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New taxa in *Goodenia* subgenus *Goodenia* section *Caeruleae* subsection *Scaevolina* (Goodeniaceae), from the Eremaean Botanical Province of Western Australia

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Abstract

Sage, L.W. & Albrecht, D.E. New taxa in *Goodenia* subgenus *Goodenia* section *Caeruleae* subsection *Scaevolina* (Goodeniaceae), from the Eremaean Botanical Province of Western Australia. *Nuytsia* 16(1): 167–174 (2006). *Goodenia hartiana* L.W. Sage and *G. azurea* subsp. *hesperia* L.W. Sage & Albr. are described, illustrated and mapped with notes on the distribution, conservation status, habitat preferences and relationships to other taxa. Keys to distinguish the new taxa are also provided.

Introduction

Goodenia subgenus *Goodenia* section *Caeruleae* subsection *Scaevolina* Carolin was erected by Carolin (1992) for those species with blue to purple corollas, bracteolate pedicels and colliculate seeds with a narrow wing. Carolin (*op. cit.*) included eight species from central and northern Australia within the subsection. An additional species was described by Holland and Boyle (2002), taking the subsection total to nine species. Recent study of herbarium material and plants in the field by the present authors indicates that further taxa warrant recognition. *G. azurea* is here treated as comprising two subspecies, and *G. hartiana* is recognised as a new species allied to *G. azurea*.

Materials and methods

Descriptive terminology follows Carolin (1992), although it is acknowledged that there are alternative interpretations for some organs (see Albrecht 2002). In cases where the inflorescence is a thyrse and where bracteoles occur not only on a flower stalk but also subtend flowers, the term bract refers only to those structures that subtend the individual cymes of the thyrse.

Floral descriptions are based on spirit or rehydrated material. Corolla length is measured as the distance between the line where the corolla tube abscises from the ovary and the tip of central abaxial corolla lobe.

Nomenclature follows Carolin (1992) and Western Australian Herbarium (2005).

Taxonomy

Goodenia azurea F. Muell., Fragm. 1:117 (1859). *Type*: Sturt Creek, [Northern Territory], February 1856, *F. Mueller s.n.* (*holo*: MEL; *iso*: K, *n.v.*).

Dense spreading or sprawling multistemmed *perennial herb or sub-shrub* to *c*. 1 m high. *Stems* (and main inflorescence axes) glabrous, often glaucous. *Leaves* basal, sub-basal, or extending slightly up the stems, often absent in mature plants, narrowed to a petiole-like base or becoming subsessile or sessile as leaves grade into bracts at base of inflorescence; lamina oblanceolate, obovate or spathulate, 8–110 mm long, 3–35 mm wide, glabrous or with minute gland-tipped trichomes 0.1–0.2 mm long on margins or rarely scattered on upper and lower surface, often glaucous, apex obtuse to sub-acute, sometimes recurved, margins entire to dentate, simple hairs sometimes present in leaf axils. *Inflorescence* a leafy divaricate terminal thyrse or raceme (occupying at least ½ height of plant); bracts alternate on main inflorescence axes and subtending cymes or solitary flowers, obovate, oblanceolate, oblong or elliptic, 4–70 mm long, 1–35 mm wide, glabrous or with minute gland-tipped trichomes 0.1–0.2 mm long on margins, entire or dentate, narrowed to a petiole-like base or sessile, sometimes recurved; bracteoles opposite or sub-opposite, broadly ovate, elliptic, oblanceolate, oblong or orbicular, 1.5–26 (–35) mm long, 1–13 (–22) mm wide, glabrous or with minute gland-tipped trichomes 0.1–0.2 mm long on margins, acute to obtuse, margins entire to dentate; peduncles 12–85 mm long, glabrous; pedicels 1.5–20 mm long, articulate 0.5–2.5 mm below the ovary, with an indumentum of minute gland-tipped trichomes above and sometimes for a short distance below the articulation. *Sepals* subequal, adnate to ovary for most of ovary length, free part lanceolate to elliptic, 2–6 mm long, with minute gland-tipped trichomes and sometimes also simple hairs on the margins, apex acute or subacute. *Corolla* 14–22 mm long, blue to purple-blue, outer surface with sparse minute gland-tipped trichomes, inner surface villous in throat and with shorter hairs below, enations in more or less longitudinal rows, usually with short hairs; anterior pouch prominent, 1.2–2.2 mm wide viewed from back, and 1–1.5 mm wide in profile, as long as the ovary. *Abaxial corolla lobes* 5.5–10 mm long, 1.8–3 mm wide; wings 5–8 mm long, 1–2.5 mm wide, entire. *Adaxial corolla lobes* 7–14 mm long, 1.5–2.5 mm wide; auricle indistinct, merged with wing 7.5–11 mm long, 1.8–2.5 mm wide; opposite wing 4.5–7.5 mm long, 1.5–2.5 mm wide, villous below wing. *Stamen* filaments 4.5–6 mm long; anthers 2.5–3.5 mm long. *Ovary* more or less cylindrical, 4–9 mm long, with a dense indumentum of minute gland-tipped trichomes; dissepiment at least two-thirds as long as the loculus; ovules *c*. 36–50 in two rows in each locule. *Style* 9–11 mm long, slightly curved distally, villous in at least the upper half; indusium obtriangular to obtriangular-oblong, 2.2–3.2 mm long, 2–3 mm wide, sparsely hairy; upper lip slightly convex with bristles 0.3–0.7 mm long; lower lip slightly shorter, with bristles 0.1–0.2 mm long. *Fruit* ovoid-cylindrical or ellipsoidal, 8–13 mm long, 3–5 mm wide, splitting into two valves that are raised 2–3.5 mm beyond point where the sepals become free from ovary. *Seeds* broadly elliptic, 1.7–2.2 mm long, 1.3–1.6 mm wide, colliculate, dark brown to almost black, with a narrow wing *c*. 0.1 mm wide. (Figures 1A, B)

Two geographically separated subspecies can be recognised, differing most significantly in the shape of the bracteoles and bracts.

Key to the subspecies of *Goodenia azurea*

1. Bracteoles broadly ovate, broadly elliptic or orbicular; bracteoles with a length/breadth ratio of mostly <2:1; bracts usually without a recurved apex; far western Queensland, central Northern Territory & central north-east WA ..... subsp. **azurea**

1: Bracteoles oblanceolate, oblong or elliptic, rarely obovate; bracteoles with a length/breadth ratio of mostly >2:1; bracts usually with a recurved apex; central Western Australia ..... subsp. **hesperia**

Goodenia azurea F. Muell. subsp. **azurea**

Leaves 20–110 mm long, 10–35 mm wide, glabrous or with minute gland-tipped trichomes 0.1–0.2 mm long on margins or rarely scattered on upper and lower surface, apex usually not recurved. *Inflorescence* a thyrse or occasionally reduced to a raceme; bracts obovate or broadly elliptic, 7–70 mm long, 5–35 mm wide, sessile, usually without a recurved apex; bracteoles broadly ovate, broadly elliptic or orbicular, 1.5–26 (–35) mm long, 1.5–13 (–22) mm wide, obtuse to sub-acute; peduncles 17–85 mm long; pedicels 1.5–10 mm long, articulate 1–2.5 mm below the ovary, with an indumentum of minute gland-tipped trichomes above and sometimes for a short distance below the articulation. *Sepals* 3–6 mm long. *Corolla* 14–22 mm long, anterior pouch 1–1.5 mm wide in profile. *Abaxial corolla lobes* 1.8–2.5 mm wide; wings 5–7 mm long. *Adaxial corolla lobes* 10–14 mm long, 1.7–2.5 mm wide; auricle merged with wing 7.5–10 mm long, 1.8–2.3 mm wide; opposite wing 5–6 mm long, 1.5–2 mm wide. *Ovules c*. 36–50 in two rows in each locule. *Indusium* obtriangular-oblong, 2–2.7 mm wide; upper lip with bristles 0.3–0.5 mm long. *Fruit* ovoid-cylindrical, 8–13 mm long. *Seeds* 1.7–2.2 mm long. (Figure 1A)

Selected specimens examined. WESTERN AUSTRALIA: Great Sandy Desert, Tanami Track, *c*. 2 km W of NT border, *c*. 225 km SE of Halls Creek, 21 May 1976, *A.C. Beauglehole* 51027 (PERTH). NORTHERN TERRITORY: 41 miles from Mt Doreen, The Granites Rd, 23 Aug. 1970, *R.C. Carolin* 7953 (PERTH); 44 miles NE of Tanami, 12 Apr. 1959, *G. Chippendale* 5658 (AD, BRI, CANB, DNA, K, MEL, NSW, PERTH); The Granites Tenements, Tanami Desert, 5 Dec. 1984, *A.C. Kalotas* 1700 (DNA, PERTH); 19 miles NNE of Inverway Station, 4 July 1949, *R. Perry and M. Lazarides* 2345 (CANB, DNA, PERTH); Buchanan Highway, 53 km E from Duncan Hwy, Victoria River District, 23 Apr. 1987, *R.W. Purdie* 3357 (CANB, DNA, PERTH); Barkly Tableland, Mittiebah Station, near Waterfall Creek, 14 July 2001, *J.A. Risler* 859 and *C.P. Mangion* (AD, B, BRI, DNA, MO). QUEENSLAND: *c*. 49 km WSW of Lawn Hill homestead, 28 Apr. 2001, *L. Bailey and D. Kelman* (BRI).

Distribution and habitat. Occurs patchily in the Northern Territory between the latitudes of 16°S and 22°S, extending westward into adjacent areas of Western Australia and eastward into Queensland near the Northern Territory border (Figure 2). Numerous collections have been made from the Tanami bioregion with fewer collections from the Mitchell Grass Downs and Great Sandy Desert bioregions.

Almost exclusively associated with lateritised plains, rises and gentle slopes, with or without an overlying veneer of sand, but may also occur in other nearby habitats influenced by ironstone such as sand plains with a mixture of sand and ironstone gravel. Frequently associated species include *Acacia hilliana*, *Eucalyptus brevifolia* and *Triodia* spp. The type subspecies is often found in areas recently disturbed by fire or earthworks.

Flowering period. Flowering may occur at any time of the year given sufficient moisture.

Conservation status. The type subspecies is relatively common in suitable habitat throughout its geographic range.

Figure 1. Herbarium specimen images of *Goodenia*.
A – *G. azurea* subsp. *azurea* (*A.C. Kalotas* 1700, PERTH 02598930);
B – *G. azurea* subsp. *hesperia* (*T.B. Bragg* 2001-25, PERTH 05663571);
C – *G. hartiana* (*R.P. Hart* 972, PERTH 05246431).

Goodenia azurea subsp. **hesperia** L.W. Sage & Albr., *subsp. nov.*

A subsp. *azurea* bracteis oblanceolatis, oblongis vel ellipticis, ratione latitudinis/ longitudinis plerumque ½, et distributione in occidente differt.

Typus: *c.* 20 km due WSW of Warburton, Western Australia, 12 July 2001, *D.E. Albrecht* 9865 (*holo*: NT A102696; *iso*: PERTH 06755968).

Leaves 8–110 mm long, 3–26 mm wide, glabrous or with minute gland-tipped trichomes 0.1–0.2 mm long on margins, apex often recurved. *Inflorescence* a thyrse or raceme; bracts oblanceolate, oblong or elliptic, rarely obovate, 4–45 mm long, 1–10 mm wide, narrowed to a petiole-like base or sessile, often recurved; bracteoles oblanceolate, oblong or elliptic, rarely obovate, 3–10 (–36) mm long, 1–5 (–8) mm wide, acute to obtuse; peduncles 12–45 mm long; pedicels 4–20 mm long, articulate 0.5–2.5 mm below the ovary, with an indumentum of minute gland-tipped trichomes above the articulation. *Sepals* 2–4.5 mm long. *Corolla* 14–21 mm long, anterior pouch *c.* 1 mm wide in profile. *Abaxial corolla lobes* 1.8–3 mm wide; wings 5–8 mm long. *Adaxial corolla lobes* 7–14 mm long, 1.5–2.5 mm wide; auricle merged with wing 7.5–11 mm long, 1.8–2.5 mm wide; opposite wing 4.5–7.5 mm long, 1.5–2.5 mm wide. *Ovules* to *c.* 50 in two rows in each locule. *Indusium* obtriangular to obtriangular-oblong, 2–3 mm wide; upper lip with bristles 0.4–0.7 mm long. *Fruit* ovoid-cylindrical or ellipsoidal, 8–12 mm long. *Seeds* 2–2.2 mm long. (Figure 1B)

Selected specimens examined. WESTERN AUSTRALIA: NE of Mt Madley, 22 May 1996, *B. Allwright s.n.* (NT); Gibson Desert Nature Reserve, 10 May 1994, *A.R. Annels* ARA 16A (PERTH); Everard Junction on Gunbarrel Hwy, 2 July 1983, *D. Edinger* 94 (PERTH); 11–12 miles E of Manunda, Warburton Rd, 20 Aug. 1962, *A.S. George* 3788 (PERTH); McLarty Hills, Great Sandy Desert, 5 Aug. 1977, *A.S. George* 14651 (PERTH); Great Sandy Desert, 10 May 1979, *A.S. George* 15690 (NT, PERTH); 40 miles W of Mt Samuel, near Warburton Mission, 18 May 1958, *H.A. Johnson s.n.* (NT).

Distribution and habitat. Endemic to Western Australia, occurring in the Great Sandy Desert, Gibson Desert, Little Sandy Desert, Great Victoria Desert, Gascoyne, Pilbara, Dampier Land and Ord-Victoria plains bioregions of the Eremaean and Northern Botanical provinces. (Figure 2)

The limited habitat data available suggests that the new subspecies is typically associated with lateritic plains but may also occur in other habitats influenced by ironstone such as in dune swales with sand and ironstone gravel. At the type location it occurs in very open shrubland with *Acacia aneura, A. rhodophloia, A. paraneura, Goodenia centralis, G. triodiophila and Triodia basedowii.*

Flowering period. Flowering specimens have been collected from April to October, though it is likely that flowering may occur at any time of the year given sufficient moisture.

Conservation status. Although the new subspecies occurs in a region that is poorly collected, there are sufficient collections and information available to indicate that it is neither uncommon nor threatened. The new subspecies is also represented in the conservation estate in reserves such as Gibson Desert Nature Reserve.

Etymology. From the Greek *hesperos*, meaning 'of the west', in reference to the western distribution of the new subspecies.

Goodenia hartiana L.W. Sage, *sp. nov.*

A *G. azurea* F. Muell. affinis sed planta viscosa, sepalis longioribus atque forma sepalorum dissimili, et bracteolis brevioribus differt.

Typus: Rudall River Region, August 1992, *R.P. Hart* 972 (*holo*: PERTH 05246431; *iso*: CANB, K).

Erect to spreading multi-stemmed *perennial herb or subshrub* to *c.* 50 cm high. *Stems* (and main inflorescence axes) with minute gland-tipped trichomes. *Leaves* sub-basal or extending slightly up the stems but often absent in mature plants, basal leaves apparently always absent; lamina oblanceolate to narrowly obovate, 6–30 mm long, 2.5–7 mm wide, with sparse minute gland-tipped trichomes on adaxial and abaxial surfaces and margins, apex rounded, margins mostly entire to denticulate, dentation ending in a gland. *Inflorescence* a multi-flowered terminal raceme to *c.* 12.5 cm long (often occupying at least ½ height of plant); bracts obovate, leaf-like but smaller, 5.2–7.5 mm long, with sparse minute gland-tipped trichomes on both surfaces and margins, apex rounded, mostly entire; bracteoles opposite, narrowly elliptic, narrowly oblong or oblanceolate, 2.5–3 mm long, with minute gland-tipped trichomes mostly on adaxial side; peduncles 3–7 mm long, with minute gland-tipped trichomes; pedicels 1–2 mm long, articulate 0–2.5 mm below the ovary. *Sepals* ± equal, narrowly ovate to lanceolate, 5.2–6 mm long, with minute gland-tipped trichomes on margins and adaxial surface, apex rounded. *Corolla* blue or purple, striate inside, 10–17 mm long, glabrous on outer surface, tufts of simple hairs concentrated near centre of lobes on internal surface and with long simple hairs on lobe wing margins, some minute glandular hairs deep in throat; four rows of enations inside, individual enations to *c.* 0.3 mm long; pouch distinct, approximately equal to length of ovary; anterior pouch distinct, approximately as long as ovary. *Abaxial corolla lobes* 5–6 mm long, 2.5–3 mm wide, apex rounded; wings 3.3–7 mm long, 1.4–1.9 mm wide, rounded, entire. *Adaxial corolla lobes* 10.5-12 mm long, 2–2.5 mm wide, apex rounded, auriculate; wings on auricle side 6.8–8.7 mm long, 2–2.5 mm wide; wings opposite auricle 4-5.7 mm long, 1.6-2 mm wide. *Stamen* filaments linear, *c.* 5 mm long; anthers *c.* 2.5 mm long. *Ovary* more or less cylindrical, 4–5 mm long, with a dense indumentum of minute gland-tipped trichomes; dissepiment *c.* ¾ as long as the loculus; ovules *c.* 24 in two rows in each locule. *Style c.* 8 mm long, with long simple hairs; indusium *c.* 3 mm long, slightly bent transversely, broadly obovate in outline, long simple hairs on lower and upper surface, bristles on upper lip to *c.* 0.6 mm long, with a purplish tinge, bristles on lower lip almost obsolete. *Fruit* ovoid to cylindrical, to *c.* 6 mm long, mature fruit not seen. *Seeds* ± ovate, flat, *c.* 2 mm long, *c.* 1 mm wide, rim narrow and brown; wing almost obsolete to *c.* 0.1 mm wide, possibly mucilaginous. (Figure 1C)

Other specimens examined. WESTERN AUSTRALIA: Between Nifty Cooper Mine and Telfer gas pipeline – off route to Nifty-Telfer gas pipeline, Pilbara, 5 Sept. 2005, *C. Day s.n.* (PERTH).

Distribution and habitat. Endemic to Western Australia, occurring in the extreme northern Little Sandy Desert and possibly the western Great Sandy Desert bioregions of the Eremaean Botanical province. (Figure 2)

Goodenia hartiana occurs on sand dune swales or sandy areas such as sandy hills. The new species has been observed to be associated with *Eucalyptus* spp., *Acacia* spp. and *Triodia* spp. Further survey and research is required to determine the specific habitat of this species.

Flowering period. Goodenia hartiana has been collected in flower in August and September. Flowering is most likely dependant upon adequate rains.

Conservation status. Conservation Codes for Western Australian Flora: Priority Two. *Goodenia hartiana* is known from three locations, only one of which has accurate locality details. This species is poorly collected, geographically restricted and under threat from mining. Full surveys are required to determine the true extent of this species.

Etymology. Named jointly for Raymond P. Hart (1952–2003), who first brought the new species to the attention of LWS, and Anthony Michael Hart (1947–2002), a relation of LWS.

Notes. Goodenia hartiana was previously known by the phrase name '*Goodenia* sp. Rudall River (R.P. Hart 972)'. *Goodenia hartiana* superficially resembles *G. azurea* subsp. *hesperia* but differs in having gland-tipped trichomes on the inflorescence axes and peduncles (glabrous in *G. azurea* subsp. *hesperia*). In addition, the leaf and bract lamina surfaces have a sparse indumentum of gland-tipped trichomes in *G.hartiana*, but such trichomes are absent or confined to the margins in *G. azurea* subsp. *hesperia.* In the field plants of *G. hartiana* are glandular-viscid to touch.

A closely-related taxon, once considered within the concept of *Goodenia hartiana*, occurs immediately to the south in the Little Sandy Desert bioregion. This taxon can be distinguished by having much longer sepals, longer and narrower leaves and is more likely to be associated with rocky habitats. This taxon is currently known by the phrase name '*Goodenia* sp. Sandy Creek (R.D. Royce 1653)'.

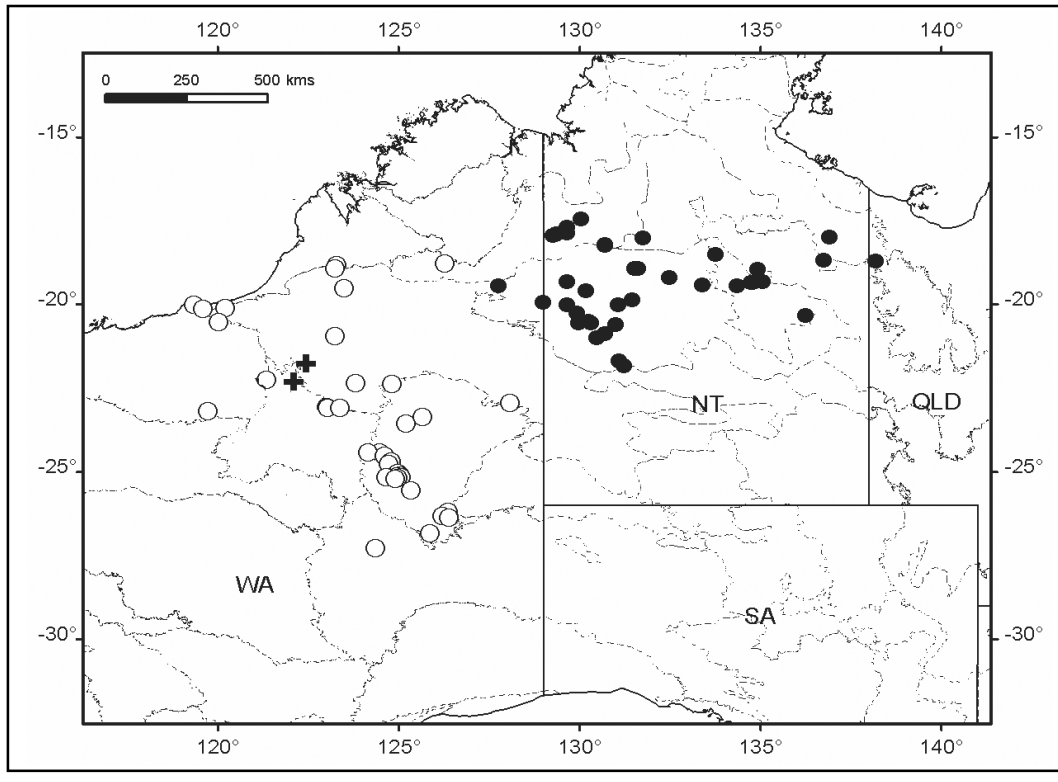

Figure 2. Distribution map with bioregional boundaries (Thackway & Cresswell 1995). *Goodenia azurea* subsp. *azurea* (●), *G. azurea* subsp. *hesperia* (○), *G. hartiana* (✚) based on herbarium records from PERTH and DNA.

Amendment to the "Flora of Australia" key to incorporate *Goodenia hartiana*

Inclusion of *Goodenia hartiana* in the *Goodenia* key in the "Flora of Australia" (Carolin 1992: 151) can be made by altering couplet 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 Bracteoles >4 mm long; seeds with aculeate cellular projections; south-western W.A. ..... **52. G. xanthotricha**
17a: Bracteoles to 3 mm long; seeds reticulate to reticulate-foveate; north-western W.A. ..... **G. hartiana**

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