7.2 mm long, 4.7–6 mm wide, smooth with faint pits or projections towards the margin; wing fawn to pale yellow, not overlapping seed margin, 1.8–3.2 mm wide, punctulate. (Figure 10)

Diagnostic features. Distinguished from allied species by the following combination of characters: robust habit 1–1.5 m high; bracts connate into a disk usually slit to near the base, apex rounded to acute, margins very shallowly to shallowly dentate; terminal clusters of (7–)10–24 flowers with an orange yellow corolla 25–29 mm long; pedicels glabrous or with scattered to moderately dense hairs 0.1–0.3 mm long basally; sepals free or almost free, outer surface with scattered to dense hairs 0.1–0.3 mm long (hairs sometimes restricted to margins and apex), apex acute to acuminate, margins entire to shallowly dentate; posterior sepal 20–22 mm long, 11–15.8 mm wide; abaxial corolla wings 3.8–5.5 mm long, 1.2–1.7 mm wide, not exceeding the length of the lobe; style 9.2–10 mm long with scattered hairs 0.6–1.5 mm long; and 14 ovules per flower.

Selected specimens examined. WESTERN AUSTRALIA: Broome lighthouse area, 7 Aug. 1965, *A.C. Beauglehole* ACB 11273 (MEL 0623269, PERTH 02713489); Anna Plains Track to Great Northern Hwy, 0.8 km from homestead, 15 Sep. 2004, *G. Byrne* 1214 (PERTH 07160992); 'Robert', northern Great Sandy Desert, 19 Aug. 2001, *C.P. Campbell* 3287 (PERTH 05935164); 2 km N of Shay Gap township, 13 Sep. 1982, *L.A. Craven* 7563 (CANB 379538, MEL 0304474, PERTH 02713241); Barnett River crossing on the Derby–Kununurra Rd, 30 June 1984, *L. Craven* 8451 (AD 99401234 *n.v.*, CANB 399445, DNA D0120977, MEL 0235156, PERTH 3590046); 35 km S along Boreline Rd from Great Northern Hwy, *c.* 40 km E of Pardoo Roadhouse, 5 Oct. 2008, *T. Erickson* TEE 587 (PERTH 08141495); Yeeda 28 miles [45 km] S.E. Derby, Apr. 1927, *A.J. Ewart s.n.* (MEL 2193258); *c*. 5 km E of Derby, Broome road, 22 May 2008, *S.W.L. Jacobs* 9868 (CANB 00726309, NSW 874780, PERTH 9590722); R2. Edgar Ra. site, Edgar Ra., SE of Broome, 7 Aug. 1976, *K.F. Kenneally* 5528 (CANB 288808, PERTH 01626345); Leopold Downs Road, 1 km N of junction with Great Northern Hwy (Hwy 1), 8 June 2022, *C.T. Martine, T.M. Williams, C. Marino & A. Wrobleski* CTM 5061 (BUPL *n.v.*, PERTH 09504362); Oscar Range, 15 km from Great Northern Hwy along road to Tunnel Creek National Park, Dampier District, 12 May 1999, *R.W. Purdie* 4894 (CANB 604320, PERTH 05945879); Karunjie Stn, Kimberleys, Nov. 1954, *D.W. Rust* 2K (CANB 109410); 16 miles [25.7 km] NE of Karunjie Stn, Kimberleys, 14 Sep. 1954, *N.H. Speck* 5011 (CANB 109409); *c*. 40 km E of Derby along Gibb River road, 14 Aug. 1977, *I.R. Telford* 6905 & *G. Butler* (CBG 7708437, NSW 2400713); Broome, Gantheaume Point, 15 May 1992, *I.R. Telford* 11733 (CBG 9206387, NSW 2400715); Roebuck Bay, Nov. 1889, *J.W.O. Tepper* 59 (MEL 0009642); Kavite Road, Riddel Beach Area, Broome Port District, 21 Sep. 2011, *J.O. Westaway* 3666 (CANB 00818636, DNA D0227777); Great Northern Hwy, 5 miles [8 km] W of Fitzroy Crossing, Kimberleys, 19 July 1974, *J.H. Willis s.n.* (MEL 2118689, MEL 2118690).

Phenology. Flowers recorded from May to November with peak flowering apparently occurring June to September. Fruits recorded July to September.

Distribution and habitat. *Goodenia panduriformis* is found across the western and central Kimberley of Western Australia in the Dampierland, Great Sandy Desert and Central Kimberley bioregions

Figure 10. *Goodenia panduriformis*. A – habit; B – disk-like bracts split on one side; C – large clusters of terminal flowers; D – flower, side view showing the narrowly ovate sepals split to the base, and long abaxial corolla lobes; E – orange yellow corolla showing adaxial lobes and auricles cupping the indusium. Vouchers: *c.* 50 km W Mt Hardman, WA, 2010 (unvouchered) (A, B, D); *G. Byrne* 1214 (PERTH 07160992) (C, E). Images by: S. & A. Pearson (A, B, D); G. Byrne (C, E).

(Figure 7). Grows on pindan sandplains, between dunes, or on coastal cliffs in deep red sand, red loam or brown sandy loam, sometimes over sandstone, and is associated with low open woodlands, shrublands or *Triodia* communities.

Conservation status. This species is relatively widespread and is not considered to be under threat.

Affinities. See comments under *G. crescentiloba*.

Notes. A chromosome number of *2n* = 16, recorded by Peacock (1963) and repeated in Carolin (1967, 1992) for *Velleia panduriformis* may be referable to *G. crescentiloba* rather than *G. panduriformis* (see notes under *G. crescentiloba* for further discussion).

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