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Lysimachia mauritiana (Primulaceae) on seacliffs in the eastern suburbs of Sydney: a new naturalised record for Australia

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Abstract: *Lysimachia mauritiana* Lam. (family Primulaceae), a small short-lived herb native to India, Indian and Pacific Ocean islands, and coastal east Asia, is described as a new naturalised record from the eastern suburbs of Sydney, New South Wales, Australia. It was first recorded in 1981 near Coogee, and grows in exposed rock crevices and seepages on the seacoast, very similar to its natural habitat overseas. *Lysimachia mauritiana* is known to have been cultivated in the area in 1961 in a home garden, which is the likely source of this introduction; it appears to be spreading locally as a weed.

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Introduction

Based on phylogenetic analyses of the *Lysimachia* complex (Manns & Anderberg 2005, 2009, and references therein) the boundaries of the genus *Lysimachia* (family Primulaceae; sometimes placed in Myrsinaceae) have recently been enlarged to include species previously regarded as members of other genera, including *Anagallis*, *Pelletiera* and *Trientalis*, along with previous combinations made for *Asterolinon* and *Glaux*. These changes affect several *Anagallis* species occurring in Australia (one native, several naturalised) and have been accepted in the *Australian Plant Census* (CHAH 2014) but not currently adopted in the *New South Wales Flora Online* (The Royal Botanic Gardens and Domain Trust 2014).

Within the original concept of *Lysimachia*, three taxa have been regarded as native or introduced in New South Wales: *Lysimachia fortunei* Maxim., *Lysimachia japonica* Thunb. and *Lysimachia vulgaris* var. *davurica* (Ledeb.) R.Knuth; the latter two also occurring in Victoria (see Kodela 2006). Three other taxa (which are usually considered naturalised) occur or have been recorded in southern Australia: *Lysimachia linum-stellatum* L. (Western Australia, South Australia, Victoria), *Lysimachia nummularia* L. (Victoria, Tasmania) and *Lysimachia vulgaris* L. var. *vulgaris* (Victoria) (CHAH 2014; see also state and territory floras and plant censuses). We report here the occurrence of an additional species in Australia, *Lysimachia mauritiana* Lam., as naturalised in New South Wales.

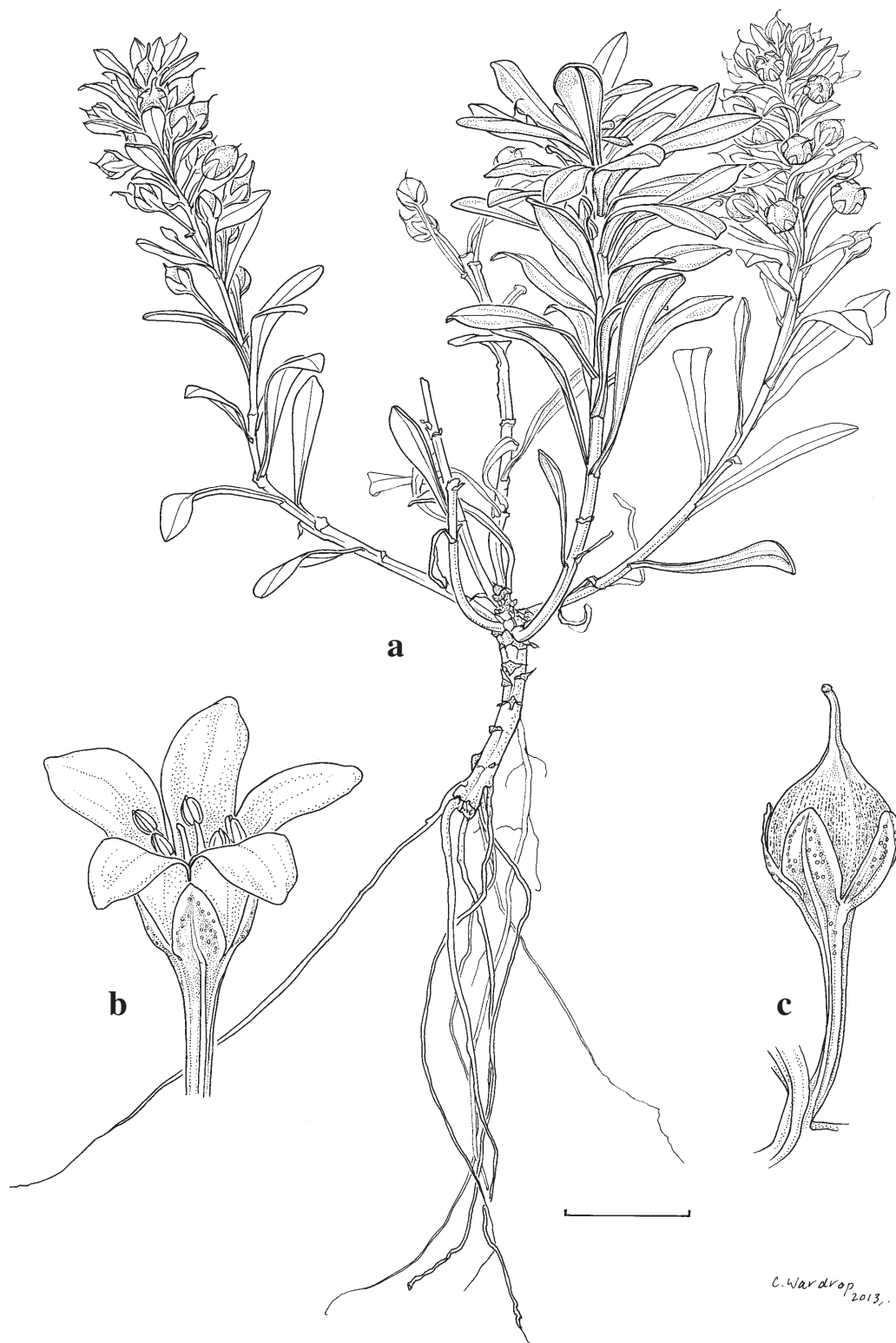


Fig. 1. *Lysimachia mauritiana*: **a**, habit; **b**, flower; **c**, fruit. Vouchers: a, c, *Leary* NSW976851; b, *Leary* NSW975610. Scale bar: a = 2.5 cm; b, c = 0.5 cm.



Fig. 2. Young plants growing on Clovelly headland, Burrows Park. Photo: M. Leary, July 2013.



Fig. 3. Sandstone headland habitat at Burrows Park, Clovelly. Photo: M. Leary, July 2013.

Although more common and widespread in the Northern Hemisphere, the occasional and often ‘spotted’ distribution of new *Lysimachia* records in Australia cannot be assumed to be naturalised records resulting from human introductions and activities. For example, the presence of *Lysimachia fortunei* in Werrikimbe National Park, first recorded in 2003, is possibly a ‘natural adventive’ distribution associated with long distance-dispersal, based on similar distribution patterns in *Lysimachia vulgaris* var. *davurica* (Kodela 2006). In the case of *Lysimachia mauritiana* recently recorded in eastern Sydney there is, however, clear evidence of human activity being the source of its introduction which has led to it spreading as a garden escape.

Methods

The investigation employed the use of specimen collections, field studies and plant record searches. The description is based on morphological observations of herbarium specimens held at NSW in conjunction with literature research (Bentvelzen 1962, Kao & DeVol 1978, Yamazaki 1993, Hu & Kelso 1996). Garden “living” collection records, including seed accessions, at the Royal Botanic Gardens, Sydney, were searched and assessed. A search (including the internet) of commercial nursery guides and catalogues in Australia was conducted, but further investigation of more historical records and archives might reveal additional information.

Taxonomic description

Lysimachia mauritiana Lam., *Encycl. [J. Lamarck & al.]* 3(2): 592 (1792)

Lubinia mauritiana (Lam.) Spreng., *Syst. Veg. (ed. 16) [Sprengel]* 1: 572 (1825)

Lubinia spathulata Vent., *Descr. Pl. Nouv.* t. 96 (1800); *Lysimachia spathulata* (Vent.) Schouw., *Linnaea* 24: 160 (1851), *fide* Bentvelzen (1962)

?*Lysimachia glaucophylla* Hook. & Arn., *Bot. Beechey Voy.* 306, t. 68 (1838), *fide* Bentvelzen (1962)

Lysimachia lineariloba Hook. & Arn., *Bot. Beechey Voy.* 268 (1838); *Lubinia lineariloba* (Hook. & Arn.) Pax in *Nat. Pflanzenfam. [Engler & Prantl]* 4, 1: 112 (1897), *fide* Bentvelzen (1962), Hu & Kelso (1996)

Lysimachia lubinioides Siebold & Zucc., *Abh. Math. – Phys. Cl. Königl. Bayer. Akad. Wiss.* 4(3): 140 (1846); *Lubinia lubinioides* (Siebold & Zucc.) Pax in *Nat. Pflanzenfam. [Engler & Prantl]* 4, 1: 112 (1897), *fide* Bentvelzen (1962)

Lysimachia nebeliana Gilg ex Gilg & Loes., *Bot. Jahrb. Syst.* 34 (1, Beibl. 75): 57 (1904), *fide* Bentvelzen (1962), Hu & Kelso (1996)

Herb, biennial or short-lived perennial; stolons stout, short; stems solitary or tufted/many, ascending to erect, 10–40 (–50) cm high, stout, terete, slightly fleshy, simple or shortly branched above, glabrous, minutely black-dotted (i.e. with



Fig 4. Plants at Lurline Bay, Coogee. Photos: P. Adam, August 2013.

black glands or glandular dots). *Leaves* alternate, lower leaves shortly petiolate, long-attenuate at base, mostly 2–5 cm long and 5–12 mm wide, upper leaves sessile or nearly so, shortly attenuate at base, mostly 1.5–2 cm long and 9–14 mm wide; lamina slightly fleshy, glabrous, black glandular punctate, oblong-obovate, obovate or spatulate, apex subrounded or obtuse to subacute, midrib prominent, lateral veins obscure, margin entire, narrowly revolute; leaf bases persistent on



Fig. 5. Cliff seepage and rock platform habitats at Lurline Bay, Coogee. Photos: P. Adam, August 2013.

stems after shedding of leaves, outer rims of petioles carried on as decurrent narrow ridges down stems (at least in dried material). *Racemes* leafy, erect, terminal, often compound-paniculate, initially coniform, gradually elongating, many-flowered, 3–15 cm long, lower bracts spatulate, identical to leaves except for shorter petiole, gradually reduced upward (corymbose at flowering/raceme-like in fruit); *pedicels* 5–15 (–25) mm long, about as long as or slightly shorter than the leaf-like bracts, glabrous. *Flowers* 5-merous; *calyx* 3.5–5 mm long, deeply divided, lobes broadly lanceolate to elliptic (or ±oblong), with midrib, black glandular-punctate, margin membranous whitish-hyaline, apex subacute to obtuse; *corolla* white to pinkish, tube 2–3.5 mm long, petals 5–6 mm long, the lobes narrowly obovate or ligulate-oblong, (with a few glandular dots at obtuse apex). *Capsules* globose-ovoid, yellow to reddish brown, 4–6 mm diam., lightly pitted, glabrous, stigma/style persistent, longitudinally dehiscent by valves, many-seeded. Figs 1, 2 & 4.

Flowers: much of summer and autumn.

Habitat: in overseas floras the habitat is reported as seashore, near beaches, headlands, in coastal regions; often growing in rock crevices and seepages; recorded in New South Wales on an exposed coastal headland, near cliff edge in cracks and pockets of skeletal soil on sandstone (Fig. 3) and in wet seeps in sandstone on a rock platform and adjacent cliff face (Fig. 5).

Distribution: in Australia recorded from near the coast in the Coogee – Clovelly area of eastern Sydney, Central Coast, New South Wales; native to India, Indian Ocean Islands (including Mauritius, Reunion), Korea, China, Taiwan, Japan, the Ryukyus, Pacific Ocean Islands (including Hawaii, Philippines, New Caledonia).

Specimens examined: **Australia:** New South Wales: Central Coast: Lurline Bay, South Coogee, 8 Feb 1961, *K. Mair s.n.*, [cultivated] seed ex Ichijoji, Kyoto (intro.786) (NSW826818); Lurline Bay, 14 Dec 1982, *P. Adam* (NSW826820, UNSW14706); Burrows Park, Clovelly headland, Apr 2011, *M. Leary* (flowering branchlet) (NSW975610); Burrows Park, Clovelly headland, Apr 2012, *M. Leary* (fruiting plant) (NSW976851). **Japan:** Hondo: Shirahama in Kii, May 1953, *T. Koyama s.n.* (NSW826821 ex TSM); Shizuoka Pref., Shimodashi, Susaki, 22 Jun 1974, *J. Murata 27* (NSW826822 ex TI).

Common names: the English common name often used overseas is Spoonleaf Yellow Loosestrife, which is misleading (and not recommended) since *Lysimachia mauritiana* has white flowers; also known as Ocean Primrose.

Notes: Distinguished from other species of *Lysimachia* in New South Wales by the slightly fleshy, often narrowly spatulate leaves, and flowers with white petals with apex acute to obtuse (petals more broadly rounded in *Lysimachia fortunei*; petals yellow in *Lysimachia japonica* and *Lysimachia vulgaris* var. *davurica*). Overseas floras indicate that the leaves in *Lysimachia mauritiana* may be larger than that described above. As seen in Figures 2 and 4, young plants often have a rosette form (rosette-like arrangement of leaves), and the basal leaves in plants are often broader than those on the stems of more mature, taller plants like the

one illustrated in Figure 1. Plants at a quasi-rosette stage of growth might occasionally flower.

Several varieties are sometimes recognised, including *Lysimachia mauritiana* var. *rubida* (Koidz.) T.Yamaz., *Fl. Jap.* (Iwatsuki *et al.*, eds.) 3a: 83 (1993) (based on *Lysimachia rubida* Koidz., *Bot. Mag. (Tokyo)* 33: 110 (1918)) and *Lysimachia mauritiana* var. *taiwaniana* S.S.Ying, *Colour. Illustr. Pl. Taiwan*, Pt 4; *Colour. Illustr. Herbac. Pl. Taiwan* 1: 155 (1980).

Discussion and Conclusion

Introduction and spread of Lysimachia mauritiana in eastern Sydney

Lysimachia mauritiana has a widespread distribution in coastal habitats in the Indian and Pacific Oceans and Asia, and the coastal habitat makes the species a likely candidate for dispersal in ocean currents (Kono *et al.* 2012) or by the agency of shore birds.

The habitats of the collections from Lurline Bay, South Coogee, and Burrows Park, Clovelly, in eastern Sydney, are similar to those in which the species occurs overseas. But while natural dispersal to Australia cannot be ruled out, there is evidence for a more parsimonious explanation – that it is a human introduction. Through international seed exchange a sample of *Lysimachia mauritiana* was provided to the Royal Botanic Gardens, Sydney, from Kyoto, Japan (RBGS Nursery index card record: 16 September 1958 [accession] from Kyoto Takeda Herbal Garden, Ichijoji), for cultivation as part of the Garden's living collection. Some of this seed was sown by former Director Mr Knowles Mair in his home garden in South Coogee. This is indicated by a cultivated specimen (NSW826818 in the National Herbarium of New South Wales) collected in 1961 from his garden. The location of the garden is a few hundred metres north of the Lurline Bay site though this history was not known to us when the Lurline Bay population was first observed in winter 1981 (P. Adam, *pers. obs.*) and collected in flower the following year; given the proximity it seems probable that the population represents a naturalised 'escape' from the earlier garden planting. We are not aware that *Lysimachia mauritiana* has ever been commercially available in Australia through the nursery trade.

It is likely that the Clovelly population has arisen from seed transported from Lurline Bay, which is c. 2.5 km directly south. The seeds are small, buoyant and could be thrown by breaking waves onto the headland. While the possibility of dispersal and subsequent successful establishment will have been low, this is a credible explanation for its occurrence. We are not aware of its occurrence in any nearby garden in Clovelly.

The range extension suggests that as further expansion in distribution may occur in the future, botanical collectors

visiting supratidal rock platforms and seacliffs should be aware of the possibility of the occurrence of *Lysimachia mauritiana* and report new localities. Despite the widespread occurrence of introduced species on seacliffs, strandlines and beaches, the impact of introductions on the native flora of these habitats has been little studied. There is no clear evidence as to whether introductions have caused declines in native species, but at the microsite level pre-emption of space by an introduced species may reduce the availability of locations which might otherwise be available for establishment of native species.

The possible spread of plants from Knowles Mair's South Coogee garden source is further supported by the following extract from his obituary (Chippendale 1999):

"His own gardens reflected some of his thoughts. They were never neat, landscaped affairs; rather, they were crammed with a wide variety of plants, exotic and native, and incorporated individual pools carved in sandstone especially for his granddaughters. When he was living at South Coogee, he referred to his seaside garden as the South Coogee Research Station, where he had great interest in seeing which species could withstand the sea spray."

Another naturalised weed, *Crithmum maritimum* L. (Apiaceae), with scattered small populations in the same area (and in the Illawarra), and appears to be spreading, may have been introduced in a similar way as *Lysimachia mauritiana*. There is a cultivated specimen in the National Herbarium of New South Wales collected from South Coogee by K. Mair, 8 March 1962, which had been grown from seed ex Genoa ([Royal Botanic Gardens accession] introduction 746, July 1958). It is likely that both taxa were part of Mair's "experiments" of species' tolerance to sea spray and were grown in his garden from seed sourced from overseas that correspond to past accessions for Living Collections at the Royal Botanic Gardens, Sydney (evidence from old Nursery record cards).

Mair's garden introductions may well be the source of other naturalised species' populations in the Coogee – Clovelly area. In the last few decades there has been an increased awareness of weeds and garden plantings. To help avoid potential problems with adventive or hazardous plants the Royal Botanic Gardens & Domain Trust, Sydney, currently has in place a policy and procedures to undertake weed risk assessments for new living accessions and taxa proposed for repropagation. Local councils and community bush regeneration groups require continued support for their programs discouraging the growing of potentially invasive plants, and removal where they occur.

Kono *et al.* (2012) discuss considerable karyotypic variation in *Lysimachia mauritiana*. If this species was found to occur elsewhere in Australia, for example in the far north where there is perhaps a slightly greater possibility of 'natural' arrival, then karyotype and molecular evidence might be a way of determining whether there are multiple introductions from different sources.

Seacliff introductions

The seacliff environment would generally be regarded as harsh. Nevertheless, in, or close to, human settlement seacliffs provide habitat for many introduced species, often of horticultural origin. For example, describing cliff vegetation near Christchurch, New Zealand, Healy (1959) concluded “The communities are now, in effect, living relics of horticultural subjects fashionable with earlier generations of gardeners”. A similar conclusion could be reached concerning cliffs in New South Wales (Adam *et al.* 1989), Victoria (Kirkpatrick 1974) and Northern Europe (P. Adam, *pers. obs.*).

The success of introduced species on cliffs may appear surprising given the apparently harsh environmental conditions. However, many of the species concerned are, like *Lysimachia maritimum*, coastal species in their native habitats. A surprisingly large number of widespread garden plants (both vegetables and ornamental plants grown for their flowers) are of coastal origin – their hardiness being one of their virtues as garden plants. Other coastal species have been transported in ships’ ballast – stones collected from near ports to stabilise vessels sailing without cargo, and discharged at other ports where cargo was loaded. With the stones, seeds and other propagules could be transported between countries. Today the most widely used form of ballast is seawater; this is unlikely to contain viable seeds, although it is a major means for the transport of marine organisms.

Cliffs often do not have continuous vegetation cover, and available niches for plants may be small and spatially disjunct, but frequently include perennial seepage zones. A propagule reaching such a niche may be able to develop free from competition from established plants; this may be an additional factor permitting the establishment of introduced species.

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