Wurmbea saccata (Colchicaceae), a lepidopteran-pollinated new species from Western Australia

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Abstract

Macfarlane, T.D. and van Leeuwen, S.J. *Wurmbea saccata* (Colchicaceae), a lepidopteran-pollinated new species from Western Australia. Nuytsia 10 (3): 429-435 (1996). *Wurmbea saccata* is described as new and illustrated with drawings and a photograph. It occurs in an apparently limited area of the remote Barlee Range Nature Reserve, south east of Onslow, Western Australia. The tepal nectaries are concealed in pouches formed by the lower part of each tepal and its adjacent staminal filament, a feature unique in the genus. The plants are commonly visited by unidentified day-flying lepidoptera. The new species is closely related to *W. densiflora* (Benth.) T.D. Macfarlane.

Introduction

In August 1993 one of us (S.v. L.) made one of the first biological investigations of the Barlee Range Nature Reserve since its reservation in 1969. This nature reserve includes the steep escarpments known as the Barlee Range and the impressive gorges along Kookhabinna Creek. This remote reserve is located south east of Onslow and is about 180 km from the north west coast of Western Australia. The area is transitional between the Gascoyne region to the south and the Pilbara region to the north. A species of *Wurmbea* Thunb. (Colchicaceae) was discovered there and collected, in fruit. On a second visit in June 1994, it was found in flower, more detailed observations were made, and fresh material was sent to the first author.

Wurmbea saccata T.D. Macfarlane & S.J. van Leeuwen, sp. nov. (Figures 1-2)

W. densiflorae (Benth.) T.D. Macfarlane affinis sed tubo perianthii longiore (1.6-2 mm longo), nectario singulari per tepalum in saccis nectariferis (ungue tepali et filamento staminis formato) occulto, stylis plerumque liberis differt.

Typus: Barlee Range Nature Reserve, 18.2 km SE of Wongida Well, 16.2 km W of Culcra Bore, 17.8 km SW of Wongajerra Well, Barlee Range, Western Australia, 23° 06' 37" S, 115° 58' 02" E, 23 June 1994, S. van Leeuwen 1846 (*holo:* PERTH 02664798; *iso:* CANB, K, KARR, MEL, NY, PRE).

Corm compressed spherical to ellipsoid, 2-2.5 cm long including tunics, 6.5-13.5 cm below ground. Plant robust, 10-30 cm tall from ground to top of inflorescence. *Cataphyll* well developed, rather fleshy, white except for the pink, slightly exposed, pointed apex. *Leaves* usually 3, occasionally 4. *Lowest leaf* basal, ascending, sometimes curved outwards, narrowly ovate or narrowly elliptic to linear, 6-15 cm long, 3-14 mm wide, concave (appearing flat when dried), not dilated basally. *Second leaf* basal or cauline and separated from the lowest leaf by a usually short internode up to 6 cm long, rarely with an internode up to 11 cm long, resembling the lowest leaf but slightly shorter and narrower, 3-14 mm wide, or when cauline, having a somewhat dilated base and then often wider than the lowest leaf. *Third leaf* well separated from the second leaf, and attached well below the inflorescence, markedly dilated in the lower half, narrow in the upper half and tapering to an acute apex, reaching from 4 cm below the lowest flower to 3 cm above the uppermost flower. *Fourth leaf*, when present, resembling the third or much smaller and narrower. *Inflorescence* dense and compact although usually the flowers becoming well spaced as the fruit develops, of 5-14 fully developed bisexual flowers, plus a cluster of approximately 1-3 reduced or vestigial flowers at the apex. *Flowers* pale pink, often darker around the base externally, or sometimes all flowers on the plant pure white, sweetly scented. *Perianth* of 6 tepals, 12-13 mm long, joined basally by linking tissue to form a tube 1.6-2 mm long; lobes spreading in the distal part, broadly elliptic to obovate, with apex rounded to obtuse, the lower part narrow, concave on the inner surface; *nectary pouches* formed by the margins of the concave lower part of each tepal being adnate to the opposite staminal filament, 2.2-2.6 mm long, extending slightly above the top of the perianth tube; in exterior view the tepals in their basal half (comprising the external part of the nectary pouches) markedly raised, rounded, separated by deep grooves the base of which consists of the linking tissue of the perianth tube; *nectary* situated at the base of the tepal, consisting of an irregular glandular thickening occupying the bottom of the pouch, concolorous with the remainder of the tepal. *Stamens* 6, 3/4 as long as the tepals, exserted at the top of the flower owing to the spreading of the tepals, erect; filaments tapering gradually, rather thick, inserted at the base of the tepal and partially adnate to it, each then adnate to the margins of the adjacent tepal for 2-3 mm to form a nectar pouch, concolorous with the perianth; anthers obloid, 2-2.5 mm long, yellow with or without red flecks or red, versatile, basifixed or dorsifixed up to 1/4 from base of connective, dehiscing latrorsely by longitudinal slits. *Ovary* obloid, c. 2 mm long, pink or green with pink flush, sharply delimited from the styles; ovules 8 -10 per loculus; styles 3, free or connate up to 1/4 of their length, exceptionally to 1/3, *c.* 6.5 mm long, erect, white, with minute terminal stigmas which at anthesis are at anther level. *Capsule* loculicidal, at first opening in the upper 1/5, subsequently opening further. *Seeds* up to 10 per loculus, spherical, often with flattened faces from contact with adjacent seeds, *c.* 1.5 mm diameter, smooth, brown, with the raphe raised as a ridge extending around half the circumference, and a small umbo near the micropylar end.

Other specimens examined. WESTERN AUSTRALIA: (all Barlee Range Nature Reserve, Barlee Range): 23° 06' 36" S, 115° 57' 55" E, 17 Aug. 1993, *S. van Leeuwen* 1674 (CANB, MEL, NSW, KARR, PERTH (2 sheets and spirit), PRE, S); 23° 07' 46" S, 115° 58' 51" E, 18 June 1994, *S. van Leeuwen* 1765 (KARR, PERTH); 23° 07' 38" S, 115° 59' 31" E, 20 June 1994, *S. van Leeuwen* 1785 (KARR, PERTH); 23° 07' 46" S, 115° 59' 06" E, 20 June 1994, *S. van Leeuwen* 1786 (KARR, PERTH); 23° 07' 46" S, 115248 58' 51" E, 20 June 1994, *S. van Leeuwen* 1787 (KARR, PERTH including spirit, S); 23° 08' 05" S, 115° 57' 57" E, 20 June 1994, *S. van Leeuwen* 1788 (KARR, PERTH); 23° 08' 12" S, 115° 58' 30" E, 20 June 1994, *S. van Leeuwen* 1789 (KARR, PERTH).

Distribution. Current knowledge of this species indicates that it is very restricted in distribution, being known only from an area about 4 km long in the isolated Barlee Range. The plants occur in creek lines, and have been found in three creeks, two of which are joined. Other creeks in the area lack *W. saccata.* Several populations of the species are known, ranging from a few hundred plants to an estimated several hundred thousand plants.

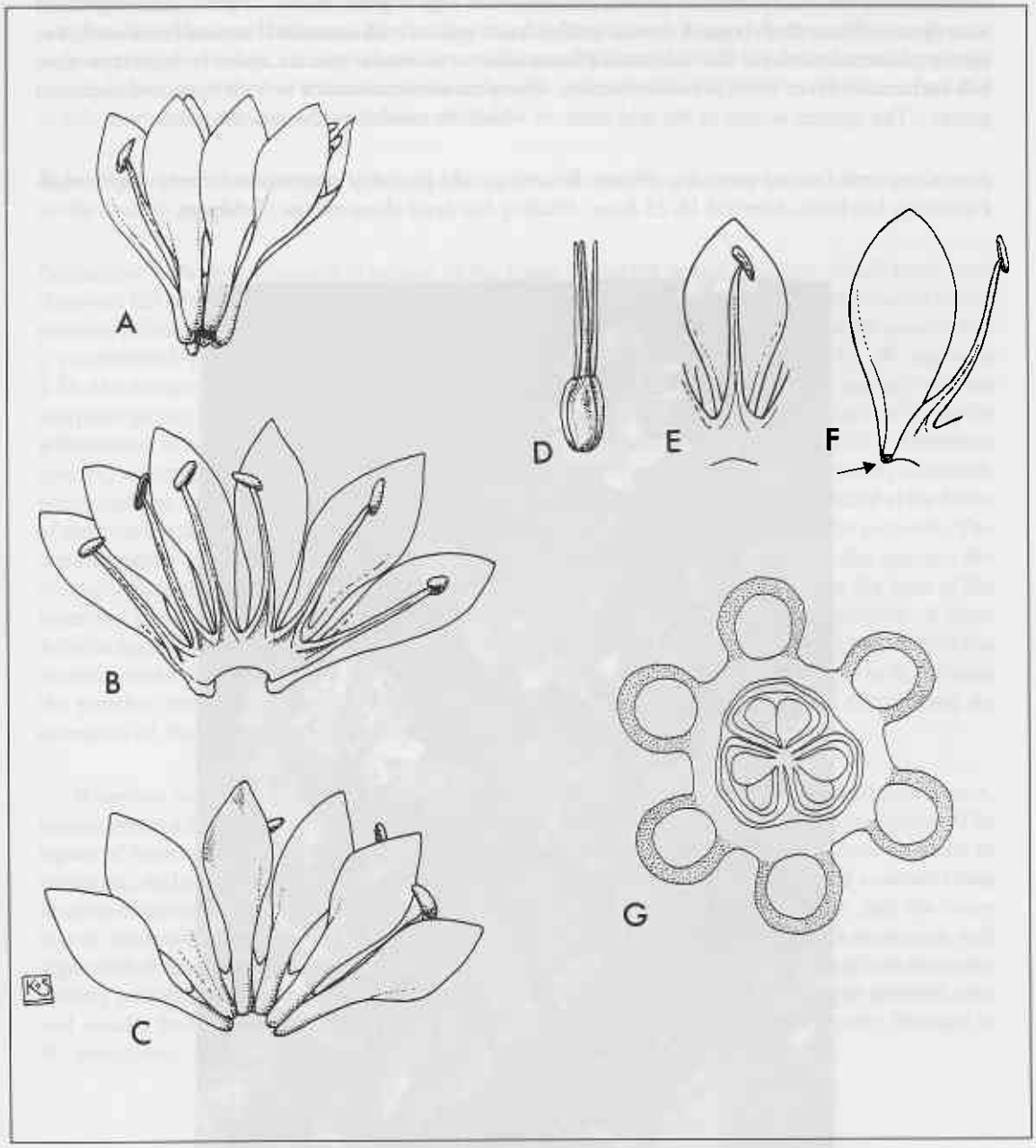

Figure 1. *Wurmbea saccata* A - detached flower (x3.2), B - flower opened out, interior view (x3.2), C - flower opened out, exterior view (x3.2), D - gynoecium (x3.2), E - a tepal, interior view (x2.8), F - a tepal, exterior view, with filament displaced and detached from edge of tepal to show nectary (arrowed) at base of pouch (x3.2), G - transverse section of flower through middle of nectary pouches, diagrammatic. Stippling indicates tissue solely derived from the tepals (x8.4). From *S. van Leeuwen* 1846 *(holotype)*. A-F drawn by K. Syme, G by T.D. Macfarlane.

Habitat. Growing in a range of sandstone hills, confined to the beds of ephemeral creeks, the nearby lower slopes, and the margins of rock pools, in red gritty or silty soil, sometimes with pebble or rock content, or occasionally in black to dark grey soil with high organic matter content. The vegetation is an open to dense shrub layer of *Acacia* or *Melaleuca* species with occasional trees of two *Eucalyptus* species, lower shrub layer of *Dodonaea, Plectranthus* or *Stemodia* species, and a herb layer or open tall herbaceous layer of *Cyperus vaginatus. Wurmbea saccata* occurs in both open and sheltered places. The species occurs in the arid zone, in which the rainfall is low and irregular.

Flowering and fruiting periods. Winter flowering, and probably responsive to irregular rainfall. Flowering has been observed 18-23 June. Fruiting has been observed on 17 August.

Figure 2. *Wurmbea saccata* habit. Photograph by S.J. van Leeuwen.

Conservation status. Although *Wurmbea saccata* appears on current knowledge to be highly geographically restricted, and is apparently dependent on habitats where there is rainfall runoff, insufficient searching has been carried out to determine whether the species occurs in adjacent ranges in the region. In view of this, and the fact that it occurs in a Nature Reserve with no obvious threats, and with large numbers of individuals in several populations, we will be recommending to the appropriate committee that it be classified as a species of Conservation Code Priority Three (see end of this journal for details of Conservation Codes).

Etymology. The epithet *saccata* is from the Latin *saccatus*, meaning pouched or saccate, in reference to the nectary pouches.

Discussion. Wurmbea saccata is unique in the genus in having nectar pouches, which have been observed full of nectar. In most species of the genus, the nectaries are exposed and are situated on the perianth lobes, the nectar appearing as a drop on the nectary. This occurs even when the species has a pronounced perianth tube as in *W. tubulosa* Benth., *W. drummondii* Benth., *W. odorata* T.D. Macfarlane and several African species of the genus (Nordenstam 1986). The nectary is often morphologically elaborated, the function of which may be to help hold the nectar drop, or it may be a thickening in consequence of the development of glandular tissue. The nectary itself (in Australian species) or part of the tepal adjacent to it (in some African species) is often differentially coloured, presumably as a pollinator attractant. In *W. saccata*, however, the nectaries are concealed at the bases of the pouches, are poorly differentiated morphologically, and are concolorous with the perianth. The copious nectar production is contained by the pouch, but remains hidden. In one other species, the Western Australian *W. densiflora*, the nectaries are somewhat hidden and occur near the base of the lobes but there is no development of a pouch. Nordenstam (1986) described the perianth of three African taxa of *Wurmbea* as shortly spurred or subcalcarate at the base, but this does not involve the nectaries and thus seems to be a different phenomenon from nectary pouch formation. In *W. saccata* the pouches are, like spurs, manifest externally, but the perianth is not spurred, there being no extension of the perianth below the point of its insertion on the axis.

Wurmbea saccata is most closely related to *W. densiflora*. They are similar in overall appearance, having dense inflorescences of pink flowers (sometimes white in *W. saccata*) of a similar shape. The tepals of both species are relatively broad, the nectaries are basal on the tepals, inconspicuous in colouring, and either partly or fully concealed, the anthers are more exposed (almost exserted) than in most other members of the genus, comparatively large and predominantly yellow, and the lower leaves are comparatively broad. Both species occur in relatively arid areas but their ranges are well separated, *W. densiflora* being more southerly. *Wurmbea saccata* differs from *W. densiflora* in having nectary pouches, a single nectary rather than two separate ones on each tepal, a longer perianth tube and usually free styles (although they are sometimes partially connate as is consistently the case in *W. densiflora*).

General discussion

Concealment of nectar in narrow, deep pouches, copious nectar production and exposed sexual organs are all aspects of a pollination syndrome associated with Lepidoptera (Armstrong 1979). This is consistent with our observation of numerous individuals of two unidentified species of Lepidoptera visiting the flowers of *Wurmbea saccata.* These were the most common visitors to the flowers. They may have been butterflies or day-flying moths, but further identification must await another expedition

to the site (unfortunately no equipment was available for collecting the insects during either of the expeditions to date). The pollinators of *Wurmbea* species are little known (Nordenstam 1986), but in southern mesic parts of Australia they are believed to be flies of the order Diptera (Macfarlane 1980). On morphological grounds too, it seems unlikely that other *Wurmbea* species in either Australia or Africa, with the possible exception of *W. densiflora* (see above), are primarily Lepidopteran-pollinated. *Wurmbea saccata* is therefore an exceptional species, the first in the genus to be reported as pollinated by Lepidoptera.

According to Keighery (1982), pollination of plants by Lepidoptera is rare in the Australian arid zone. He stated that plants with narrow tubular flowers which are often primarily pollinated by Lepidoptera outside the arid zone are often pollinated by bee flies (Bombyliidae) within the zone. Examples cited of genera containing such species were *Calytrix* (Myrtaceae), *Pimelea* (Thymelaeaceae) and *Stenopetalum* (Brassicaceae). Our observations indicate that flower-visiting Lepidoptera occur in the Barlee Range, that they visit *Wurmbea saccata*, and at the time of the observations of that species reported here, the Lepidoptera were the major group of insects visiting its flowers. It is possible that Bombyliid Diptera were among the minor visitors which were seen, and that they may at times be common, or even dominant, visitors (see Armstrong 1979, p. 474). Further observations would be of interest, and we plan to collect samples of insect visitors for identification and to test our theories regarding the nature of pollination in *W. saccata*.

The postulated close relationship between *Wurmbea saccata* and *W. densiflora* is of interest because previously the latter species has been regarded as rather isolated taxonomically (Macfarlane 1980). One reason for this was that it was formerly thought to lack nectaries, although it was subsequently (Macfarlane 1987) found from observation of fresh material that they were present but poorly differentiated, concolorous, unusually close to the tepal base and somewhat concealed. These nectary features are shared with *W. saccata*, with the additional development in the latter species of a nectary pouch. Therefore, it can be speculated that during the evolution of *W. saccata* from an ancestor resembling *W. densiflora*, the tepal margins became adnate to the adjacent staminal filament, thus forming the nectary pouch as part of a shift of pollination vector.

Although *Wurmbea densiflora* was regarded as taxonomically isolated, its isolation had not been considered by Macfarlane (1980) to be of sufficient magnitude to justify separation at either infrageneric or generic level because of its similarity to other species in many important features. The discovery of *W. saccata*, regarded here as a close relative of *W. densiflora*, does not affect the situation even though a pair or more of species may sometimes be given greater weight than single species for taxonomic separation. This is particularly so when, as in this case, the major character differentiating *W. densiflora* from the majority of other Australian *Wurmbea* species, namely the presence or absence of a nectary, is now known to have been misinterpreted.

Acknowledgements

Wurmbea saccata was discovered during the biological survey of the Barlee Range Nature Reserve in August 1993, which was funded by the Heritage Council of Western Australia through the National Estates Grant Program (Project N92/5). Thanks are due to Robert Bromilow, Michael Hughes, Peter Kendrick and Phil Fuller for field assistance and for locating some of the populations of the new species, to Katie Syme for her drawings, and to Paul Wilson for translating the diagnosis into Latin.

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