



Goodenia austrina and *G. vanleeuweniana* (Goodeniaceae), two new blue-flowered species from Western Australia

Leigh W. Sage^{1,3} and Kelly A. Shepherd² 

¹Swan Coastal District, Parks & Wildlife Service,
Department of Biodiversity, Conservation and Attractions,
5 Dundobar Rd, Wanneroo, Western Australia 6065

²Western Australian Herbarium, Biodiversity and Conservation Science,
Department of Biodiversity, Conservation and Attractions, Locked Bag 104,
Bentley Delivery Centre, Western Australia 6983

³Corresponding author, email: Leigh.Sage@dbca.wa.gov.au

SHORT COMMUNICATION

Two new blue-flowered species of *Goodenia* R.Br. are described and illustrated. *Goodenia austrina* L.W.Sage & K.A.Sheph. (subg. *Monochila* sect. *Caerulea* (Benth.) Carolin), previously phrase-named as *G.* sp. South Coast (A.R. Annels ARA 1846), is a new conservation listed species confined to a few scattered populations in southern Western Australia. *Goodenia vanleeuweniana* L.W.Sage & K.A.Sheph. (subg. *Monochila* sect. *Scaevolina* (Carolin) K.A.Sheph.), a new species centred around the Little Sandy Desert region previously phrase named as *G.* sp. Sandy Creek (R.D. Royce 1653), is named for Professor Stephen van Leeuwen, the BHP Curtin Indigenous Professor in Biodiversity & Environmental Science at Curtin University. Both species were supported as distinct based on nrDNA and cpDNA sequence data (Shepherd *et al.* 2020), with *G. vanleeuweniana* (as *G.* sp. ‘Sandy Creek’) placed sister to *G. hartiana* L.W.Sage in the ‘*Scaevolina*’ clade, and *G. austrina* (as *G.* sp. ‘South Coast’) with an unresolved position without clear affinities within the *Caerulea* clade (‘*Coerulea*’ in Shepherd *et al.* 2020, Figure 8; see *Notes* below).

Taxonomy

Goodenia austrina L.W.Sage & K.A.Sheph., *sp. nov.*

Type: South Coast Highway, west of Denmark, Western Australia [precise locality withheld for conservation reasons], 25 October 2016, *K.A. Shepherd & C.F. Wilkins* KS 1644 (*holo*: PERTH 09101926; *iso*: AD, BRI, CANB, K, MEL, NSW).

Goodenia sp. South Coast (A.R. Annels ARA 1846), Western Australian Herbarium, in Florabase, <https://florabase.dbca.wa.gov.au/> [accessed 7 March 2024].

Erect to spreading, multi-stemmed, perennial *subshrub* 0.2–0.4 m high. *Stems* straight to slightly zig-zag, glandular, without a strong odour. *Leaves* in a basal rosette and some leaves extending up the stems, linear, entire, with scattered small lobes, or lyrate, flat, lamina (including petiole) 21–44 mm long, 0.5–2.2 mm wide, with dense, short glandular hairs on both surfaces and a dense tuft of white hairs in the axil, apex acute, base attenuate. *Inflorescence* a terminal raceme; peduncles 14–69 mm long, with glandular hairs; bracts linear, leaf-like but smaller, entire, 3–40 mm long, 0.5–2 mm wide, densely glandular hairy on both surfaces, apex rounded to acute; bracteoles very narrowly ovate to linear, 1.9–16 mm long, 0.2–0.9 mm

wide, densely glandular hairy, apex rounded to acute; pedicels 2.9–16.6 mm long, articulate below the ovary. *Sepals* ± equal, narrowly elliptic to elliptic, 3.5–6.3 mm long, 0.3–0.8 mm wide, usually appressed to corolla tube, densely, glandular hairy on both surfaces and margin, sometimes with occasional simple hairs, apex acute. *Corolla* 10.5–16 mm long, blue with white at base of lobes and in throat, pouch absent, outer surface with scattered glandular hairs, sometimes with scattered simple hairs on wings, inner surface mostly glabrous but with hairs 0.2–0.6 mm long lower down in throat. *Abaxial corolla lobes* 4.9–8.6 mm long, 1.3–2.4 mm wide, apex acute, basally fused for a further 3.2–5.2 mm; wings 4.9–8.7 mm long, 1.7–2.8 mm wide, entire, slightly undulate, slightly exceeding the lobe. *Adaxial corolla lobes* 7.3–9.8 mm long, 1.6–2.1 mm wide, apex acute, basally fused for a further 1.4–2.3 mm; auricle 2.7–4.3 mm long, 1.5–2.7 mm wide, with dense hairs 0.6–0.9 mm long on the inner margin; wing above auricle 5.3–6.7 mm long, 2–2.7 mm wide; wing opposite auricle 4–6 mm long, 1.8–2.5 mm wide. *Stamen* filaments linear, 2.9–3.7 mm long, 0.3–0.5 mm wide; anthers linear to narrowly oblong, 0.9–1.8 mm long. *Style* 4.3–5 mm long, 0.2–0.5 mm wide, upper half with scattered white hairs 0.3–0.7 mm long, indusium obovoid, 1.2–2 mm long, 1.8–3 mm wide, abaxial surface glabrous, adaxial surface with scattered hairs 0.3–0.7 mm long, upper lip with dense, white or purple-tinged bristles 0.3–0.5 mm long, lower lip glabrous or with bristles to 0.1 mm long near each outer margin. *Ovary* cylindrical, with sepal bases fused to outer surface and dark in appearance, tapering towards base, (3)4–8.2 mm long, 1.6–2.9 mm wide, with scattered to moderately dense glandular hairs, septum 2/3 to almost as long as locules, with 14–24 ovules in 2 rows. *Fruit* a cylindrical capsule, 8–9 mm long, with glandular hairs, valves opening. *Seeds* ovate, flat, cream, 1.1–1.8 mm long, 0.8–1.4 mm wide, faintly areolate; wing 0.1–0.2 mm wide, slightly overlapping seed margin. (Figure 1)

Diagnostic features. Unique within *G.* subg. *Monochila* sect. *Caerulea* in being a multi-stemmed perennial with the following features: a basal rosette of linear to lyrate leaves covered in glandular hairs; leaf-like bracts; very narrowly ovate to linear bracteoles 1.9–16 mm long; narrowly elliptic to elliptic, acute sepals 3.5–6.3 mm long and 0.3–0.8 mm wide; a blue corolla 10.5–16 mm long, with scattered glandular hairs on the outer surface and a white throat with hairs 0.2–0.6 mm long deep inside; a cylindrical and smooth ovary (3)4–8.2 mm long and 1.7–2.9 mm wide, tapering towards the base with 14–24 ovules; and cream, faintly areolate seeds 1.1–1.8 mm long and 0.8–1.4 mm wide with a wing 0.1–0.2 mm wide.

Other specimens examined. WESTERN AUSTRALIA [localities withheld for conservation reasons]: 1 Dec. 2010, *D. Angus* DA 068 (PERTH 08391890); 29 Oct. 1991, *A.R. Annel*s ARA 1846 (PERTH 03176738; PERTH 04297628); 5 Oct. 2000, *A. Burchell* 409 (PERTH 05831644); 27 Nov. 2001, *R.J. Cranfield* 17578 (PERTH 06749852); 19 Nov. 1983, *E.J. Croxford* 5714B (PERTH 04420128); 19 Nov. 1983, *E.J. Croxford* 5724 (PERTH 02837609); 28 Jan. 1985, *E.J. Croxford* 4500 (PERTH 03230252); 11 Jan. 1987, *G.J. Keighery* 9359 (PERTH 02647885).

Phenology. Flowering material has been observed from September to November (spring to early summer). Fruits are present on specimens collected in November.

Distribution and habitat. Currently known from several populations near the southern coast of Western Australia from east of Walpole to Waychinicup National Park, east of Manypeaks, in the Esperance Plains, Jarrah Forest and Warren bioregions (Figure 2). It grows in brown loamy sand near exposed granite in fringing vegetation including *Eucalyptus preissiana*, *E. marginata*, *Banksia coccinea*, *Melaleuca* sp., *Adenanthos* sp., *Leucopogon* sp., *Commersonia corniculata* and sedges.

Conservation status. Listed as Priority Three under Conservation Codes for Western Australian Flora (Western Australian Herbarium 1998–), under the phrase name *G.* sp. South Coast (A.R. Annel's ARA 1846). This species is currently only known from a few populations found on shallow soils near exposed granite outcrops. These populations may be susceptible to significant threats such as weed invasion, too frequent fires, population disturbance (through off-road vehicle activity and feral animals), and severe drought conditions, exemplified by those that occurred in the south-west of Western Australia during early 2024.



Figure 1. *Goodenia austrina*. A – habitat at the type locality; B – habit; C – basal leaves; D – flower; E – inflorescence showing the long bracteoles; F – flower from above; G – flower from below; H – flower, side view showing the absence of a pouch and small, elliptic sepals. Voucher: *K.A. Shepherd & C.F. Wilkins* KS 1644. Images by K.A. Shepherd.

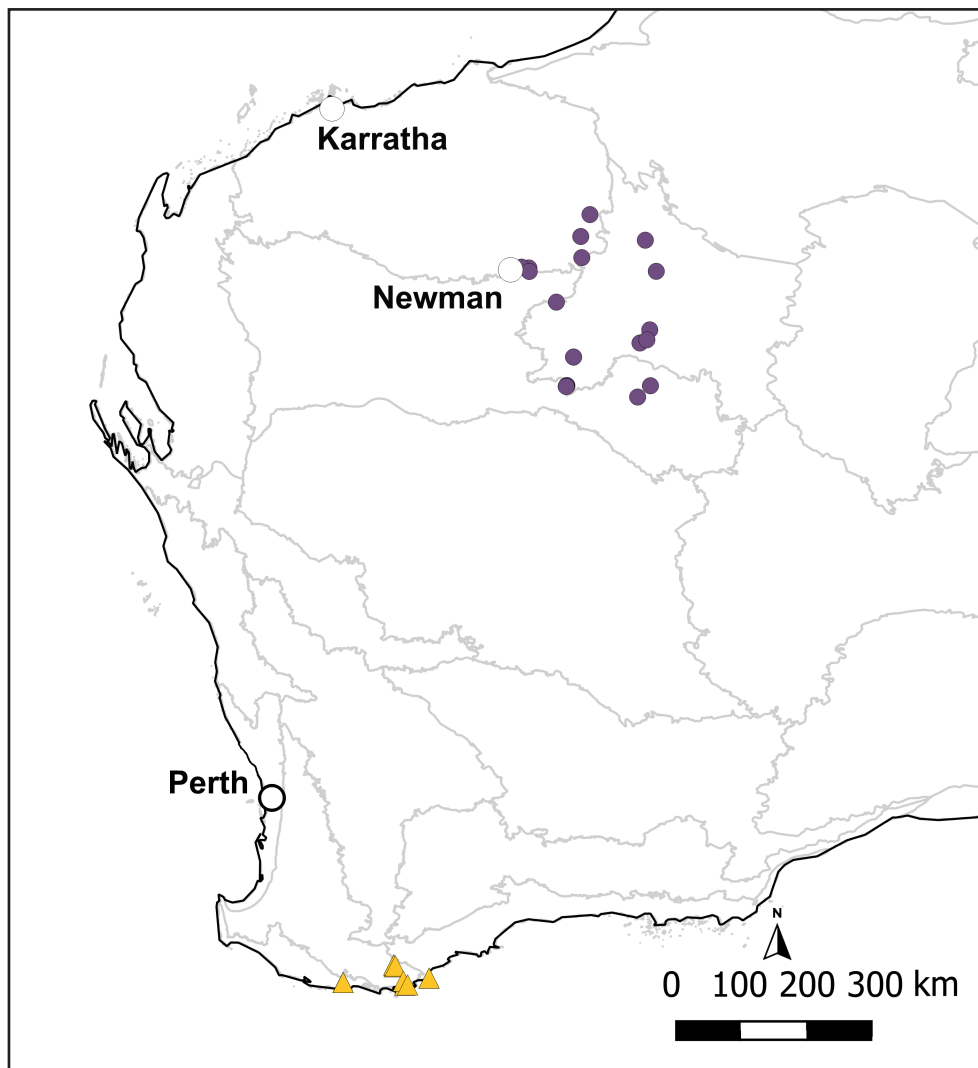


Figure 2. Distribution of *Goodenia austrina* (▲) and *G. vanleeuweniana* (●) in Western Australia based on PERTH specimen data, with IBRA subregions (Australian Government Department of Agriculture, Water and the Environment 2012) in pale grey.

Etymology. Named from the Latin *austrinus* (southern), in reference to its distribution in southern Western Australia.

Common name. Southern blue-flowered Goodenia.

Affinities. Based on analyses of nuclear and chloroplast DNA sequence data, *G. austrina* is placed within the subg. *Monochila* sect. *Caeruleae* clade *sensu* Shepherd *et al.* (2020), which includes the blue-flowered species of *Goodenia* from southern Western Australia that have seeds with a wing more than 0.1 mm wide. It should be noted that *G. austrina* did not align closely with any other species in this clade. Morphologically it is similar to the widespread *G. caerulea* R.Br. but is readily distinguished by its ovary, which is cylindrical with a tapered base and $(3)4\text{--}8.2 \times 1.7\text{--}2.9$ mm (*cf.* ovary shape with a rounded base and $2.5\text{--}4(5) \times 1.4\text{--}2.2$ mm in *G. caerulea*), and blue corolla with a white throat (*cf.* blue corolla with a yellow throat).

Notes. Shepherd *et al.* (2020) referred to sect. *Caeruleae* as sect. '*Coeruleae*'. It has now come to light that the original name '*caerulea*' has been misinterpreted as '*coerulea*' more than once, for example in Carolin (1990), and in recent citations on the *Australian Plant Name Index* (Council of Heads of Australasian Herbaria 2006–) and *Florabase* (Western Australian Herbarium 1998–), most likely due to a misreading of the 'ae' diphthong in the original protologue (Brown 1810) (A. Monro pers. comm.).

Goodenia vanleeuweniana L.W.Sage & K.A.Sheph., *sp. nov.*

Type: Dolerite ridge, 37 km north-east of Mt Essendon, 22 km south-east of Lake Sunshine, Little Sandy Desert, Western Australia, 6 September 2002, *L.W. Sage, S. van Leeuwen, R.J. Cranfield, C. Wilkins, P. Nikulinsky, B. Bromilow, J. Tucker & M. Tutt* LWS 2506 (*holo:* PERTH 06962890 [Sheet 1 of 2], PERTH 06962882 [Sheet 2 of 2]; *iso:* BRI, CANB, DNA).

Goodenia sp. Sandy Creek (R.D. Royce 1653), Western Australian Herbarium, in *Florabase*, <https://florabase.dbca.wa.gov.au> [accessed 7 March 2024].

Erect to spreading, multi-stemmed, perennial *subshrub* to *c.* 0.6 m high. *Stems* straight, glandular viscid with a strong unpleasant odour. *Leaves* cauline (basal leaves apparently always absent), very narrowly obovate, entire or unevenly denticulate to serrate, conduplicate, lamina (including petiole) 14–40 mm long, 2.5–7 mm wide, with dense, short, glandular hairs on both surfaces and margins but lacking hairs in the axil, apex obtuse to acute and usually recurved, base usually tapering. *Inflorescence* a terminal raceme or thyrse; peduncles 7–25 mm long, glandular hairy; bracts very narrowly obovate to linear, leaf-like but smaller, mostly entire, 12–38 mm long, 1.9–5 mm wide, densely, glandular hairy on both surfaces and the margins, apex obtuse to acute; bracteoles mostly linear to very narrowly obovate, 2.5–18 mm long, 0.7–1.5 mm wide, densely, glandular hairy, apex obtuse to acute; pedicels 1–8.1 mm long, articulate below the ovary. *Sepals* ± equal, very narrowly ovate to lanceolate, 6–11 mm long, *c.* 1 mm wide, spreading, densely, glandular hairy on the adaxial surface and margins, apex acute. *Corolla* 15–20 mm long, blue or purple with a lighter blue, purple or white throat and blue or purple striations on lobes, with a distinct pouch *c.* equal to length of ovary, outer surface with sparse glandular hairs and occasional long, simple hairs, inner surface with simple hairs and enations lower in throat, lobe margins with villous simple hairs. *Abaxial corolla lobes* 7.5–10.4 mm long, 2–2.6 mm wide, apex rounded; wings 6.1–8 mm long, 1.7–2.5 mm wide, rounded, entire, slightly exceeding the lobe. *Adaxial corolla lobes* 9.7–14.5 mm long, 1.9–2.6 mm wide, apex rounded, basally fused for a further *c.* 9 mm; auricle not obvious; wing above auricle 3.4–6 mm long, 1.8–2.2 mm wide; wing opposite auricle 4.3–7.8 mm long, 1.7–2.7 mm wide. *Stamen* filaments linear, 5–6.5 mm long, 0.3–0.6 mm wide; anthers narrowly oblong, 2.5–3.2 mm long. *Style* 9.7–11 mm long, 0.6–0.8 mm wide, villous, with simple hairs 0.4–1.8 mm long; indusium obovoid, 2–2.9 mm long, 2–2.8 mm wide, with simple, antrorse hairs 1.4–1.8 mm long on both surfaces, upper lip with prominent purplish-tipped white bristles 0.3–0.5 mm long, lower lip bristles to 0.1 mm long. *Ovary* ± cylindrical, tapering towards base, 6.7–9.5 mm long, with dense, glandular hairs to 0.5 mm long; septum two thirds to almost as long as locules, with 24–44 ovules in two rows, articulation below the ovary. *Fruit* a cylindrical capsule, *c.* 11 mm long, glabrous, valves opening. *Seeds* poorly known, only immature seen, ± ovate, flat, *c.* 1.7 mm long, *c.* 1.3 mm wide, reticulate to reticulate-foveate, with a narrow, brown rim; wing almost obsolete to *c.* 0.1 mm wide, possibly mucilaginous. (Figure 3)

Diagnostic features. *Goodenia vanleeuweniana* is a viscid, multi-stemmed perennial that has a distinctive foetid odour and a preference for rocky habitats and is further distinguished as unique within *G.* subgen. *Monochila* sect. *Scaevolina* by virtue of the following characters: leaves very narrowly obovate, conduplicate, 14–40 mm long; bracts very narrowly obovate to linear, leaf-like; bracteoles densely glandular hairy; sepals very narrowly ovate to lanceolate, 6–11 mm long and *c.* 1 mm wide; corolla 15–20 mm long, blue or purple with a lighter blue, purple or white throat and blue or purple striations on lobes, with sparse, glandular or simple hairs on the outer surface, villous hairs on the margins, and simple hairs and enations in the throat; ovary cylindrical with a tapering base and 24–44 ovules; and seeds ovate, with a narrow rim and almost obsolete wing *c.* 0.1 mm wide.

Other specimens examined. WESTERN AUSTRALIA: between Earaheedy and Glen Ayle Stations (ENE of Meekatharra), 20 July 1967, *J.S. Beard* 4795 (PERTH 02600781); Mine tenement, near Newman, 17 May 2007, *E. Carroll* WJ 18/11 (PERTH 08367701); 0.5 km S of Mobile Equipment Workshop, Ore Body 18 *c.* 30 km NE of Newman, 3 Sep. 2011, *R.J. Chinnock* 10303 (AD *n.v.*, PERTH 09191798); locality not given, 7 June 1979, *G. Davis* 90 (PERTH 01873997); 3 km NW of Glen Ayle Station, 18 Aug. 2000, *D.J. Edinger* 2209 (PERTH 05727235); *c.* 19 km NE of Newman, 24 Apr. 2009, *T. Edwards* 53



Figure 3. *Goodenia vanleeuweniana*. A – habit; B – flowers; C – bud, showing spreading sepals; D – open flower, side view showing the obvious pouch and hairy style. *Goodenia hartiana*; E – habit; F – flowers. Vouchers: L. W. Sage LWS 2888 (A–B), M. Goods DD 551 (C), G. Goods DD 507 (D); unvouchered plant near Telfer (E, F). Images by L.W. Sage (A, B, E, F) and M. Goods (C–D).

(PERTH 08678278); near camp, c. 4.1 km on a bearing of 297 degrees from Trig Point M6, Carnarvon Range, Birriliburu Indigenous Protected Area [plot C013], 10 Aug. 2012, *N. Gibson, S. van Leeuwen, M.A. Langley & K. Brown* NG 6968 (PERTH 08819718); western end of Carnarvon Range, c. 3.5 km on a bearing of 303 degrees from Trig Point M6, Carnarvon Range, Birriliburu Indigenous Protected Area [plot C012c], 9 Aug. 2012, *N. Gibson, S. van Leeuwen, M.A. Langley, & K. Brown* NG 6969 (PERTH 08819696); Canning Stock Route, 13.3 km N of Well 12 – E of CSR, 24 May 2013, *G. Goods* DD 507 (PERTH 08749221); Canning Stock Route, 4.8 km N of Well 12, 25 May 2013, *M. Goods* DD 551 (PERTH 08749248); Serpents Glen, Carnarvon Range, Little Sandy Desert, 4 Aug. 2001, *K.F. Kenneally & D.J. Edinger* K 12183 E 2647 (PERTH 05848598); 2 km N of Serpents Glen, Carnarvon Range, Little Sandy Desert, 5 Aug. 2001, *K.F. Kenneally & D.J. Edinger* K 12195 E 2660 (PERTH 05848709); c. 2 km S of Balfour Downs Homestead on homestead access road to Talawanna Track, 8 Apr. 1995, *A.A. Mitchell* PRP 58 (NSW *n.v.*, PERTH 04272528); Little Sandy Desert, 23 Apr. 1979, *A.S. Mitchell* 554 (NT *n.v.*, PERTH 02598841); between Lake Disappointment and Robertson Range, Aug. 1973, *G.N. Royce s.n.* (PERTH 02640848); 10 miles N of Sandy Creek on Rabbit Proof Fence, 14 May 1947, *R.D. Royce* 1653 (PERTH 02603926); 10 km N of Well 13, Canning Stock Route, 17 Aug. 2007, *W.A. Thompson* WAT CSR 16 (PERTH 09153950); Little Sandy Desert, 28 km N of Cooma Well along the No. 1 Vermin Proof Fence, 14 Aug. 2001, *S. van Leeuwen* 4881 (PERTH 06473059); BDRN03, 13.9 km WNW of Christie Crossing on Oakover River, 9.7 km WNW of Mt Hodgson, 114.8 km ESE of Nullagine, Mt Divide Station, Pilbara IBRA, 6 May 2006, *S. van Leeuwen et al.* PBS 5778 (PERTH 08899886); BDRN03, 13.9 km WNW of Christie Crossing on Oakover River, 9.7 km WNW of Mt Hodgson, 114.8 km ESE of Nullagine, Mt Divide Station, Pilbara IBRA, 12 Aug. 2006, *S. van Leeuwen et al.* PBS 5798 (PERTH 08899894).

Phenology. Observed flowering from April to September. Flowering is most likely dependent upon adequate rains. Fruiting from early summer.

Distribution and habitat. Endemic to Western Australia, occurring north and eastwards of Newman, predominantly in the Little Sandy Desert bioregion but extending into the adjacent areas of the Pilbara and Gascoyne bioregions (Figure 2). It occurs primarily on rocky soils including on rocky ridges tops, buckshot plains or low stony hills, and is associated with *Eucalyptus* spp., *Acacia* spp., *Triodia* spp. and other Goodeniaceae species.

Conservation status. A relatively widespread species currently known from 19 populations, so it is not considered to be a species of conservation concern, though no populations are currently known from the conservation estate.

Etymology. Named for Professor Stephen J. van Leeuwen (SVL) in recognition of his substantial contribution to the conservation of Western Australia's flora, especially his passionate work in the Pilbara. This has included leading the Pilbara biological surveys (in which we participated), tireless work in support of conservation research, mentoring others, and providing inspiring Indigenous leadership, particularly through his recent appointment as the BHP Curtin Indigenous Chair of Biodiversity and Environmental Science. Stephen has provided ongoing support and encouragement to both of us, particularly during his tenure at the Department of Biodiversity, Conservation and Attractions (and its predecessors), for which we are very grateful.

Common name. van Leeuwen's Goodenia.

Affinities. Phylogenetic analyses of chloroplast and nuclear molecular data placed *G. vanleeuweniana* within the subg. *Monochila* sect. *Scaevolina* clade, sister to *G. hartiana* (Shepherd *et al.* 2020). It can be distinguished from this species by its attenuate ovary base (*cf.* rounded in *G. hartiana*), conduplicate, very narrowly oblanceolate leaves with an obtuse to acute apex (*cf.* flat, oblanceolate leaves with a rounded apex), slightly larger flowers (corolla 15–20 mm long *cf.* 10–17 mm), and longer bracteoles (2.5–18 mm long *cf.* 2.5–3 mm). *Goodenia vanleeuweniana* is found primarily in rocky habitats whereas *G. hartiana* is situated in sandy habitats including dune swales and sand hills (Sage & Albrecht 2006). *Goodenia*

vanleeuweniana could be confused with the arid zone taxon *G. azurea* subsp. *hesperia* L.W.Sage & Albr. but differs by the absence of basal leaves and its longer sepals (6–11 mm long *cf.* to 4.5 mm).

Notes. Field observations and collection details from herbarium material suggest that *G. vanleeuweniana* resprouts from a basal stock following fire or mechanical disturbance such as road or track grading. Plants of *G. vanleeuweniana* are viscid to touch and have a distinctive and lingering unpleasant odour.

Amendments to the *Flora of Australia* key for *Goodenia*

Goodenia austrina may be inserted into the *Flora of Australia* key to *Goodenia* (Carolin 1992: 150) by altering couplets 9, 13 and 14 of Group 1, as follows:

- 9 At least the lower leaves lyrate or pinnately lobed
- 10 Leaf lobes broader than linear; Vic **57. *G. macmillanii***
- 10: Leaf lobes linear; northern Australia **17. *G. gloeophylla***
- 9: None of the leaves lyrate or pinnately lobed
11. Corolla lobes almost equal in length (adaxial lobes *c.* 3/4 as long as abaxial lobes) **27. *G. scaevolina***
- 11: Corolla lobes very unequal in length (adaxial lobes 1/2 to 3/5 as long as abaxial lobes)
- 12 Herb with basal leaves
- 13 Corolla to 7 mm long; leaves obovate to lanceolate; northern Australia **20. *G. viscidula***
- 13: Corolla more than 11 mm long
- 14 Leaves linear; south-western W.A.
- 14b Ovary with a rounded base; corolla prominently pouched; abscission line below ovary; fruit ovoid **34. *G. caerulea***
- 14b: Ovary tapering towards base; corolla not pouched or inconspicuous; no abscission line below ovary; fruit cylindrical ***G. austrina***
- 14: Leaves broader than linear; north-western Australia **28. *G. stobbsiana***

Goodenia vanleeuweniana and *G. hartiana* (as per Sage & Albrecht 2006), can be included in the *Flora of Australia* key to *Goodenia* (Carolin 1992: 151) by altering couplets 16 and 17 of Group 1, as follows:

- 16: Leaves linear to oblanceolate, narrowly elliptic or narrowly obovate, mostly to 7 mm wide
- 17 Sepals to 2 mm long; corolla lacking enations; bracteoles linear; ovules numerous; monsoonal northern Australia **17. *G. gloeophylla***
- 17: Sepals >3 mm long; corolla with enations; bracteoles broader than linear; ovules to *c.* 24; south-western and arid W.A.
- 17a Ovules to 15; seeds with aculeate cellular projections; south-western W.A. **52. *G. xanthotricha***
- 17a: Ovules 24–44; seeds reticulate to reticulate-foveate; north-western W.A.
- 17b Ovary rounded at base; ovules *c.* 24; leaves flat, apex round; occurs on sandy soils ***G. hartiana***
- 17b: Ovary tapering at base; ovules 24–44; leaves conduplicate, apex obtuse to acute; occurs on rocky habitats ***G. vanleeuweniana***

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