New species and notes on central Australian *Goodenia* (Goodeniaceae)

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Abstract

Albrecht, D.E. New species and notes on central Australian *Goodenia* (Goodeniaceae). *Nuytsia* 15(1): 1–9 (2002). *Goodenia halophila* Albr. *sp. nov.* and *G. cylindrocarpa* Albr. *sp. nov.* are described, with notes on their distribution, conservation status, habitat and relationships with other species of *Goodenia* Sm.. Notes are also provided on the Northern Territory populations of *G. angustifolia* Carolin and *G. glandulosa* K.Krause, and on all populations of *G. anfracta* J.M.Black and *G. maideniana* W.Fitzg. Further studies are needed to establish whether *G. anfracta*, which currently has conservation priority in Western Australia, should be reduced to synonymy under *G. maideniana*.

Introduction

In the course of preparing a checklist of the vascular plants of the southern part of the Northern Territory (Albrecht *et al.* 1997), it became apparent that the treatment of *Goodenia* Sm. (Goodeniaceae) in "Flora of Australia" (Carolin 1992) needed updating for the central Australian region. Two undescribed species of *Goodenia* section *Porphyranthus* G.Don occur within this region and were listed informally by Dunlop *et al.* (1995). Both species are known from few localities, and to facilitate their recognition and protection they are here described. Notes are also provided for several other central Australian species of *Goodenia*, including two not previously recorded by Carolin (1992) for the Northern Territory.

Materials and methods

The terminology adopted mostly follows that used in the most current and comprehensive treatment of *Goodenia* by Carolin (1992). In the two species described here the inflorescences have structures that closely resemble bracteoles in general appearance but frequently have axillary flowers. Following Briggs & Johnson (1979), who interpret bracteoles as two distal "empty" phyllomes (i.e. leaf-organs lacking axillary buds or such buds not developing further) on an axis terminating a flower, I have used 'opposite or sub-opposite bracts' rather that 'bracteoles' to describe this situation.

The term floral tube has been used to describe the structure consisting of the fused portions of the corolla, calyx and filament bases that are adnate to the ovary.

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 floral tube and the tip of central abaxial corolla lobe.

New species descriptions

Goodenia cylindrocarpa Albr., *sp. nov.*

Goodenia lamprospermae F.Muell. affinis sed historia vitae annua, corolla minori et sacco anterico corollae obscuro, stylo breviore, lobis calycis longioribus, capsulis largioribus non-abscissis prompte differt.

Typus: 10 km north-north-east of Connells Bore (Pictorella Swamp), Northern Territory, 30 June 1982, *P.K. Latz* 9109 (*holo:* DNA A69693; *iso:* NT).

Erect annual *herb* to *c.* 25 cm high, vegetative parts glabrous or with tiny inconspicuous simple hairs and gland-tipped trichomes, longer septate hairs present in leaf and bract axils. *Leaves* in a basal tuft, persistent, flat, oblanceolate, obovate or spathulate, 20–85 mm long (including a contracted petiole-like base 5–50 mm long), 3.5–20 mm wide, dentate or rarely subentire, apex acute. *Flowers* arranged in bracteate panicle-like inflorescences composed of cymose part-inflorescences; bracts leaf-like in lower part of inflorescence becoming reduced towards distal parts, those below flowers opposite or sub-opposite and resembling bracteoles, linear; pedicels to *c.* 10 mm long, an articulation line not evident in flowering specimens but sometimes apparent *c.* 0.5–1 mm below the pedicel-floral tube junction in fruiting specimens. *Floral tube* obconical, glabrous or with tiny inconspicuous simple hairs and gland-tipped trichomes; calyx lobes linear-lanceolate, 2.5–4 mm long, attached in the upper half or third of the floral tube. *Corolla* yellow, sometimes faintly purple-tinged in dried specimens, 5–6.5 mm long, with simple hairs and gland-tipped trichomes externally and few simple hairs internally, without enations, anterior pouch obscure; abaxial lobes with equal wings *c.* 0.5 mm wide on either side, the 2 auriculate adaxial lobes separated lower and unequally winged. *Anthers* 0.7–0.9 mm long post dehiscence, apiculate. *Ovary* with a dissepiment almost as long as the loculus and bearing numerous (*c.* 120 per locule) ovules scattered over placentas; style 2.5–3 mm long, almost straight to weakly s-shaped, sparsely hairy; indusium obtriangular, 1–1.1 mm wide, with scattered hairs particularly on adaxial side, ciliate on straight distal abaxial edge, the distal adaxial edge usually glabrous but with hairs from the indusium face extending beyond the edge. *Fruit* cylindrical, 7–9 mm long, 2–3 mm wide, dehiscing through two entire valves that are raised 2–3 mm beyond the attachment point of calyx lobes. *Seeds* lenticular, brown, elliptic to ovate, 0.7–0.8(1) mm long, 0.5–0.7 mm wide, very faintly reticulate-foveate, glossy, with a narrow transparent wing 0.05–0.1 mm wide. (Figure 1A)

Selected specimens examined. NORTHERN TERRITORY: Toko Range, above Alcoora Spring, 23 Mar. 1995, *D.E. Albrecht* 6359 *& P.K. Latz* (BRI, DNA, NT); Creswell Downs Station, 11 July 2000, *C. Materne s.n.* (NT); 7 km S of Dunmarra, 8 June 1975, *D. Symon* 10357 (AD, SYD); Connells Lagoon Reserve, 24 Aug. 1989, *B.G. Thomson* 3334 (DNA).

Figure 1. A – Specimen of *Goodenia cylindrocarpa* (*D.E. Albrecht* 6359, NT 90786). B – Specimen of *G. halophila* (*D.E. Albrecht* 7948, NT 94082).

Distribution and conservation status. *Goodenia cylindrocarpa* is apparently endemic in the Northern Territory, but is likely to occur in arid or semi-arid Queensland. It is presently known from four disjunct populations (Figure 2A), two of which occur in the Mitchell Grass Downs bioregion and one each from the Sturt Plateau and Channel Country bioregions. Suitable habitat occurs between the known sites and additional populations are likely to be located in the intervening areas. One of the populations in the Mitchell Grass Downs bioregion occurs within the Connells Lagoon Conservation Reserve. There is presently too little information to assess the size of populations, reservation status and threats. As a tentative measure *Goodenia cylindrocarpa* is assigned a risk code of 3KC.

Habitat and ecology. All known populations occur on heavy clay soil in areas subject to seasonal inundation. On the Barkly Tablelands it occurs in *Chenopodium auricomum*-dominated swamps and drainage lines. On the Toko Range it has been found in a grassy perched swamp on a heavy soil plateau.

The presence and relative abundance of plants at a particular site each year appears to be dependant on the amount of rainfall (G. Allan pers. comm.). An attempt to relocate *Goodenia cylindrocarpa* in 1995 at one of the previous collection sites (Dunmarra) was unsuccessful, presumably because of inadequate rain. The original specimen from this site (Symon 10357) was collected during a year of exceptional rainfall.

Phenology. Flowering specimens have been collected between March and June, and fruiting specimens between March and August.

Etymology. The compound Latin/Greek specific epithet is descriptive of the cylindrical (torpedo-shaped) fruit.

Notes. *Goodenia cylindrocarpa* is the entity listed as *Goodenia* D70208 Barkly by Dunlop *et al*. (1995) and Albrecht *et al*. (1997). Despite its rather wide geographic range there appears to be little morphological variation except for plant size.

Having yellow corollas and numerous ovules scattered over the placentas, *Goodenia cylindrocarpa* is placed in the section *Porphyranthus*. It has been confused with *G. lamprosperma* F.Muell., but differs from that species in being an annual rather than perennial herb, in having smaller corollas (5–6.5 mm long, cf. (7)8–11 mm long) lacking a visible anterior pouch, shorter styles (*c.* 3 mm long, cf. 4.5–7 mm long), longer calyx lobes (2.5–4 mm long, cf. 1.5–2 mm long) and larger capsules (7–9 mm long, cf. 3–6 (7) mm long) that do not readily abscise. *G. cylindrocarpa* also bears some resemblance to *G. berringbinensis* Carolin, particularly with regard to the fruit, but that species has a conspicuous indumentum of soft spreading hairs, a broader indusium (1.3–1.5 mm wide, cf. 1 mm wide) and larger corollas (*c.* 12 mm long) with enations, a conspicuous anterior pouch and broader wings.

Goodenia halophila Albr., *sp. nov*.

Goodenia modestae J.M.Black affinis sed fructibus 2- (non 4-) valvibus, seminibus minoribus distortis non-alatis vel ala angustissima, marsupio nectarii obscuro, stylo breviore differt.

Typus: 9 km east of Rabbit Flat, Northern Territory, 7 July 1980, *P.K. Latz* 8459 (*holo:* DNA A63763; *iso:* MO, NSW, PERTH).

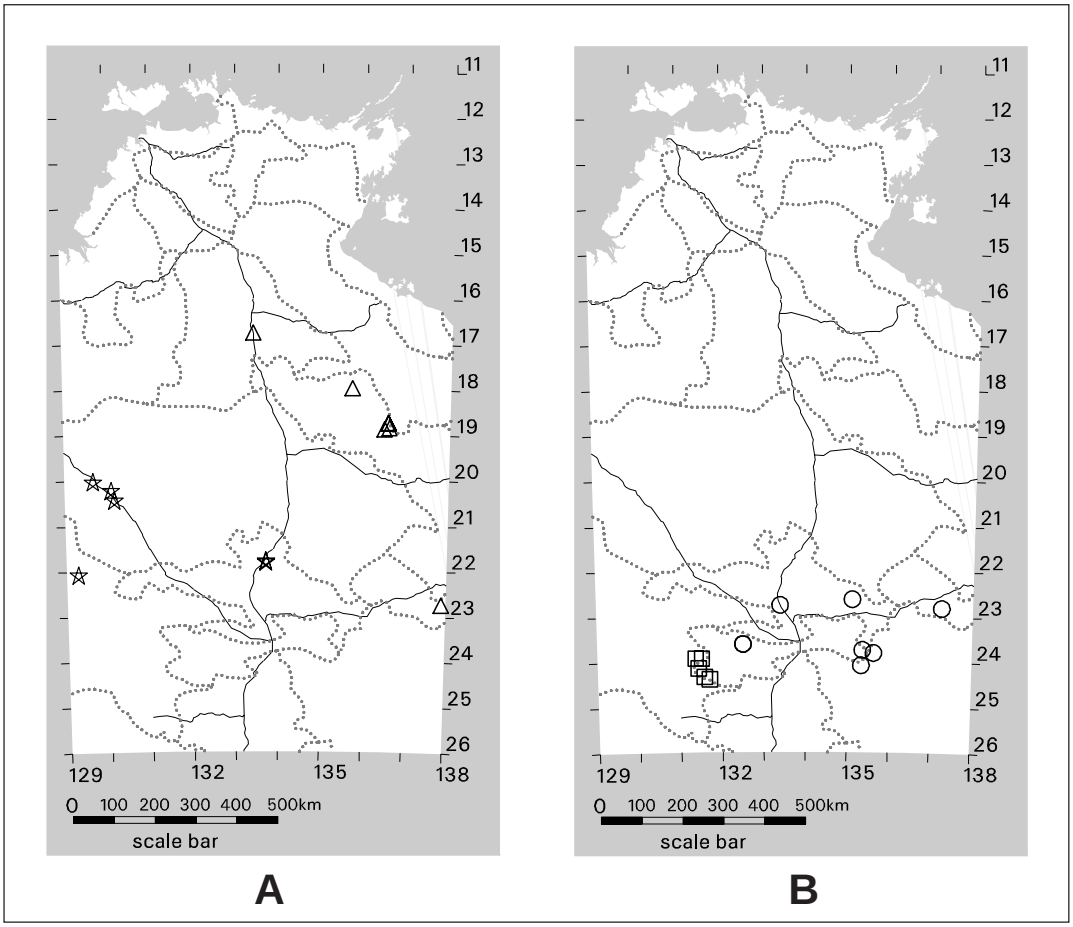

Figure 2. Distribution maps, with major roads and bioregional boundaries (Thackway & Cresswell 1995) shown. A – *Goodenia cylindrocarpa* (△) and *G. halophila* (✡) in the Northern Territory based on herbarium records from AD, DNA, NT & SYD. B – *Goodenia angustifolia* (○) and *G. glandulosa* (□) in the Northern Territory based on herbarium records from DNA and NT.

Delicate annual *herb* with a basal tuft of leaves and erect or decumbent flowering stems to 35 cm long; vegetative parts with an inconspicuous indumentum of sparse minute simple hairs and gland-tipped trichomes, becoming glabrous with age, hairs ± denser in leaf and bract axils. *Leaves* mostly in a basal tuft; basal leaves persistent but sometimes dead at fruiting stage, flat, spathulate to oblanceolate, 7–60 mm long, 2–18 mm wide, pinnatifid, dentate or rarely subentire, base tapered so that petiole rarely distinguishable, apex obtuse to acute; cauline leaves similar but smaller, grading into bracts. *Flowers* arranged in cymose part-inflorescences along the usually zig-zag stems, the whole inflorescence occupying most of the plant; bracts leaf-like in lower part of inflorescence, reducing to linear-lanceolate and ± concave towards distal parts, those below flowers opposite or sub-opposite, slightly fleshy and resembling bracteoles; pedicels thread-like, curved, to *c.* 10 mm long, articulate *c.* 0.5–1.5 mm below the pedicel-floral tube junction. *Floral tube* obconical, glabrous; calyx lobes lanceolate, 1.7–2.5(3) mm long. *Corolla* yellow, the midvein and/or auricle of the 2 adaxial lobes sometimes purple-tinged or flecked, 7–10 mm long, with sparse minute simple hairs and rarely also gland-tipped trichomes externally, glabrous internally or with sparse minute simple hairs towards base of tube, without enations,

anterior pouch obscure; abaxial lobes with equal wings *c.* 0.8–1.5 mm wide on either side, the 2 auriculate adaxial lobes separated lower and unequally winged. *Anthers c.* 1.5 mm long in bud, 0.8–1.2 mm long post dehiscence. *Ovary* with a dissepiment two-thirds to almost as long as the loculus and bearing numerous ovules scattered over placentas; style purple, 2.7–3.5 mm long, more or less straight, glabrous or villous distally; indusium purple, obtriangular to almost square, sides convex, *c.* 1.5 mm wide, with scattered hairs, ciliate on the concave or straight distal edges, the hairs along the abaxial edge longer than those on the adaxial edge. *Fruit* ellipsoid to narrowly ovoid, 3–4 mm long, 1.7–2 mm wide, splitting into two valves that are raised *c.* 1.5 mm beyond attachment point of calyx lobes, dehiscing septicidally. *Mature seeds* not seen; immature seeds brown, asymmetrically orbiculate-ovate or elliptic, distorted, *c.* 0.4–0.5 mm diam., minutely and densely papillate, usually with a rudimentary narrow wing < 0.05 mm wide. (Figure 1B)

Other specimens examined. NORTHERN TERRITORY: Stirling Station, 12 Aug. 1996, *D.E. Albrecht* 7948 (NT); cultivated, Arid Zone Research Institute, 11 Nov. 1996, *D.E. Albrecht* 7965 (NT); Tanami track, 27 km NW of the Granites, 20 May 1976, *A.C. Beauglehole* 50934 (SYD); 12 mi [19 km] SE of Rabbit Flat, 17 July 1973, *P.K. Latz* 3947 (DNA); 8 km E of NW corner of Lake Mackay, 6 Oct. 2001, *P.K. Latz* 18187 (NT, AD, PERTH); N of Tanami, 1973, *C. Lendon* 20 (DNA); Stirling Station, 3 July 1974, *A. Mitchell* 46 (DNA).

Distribution and conservation status. At present *Goodenia halophila* is known only from arid regions of the Northern Territory, but it is extremely likely to occur in adjacent areas of Western Australia. Five populations are currently known (Figure 2A); three occur in the Tanami bioregion and one each in the Burt Plain and Great Sandy Desert bioregions. The species occurs within a region that is relatively poorly surveyed and it is difficult to predict its actual distribution. No populations occur within a gazetted biological reserve. Presently there is too little information to assess the size of populations and threats. Further field work after good rains will help to resolve the conservation status of this species and as a tentative measure *Goodenia halophila* is assigned a risk code of 3K.

Habitat and ecology. All known populations occur in low-lying saline or semi-saline areas associated with seasonal lakes or paleodrainage line systems. Soils range from sandy loam to sandy clay, and the pH at one site tested (Stirling Swamp) is 10. Associated species include *Frankenia cordata*, *Eragrostis dielsii*, *Heliotropium curassavicum*, *Triglochin hexagonum*, *Atriplex holocarpa* and *Triodia salina*.

The presence and relative abundance of plants at a particular site each year appears to be highly dependant on the amount of rainfall. Attempts to relocate the species from known locations in the Western Tanami in 1996 were unsuccessful because of the lack of rain. In contrast, *G. halophila* appeared in profusion at Stirling Swamp following exceptional rainfall in early 2000.

Phenology. Flowering and fruiting specimens have been collected between May and August. Under glasshouse conditions in Alice Springs transplants from Stirling Swamp flowered continuously from July 2000 to February 2001 (plants still alive and flowering but becoming senescent at this time).

Etymology. The specific epithet is derived from Greek *halo-*, salt, and *phileo*, I love, referring to the habitat preference for saline or semi-saline environments.

Notes. *Goodenia halophila* is the entity listed as *Goodenia* A44284 (subsaline) by Dunlop *et al*. (1995) and Albrecht *et al*. (1997).

Like *Goodenia cylindrocarpa*, *G. halophila* belongs to section *Porphyranthus*. *Goodenia halophila* is closely allied to *G. modesta* J.M.Black, in which it was included by Carolin (1992). *G. halophila* differs from *G. modesta* in the mode of dehiscence of the fruit (2-valved, cf. 4-valved), the smaller seeds (0.4–0.5 mm long, cf. (0.6)0.7–0.8(1) mm long), the obscure nectary pocket, and shorter style (2.7–3.5 mm long, cf. 4–5 mm long). In addition *G. halophila* has a more delicate disposition, the flowering stem axes are more distinctly zig-zag, the calyx lobes are generally shorter (1.7–2.5 (3) mm long, cf. (2)2.5–3.5(4.5)), the pedicels are strictly thread-like (*c.* 0.1(1.5) mm wide at midpoint, cf. (0.1)0.15–0.3 mm wide at midpoint) and the habit strictly annual (cf. perennial or perhaps rarely annual). *G. halophila* also occurs in saline or semi-saline drainage systems and lakes, whereas *G. modesta* is associated with seasonally moist non-saline habitats.

Goodenia halophila also bears a superficial resemblance to the recently described *G. gypsicola* Symon (Symon 2000), particularly with respect to the zig-zag inflorescences and fine pedicels. However *G. gypsicola* is readily distinguished by the perennial habit, pale blue corollas, smaller fruit 1.5–2.8 mm long and thicker seeds.

Goodenia halophila exhibits little variation in floral and fruit characters, though plant size, leaf dimensions and the degree of branching of part-inflorescences are rather variable. The variation in these latter characters appears to be correlated with the availability of water during the growing season. Specimens collected at Stirling Swamp during the exceptionally wet year of 1974 are robust with large leaves and much branched part-inflorescences, whereas specimens collected in 1996 from the same site but during a period of relatively low rainfall are of a much smaller stature with smaller leaves and less branched part-inflorescences. Seedlings transplanted from Stirling Swamp in 1996 and grown in irrigated containers developed into robust plants with large leaves and much branched part-inflorescences.

Notes on other central Australian species

Goodenia angustifolia Carolin

At the time the treatments of Carolin (1980, 1992) were being prepared, *Goodenia angustifolia* was only known from the type collection in south-western Queensland. Since that time additional collections from south-west Queensland and the central eastern part of arid Northern Territory (Figure 2B) have been made. Carolin's descriptions require amendment to accommodate the level of variation observed in Northern Territory populations. Bracteoles are present or absent in Northern Territory populations, leaves are mostly terete but occasionally some have a channel on the upper surface, the corolla length ranges from 10 to 16 mm (cf. 10–12 mm long in descriptions) and its external surface is either glabrous or the tube has scattered hairs. The Northern Territory populations occur in open situations on soils with a stony (typically quartz) surface layer. This habitat preference is consistent with known locations in Queensland.

Specimens examined. NORTHERN TERRITORY: Namatjira Drive, 50 m W of the Redbank Gorge turnoff, 20 Oct. 1999, *D.E. Albrecht* 8987 (NT); Stuart Highway, 116 km N of Alice Springs, 18 Oct. 2000, *D.E. Albrecht* 9439 (NT); 7 km S of Casey Bore, 2 June 1995, *D.E. Albrecht* 6729 *& P.K. Latz* (BRI, DNA, NT); MacDonald Downs, 22 Oct. 1974, *P.K. Latz* 5773 (CANB, DNA, NSW); 33 km NE of Numery Homestead, 16 Sep. 1993, *P.K. Latz* 13383 (DNA, NT); Marqua Station, 25 May 1972, *P.K. Latz* 2621 (CANB, NSW, NT).

QUEENSLAND: near railway crossing, 5 km N of Malbon Vale Homestead, 0ct. 1984, *V.J. Neldner* 1627 (BRI); 6 km N of Malbon, Oct. 1984, *V.J. Neldner* 1615 (BRI); *c.* 27 km E of 'Cluny', 10 Sep. 1978, *R.W. Purdie* 1447 (BRI, DNA).

Goodenia glandulosa K.Krause

Carolin (1992) records the distribution of *Goodenia glandulosa* as Western Australia and South Australia. The species is here reported to occur in the Northern Territory (Figure 2B), where a small number of collections have been made within about a 100 km radius of Kings Canyon (Watarrka) and a further occurrence noted by the author west of Docker River near the Western Australian border (unmapped). The Northern Territory populations occur on low sand dunes and in swales with *Trioda schinzii*. This habitat is atypical for the species which is reported to occur usually on rocky hillsides (Carolin loc. cit.).

Goodenia glandulosa warrants further study as it appears to be a variable species, particularly with respect to corolla size (5–11 mm long, cf. 8–11 mm in Carolin's description), the width of corolla lobe wings and the presence or absence of bracteoles. The populations near Kings Canyon have corollas at the smaller end of the size range (i.e. 5 mm long). *Goodenia glandulosa* has a rather distinctive stem and leaf indumentum consisting of mostly ascending arcuate swollen-based hairs overlying gland-tipped trichomes of variable density. The glandular trichomes are not conspicuous and the plants are neither viscid or varnished on younger parts. Consequently specimens of this species can not be determined accurately using the key provided by Carolin (1992).

Selected specimens examined. NORTHERN TERRITORY: 12 km W of Mereenie base camp, 21 Nov. 2000, *D.E. Albrecht* 9499 *& P.K. Latz* (NT); NW Kings Canyon, 8 Nov. 1976, *P.K. Latz* 6662 (NT); Bore Rd, Watarrka, 25 Aug. 1988, *D. Schunke* 237 (NT).

Goodenia anfracta J.M.Black and **G. maideniana** W.Fitzg.

The type specimens of *Goodenia anfracta* (from Cootanoorina, South Australia) and *G. maideniana* (from Nannine, Western Australia) look grossly dissimilar, largely because of the difference in shape of the cauline leaves (linear in *G. anfracta*, obovate in *G. maideniana*) and the pronounced zig-zag stems on the type of *G. anfracta*. These distinguishing characteristics were emphasised by Carolin (1992) who treated them as distinct species.

Several specimens from South Australia more or less match the type of *G. anfracta* but none from there match the type of *G. maideniana*. In the Northern Territory there is only a single specimen from Lake Bennett that more or less matches the type of *G. anfracta*. All other specimens from the Northern Territory are unlike the types of both taxa, having cauline leaves that are oblanceolate grading to linear towards the distal end of the stems. No Northern Territory material has obovate cauline leaves as in the type of *G. maideniana*. Western Australian material is variable, including specimens matching the types of both of the named species as well as specimens with intermediate features similar to those in the Northern Territory. *G. anfracta* is currently listed as having a high (Priority One) conservation status in Western Australia, as only a few specimens close to the eastern border of the State match the type of this taxon.

Comparing Carolin's (1992) descriptions of *G. anfracta* and *G. maideniana* suggests that several additional characters may be helpful for distinguishing these species. However after examining the types

and specimens matching the types of both species, it became apparent that most of the characters in question (i.e. branch length, pedicel length, corolla length and the length of the adaxial corolla lobes) have almost completely overlapping ranges rather than non-overlapping ranges. As the type of *G. maideniana* lacks fruit and all other Western Australian specimens matching the type of *G. maideniana* also lack fruit, it is not possible to determine whether fruit shape and the relative length of the ovary septum to total ovary length have non-overlapping ranges.

Specimens assigned to either species have been collected from mound springs and salt lakes. The commonality in habitat, and variability in floral and vegetative morphology suggest that perhaps only a single variable species is involved. Further collections from plants matching the type of *G. maideniana* are required, particularly with ripe fruit and seed. Study of intra-population variation is also required. The status of these two taxa is likely to remain unresolved until these tasks are undertaken.

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