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## THE SPECIES OF *WURMBEA* (LILIACEAE) IN SOUTH AUSTRALIA

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### Abstract

Nine species of *Wurmbea* Thunb. are recognised in South Australia. *W. biglandulosa* (R. Br.) Macfarlane, *W. deserticola* Macfarlane and *W. sinora* Macfarlane are recorded for the first time; *Wurmbea biglandulosa* ssp. *flindersica*, *W. centralis* ssp. *australis*, *W. decumbens*, *W. dioica* ssp. *citrina*, *W. dioica* ssp. *lacunaria*, *W. latifolia* ssp. *vanessae* and *W. stellata* are described. A key, together with notes on each species is provided.

Macfarlane (1980) revised the genus for Australia. He placed *Anguillaria* R. Br. under *Wurmbea* and recognised *W. dioica* (R. Br.) F. Muell., *W. centralis* Macfarlane, *W. latifolia* Macfarlane and *W. uniflora* (R. Br.) Macfarlane as occurring in South Australia. Before this only one species, *W. dioica* (as *Anguillaria dioica*) was listed for South Australia (J.M. Black 1922, 1943). Macfarlane stated that he had seen no live material of South Australian species. The present author has made extensive field studies of taxa discussed in this paper, has cultivated most and studied herbarium material. Several trips have been made to other states to allow further comparisons to be made. For information on the nomenclatural history, general morphology, biology and ecology of *Wurmbea* see Macfarlane 1980.

### Key to the South Australian species of *Wurmbea*

- 1 Lower leaves paired (almost opposite), basal, of same shape and size ..... 2
- 1: Lower leaves well separated, often of different shape and size ..... 4
- 2 Leaves with serrate margins, flowers unisexual, nectaries 1 per tepal, a single band of colour .... 6. *W. latifolia*
- 2: Leaves without serrate margins, flowers hermaphroditic, nectaries 2 per tepal ..... 3
- 3 Lower leaves narrow-linear, decumbent, flower 1, < 7 mm across, capsule elongate on a decumbent stem ..... 3. *W. decumbens*
- 3: Lower leaves broadly linear-lanceolate, flowers several, > 7 mm across, capsule ovoid on an erect stem ..... 2b. *W. centralis* ssp. *australis*
- 4 Nectary 1 per tepal, forming a single band of colour, flowers unisexual ..... 5. *W. dioica*
- 4: Nectaries 2 per tepal, flowers hermaphroditic ..... 5
- 5 Flower single, tepals < 3 mm broad ..... 6
- 5: Flowers several, tepals > 3 mm broad ..... 8
- 6 Flower < 10 mm across, tepals clasping filament (at least in living plant), outer margin of nectary winged ... 7
- 6: Flower > 10 mm across, tepals not clasping filament, outer margin of nectary not winged ..... 8. *W. stellata*
- 7 Basal leaf linear-lanceolate, receptacle thickened, anthers yellow, spring flowered ..... 9. *W. uniflora*
- 7: Basal leaf filiform, receptacle not thickened, anthers purple, winter flowered ..... 7. *W. sinora*
- 8 Tepals connate, forming a cup-shaped tube up to 1/3 of length, nectaries small, elliptical with margins elevated all round, styles connate ..... 4. *W. deserticola*
- 8: Tepals not connate, not forming a cup-shaped tube, nectaries large, not elliptical, without elevated margins all round, styles not connate ..... 9
- 9 Flowers moderately crowded, nectaries semi-oval, desert plants ..... 2a. *W. centralis* ssp. *centralis*
- 9: Flowers well spaced, nectaries like broad ledges, southern plants ..... 1. *W. biglandulosa*



Fig. 1. Habit of *Wurmbea* species (natural size). A, *W. biglandulosa* ssp. *flindersica* (R. Bates 10264); B, *W. dioica* ssp. *citrina* (R.W. Rogers 464); C, *W. decumbens* (R. Bates 25630); D, *W. dioica* ssp. *lacunaria*, male (R. Bates 10483); E, *W. latifolia* ssp. *latifolia*, male (R. Copley 5213); F, *W. latifolia* ssp. *vanessae*, male (R. Bates 25606); G, *W. stellata* (R. Bates 19760).

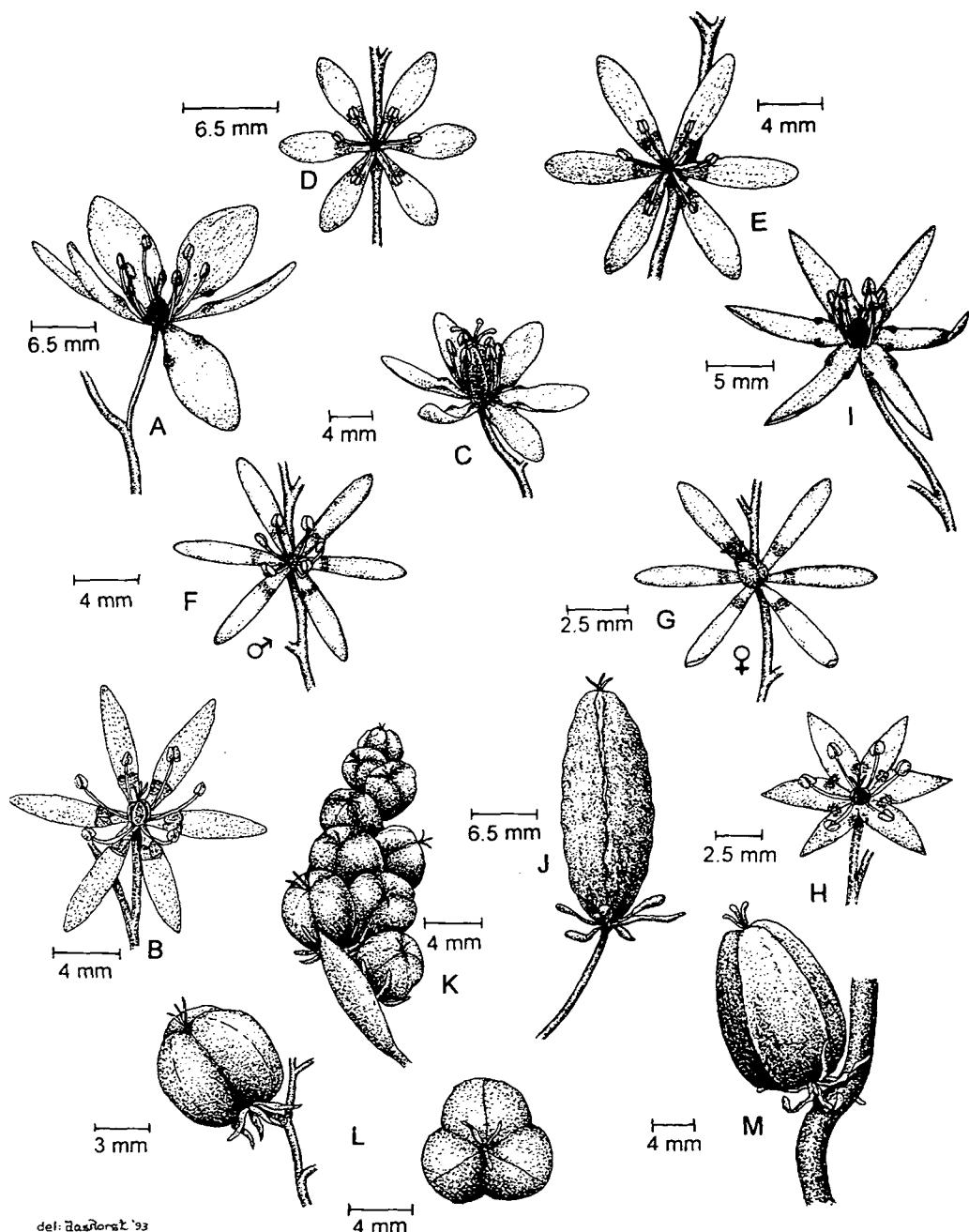


Fig. 2. A-I Flower. A, *Wurmbea biglandulosa* ssp. *flindersica* (R. Bates 10264); B, *W. centralis* ssp. *australis* (R. Bates 40825); C, *W. decumbens* (R. Bates 28725); D, *W. dioica* ssp. *citrina* (R.W. Rogers 464); E, *W. dioica* ssp. *lacunaria* (R. Bates 10483); F, G, *W. latifolia* ssp. *vanessae* (R. Bates 25606); F, male flower; G, female flower; H, *W. sinora* (R. Bates 26263); I, *W. stellata* (R. Bates 19760). J-M, Fruits. J, *W. decumbens* (R. Bates 25672); K, *W. dioica* ssp. *citrina* (R. Bates 20788); L, *W. latifolia* ssp. *latifolia* (B. Copley 5213); M, *W. latifolia* ssp. *vanessae* (R. Bates 32462).

1. *Wurmbea biglandulosa* (R. Br.) Macfarlane, *Brunonia* 3 (1980) 191; *Fl. Austr.* 45 (1987) 400.

*Anguillaria biglandulosa* R. Br., *Prodr.* 273 (1810).

*Anguillaria australis* F. Muell., *Fragm.* 7 (1870) 74, p.p., *nom. illeg.*

*Melanthium brownii* Schldl., *Linnaea* 1 (1826) 86, p.p., *nom. illeg.*

*W. biglandulosa* has not previously been recorded for South Australia despite having been collected here over one hundred years ago and being locally common. The type form does not appear to occur here, and the South Australian plants are described as a separate subspecies.

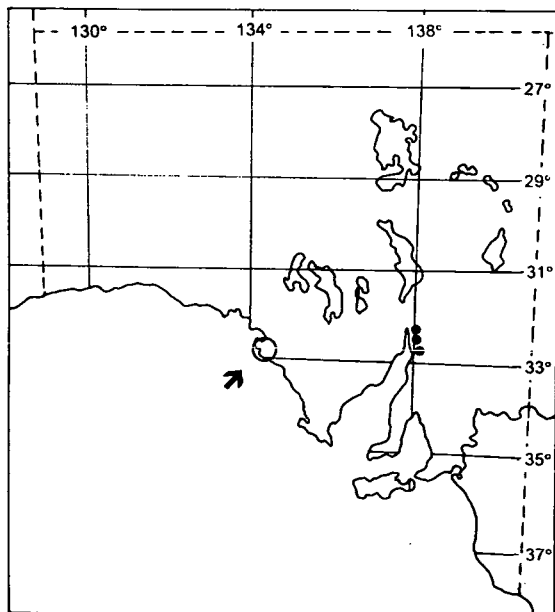
### Key to subspecies

- 1 Uppermost leaf long, acuminate, flowers white, thin textured, nectaries clasping filaments (in living plants) ..... 1a. *ssp. biglandulosa*  
 1: Uppermost leaf short, acute, flowers pink (at least outside) thick textured, nectaries not clasping filaments ..... 1b. *ssp. flindersica*

1b. *ssp. flindersica* R. Bates, *ssp. nov.* (Figs 1A, 2A)

A *ssp. biglandulosa* habitu robusto, tepalis longioribus crassis roseis (non albis), nectariis filo non amplexantibus et foliis supremis brevior differt.

*Type:* On burnt ground, roadside opposite Army Camp at Hughes Gap (NL), 10.viii.1992, A.G. Spooner 13351 (holo.: AD; iso.: AD, MEL, PERTH).



Map. 1. Distribution of *W. biglandulosa* *ssp. flindersica* ●, & *W. sinora* ○ in South Australia.

Plants moderately large, 5–30 cm tall. *Corm* ellipsoidal, 1.5–2 × 0.8 cm, 1–4 cm below ground. *Leaves* 3, well separated; lowest one basal, hardly dilated at base, linear, 5–15 cm long, 2–4 mm diam. at middle; middle leaf shorter dilated at base, upper portion long and tapering, filiform; uppermost leaf markedly dilated at base, with a short acuminate apex, attached well below the inflorescence. *Flowers* 2–6, all hermaphrodite. *Perianth* deep-pink outside, paler pink or white inside. *Tepals* 6, up to 12 mm long, shortly connate at base or free, segments narrow below nectaries, broader and spreading beyond, narrow elliptic. *Nectaries* 2 per tepal, brilliant carmine, situated 1/3 from base, in shallow pits, separated at the centre and reaching to margins, not clasping filaments. *Stamens* two thirds length of tepals,

filaments adnate to perianth only near base, not swollen. *Anthers* oblong, 2 mm long, versatile, attached at middle, deep purple-red. *Ovary* oblong, carpels sharply delimited from the free styles. *Capsules* dehiscent loculicidally. *Seeds* dark brown, 2 mm diam.

#### *Distribution and ecology* (Map 1)

Endemic to the southern Flinders Ranges from Gladstone north to Quorn, a distance of about 100 km. Common in open woodland dominated by *Eucalyptus cladocalyx* and *Callitris glaucophylla* usually on rocky slopes in fertile soils; in places forming a dominant ground cover after fire. Flowers: August to October; perfume – sweet, honey-like.

#### *Distinguishing features*

Easily recognised by the 2 large pink nectaries on each tepal. It can be separated from ssp. *biglandulosa* (which is confined to the Eastern States) by its pink rather than white flowers, the thick textured tepals with brilliant pink nectaries which do not clasp the filaments, and the shorter top-leaf. The 2 subspecies are separated geographically by over 500 km.

*Variation*: A rather constant taxon, varying only in number and size of flowers. In good seasons or after fires plants produce more and larger flowers.

#### *Sympatric species*

*W. biglandulosa* ssp. *flindersica* is often found with *W. centralis* but flowers 1–4 months later. Near Wirrabara it flowers together with *W. dioica* ssp. *dioica* in August and north of Melrose it occurs with *W. latifolia* ssp. *latifolia* in *Eucalyptus camaldulensis* woodland. Hybrids have not been recorded.

*Etymology*: As subspecies *flindersica* is only found in the Flinders Ranges the epithet is appropriate.

*Conservation status*: Common and well conserved throughout its range.

#### *Notes*

Macfarlane (1980, 84) did not record *W. biglandulosa* from South Australia. He identified some collections, i.e. 'H.M. Cooper Melrose' as *W. centralis* and his reference to pink flowered forms of *W. dioica* from South Australia may have been due to notes on collections of *W. biglandulosa*.

Both flies and native bees have been observed pollinating *W. biglandulosa* near Telowie Gorge.

#### *Selected specimens seen* (from c. 50 seen at AD)

SOUTH AUSTRALIA. FLINDERS RANGES: Alligator Gorge, 12.ix.1987, *R. Bates* 10264; Melrose, ix.1960, *H.M. Cooper s.n.*; Mt Remarkable, -ix.1974, *H.M. Cooper s.n.*; Horrocks Pass, 29.xii.1922, *T.G.B. Osborne s.n.* (this bears the collector's label ... '*Anguillaria dioica* var. *hermaphrodita*'); Mambray Creek, -x.1960, *J. Shillabeer s.n.*; On ridge N side of Mambray Creek, 5.ix.1974, *D.J.E. Whibley* 4270; N slopes of Mt Brown, 20.x.1958, *P.G. Wilson* 623. NORTHERN LOFTY: Telowie Gorge, 25.ix.1989, *R. Bates* 20543; Near the Bluff E of Port Pirie, 1.x.1978, *A.G. Spooner* 6019; 10 km N of Gladstone in Explosives Reserve, 7.ix.1991, *R. Bates* 24865.

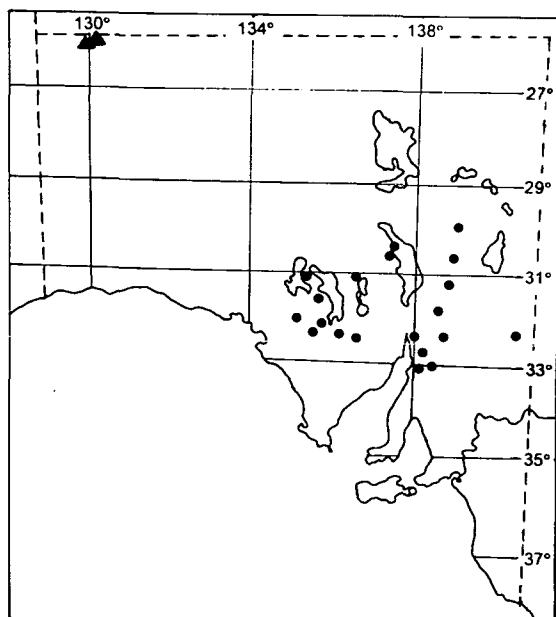
2. *Wurmbea centralis* Macfarlane, *Brunonia* 3 (1980) 188; in Jessop, J.P. (ed.), *Fl. Central Austr.* 422 (1985); in Jessop, J.P. & Toelken, H.R. (eds), *Fl. S. Austr.* 4 (1986) 1772; *Fl. Austr.* 45 (1987) 395.

According to Macfarlane (1980) the type location of this species (Mt Olga) '... is far from the nearest South Australian locality,' and he predicted that it would occur in the Musgrave and Everard Ranges of South Australia.

Macfarlane's concept of *W. centralis* (1980, 1987) was very broad, he had seen no live material and included under *W. centralis* collections from as far afield as Kangaroo Island and the southern Flinders Ranges. He suggested (1980) that 'Study of living plants ...' might help resolve the true limits of the species. Field studies by the present author have shown that collections identified by Macfarlane as *W. centralis* actually represent at least 4 taxa. Tiny single flowered plants with narrow-linear leaves and decumbent scapes from Kangaroo Island and southern Eyre Peninsula belong to a distinct species described here as *W. decumbens*. Spring flowered plants from high rainfall areas of the Flinders Ranges with well spaced leaves belong to *W. biglandulosa* ssp. *flindersica* while winter flowering plants from southern, semi-arid South Australia with broad, flat, paired basal leaves and narrow tepals are here described as a separate subspecies *W. centralis* ssp. *australis*. Recent collections have increased the known distribution of *W. centralis* considerably.

### Key to subspecies

- 1 Lower leaves basal and similar, broadly linear-lanceolate, not channelled; flowers usually less than 5, well separated, with narrow acute tepals; nectaries deeply pitted, clasping the filaments or not..... 2b. ssp. *australis*  
 1: Lower leaves well separated, dissimilar, linear, channelled above; flowers often more than 5, moderately crowded at least in early spike, with broad, rounded tepals; nectaries shallow, clasping the filaments at least in fresh flowers ..... 2a. ssp. *centralis*



Map 2. Distribution of *W. centralis* ssp. *centralis* ▲, & *W. centralis* ssp. *australis* ● in South Australia

### 2a. ssp. *centralis*.

Plants large, 10–30 cm tall. *Corms* ellipsoidal, 0.5–2.5 × 0.3–1.5 cm, 5–18 cm below ground. *Leaves* 3, well separated, lowest leaf linear, thick and channelled, not inflated, to 20 cm long and 1 cm broad, suberect; middle one similar but with a dilated base; upper leaf dilated at the base with an acuminate apex to 5 cm long. *Flowers* 3–15, all hermaphrodite. *Perianth* pink, nectaries deeper pink. *Tepals* up to 8 mm long, shortly connate at the base, segments narrow below the nectaries, obovate beyond them, apex rounded. *Nectaries* 2 per segment, situated one-third from base of tepal, consisting of broad semi-oval ledges, separated at the centre, reaching the tepal margins, abruptly raised at their lower margins, clasping the filaments (not obvious in dried material where the nectaries resemble shrunken pouches). *Stamens* two-thirds as long as perianth, filaments adnate to tepals below nectaries, broad

near base but not grossly swollen. *Anthers* ovate, 1–1.5 mm long, versatile, attached at middle, purple-red. *Ovary* spherical, carpels sharply delimited from styles, styles free or basally connate. *Capsules* not seen.

#### *Distribution and ecology* (Map 2)

Only known from 3 sites in Central Australia, at the base of rocks near springs, i.e. Kata Tjuta (The Olgas) and in the Musgrave Ranges in far northern South Australia and near Wa Wee Waterhole in Western Australia. Flowers: May to September, depending on rainfall.

#### *Distinguishing features*

The long channelled leaves, and numerous, large, crowded pink flowers with rounded segments make this subspecies easy to separate from *ssp. australis*. It is closely related to *W. biglandulosa*, a spring flowered species which is much less robust and has a very different distribution and habitat.

*Variation*: A very constant taxon.

*Sympatric species*: The Helms collection below includes plants of *W. dioica* *ssp. citrina* which suggests the two were growing together. The Helms collection was from near Wa Wee Waterhole which is an Elder Expedition collection site in Western Australia.

*Conservation status*: Apparently rare but conserved in Uluru National Park.

#### *Specimens examined* (AD)

SOUTH AUSTRALIA. NORTH WEST: Upper Alaka Creek (Musgrave Ranges), 19.v.1983, *R. Bates* 3073. WESTERN AUSTRALIA. Near Wa Wee Waterhole, 25.v.1891, *R. Helms* s.n.

#### 2b. *ssp. australis* R. Bates, *ssp. nov.* (Fig. 2B)

A *ssp. centrali* foliis inferis latioribus ecanaliculatis confertis, tepalis angustis non rotundatis, nectariis fila nectariis amplectantibus differt.

*Type*: Siam Station, Gawler Ranges, on rocky hills of granite porphyry, 11.vii.1991, *R. Bates* 25633 (holo.: AD, specimen A; iso.: AD, CANB, PERTH).

Plants robust, 7–20 cm tall. *Corms* spherical, 1.5–2.5 cm diam., dark brown, 3–10 cm below ground. *Leaves* 3, lowest 2 basal and similar, broadly linear-lanceolate, up to 10 cm long and 2.4 cm broad, leathery and often decumbent; the uppermost one distant from the base and markedly dilated, to 3 cm long with an acute apex. *Flowers* 1–5, all hermaphrodite, well spaced. *Perianth* pink, nectaries deeper pink. *Tepals* up to 12 mm long, shortly connate at the base, segments narrow below nectaries, narrow-elliptic beyond them, apex acute. *Nectaries* 2 per segment, situated less than one third above base of perianth, consisting of deeply pitted, semi-oval ledges, separated at the centre and reaching tepal margins, raised on lower margins, not clasping filaments. *Stamens* half as long as perianth, filaments adnate to tepals below nectaries, broader near base but not grossly swollen. *Anthers* ovate, 1–1.5 mm long, versatile, attached at middle, purplish. *Ovary* spherical, carpels sharply delimited from the styles, styles free. *Capsules* box-like, to 2.5 cm long (the largest of any Australian *Wurmbea*), dehiscence apical-loculicidal. *Seeds* dark, spherical.

#### *Distribution and ecology* (Map 2)

Endemic to arid or semi-arid South Australia, south of 29°S, mostly about rock outcrops, rarely along rocky ephemeral watercourses sometimes forming large dense populations in



the Gawler Ranges, sparse elsewhere. Flowers: May to August, depending on rainfall. The flowers are sweetly perfumed.

### *Distinguishing features*

The broad, leathery leaves make *W. centralis* ssp. *australis* easily recognisable even when not in flower. The large bright pink, fleshy, narrow tepaled flowers, which open before other species in the same area, ensure it is not easily confused. The large papery seed capsules which open from the top and look like dried flowers rattle in the wind and allow identification even after the leaves have shrivelled. This subspecies appears very different from ssp. *centralis* in habit for that subspecies is a tall plant with long, narrow, channelled leaves, and somewhat crowded and more numerous flowers with broad, rounded tepals. The general flower morphology, size and colour are very similar and clearly indicate the relationship of the two taxa which are geographically separated by several hundred kilometres of desert.

*Variation:* Most variation is due to climatic conditions; after a wet autumn flowering is abundant, leaves and flowers are larger than usual. Plants from the Flinders Ranges are sometimes smaller in all their parts.

### *Sympatric species*

*W. centralis* ssp. *australis* has been observed growing with *W. dioica* ssp. *citrina* in rocky places in the northern Flinders Ranges, and the Plumbago Hills; it commonly occurs with *W. dioica* ssp. *dioica* on the edges of rock outcrops in the Gawler Ranges and in the mid Flinders Ranges; in the southern Flinders Ranges it grows with *W. biglandulosa* ssp. *flindersica* and with *W. stellata* near Mt Ive Station in the Gawler Ranges. Near Melrose it occurs within a few hundred metres of *W. latifolia*, the two flowering together. No hybrids have been noted.

*Etymology:* The epithet *Australis* (L.), southern, refers to the more southerly distribution of the subspecies.

*Conservation status:* Common and well conserved particularly in the Flinders and Gawler Ranges.

### *Notes*

Macfarlane (1980) determined collections from southern Eyre Peninsula and Kangaroo Island as *W. centralis* but these plants are here treated as a separate species (*W. decumbens*). Macfarlane's description (1980, 1987) of *W. centralis* is very broad and covers at least 4 taxa treated in this paper.

### *Selected specimens (from 37 seen at AD)*

SOUTH AUSTRALIA. LAKE EYRE: Terrapinna Springs, far Northern Flinders Ranges, 2.vii.1988, R. Bates 14727. GAIRDNER-TORRENS: Andamooka Is., Lake Torrens, 14.vi.1989, K. Bellchambers & G. Carpenter 2818; Eucola Ck. near Woomera, 17.viii.1974, F.A. Mason 63. FLINDERS RANGES: Mt Falkland, 17.vi.1959, E.N.S. Jackson 90; Wilpena Pound, 6.ix.1961, D.E. Symon 1363. EASTERN: NE Plumbago Stn, 11.vi.1989, R. Bates 18805. EYRE PENINSULA: Nonning, 20.ix.1973, T. Reichstein 1582. NORTHERN LOFTY: Telowie Gorge, 5.v.1980, R. Bates 12354.

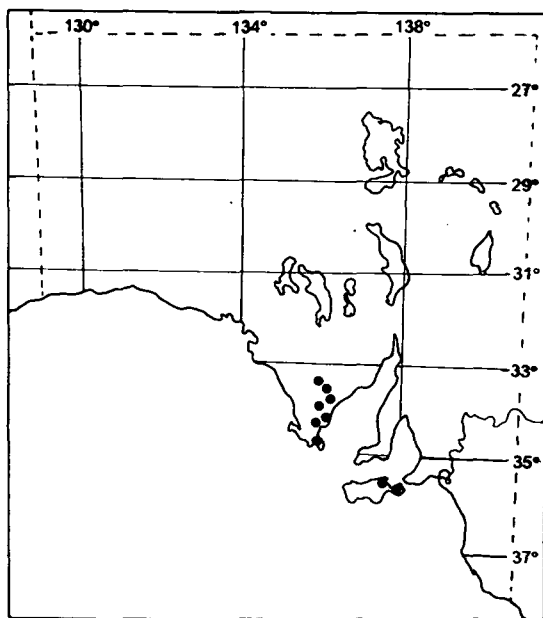
### 3. *Wurmbea decumbens* R. Bates, *sp. nov.* (Figs 1C, 2C, J)

A *W. centrali* foliis longis angustis decumbentibus, flore minuto singulo, scapo decumbente, capsulis elongatis differt.

*Type:* Darke Range, Eyre Peninsula, 10.vii.1991, R. Bates 25672 (holo.: AD, specimen A; iso.: AD, CANB, PERTH).

Plants to 8 cm high. *Corms* ellipsoidal,  $1.5\text{--}2 \times 0.8$  cm, 1–5 cm below ground. *Leaves* 3, lower leaves both basal and similar, flaccid, decumbent, narrow-linear, pale green, 5–20 cm long, 0.2–0.5 cm wide, not dilated at base; upper leaf ovate, short, inflated, bract-like, acute, to 1 cm long. *Scape* very much shorter than leaves, 3–9 cm long, green, filiform, at first erect but becoming decumbent soon after anthesis. *Flower* single rarely 2, very small, hermaphrodite. *Perianth* cup-shaped, to 7 mm across, white, often turning purple with age. *Tepals* 6, narrow-elliptic, often irregular in size and shape, 3–5 mm long and 1–1.5 mm wide, free or partly conjoined basally; nectaries 2 per tepal, concolorous with the tepals, about 2 mm diam., situated just below the tepal midpoint, marginal, pitted, with small auricles projecting from the outer margins. *Stamens* 2 mm long, filament adnate to tepal for 0.5 mm, not swollen at base. *Anthers* ovate, 1 mm long, versatile, attached at middle, purple. *Ovary* oblong, carpels sharply delimited from the free styles. *Capsule* to 2 cm long and 1 cm wide after flowering, dehiscing loculicidally. *Seeds* spherical, orange, roughened, to 1.2 mm diam.

#### Distribution and ecology (Map 3)



Map 3. Distribution of *W. decumbens* in South Australia.

collections of *W. decumbens* as probable depauperate forms of *W. centralis* but did (p. 198) note their similarity to *W. sinora*.

*Variation:* A very constant species and not likely to be confused with any others.

While endemic to South Australia, it is widespread and locally common on Eyre Peninsula but rare on Kangaroo Island. Rarely collected until 1991 when the author found it on numerous rocky hills on central Eyre Peninsula, mostly on sheltered southern slopes at the base of rocks. Flowers: May to July, perfume faintly lemon-scented.

#### Distinguishing features

*W. decumbens* is a distinctive species recognised by the long narrow decumbent leaves, the tiny, usually single flower and the large elongated seed capsule on its decumbent scape. Its closest ally is probably *W. sinora* Macfarlane, which differs in having the lower leaves spaced and erect not paired and decumbent. *W. sinora* also does not have such a large seed capsule and the scape remains erect. Both species do have a single tiny flower with winged outer margins to the nectaries. Macfarlane (1980) determined

*Sympatric species*

*W. dioica* ssp. *dioica* was present at all the known sites of *W. decumbens* and the two flower at the same time but no hybrids were seen. Near Koppio *W. decumbens* grows with *W. latifolia* ssp. *vanessae* again with an overlap in flowering times but without hybrids.

**Etymology:** The epithet *decumbens* (L.), refers to the decumbent leaves and scape.

**Conservation status:** Most of the known populations are in reserves. Suggested conservation status – 3RC.

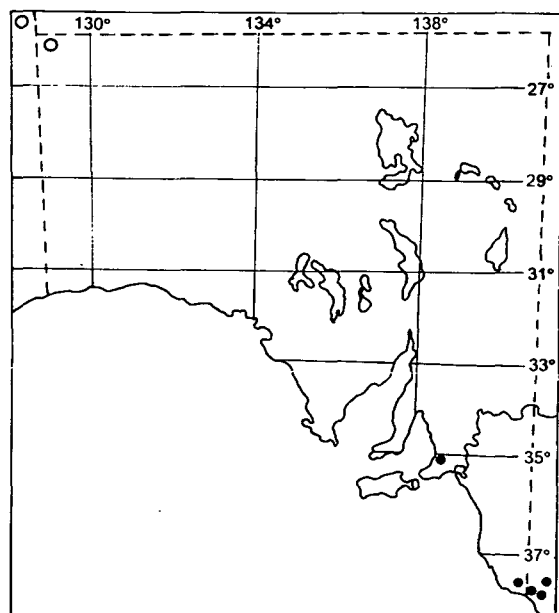
*Notes*

*W. decumbens* is locally common at several well botanised sites, the probable reason for the lack of collections is the early flowering time, the small size and the generally held belief that all *Wurmbea* in the area would be the common *W. dioica*. From observations of cultivated plants it would seem that flowers are self pollinated or perhaps apomictic as all flowers set large seed capsules even though anthers remain intact.

*Selected specimens* (from 15 seen at AD)

SOUTH AUSTRALIA. EYRE PENINSULA: Caralue Bluff, 10.vii.1991, *R. Bates* 25630; Hillock by the pump station, 7 km N of Tumby Bay, 9.vii.1991, *R. Bates* 25599; Wharminda Soak, 9.vii.1991, *R. Bates* 25595; Flinders Monument, Lincoln Conservation Park, 9.vii.1991, *R. Bates* 25609; Carrapee Hill, 28.ix.1989, *R. Bates* 20813 (in seed). KANGAROO ISLAND: Council quarries, Kingscote, 17.vii.1963, *G. Jackson* 258.

4. *Wurmbea deserticola* Macfarlane, *Brunonia* 3 (1980) 185; in Jessop, J.P., (ed.), *Fl. of Central Austr.* 422 (1985); *Fl. Austr.* 45 (1987) 398.



Map 4. Distribution of *W. deserticola* ○ and *W. uniflora* ● in South Australia.

Plants large, 7–25 cm tall. *Corm* ellipsoidal, 1–2 cm long, buried 10–16 cm below ground level. *Leaves* 3, lower one basal, broad-linear, more than 3 mm broad, to 20 cm long, channelled above, not dilated at base; middle leaf set well above basal one, much shorter, markedly dilated at first with a long tapering apex to 10 cm; uppermost one much shorter, dilated basally, apex short, acute, set well below inflorescence. *Flowers* (1) 3–11 in an open spike, all hermaphrodite. *Perianth* pink, nectaries deeper pink. *Tepals* 6, to 15 mm long, connate for one third their length to form a cup-shaped tube, connecting tissue between tepal bases thin, segments broad-elliptical, apex rounded. *Nectaries* 2 per tepal, situated near margins of segments slightly above top of tube and clasping filaments, consisting of raised narrow-elliptical areas, all margins distinct and raised. *Stamens* over half length of tepals,

filaments adnate to base of tepals, not swollen basally. *Ovary* spherical, carpels sharply delimited from the styles; styles connate up to half their length. *Capsules* globose to 1 cm diam. *Seeds* brown spherical, 2 mm diam.

#### *Distribution and ecology* (Map 4)

Widespread in desert areas of Western Australia and the Northern Territory. Recently recorded for South Australia, apparently rare in red sand dunes or rocky places near water. Flowers: May to August, depending on rain.

#### *Distinguishing features*

The tall stems with well-spaced, large, pink, hermaphroditic flowers and the conjoined styles make this an easily recognised species. The only *Wurmbea* throughout most of its range.

*Sympatric species*: Not recorded as growing with any other species.

*Conservation status*: Not known but probably more widespread than the sparse collections indicate. It is likely to be found in the Simpson Desert Regional Park or the Great Victoria Desert, both vast areas poorly botanised.

#### *Specimens examined* (AD)

SOUTH AUSTRALIA: NORTH -WESTERN: In clay-sand by rocks near Pipalatjara Camp, 7.v.1980, C. Aitken *s.n.*

5. *Wurmbea dioica* (R. Br.) F. Muell., *Fragm.* 10 (1877) 119; Macfarlane, *Brunonia* 3 (1980) 159–165; G.R. Cochrane et al., *Fl. Pl. Victoria & Tasmania* 71 (1980) t. 321; Macfarlane in Jessop, J.P., & Toelken, H. (eds.) *Fl. S. Austr.* 4 (1986) 1772; *Fl. Austr.* 45 (1987) 389.

*Anguillaria dioica* R. Br., *Prodr.* 273 (1810); J. Black, *Fl. S. Austr.* edn 1 (1922) 106; edn 2 (1943) 186.

This is by far the commonest and most variable species in South Australia. Macfarlane (1980) noted that there were several forms in South Australia, with flowers of different colour and morphology but stated that having not studied living material from this State he was not in a position to subdivide the species.

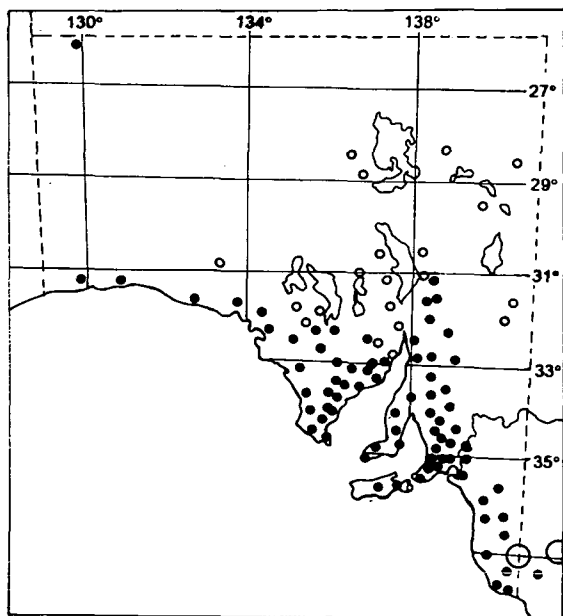
Field studies have shown that there are 3 subspecific taxa within *W. dioica* in South Australia, each with a discrete geographical range and specific habitat.

#### Key to subspecies

- 1 Flowers yellow-green, perianth thick textured, seed capsule globose, not ribbed, desert plants ..... 5b. *ssp. citrina*
- 1: Flowers cream, white, or tinged pink, perianth thin textured, capsule oblong, ribbed ..... 2
- 2 Semi-aquatic plants, usually over 20 cm tall, flowers cream coloured, nectaries pale greenish, anthers yellow ..... 5c. *ssp. lacunaria*
- 2: Not aquatic, less than 20 cm tall, flowers white or tinged pink, nectaries purplish, anthers purple-red ..... 5a. *ssp. dioica*

**5a. ssp. dioica.**

Plants small to moderately small, up to 20 cm tall. *Corm* spherical to ellipsoidal, 0.5–1.5 cm diam., to 5 cm below ground. *Leaves* 3, well spaced; lowest one basal, not or slightly dilated basally, filiform or narrow linear, channelled, to 10 cm long and to 1.5 mm broad; middle leaf shorter, dilated at base with a long tapered filiform or linear apex; uppermost leaf variable but smaller than middle one, attached well below inflorescence in some forms, just below in others, with tapering upper part short or long. *Flowers* (1) 2–5 (7), plants dioecious, female plants generally with larger flowers. *Perianth* white with purple nectaries, sometimes tepal edges purple or whole flower purple in the red-stemmed forms. *Tepals* 4.5–10 mm long, connate only at base, segments ovate to obovate. *Nectary* situated one third from base of tepal, consisting of a continuous transverse flat band, not folded around filament. *Stamens* about half as long as tepals, filaments adnate to perianth only near the base, broader toward base but not swollen; in female flowers absent or present only as short or long filaments. *Anthers* ovate, oblong, sharply delimited from the free styles. *Capsule* ovoid, dehiscing loculicidally. *Seeds* brown, spherical, c. 1 mm diam., several per locule.

**Distribution and ecology (Map 5)**

**Map 5.** Distribution of *W. dioica* ssp. *dioica* ●; *W. dioica* ssp. *citrina* ○ and *W. dioica* ssp. *lacunaria* ○.

This is the type form common in the Eastern States. In drier, plains areas, often in calcareous or alkaline soils i.e. Eyre Peninsula, Yorke Peninsula, the Adelaide and Murray Plains plants have a short top leaf, often with smaller flowers and sometimes with pink tints. In the dry, granite country of the Gawler Ranges, in fertile loams, plants have filiform leaves, small flowers, the female ones particularly, turning purple-pink with age.

Widespread and common in a range of habitats throughout southern parts of the State within the 250 mm isohyet; in forest, woodland, grassland, rock outcrops, mallee and mallee-heath. *Flowers*: June to November, in dense scrub flowers well only after bushfires. *Perfume* indistinct, floral.

**Distinguishing features**

The thin-textured, white, dioecious, sexually dimorphic flowers with purple nectaries in a transverse band, the well spaced leaves with swollen bases and angular ribs on the seed capsules are all features of this variable taxon.

**Variation:** There are several distinct, habitat specific forms with discrete distribution which can be recognised even from dried material. In areas of high rainfall, i.e. the southern Flinders Ranges, Mt Lofty Ranges and lower South-East, in acid soils, plants have a long acuminate apex to the top leaf, the flowers moderately large with no pink

*Sympatric taxa*

*W. dioica* ssp. *dioica* has been found growing in the same areas as all other South Australian *Wurmbea* species except *W. deserticola*.

*Conservation status*: Abundant and well represented in many Conservation Parks.

*Selected specimens* (from 60 seen at AD)

SOUTH AUSTRALIA. NULLARBOR: 78 km E of W.A. border, on edge of Highway, 8.viii.1989, *E.M. James* 80. GAIRDNER-TORRENS: Moonaree, on red sands by rocks, 11.vii.1991, *R. Bates* 25641. FLINDERS RANGES: Floor and sides of Wilpena Pound, 16.ix.1960, *D.E. Symon* 7471. EASTERN: Hills NE of Oodlawirra, 9.vii.1988, *R. Bates* 14565. EYRE PENINSULA: On red sandy by Caroon-Siam road, 11.vii.1991, *R. Bates* 25640; S Port Neill, 19.vii.1965, *C.R. Alcock* 669. NORTHERN LOFTY: Spring Gully Conservation Park, 26.viii.1980, *E.N.S. Jackson* 3785; Near the King Tree, Wirrabara, 10.ix.1989, *R. Bates* 20497. MURRAY: 15 km SW of Purnong, 11.viii.1963, *Hj. Eichler* 17206; 28 km N of Keith in sand, 25.viii.1961, *P.G. Wilson* 1975. YORKE PENINSULA: Near Daley Head, 27.viii.1976, *B. Copley* 4971; The Pines via Corny Point in dry sand, 2.viii.1987, *R. Bates* 10084. SOUTHERN LOFTY: Anstey Hill, 21.viii.1983, *A.G. Spooner* 8735; Mile End Railway Line (Adelaide Railway Station), 19.viii.1928, *E.H. Ising s.n.*. KANGAROO ISLAND: On cliffs between Kingscote and Brownlow, 10.ix.1988, *G. Jackson* 41. SOUTH-EASTERN: Mt Macintyre, 20.x.1989, *R. Bates* 21239.

5b. ssp. *citrina* R. Bates, ssp. nov. (Figs 1B, 2D, K)

A ssp. *dioica* tepalis rotundatis crassis citrinis, capsulis sphaericis ecostatis differt.

*Type*: Common at Lake Eyre South in low sandhills, 9.vi.1978, *F.J. Badman* 61 (holo.: AD, specimen A; iso.: AD.)

Plant slender to robust, often dwarfed, 2–30 cm tall. *Corm* large, ellipsoidal, 2–3 × 1–2 cm, deeply buried, 5–35 cm below ground and covered in numerous, black, parchment-like sheaths. *Leaves* 3, well spaced, leathery, lowest one basal, linear-lanceolate, erect, base not inflated, 5–10 cm long, about 3–15 mm diam.; middle leaf shorter, erect, inflated at base, with a long tapering apex; uppermost leaf very short, greatly inflated at base, acuminate, erect. *Flowers* several to many (-15), plants strongly dioecious, sexually dimorphic, male flowers larger, fewer, with narrower tepals, female flowers more rigid, spike often flexuose. *Perianth* yellow-green, thick textured, with greenish-brown nectaries. *Tepals* ovate-elliptic, 7–8 × 3–4 mm, connate at base. *Nectary* situated about one third from base of tepal, a continuous, transverse, hardly raised green-brown band, not clasping the filaments. *Stamens* half as long as perianth, filaments adnate only at base, not swollen, present in male flowers only. *Anthers* ovate, 1.5 mm long, purple-brown. *Ovary* globose, on female plants only, capsule with rounded segments which are not ribbed, splitting sepicidally. *Seeds* dark brown, spherical c. 1.2 mm diam.

*Distribution and ecology* (Map 5)

Widespread and common throughout arid South Australia and western New South Wales in a variety of habitats but especially in shallow sand overlying fertile clays. Ssp. *citrina* replaces ssp. *dioica* throughout most of its range. Flowers: May to September, depending on rainfall. Perfume faint, floral.

*Variation*: Size and number of flowers is dependent on seasonal conditions. In deeper clay soils flowers seem to be a brighter green, the tepals glossy and leaves particularly broad.

*Sympatric species*

For most of its range *W. dioica* ssp. *citrina* is the only *Wurmbea* present but it has been collected with *W. centralis* on several occasions usually flowering slightly later, it occurs

within a few hundred metres of *W. stellata* near Mt Finke and in the Gawler Ranges and in the latter area within 1 km of *W. dioica* ssp. *dioica*. Intermediates have not been noted.

**Etymology:** The epithet *citrina* (L.) citrus- or lemon-coloured, alluding to the striking greenish-yellow flowers unique in this genus in Australia.

**Conservation status:** A common taxon in South Australian deserts and probably well conserved.

#### Notes

The ssp. *citrina* does not intergrade with ssp. *dioica*, in fact inland populations of ssp. *dioica* are less similar to it than southern populations as they have slender leaves, narrow perianth and pink tinted flowers. Further research may show that ssp. *citrina* may be better treated as a separate species. Ssp. *citrina* is very drought tolerant, occurring in areas receiving less than 125 mm rain a year., i.e. in the driest part of the continent. The deeply buried corms suggest that this taxon may avoid droughts by not sprouting unless good rains occur.

#### Selected specimens (from c. 40 at AD)

SOUTH AUSTRALIA. LAKE EYRE: Cooper Creek crossing on Birdsville Track, 10.vi.1979, *B. Crisp* 580; Boorthanna on railway, sandy ground, 1954, *T.R.N. Lothian* 39; 150 km NW of Marree on road to Oodnadatta, *J.Z. Weber* 767; 2 km N of Stuart Creek, opal fields on sandplain at edge of claypan, 25.vi.1989, *F.J. Badman* 2863. GAIRDNER-TORRENS: Interdune swales on clay near Mt Finke, 30.viii.1976, *R. Bates* 100; Andamooka Island, Lake Torrens saltpan, 14.vi.1989, *K. Belchambers & G. Carpenter* 2758; Sand dunes, NE corner of Lake Gairdner, 6.vii.1971, *B. Lay* 330 ('bulbs over 30 cm from surface'). FLINDERS RANGES: Brachina Track W of Gorge, 17.vii.1988, *K. Alcock* 19; Moralan Station, 12.vii.1987, *D.E. Symon* 14652. EASTERN: Cathedral Rock, Old Boolcoomatta, 10.vi.1989, *R. Bates* 20788; 5 km NNW of Strathearn Stn. on edge of claypan, 22.vii.1978, *L.D. Williams* 9960. EYRE PENINSULA: Southern shores of Lake Acraman, in red sandy loam on plain, 26.ix.1989, *R. Bates* 20788 (in seed).

#### Sc. ssp. *lacunaria* R. Bates, ssp. nov. (Figs 1D, 2E)

A ssp. *dioica* foliis longis, spicis longis, floribus cremeis nectariisque pallidis, antheris flavis differt.

**Type:** Waterholes NE of Goroke on road to Desert Lodge, western Victoria, 15.x.1991, *R. Bates* 26010 and *Vanessa* (holo.: AD, specimen A; iso.: AD, BM, CANB, MEL).

Plant tall, slender, 10–40 cm high. *Corm* ellipsoidal, 1.2–2.0 × 1.0–1.5 cm, shallowly buried, dark brown. *Leaves* 3, linear, channelled, widely spaced, very erect, lowest one basal, base not inflated, 10–30 cm long, 3–5 mm diam., middle leaf similar but inflated at base, longer to 35 cm, uppermost leaf similar to others but more distinctly inflated at base, apex long and tapered. *Plants* strongly dioecious, the sexes similar. *Flowers* (1) 3–15, well spaced in a long narrow spike. *Perianth* cream coloured, drying yellowish, thin textured, with pale nectaries. *Tepals* elliptic, 8–12 × 3–4 mm, free. *Nectary* one third from base, a continuous transverse hardly raised band of pale green or brown, not clasping the filaments. *Stamens* about half as long as tepals, adnate to segments for lowest 1 mm, broader towards base but not swollen; in female flowers absent or present only as short filaments. *Anthers* ovate, to 2 mm long, versatile, attached at middle, yellow not red. *Ovary* ovoid, sharply delimited from the free styles. *Capsule* oblong, ribbed, septicidal. *Seeds* brown, spherical, c. 1 mm diam., several per locule.

#### Distribution and ecology (Map 5)

So far only known from a few seasonal waterholes in *Eucalyptus camaldulensis* woodland, in water to 50 cm deep, in the far South East of South Australia and western

Victoria. Most such waterholes have been badly damaged by stock and do not contain any *Wurmbea*. Flowers Late September to November. Fragrance sweet-floral.

### *Distinguishing features*

The tall spikes, long leaves, cream coloured flowers, pale nectaries, yellow not red anthers, and the unusual habitat make this an easily recognised taxon.

*Variation:* Very constant over its limited range.

### *Sympatric taxon*

*W. dioica* ssp. *dioica* occurs in woodland within 100 m of ssp. *lacunaria* but the two do not intergrade.

*Etymology:* The epithet *lacunaria* (L.), lagoon, in reference to the habitat of this taxon.

*Conservation status:* Highly localised and poorly conserved. Suggested status 2EC.

### *Notes*

This is the only semi-aquatic *Wurmbea* in Eastern Australia, although there are several taxa in Western Australia from similar habitats. The lowest leaf is often rotted away at flowering. In wet years flowering is delayed until water levels fall below 30 cm. In drought years when waterholes remain empty flowering does not occur.

### *Specimen examined* (AD)

SOUTH AUSTRALIA. SOUTH-EASTERN: Waterhole off Mi Mia Mia Road North of Bangham, 25.ix.1988, R. Bates 15625.

6. *Wurmbea latifolia* Macfarlane, Brunonia 3 (1980) 170; in Jessop, J.P. & Toelken, H. (eds.) Fl. S. Austr. 4(1986)1772; Fl. Austr. 45 (1987) 394.

There are two distinct forms of this species in South Australia. The type form with very short, broad leaves, the lower two strictly paired and basal and with very short flower spikes, the capsules globose and flowers in May to July; a second more widespread form with longer, narrower leaves, basal two not always paired and taller flower spikes, the seed capsules ovoid, flowers in July to September. The two have separate ranges and are treated here as distinct subspecies.

### Key to subspecies

- |    |   |                           |
|----|---|---------------------------|
| 1  | Basal leaves opposite, < 10× as long as wide, female flower spike dense and hardly exerted from the leaves, capsule glabrous .....          | 6a. ssp. <i>latifolia</i> |
| 1: | Basal leaves not opposite > 10× as long as wide, female flower spike not dense, exerted on a scape at least 2 cm long, capsule oblong ..... | 6b. ssp. <i>vanessae</i>  |

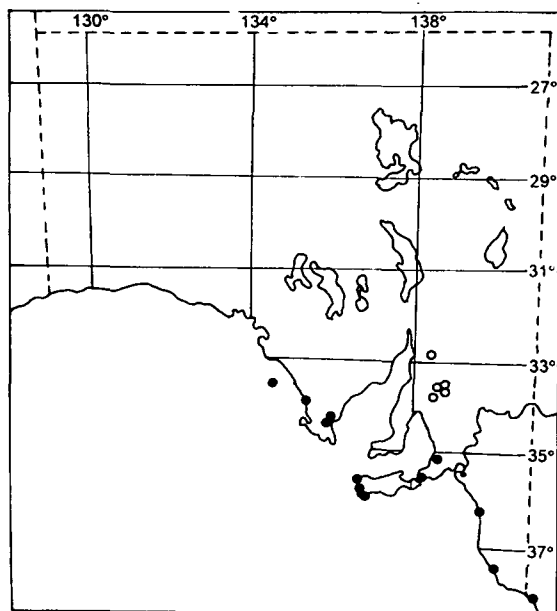
### 6a. ssp. *latifolia*. (Figs 1E, 2L)

Plants small but stout, generally less than 8 cm tall. *Corm* spherical, 1–2 cm diam., 2–4 cm below ground level. *Leaves* 3, the lower 2 similar, almost opposite, basal, with serrate margins, lanceolate to broad-lanceolate, to 8 cm long and 6–12 mm broad, with the inflorescence almost concealed between them, the upper leaf very short, lanceolate, just below or partly concealed within inflorescence. *Flowers* 2–6, dioecious, sexually dimorphic; females small, rounded, hidden at base of leaves; males larger more angular,



exserted from leaf-base. *Perianth* white, nectary pale. *Tepals* 4–6 mm long, connate at base, segments narrow-ovate, shorter and broader on female plants. *Nectary* about 2 mm from base of tepal, a narrow, continuous, semi-circular ridge, slightly thicker toward the tepal margins. *Stamens* 3–4 mm long, the filaments slightly thicker toward base. *Anthers* ovate, 1.3 mm long, purple, attached at middle. *Ovary* globular, sharply delimited from the free styles. *Capsule* dehiscent loculicidally. *Seeds* dark-brown, 1.5 mm diam., spherical.

#### *Distribution and ecology* (Map 6)



Map 6. Distribution of *W. latifolia* ssp. *latifolia* ○ and *W. latifolia* ssp. *vanessae* ● in South Australia.

Endemic to the northern Mt Lofty Ranges and adjacent Flinders Ranges in heavy, often waterlogged soils of open forest and woodland, not coastal. Flowers: June, July; fragrance faint, floral.

#### *Distinguishing features*

A very distinct taxon because of the short, broad, almost opposite basal leaves, the short dense female flower spike often partly concealed in the basal leaves, the pallid sexually dimorphic flowers and the globose seed capsule.

*Variation*: This is a very constant taxon.

*Sympatric species*: Near Mt Remarkable *W. latifolia* ssp. *latifolia* occurs near *W. centralis* and near Brinkworth with *W. dioica* ssp. *dioica* without intermediates.

*Conservation status*: 2VC. Small populations occur in the Mt Remarkable National Park, a heritage reserve near Koolunga and a water reserve at Bundaleer.

#### *Specimens examined* (AD)

SOUTH AUSTRALIA. FLINDERS RANGES: Melrose Flats, Mt Remarkable National Park, 14.vii.1991, *R. Bates* 25675. NORTHERN LOFTY: Pedlers Heritage Scrub via Koolunga, 31.viii.1992, *R. Bates* 28986; Bundaleer Reservoir, 31.vii.1992, *R. Bates* 28976; Barunga Gap Rail Reserve, 12.vi.1967, *B. Copley* s.n.; Georgetown, 1839, *Richardson* s.n.; Roadside N Brinkworth, 24.vi.1978, *A.G. Spooner* 5820; Yackamoorundie Range, in shallow soil among rocks, 24.vi.1978, *A.G. Spooner* 5831.

#### 6b. ssp. *vanessae* R. Bates, ssp. nov. (Figs 1F, 2F, G, M)

A ssp. *latifolia* foliis angustioribus latius dispositis, spicis longis, floribus majoribus nectariis coloratis capsulisque elongatis differt.

?*Anguillaria dioica* R. Br. var. *multiflora* J.D. Hooker, Fl. Tasmania 2 (1858) 46.

*Type*: Deep Creek Conservation Park, South Australia, on windswept headlands, 4.viii.1991, *R. Bates* 26207 (holo.: AD, specimen A; iso.: AD, HO, MEL).

Plants small, 5–12 cm tall. *Corm* spherical, 1–2 cm diam., black, about 3 cm below ground level. *Leaves* 3, lower 2 similar, close together or separated by up to 2 cm, broadly linear, 5–10 cm long, 1.5–8 mm broad, with serrate margins; lowest one basal, not dilated; middle leaf slightly more erect and sometimes dilated basally; upper leaf smaller, inflated at base with a short acuminate erect apex. *Flowers* 3–7, plants dioecious, the inflorescence open and well above the basal leaves. *Perianth* white or pink, nectary variable in colour, sometimes concolorous with tepals more often coloured greenish to deep purple. *Tepals* 6–9 mm long, connate only at the base. *Nectary* 2 mm from base of tepal, either a narrow continuous ridge, thicker toward tepal margins, or more often with a narrow break at centre. *Stamens* 4 mm long, filaments adnate to tepal base, and broader near base. *Anthers* ovate, 1–1.2 mm long, attached at middle, purple-brown. *Ovary* oblong, sharply delimited from the free styles. *Capsule* dehiscent loculicidally. *Seeds* brown, 1.5 mm diam., several per locule.

#### *Distribution and ecology* (Map 6)

Widespread along the coast and offshore islands from Eyre Peninsula, Fleurieu Peninsula, Kangaroo Island, and the South-East of South Australia, extending into Victoria and Tasmania. Occurs in low scrub on exposed sites such as headlands, stabilised sandhills, windswept islands and cliff faces, more rarely up to 20 km inland. Flowers: July to September, which is later than for *ssp. latifolia*. Fragrance strong, sweet.

#### *Distinguishing features*

Despite being more closely related to *W. latifolia* *ssp. latifolia* it is easy to confuse with *W. dioica* *ssp. dioica*. From the former it differs in the narrower leaves, taller, more slender flower spikes, oblong seed capsules, and later flowering; from the latter in having the lower leaves similar, less tapering, with serrate margins and floral nectaries often separated in the middle.

*Variation*: More variable than the type subspecies, particularly in regard to position of the lower leaves, which may be almost opposite or not, and in length of scape, flower shape and colour of nectaries. It is possible that some of this variation is due to introgression with *W. dioica* *ssp. dioica*.

#### *Sympatric species*

Often found with *W. dioica*, less commonly with *W. decumbens*, flowering times do overlap and introgression may occur with *W. dioica* *ssp. dioica*. Occurs within 100 m of *W. uniflora* near Mt Richmond (Vic.) but the flowering times do not overlap.

*Etymology*: Named after Vanessa, my wife and companion on field trips.

*Conservation status*: A taxon of sporadic occurrence but locally common and well conserved. It is certainly more widespread and common than the few collections suggest.

#### *Notes*

Further work is required to show the relationship between *W. latifolia* *ssp. vanessae* and Tasmanian and New South Wales plants, referred to *W. latifolia* by Macfarlane (1980). It may later be found that island and mainland plants belong to different subspecies.

#### *Specimens examined* (AD)

SOUTH AUSTRALIA. EYRE PENINSULA: Freeling Is. (St Francis group), 10.vi.1975, *Dr N. Wace* 489; Section 108, Hundred of Koppio, 10.ix.1966, *C.R. Alcock* 1290; 1.3 km W of Tod Reservoir near Port Lincoln (with *W. dioica* and *W. decumbens*), 9.vii.1991, *R. Bates* 25606. SOUTHERN LOFTY: Mt Bold Reservoir cliffs, 22.viii.1983, *R. Bates* 3222. KANGAROO ISLAND: Near the Ravine de Casoars, in limestone under mallee,

10.x.1992, *R. Bates 29418*; Cape Du Couedic lighthouse, 22.viii.1982, *E.N.S. Jackson 4380*. SOUTH-EASTERN: Coorong National Park, in red sandy soil, 19.viii.1983, *M.B. Thompson 23*; Little Dip Conservation Park, 5.xi.1983, *E.N.S. Jackson 4856*.

VICTORIA: Portland, Discovery Bay above Whites Beach, 12.viii.1956, *A.C. Beauglehole 19532*.

**7. *Wurmbea sinora* Macfarlane, Brunonia 3 (1980) 196; Fl. Austr. 45 (1987) 401. (Fig. 2H).**

Plant small, slender 3–8 cm tall. *Corms* ovoid, black, to 1 cm diam. *Leaves* 3, well spaced, lowest one filiform, not or scarcely dilated at base, erect, to 10 cm long; middle leaf shorter, markedly dilated at base with a long filiform upper portion; upper leaf markedly dilated at base with a short acute or acuminate apex, attached well below inflorescence. *Flowers* 1–3, usually 1 in South Australian populations, hermaphrodite. *Perianth* white, nectaries white. *Tepals* c. 5 mm long, sepals 6, connate only at base, narrow below nectaries lanceolate above. *Nectaries* 2 per tepal, situated 1 mm from base of tepal, consisting of well separated marginal, winged or shelf-like thickenings, lower and outer margins distinct, upper ones indistinct, tepals clasping filaments. *Stamens* c. 3 mm long, filaments adnate in lower part, not swollen. *Anthers* shortly ovate, 0.5 mm long, versatile, attached near middle, dark purple. *Ovary* globose, carpels sharply delimited from the free styles. *Capsules* ovoid, to 0.8 mm long. *Seeds* spherical, brown 0.5 mm diam.

*Distribution and ecology* (Map 1)

Known with certainty only from one site in South Australia but probably more widespread on Eyre Peninsula. Certainly recorded from over a wide range in Western Australia where it favours rock outcrops and ephemeral drainage lines. Flowers: July, August.

*Distinguishing features*

The small stature, single, tiny, white flower, with winged nectaries and purple anthers, together with late winter flowering time set the latter apart from all species except *W. decumbens*, which differs in having long, paired, decumbent, not filiform, basal leaves, and decumbent scape as well as very long seed capsule and has finished flowering before *W. sinora* begins to bloom.

*Variation*: South Australian material matches very well with collections from east of Esperance in Western Australia.

*Conservation status*: 2E in South Australia. Not conserved. Sporadic and uncommon in Western Australia.

*Notes*

This species has not previously been recorded for South Australia. It is locally common on the coast and sometimes inland, from the Fitzgerald River to Twilight Cove in Western Australia. In South Australia it has so far only been found in sand, near granite outcrops close to the coast of Eyre Peninsula.

Macfarlane (1980) noted the similarity of 'forms of *W. centralis*' from Eyre Peninsula to *W. sinora*, but did not cite collections. It is likely these plants were *W. decumbens* or *W. sinora* and not *W. centralis*.

*Specimens examined* (AD)

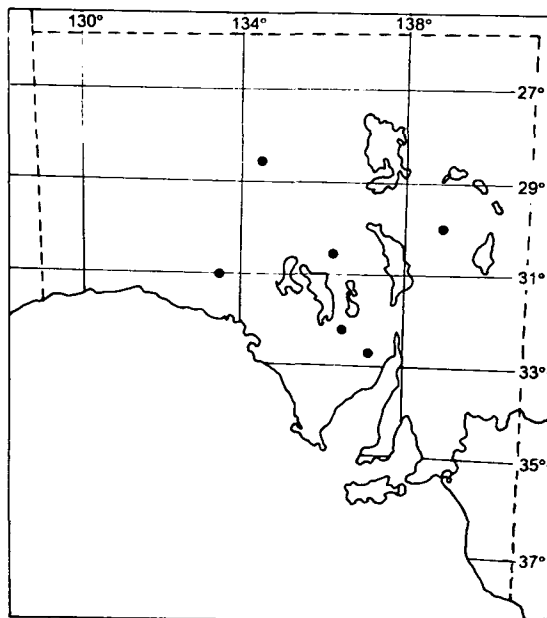
SOUTH AUSTRALIA. EYRE PENINSULA: Rocks near Murphy's Haystacks, 25.viii.1983, *R. Bates* 6529; 1 km E of Murphy's Haystacks, 19.vii.1988, *C. Peters* 311.

**8. *Wurmbea stellata* R. Bates, *sp. nov.* (Figs 1G, 2I)**

*A. W. centrali* foliis scapisque angustis et purpuris, floribus singulis stellatis bicoloribus tepalis angustis rigidis et nectariis saccatis angustis differt.

*Type:* Caroon Hill (EP), on rocky slope of gorge in red clay amid low mallee, 7.vii.1991, *R. Bates* 25542 (holo.: AD, specimen A; iso.: AD, BM, CANB, MEL, PERTH).

Plants slender, purplish-green, to 10 cm tall. *Corm* ovoid, 1–2 cm long, black, 3–8 cm below ground level. *Leaves* 3, lower 2 well separated, upper 2 close together, lowest leaf filiform to linear, channelled, 4–10 cm long, base purple, not dilated, apex lax or decumbent, internode 2–3 cm; 2nd leaf linear, 1–2 cm long, dilated basally; uppermost leaf small just below the flower, dilated basally, ovate, acute. *Flower* usually single, hermaphrodite, widely expanding, starry, large for size of plant. *Perianth* white, usually with bright purple-pink margins, nectaries concolorous. *Tepals* 6, free from the base, narrow elliptic, 7–8 mm long, 2–3 mm broad, acute, with thickened margins; nectaries 2 per tepal, situated about 1 mm from tepal base, narrow oval, longitudinal, pouch-like, very close to tepal margins, all margins distinct and raised. *Stamens* 4 mm long, falcate, with inflated bases adnate to the tepals, pink or white. *Anthers* oblong, 1 mm long, versatile, attached below middle, purple. *Ovary* oblong, carpels sharply delimited from the 1.5 mm long styles. *Capsule* ovoid, to 1 cm long, loculicidal. *Seeds* spherical, c. 1 mm diam., dark brown.

*Distribution and ecology* (Map 7)

Endemic to South Australia, in arid or semi-arid areas westward from the Flinders Ranges to the Great Victoria Desert and south to the Gawler Ranges, growing in red clay soils on plains or rocky hills, often in exposed sites free of other vegetation. Flowers: June to July. Fragrance sweet, floral.

*Distinguishing features*

The narrow, purple-tinted leaves and stem, the closely spaced upper leaves, the single, star-like, bicoloured flowers, with their narrow rigid tepals, thickened margins and narrow, concolorous, pouched, marginal nectaries make this a very distinct species.

*Variation:* Plants from northern plains have broader leaves and larger nectaries.

Map 7. Distribution of *W. stellata* in South Australia.

*Sympatric species*

In the Gawler Ranges it commonly occurs with *W. dioica* ssp. *dioica* and *W. centralis* and their flowering times overlap. Hybrids have not been noted but some of the features of the Gawler Ranges race of *W. dioica* ssp. *dioica* may be derived from influence of *W. stellata* i.e. the filiform, purplish, basal-leaf and purple tinged tepals. On inland plains it sometimes occurs near or with *W. dioica* ssp. *citrina*.

*Etymology*: The epithet *stellata* (L.), starry, alluding to the flat star-like flowers.

*Conservation status*: Widespread, but highly localised and never occurring in large numbers. As it is not known from any conservation park its suggested rating is 3R.

*Notes*

Macfarlane (1980) makes no reference to this taxon, he apparently did not see any material of it.

*Specimens examined* (AD)

SOUTH AUSTRALIA. NORTH-WESTERN: N Marla, on sandy-clay flats between hills, 5.vii.1989, R. Bates 19760. LAKE EYRE: 50 km S Coober Pedy, on red sandy-clay flats, 3.vii.1989, R. Bates 18931. GAIRDNER-TORRENS: Mt Finke, on lower slopes, 15.vi.1987, P. Canty 1445. FLINDERS RANGES: 20 km E of Mt Lyndhurst, low stony hills in *Maireana astrotricha* low shrubland, 17.vi.1988, J. Reid 1443. EYRE PENINSULA: 25 km W of Mt Ive, 27.vii.1968, J.Z. Weber 1201; specimens labelled A & B on sheet of *W. dioica*.

9. *Wurmbea uniflora* (R. Br.) Macfarlane, *Brunonia* 3 (1980) 194; in Jessop, J.P. & Toelken, H. (eds.), *Fl. S. Austr.* 4 (1986) 1773; *Fl. Austr.* 45 (1987) 402.

*Anguillaria uniflora* R. Br., *Prodr.* 273 (1810).

*Anguillaria australis* F. Muell., *Fragm.* 7 (1870) 74 p.p., *nom. illeg.*

Plants small, 4–14 cm tall. *Corm* ovoid, c. 1 cm long, 2–3 cm below ground level. *Leaves* 3, well spaced; lowest one narrow-linear, to 10 cm long, 1.5–2 mm broad at middle, not dilated at base; middle one shorter, filiform or narrow-linear, dilated at base; uppermost one much shorter with markedly dilated base and a short to long acuminate apex, attached well below inflorescence. *Flowers* usually single, rarely 2, facing upward, hermaphrodite. *Perianth* usually white, faintly purple tinged with age or less often bright pink from anthesis, nectaries concolorous with perianth 5–7 mm long. *Tepals* 6, shortly connate or free from base, segments elliptic to oblanceolate, apex acute to slightly rounded. *Nectaries* 2 per segment, situated just below middle of tepal, consisting of well separated, marginal, longitudinally extended, thickened ledges, the lower and lateral margins distinct and slightly raised, the upper margin indistinct, tepal folded around filament so that a nectary lies on either side of it. *Stamens* greater than half length of tepals, filaments adnate to perianth below nectaries not swollen at base. *Anthers* ovate, 1 mm long, versatile, attached at middle, yellow. *Ovary* oblong, carpels sharply delimited from the free styles which are often recurved. *Capsule* ovoid to 1 cm long. *Seeds* brown c. 0.8 mm long.

*Distribution and ecology* (Map 4)

Probably extinct in the Mt Lofty Ranges and known from a single site in the South East but locally common in a variety of habitats particularly in fertile red loams in forest or woodland in southern and eastern Victoria and Tasmania, probably extinct in New South Wales.

*Distinguishing features*

Not likely to be confused with any other species due to its late flowering and tiny flowers with yellow anthers and uncoloured nectaries. Single flowered specimens of *W. dioica* have sometimes been confused with *W. uniflora* but these do not have hermaphrodite flowers and their nectaries are most unlike those of *W. uniflora*.

*Variation:* A very constant taxon varying only in size of plant and flower colour.

*Sympatric species*

Growing in the same area as *W. dioica* in South Australia and *W. latifolia* ssp. *vanessae* in south-western Victoria.

*Conservation status:* 3E, known only from a single population of less than 10 plants on a fire break.

*Notes*

Macfarlane (1980) suggested that this species may have become extinct in South Australia. It does seem highly unlikely that it still occurs in the Mt Lofty Ranges but it has been recently located in the south-east of South Australia and is common in Victoria's Glenelg River National Park adjacent to the South Australian border. Macfarlane notes that the flowers are white but there are pink flowered forms, especially along the Lower Glenelg River.

*Specimens examined*

SOUTH AUSTRALIA. SOUTHERN LOFTY: Clarendon, on black, moist soil, near the (Onkaparinga) River, 28.x.1881, *J.G.O. Tepper s.n.* (MEL). SOUTH-EASTERN: Mt Macintyre summit, 7.xi.1980, *R. Bates 7890* (AD).

VICTORIA. (Near South Australian border) Glenelg River National Park, in red loams, 16.x.1991, *R. Bates 26040 & Vanessa* (AD).

**Unplaced specimens**

Larger populations will need to be found and studied in the field before the status of the following collections can be ascertained.

SOUTH AUSTRALIA. LAKE EYRE: 39 km SW Murnpeowie on low stony slopes, 15.viii.1968, *D. Symon 5613*. Most of the plants on this sheet resemble *W. centralis* but the lower leaves do not appear opposite. One flower has the characteristics of *W. deserticola*.

SOUTH AUSTRALIA. EYRE PENINSULA: Pine Lodge, Gawler Ranges, 25.ix.1989, *R. Bates 21483*. This single plant has several tiny, white flowers with nectaries as for *W. sinora*, but the leaves are as for *W. dioica*.

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