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Three new perennial species of *Calandrinia* (Montiaceae) from southern Western Australia

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Abstract

Obbens, F.J. Three new perennial species of *Calandrinia* (Montiaceae) from southern Western Australia. *Nuytsia* 29: 193–204 (2018). Three new species of *Calandrinia* Kunth. sect. *Pseudodianthoideae* Poelln. from Western Australia (*C. quartzitica* Obbens, *C. lefroyensis* Obbens and *C. wilsonii* Obbens) are described and illustrated. All occur in the south-west, where there is only one other perennial species known to date.

Introduction

Whereas a series of recently published papers (Obbens 2011, 2012, 2014a, 2014b) dealt with the taxonomy of new annual species of *Calandrinia* Kunth. from Western Australia, this paper describes three new perennial species. *Calandrinia quartzitica* Obbens and *C. lefroyensis* Obbens are conservation priority species found mainly within samphire communities adjacent to salt lakes of the Eastern Goldfields. The third species, *C. wilsonii* Obbens occurs within similar habitats and is also an uncommon species of the Avon Wheatbelt bioregion. Although these species are perennials, they are not tuberous and therefore are placed within sect. *Pseudodianthoideae* Poelln. One other perennial species, known by the phrase-name *C.* sp. Gypsum (F. Obbens & L. Hancock FO 10/14) also occurs in south-western Australia.

Methods

Methods used are the same as those described in Obbens (2011). The descriptions refer to stem leaves only for *C. quartzitica* and *C. lefroyensis*, as no distinction between basal and stem leaves was observed, the stems usually being quite leafy and sub-fasciculate from near ground level to the stem ends. Occasionally, only the apical portions of stems are leafy in the two taxa, but leaf scars are still evident beneath. If there is a distinct basal leaf whorl, then these leaves may be deciduous prior to flowering and therefore were not seen in the examined collections. *Calandrinia wilsonii* usually has an inconspicuous basal rosette and stem leaves that are more scattered and alternate.

SEM images were produced using a Joel NeoScope JCM-6000 scanning electron microscope, operating at a current of 15Kv with high vacuum. Seeds were coated with gold before scanning. Images were subsequently processed using Photoshop 2.0. The term ‘collicula’ (pl. ‘colliculae’) is used here

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to describe the individual domed protuberances characteristic of a colliculate seed surface pattern commonly seen in many *Calandrinia* species.

The bioregions and sub-bioregions referred to in the text, species distribution statements, and those indicated on the map, are from *Interim Biogeographical Regionalisation for Australia (IBRA) Version 7.0* (Department of the Environment 2013).

Taxonomy

Calandrinia quartzitica Obbens, *sp. nov.*

Type: Goongarrie Lake edge, Western Australia [precise locality withheld for conservation reasons], 10 October 2013, *F. Obbens, F. Hort & J. Hort* FO 18/13 (*holo*: PERTH 08479143 [Sheet 1 of 2] & PERTH 08479151 [Sheet 2 of 2]; *iso*: AD, CANB, MEL).

Calandrinia sp. Goongarrie (F. Obbens, F. Hort & J. Hort FO 18/13), Western Australian Herbarium, in *FloraBase*, https://florabase.dpaw.wa.gov.au/ [accessed November 2017].

Semi-erect to erect *perennial herbs*, usually scrambling through other plants, 150–500 mm tall, 40–350 mm wide, glabrous, the root system comprising a moderate to large taproot with several lateral roots. *Stems* usually 1–7, 14–130 mm long, leafy, radiating from base. *Stem leaves* very fleshy, narrowly linear to narrowly obovate, occasionally broader, 10.7–67 mm long, 1.9–5.5 mm wide, usually terete to compressed in T.S., rarely flatter with a subtle, shallow, medial groove on the adaxial surface, scattered to sub-fasciculate over entire stem or sometimes confined to the stem ends, apex often acute and mucronate, usually reddish-brown. *Scapes* 60–210 mm long, with 2 or more residual leaves and/or bracts evenly scattered along the scape, occasionally once-branched. *Inflorescence axis* 30–110 mm long, bare except for 3 to several ± scarious bracts, mostly opposite particularly on the upper axis, generally forming a loose cyme. *Inflorescence axis bracts* appressed to ± spreading, triangular, occasionally broader, 1.5–3.2 mm long, 1.7–3.1 mm wide, apex long-acuminate. *Pedicels* 7–29 mm long and erect, to 36 mm long in fruit and moderately reflexed. *Flowers* 17–35 mm diam. *Sepals* thick, ovate to broadly ovate, 4.2–6.3 mm long, 3.1–4.7 mm wide, free to base, mucronate, with a moderately prominent midvein and several roughly parallel lateral veins with some reticulation. *Petals* 5, creamy white tinged with pink or entirely light or mid-pink, obovate to broadly obovate, sometimes with a small notch at apex, 8.3–14.2 mm long, 5.5–9.8 mm wide, free to base. *Stamens* 65–96 in 2 or 3 ill-defined rows with the inner series longest; filaments free, 1.4–5.1 mm long, attached to the top of basal ring beneath ovary, papillose on lower half of basal adaxial portion; anthers elliptic to oblong in outline, 0.75–1.1 mm long, 0.5–0.6 mm wide, versatile, extrorse, dehiscing longitudinally. *Ovary* obloid to obovoid, 1.3–2.1 mm diam., brown. *Stigmas* 3, squat-triangular, lengthening, spreading somewhat and becoming narrowly triangular to linear with maturity, 0.9–3.6 mm long, free to base, with a dense covering of moderately long stigma trichomes. *Capsule* ovoid to broadly ovoid, 3.4–6.2 mm long, 2.4–4.4 mm wide, the apex obtuse, usually level with the sepals, occasionally slightly shorter or longer; valves 3, splitting from apex to base with age. *Seeds* 98–209 per capsule with an obvious, bright metallic lustre when mature, reniform, 0.65–0.75 mm long, 0.6–0.7 mm wide, 0.4–0.5 mm thick, surface pattern strongly colliculate, in plan view the surface with elongated and moderately domed colliculi, sometimes each colliculum with a papilla or fingertip-like projection distally, together these papillae or projections forming 3 or more even-swirled rows in plan view and 7 or more parallel rows dorsally. (Figures 1, 2)

Figure 1. *Calandrinia quartzitica*. A – habitat; B – habit, with acute leaf apices arrowed. Photographs by Brian Moyle.

Diagnostic features. *Calandrinia quartzitica* may be uniquely diagnosed among Western Australian species by the following combination of characters: perennial and scrambling habit; seeds with an obvious, bright metallic lustre at maturity; terete, mostly linear leaves with acute apices; an unusual habitat dominated by quartzite or at least grows in soils wholly or in part derived from quartz.

Other specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 28 Sep. 2003, *R. Davis* 10635 (PERTH); 13 Oct. 2016, *F. Hort, J. Hort & F. Obbens* FH 4097 (PERTH); 13 Oct. 2016, *F. Hort, J. Hort & F. Obbens* FH 4101 (PERTH); 20 Sep. 2013, *J. Jackson & B. Moyle* 271 (PERTH); 8 Oct. 2014, *F. Obbens & L. Hancock* FO 05/14 (PERTH); 15 Oct. 2015, *F. Obbens, F. Hort & J. Hort* FO 24/15 (PERTH); 16 Oct. 2015, *F. Obbens, F. Hort & J. Hort* FO 26/15 (PERTH).

Phenology. Flowering and fruiting collections of *C. quartzitica* have been made from mid-September to mid-October, but the actual period is likely to be longer.

Distribution and habitat. *Calandrinia quartzitica* is currently known from the edge of five salt lakes just north of Kalgoorlie in the Eastern Murchison sub-bioregion (Figure 3). It occurs on the samphire-dominated lake edges and lake channels, and at the base and runoff flats of closely adjacent quartzitic ridges and breakaways or quartzitic hummocky ground, where these occur near salt-lake edges. On the salt-lake flats the soils are brown silty sand or red-brown silty loams strewn with quartzite pieces, while the nearby ridges and breakaway slopes are very rocky with residual soil pockets. At locations where there are no obvious quartzitic ridges or hummocks it grows on lake edge floodplains in red-brown silty sand derived wholly or in part from pre-existing quartz geology, as seen from the Geological Survey of Western Australia, 1:250,000 Geological Series maps (Kriewaldt 1970, Thom & Barnes 1977). On these lake edge flats *C. quartzitica* usually grows through samphire shrubs using them as support. The samphire community includes some of the following: *Atriplex codonocarpa*,

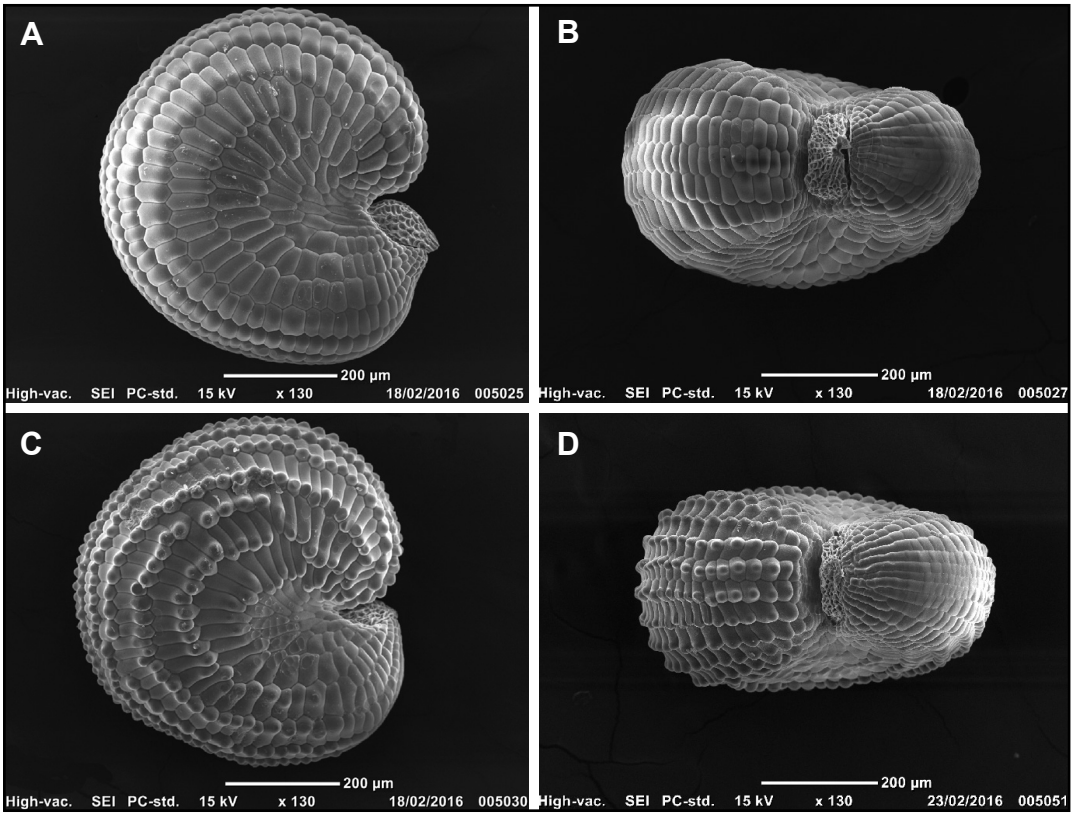

Figure 2. *Calandrinia quartzitica* seeds from the type location at Lake Goongarrie (A, B) and from Lake Moriarty (C, D). A – plan view; B – dorsal view; C – plan view; D – dorsal view.

Maireana amoena, *M. glomerata*, *Lawrencia squamata*, *Tecticornia* sp., *Eremophila glabra* subsp. *verrucosa*, *Frankenia* sp., *Disphyma crassifolium*, *Eragrostis dielsii* and *Brachyscome ciliaris*. Ridge sites generally comprise open shrublands of *Eremophila oppositifolia*, *Scaevola spinescens*, *Ptilotus rigidus* etc. with a mulga species dominating the ridgetops and breakaway summits.

Conservation status. Listed by Smith and Jones (2018) as Priority One under Department of Parks and Wildlife Conservation Codes for Western Australia Flora, under the name *Calandrinia* sp. Goongarrie (F. Obbens, F. Hort & J. Hort FO 18/13). *Calandrinia quartzitica* is a medium-range endemic that has evolved within an unusual habitat type. The combination of salt lakes and samphire flats next to quartzite geology is relatively uncommon and it is probable that this species will only be found at locations that have similar geology. There are eight collections of *C. quartzitica* at PERTH over a range of approximately 150 km north to south, but not all are from different populations and there are no records from any conservation areas. Several lake systems occur in the general area, and searches for more populations of *C. quartzitica* should be undertaken there.

Etymology. The epithet is derived from the quartz geology that exists at sites where this species has been collected. It not only refers to the obvious associated landscape features such as quartzitic ridges and quartzitic hummocks, but also to flatter terrain where this species grows in soils wholly or in part derived from quartz or quartz-related geology.

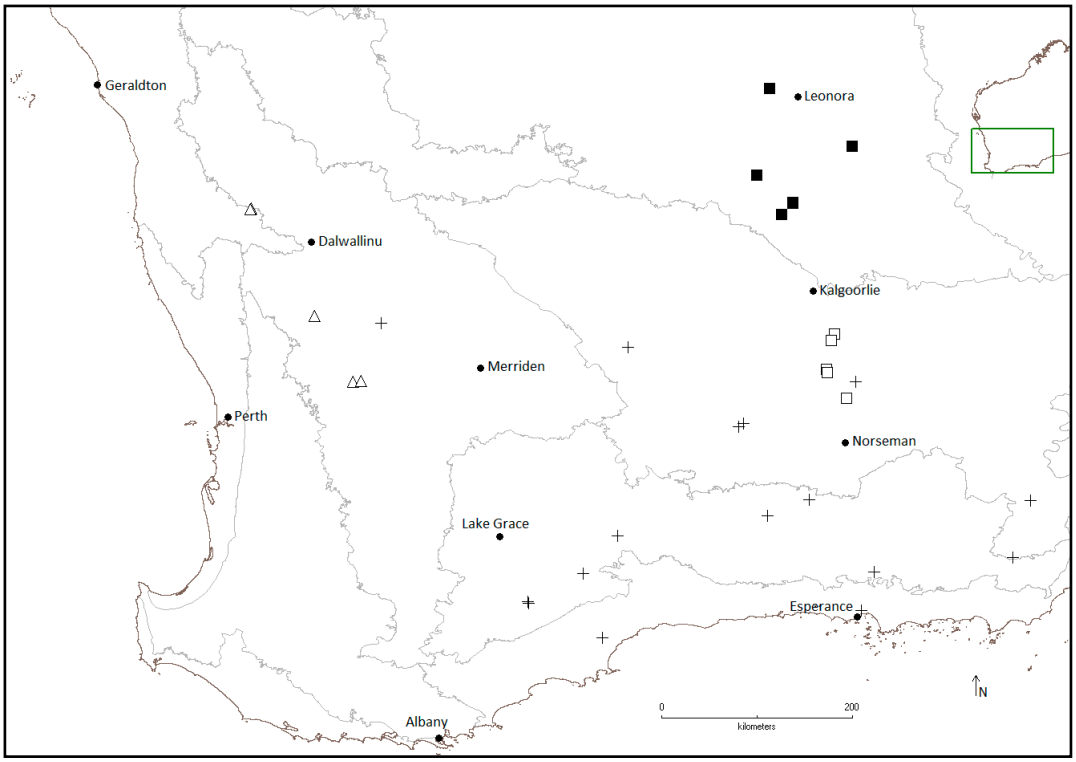

Figure 3. Distribution of *Calandrinia quartzitica* (■), *Calandrinia lefroyensis* (□), *Calandrinia wilsonii* (Δ) and *Calandrinia* sp. Gypsum (F. Obbens & L. Hancock FO 10/14) (+).

Affinities. Previously (see notes below) *C. quartzitica* has been confused with *C. polyandra* Benth., which differs in being an erect annual species, with less succulent leaves that are more compressed and have very distinct adaxial grooves. However, a recent molecular phylogeny of Australian *Calandrinia* has *C. sculpta* Obbens & J.G.West as sister to *C. quartzitica* (with moderate bootstrap support), while *C. polyandra* is placed some distance away (Hancock *et al.* in press). *Calandrinia sculpta* differs from *C. quartzitica* in being an annual, decumbent species with black seeds, but is somewhat similar in its seeds having dorsal rows of papillae, however, these rows are fewer, well-spaced and with much larger papillae.

Somewhat similar in morphology to *C. quartzitica* is the other new taxon described here, *C. lefroyensis* Obbens. This species was not included in the above molecular analyses. See the affinities section under that species for differences between the two taxa.

Notes. In 2003, R. Davis made the first collection of *Calandrinia quartzitica* under the name *C. polyandra* noting that it was possibly a perennial. It was not collected again until 2013, when J. Jackson and B. Moyle discovered *C. quartzitica* while looking for another conservation-listed species that preferred quartzite ridges. They recognised it as a potentially new species, and not long after it was phrase-named.

Mature seeds of *C. quartzitica* can be readily distinguished by their bright, metallic lustre, but immature seeds may lack this lustre and be more similar in colour to mature seeds of *C. polyandra*. In mature seeds of *C. quartzitica* the rows of papillae on the dorsal surface vary from partially to well expressed and might occasionally be almost absent. Certainly they are not always evident in immature seeds.

Calandrinia lefroyensis Obbens, *sp. nov.*

Type: Lake Lefroy system, Western Australia [precise locality withheld for conservation reasons], 4 November 2013, *F. Obbens & E. Reid* FO 9/05 (*holo*: PERTH 07215606; *iso*: CANB, MEL).

Calandrinia sp. Widgiemooltha (F. Obbens & E. Reid FO 9/05), Western Australian Herbarium, in *FloraBase*, https://florabase.dpaw.wa.gov.au/ [accessed November 2017].

Semi-erect to erect *perennial herbs*, usually scrambling through other plants, 135–260 mm tall, 40–160 mm wide, glabrous, the root system comprising a moderate-sized taproot with a few lateral roots. *Stems* usually 1–4, 10–48 mm long, leafy, radiating from base. *Stem leaves* very fleshy, narrowly obovate to obovate, occasionally broader, 4–31 mm long, 0.8–7.3 mm wide, usually semi-terete to compressed in T.S., occasionally flatter with a subtle, shallow, medial groove on the adaxial surface, scattered to sub-fasciculate over entire stem or sometimes confined to the stem ends, apex often obtuse, usually grey-green. *Scapes* 44–170 mm long, with 2 or more residual leaves and/or bracts evenly scattered along the scape, occasionally 2 scapes arising from a stem end. *Inflorescence axis* 20–115 mm long, bare except for 3 to several ± scarious bracts, mostly opposite particularly on the upper axis, generally forming a loose cyme. *Inflorescence axis bracts* appressed to ± spreading, narrowly triangular to triangular, 1.3–2.9 mm long, 1.3–2.2 mm wide; apex acuminate and shortly mucronate. *Pedicels* 7–22 mm long and erect, to 31 mm long in fruit and moderately to strongly reflexed. *Flowers* 16–23 mm diam. *Sepals* thick, ovate to broadly ovate, 4.7–5.7 mm long, 3.5–5 mm wide, free to base, mucronate, with a prominent midvein and several or less, roughly parallel lateral veins with very little reticulation. *Petals* 5, mid-pink to dark pink, obovate to broadly obovate, sometimes shallowly emarginate at apex, 7.8–10.3 mm long, 5.4–8.5 mm wide, free to base. *Stamens* 119–126 in 3 or 4 ill-defined rows with the inner series longest; filaments free, 1.2–3.1 mm long, attached to the top of basal ring beneath ovary, papillose on lower third of basal adaxial portion; anthers oblong to broadly oblong in outline, 0.6–0.7 mm long, 0.4–0.5 mm wide, versatile, extrorse, dehiscing longitudinally. *Ovary* obovoid, 1.2–1.6 mm diam., brown. *Stigmas* 3, squat, narrowly triangular, lengthening, spreading somewhat and becoming narrowly linear with maturity, 1.2–3.3 mm long, free to base, with a dense covering of long stigma trichomes. *Capsule* ovoid, 3.5–5.2 mm long, 2.6–3.8 mm wide, the apex obtuse, usually level with the sepals occasionally slightly shorter; valves 3, splitting from apex to base with age. *Seeds* 59–72 per capsule, metallic grey, dull, sub-reniform to reniform, 0.6–0.8 mm long, 0.5–0.7 mm wide, 0.45–0.65 mm thick, strongly colliculate, in plan view the surface with very elongated and well-domed colliculi, most with a papilla (i.e. fingertip-like) or a tubercle distally, together these papillae/tubercles forming a few erratic swirled rows in plan view and 4 or 5 distinctly separated, parallel rows in dorsal view. (Figures 4, 5)

Diagnostic features. *Calandrinia lefroyensis* may be uniquely diagnosed among Western Australian species by the following combination of characters: scrambling perennial habit; seeds a distinctive dull, metallic grey at maturity; seeds with a strongly colliculate structure containing very obvious rows of papillae/tubercles; mostly semi-terete to compressed, obovate leaves with obtuse apicies; an unusual habitat on the ecotone of samphire and open woodlands.

Other specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons]: 9 Oct. 2014, *F. Obbens & L. Hancock* FO 09/14 (PERTH); 30 Oct. 2015, *G. Owen & P. Moonie* PM 65 (PERTH); 14 Nov. 2016, *G. Wells* RS 089-05 (PERTH); 15 Nov. 2016, *G. Wells* SI0054-01 (PERTH).

Phenology. Based on material seen, *C. lefroyensis* flowers and fruits from early October to mid-November, but a longer flowering/fruiting period is possible.

Figure 4. *Calandrinia lefroyensis* from Lake Cowan. A – habitat; inset – flower. Photographs by Lillian Hancock.

Distribution and habitat. *Calandrinia lefroyensis* occurs on salt-lake flats among samphire communities. It is currently known from three lakes south of Kalgoorlie in the Coolgardie bioregion (see Figure 3). The soils are brown silty loams or brown-grey sandy clays. In general, *C. lefroyensis* appears to favour the outer edges of samphire communities including within the ecotone of adjacent communities where there are open assemblages of taller species such as *Casuarina obesa* and *Eucalyptus* spp. It has also been collected up to several hundred metres from the lake shoreline. Associated species at the known sites include *Atriplex nana*, *Maireana glomerifolia*, *Tecticornia doleiformis*, *Frankenia setosa*, *Senecio pinnatifolius* and *Austrostipa* sp.

Conservation status. Listed by Smith and Jones (2018) as Priority One under Department of Parks and Wildlife Conservation Codes for Western Australian Flora, under the name *Calandrinia* sp. Widgiemooltha (F. Obbens & E. Reid FO 9/05). *Calandrinia lefroyensis*, like *C. quartzitica*, appears to be a medium-range endemic that has evolved around lakes with a similar underlying geology. So far, all known populations are outside conservation estate. Suitable habitat most likely occurs around other lakes in the region and the current distribution probably will be extended locally with targeted surveys.

Etymology. The species is named after Lake Lefroy where it was first collected.

Affinities. *Calandrinia lefroyensis*, *C. quartzitica* and the following described species, *C. wilsonii*, all have flowers with a similar general morphology (having five petals, three stigmas and numerous stamens) to many other species in sect. *Pseudodianthoideae* Poelln. They obviously differ from other species in this section in having distinctive seeds and in being perennials with a scrambling habit. Their distinctive seeds, along with other characters clearly separate them from each other.

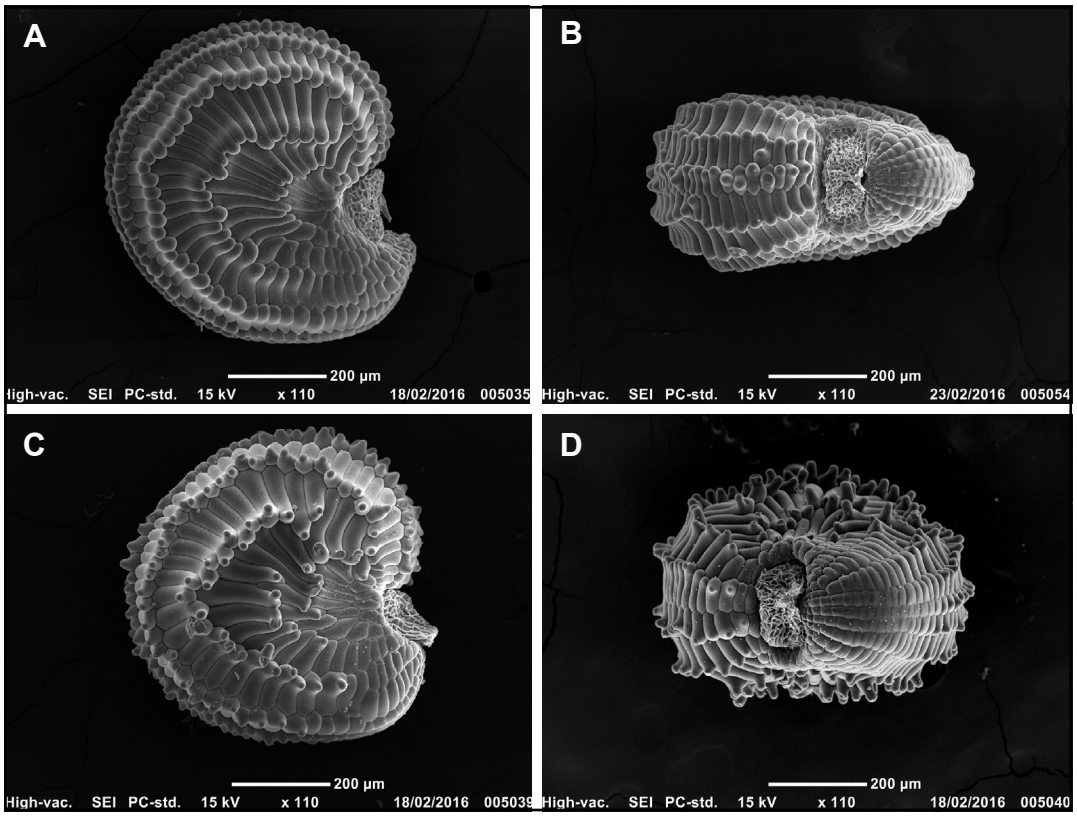

Figure 5. *Calandrinia lefroyensis* seeds from the type locality at Lake Lefroy (A, B) and from Lake Cowan (C, D). A – plan view; B – dorsal view; C – plan view; D – dorsal view.

For example, *C. quartzitica* stem leaves are numerous, mostly terete and linear with an acute apex and often reddish brown, whereas *C. lefroyensis* has somewhat fewer stem leaves that are mostly semi-terete to compressed, narrowly obovate with an obtuse apex and regularly grey-green, and *C. wilsonii* has compressed to more flattened stem leaves that are widely elliptic to obovate and appear light grey to greyish-maroon at maturity. Additionally, *C. lefroyensis* has dull, metallic grey seeds with four or five prominent dorsal rows, whereas mature *C. quartzitica* seeds have a bright, metallic lustre with seven or eight dorsal rows. *Calandrinia wilsonii* differs markedly from both those species in having glossy, brown or tan seeds with a smoother surface, the colliculae being scarcely raised. Its seeds are also non-papillate (see Figures 2, 5, 6).

Notes. While *C. quartzitica* and *C. lefroyensis* both occur on the edges of salt-lake systems of the Eastern Goldfields region the geology of their habitats differs substantially. For instance, north of Kalgoorlie (i.e. within the distribution of *C. quartzitica*) the majority of lake edges consist of alluvial or aeolian deposits often red-brown, silty, quartz sands usually in sheets or dunes and in part also saline and gypsiferous. Also near salt lakes, quartz gabbro is scattered on flats below quartzitic ridges and sometimes even quartz and feldspar from nearby granites (Kriewaldt 1970; Thom & Barnes 1977). This differs markedly to the major geology of salt-lake edges south of Kalgloorie (i.e. within the distribution of *C. lefroyensis*). These areas consist of alluvium and colluvium deposits of semiconsolidated, ferruginous sandstone or metasedimentary rocks and soils such as metaconglomerate, chert and metafelsic volcaniclastic rocks and soils (Griffin 1989). The geology of the agricultural belt where *C. wilsonii* is distributed also contrasts markedly to the above. The

salt lakes and river flats here are generally situated upon granitic and gneissic bedrock covered with shallow assorted deposits. These systems frequently develop wind-blown small rises or lunettes or flats of fine, silty sand or loam, often with significant gypsum content (Chin 1986), and this is where *C. wilsonii* frequently occurs.

Calandrinia wilsonii Obbens, *sp. nov.*

Type: east of Meckering, Western Australia [precise locality withheld for conservation reasons], 28 October 2002, *F. Obbens* 42/02 (*holo*: PERTH 06204457; *iso*: CANB, MEL).

Calandrinia sp. Meckering (F. Obbens 42/02), Western Australian Herbarium, in *FloraBase*, https://florabase.dpaw.wa.gov.au/ [accessed November 2017].

Semi-erect to erect *perennial herbs*; usually scrambling through other plants, 70–370 mm tall, 50–330 mm wide, glabrous, the root system comprising a moderate-sized taproot with several lateral roots. *Basal leaves* fleshy, narrowly spathulate to obovate, 10–72 mm long, 1–11 mm wide, with a shallow medial groove on adaxial surface, green, often insignificant on most specimens. *Stems* usually 1–14, 18–190 mm long, radiating from base. *Stem leaves* very fleshy, elliptic to obovate occasionally linear, 3.5–31.5 mm long, 1.2–7.8 mm wide, usually compressed or more flattened in T.S., alternate, often light grey-maroon when mature. *Scapes* 35–165 mm long, with 2 or 3 residual leaves/bracts evenly spaced, occasionally once-branched. *Inflorescence axis* 20–106 mm long, containing 3 to several ± scarious bracts, mostly opposite on upper axis, generally forming a loose cyme, the surface often finely warty and/or glandular. *Inflorescence axis bracts* appressed to ± spreading, triangular, 1.6–3.5 mm long, 1.4–3 mm wide; apex acute and occasionally recurved. *Pedicels* 9–47 mm long, to 72 mm long in fruit, moderately to strongly reflexed. *Flowers* 15–24 mm diam. *Sepals* thick, ovate to broadly ovate, 3.2–5.8 mm long, 2.9–5 mm wide, free to base, with a indistinct midvein and several, indistinct, parallel lateral veins with some reticulation. *Petals* 5, mid-pink, broadly obovate, with obvious notch or depression at apex, 8.8–11.4 mm long, 7.3–8.9 mm wide, free to base. *Stamens* 65–77 in 2 or 3 ill-defined rows with the inner series longest; filaments free, 1.4–3.5 mm long, attached to top of a basal ring beneath ovary, papillose on lower third of basal adaxial portion; anthers oblong to broadly oblong in outline, 0.8–1.05 mm long, 0.5–0.6 mm wide, versatile, extrorse, dehiscing longitudinally. *Ovary* obovoid, 1.5–2.1 mm diam., brown. *Stigmas* 3, squat-triangular, lengthening, spreading slightly and becoming narrowly triangular to linear with maturity, 1.2–2.1 mm long, free to base, with a dense covering of stigma trichomes. *Capsule* ovoid, 3.3–5.3 mm long, 2.1–3.6 mm wide; apex obtuse, usually equal to or slightly protruding beyond sepals; valves 3, splitting from apex to base with aging. *Seeds* 84–97 per capsule, brown or tan, semi-glossy to glossy, reniform to orbicular, usually with an obvious central depression in plan view, 0.45–0.7 mm long, 0.4–0.6 mm wide, 0.2–0.35 mm thick; surface pattern finely colliculate, the colliculae scarcely raised. (Figure 6)

Diagnostic features. *Calandrinia wilsonii* can be uniquely diagnosed among Western Australian species by the following combination of characters: it is a perennial species with a scrambling habit, it has seeds superficially like *C. polyandra*, but they differ in that the colliculae are smaller, finer and flattened (i.e. not domed). The seeds of this species usually have a central depression on either side in plan view. The inflorescence axis can often be finely warty and/or glandular.

Other specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 26 Sep. 1999, *M.N. Lyons & S.D. Lyons* 3973 (PERTH); 3 Oct. 2000, *M.N. Lyons & S.D. Lyons* 4081 (PERTH); 2 Oct. 2002, *F. Obbens* 37/02 (PERTH); 28 Oct. 2002, *F. Obbens* 43/02 (PERTH); 16 Oct. 2003, *F. Obbens* FO 82/03 (PERTH); 6 Nov. 2015, *F. Obbens* FO 29/15 (PERTH).

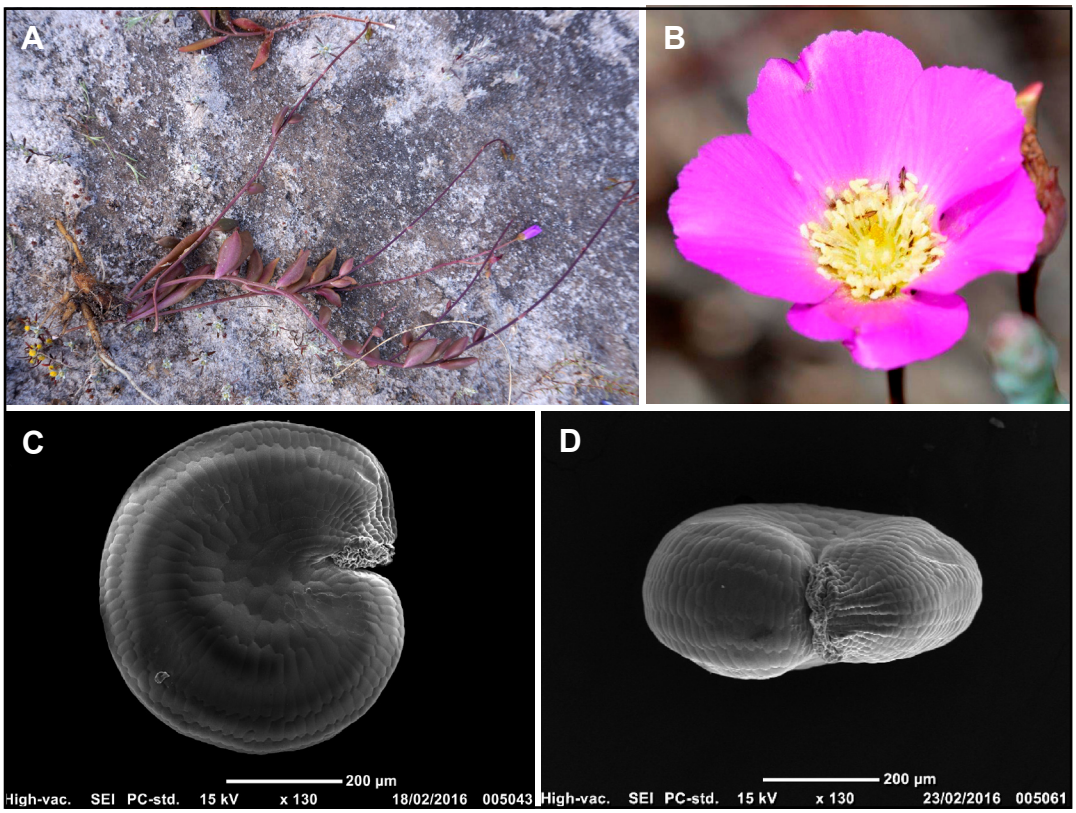

Figure 6. *Calandrinia wilsonii* from Mortlock East River (A, B) and seeds from the type location (C, D). A – habit including rootstock; B – flower; C – plan view; D – dorsal view. Photographs by Lillian Hancock (A) and Jean Hort (B).

Phenology. *Calandrinia wilsonii* flowers and fruits from mid-October through to late November and possibly longer.

Distribution and habitat. This species occurs on small rises or lunettes or flats just above the waterline of salt lakes or saline river floodplains. It has a scattered distribution from near Coorow in the north to east of Meckering (see Figure 3). *Calandrinia wilsonii* grows in a variety of soils frequently described as grey, silty loams/clays to brown or grey-brown, silty sandy clays. Only three collections state that the soil contains gypsum, but it is almost certain that gypsum will be found at some level within these habitats. All collection labels refer to *C. wilsonii* as occurring in samphire or halophytic communities dominated by *Tecticornia* species such as *T. halocnemoides*, *T. leptoclada*, *T. peltata*, *T. undulata* and *T. pergranulata*. Other common species include *Frankenia* sp., *Maireana* sp., *Acacia* sp., *Didymanthus roei*, *Triglochin mucronata*, and often the weed *Mesembryanthemum nodiflorum* and several grassy weeds.

Conservation status. Recently listed as Priority Two under Conservation Codes for Western Australian Flora, as *Calandrinia* sp. Meckering (F. Obbens 42/02). Currently there are seven collections at PERTH from three localities. The distribution is medium-range and it is probably under-collected; however, the low number of plants at most of these sites and the strong impact of salinity and weeds is cause for concern. A targeted survey of 20 or more lakes across and beyond the distribution of *C. wilsonii* during late spring 2015 and 2016 only found one new location with very few plants near Wongan

Hills. This suggests that *C. wilsonii* may be impacted quite severely within the habitat it prefers and more surveys should be undertaken to determine its true conservation status.

Etymology. This species is named in honour of Paul Wilson who has given me taxonomic advice and encouragement with this project over many years. Paul was also responsible for directing me to the site east of Meckering where this species was first discovered. Paul spent most of his working career at the Western Australian Herbarium dedicated to the task of naming and understanding Western Australia's flora.

Affinities. The recent molecular phylogeny of Australian *Calandrinia* (L. Hancock *et al*. in press) has *C. wilsonii* as sister to *C.* sp. Gypsum (F. Obbens & L. Hancock FO 10/14) (100% bootstrap support), while *C. polyandra* is some distance away. However, *C. wilsonii* seeds are similar to those of *C. polyandra*, in size, shape and colour, but differ markedly as the colliculae are smaller, finer, not domed and more-glossy overall. Frequently, the seeds of *C. wilsonii* also differ from *C. polyandra* and other *Calandrinia* species in having a noticeable central depression on either side when in plan view. The inflorescence axis often can be finely warty and/or glandular.

As might be expected from their close relationship, the perennial species *C.* sp. Gypsum (F. Obbens & L. Hancock FO 10/14) is similar in habit and habitat to *C. wilsonii*, hence some confusion between these two species is potentially possible. *Calandrinia* sp. Gypsum (F. Obbens & L. Hancock FO 10/14) differs substantially from *C. wilsonii* in having somewhat glossy, dark red-brown to black seeds that are colliculate and finely papillate at maturity; those of *C. wilsonii* are non-papillate.

See notes under *C. lefroyensis* for differences from the other two described species in this paper.

Notes. At present, the distributions of *C. wilsonii* and *C.* sp. Gypsum (F. Obbens & L. Hancock FO 10/14) are quite different and do not overlap (see Figure 3). There are a number of collections of *Calandrinia* perennials from the Lake Magenta and Lake King areas that are sterile or lack mature seeds. These are now designated as *C.* ? sp. Gypsum (F.Obbens & L. Hancock FO 10/14) until future fieldwork can determine their true identity. A description for *C.* sp. Gypsum (F. Obbens & L. Hancock FO 10/14) is also still in progress.

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