

**Taxonomic notes on *Calandrinia remota* (Montiaceae) and a reassessment of the status of *C. polyandra* var. *leptophylla* and *C. polyandra* var. *monantha***

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**SHORT COMMUNICATION**

*Calandrinia remota* J.M.Black (Montiaceae) is an annual, erect to semi-erect species with smooth, tan, orbicular seeds (elliptic in cross-section) and a widespread, but very disjunct distribution. In Western Australia it occurs over a relatively wide area of the Mid-West region, while interstate populations are found across the arid central and eastern parts of South Australia, just extending into far north-western New South Wales and far south-western Queensland (i.e., a disjunction of ~1400 kms between the closest western and eastern populations).

The species was first described by Black (1923, p. 369) from collections gathered at Gawler Range and northern parts of the Flinders Range to Cooper's Creek in South Australia. I have seen high-quality images of these syntypes (including seed) which are listed in the appendix. In a later publication Black (1932, pp. 41–42) added supplementary information to the protologue for *C. remota* saying he originally described the species from small, dried specimens collected near Mount Gunson and Tarcoola (omitting the Cooper's Creek syntype locality), but goes on to cite other locations from which he believed it occurred including Wynbring, Ooldea, Lake Callabonna, Strzelecki and Cooper's Creeks, and also Central Australia and Victoria Desert, Western Australia. He concluded by stating, "*C. polyandra* (Hook.) Benth. var. *leptophylla*, Benth., quoted for the "W. coast" of Western Australia, is perhaps the same as *C. remota*." Black (1948), later confirmed this view by placing *C. polyandra* var. *leptophylla* in synonymy under *C. remota* and, in so doing, established the usage of the latter name for the Western Australian flora.

Since Black's time numerous Western Australian collections have been referred to *C. remota*, and there are certainly good morphological reasons for doing so. Despite their disjunct distribution, the Western Australian collections are broadly similar to interstate ones seen. In particular, there is generally a close similarity in the seed morphology, which is always an important character in the taxonomy of the genus (Carolin 1987; Syeda & Carolin 1989). This disjunction is very similar to that also seen in *C. disperma* J.M.Black demonstrating that a large separation between populations of a species does not always result in morphological differentiation, but one should also not discount this possibility.

Collections of *C. remota* on loan from AD (26 specimens), BRI (20 specimens) and DNA (6 specimens) were examined and of these only nineteen collections were determined as *C. remota*. This included fifteen specimens from across much of central and north-eastern South Australia, two from far south-western Queensland and two from far north-western New South Wales that I had determined at NSW in 2006 – see appendix. Two of the six Northern Territory collections, like many of the Queensland and some of the South Australian collections, were confused with and thus redetermined as *Calandrinia* sp. Lumeah (R.W. Purdie 2168), a mostly prostrate to decumbent species with smooth, brown, globular seeds found growing on heavier soils that are often stony or rocky. A further two Northern Territory collections were *C. polyandra* while the remaining two sterile specimens were possibly *C. reticulata*, but definitely not *C. remota*. All the true *C. remota* collections above were relatively homogeneous morphologically, with populations restricted to sand dune habitats or undulating sandplains that are extensive throughout its eastern distribution. While the Northern Territory loan did not include a single *C. remota* specimen, there appears to be abundant suitable habitat, especially in the far south-east where the Simpson Desert occurs in all three states. Deep sand habitat thus might serve as a spotting feature for *C. remota* as collections made from other habitats should be considered doubtful for this species, keeping in mind that *C. balonensis* Lindl., *C. polyandra* and others may also occur on deep sands.

By comparison, Western Australian specimens of *C. remota* are much more diverse in habitat and display a more variable habit and basal leaf morphology. Amongst the above Western Australian collections there are several specimens that appear morphologically very similar to *C. remota sens. str.* and some of these even occur on sand dunes. Beside these, as previously indicated, many more specimens have characters with varying degrees of similarity and sometimes rather dissimilar. For these reasons two entities were segregated from Western Australian *C. remota* as potentially new taxa. The first, *C. sp.* Shark Bay (A. Markey 1405), is an annual species with black, smooth seeds (rather than tan, smooth seeds as seen in *C. remota sens. str.*) and is confined to coastal or near coastal calcareous habitat. A subspecies ranking is probably most appropriate for this entity. The other segregate, *C. sp.* Cape Range (F. Obbens FO 10/18), is a scrambling perennial often found growing through *Triodia* sp., on hard, limestone habitats in the Cape Range area and on Barrow Island. *Calandrinia* sp. Cape Range (F. Obbens FO 10/18) was included in a recent phylogeny of Australian *Calandrinia* (Hancock *et al.* 2018) and placed in the bottom branch of clade 2 (i.e., aligns mostly with section *Pseudodianthodiae*) well separated from other Western Australian accessions of *C. remota* (labelled as *sens. str.*). Although it should be noted the bootstrap values are relatively poor for the lower half of this clade, this result supports the recognition of *C. sp.* Cape Range (F. Obbens FO 10/18) as a distinct taxon. Unfortunately, genetic sampling of *C. remota* from other states was not included in this research. Following removal of the phrase name specimens, the remaining collections of *C. remota* at PERTH are still quite variable in morphology and habitat.

Apart from the presence of the above-mentioned segregates within Western Australian *C. remota*, the overarching question is whether any of the remaining western collections of the species should be truly regarded as conspecific with the syntypes. Currently, this is an open question that would require a dedicated study to resolve, and at the very least, an examination of spirit material from across its range. Even then, these plants are quite variable on a population basis and also within populations so finding several minor differences will not necessarily resolve this matter. It would seem that the most effective solution should be a combination of the above with a wider molecular-genetic study. Consequently, *C. remota* is currently considered to occur in Western Australia.

The name *C. polyandra* var. *leptophylla* was first published in *Flora Australiensis* (Bentham 1863). The type specimen, from Western Australia, was cited as, ‘W. coast, with the commoner form, *Bynoe*’. Benjamin Bynoe was a surgeon with the English navy who sailed extensively around Australia and

nearby. He collected from several areas all around Australia, but in Western Australia he collected predominantly from coastal and near coastal mainland sites and on islands of the Kimberley and Pilbara, with the majority of his collections originating from northern Australia.

Bynoe's type is a K collection previously on loan to CANB at the time of this study, but now has been returned. I have seen a high-quality image of this type and also had communicated with staff at CANB regarding this collection while it was still on loan. Six stems of early flowering material are attached to the type sheet with no fruiting/seeding material being available for examination. Rather than coming from the west coast as indicated in Bentham's protologue, the specimen is clearly labelled as 'N.W. Coast of Australia, Bynoe'. My assessment is that the specimen actually represents *C. strophiolata* (F.Muell.) B.D.Jacks. and is likely to have been collected from either the Kimberley coast or north-eastern Pilbara coast or nearby islands. Neither *C. polyandra* nor *C. remota* occur that far north. It is known that Bynoe once landed at Champion Bay (now Geraldton, Western Australia) where the above two species could have been collected in the wider area, but that trip was in mid-December, a time when these annual species are well past flowering or fruiting. Additionally, some of the more opened flowers of the Bynoe type specimen appear to have more than five petals, which definitely precludes the consistently five-petalled species *C. polyandra* and *C. remota*. On the other hand, *C. strophiolata* usually has ten to twelve petals. *Calandrinia polyandra* var. *leptophylla* is therefore considered to be a synonym of *C. strophiolata*.

The name *C. polyandra* var. *monantha* is a *nomen nudum* (Mueller & Tate 1896) and is accredited to a collection made by R. Helms near camp 49 on 12<sup>th</sup> September 1891 from the Great Victoria Desert, Western Australia (i.e., AD97601320A). It is probably this specimen that Black referred to when he stated that *C. remota* occurred in that Western Australian region. It is also possible that Black confused this with another collection Helms made from the Great Victoria Desert in South Australia near the Musgrave Range. Both collections are from the Elder Exploring Expedition of which Helms was the botanist. These two collections are relatively poor (particularly the latter one) and there are no seeds available on either. The former is vaguely similar to a small specimen of *Calandrinia* sp. Lumeah (R.W. Purdie 2168) which often has scapes terminating with a single flower (sometimes more) or more likely is a stunted specimen of *C. polyandra* due to poor seasonal conditions. Both these species can occur in this region, but without seed a positive determination is difficult, if not impossible. However, it is clear that Helms' Western Australian collection is not *C. remota* as Black indicated as no other collection of *C. remota* has ever been made in this region since.

## Appendix

***Calandrinia remota*** J.M.Black, *Trans. & Proc. Roy. Soc. South Australia* 47: 369 (1923). *Type*: South Australia, Lake Eyre Basin, east. Cooper's Creek, on Birdsville Track, no date or collector given (*syn*: AD 96415069); West of Lake Torrens. Mt. Gunson, c. 135 km north-north-west of Port Augusta, September 1913, *Mrs Beckwith* (*syn*: AD 96416001; *isosyn*: K001097823, image seen); Kanowarra (probably now Kanowana, ca. 110 km west of Innamincka), 10 October 1916, *S.A. White* (*syn*: AD 96416002).

*Other specimens examined*. WESTERN AUSTRALIA (selection; all in PERTH except where indicated): S of Carnarvon Tracking Stn, 17 Aug. 1969, *A.M. Ashby* 2970 (CANB *n.v.*, PERTH); Transect RB, Red Bluff, Kalbarri NP, 9 Sep. 2003, *D. & B. Bellairs* 6324; Dalgara Well, c. 5 km SE of Dalgara Stn HS, which is situated c. 80 km NE of Yalgoo, 17 Sep. 2011, *B. & H. Bennetts, M. & R. Skeet, G. Marsh* GM 146; Camel Soak on Number 2 Rabbit Proof Fence Rd, Perenjori, 8 Oct. 2003, *G. Byrne* 546A; on a granite outcrop 200 m to the E of the S Entrance Rd approximately

3.2 km from the Barnong Stn HS, 16 Aug. 2008, *G. Byrne* 3598; 72 km S of Carnarvon, 27 Oct. 1978, *H. Demarz* 7135 (CANB *n.v.*, PERTH); breakaway opposite Waterloo Reserve, NNW of Woolgorong Stn HS, 11 Sep. 2007, *D.J. Edinger* 6420; Quadrat 7, on Burnerbinmah – Nalbarra Rd, just N of Clinche’s Bore, in Thundelarra Stn, 14 Sep. 2008, *D.J. Edinger* 6888 C; Gabyon Station/Cue Rd, Shire of Yalgoo, 19.4 km NE of Courin Hill, 8 Oct. 2004, *F. Hort, J. Hort & J. Shanks* 2365B; Barloo Well, c. 11 km WSW of Lakeside Stn HS, which is c. 53 km WSW of Cue, 22 Sep. 2012, *G.J. Marsh* GM 342; Jack Hills, survey site JACK 04, c. 8 km WSW of spot-height 514 m, and approximately 5 km from the junction of Berringarra – Cue Rd and the main track running adjacent and parallel N of the Jack Hills Range, 23 Aug. 2005, *R. Meissner & Y. Caruso* 703; 13 km SW of Coodardy HS, 15 Sep. 1986, *A.A. Mitchell* 1561; c. 3.9 km upstream of the Greenough River where it crosses the Yuna – Tenindewa Rd (i.e. Noondamurra Crossing), 14 Oct. 2003, *F. Obbens* FO 73/03; c. 100 m S down track to Karara HS from junction with Mungada Rd, c. 50 km directly NE of Perenjori, 10 Sep. 2007, *F. Obbens* FO 7/07; on access track to Red Bluff, Quobba Stn, just off track before descent into beachfront and campgrounds, c. 2 km N of Red Bluff, 2 Sep. 2020, *F. Obbens* FO 03/20; along Butchers Track, 25.7 km E of where gas pipeline crosses track and also c. 93 km E of the North West Coastal Hwy, 19 Aug. 2008, *F. Obbens, F. Hort & J. Hort* FO 11/08; 12.7 km N along Twin Peaks-Woolleen Rd from Twin Peaks Stn turnoff (i.e. vicinity of Mt Hope), 17 Sep. 2008, *F. Obbens, F. Hort & J. Hort* FO 37/08; 21.2 km N of Gascoyne Junction townsite on the Ullawarra Rd (E side of Rd), 13 Oct. 2011, *F. Obbens & G. Marsh* FO 16/11; c. 22 km WNW of Mingenew townsite, 1 Oct. 2008, *B. Taylor & K. Greenacre* MING 68-01; adjacent to Quadrat WUN1 on Eurardy Stn, which is c. 43 km N of Kalbarri turnoff on the North West Coastal Hwy and N of the Murchison River in the Shire of Northampton, 29 Aug. 2003, *Wildflower Society of WA* EURA 57. SOUTH AUSTRALIA: Uro Bluff, Yudnapinna locality, Sep. 1939, *Anon. s.n.* (AD 98590874, AD 98590882); Gawler Ranges, Kolendo Stn, 18 Oct. 1985, *Anon. s.n.* (AD 98649124); 13 km ESE of Billa Kalina HS, 21 Dec. 1984, *F.J. Badman* 1602 (AD); 8 km NE of Bulgunnia HS, 13 Nov. 1992, *F.J. Badman* 6456 (AD); 12 km S of Innamincka No. 3 Bore, Innamincka Regional Reserve, 14 Oct. 1996, *F.J. Badman* 9996 (AD); 32.2 km direct SSE of King Lookout, Innamincka Regional Reserve, 18 Sep. 2008, *M. Barnett* BS612-323 (AD); 100 m S of creek crossing by Cadnawatina Dam, Coronation paddock, Witchelina, [4.2 km direct ESE of The Bend], 13 Oct. 2010, *P.J. Lang & N.R. Neagle* BS719-207 (AD); Drive N from Marqualpie Bore to boundary with Cordillo Downs, then turn W and drive 11.5 km, [10.8 km direct ESE of Ootadoola Hill], Innamincka Regional Reserve, 19 Sep. 2008, *N.R. Neagle & M. Thomas* BS612-787 (AD); 21.6 km direct SSW of Arrabury, Innamincka Regional Reserve, 25 Sep. 2008, *N.R. Neagle & G.M. Kluske* BS612-1062 (AD); NE Andamooka Mine, Town Dam track, 22 Oct. 2004, *M.C. O’Leary* 4554 (AD); 9.3 km WNW from May Hill, property: Wirraminna, 8 Nov. 1996, *G.A. Pickerell & T.M. Celebrezze* BS69-31199 (AD); 3.6 km S from Marsella Hill, [1.5 km direct WSW of The Pines], property: Arcoona, 12 Nov. 1996, *S.J. Pillman & T.S. Goodman* BS69-30663 (AD). QUEENSLAND: 23 miles WNW of Thargomindah on loose red sandhill, 12 Sep. 1967, *L. Pedley* 2471 (AD, BRI); QNC Trip, Site 5, 30 km ENE of Rosebirth [roughly halfway along Rd between Birdsville and Betoota], 22 Aug. 1978, *R.W. Purdie* 1282 (BRI). NEW SOUTH WALES: Camerons Corner, 9 Sep. 1981, *S.W.L. Jacobs* 4148 (NSW 679874); 18 km E of Cameron Corner, near Olive Downs HS, 29 Oct. 1986, *A.N. Rodd, J. Gentle & Peter G. Wilson* 5779 (NSW 196383).

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