New taxa in *Goodenia* (Goodeniaceae) from the south-west of Western Australia, with an update to the *Goodenia* key in the Flora of Australia

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Abstract

Sage, L.W. New taxa in *Goodenia* (Goodeniaceae) from the south-west of Western Australia with an update to the *Goodenia* key in the Flora of Australia. *Nuytsia* 13(2): 367–377 (2000). Two new species of *Goodenia* from the South West Botanical Province, *G. heatheriana* Sage and *G. lancifolia* Sage & Cranfield are described, illustrated and mapped. *G. heatheriana* has conservation priority while *G. lancifolia* is apparently common throughout its known range. Two subspecies are recognized for the Western Australian species *Goodenia scapigera* R. Br. The type subspecies is widespread in sandy soils of the south-west of the state, whereas the newly named subspecies *graniticola* Sage is restricted to granitic habitats in the vicinity of Peak Charles National Park and has conservation priority. Both subspecies are mapped and illustrated. An error in the key to *Goodenia* species given in "Flora of Australia" Volume 35 is corrected and the key is updated for the new species.

Introduction

As part of an overall review of the genus *Goodenia* Smith (Goodeniaceae) in Western Australia (including conservation status and biology) the author has been working on several undescribed taxa that require formal recognition. This paper describes two new species and one new subspecies from the South West Botanical Province of Western Australia. The characters used in the description of the new species will form the basis of a DELTA database of the Goodeniaceae family being produced by the author.

The three new taxa had been collected prior to the publication of a "Flora of Australia" account of *Goodenia* (Carolin 1992), but all were still very poorly known at that stage. Recent collections have facilitated recognition of their distinctive characters. Many of the older specimens of *Goodenia* are of limited taxonomic value because they have been inadequately pressed and have had insufficient collection data recorded for them. Future collectors of this genus are urged to press the specimens as soon as possible after taking them to preserve floral details, and to note the colour of the corolla throat as well as the adaxial and abaxial lobes. Other data that can be very significant for elucidating the taxonomy of the plants are details of the plant's habit, life history (e.g. annual or perennial and whether clonal), response to fire and disease, and habitat (e.g. substrate, proximity to features such as watercourses and vegetation type).

In addition to naming the new taxa, this paper corrects a significant error in the key to the species of *Goodenia* in "Flora of Australia" and updates the key to include the two new species.

Taxonomy

Goodenia heatheriana Sage, *sp. nov.*

Goodenia pinnatifidae affinis sed sepalis minoribus, ovulis paucioribus, seminibus tantum ad c. 2 mm longis, extremitae loborum adaxialium corollae cum pilis glandularibus purpureis ornatis differt.

Typus: Parker Range [precise locality withheld for conservation purposes], Western Australia, 18 October 1994, *N. Gibson & M. Lyons* 2250 (*holo:* PERTH sheet 05312337).

Annual herb to *c.* 15 cm, spreading, acaulescent, with ± appressed stiff, sharp hairs. *Leaves* basal, narrowly ovate, lobed to entire, 4–21 x 2–10 mm, petiolate, with scattered ± adpressed stiff, sharp hairs; base attenuate to cuneate; apex rounded. *Inflorescence* a raceme to 70 mm; flowers mostly solitary; pedicels 13–42 mm long, hirsute; bracteoles absent; bracts leaf- like, hirsute, acute, 7–10 x 0.5–5 mm. *Corolla* yellow, *c.* 10 mm long, articulate below ovary, auriculate, with an indistinct pouch to *c.* 1 mm x *c.* 0.5 mm; long simple hairs inside the throat and minute glandular hairs and stiff, sharp, appressed hairs outside; long simple hairs on auricle margin; distinctive purple glandular hairs to *c.* 1 mm with glandular head to *c.* 0.2 mm outside near tip of the adaxial corolla lobe along margin. *Sepals* narrowly ovate, acute, 2–2.2 mm long, ± equal, adnate at *c.* three-quarters up the ovary, appressed stiff, sharp hairs mostly on the mid-line, apex acute. *Abaxial corolla lobes* 3.2–3.5 x 1.5–1.7 mm, fused for 3–3.5 mm further than adaxial lobes, wings to *c.* 4 x *c.* 1.5 mm, entire. *Adaxial corolla lobes c.* 4 x *c.* 1 mm, auricle *c.* 1 x 1 mm, wings 2.4–3 mm long, 1–1.4 mm wide opposite to auricle, *c.* 0.5 mm wide above auricle. *Stamen* filaments linear, 1.7–2.2 mm long; anthers 0.9–1.1 mm long. *Ovary c.* 2 mm long, hirsute with appressed stiff, sharp hairs, incompletely 2-locular; septum *c.* half as long as ovary; ovules *c.* 9, in two rows on either side of septum. *Style* 2.3–2.8 mm long; indusium *c.* 1.5 x 1.3 mm, laterally compressed or folded with a tuft of long simple hairs below and scattered simple hairs above and below, bristles on upper and lower lips ± equal, *c.* 0.2 mm long. *Fruit* (mostly immature seen) broadly ellipsoid, *c.* 1 mm long. *Seeds* ovate, flat, *c.* 2 x 1.5 mm, smooth to reticulate; body black; wing *c.* 0.3 mm, yellowish tan. (Figure 1)

Other specimen examined. WESTERN AUSTRALIA: Parker Range [precise locality withheld], 21 Sep. 1979, *K.R. Newbey* 6036 (PERTH).

Distribution. Known from the type location, south-east of Marvel Loch in the Parker Range, and one other location nearby (possibly the same one). Both localities are in the Avon Wheatbelt Interim Botanical Region near the border of the South West and Eremean Botanical Provinces. (Figure 2)

Habitat. Open low *Eucalyptus corrugata* Luehm. woodland with *Eucalyptus yilgarnensis* (Maiden) Brooker mallees, shrubs to 1–2 m and dwarf shrubs to 0.5 m (Muir 1977). Found roadside in red, crumbly clay with greenstone gravel and cobbles.

Phenology. Flowers in late September and October.

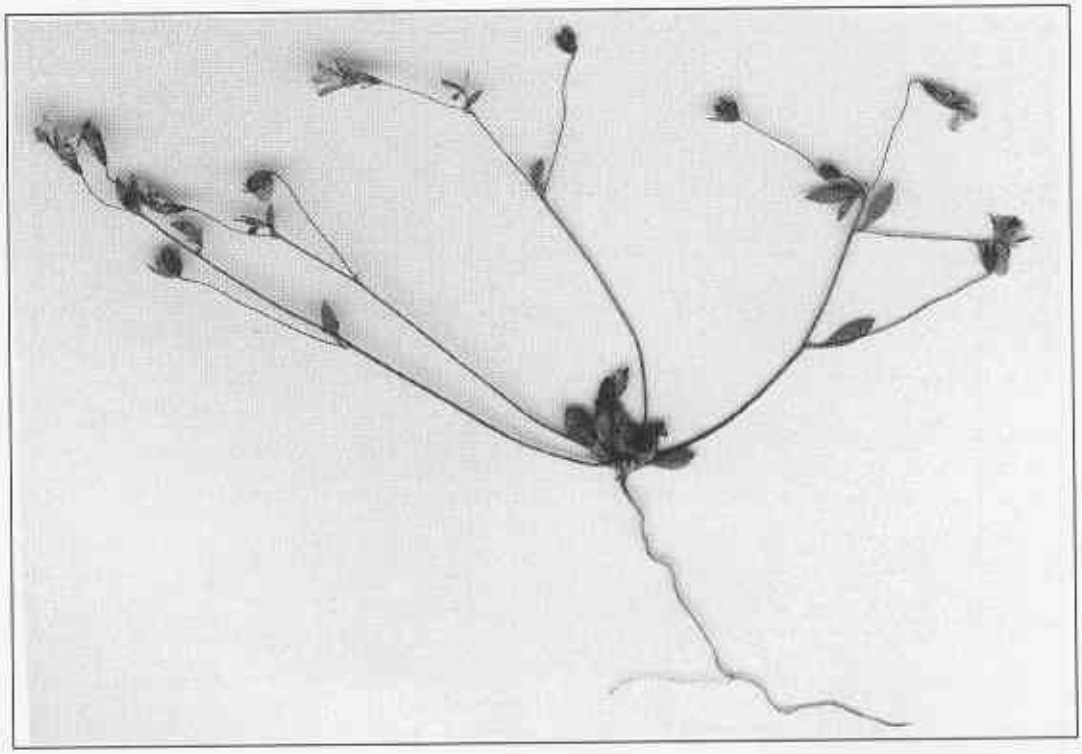

Figure 1. *Goodenia heatheriana* holotype (*N. Gibson & M. Lyons* 2250).

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority One. The species is known only from two populations (possibly the same one though not immediately apparent from discrepancies in the locality details of both known collections). It is under immediate threat from road works and requires urgent survey effort.

Etymology. Named for the author's wife, Heather Susan Roberton Sage (nee Price).

Notes. Goodenia heatheriana Sage was initially collected by the late Ken Newbey in 1979 from the Parker Range as part of a biological survey of the eastern goldfields of Western Australia. The species was recognized as distinct after a second collection of it was made by Neil Gibson and Mike Lyons, of the Department of Conservation and Land Management's Woodvale Research Centre. It was allocated the phrase name *Goodenia* sp. purple hairs (*N. Gibson & M. Lyons* 2250) as it differs from other *Goodenia* species by the presence of long purple hairs on the outside of the adaxial corolla lobes. It is related to *Goodenia pinnatifida* Schldl., which can be easily distinguished by its larger sepals (2.5–5 mm long), more numerous ovules (20–35) and larger seeds (*c.* 5 mm long).

Goodenia lancifolia Sage & Cranfield, *sp. nov.*

Goodenia leptocladae Benth. affinis sed foliis lanceolatis vel anguste lanceolatis, corollae lobis abaxialibus brevioribus, et aliis loborum corollae minoribus.

Typus: 2.2 km south-west on Black Point Rd from Stewart Rd, north-west of Pemberton, Western Australia, 29 January 2000, *L.W. Sage* 2360 *& R.J. Hazeldean* (*holo:* PERTH sheet 05539528; *iso:* AD, BRI, CANB, DNA, G, HO, K, MEL, NSW, NY, SYD).

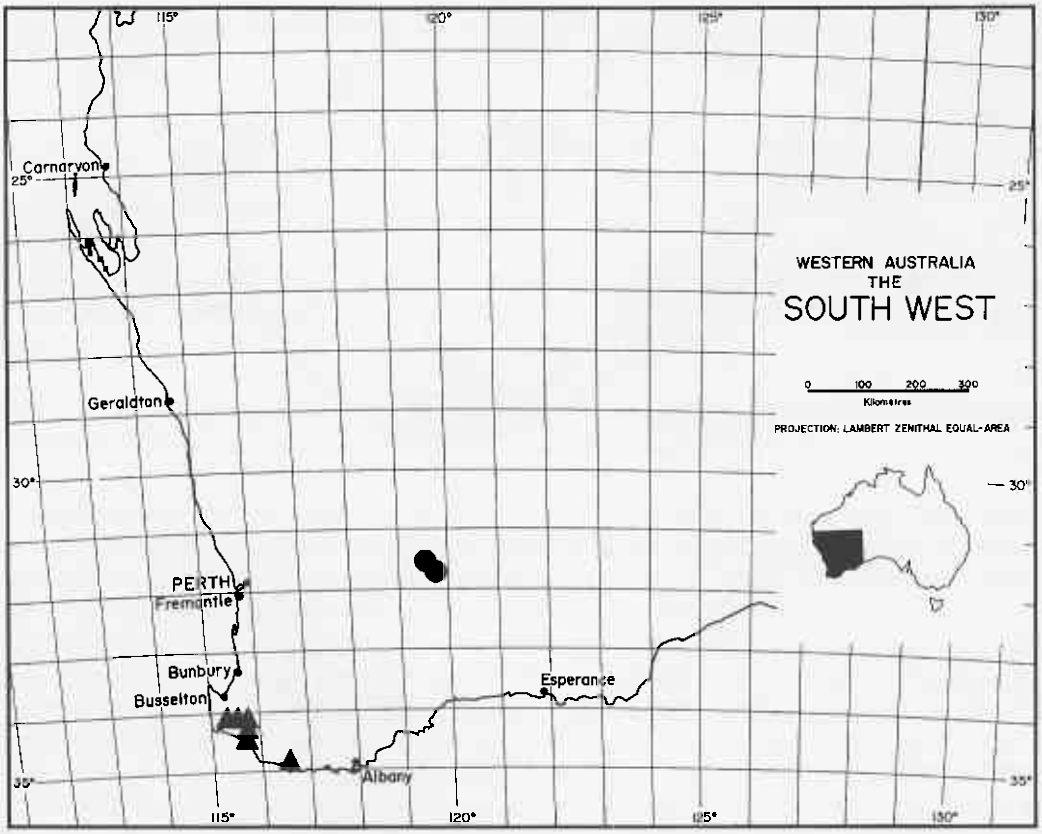

Figure 2. Distribution map of *Goodenia lancifolia* ▲ and *G. heatheriana* ●.

Perennial herb to *c.* 20 x 40 cm, sprawling to erect, open, with long, non-appressed, ± tangled hairs. *Basal leaves* linear to narrowly obovate, 14–65 x 1–4 mm; hairs scattered. *Cauline leaves* sessile, ± stem clasping, lanceolate to narrowly ovate, entire to dentate or lobed, apex acute, 7–28 x 1–5.5 mm, hairs scattered. *Inflorescence* a raceme to *c.* 25 cm long, axis ± flexuose; peduncles 3–32 mm long; bracts leaf like, acute, 7–30 x 1–5 mm, with scattered hairs; pedicels 0–8 mm long, hirsute; bracteoles 2–9 mm long, narrowly lanceolate to linear, acute. *Corolla* dark blue or blue with a white throat, 6–12 mm long, auriculate; tube 0.3–0.8 mm long; pouch absent or obscure; hairs inside corolla throat, enations absent or obscure, long non-adpressed hairs outside, simple hairs on auricle margin. *Sepals* narrowly ovate, acute, 2.4–3.7 x *c.* 0.8 mm, ± equal, often densely hirsute. *Abaxial corolla lobes* 3.5–5.9 x 1.4–2.1 mm, fused for a further 3.3–4.5 mm longer than adaxial lobes; wings 2.8–4.8 x 1.1–1.9 mm, entire. *Adaxial corolla lobes* 4.5–8.0 x 1.4–1.8 mm; wings 2.2–4.8 mm long, 1.5–2.0 mm wide opposite auricle side of lobe (0–0.5 mm difference), 1.3–2.1 mm wide above auricle, the auricle 1.4–2.5 x 1.4–2.0 mm. *Stamen* filaments linear, 2.5–3.3 mm long; anthers 1.3–2.0 mm long 1.3–2.0 mm long. *Ovary* 1.8–3.5 mm long, often densely hirsute, incompletely 2-locular; septum *c.* half to *c.* three-quarters as long as ovary; ovules 11–15, in 2 rows in each locule. *Style* 4.2–5.4 mm long; indusium 1.5–1.9 x 2.1–2.5 mm, deltoid to broadly deltoid, single tuft of simple hairs above with scattered hairs above and below, bristles on lips *c.* 0.2 mm long, ± equal above and below. *Fruit* ellipsoidal to ovoid, split *c.* half to base at maturity. *Seeds* ovate to elliptic, *c.* 1 mm, reticulate-foveate; body brown; wing obscure or obsolete, rim *c.* 0.1 mm. (Figure 3)

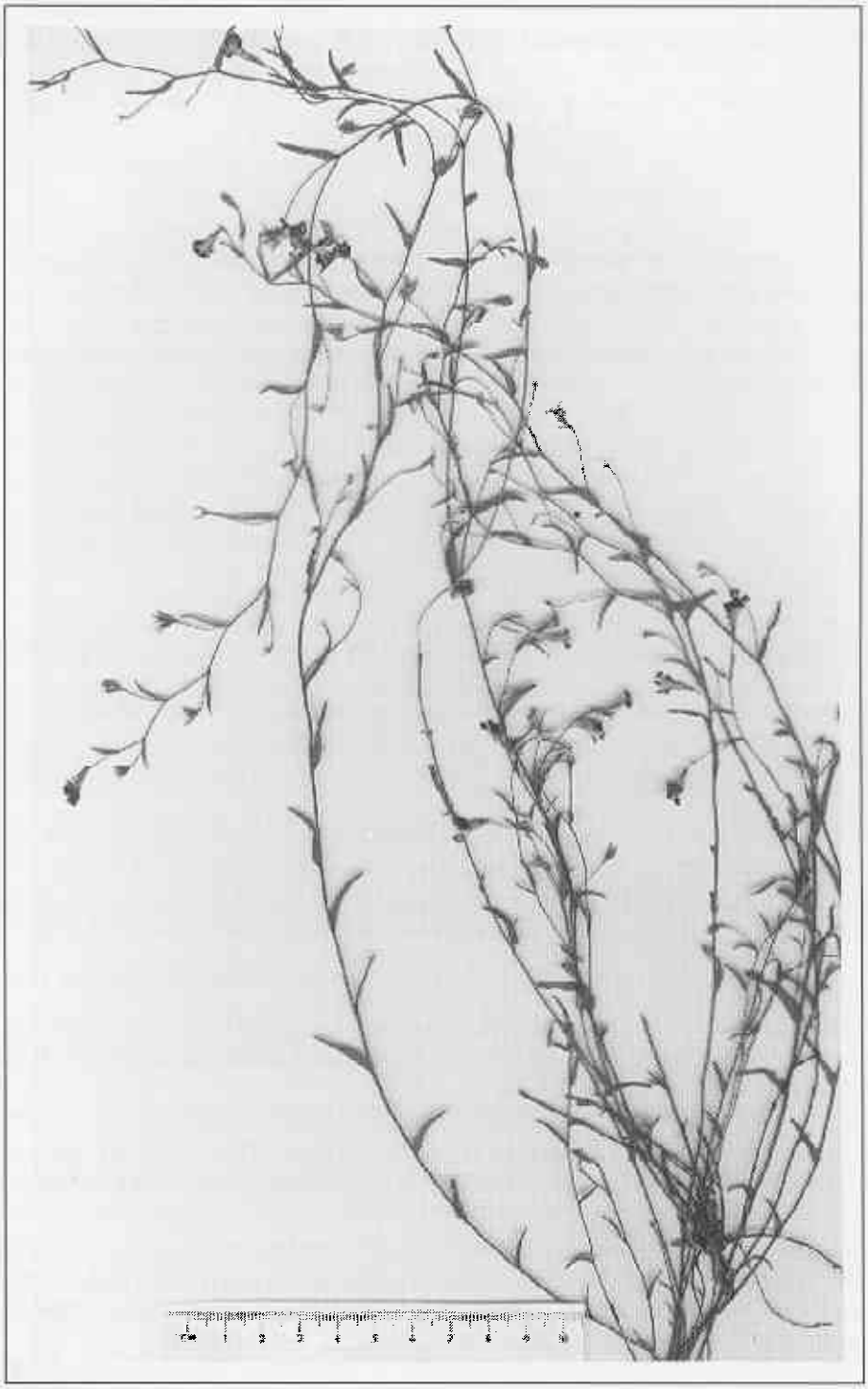

Figure 3. *Goodenia lancifolia* holotype (*LW. Sage* 2360 *& R.J. Hazeldean*).

Other specimens examined. WESTERN AUSTRALIA: N of D' Entrecasteaux National Park on Pneumonia Rd, 1 Jan. 1997, *E.M. Bennett & C. Day* B 133.2 (PERTH); Brockman Highway W of Sues Rd, 13 Jan. 1997, *D. Bright & N. Casson* SC 179.2 (PERTH); Boggy Lake SW of Walpole, 27 Dec. 1957, *D. Churchill s.n.* (PERTH); Black Point Road NW of Pemberton, 11 Mar. 1997, *R.J. Cranfield* 11018 (PERTH); Dennis Road S of Brockman Highway, 14 Jan. 1997, *P. Ellery & T. Annels* SC 185.1 (PERTH); N on Black Point from Wapet Track, 30 Jan. 1997, *B. Evans & E.M. Bennett* P 11.17 (PERTH); Scott National Park, 2 January 1991, *C.J. Robinson* 410 (PERTH); Nillup, SE of Margaret River, 14 January 1945, *R.D. Royce* 4 (PERTH); Scott River, 17 Jan. 1945, *R.D. Royce* 71 (PERTH).

Distribution. Occurring in the extreme south-west corner of Western Australia in the Warren Interim Botanical Region from Scott River National Park south-east to near Walpole. (Figure 2)

Habitat. Occurring in winter wet swamps or lake side vegetation in the *Eucalyptus marginata* forest of the extreme south-west corner of the Warren Interim Botanical Region.

Phenology. Flowers from late December to January (March).

Conservation status. Apparently common throughout its known range though may require monitoring if development in the area (specifically mining) increases. Shown to be more abundant than previously thought through a recent regional flora survey.

Etymology. Named for the typically lanceolate shape of the cauline leaves and bracts of the species.

Notes. Goodenia lancifolia was rarely collected until recent collector effort in the Warren area resulted in finds of further populations and highlighted the need for formal recognition. The co-author of this species, Ray Cranfield, is a botanist with the Western Australian Herbarium based in Manjimup.

Carolin (1992) included this species within the concept of *Goodenia leptoclada* Benth., with few collections of the new species then being available. Distinguished from *G. leptoclada* by leaves narrowly ovate to lanceolate rather than ovate to oblong, smaller abaxial corolla lobes, smaller abaxial corolla lobe wings, ovules 11–15 rather than 4 or 5 and distribution from Scott River to just west of Walpole.

Goodenia scapigera R.Br., Prodr. 578 (1810). – *Stekhovia scapigera* (R.Br.) Vriese, *Natuuk. Vern. Holl. Maatsch. Haalem* ser. 2, 10: 167 (1854). *Type:* Bay I [Lucky Bay, Western Australia], 11 January 1802, *R. Brown* (*holo:* BM, *n.v.*).

Scaevola stricta Vriese *in* J.G.C. Lehmann, Pl. Preiss. 1: 408 (1844). *Type:* near Konkoberup Hill [Mt Melville, near Cape Riche], Western Australia, 19 November 1840, *L. Preiss* 1511 (*isolecto:* MEL).

Notes. During examination of collections of *Goodenia scapigera* at the Western Australian Herbarium, the author recognized material belonging to an undescribed variant restricted to a region of granitic soils within the range of the much more widespread typical variant. These plants are morphologically and geographically distinct and recognition at the subspecific level is required.

In a note under his description of *Goodenia scapigera* in the "Flora of Australia", Carolin (1992) mentioned a collection (*C.A. Gardner s.n.*, near Lake Hope, September 1929) that has very narrow leaves. This collection was the first of the new subspecies and the only one seen by Carolin (1992).

Goodenia scapigera R.Br. subsp. **scapigera**

Erect shrub to 1 m tall. *Leaves* cauline, not fasciculate, linear to narrowly obovate, entire to dentate; lamina to 6 cm long, 2–10 mm wide. (Figure 4)

Selected specimens examined. WESTERN AUSTRALIA: near Phillips River, Oct. 1903, *C. Andrews s.n.*; E of Bremer Bay, 30 Oct. 1963, *T.E.H. Aplin* 2758a; 60 km SW of Israelite Bay ruins, opposite Mount Baring, 7 Jan. 1979, *B. Barnsley* 378; 5 miles [8 km] W of Kukerin, 29 Oct. 1962, *J.S. Beard* 2132; Lucky Bay, 30 Oct. 1967, *J.S. Beard* 5367; Ravensthorpe Range, Sept.1980, *E.M. Bennett s.n.*; Beverley Road verge, 8 km NNE of Pingelly, 15 Nov. 1996, *D. Box* 241; Wickepin, 25 Oct. 1957, *W.H. Butler s.n.*; Scanden [Scaddan], 6 Nov. 1978, *R.J. Cranfield* 1064; Hopetoun, 15 Jan. 1974, *H. Demarz* 5035; Wittenoom Hills (Wittenoom Hills are *c.* 50 km NNE of Esperance), 4 Oct. 1968, *N.N. Donner* 2885; Lake Grace area, Oct. 1963, *D.M. Dorrien-Smith s.n.*; Pingelly, 27 Oct. 1920, *C.A. Gardner* 1020; 8 km E of Cape Arid National Park on Fisheries Road , 21 Nov. 1986, *J.W. Green* 5117; near Two Mile Lake, S margin of Stirling Range, 15 Nov. 1982, *G.J. Keighery* 5839; Cut Hill Lakes–York, 19 Sep. 1962, *F. Lullfitz* L1691; W of Lake King, 29 Nov. 1964, *F. Lullfitz* L3941; Whoogarup Range (SE spur), Fitzgerald River National Park, 26 Sep. 1997, *F. Obbens* 6/97; Location 1110, *c.* 40 km ENE of the coast at Stokes Inlet, 16 Oct. 1968, *A.E. Orchard* 1559; along road between the Bremer Bay road and Gardner River, 12 Sep. 1971, *S. Paust* 594; Mylies Beach, Fitzgerald River National Park, 7 Sep. 1986, *B. Pellow* 62; Dryandra State Forest, 9 Oct. 1987, *D.M. Rose* 364; base of Bluff Knoll, S side of Stirling Range, 27 Oct. 1959, *R.D. Royce* 6039; Frank Hann National Park, 10 Dec. 1971, *R.D. Royce* 10204; Noble Rd, NE of Arthur River, 28 Oct. 1998, *L.W. Sage 1060 & F. Obbens*; Mt Toolbrunup [Toolbrunup Peak], Stirling Range, Mar. 1966, *F.A. Spratt* 31; 60 mile peg Brookton road [3.5 km E of Dale on Brookton Highway], 21 Oct. 1972, *E. Wittwer* W.870.

Distribution and habitat. Occurs in the Avon Wheatbelt, Esperance Plains, Jarrah Forest, Mallee and Swan Coastal Plain regions of the South West Botanical Province. Also in the Coolgardie region of the South-western Interzone. Usually occurring in sandy soil in woodland or heath (Carolin 1992). (Figure 5)

Conservation status. Goodenia scapigera subsp. *scapigera* is common throughout its known range.

Flowering period. September to January.

Goodenia scapigera subsp. **graniticola** Sage, *subsp. nov.*

A subspecie typico differt foliis anguste linearibus fasciculatus non nisi in solo granitico cresenti.

Typus: Peak Charles National Park [precise locality withheld for conservation purposes], Western Australia, 17 September 1985, *P.J. Poli* 29 (*holo:* PERTH sheet 1874837; *iso:* NSW).

Erect shrub, to 1.5 m tall. *Leaves* cauline, fasciculate, narrowly linear, entire; lamina to 6 cm long, to 2 mm wide. (Figure 5)

Other specimens examined. WESTERN AUSTRALIA: Peak Charles National Park, 10 Oct. 1995, *S. Barrett* 460; near Lake Hope, Sept. 1929, *C.A. Gardner s.n.*; Peak Charles National Park, 8 Nov. 1979, *K.R. Newbey* 6369.

Figure 4. *Goodenia scapigera* subsp. *scapigera* – portion of stem of *L.W. Sage* 1060 & *F. Obbens*, showing typical leaves.

Figure 5. *Goodenia scapigera* subsp. *graniticola* – portion of stem from the holotype (*P.J. Poli* 29).

Distribution and habitat. Restricted to heath on granitic soils in the vicinity of the Peak Charles National Park in the south-west of Western Australia, Mallee Interim Botanical region of the South West Botanical Province. (Figure 6)

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Two. This subspecies is currently known only from three collections within the Peak Charles National Park and one in the vicinity of Lake Hope.

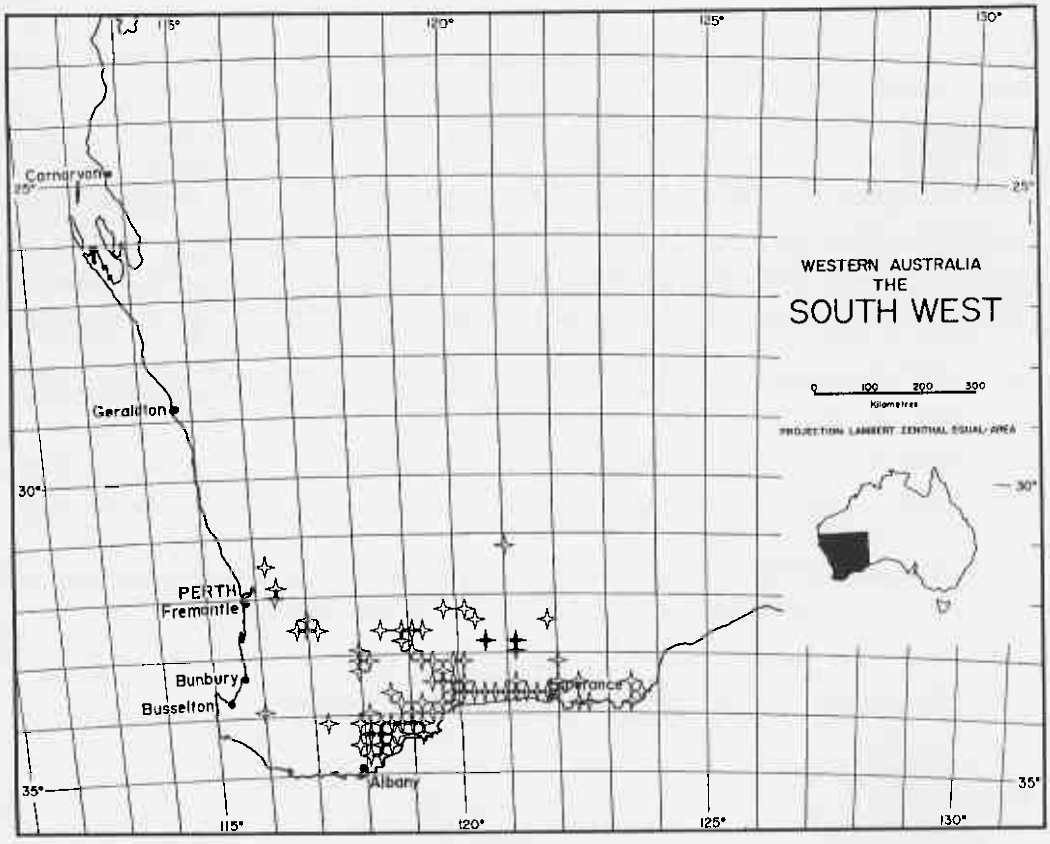

Figure 6. Distribution map of *Goodenia scapigera* subsp. *scapigera* ✧ and *G. scapigera* subsp. *graniticola* ✦

Flowering period. September to November.

Etymology. Named for the occurrence of the subspecies on granitic soils.

Notes. This taxon has been known by the phrase name *Goodenia* sp. Peak Eleanora (*P.J. Poli* 29). The fasciculate, narrowly linear leaves of *Goodenia scapigera* subsp. *graniticola* are very similar to those found on *G. drummondii* subsp. *megaphylla* Sage (Sage 1998). The latter subspecies is also only known from granitic soil and the leaf morphology of both taxa may signify an adaptation to the harsh temperatures found on the surface of granite outcrops in summer in Western Australia.

Update to *Goodenia* key

Couplet 3 of the *Goodenia* key to species of the "Flora of Australia" Volume 35 (Carolin 1992: 149) incorrectly has 'abaxial corolla lobes' instead of 'adaxial corolla lobes'. The bracketed description of Group 8 on page 164 also has this error. As illustrated in Harris & Harris (1994), the abaxial portion of any plant structure is the part away from the axis and the adaxial portion is towards the axis of the plant. In *Goodenia* the abaxial part of the corolla is the lower three corolla lobes and the adaxial part the upper two corolla lobes (see Figure 7). The upper two corolla lobes often have an auricle on the inside below the wings. In the key to species on page 149, the selection of either option in Couplet 3 is based on the width of the lobe wing above the auricle relative to that of the wing on the opposite side of the same lobe (see Figure 7B).

Inclusion of the two new species in the *Goodenia* key can be made by altering couplets 18 and 19 in Group 1 (Carolin 1992: 151) and couplet 10 in Group 8 (Carolin 1992: 164), as follows:

18 Cauline leaves lanceolate or ovate-elliptic
19a Corolla glabrous outside ..... **G. eatoniana**
19a: Corolla cottony hairy ouside
19b Ovules 4 or 5; leaves ovate to oblong ..... **G. leptoclada**
19b: Ovules 11–15; leaves lanceolate to narrowly ovate ..... **G. lancifolia**

10a Leaves linear, entire ..... **G. integerrima**
10a: Leaves wider than linear
10b Ovules 20–35; seeds *c.* 5 mm long ..... **G. pinnatifida**
10b: Ovules *c.* 9; seeds *c.* 2 mm long ..... **G. heatheriana**

Goodenia heatheriana may also key out to couplet 13, *G. pascua* Carolin, but is easily distinguished from this species by smaller abaxial lobes, fewer ovules and disjunct distribution.

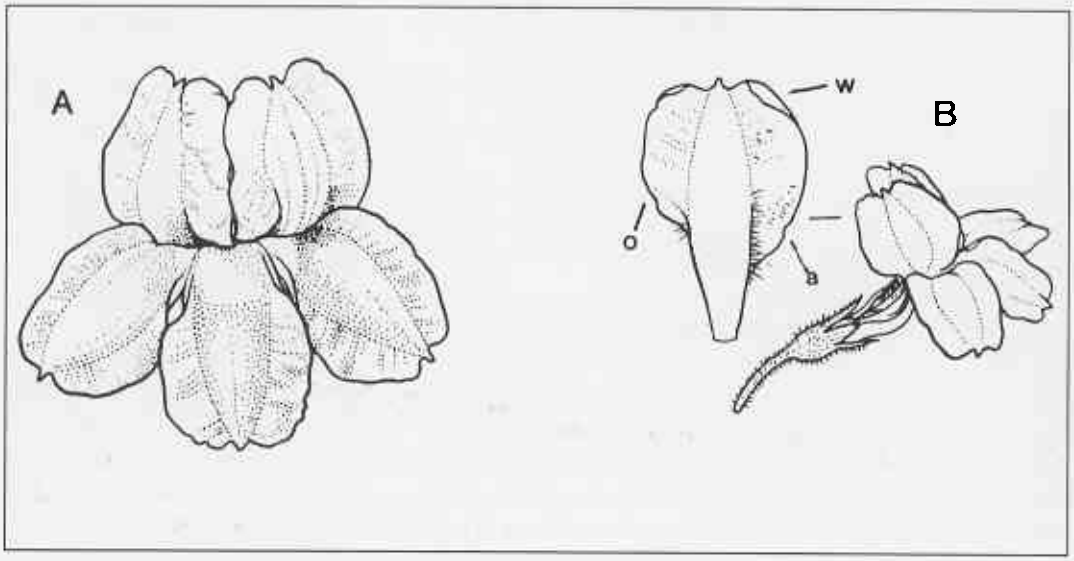

Figure 7. *Goodenia caerulea*. A – corolla; the upper two lobes are adaxial and the lower three lobes abaxial. B – side view of flower with enlargement of an adaxial corolla lobe showing the auricle (a), the wing above the auricle (w), and the wing on the opposite side which lacks an auricle (o). Reproduced with permission from Marchant *et al.* (1987: Figure 232).

Acknowledgements

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