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Bush Blitz collections and iNaturalist observations assist the recognition of a new species from New South Wales, *Lomandra briggsiana* (Asparagaceae)

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Abstract

A new species of *Lomandra* Labill., *Lomandra briggsiana* R.L.Barrett & T.C.Wilson, is described from the Great Dividing Range and Western Slopes of New South Wales. The new species has affinity to the widespread south-eastern Australian species *Lomandra multiflora* (R.Br.) Britten, and to *L. decomposita* (R.Br.) Jian Wang ter & A.R.Bean and *Lomandra ramosissima* Jian Wang ter from Queensland. It has previously been included under *L. multiflora* as a 'terete-leaved' form in the *Flora of New South Wales* and recognised as *Lomandra* sp. Oxley Wild Rivers (T.M. Collins 924) on PlantNET. While the taxon has been known for some time, many of the existing collections are sterile or have only immature or old inflorescences present, and all but one of the collections represent only a single sex. Formal description has been prompted by the collection of fertile material during a Bush Blitz expedition in Oxley Wild Rivers National Park and good-quality photographs of flowering material posted on iNaturalist.

Introduction

Permanently preserved specimens held in accessible research collections provide a wealth of knowledge about our natural world. These records are evidence supporting both a contemporary and historical understanding of species distributions. However, it is not uncommon to find that some specimens represent species that are yet to be formally named. Bebber *et al.* (2010) estimated that of 50% of undescribed plant species are already represented in herbaria. This is indeed the case for the new species described here, with existing herbarium specimens dating back to 1949. Taxonomists have at times been criticised for 'overlooking' novel entities for such long periods of time. However, as in other categories of science, taxonomy is progressive and over time its hypotheses of relationships and species limits are tested by an increasing wealth of evidence. Advancing knowledge of defensible taxonomic boundaries therefore provides a foundation for targeted conservation action (Thomson *et al.* 2018), with newly recognised species often having restricted distributions and conservation requirements.

The mat rush genus *Lomandra* Labill. is exemplary of a group with many unresolved taxonomic problems, including undescribed entities and uncertainty regarding the appropriate taxonomic rank for currently recognised infra-specific taxa. This non-charismatic plant group has at least 60 species, all but two of which

are endemic to Australia where they commonly inhabit woodland and heathland communities (Lee 1966; Lee & Macfarlane 1986; Quirico 1993; Conn 1994). Ten of these species have only been described in the last decade (Macfarlane & Conran 2015; Wang & Bean 2017; Barrett 2018; Wang 2018, 2021a, 2021b, 2023a, 2023b). *Lomandra* species are found across most of Australia, though only a few species occur in limited parts of the arid zone, with centres of diversity in both south-western and south-eastern Australia (Lee & Macfarlane 1986).

What makes *Lomandra* particularly difficult to identify is that its vegetative growth generally consists of rhizomatous shoots that produce above-ground strap-like or terete leaves, thereby leaving few readily-identifiable morphological characters for species delimitation in the absence of fertile material (Donnon 2009). There are some useful inflorescence and floral characters that require better quantification, including inflorescence branching patterns, floral bract arrangement, flower arrangement, flower shape, and tepal size, shape, and colour when fresh (Donnon 2009). Fruit might provide informative characters, but little is known of their taxonomic utility given that they seldom are present on herbarium specimens.

Complicating the taxonomy of *Lomandra* further is that most species are functionally dioecious, and despite many species appearing markedly different in inflorescence morphology, separate sexes are nearly indistinguishable by vegetative characters. Compared to male inflorescences, female inflorescences are quite inconspicuous because their flowers are usually sessile. Since most gatherings of *Lomandra* include only one sex, it appears that such a clear morphological difference may have led to mistaken assumptions that individuals of different sex were distinct species. Less-prominent female flowers may also be incorrectly interpreted by field collectors as immature and thus not collected.

Lomandra multiflora (R.Br.) Britten is a particularly widespread and variable taxon in eastern Australia, with two subspecies currently recognised (Lee & Macfarlane 1986). Members of this complex share a number of general similarities in appearance, including leaf apices that are ± entire, whorled branching in the inflorescence (each whorl usually many-flowered), and opposite, imbricate floral bracts (Lee & Macfarlane 1986; Wang & Bean 2017; Wang 2018). The usually flat (or sometimes concave) leaves are consistent throughout typical *L. multiflora* and also match other closely related species like *L. patens* A.T.Lee, a species with a much larger and more branched inflorescence found further inland than *L. multiflora*. However, there also exists a terete-leaved form noted in the *Flora of Australia* and *Flora of New South Wales* (Lee & Macfarlane 1986; Quirico 1993) and more recently recognised under the phrase name *Lomandra* sp. Oxley Wild Rivers (T.M. Collins 924) on PlantNET (2023), which appears to be restricted to New South Wales.

Historically, there have been few collections of this form to provide a rigorous taxonomic assessment of its status relative to *L. multiflora*. However, several collections were made on the Oxley Wild Rivers *Bush Blitz* Expedition in 2015, a program specifically aimed at new species discovery and documentation of biodiversity (see Barrett 2015; Preece *et al.* 2015). On this expedition, *Lomandra* sp. Oxley Wild Rivers was shown to co-occur with *L. multiflora*, with plants of both sexes collected for both species, and no observed evidence of introgression (A. Orme, pers. comm.). These field observations suggest genetic isolation between the two entities. The concept of *Lomandra* sp. Oxley Wild Rivers continued to mature when the authors acquired morphologically similar specimens from the serpentinite outcrops of Watchimbark Nature Reserve in 2018. Furthermore, its recognition is also assisted by the steadily growing observations of *Lomandra* on iNaturalist (2023, https://inaturalist.ala.org.au/), a citizen science platform that is increasingly being recognised for its utility with taxonomic research and discovery (Mesaglio *et al.* 2023; Webb *et al.* 2023). Observations of *Lomandra* sp. Oxley Wild Rivers posted on iNaturalist enabled assessment of floral characters from photographs, and guided collection of additional fertile specimens which were instrumental in describing the species for this paper. Some additional sterile, but atypical collections at NSW could be confidently excluded from this species concept following examination of iNaturalist records representing those populations.

Given the apparent paucity of macro-morphological characters useful for species relationships and species limits of *Lomandra*, an advanced taxonomy of *Lomandra* will likely benefit from molecular analysis paired with careful morphological study. At present only preliminary data are available that do not include multiple accessions of *L. multiflora* (see Donnon 2009; Gunn *et al.* 2020). However, recent unpublished work that was initiated in parallel with our morphological study has constructed a large molecular dataset using the Angiosperms353 bait capture set (Baker *et al.* 2022). Preliminary results indicate that *Lomandra* sp. Oxley Wild Rivers is recovered within the *Lomandra multiflora* complex. However, most relationships within the complex remain uncertain due to a lack of corresponding branch support (T.C.Wilson, R.L.Barrett, J.L.Birch & B.F.Gunn, unpubl. data).

In this paper we describe a new species, *Lomandra briggsiana* R.L.Barrett & T.C.Wilson based on our morphological examination of *L.* sp. Oxley Wild Rivers (T.M. Collins 924). Given evidence is restricted, we circumscribe it as a distinct species based primarily on the unique leaf morphology consistent between female and male plants relative to other entities in the *L. multiflora* complex.

Methods

This description is based on measurement of herbarium specimens held at CANB and NSW. Field observations of *L. briggsiana* R.L.Barrett & T.C.Wilson have been made by the authors. Terminology and the layout of the description follows Wang and Bean (2017) and Wang (2018). Illustrations are based on photographs of live plants and from herbarium material at NSW.

Taxonomy

Lomandra briggsiana R.L.Barrett & T.C.Wilson, *sp. nov*.

Type: New South Wales: Hunt's property, 'Kilmarnoc', between Attunga and Halls Creek, 11 Sept. 1996, *J.R. Hosking 1289* (holo: NSW 597650 (♀); iso: CANB 533038.1, CANB 533038.2, MEL 0285175, NE 66058, NSW 597651).

Lomandra sp. Oxley Wild Rivers (T.M. Collins 924)

Plants robust, perennial, forming tussocks from condensed erect ramets, rhizome vertical (taproot-like), 4.5–16 mm diam. Each tussock comprising 1–5 poorly distinguished tufts (ramets). Leaves firm, erect to slightly curved. Leaf sheath white to cream, margins at first membranous, fraying into short to long strips or fibres up to 4.5 cm long, translucent, white. Leaf blades glaucous, smooth, usually terete (sometimes slightly compressed) for most of their length, but partially flattened above in the sheathing portion and rarely above the sheath on some leaves, 17–47 cm long, 0.9–1.4(–1.7) mm wide, with 22–30 parallel veins; apex acute to pungent, without teeth; the margins of the sheathing portion slightly thickened and smooth or sometimes minutely serrulate. Male inflorescences 1–4 per plant, usually a 1-branched panicle with numerous flower clusters, rachis and scape elongating with age; scape 2–13.5 cm long, 0.5–1.4 mm wide, subterete to compressed, smooth to minutely verrucate; rachis often angled, minutely verrucate; branches and flower clusters appearing whorled or opposite at nodes; the primary rachis 3.5–18.5 cm long, the secondary rachis usually 1–3 cm long. Cluster bracts usually 5–7, with 1 or 3 obvious veins, narrowly triangular, 2–3.5(–7) mm long, 1–1.5 mm wide at the base, largest at the basal node of primary rachis, shorter and narrower distally. Flowers in groups of 4–17, each subtended by usually 3 bracteoles, *c*. 1.2 mm long and 0.8 mm wide, membranous, completely encircling the flower base, pedicellate, the pedicels 3.2–5.9 mm long, 0.15 mm wide, similar ages within each cluster; outer 3 tepals broadly elliptical, thin, free, somewhat cucullate, uniform in size and texture, 2.2–2.6 mm long, *c*. 1.2 mm wide, adnate at the base; inner 3 tepals narrow-ovate, not cucullate, 2.3–2.8 mm long, *c*. 1.0 mm wide, adnate near base. Pistillode poorly developed, *c*. 0.1 mm long, pale yellow. Female inflorescence 1 per ramet, paniculate, much shorter than longest leaf; the peduncle ± terete (angular when dried), smooth to minutely verrucate, 2–4 cm long, usually 0.3–0.8 mm diam., greenish to cream; the primary rachis ± terete and smooth or finely ribbed, or 5-angled when dry, smooth to minutely verrucate, 2–8 cm long, not branched, with 3–9 flower clusters, appearing whorled at nodes, the flowers in groups of 10–24 in each cluster, all of similar age within each cluster; flower clusters 0.5–1 cm apart on the rachis. Cluster bracts usually 3 or 4, short-deltoid, up to 2 mm long, *c*. 1 mm wide at the widest point, with 1 or 3 obvious veins, largest at the basal node of rachis, shorter and narrower upwards along rachis. Bracteoles 3, ± cucullate, but apex divided, so appearing broadly obsagittate in outline, apices subacute, *c*. 1.2 mm long and 1 mm wide, membranous, completely encircling the pedicel. Flowers subsessile, pedicels to 0.6(–1.2) mm long, hidden by bracts. Flower buds obovoid, purplish brown, at anthesis becoming campanulate, creamy-yellow to yellow. Perianth segments 6, with distinct outer and inner whorls; outer tepals 3, broadly elliptical, thin, free, somewhat cucullate, uniform in size and texture, 2.1–2.5 mm long, 1.0–1.1 mm wide, pale yellow with a broad purplish-brown mid-stripe; inner tepals 3, elliptical, free except on lower 1/4, not cucullate, uniform in size and texture, 2.2–2.7 mm long, 0.7–0.8 mm wide, creamy yellow. Stamens 6, adnate basally to the inner tepals, the filament often connate to the inner tepals for most of its length; anthers all similar, 0.5–0.55 mm long, 0.3–0.4 mm wide, creamy yellow; anthers of inner tepals slightly more distal than the antetepalous anthers. Staminodes 6, whitish-transparent, with well-developed filaments and vestigial anthers, inserted on basal part of tepal, adnate for 1/2 length. Pistil conspicuous, the ovary obovoid, *c*. 0.8 mm long, *c*. 0.6 mm diameter; styles fine, fused, with 3 minute out-curved stigmatic lobes; ovary with 3 locules; ovules 1 per loculus. Fruit not seen. (Figures 1–4)

Fig. 1. *Lomandra briggsiana* at Dunedoo. A. Habitat. B. Habit. C. Male flowering plant. D. Female plant with old inflorescences. E. Plant base with old female inflorescences. F. Terete, glaucous leaves. G. Leaf sectioned by secateurs. H. Clasping leaf base. I. leaf base (left) and young apex (right). J. Male inflorescence. Photos: A, D–I by Russell Barrett (voucher: *R.L. Barrett et al. RLB 9477*); B by Anthony O'Halloran; C, J: by Anne Kable (also posted on iNaturalist 59760073).

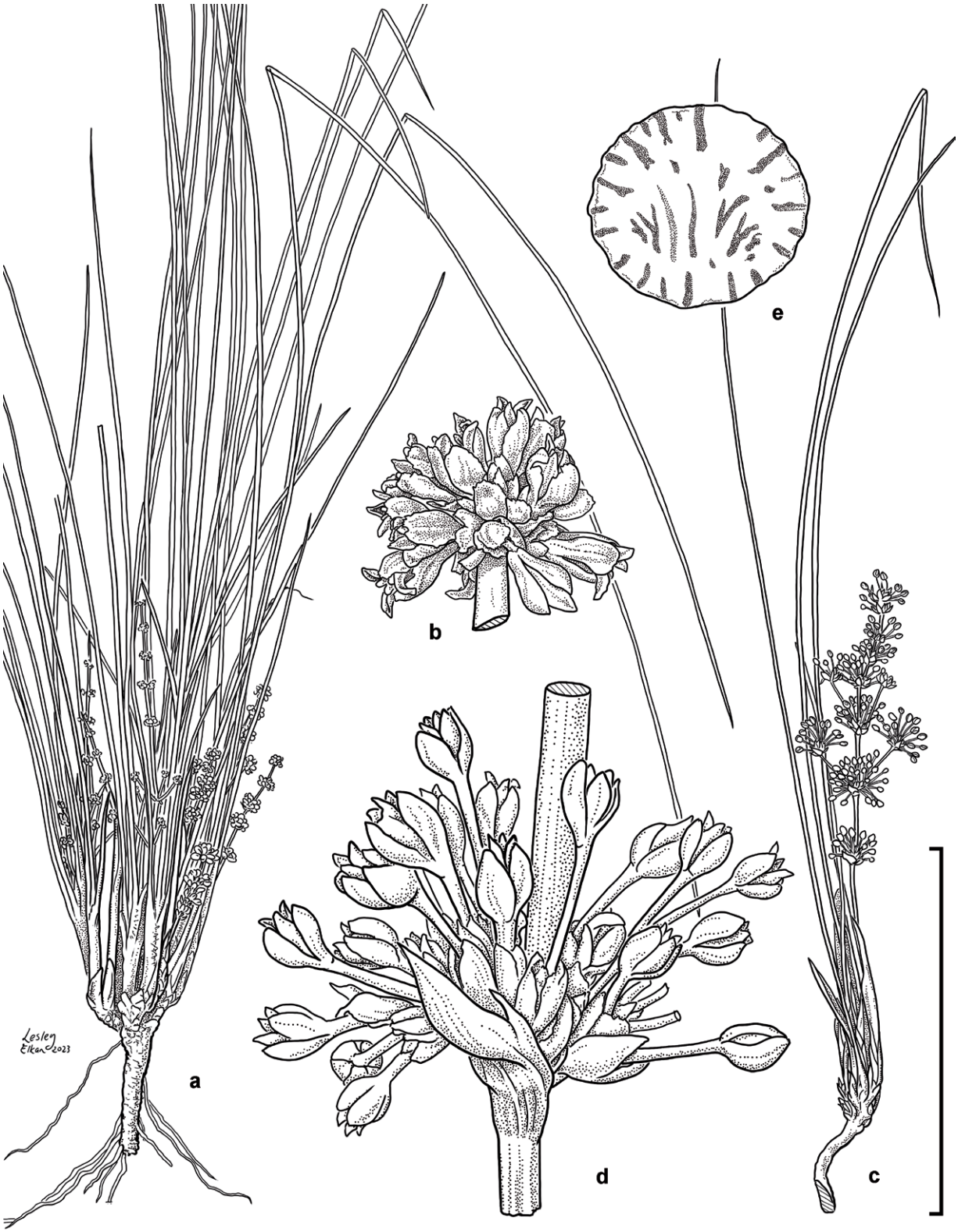

Fig. 2. *Lomandra briggsiana*. A. Habit of female plant with inflorescence. B. Female inflorescence. C. Habit of male plant with inflorescence. D. Male inflorescence. E. Transverse section of a leaf. Vouchers: A, B, *J.R. Hosking 1289* (NSW 597650); C, D, *V. Klaphake 1229* (NSW 395354); E, *R.L. Barrett et al. RLB 9477* (NSW). Scale bars: A, C = 10 cm; B, D = 1 cm; E = 3.3 mm. Illustration by Lesley Elkan.

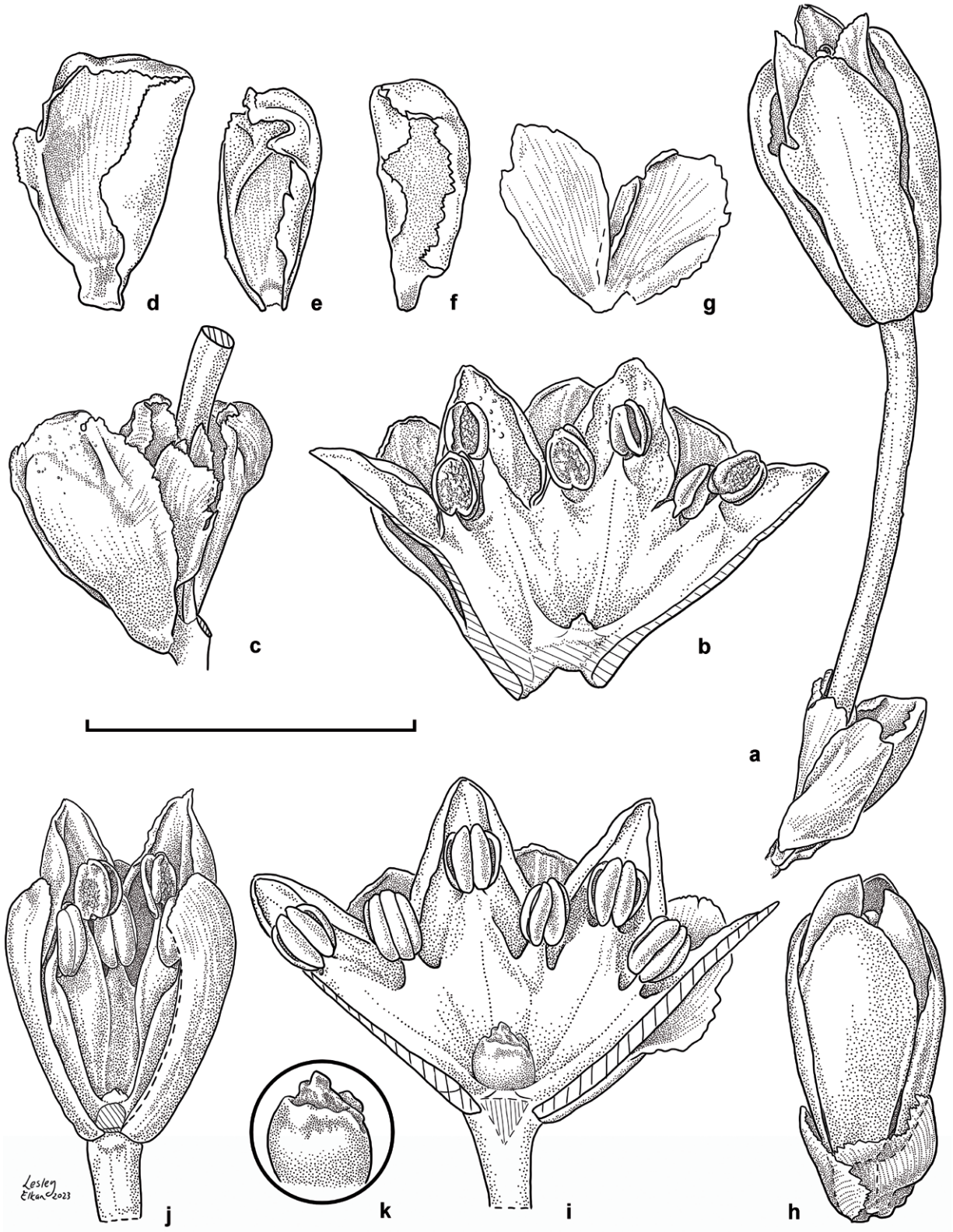

Fig. 3. *Lomandra briggsiana*. A–G, Male Flower. A. Flower with pedicel and bracts. B. Openly dissected flower. C. Bract arrangement around pedicel of male flower. D–G. Floral bracts. H–K, Female flower. H. Female flower. I. Open flower. J. Flower with one tepal removed. K. Ovary and stigma detail. Vouchers: A, B: *M.F. Duretto 4124*; C–G: *R.L. Barrett et al. RLB 9477*; H–J: *J.R. Hosking 1289*; K (and inserted within I): *R. Coveny 9215* (all NSW). Scale bars: A–J = 3 mm. K = 1.8 mm. Illustration by Lesley Elkan.

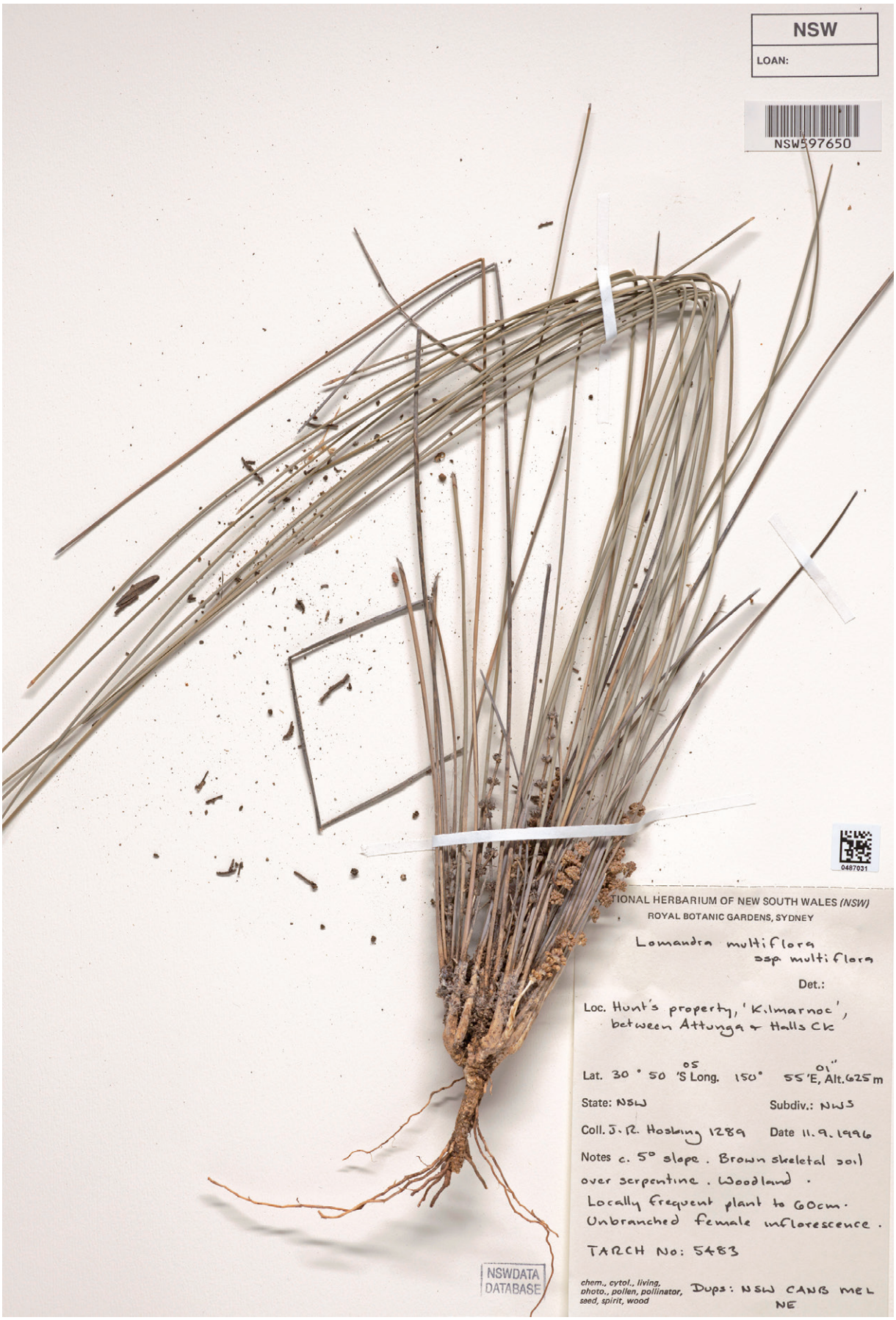

Fig. 4. Holotype of *Lomandra briggsiana*, *J.R. Hosking 1289* (NSW 597650).

Diagnostic characters: Differs from *Lomandra multiflora* by its terete (*vs* flat to concave), glaucous (*vs* green) leaves with an undivided (*vs* toothed), often pungent (*vs* usually blunt) apex, and its erect (*vs* lateral) rhizomes. Differs from *L. decomposita* (which does have glaucous leaves) in its terete (*vs* convex or inrolled) leaves 0.9–1.4(–1.7) (*vs* 2.3–4.5(–6.5)) mm wide. Differs from *L. ramosissima* by its white to cream (*vs* reddish to dark brown) coloured leaf sheaths and terete leaves 0.9–1.4(–1.7) mm wide (*vs* flat to convex leaves 2.5–5 mm wide).

Specimens examined: NEW SOUTH WALES: Watchimbark Nature Reserve, 23 Jan. 2018, *R.L. Barrett, M.A.M. Renner, H. Sauquet, P. Weston & T.C. Wilson RLB 9121* (NSW); Old Cemetery Reserve, Dunedoo, 6 Apr. 2022, *R.L. Barrett, Z.E. Davies, X.V. Davies & F.F. Barrett RLB 9477* (AD, MEL, NSW); Coulsons Creek, foot of Liverpool Range, N of Merriwa, 28 Sept. 1968, *B.G. Briggs 2204* (♂) (NSW); Spring Creek gorge rim, *c.* 800 m from head of gorge, Oxley Wild Rivers National Park, 6 Nov. 2015, *T.L. Collins 924* (NSW); *c.* 60 km WNW of Armidale, along creekline in NW section of reserve, Stony Batter Creek Nature Reserve, 21 Nov. 2001, *L.M. Copeland 3265* (♀) (BRI, CANB, MEL, NE, NSW); Glen Alice, 7 Apr. 1977, *R.G. Coveny & P.D. Hind 9215* (♂) (NSW); West Cookeys Plains State Forest, Yarrabundi, 22 July 1976, *G.M. Cunningham & P.L. Milthorpe* (per *R.J. Turner*) *4713* (CANB); S side of Yarrowitch River Gorge, Oxley Wild Rivers National Park, 11 Nov. 2015, *M.F. Duretto 4112* (NSW); N of Yarrowitch Falls, Oxley Wild Rivers National Park, 11 Nov. 2015, *M.F. Duretto 4124* (♂) (NSW); N of Yarrowitch Falls, Oxley Wild Rivers National Park, 11 Nov. 2015, *M.F. Duretto 4125, T.L. Collins & A.E. Orme* (NSW); Oxley Wild Rivers National Park, 11 Nov. 2015, *M.F. Duretto 4126* (NSW); 3 km N Willows, *c.* 46 km NW of Glen Innes, Bonshaw Road, 5 Apr. 1995, *J.T. Hunter 2971* (NSW 470815); Crown Creek, 8 km by road S of Capertee–Glen Davis road, 2 km SE of Pantoneys Crown, Wollemi National Park, 19 Sept. 1995, *V. Klaphake 1229* (♀, ♂) (NSW); Western Way / F Line Rd, Merriwindi State Forest, 2 Oct. 1986, *D.F. Mackay s.n.* (♀) (NE, *n.v.*, NSW 597656); Old Cemetery Reserve, Dunedoo, 27 Sept. 2020, *A. O'Halloran s.n.* (BRI, CANB, NE, NSW); Browns Lane, near Kandos May 1998, *H. Washington s.n.* (♀) (NSW 1059550); 'Watervale', Capertee Valley, Block 2, 6 May 2000, *H. Washington s.n.* (♀) (NSW 597504); Mudgee district, Oct. 1949, *K. Watts s.n.* (♂) (NSW 66113); Bullock Creek *c.* 72 km E of Armidale, 19 Mar. 1970, *J.B. Williams s.n.* (♂) (MEL, NSW 597866).

iNaturalist observation: https://inaturalist.ala.org.au/observations/59760073

Distribution and habitat: Known from scattered collections between the Capertee Valley, Dunedoo, Tamworth and Barrington Tops, New South Wales (Figure 5).

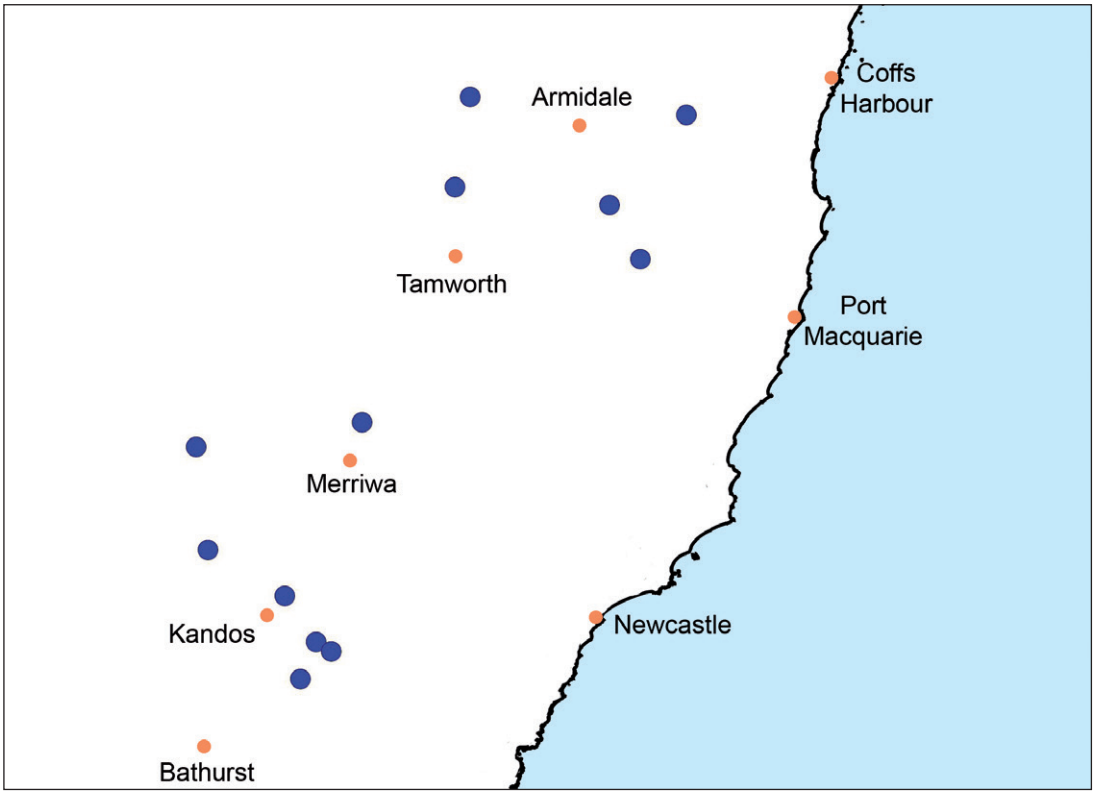

Fig. 5. Distribution map for *Lomandra briggsiana* (●). Map derived from Australia's Virtual Herbarium (http://avh.ala.org.au; accessed 3 May 2023).

Recorded from a wide variety of habitats on sandstone, granite, clays and serpentinite, on ridges, gentle slopes and in steep gorges, usually in Eucalypt woodland with a shrubby understory, but also in low heath communities. Grows in association with *Acacia difformis*, *A. implexa*, *A. ixiophylla*, *A. serpentinicola*, *Allocasuarina luehmannii*, *A. littoralis*, *A. ophiolitica*, *Angophora floribunda*, *Brachyscome procumbens*, *Bursaria spinosa*, *Callitris glauca*, *Calytrix tetragona*, *Dampiera adpressa*, *Eremophila mitchellii*, *Eucalyptus albens*, *E. andrewsii*, *E. bridgesiana*, *E. crebra*, *E. moorei* subsp. *serpentinicola*, *E. pilligaensis*, *E. prava*, *E. rubida*, *E. rossii*, *Grevillea granulifera*, *Hovea cymbiformis*, *Hovea lorata*, *Leionema* sp., *Lepidosperma laterale*, *Leptospermum brevipes*, *L. divaricatum*, *Lomandra multiflora*, *Muehlenbeckia rhyticarya*, *Philotheca difformis* subsp. *difformis*, *Pomaderris andromedifolia* subsp. *andromedifolia*, *P. brunnea*, *Templetonia stenophylla* and *Westringia cheelii*.

Phenology: Flowering recorded for August–November. Fruiting not observed.

Conservation status: This species is known from eleven locations including Wollemi National Park, Watchimbark Nature Reserve and Goonoo State Forest. The species is easily overlooked and is probably more common than current collections indicate. IUCN: Least Concern.

Etymology: The epithet honours the work of Barbara Gillian Briggs AM, for a lifetime's work on the Australian flora and for inspiring multiple generations of botanists. This is one of many novel species she collected during a long career of quiet yet globally significant achievements.

Notes: Confirmed by molecular data (T.C.Wilson, R.L.Barrett, J.L.Birch & B.F.Gunn, unpubl.) to be most closely related to *Lomandra multiflora*, *L. decomposita* and *L. ramosissima*, differing from all of these species by the combination of its terete, glaucous leaves 0.9–1.4(–1.7) mm wide and a distinctive, erect rhizome.

Collections from the southern part of the range are all sterile or immature. However, it may be that they have consistently shorter inflorescences with longer branches as indicated by the available herbarium specimens, or this may be an artefact of maturity stage. In any case, further collections from across the range of the species are desirable to assess possible variation within this species.

Table 1. Distinctive characters for taxa allied to *Lomandra multiflora* based on Lee & Macfarlane (1986), Quirico (1993), Conn (1994), Wang & Bean (2017) and Wang (2018).

Taxon	*L. multiflora* subsp. *multiflora*	*L. multiflora* subsp. *dura*	*L. patens*	*L. decomposita*	*L. ramosissima*	*L. briggsiana*
Rhizome	lateral	lateral	lateral	lateral	semi-erect	erect
Leaf sheath	white, purplish or brown	White to pale brown	white, grey or brown	white or pale to dark brown	reddish to dark brown	white to cream
Leaf blade	green or greyish green	greyish green	green	glaucous	glaucous	glaucous
Leaf shape	flat or slightly concavo-convex	flat or slightly concavo-convex	concavo-convex	slightly convex or inrolled	flat or slightly convex	± terete
Leaf width	1.5–4.5 mm	2–4.5 mm	2.5-4.5 mm	2.3–4.5(–6.5) mm	2.5–5 mm	0.9–1.4(–1.7) mm
Inflorescence branching	1–3	1 or 2	2–3	1–3(–4)	1–3(–4)	1 or 2
Male flowers per whorl	8–22	5–15	3–12	4–15(–25)	6–14	4–17
Male pedicel length	3–8(–12) mm	0(–2) mm	0–1 mm	1.5–2.5(–3.5) mm	1–1.5(–2) mm	3.2–5.9 mm
Male inner tepal length	2.5–3.5 mm	2.1–3.0 mm	4–6 mm	1.1–1.2 mm	2.5–2.9 mm	2.3–2.8 mm
Female pedicel length	sessile	sessile	sessile	*c.* 0.5 mm	0.3–0.5(–1.5) mm	0.6(–1.2) mm
Female inner tepal length	*c.* 4.5 mm	2–3 mm	2.9–3.5 mm	*c.* 3 mm	*c.* 3.2 mm	2.2–2.7 mm
Capsule length	*c.* 6 mm	*c.* 5 mm	4.5–6.1 mm	7.5–8 mm	4–5 mm	not known

Modification to the PlantNET key to *Lomandra* species in New South Wales

10. Tepals divided to base 10A

10: Tepals fused in lower half 12

10A. Rhizomes erect; leaves terete, 0.9–1.4(–1.7) mm diam., glaucous, apex often pungent..... ***L. briggsiana***

10A: Rhizome lateral; leaves flat or slightly concavo-convex or inrolled, 1.5–4.5 mm wide, green or greyish green, apex obtuse 11

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