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## TAXONOMIC REVISION OF *BERGIA* (ELATINACEAE) IN AUSTRALIA

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### Abstract

A taxonomic revision of *Bergia* in Australia is presented. The following ten species are recognised: *B. pedicellaris*, *B. henshallii*, *B. perennis*, *B. barklyana*, *B. auriculata*, *B. ammannioides*, *B. trimera*, *B. occultipetala*, *B. diacheiron* and *B. pusilla*. *B. barklyana*, *B. auriculata*, *B. henshallii*, *B. occultipetala* and *B. diacheiron* are described as new. *B. perennis* comprises three subspecies. The existing infrageneric classification is considered inadequate and four informal groups based on Australian taxa are suggested. *B. ammannioides* and *B. trimera* have an extra-Australian distribution; all other taxa are endemic. A key to the species and distribution maps are provided.

### Introduction

The Elatinaceae are a small family of aquatic or wetland plants with an almost global distribution but absent from colder regions. Recent workers e.g. Cronquist (1981) have concurred with placement of the Elatinaceae in the Theales and that its closest affinity is to the Clusiaceae. Tucker (1986) provides a recent summary and detailed references to the family. *Bergia* is one of two genera recognised in the Elatinaceae, the other being *Elatine*. Both genera are recorded for Australia, *Bergia* now with 12 taxa recognised, and *Elatine* generally accepted as represented by a single species.

The genus *Bergia* was described by Linnaeus in 1771 and commemorates Petrus Jonas Bergius (1766-1790), a Swedish pupil of Linnaeus and later professor of natural history and pharmacy at the Collegium Medicum in Stockholm.

Statements as recent as those by Tucker (1986) that only two species are known for Australia and that Africa was the centre of greatest diversity indicate the paucity of knowledge of the genus in Australia. Verdon (1981) recognised a number of undescribed taxa occurring in central Australia but suggested material was generally inadequate to delimit these. The author feels that *Bergia* is under-collected and poorly represented in most Australian herbaria. In recognition of this problem *Bergia* species have been actively collected by staff at NT, notably S. Parker, T.S. Henshall and P.K. Latz. Examination of this material by the author in preparation for a generic treatment in the revised 'Flora of Central Australia' showed that a considerable number of sheets had accumulated and that it was now possible to morphologically delimit a number of new taxa. Subsequent examination of all material at other Australian state herbaria supported the groupings initially delimited and also led to the recognition of an additional two species outside central Australia. This revision is therefore based on a morphological study of most available Australian herbarium material. A limited number of extra-Australian sheets were also examined from MEL and NSW. Measurements reported are from dried herbarium specimens. The distribution maps show all specimens examined.

### Generic and infrageneric relationships

*Elatine* is distinguished by its membranous sepals and capsules from *Bergia* which has herbaceous sepals and crustaceous capsules. As pointed out by Bentham (1863), the slight morphological generic differences are associated with significant differences in habit; *Elatine* is principally aquatic, while *Bergia* is predominantly terrestrial although favouring habitats that

are periodically inundated. Although von Mueller (1861, 1862) clearly did not recognise *Bergia* and described some species as *Elatine* there has otherwise been broad acceptance of the generic distinction by most taxonomists.

Nieden zu (1925) divided *Bergia* into two sections and each of these further into two subsections. The sectional subdivision was based primarily on whether flowers are solitary or in dichasia. Characters used for subsectional groupings include shape and apex of perianth parts, ovary shape and length relative to the stamens, seed surface, general indumentum and leaf margin. This infrageneric classification was clearly developed with minimal reference to Australian material. For example, Australian taxa within an obviously closely related natural group are contrasted by ovoid or globular ovaries, generally glabrous or pubescent, serrate or  $\pm$  entire leaf margins and acuminate or obtuse sepals and petals. Further, it is not possible to logically place a number of Australian taxa with particular combinations of characters within Niedenzu's scheme. Any further formal proposals for a infrageneric classification must await a detailed monographic treatment. However, from this study it is suggested that inflorescence type, number of staminal whorls, style length and seed texture best delimit apparent natural groupings of Australian taxa. On this basis four informal groups are recognised. Listed under each are the species belonging to these groups.

Group 1. Flowers in dense many-flowered axillary clusters; stamens in a single whorl; style short; seeds smooth or sculptured. *B. ammannioides*, *B. trimera*.

The highly reduced *B. pusilla*, even though with solitary flowers, is probably best placed in this group.

Group 2. Flowers typically 2 per leaf axil; stamens in 2 whorls; style short; seeds smooth. *B. pedicellaris*.

Group 3. Flowers solitary but usually on condensed short shoots; stamens in a single whorl; style short; seeds sculptured. *B. diacheiron*, *B. occultipetala*.

Group 4. Flowers solitary; stamens in 2 whorls; style long; seeds sculptured. *B. auriculata*, *B. barklyana*, *B. henshallii*, *B. perennis*.

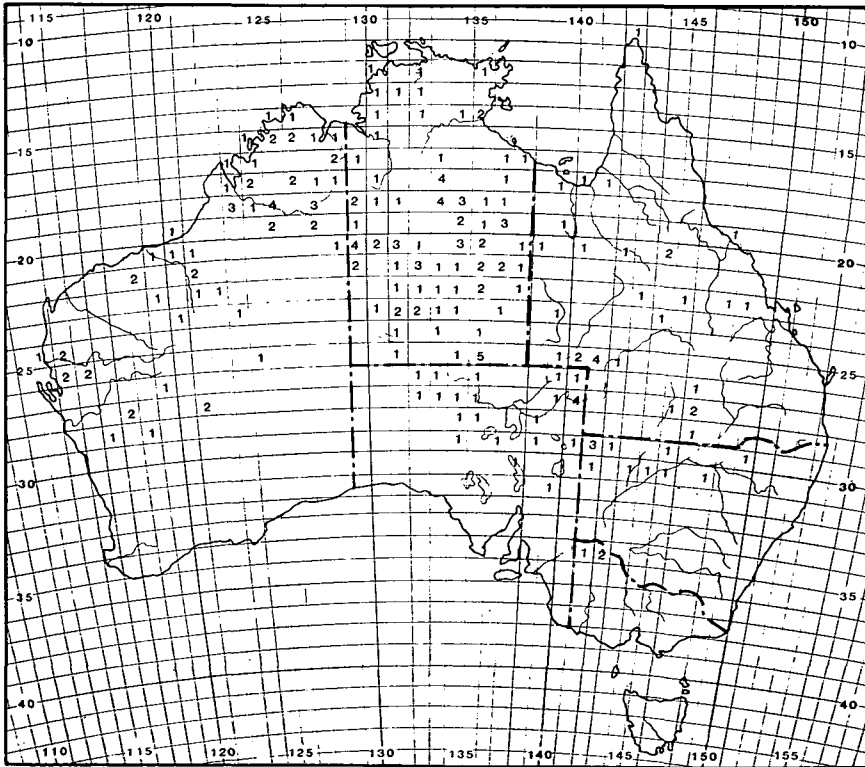
### Biology and geography

There are about 24 species of *Bergia* worldwide with centres of diversity in southern Africa and Australia. The genus has an essentially Gondwanan distribution, being represented in Africa, India, Australia and South America. Ten species are recorded for southern Africa, eight of which are restricted to this region (Obermeyer 1976). Two species, *B. ammannioides* Roxb. and *B. capensis* L., are widespread from southern Africa through to India and parts of South East Asia (Backer 1951). *B. capensis* has also been recorded as an adventive in South America and Europe (Tucker 1986). *B. ammannioides* is further distributed to southern China, Taiwan, the Philippines and south through Java, Timor to Australia (Backer 1951). Five species are recorded from the Indian subcontinent; of these *B. ammannioides* and *B. capensis* are widespread, *B. suffruticosa* (Delile) Fenzl extends through the Middle East to tropical Africa, *B. aestivalis* Wight & Arnott appears restricted to the region, while the remaining species, *B. trimera* Fischer & C. Meyer, is disjunct, being also recorded from Australia (Thiselton Dyer 1874). A further species, *B. serrata* Blanco, is endemic to the Philippines although some workers (e.g. Backer 1951) have doubted the validity of its distinction from *B. ammannioides*. Based on the limited material seen, *B. serrata* appears quite distinct from Australian material of *B. ammannioides*. In particular, *B. serrata* has ten stamens which clearly distinguishes it from Australian *B. ammannioides*. Currently only two native species are known from the New World: *B. arenarioides* Camb. from Brazil and *B. texana* (Hook.) Seub. from southern U.S.A. and northern Mexico.

Australia as the other centre of diversity has 12 taxa (ten species, one with three subspecies). Two species, *B. ammannioides* and *B. trimera* extend outside Australia; the remainder are endemic. Despite its Gondwanan distribution *Bergia* is not recorded for Tasmania, New Zealand or New Guinea.

In Australia the genus is centred within the arid zone and notably absent from the south western area, most of the east coast and Tasmania (Map 1). *Bergia* occurs in habitats subject to periodic inundation and within the arid zone is restricted to habitats such as floodouts, claypans, swales and creek lines. The absence of *Bergia* from the more mesic areas of Australia is of interest particularly for a genus with apparent high dispersal ability and adaptations to seasonally inundated habitats. A possible explanation may be that *Bergia* is not a strong competitor with other wetland species in favourable conditions. The ability of *Bergia* species to survive higher salinities, higher temperatures and extended dry periods, however, means that they establish well under the low competition in the marginal wetland habitats of the arid zone.

*B. trimera* is the most widespread species in Australia (Map 8) and is also recorded from India (Thiselton Dyer 1874). Its occurrence in Malesia would seem likely, but has not been confirmed. As it is easily confused with *B. ammannioides* there is a need to examine Malesian specimens. *B. ammannioides*, although widespread globally, is not as common nor as widespread in Australia as *B. trimera*. This may suggest that *B. trimera* is of Australian origin and that *B. ammannioides* is a recent arrival in Australia from Malesia. Further critical studies into the patterns of variation shown by *B. ammannioides* are needed.



Map 1. Distribution of *Bergia* in Australia as recorded from herbarium specimens. Figures show the number of taxa recorded from each 1° square.

*Bergia* species can clearly disperse long distances and successfully establish in new areas as exemplified by the introductions recorded for Europe and South America (Tucker 1986). A number of authors (e.g. Verdcourt 1968) have suggested that the small seeds could be easily dispersed by birds. *Elatine* seed, which is of similar size and texture to *Bergia*, has been recorded in the mud attached to feet and feathers of birds (Salisbury 1967). Floodwaters would also be an important dispersal agent. Salisbury (1967) suggested that in *Elatine* the pitted seed surface would greatly enhance their buoyancy; this would apply equally to *Bergia*. The most widespread species, *B. ammannioides* and *B. capensis*, are also the two species known to have become established as adventives.

There appear to be no studies of pollination biology in *Bergia*. Cleistogamy is a frequent reproductive strategy in aquatic plants (Sculthorpe 1967) and is reported for some taxa of *Elatine* (Keighery 1984; Salisbury 1967). No open flowers have been observed on herbarium specimens of either *B. occultipetala* or *B. diacheiron*. The flowers are also sessile and highly cryptic due to the surrounding stipules and bracteoles. In some dissected flowers the anther has been found adhering to the stigma. As the capsule matures and expands the adherence of the anther to the stigma appears to be strong enough to cause detachment of the anther from the filament. These species (Group 3) are likely to be cleistogamous.

Other species having small inconspicuous flowers which appear to be chasmogamous are considered likely to be self-pollinated. Similar observations of the anther adhering to the stigma have been made by the author in *B. trimera*, *B. ammannioides* and *B. pedicellaris*. At anthesis the stamens and stigma are at the same level within the flower. *B. pusilla* would also belong in this group. Several Australian species (Group 4) have colourful flowers often with the pale pink petals contrasting with the blue to purple gynoecium. The petals are prominently reflexed during anthesis with the anthers separated from the stigma. This group of species may have some degree of outcrossing and in cultivation the flowers of *B. henshallii* are visited by ants.

### Morphological characters

The following characters proved to be of taxonomic value within Australian *Bergia* species.

#### *Pubescence*

Both glandular and eglandular hairs are found on Australian species of *Bergia* and the indumentum is of some taxonomic value. The eglandular hairs (type c) are uniseriate, c. 0.5 mm long, shiny, transparent and colourless (Fig. 1B). The septa are usually readily observed. As described by Ramayya and Prabhakar (1975), the glandular hairs are multiseriate and capitate. These authors also recorded sessile forms of the glandular hairs. Two forms were also noted in Australian species. The shorter, type b glandular hairs (c. 0.1 mm long) have a persistent, enlarged, globular terminal head with copious secretion which results in a shiny, transparent, resinous appearance (Fig. 1B). The longer, type a glandular hairs (c. 0.25 mm long) mostly lack a distinct terminal head and the hair appears dull and opaque (Fig. 1B).

#### *Inflorescence*

Variation of inflorescence type is shown within the genus by species having the following attributes: flowers solitary, 1-2 per axil, 2-8 per axil, numerous flowers in dense axillary clusters, compound cymes. The inflorescence in Australian species is predominantly a solitary flower which in most taxa is conspicuously pedicellate although two taxa (*B. diacheiron*, *B. occultipetala*) have sessile flowers. *B. pedicellaris* typically has two flowers per axil; *B. trimera* and *B. ammannioides* have numerous flowers in dense axillary clusters. The inflorescence type has been used as an important primary character for the infrageneric classification of *Bergia* (Niedenzu 1925).

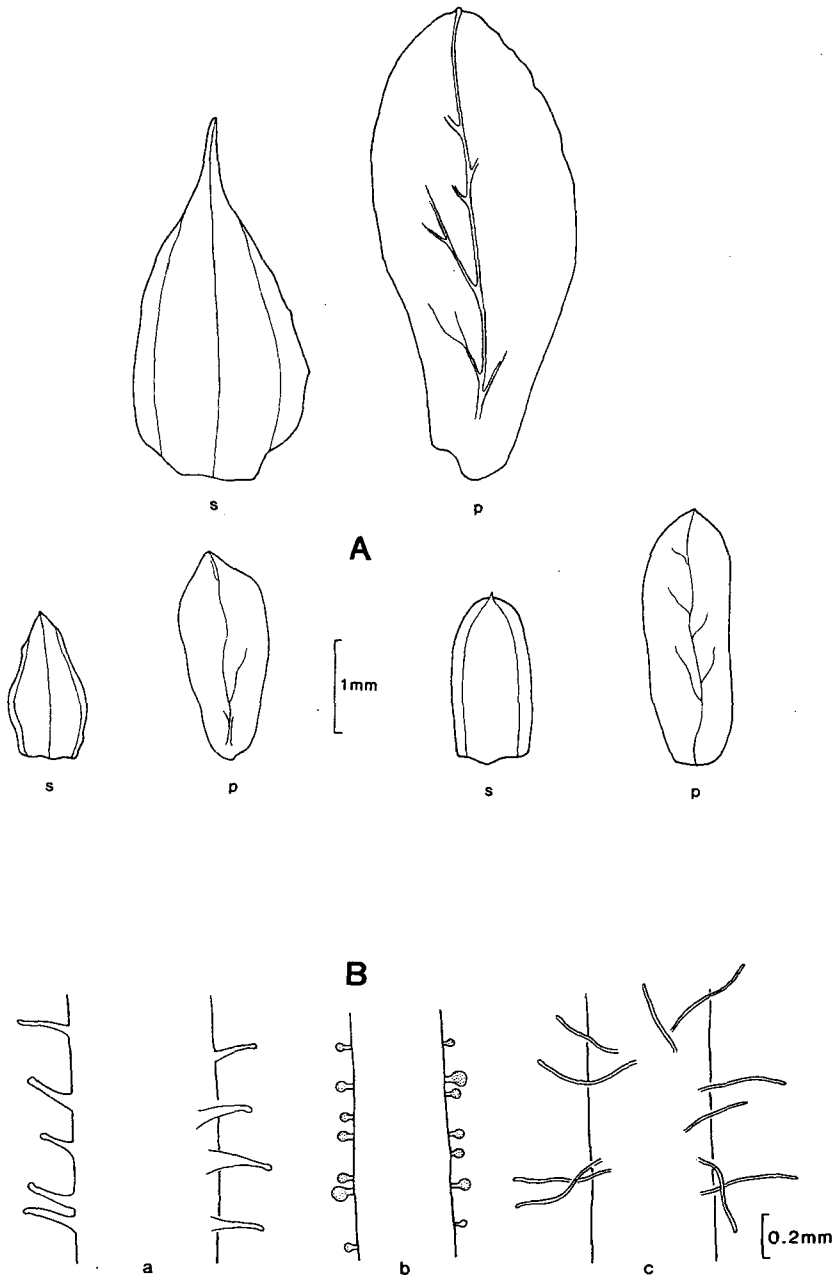


Fig. 1. A. Representative sepals (s) and petals (p) of the three subspecies of *Bergia perennis*. Upper: subsp. *perennis* (Maconochie 2470); lower left: subsp. *exigua* (Badman 1070); lower right: subsp. *obtusifolia* (Thomson 886). B. Indumentum types found in Australian *Bergia* species. a, long glandular hairs lacking globular terminal head; b, short glandular hairs with enlarged globular head; c, uniseriate eglandular hairs. (a, Royce 10331; b, Leach 796; c, Parker 285).

*Flower and fruit*

The flowers in Australian species of *Bergia* vary from the small inconspicuous flowers of *B. occultripetala* to the large flowers with conspicuous pink petals of *B. henshallii*. Apart from floral part number, features of the sepals and ovary shape have proved useful taxonomic characters.

The sepals have a scarios margin which may only be obvious in the basal part. Where the margin is lacking apically, the sepals typically have an acute to acuminate apex (Fig. 1A). In some taxa such as *B. perennis* subsp. *obtusifolia* (Fig. 1A) the scarios margin continues for the length of the sepal to produce an obtuse apex, often with a protruding short mucro. The margin has been interpreted by Obermeyer (1976) as stipular in origin, supported by observations in *B. glomerata* (a South African Cape endemic), where in the outer sepals the margin is separated to form a basal pair of stipule-like auricles. A similar occurrence is reported in *B. auriculata* (q.v.) where the outer three sepals also have a basal pair of auricles while the inner two sepals have the margin continuously attached to the sepal. Dimorphism of the sepals also occurs in *B. occultripetala* where the three outer sepals are larger than the inner two (q.v.).

The stamens, present in one or two whorls, are either equal to or twice the number of sepals or petals. The outer whorl, alternating with the petals, has filaments with broadly dilated bases. The inner whorl is generally slightly shorter. In those taxa with only one whorl the members alternate with the petals. The number of staminal whorls is a reliable character within the Australian species and is also considered a useful character in defining some species groups. However Verdcourt (1968) reported *B. ammannioides* in Africa as varying with 3-12 stamens in either one or two whorls.

The ovary and subsequent mature capsule is ovoid to pyriform in some taxa, globular to depressed-globular in others. The styles can be comparatively long with a terminal capitate stigma or the stigmas  $\pm$  sessile on the ovary summit and often recurved.

*Seed*

Most Australian *Bergia* species have an alveolate, deeply pitted seed surface but three taxa have distinctive smooth to faintly striate seeds.

**BERGIA L.**

**Bergia L.**, Mant. Pl. Alt. :152, 241 (1771); DC., Prodr. 1:390 (1824); Benth. & Hook., Gen. Pl. 1:162 (1862); Thiselton Dyer, Fl. Brit. India 1:251 (1874); Niedenzu, Pflanzenfam. ed. 1, 3, 6:281 (1895); ed. 2, 21:273 (1925); Backer, Fl. Malesiana 4:204 (1951); Obermeyer in Fl. Southn Afr. 22:24 (1976).

*Type species: B. capensis* L.

Erect to prostrate herbs, annual or perennial, usually in seasonally wet areas. *Indumentum* of multiseriate glandular or uniseriate eglandular hairs. *Leaves* opposite, usually serrulate, with teeth often conspicuously red gland-tipped, base attenuated into a short petiole. *Stipules* narrow-triangular, herbaceous with scarios, laciniate margins, usually with conspicuous midrib, apex acuminate, bases often connate and/or adnate to petioles, persistent. *Flowers* solitary, paired or in dense fascicles, bracteoles present. *Sepals* 3-5, conspicuous, usually herbaceous with scarios margins,  $\pm$  fimbriate, concave, sometimes keeled, persistent. *Petals* as many as sepals, white to pink, persistent. *Stamens* 3-10, persistent, pink to purple. *Capsule* often obscured by persistent floral parts, walls subcrustaceous. *Seeds* cylindrical, straight or curved, smooth, faintly marked or alveolate.

About 24 species in the drier parts of tropical and warm-temperate regions of the world and with 10 species in Australia.

## Key to species in Australia

1. Stamens 10 ..... 2  
Stamens 3-5 ..... 6
2. Indumentum of short glandular hairs with globular terminal cell ..... 3  
Plant glabrous or indumentum eglandular or of long glandular hairs lacking an enlarged terminal cell ..... 5
3. Leaves longer than 6 mm ..... 4  
Leaves shorter than 6 mm ..... 5. *B. auriculata*
4. Annual,  $\pm$  erect; pedicels 15-25 mm long; capsule globular; stigmas  $\pm$  sessile; seeds smooth, to 0.3 mm long ..... 1. *B. pedicellaris*  
Perennial, prostrate; pedicels to 7.5 mm long; capsule pyriform; styles 1-1.5 mm long; seeds alveolate, 0.5-0.75 mm long ..... 2. *B. henshallii*
5. Stems glabrous; leaves mostly greater than 10 mm long,  $\pm$  entire; stipules greater than 1 mm broad; sepals 5-6 mm long ..... 4. *B. barklyana*  
Stems mostly pubescent, rarely glabrous; leaves less than 10 mm long, serrate; stipules to 0.5 mm broad; sepals to 3.5 mm long ..... 3. *B. perennis*
6. Calyx and corolla 5-merous ..... 7  
Calyx and corolla 3-4-merous ..... 9
7. Flowers in dense fascicles; bracteoles inconspicuous at base of pedicel; seed faintly striate ... 6. *B. ammannioides*  
Flowers solitary; bracteoles prominent, at apex of pedicel; seed distinctly alveolate ..... 8
8. Sepals longer than petals, externally with blunt, transparent, strap-like, long (c. 0.7 mm) hairs; capsule c. 2 mm diam., 5-(rarely 4-) locular ..... 8. *B. occulipetala*  
Sepals shorter than petals, externally glabrous or sparsely pubescent with short (less than 0.5 mm) hairs; capsule 1-1.2 mm diam., 3-locular ..... 9. *B. diacheiron*
9. Annual, erect, glabrous; capsule 4-locular ..... 10. *B. pusilla*  
Perennial or annual, prostrate or decumbent, rarely erect in young stages, mostly pubescent; capsule 3-(rarely 4-) locular ..... 7. *B. trimera*

1. *Bergia pedicellaris* (F. Muell.) Benth., Flora Australiensis 1:180 (1863); Ewart & Davies, Fl. N. Terr. 194 (1917); Niedenzu in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21:274 (1925); Chippendale, Proc. Linn. Soc. N.S.Wales 96:249 (1971); Verdon in Jessop, Fl. Central Austral. 229 (1981); Green, Census Vasc. Pl. W.Austral. 188 (1985).

*Elatine pedicellaris* F. Muell., Fragm. Phytogr. Austral. 2:145 (1861).

*Lectotype* (here designated): Fitzmaurice River, *F. Mueller s.n.* (Lecto.: MEL 534788, isolecto.: K).

Spreading or erect annual to 30 cm high. *Indumentum* of long type a glandular hairs or rarely lacking. *Leaves* elliptic to narrow-elliptic, 10-35 x 3-11 mm, acute, glandular hairy on midvein and at base, margin serrate, mid-vein prominent. *Stipules* 2.5-3 mm long, c. 0.3 mm wide at base. *Flowers* single or paired; pedicel slender, 15-40 mm long. *Bracteoles* at base of pedicels, narrow-triangular, c. 1 x 0.1 mm. *Sepals* 5, ovate, 2-3.5 x 1-1.5 mm, acuminate, glandular-pubescent, green or pink, margin fimbriate, keel absent or rarely slightly developed. *Petals* 5, elliptic, c. 3 x 1-2 mm, acute, shorter or equalling sepals, erect at anthesis. *Stamens* 10,  $\pm$  equal, 1.5-2 mm long; filament base slightly expanded to c. 0.2 mm. *Capsule* globular, 2.5-3.5 mm diam., 5-locular; stigmas  $\pm$  sessile. *Seeds* ellipsoid or slightly curved, 0.25-0.3 x 0.1-0.15 mm, smooth, shiny, light brown.

*Habitat*

Frequently on cracking clay soils, rarely on alluvial sandy soils.



*Selected specimens from 63 collections examined*

WESTERN AUSTRALIA: Durack River, ± 80 km SSW Wyndham, *A.C. Beaglehole 51474*, 28.v.1976 (PERTH); Yule River, Woodstock Station, *N.T. Burbidge 5947*, 30.iv.1958 (CANB); Halls Creek, *C.A. Gardner 7160*, 14.v.1944 (PERTH); Euro Gorge, Drysdale River National Park, *K. Kenneally 4411*, 17.viii.1975 (PERTH); 4 km SW Shay Gap, *Newbey 10256*, 2.vii.1984 (PERTH); Googhenama Creek, *R.D. Royce 1801*, 18.v.1947 (PERTH).

NORTHERN TERRITORY: Calvert River, *L.J. Brass 93*, xi.1921 (BRI, CANB); Skull Creek, *N. Byrnes 742*, 10.v.1968 (BRI, NT); Newcastle Waters, *G.M. Chippendale 5832*, 18.iv.1959 (NT); Andado Station, *P.K. Latz 6763*, 14.iv.1977 (AD, CANB, NSW, NT, PERTH); 42 miles W Wavehill Police Station, *R.A. Perry 2274*, 27.vi.1949 (CANB, NT).

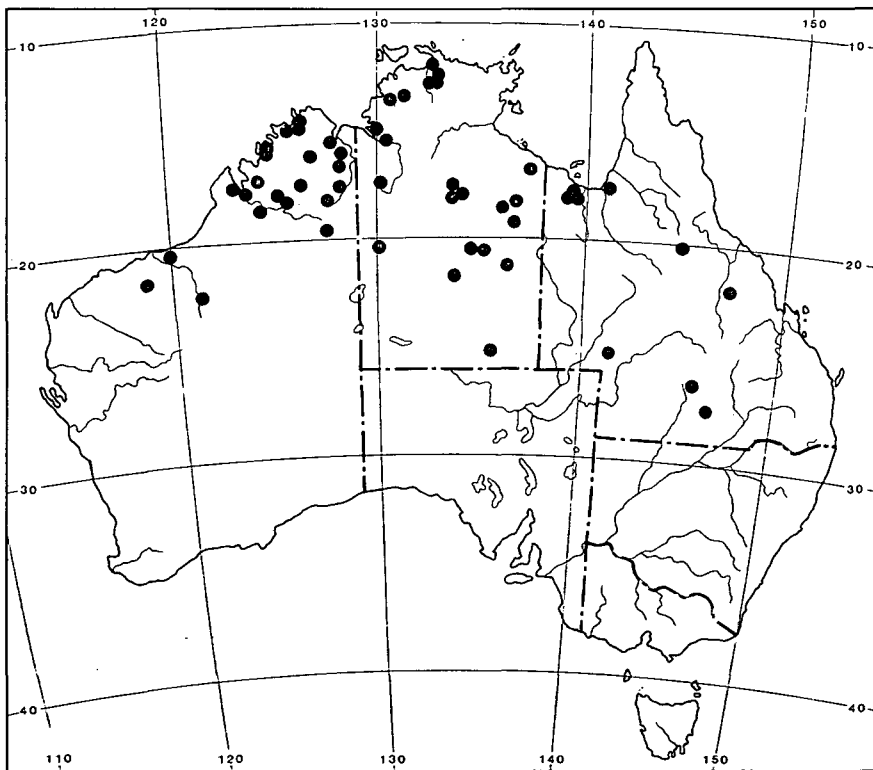
QUEENSLAND: Lowholm, NW Pentland, *S.T. Blake 19366*, 4.vii.1954 (BRI); Elmina Station, *S.L. Everist 2947*, 26.iii.1947 (BRI); Currawilla, *S.L. Everist 4090A*, 29.viii.1949 (BRI); c. 10 km SW Normanton, *R. Pullen 8853*, 23.iv.1974 (BRI, CANB); Leichhardt River, SE Burketown (CANB), *R. Pullen 9052*, 3.v.1974 (CANB).

*Distribution*

Found in all districts of the Northern Botanical Province and in the Fortescue and Mueller Districts of the Eremaean Botanical Province of Western Australia; in all botanical provinces of the Northern Territory; and in the Burke, Gregory North, Maranoa, North Kennedy, South Kennedy and Warrego Pastoral Districts of Queensland (Map 2).

*Etymology*

The specific epithet refers to the prominent long pedicels of this species.



Map 2. Distribution of *B. pedicellaris*.

### Notes

Mueller records this species from the Victoria and Fitzmaurice Rivers and their tributaries. The MEL sheet from the Fitzmaurice River with Mueller's handwriting is here designated as the lectotype. In the protologue of *Elatine pedicellaris*, Mueller clearly had no intention of publishing the name under *Bergia*. Hence the combination *Bergia pedicellaris* made by Bentham should be attributed to Bentham alone. This species appears closely related to the African *B. anagalloides* E. Mey. ex Fenzl and *B. polyantha* Sond.; particularly the latter. It differs by the glandular indumentum, longer pedicels and smooth seeds.

### 2. *Bergia henshallii* G. Leach, sp. nov.

*Bergia perennis* (F. Muell.) Benth. form B, Verdon in Jessop, Fl. Central Austral. 229 (1981).

*B. perenni* (F. Muell.) Benth. affinis, sed pilis glandulosis, plerumque foliis longioribus et latioribus, sepalis longioribus et manifeste carinatis, utrinque carina conspicua laciniata differt.

*Type:* B.G. Thomson 887, 15 km S Tennant Creek, 23.x.1985 (Holo.: NT, iso.: CANB, BRI, MEL).

Prostrate perennial. *Indumentum* of sparse to dense short type b glandular hairs. *Leaves* narrow-elliptic to elliptic, 6-25 x 2.5-7.5 mm, acute, glandular hairs often restricted to leaf base, margin serrate, veins prominent. *Stipules* 2-4 mm long, c. 0.5 mm wide at base. *Flowers* solitary; pedicel 0.6-7.5 mm long. *Bracteoles* inconspicuous, at base of pedicel, narrow-triangular, c. 3 x 0.5 mm, pubescent, margin fimbriate. *Sepals* 5, narrow-ovate, 3-7 x 1.2-2.4 mm, acute to shortly acuminate, glandular-pubescent, green or pink, margin broad, often fimbriate, keel prominent, laciniate. *Petals* 5, narrow-obovate, 3.5-6.5 x 1.8-2.5 mm, acute to obtuse, mostly longer than sepals, reflexed at anthesis. *Stamens* 10; antipetalous ones 1.3 mm long, filament flattened, narrowly dilated to c. 0.4 mm wide at base; antisepalous 1.6-4 mm long, filament broadly dilated to c. 0.8 mm wide at base, margin recurved. *Capsule* pyriform, 1.75-2.8 mm long, 1.5-3 mm diam., 5-locular; styles 1-1.5 mm long; stigmas clavate, pink. *Seeds* reniform, 0.5-0.75 x 0.25-0.3 mm, alveolate, dark brown. (Fig. 2C).

### Habitat

Commonly in inundated areas such as river beds and floodouts on sandy soil.

### Selected specimens from 51 collections examined

WESTERN AUSTRALIA: 80 km from Halls Creek to Wolf Creek Crater, *N.B. Carriage* 63, 26.vii.1979 (PERTH); Dampier Downs Station, *M. Delong s.n.*, 25.iii.1983 (PERTH); Dusty Bore, Gogo, *C.A. Gardner* 10152, 6.v.1957 (PERTH); E of Gregory Range, *R.D. Royce* 1898, 22.v.1947 (PERTH).

NORTHERN TERRITORY: 10 miles NE Argadargada Homestead, *G.M. Chippendale* 388, 22.ix.1954 (NT); Simpson Desert, *T.S. Henshall* 1414, 14.iv.1977 (NT); Georgina Downs Station, *T.S. Henshall* 4117, 24.viii.1986 (NT); 20 miles WNW Papunya, *P.K. Latz* 1337, 23.iii.1971 (NT); Merrina Waterhole, *G.J. Leach* 796, 5.ix.1986 (NT); Alroy Downs, Bore 28, *B.G. Thomson* 223, 14.ix.1982 (NT).

### Distribution

Found in the Fortescue and Canning Districts of the Eremaean Botanical Province, and in the Dampier and Hull Districts of the Northern Botanical Province of Western Australia; and in the Central South, Central North, Barkly Tablelands and Victoria River Botanical Provinces of the Northern Territory (Map 3).

### Etymology

The specific epithet acknowledges the botanical efforts of Tom Henshall over many years;

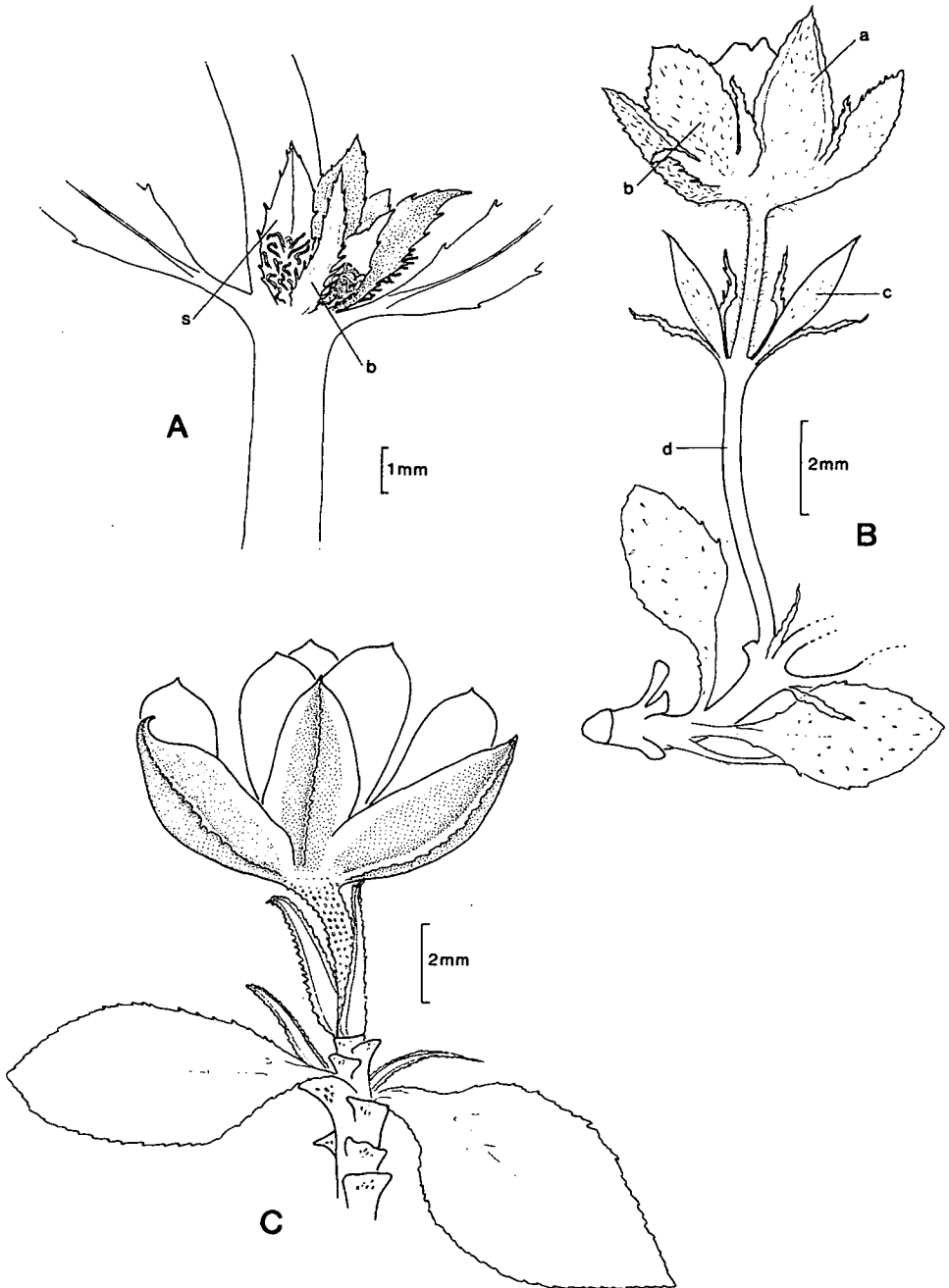


Fig. 2. A. Flower of *Bergia occultipetala* with stipules removed. s, sepal; b, bracteole. (Symon 6924A). B. *Bergia auriculata*. a, inner sepal with entire margin; b, outer sepal with auricles; c, bracteole; d, pedicel (Gardner 7828). C. Flower of *Bergia henshallii* (Thomson 887).

well known for his collections of, and enthusiasm for, the Australian arid zone flora and in particular his attention to collecting Northern Territory bergias.

### Notes

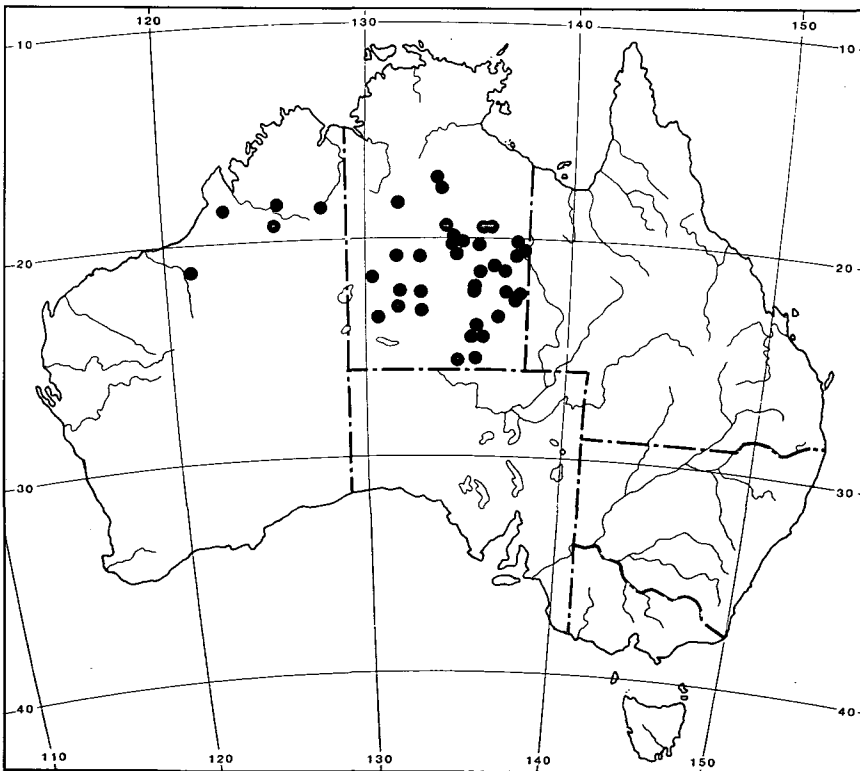
Collections from the Tennant Creek area and eastwards are generally of larger dimensions in leaves and flowers and many specimens have particularly showy flowers. These have some potential as an ornamental ground cover.

3. ***Bergia perennis*** (F. Muell.) Benth., *Flora Australiensis* 1:181 (1863); F.M. Bailey, *Qld Fl.* 1:100 (1899); Ewart & Davies, *Fl. N. Terr.* 194 (1917); Niedenzu in Engl. & Prantl, *Nat. Pflanzenfam.* ed. 2. 21:274 (1925); Chippendale, *Proc. Linn. Soc. N.S. Wales* 96:249 (1971); Green, *Census Vasc. Pl. W. Austral.* 188 (1985); Jessop in Jessop & Toelken, *Fl. S. Austral.* 883 (1986).

*Elatine perennis* F. Muell., *Fragm. Phytogr. Austral.* 2:146.

*Lectotype* (here designated): Sturts Creek, *F. Mueller s.n.* (Lecto.: MEL 534789, isolecto.: K, ?AD 97620385).

Prostrate perennial. *Indumentum* of eglandular or type a glandular hairs or lacking. *Leaves* narrow-elliptic to almost circular, 1.5-10 x 0.75-3.5 mm, acute to obtuse, glabrous



Map. 3. Distribution of *B. henschallii*.

to sparsely pubescent, margin entire to serrate, secondary venation obscure. *Stipules* 0.7-2.5 mm long, c. 0.5 mm wide at base. *Flowers* solitary; pedicel to 6 mm long. *Bracteoles* usually inconspicuous, 0-1.5 mm from base of pedicel, 0.75-2.5 x 0.2-0.4 mm, like stipules. *Sepals* 5, elliptic to ovate, 0.75-3.5 x 0.5-2 mm, obtuse to acuminate, glabrous to sparsely pubescent, green to pink, margin broad, entire to serrulate, keel absent or rarely midrib prominent but never winged. *Petals* 5, narrow-obovate to spatulate, 1.25-5 x 0.5-2 mm, obtuse often mucronate, reflexed at anthesis. *Stamens* 10; antipetalous ones c. 1-2 mm long, filament slightly dilated at base, to 0.25 mm wide; antisealous 1.5-3 mm long, filament dilated to 0.5 mm wide at base. *Capsule* globular to pyriform, 1-2.2 x 1-2.2 mm, 5-locular; styles 0.5-1.5 mm long. *Seeds* ovoid to reniform, 0.5-0.75 x 0.25-0.45 mm, alveolate, brown.

### Etymology

The specific epithet refers to the perennial nature of this species.

### Notes

There is considerable variation within *B. perennis* with some variants morphologically and geographically distinct as to warrant recognition at the subspecific level. These have been long informally recognised (Verdon, 1981).

As discussed previously in the introduction and under *B. pedicellaris*, Mueller clearly had no intention of accepting *Bergia* at the generic level. Thus the transfer of *Elatine perennis* to *Bergia* should be attributed to Bentham alone.

As Mueller records the species only from Sturts Creek the MEL sheet with Mueller's handwriting is here designated as the lectotype.

### Key to subspecies

1. Leaves narrow-elliptic to elliptic; capsule pyriform ..... a. subsp. *perennis*  
    Leaves elliptic to  $\pm$  circular; capsule globular ..... 2
2. Leaf apex obtuse; bracteoles obscure, at base of pedicel; sepals mostly greater than 1.5 mm long, c.  $\frac{1}{2}$  length of petal, apex obtuse; indumentum if present of eglandular uniseriate hairs ..... b. subsp. *obtusifolia*  
    Leaf apex acute, rarely obtuse, bracteoles conspicuous, mostly well above base of pedicel, sepals mostly less than 1.5 mm long, c.  $\frac{3}{4}$  length of petal, apex acute; indumentum if present of multiseriate glandular hairs ..... c. subsp. *exigua*

### 3a. subsp. *perennis*.

Indumentum of dense eglandular hairs, glabrescent on older parts. *Leaves* narrow-elliptic to elliptic, 3-10 x 2-3.5 mm, acute, margin serrate. *Stipules* 2-2.5 mm long. *Bracteoles* inconspicuous, at base of pedicel, c. 2.5 x 0.4 mm. *Sepals* ovate, 2-3.5 x 1.3-2 mm, acute to acuminate. *Petals* 3.5-5 x 1.25-2 mm, longer than sepals. *Stamens* 2-3 mm long. *Capsule* pyriform, to 2.2 x 2.2 mm; styles 1-1.5 mm long. (Fig. 1A).

### Habitat

In clay or sand soils, occasionally in saline situations.

### Specimens examined

WESTERN AUSTRALIA: Two Mile Creek, Warralong Stn, N.T. Burbidge 767, 19.v.1941 (PERTH).

NORTHERN TERRITORY: 40 km W Suplejack Stn, T.S. Henshall 2352, 30.ix.1978 (NT); 12 km E No. 37 bore, Wallamunga Stn, W.A. Low 381, 19.x.1987 (NT); Sanctuary Swamp, J.R. Maconochie 2470, 3.vii.1980 (B, CBG, NT); 45 miles SW Mongrel Downs Homestead, S. Parker 284, 285, 2.viii.1970 (NT); 6 km SW MacFarlanes Bore, S. Parker 311, 5.viii.1970 (AD, NT).

*Distribution*

Found in the Fortescue and Mueller Districts of the Eremaean Botanical Province of Western Australia; and in the extreme western area of the Central Northern Botanical Province and the southwestern Victoria River Botanical Provinces of the Northern Territory. (Map 4).

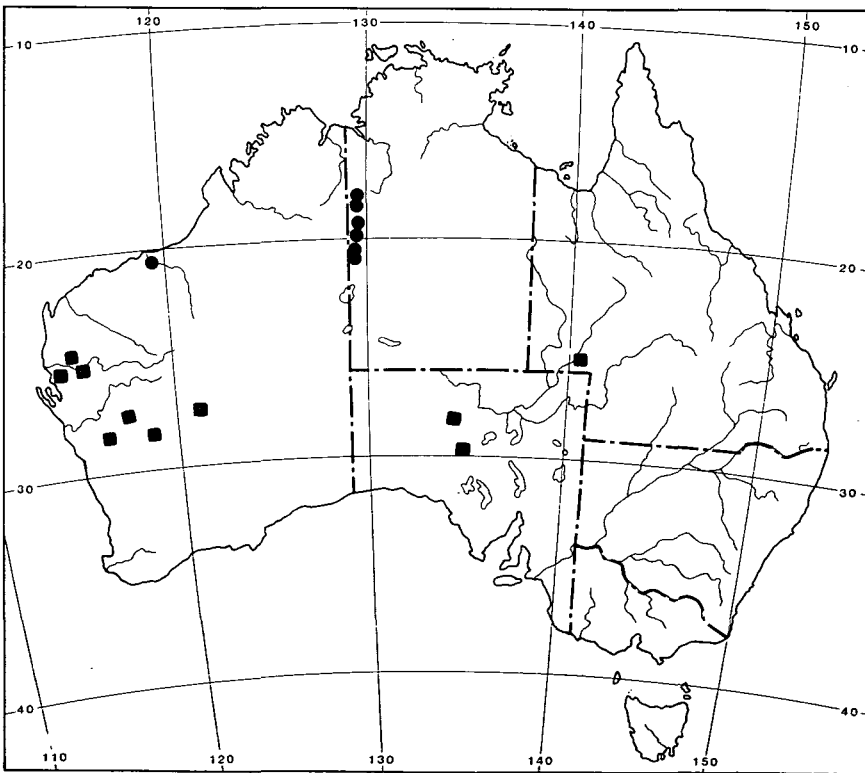
3b. subsp. *obtusifolia* G. Leach, subsp. nov.

*Bergia perennis* (F. Muell.) Benth. form A, Verdon in Jessop, Fl. Central Austral. 229 (1981).

Ab aliis subspeciebus foliis ellipticis ad rotundis, apicibus obtusis, marginibus integris vel vix serrulatis, floribus minoribus, apicibus sepalorum obtusis, capsulis globosis differt.

*Type:* B.G. Thomson 886, Stirling Swamp on Stuart Highway, c. 32 km S.W. of Barrow Creek, Northern Territory, 23.x.1985: (Holo.: NT, iso.: AD, BRI, CANB, CBG, DNA, K, L, MEL, NSW, PERTH).

*Indumentum* of eglandular hairs or lacking. *Leaves* elliptic to almost circular, 1.5-10 x 1-2.25 mm, obtuse, margin smooth to inconspicuously serrulate. *Stipules* 0.7-1.5 mm long. *Bracteoles* inconspicuous, at base of pedicel, c. 1 x 0.25 mm. *Sepals* elliptic to ovate, 1.25-2.5 x 1-2 mm, obtuse. *Petals* 2-3.8 x 0.9-1.25 mm, to twice length of sepals. *Stamens* to 1.75 mm long. *Capsule* globular, 1-1.5 x 1-1.5 mm; styles 0.75-1 mm long. (Fig. 1A).



Map 4. Distribution of *B. perennis* subsp. *perennis* ● and subsp. *exigua* ■.

**Habitat**

In sandy or loam soils; often in saline areas.

**Selected specimens from 24 collections examined**

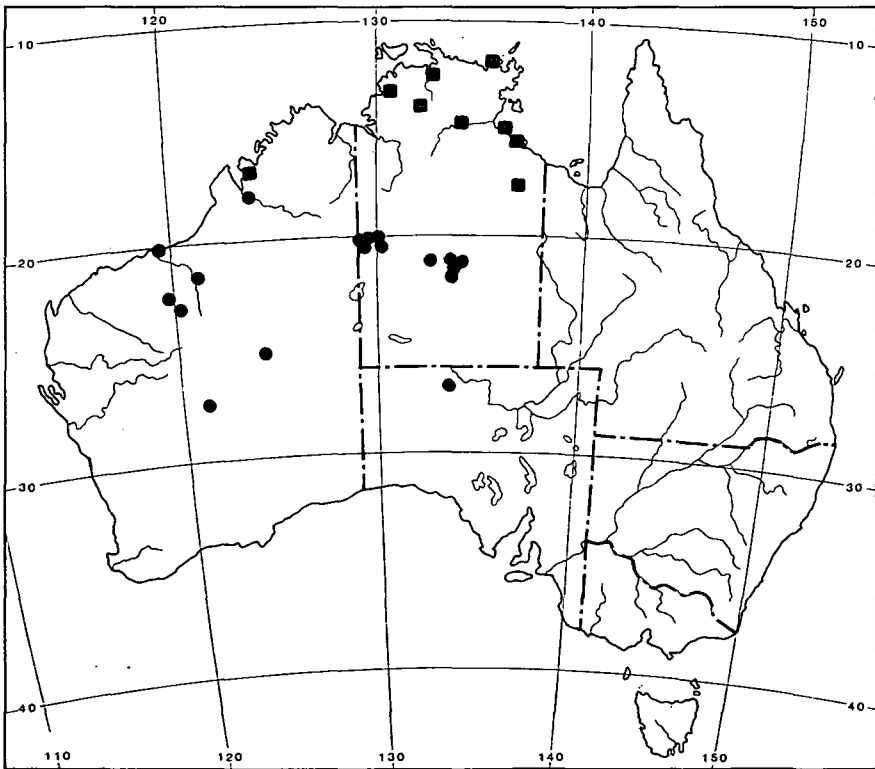
WESTERN AUSTRALIA: Fortescue River, just S Roy Hill, *A.C. Beaglehole 11411*, 12.viii.1965 (NSW); Yandal, NNW Leonora, *W.E. Blackall s.n.*, ix.1939 (PERTH); Mungilli claypan, *A.S. George 5441*, 26.vii.1963 (PERTH); near Livinga Station, *M. Lazarides 6471*, 1.viii.1959 (CANB, MEL, PERTH); Rabbit proof fence, E of Gregory Range, *R.D. Royce 1897*, 22.v.1947 (PERTH).

NORTHERN TERRITORY: Stirling Creek, *N. Byrnes 1124*, 22.xi.1968 (DNA, NT); 9 km SE Rabbit Flat, *T.S. Henshall 3996*, 22.v.1986 (CANB, DNA, NT, PERTH); 8 mile bore, 14 miles N Willowra homestead, *P.K. Latz 1230*, 15.i.1971 (AD, NT, PERTH); Lake Ruth, *J.R. Maconochie 1045*, 26.v.1970 (AD, BRI, NT, PERTH); Lake Alex, *D. Nelson 1923*, 30.viii.1969, (AD, NT, PERTH).

SOUTH AUSTRALIA: 10 miles SW Granite Downs, *N. Forde 1008*, 26.ix.1960 (CANB).

**Distribution**

Found in the Dampier District of the Northern Botanical Province and in the Austin, Carnegie and Fortescue Districts of the Eremaean Botanical Province of Western Australia; in the Central North Botanical Province of the Northern Territory; and in the North Western region of South Australia. (Map 5).



Map 5. Distribution of *B. perennis* subsp. *obtusifolia* ● and *B. pusilla* ■.

### Etymology

The subspecific epithet refers to the obtuse leaf apices; a distinguishing feature from the other subspecific taxa of *Bergia perennis*.

### 3c. subsp. *exigua* G. Leach, subsp. nov.

*Bergia perennis* (F. Muell.) Benth. form C, Verdon in Jessop, Fl. Central Austral. 229 (1981).

*Bergia* aff. *pedicellaris* (F. Muell.) Benth. of Jessop in Jessop & Toelken, Fl. S. Austral. 883 (1986).

*B. perennem* subsp. *obtusifoliam* G. Leach aemulans, ab aliis subspeciebus bracteolis manifestis supra basim pedicelli, floribus parvissimis, sepalorum apicibus acutis, petalis sepalae aequantibus vel paulo superantibus, capsulis globosis differt.

*Type:* F.J. Badman 1070, 30 km S Mt Willoughby Homestead and 1 km W of Stuart Highway, South Australia, 1984, (Holo.: AD, iso.: NT).

*Indumentum* of long type a glandular hairs or lacking. *Leaves* elliptic to broad-elliptic, 1.5-5 x 0.75-2 mm, acute, rarely obtuse, margin entire to serrate. *Stipules* 0.75-1.5 mm long. *Bracteoles* usually conspicuous, (0.25-) 0.5-1.5 mm from base of pedicel, 0.75-1.5 x c. 0.2 mm. *Sepals* ovate, 0.75-2 x 0.5-1 mm, acute. *Petals* 1.25-2.25 x 0.5-1 mm, barely exceeding sepals. *Stamens* 1-1.5 mm long. *Capsule* globular, 1-1.75 x 1-1.75 mm; styles to 0.75 mm long. (Fig. 1A).

### Habitat

Predominantly on clay pans.

### Specimens examined

WESTERN AUSTRALIA: Lake Yandel, *W.E. Blackall s.n.*, ix.1939 (PERTH); 3 km E Pell Creek, *R.J. Cranfield 2005*, 24.iv.1982 (PERTH); Marron Station, *R.J. Cranfield 2256*, 6.v.1982 (PERTH); 4 miles W Yalgoo, *C.A. Gardner 7759*, 10.x.1945 (PERTH); Nallan, *C.A. Gardner 7825*, 13.x.1945 (PERTH); 13 km W Yalgoo, *G.J. Keighery 5132*, 25.viii.1982 (PERTH); 18 miles N Youanmi, *R.D. Royce 10331*, 13.x.1972 (PERTH); 115 km E Carnarvon, *P.G. Wilson 8417*, 29.vii.1969 (CANB, PERTH).

SOUTH AUSTRALIA: McDoull Peak Station, *Cleland s.n.* (2 sheets), 31.x.1929 (AD).

QUEENSLAND: Mooraberree, about 40 miles ENE Betoota, *S.E. Everist 4107*, 3.ix.1949 (BRI).

### Distribution

Found in the Austin and Carnarvon Districts of the Eremaean Botanical Province of Western Australia; in the Lake Eyre Basin region of South Australia; and in the Gregory South Pastoral District of Queensland. (Map 4).

### Etymology

The subspecific epithet refers to the diminutive nature of this taxon relative to the other subspecies of *B. perennis*.

### 4. *Bergia barklyana* G. Leach, sp. nov.

*Bergia perenni* (F. Muell.) Benth. subsp. *perenni* et *B. henshallii* G. Leach affinis, ab utroque indumento destituto, stipulis latioribus et plerumque foliis integris, a *B. perenni* subsp. *perenni* omnibus partibus majoribus, a *B. henshallii* sepalis glabris et carina laciniata carenti differt.

*Type:* P.K. Latz 461, 12 miles SE Elliott, Northern Territory, 20.ii.1969 (Holo.: NT, iso.: AD, MEL).



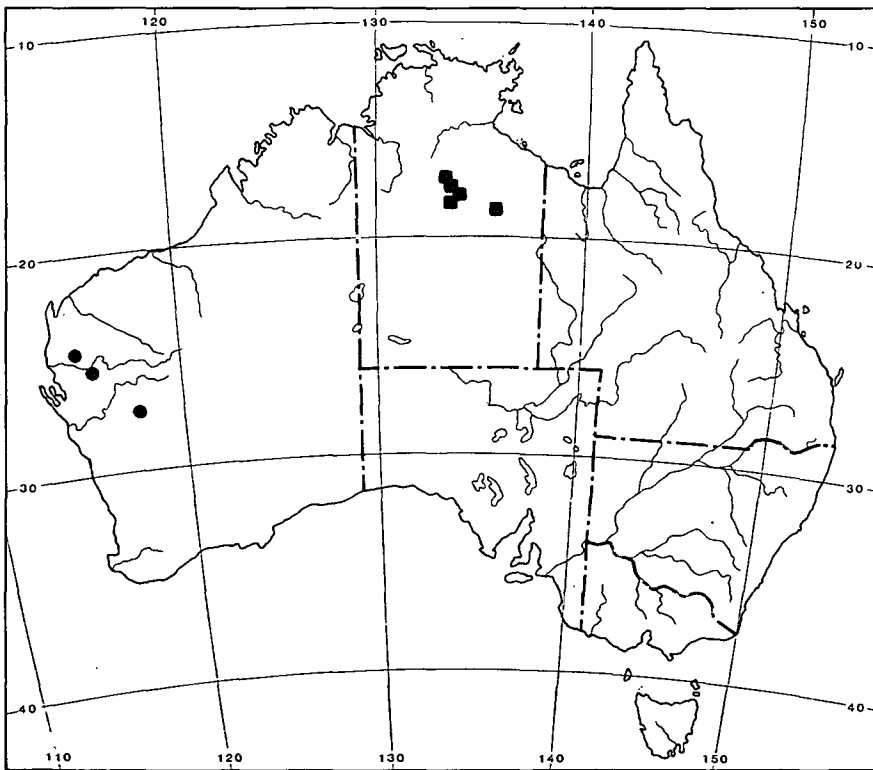
Prostrate perennial. *Indumentum* lacking, glaucous. *Leaves* elliptic (8) 12-24 x 4-9 mm, acute, margin entire, rarely with a few inconspicuous teeth, mid-vein prominent. *Stipules* 2.5-5.2 x 1-1.5 mm. *Flowers* solitary; pedicel 3-8 mm long. *Bracteoles* like stipules, at base of pedicel. *Sepals* 5, narrow-ovate, 5-6 x 2-2.5 mm, acuminate, glabrous, green, margin broad, entire, rarely with a few inconspicuous teeth, midnerve prominent but lacking keel. *Petals* 5, narrow-obovate, 4.5-6 x 1.6-2.2 mm, obtuse, ± equalling sepals, reflexed at anthesis. *Stamens* 10; antipetalous ones c. 3 mm long, filament flattened, narrowly dilated to c. 0.2 mm wide at base; antisepalous c. 3 mm long, filament margin recurved, broadly dilated, 0.5-1 mm wide at base. *Capsule* pyriform, 2.5-3 mm long, c. 2-3 mm diam., 5-locular; styles c. 1 mm long; stigmas clavate, purple. *Seeds* reniform, 0.5-0.6 x c. 0.25 mm, alveolate, dark brown.

*Habitat*

“Gravelly clay soil on edge of black soil plain”.

*Specimens examined*

NORTHERN TERRITORY: Corella Lagoon, Upper Georgina River, *Lt Dittrich s.n.*, viii.1886 (MEL); Upper Georgina River, *Lt Dittrich s.n.*, 1886 (MEL); Powells Creek, near Lake Woods, *W. Holtze 223*, 1895 (MEL); 25-30 km SE Elliott, *S. Ingleby s.n.*, 24.vi.1986 (NT); E of Rifle Range, Elliott, *S. Ingleby s.n.*, 28.vi.1986 (NT); 32 km SE Elliott, No. 7 bore, *S. Ingleby s.n.*, 5.vi.1987 (NT).



Map 6. Distribution of *B. barklyana* ■ and *B. auriculata* ●.

*Distribution*

Known from the Barkly Tableland Botanical Province of the Northern Territory. (Map 6).

*Etymology*

The specific epithet refers to the distribution of this species in being restricted to the Barkly Tableland.

5. *Bergia auriculata* G. Leach, sp. nov.

*B. perenni* (F. Muell.) Benth. et *B. henshallii* G. Leach pilis glandulosis ad 1 mm longis, calyx pilis densis affinis; sepalis dimorphis, 3 exterioribus auriculatis, 2 interioribus margine membranaceo integro, auriculis destitutis differt.

*Type: C.A. Gardner 7828*, Nallan, Western Australia, 13.x.1945 (Holo.: PERTH).

Prostrate perennial. *Indumentum* of dense type a glandular hairs, 0.5-1 mm long. *Leaves* elliptic, 3-4 x 2-3 mm, acute, pubescent, margin ciliate to serrulate, veins obscure. *Stipules* 1.5-3 mm long, 0.2-0.5 mm wide at base. *Flowers* solitary; pedicel 3-7 mm long. *Bracteoles* conspicuous, inserted at middle of pedicel, narrow-elliptic, to 4.5 x 1 mm, pubescent, margin serrulate, auriculate at base. *Sepals* 5, ovate, 3-4.5 x 1.25-2 mm, acute, densely pubescent, outer 3 sepals lacking membranous margin and with lacinate auricles 1.5-2.2 mm long, inner 2 sepals with membranous margin and lacking auricles, keel absent. *Petals* 5, obovate, 2.5-4 x 2-2.5 mm, obtuse, equalling or shorter than sepals, reflexed at anthesis. *Stamens* 10; antipetalous ones c. 2 mm long, filament flattened narrowly dilated to c. 0.25 mm wide at base; antisepalous 2.8-3.8 mm long; filament broadly dilated to c. 0.5 mm wide at base, margin slightly recurved or flat. *Capsule* globular 2-3 mm long, 1.5-2 mm diam., 5-locular; styles 5, 1-1.5 mm long, stigma capitate. *Seeds* reniform, 0.7-1 x 0.4-0.5 mm, alveolate, dark brown. (Fig. 2B).

*Habitat*

On mud flats and clay soils.

*Specimens examined*

WESTERN AUSTRALIA: Nallan, *C.A. Gardner 7828*, 13.x.1945 (Holo.: PERTH); 82 km E Carnarvon, *P.G. Wilson 8404*, 29.vii.1969 (PERTH); 72 km W Gascoyne Junction, *Wittwer 1751*, 7.viii.1976 (PERTH).

*Distribution*

Known from the Austin and Carnarvon Districts of the Eremaean Botanical Province of Western Australia. (Map 6).

*Etymology*

The specific epithet refers to the distinctive character of the auricles found at the base of the outer three sepals.

6. *Bergia ammannioides* Roxb., Hort. Beng. 34 (1814); Ser. in DC., Prodr. 1:390 (1824); Benth., Fl. Austral. 1:180 (1863); F.M. Bailey, Qld Fl. 1:100 (1899); Niedenzu in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21:274 (1925); Backer, Fl. Malesiana 4:205 (1951); Chippendale, Proc. Linn. Soc. N.S. Wales 96:249 (1971); Willis, Handb. Plants Vic. 2:394 (1972); Verdon in Jessop, Fl. Central Austral. 228 (1981); Cunningham et al., Pl. W. N.S.Wales 499 (1982); Green, Census Vasc. Pl. W. Austral. 188 (1985); Jessop in Jessop & Toelken, Fl. S. Austral. 883 (1986).

*Type: Heyne s.n., India (location not known).*

Prostrate or erect herb to 40 cm, annual. *Indumentum* of eglandular hairs with occasional long type a glandular hairs. *Leaves* narrow-elliptic to elliptic, 8-25 x 3-8 mm, acute, glabrous or sparse hairs usually restricted to base or nerves, margin serrate, veins prominent. *Stipules* 1.5-2 mm long, 0.5 mm wide at base. *Flowers* in dense fascicles; pedicel to 4 mm long. *Bracteoles* inconspicuous, at base of pedicel, linear, c. 1 mm long. *Sepals* 5, narrow-ovate, 1.2-2 x c. 0.5 mm, acute to acuminate, pubescent, green, margin narrow, fimbriate, keel absent. *Petals* 5, narrow-ovate, 1.5-2 x c. 0.5 mm, acute, ± equal to sepals, erect at anthesis. *Stamens* 5, c. 1 mm long, filament base slightly expanded. *Capsule* globular, 1.5-2 mm diam., 5-locular; styles c. 0.25 mm long, stigmas capitate. *Seeds* ellipsoid, 0.25-0.3 x 0.15 mm, faintly striate, light brown.

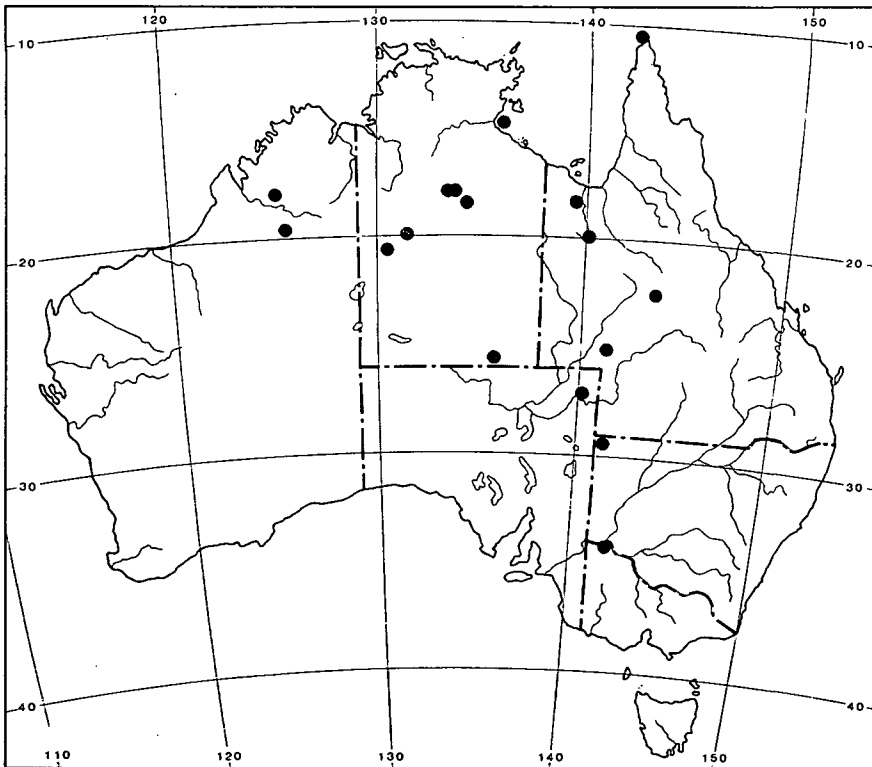
*Habitat*

By clay-pans, swamps, creeks and saline areas, in clay or sand.

*Specimens examined*

WESTERN AUSTRALIA: 19°52', 125°15', *T.J. Fatchen 968*, 27.v.1984 (AD); West Kimberley, *F.M. House s.n.*, 1901 (PERTH).

NORTHERN TERRITORY: Maria Island, *C.R. Dunlop 2969*, 13.vii.1972 (DNA, NT); Lander Creek, *G.F. Hill 315*, 10.vi.1911 (MEL); Powell Creek, *W. Holtze s.n.*, 1895 (MEL); Indinda Swamp, Andado Station, *P.K. Latz 6829*, 17.iv.1977 (AD, CANB, MEL, NT); c. 35 km SSE The Granites, *P.K. Latz 8709*, 24.vi.1981 (NT); Junction Reserve,



Map 7. Distribution of *B. ammannioides*.

*P.K. Latz 9307*, 16.vii.1982 (NT); 10 km S Sangsters Bore, *P.K. Latz 9392*, 8.viii.1982 (CANB, NT); Victoria River, *F. Mueller s.n.*, s.d. (K); 42.9 miles E Helen Springs, *R.A. Perry 211*, 5.vii.1947 (CANB).

QUEENSLAND: Kajabbi, Leichhardt River, *S.T. Blake 9309*, 6.vi.1935 (BRI); 40 miles NW Longreach, *Davidson 281*, viii.1952 (BRI); Currawilla, *S.L. Everist 3974*, 11.vi.1949 (BRI); Thursday Island, *Palmer s.n.*, s.d. (BRI); Leichhardt River, SE Burketown, *R. Pullen 9053*, 3.v.1974 (CANB).

NEW SOUTH WALES: Fort Grey Basin, *S. Jacobs 3089*, 8.v.1977 (AD, NSW).

VICTORIA: 3.5 km N Mildura, *J.H. Browne 108*, 3.v.1982 (AD, MEL); 2.5 km SE Psyche Bend, *J.H. Browne s.n.*, 13.iii.1982 (AD, MEL).

### Distribution

Found in the Dampier District of the Northern Botanical Province and in the Canning District of the Eremaean Botanical Province of Western Australia; in all Botanical Provinces of the Northern Territory; in the Burke, Cook, Gregory North, Maranoa and Mitchell Pastoral Districts of Queensland; in the North Far Western Plains Botanical Division of New South Wales and the Mallee Study Area of Victoria. Widespread from tropical Africa through tropical Asia, southern China, Java, Philippines, Timor. (Map 7).

### Etymology

The specific epithet refers to the superficial similarity of this species to *Ammannia* (Lythraceae).

### Notes

*B. ammannioides* in Australia is morphologically quite uniform. However, Verdcourt (1968) comments that although a highly variable species, the Australian material appears racially distinct from African and presumably Asian material. Following examination of a limited selection of material from Africa and Asia I can see no morphological basis to support any distinction from Australian specimens. Despite frequent citation in the literature that the type is at K, the specimen has not been located there (Verdcourt 1968). Location of the type and detailed examination of Indian material is required to confirm the application of the name to Australian material.

7. *Bergia trimera* Fischer & C. Meyer, *Linnaea* 10:74 (1836); Niedenzu in Engl. & Prantl, *Nat. Pflanzenfam.* ed. 2, 21:274 (1925); Chippendale, *Proc. Linn. Soc. N.S. Wales* 96:249 (1971); Jacobs & Pickard, *Pl. N.S.Wales* 111 (1981); Verdon in Jessop, *Fl. Central Austral.* 229 (1981); Cunningham et al., *Pl. W. N.S. Wales* 499 (1982); Green, *Census Vasc. Pl. W. Austral.* 188 (1985); Jessop in Jessop & Toelken, *Fl. S. Austral.* 883 (1986).

*Bergia ammannioides* var. *trimera* (Fischer & C. Meyer) Benth., *Flora Australiensis* 1:180 (1863).

*Type*: India orientali, (location not known, not at K or LE).

*Bergia tripetala* F. Muell., *Trans. Philos. Inst. Victoria* 2:66 (1858).

*Elatine tripetala* (F. Muell.) F. Muell., *Pl. Vict.* 1:196, t. 9. (1862).

*Type*: *F. Mueller s.n.*, at the confluence of the rivers Murray and Darling (Holo.: MEL534790).

Prostrate or erect herb to 15 cm, annual, ? perennial. *Indumentum* of eglandular hairs. *Leaves* narrow-obovate to narrow-elliptic, 3.5-30 x 1.5-8 mm, acute, glabrous, margin serrate, veins obscure. *Stipules* 1.2-2 mm long, c. 0.5 mm wide at base. *Flowers* 4-20 in dense fascicles; pedicel 0-2.5 mm long. *Sepals* 3-4, narrow-elliptic, 0.7-1.5 x c. 0.3 mm, acute, glabrous, rarely

pubescent, green or pink, margin broad, entire or fimbriate, keel absent. *Petals* 3-4, elliptic, 0.7-1.5 x 0.4-0.6 mm, obtuse, equalling sepals, erect at anthesis. *Stamens* 3-4, 0.5-1 mm long; filament base slightly expanded to c. 0.1 mm. *Capsule* globular, 1-1.2 x 0.8-1 mm, 3-4-locular; stigmas  $\pm$  sessile. *Seeds* ovoid or reniform, 0.3-0.4 x 0.2 mm, alveolate, brown.

*Habitat*

In sand, loam or clay soils, often saline.

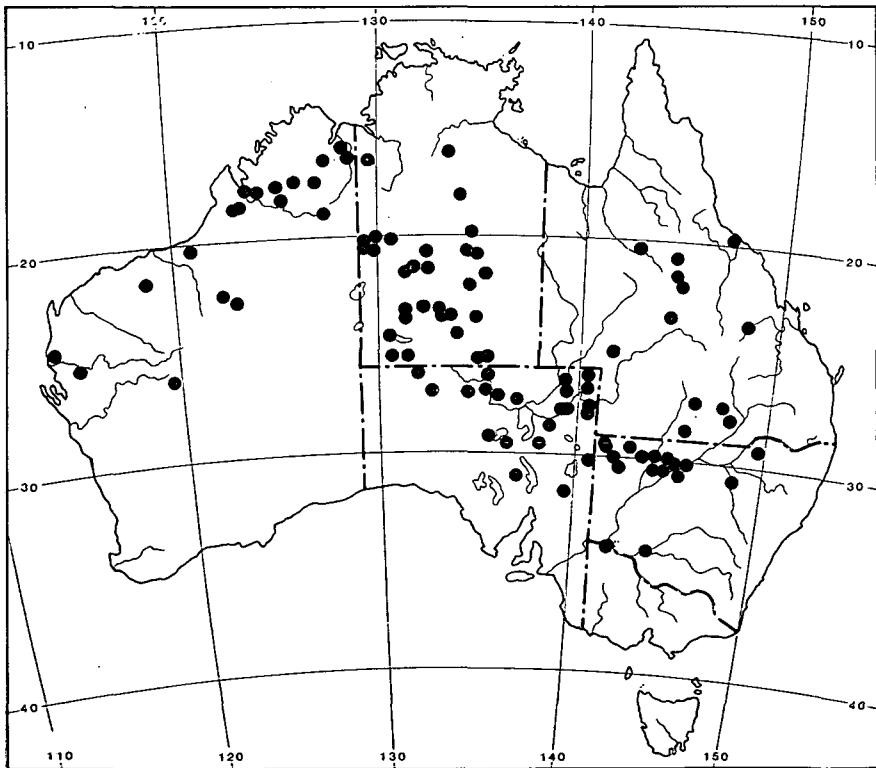
*Selected specimens from 113 collections examined*

WESTERN AUSTRALIA: Sturt Creek near Billilune, *A.C. Beauglehole* 47490, 14.vii.1974 (PERTH); Turner River, Abydos Station, *N.T. Burbidge* 5855, 24.iv.1958 (CANB); 2 miles SW Fitzroy Crossing, *A.J. Ewart s.n.*, 1927 (PERTH).

NORTHERN TERRITORY: Lake Amadeus area, *T.S. Henshall* 740, 18.ix.1974 (NT); Lander Creek, *G.F. Hill* 305, 10.vi.1911 (MEL); 9 miles S Mongrel Downs homestead, *P.K. Latz* 748, 4.viii.1970 (AD, NT).

SOUTH AUSTRALIA: Macumba Station, *Ising* 35, xi.1950 (AD); Innamincka, Coopers Creek, *Tate s.n.*, 1884 (AD); Goyders Lagoon, *J.Z. Weber* 4508, 14.viii.1975 (AD); c. 10 km W Quinyambie homestead, *D.J.E. Whibley* 3560, 30.vii.1971 (AD).

QUEENSLAND: 30 miles SW Bollon, *G.H. Allen* 662, 20.ii.1944 (CANB); Emerald, *S.T. Blake* 8210, 18.iii.1935 (BRI); Dingwall, *S. Everist* 3412, 19.iv.1948 (BRI, CANB).



Map 8. Distribution of *B. trimera*.

NEW SOUTH WALES: Yantara Lake, *W. Bäuerlen* NSW 141289 (NSW); 21 km E Brindiwilpa, *R. Chinnock* 3631, 12.v.1977 (AD); Lake Fort Grey, *S. Jacobs* 3438, 15.xi.1978 (NSW); Horsefalls Billabong, Bourke, *E.J. McBarron* 18593, 14.xi.1969 (AD).

VICTORIA: Kings Billabong State Game Refuge, *J. Browne* 79, 13.i.1982 (MEL); Boonie Doon Bend, 7 km E Red Cliffs, *J. Browne* 118, 18.vii.1982 (MEL).

### *Distribution*

Found in all districts of the Northern Botanical Province and in the Austin, Canning, Carnarvon, Fortescue, Keartland and Mueller Districts of the Eremaean Botanical Province of Western Australia; in all Botanical Provinces of the Northern Territory; in the Eastern, Gairdner-Torrens, Lake Eyre Basin and North-western regions of South Australia; in the Burke, Gregory North, Leichhardt, Maranoa, Mitchell, North Kennedy and Warrego Pastoral Districts of Queensland; in the North Western Plains and North Far Western Plains Botanical Subdivisions of New South Wales; and in the Mallee Study Area of Victoria. Also from India and Sri Lanka. (Map 8).

### *Etymology*

The specific epithet refers to the predominantly 3-merous flowers; a distinguishing feature from the closely related *B. ammannioides*.

### *Notes*

Some authors (Thiselton Dyer 1872; Bentham 1863) have reduced *B. trimera* to a variety or a synonym (Sohmer 1980) of *B. ammannioides*. The Australian material is sufficiently distinct to warrant recognition at the specific level. Further work is needed to clarify the global distribution of *B. trimera*. Failure to recognise the distinction from the closely related *B. ammannioides* may account for apparent disjunctions between Australia and India. As for *B. ammannioides* there is a need to examine Indian material to clarify application of the name to Australian material.

## 8. *Bergia occultipetala* G. Leach, sp. nov.

Species nova affinitatibus obscuris, floribus sessilibus solitariis, bracteolis persistibus et adpressis calyci, sepalis ecarinatis, sepalorum pilis dorsis ligulatis obtusatis hyalinis longis (ad 0.7 mm), petalis a sepalis plerumque obtectis, staminibus 5, ovario 5-loculari raro 4-loculari, stylis brevissimis, seminibus alveolatis.

*Type*: D.E. Symon 6924A, 22 km NE Wilson Creek Bore, 17.v.1971 (Holo.: NT).

Prostrate perennial. *Indumentum* of eglandular hairs. *Leaves* elliptic, 8-25 x 3-7.5, acute, glabrous, margin serrate, mid-vein prominent, leaves on condensed axillary shoots smaller, 3-3.5 x 1-1.5 mm. *Stipules* 2.5-3.5 mm long, 1-1.5 mm wide at base. *Flowers* solitary, sessile. *Bracteoles* appressed to calyx, 1-4.5 x 0.7-1.5 mm, acuminate, green, margin white, lacinate, sometimes separated as distinct auricles. *Sepals* 5, elliptic, 2-4.5 x 1-2 mm, acuminate, dimorphic with inner 2 sepals smaller, green, margin fimbriate, keel absent, pubescent externally on basal half with blunt, transparent, strap-like hairs to 0.7 mm long. *Petals* 5, narrow-obovate to spatulate, 1.6-2.5 x 0.5-0.9 mm, obtuse, shorter than sepals, enclosed within sepals at anthesis. *Stamens* 5, c. 1.5 mm long; filament flattened, linear or narrowly dilated at base. *Capsule* globular, 1.5-2.5 mm diam., 5-, rarely 4-locular; styles absent or to 0.5 mm long. *Seeds* ellipsoid or reniform, 0.5 x 0.1-0.2 mm, alveolate, dark brown. (Fig. 2A).

### *Habitat*

Grows on sandy or clay soils. Recorded from lower dune slopes and swamp margins.

*Specimens examined*

NORTHERN TERRITORY: Old Andado, *R. Buckley* 1692, 24.viii.1976 (CANB); Indindo Swamp, Andado Station, *T.S. Henshall* 1479, 17.iv.1977 (NT, PAUH, SP).

SOUTH AUSTRALIA: Camerons Corner, *S. Jacobs* 3851, 6.vii.1980 (NSW); 10 km SE Callamurra W.H., *L.D. Williams* 8219, 27.v.1976 (AD); 5 km SW Innamincka Bore No. 3, *L.D. Williams* 8257, 28.v.1976 (AD).

*Distribution*

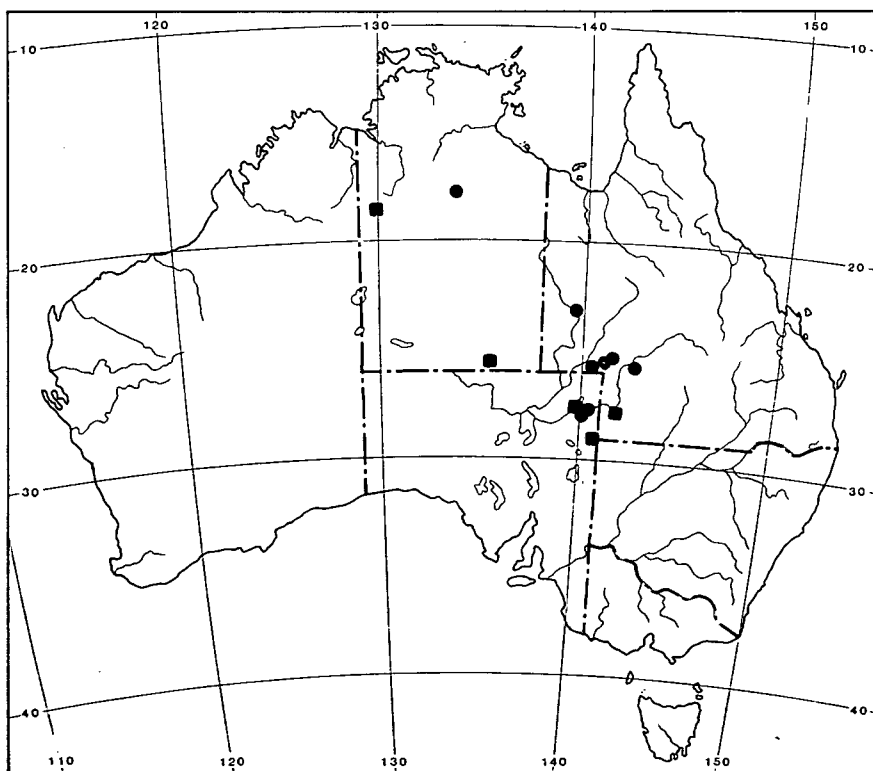
Found in the Victoria River and Central South Botanical Provinces of the Northern Territory and the Lake Eyre Basin region of South Australia. (Map 9).

*Etymology*

The name refers to the petals which remain enclosed within the calyx.

*Notes*

The flowers are almost certainly cleistogamous. While the species must be presently considered rare, it is likely that the inconspicuous nature of the flowers has meant the species being often overlooked by collectors.



Map 9. Distribution of *B. occultipetala* ■ and *B. diacheiron* ●.

### 9. *Bergia diacheiron* Verdon ex G. Leach, sp. nov.

*B. occulipetalae* G. Leach affinis, a qua sepalorum pilis longis propriis destitutis, petalis calycem superantibus, ovario 3-loculari differt.

*Type:* P.K. Latz 460, 13 miles SE Elliott, 20.ii.1969 (Holo.: NT, iso.: BRI, AD).

Prostrate perennial. *Indumentum* of eglandular hairs or lacking. *Leaves* elliptic, 1.5-5.5 x 1.4-2.5 mm, acute or rarely mucronate, glabrous, margin serrate, venation obscure. *Stipules* 1.2-2 x 0.5-1 mm. *Flowers* solitary,  $\pm$  sessile. *Bracteoles* appressed to and shorter than calyx, elliptic, 1-2 x 0.4-0.6 mm, margin broad, white, fimbriate. *Sepals* 5, ovate, 1.2-2.2 x 0.8-1.2 mm, acuminate, glabrous or sparsely pubescent, green, margin broad, white, lacinate, keel obscure or absent. *Petals* 5, narrow-obovate, 2-2.5 x 0.45-0.7 mm, obtuse, rarely mucronate, longer than sepals, erect at anthesis. *Stamens* 3-5, 1.2-1.6 mm long; filament flattened, dilated at base. *Capsule* globular, 1-1.2 mm diam., 3-locular; styles 0-0.25 mm long; stigmas capitate. *Seeds* ovoid, slightly curved, 0.3-0.5 x 0.15-0.25 mm, alveolate, light to dark brown.

#### *Habitat*

On sandy, gravelly or clay soils.

#### *Specimens examined*

SOUTH AUSTRALIA: Innamincka homestead, *N. Lothian* 683, 29.viii.1960 (AD); 4 km S Innamincka bore No. 3, *L.D. Williams* 8255, 28.v.1976 (AD).

QUEENSLAND: Currawilla, *S. Everist* 3980, 11.vi.1949 (BRI, CANB); Birdsville, *E.R. Gowan s.n.*, 18.ix.1957 (BRI); Windorah, *L.S. Penrose* 2525, 9.v.1975 (BRI); 3 km SSW Mudgeacca, *Purdie* 1452, 11.ix.1978 (BRI); 14 km S Mooraberrie, *Purdie* 1494, 19.x.1978 (BRI).

#### *Distribution*

Found in the Barkly Tableland Botanical Province of the Northern Territory; the Lake Eyre Basin region of South Australia; and in the Gregory South and Gregory North Pastoral Districts of Queensland. (Map 9).

#### *Etymology*

The specific epithet refers to the character of the prominent bracteoles clasping and partially enclosing the flower.

#### *Notes*

One specimen from Currawilla, Qld, (*Everist* 3980) differs from the typical by leaves up to 12 x 4 mm and much longer internodes. It is probably a growth form responding to more favourable conditions.

10. *Bergia pusilla* Benth., *Flora Australiensis* 1:180 (1863); Ewart & Davies, *Fl. N. Terr.* 194 (1917); Chippendale, *Proc. Linn. Soc. N.S. Wales* 96:249 (1971).

*Lectotype* (here designated): *F. Mueller s.n.*, Arnhem Land, Roper River, 10.vii.1856 (Lecto.: MEL 534787, isolecto.: K).

Erect annual herb to 6 cm high. *Indumentum* lacking. *Leaves* narrow-elliptic to elliptic, 3-9 x 1.5-2.5 mm, acute, margin entire or occasionally glands prominent, veins obscure, prominent brown apical gland. *Stipules* 1.25-2.5 x 0.25-0.5 mm. *Flowers* single per axil, appearing clustered terminally; pedicel 1-2.5 mm long. *Bracteoles* absent. *Sepals* 4, narrow-elliptic, 2.5-5 x 0.5-1 mm, acuminate, often with mucro to 0.4 mm long, glabrous, margin narrow, entire, naviculate, keel mostly prominent, sinuate. *Petals* 4, narrow-ovate, 1.5-2.5 x 0.5-1 mm, acute,



mucronate, c.  $\frac{1}{2}$  to subequal with sepals, erect at anthesis. *Stamens* 4; antisepalous, 1-1.5 mm long, filament flattened, scarcely dilated at base. *Capsule* pyriform, 1.75-2.5 x 1-1.5 mm, 4-locular; styles  $\pm$  sessile - 0.25 mm long; stigmas clavate. *Seeds* ellipsoid, c. 0.3 x 0.1 mm, smooth to faintly alveolate, shiny, pale yellow-brown.

### *Habitat*

Seasonally inundated areas; typically on sandy soil associated with watercourses.

### *Specimens examined*

WESTERN AUSTRALIA: Meda-oobagooma road, A.C. Beaglehole 52752, 13.vi.1976 (PERTH).

NORTHERN TERRITORY: Katherine, S.T. Blake 17436, 24.iv.1947 (BRI); vicinity of Woolaning Homestead, Craven & Dunlop 6667, 4.iv.1981 (CANB); Maria Island, C.R. Dunlop 2822, 13.vii.1972 (DNA, NT); 10 miles W Borroloola, N. Henry 71, 5.vi.1971 (NT); Galiwinku, Elcho Island, J.R. Maconochie 2165, 9.vii.1975 (CANB, DNA, K, L, MEL, NT); c. 80 km SW Calvert Hills, R. Pullen 9268, 15.v.1974 (CANB, DNA); Koongarra, B.L. Rice 2928, 3.vi.1978 (CANB); Koongarra, B.L. Rice 3356, 19.v.1981 (CANB).

### *Distribution*

Found in the Dampier District of the Northern Botanical Province of Western Australia; and in the Darwin and Gulf and Barkly Tablelands Botanical Provinces of the Northern Territory. (Map 5).

### *Etymology*

The specific epithet refers to the small individual size typical of the species.

### *Notes*

Bentham (1863) in his description of *B. pusilla* cites *Elatine verticillaris* F. Muell. apparently as a validly published synonym. Mueller, however, includes *E. verticillaris* under his discussion of *E. ammannioides* and mentions it as a herbarium name used for specimens collected during the Gregory Expedition. It would appear he had no intention of recognising or publishing *E. verticillaris*.

Type material of Mueller's collection from the Roper River is at K and MEL. The MEL sheet has Bentham's initial and his statement concerning *Bergia verticillata* Willd. as it appears in the protologue. The MEL sheet is therefore here designated the lectotype.

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