

Two new Australian species and a new combination in *Muehlenbeckia* (Polygonaceae)

Karen L. Wilson  & Robert O. Makinson

National Herbarium of New South Wales, Botanic Gardens of Sydney,
Locked Bag 6002, Mount Annan, New South Wales 2567, Australia
Author for correspondence: karen.wilson@botanicgardens.nsw.gov.au

Abstract

Two new species of *Muehlenbeckia* Meisn. are described, and a key is provided to these and similar species in eastern Australia. *Muehlenbeckia arnhemica* K.L.Wilson & Makinson grows on rocky outcrops in the northern tropical part of the Northern Territory. *Muehlenbeckia costata* K.L.Wilson & Makinson is restricted to rocky outcrops in ranges in southeastern Queensland and northern New South Wales. A new combination is made for *M. stenophylla* F.Muell. as a subspecies of *M. diclina* (F.Muell.) F.Muell., and lectotypes are selected for these two names.

Keywords: Polygonaceae; Systematics; Australia; Fire-ephemeral

Introduction

Two new species of *Muehlenbeckia* Meisn. are here described. They were distinguished while revising the genus and preparing treatments of the family Polygonaceae for the *Flora of New South Wales* (Wilson 1990) and the *Flora of Australia* (Wilson and Makinson, submitted). They are both pioneering fire-ephemerals, germinating from the soil seedbank or regenerating from rootstocks after bushfires and growing prolifically for several years before senescence or regrowth of other species crowds them out (Russell-Smith 1986; Hunter 1995). Hunter *et al.* (1998) suggested that the decline in populations of *M. costata* K.L.Wilson & Makinson is exacerbated by the presence of a rust fungus on vegetative parts.

Recognition of these new species is based on morphological features. Their status is supported in a molecular study by Schuster *et al.* (2011) of *Muehlenbeckia*, *Duma* T.M.Schust., *Fallopia* Adans. and *Reynoutria* Houtt. That study used five chloroplast regions (*matK*, *ndhF*, 3' *rps16-5' trnK*, *trnL-trnF* and 3' *trnV-ndhC*) and two nuclear gene regions (second intron of *LEAFY* and *ITS*) to assess the monophyly and phylogeny of these groups. *M. arnhemica* K.L.Wilson & Makinson was sister to *M. zippelii* (Meisn.) Danser (another tropical climbing species, found in Queensland (Cape York) and New Guinea), while *M. costata* was sister to *M. gracillima* Meisn. and *M. adpressa* (Labill.) Meisn., both occurring in temperate Australia.

Muehlenbeckia stenophylla F.Muell. has been considered a synonym of *M. diclina* (F.Muell.) F.Muell. but morphological and ecological differences and geographic separation led us to the conclusion that the former should be recognised as a subspecies of the latter. The relevant combination is made here and lectotypes are selected.

Wilson KL & Makinson RO (2024)
Two new Australian species
and a new combination in
Muehlenbeckia (Polygonaceae).
Telopea 27: 1-10. doi:10.7751/
telopea17685

Received: 23 August 2023
Accepted: 20 November 2023
Published: 12 April 2024

© 2024 The Author(s) or their
employer(s). Published by Botanic
Gardens of Sydney.
This is an open access article
distributed under the Creative
Commons Attribution-
NonCommercial 4.0 International
License (CC BY-NC)
OPEN ACCESS

Material and methods

Morphological features were examined in the field and in herbaria to assess the status of the taxa recognised here. Specimens were consulted in the following herbaria: AD, B, BRI, CANB, CNS, DNA, E, FI, G, K, MEL, NE, NSW, PERTH. Cited specimens have been seen except for those indicated as 'n.v.'

Maps were produced using SimpleMappr (Shorthouse 2010), with specimen records from the Australasian Virtual Herbarium (<https://avh.ala.org.au/>) (accessed June 2023) and our own records of specimens seen by us.

There is still no generally agreed system for describing inflorescences (see, for example, Endress 2010, Classen-Bockhoff and Bull-Hereñu 2013). Inflorescences in *Muehlenbeckia* ('flowering shoot systems' in the terminology of Classen-Bockhoff and Bull-Hereñu 2013) are complex structures, as discussed by Brandbyge (1992), with the basic inflorescence unit (i.e., the structures enclosed by an ocrea that may appear superficially to be a single flower or a cluster of flowers) described by him as a 'condensed cymose entity'. Descriptive terms commonly used, especially in Flora treatments (e.g. Wilson 1990, Walsh 1996, Short 2011), include terminal or axillary, spike or spike-like, raceme or raceme-like, panicle or panicle-like, and [flowers] solitary. We have not investigated the ontogeny of these structures, so we are using commonly used terms to describe the superficial appearance of the inflorescences. Flowers are shortly pedicellate so we use the term 'raceme' for the raceme-like partial inflorescences.

Taxonomy

Muehlenbeckia arnhemica K.L.Wilson & Makinson, sp. nov.

Type: Northern Territory: Nawurlandja (formerly Little Nourlangie Rock), Kakadu National Park, K.L. Wilson 9672, J.J. Bruhl, K.L. Clarke & I.D. Cowie, 14 March 1999 (♀, ♂ – monoecious; holo (mounted on 2 sheets): NSW 785289, NSW 1102070; iso: BRI, CANB, DNA, K, MO, NE). Figure 1.

Diagnosis: *M. arnhemica* is a scrambler, twiner, or decumbent subshrub. It is allied to *M. zippelii*, differing from that species in the following features: leaves with a shortly acuminate to obtuse apex (versus leaves with an elongated 'drip-tip' 5–20 mm long in *M. zippelii*), inflorescence with partial inflorescences elongated and raceme-like but less conspicuous and less branched than in *M. zippelii*, and nut broad-elliptic in outline (versus elliptical in *M. zippelii*). *M. zippelii* is a much stronger climber than *M. arnhemica*.

Muehlenbeckia sp. Mt Brockman (L.A.Craven 2357) K.L.Wilson & Makinson, *sensu* Australian Plant Name Index (<https://biodiversity.org.au/nsl/services/rest/name/apni/222208/api/apni-format>), accessed 23 August 2023).

Illustrations: Brandbyge (1992: fig. 6B), fruit, as *M. rhyticarya*; Short (2011: fig. 2), as *M. sp.* Mt Brockman (L.A. Craven 2357).

Scrambler, twiner, or decumbent subshrub, forming thickets to 2 m high; dioecious or rarely monoecious. Stems becoming woody with age, to c. 5 mm diam., green to reddish, not glaucous, smooth or weakly and regularly striate. Leaves simple, solitary, persistent, semi-succulent, glabrous, bright green, slightly discolorous, not or rarely slightly glaucous, petiolate; petiole 10–35 mm long, usually about 1/2 as long as blade or slightly shorter, with small extrafloral pit nectary present abaxially at base; blade cordate to ovate,

20–80 mm long, 10–55 mm wide; distal third of blade with edges more or less convex; base truncate to cordate; margins smooth or finely crisped, flat; apex shortly acuminate to obtuse; ocrea short-tubular, not ciliate on upper margin, soon disintegrating. Inflorescence compound, with lax terminal or axillary raceme-like partial inflorescences 5–20 cm long, often crowded sub-terminally. Flowers shortly pedicellate, 2–5 per cluster. Perianth 5-merous, sepeloid, divided for most of its length; perianth segments 1.3–2.5 mm long, persistent, greenish white, in fruiting stage enlarged, whitish and fleshy, papery when dry. Stamens 8; anthers 0.5–0.9 mm long. Style 3-fid. Nut broad-elliptical in outline, subglobose to trigonous in cross-section, 2.7–3.5 mm long, 2.2–3.3 mm diam., black, ± shining, strongly transversely rugose and minutely granulate, partly enclosed by persistent perianth. Figure 2A.

Distribution and habitat: Endemic to the Top End of the Northern Territory (in Kakadu National Park and Arnhem Land), extending to Elcho and Melville Islands (Figure 3). In tall heath on sandstone and in monsoon forests, usually on sandy soils; common after disturbance such as fire.

Conservation status: Apparently widespread in its region of occurrence, including in Kakadu National Park, and in rocky sites likely to be subject to relatively infrequent or low-intensity fires, therefore assessed (Ian Cowie, pers. comm.) as of Least Concern (IUCN 2022).

Etymology: The specific epithet refers to the occurrence of this species mainly in the Arnhem Land region of the Top End of the Northern Territory. The region acquired its name from the Dutch East India Company ship *Arnhem*, which sailed into the Gulf of Carpentaria in 1623. The ship was named after the city of Arnhem in The Netherlands.

Common name: None known.

Notes: The species seems to be mainly dioecious but is at least occasionally monoecious (e.g., the type specimen).

The molecular analysis of Schuster *et al.* (2011) found *M. arnhemica* to be sister to *M. zippelii*, which is a robust climber (climbing to about 10 m up trees) found in north-eastern Queensland and New Guinea. *Muehlenbeckia arnhemica* differs from that species in having leaves with a shortly acuminate to obtuse apex (versus leaves with a 'drip-tip' 5–20 mm long in *M. zippelii*), inflorescence 'racemes' more conspicuous and often much-branched in *M. zippelii*, and nut shape (broad-elliptic in outline in *M. arnhemica* versus elliptical in *M. zippelii*). The collection *Dunlop 3943* from Elcho Island has a somewhat more pointed apex to the fruit, approaching *M. zippelii* in this, but in other features it agrees closely with mainland populations of *M. arnhemica*.

In the past, this species has been referred to *M. rhyticarya* F. Muell. ex Benth. However, our study of morphological characters, distribution and regeneration strategies found that these are distinct taxa. *M. rhyticarya* occurs in temperate to subtropical eastern Australia, differing from *M. arnhemica* in usually being an erect subshrub (sometimes decumbent; not woody), with leaves that are usually glaucous (often less so when young) with an apex usually obtuse to emarginate (occasionally acute), with a fruiting perianth that is more succulent and whitish with a tinge of pink at maturity, and with a nut that is more acutely trigonous and ovate in outline. In addition, *M. rhyticarya* is a reseeder after fire, not a resprouter like *M. arnhemica* (Russell-Smith 1986).



Figure 1. *Muehlenbeckia arnhemica* holotype (two sheets: NSW 785289, NSW 1102070).

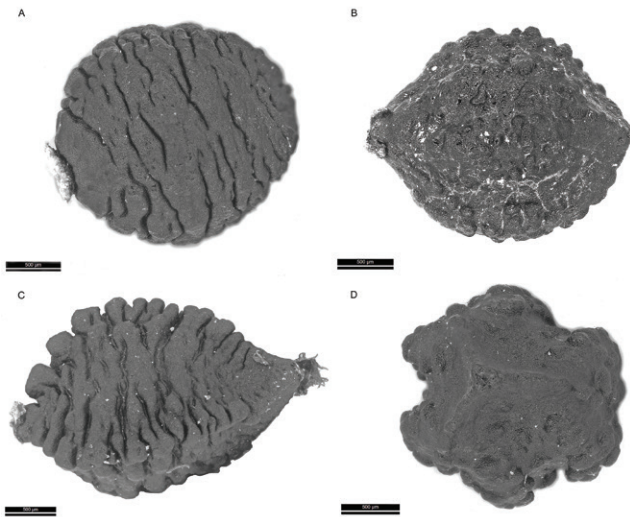


Figure 2. Fruits of A, *Muehlenbeckia arnhemica* (NSW 785289); B, *M. costata* (side view; NSW 1101932); C, *M. rhyticarya* (NSW 775891); D, *M. costata* (top view, with scar of style base in centre and showing the three longitudinal ridges near apex and six broader ribs and tubercles below; NSW 1101933). Scale bar = 500 µm.

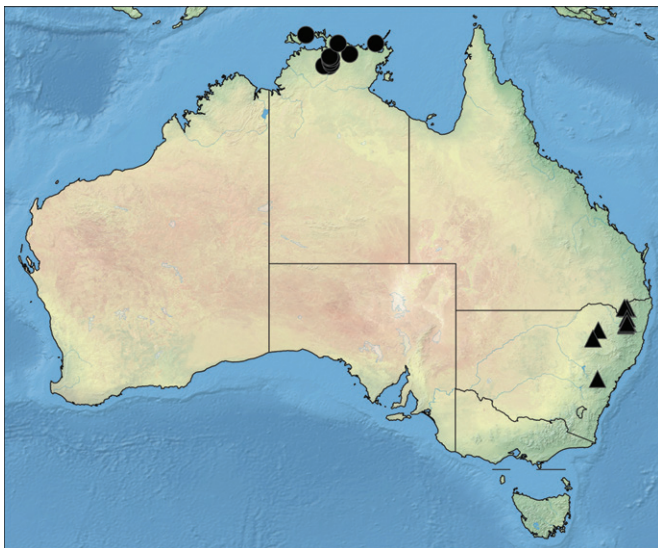


Figure 3. Distribution of *Muehlenbeckia arnhemica* (circles) and *M. costata* (triangles).

Selected specimens examined: Northern Territory: Arnhem Land, Mount Brockman Range c. 15 km S of Jabiru, L.G. Adams & L.A. Craven 3063, 23 Feb 1973 (♀, BRI-AQ277371, CANB 273638, DNA A0063585, G, K, NSW 1101905); c. 56 km S of Maningrida, Arnhem Land, I.D. Cowie 8551, 17 Mar 2000 (♀, DNA D0140753, NSW 522284); N facing wall in central part of Mount Brockman, L.A. Craven 2357, 23 Feb 1973 (♂, BRI 238137, CANB 271513, DNA A0055597, PERTH), L.A. Craven & E. Eversons 2358, 23 Feb 1973 (♀, BRI 238136, CANB, DNA A0055648); 17.5 km SSE of Koongarra, L.A. Craven 6270, 2 June 1980 (♂, BRI 285139, CANB, DNA D0144437, MEL 605667); Arnhem Land, Lightning Dreaming, C. Dunlop 6584 & G. Wightman, 22 Feb 1984 (♀, DNA D0023043); Elcho Island, C. Dunlop 3943, 18 July 1975 (♂, DNA D0009690), (♀, CANB 256984, DNA A0047991, K); Pullchoo Bay, Melville Island, R. Fensham 907, 27 June 1988 (♂, DNA D0045861); Mount Brockman Outlier, 15 km SE of Jabiru, R.W. Johnson 4787, 20 Apr 1989 (♀, BRI-AQ657088, CANB 539888, DNA D0152877, NSW 811743); Mount Brockman, Kakadu, J. Russell-Smith 8040

& D. Lucas, 20 Apr 1989 (♀, DNA D0041833, MEL 1583505, NSW 811744); 7 km WSW of King River mouth, J. Russell-Smith 3719 & D. Lucas, 23 Oct 1987 (vegetative; DNA D0031368); southern end of Mount Brockman outlier, Kakadu National Park, K.L. Wilson 9707, J.J. Bruhl, K.L. Clarke & I.D. Cowie, 16 Mar 1999 (♀, DNA, NE, NSW 785325).

Muehlenbeckia costata K.L. Wilson & Makinson, sp. nov.

Type: New South Wales: Kaputar West Rock Lookout, Mt Kaputar National Park, K.L. Wilson 6990 & R.O. Makinson, 29 Nov 1986 (♀; holo: NSW 894301; iso: BRI, K, NY). Figure 4.

Diagnosis: *Muehlenbeckia costata* is a decumbent to scrambling subshrub. It was previously lumped into *M. rhyticarya* F. Muell. ex Benth., but it differs from that species in its habit (*M. rhyticarya* is an erect subshrub – occasionally decumbent); its non-glaucous and yellow-green leaves (glaucous at least at maturity in *M. rhyticarya*), with strongly crisped leaf margins (usually smooth and even in *M. rhyticarya*); and its subterete to broadly trigonous nut with secondary, longitudinal ridges (trigonous and lacking secondary ridges in *M. rhyticarya*).

Muehlenbeckia sp. Mt Norman (J.T. Hunter 3847) *sensu* Australian Plant Name Index (<https://biodiversity.org.au/nsl/services/rest/name/apni/222209/api/apni-format>, accessed 23 August 2023).

Muehlenbeckia sp. (Stanthorpe A.R. Bean 12466) *sensu* Queensland Herbarium, *p.p.* (<https://www.data.qld.gov.au/dataset/census-of-the-queensland-flora-and-fungi-2022> accessed 7 July 2023).

Illustrations: Wilson (1990: 286); Hunter *et al.* (1998: figs 1, 2); NSW Office of Environment and Heritage (2023).

Scrambling or climbing subshrub or twiner to 4 m in height, dioecious. Stems slender, green to reddish, not glaucous, weakly striate, to 5 m long. Leaves solitary, simple, persistent, not succulent, yellow-green, slightly paler abaxially, often reddish on margins and veins, not glaucous, petiolate; petiole 10–20(–25) mm long, usually no more than 1/3 as long as blade, with small extra-floral pit nectary present abaxially at base; blade ovate to oblong-ovate, 25–75(–140) mm long, 10–50(–90) mm wide; distal third of blade with edges strongly convex; base truncate to more or less cordate or sagittate; margins strongly crisped, slightly wavy; apex obtuse, emarginate, or acute, occasionally short-apiculate (apiculum to 3 mm long); ocrea short-tubular, not ciliate on upper margin, soon disintegrating. Inflorescence compound, consisting of several to numerous axillary ‘racemes’ 0.5–10 cm long. Flowers shortly pedicellate, 2–5 per cluster. Perianth 5-merous, sepeloid, divided for 2/3–3/4 of its length in female flowers, rather more in male flowers; perianth segments 1.5–2.0 mm long, persistent, greenish becoming orange and fleshy in fruiting stage, papery when dry. Stamens 8; anthers 0.7–0.9 mm long. Style 3-fid. Nut broad-elliptical in outline, subterete to broadly trigonous, 3–4 mm long, with (3–)6 broad rounded longitudinal ridges, black, dull, usually prominently tuberculate, partly enclosed by persistent perianth. Figure 2B.



NSW
LOAN:

NSW894301

6990
Lw

National Herbarium of NSW
HOLOTYPE
Muehlenbeckia costata K.L.Wilson & R.O.Makinson
Determinavit Karen L. Wilson April 2021

NATIONAL HERBARIUM OF NEW SOUTH WALES (NSW)
ROYAL BOTANIC GARDENS, SYDNEY

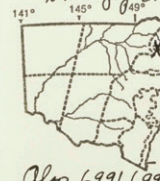
Muehlenbeckia sp. *costata*

Det.:
Loc. Kaputar West Rock Lookout,
Mt. Kaputar National Park
N.S.W. Subdiv.: NT

Lat. 30° 16' S Long 150° 09' E, Alt. m

Coll. K. L. Wilson 6990 Date 29. XI. 1986
& R. Makinson

Notes
♀; flowers greenish, stigmas white.
leaves yellow-green, discolorous, not
glaucous, scarcely undulate but margins
strongly crisped. Fruiting panicle
25° enlarged & ± fleshy
but no really succulent
-31° perianth seed. Flowering
Dupl. to:
33° stems erect, but below
scrambling. In rock
35° crevices on open, cytol., living,
rocky slope (just seed, photo., pollen,
37° E. of lookout) pollinator, spirit, wood
Also 6991, 6992. Dupl.: BRL, K, NY



894301

Figure 4. *Muehlenbeckia costata* holotype (NSW 893401).

Distribution and habitat: At higher altitudes (c. 1100 m) on the New England Batholith, south from Mount Norman near Wallangarra, Queensland, and the adjoining Bald Rock area in New South Wales, to the mountains east of Guyra, extending to the Nandewar Range (Mt Lindesay, Mt Kaputar), and with an outlying occurrence on an isolated lower peak in the Willala Aboriginal Area on the eastern edge of the Pilliga Scrub (observed and photographed there by John Hunter (2011), not vouchered; NSW Office of Environment and Heritage (2013)). An old (1901) specimen from Wallerawang near Lithgow (NSW Central Tablelands), while morphologically congruent with other material, is very disjunct from the nearest known occurrences in the Nandewar Range and Pilliga, and at a much lower altitude (c. 480 m) compared to the main populations closer to the Queensland–New South Wales border. We have searched without success in the broad Wallerawang area, but it is possible that the plant was collected from a site that is now under water in Lake Wallace. Figure 3.

Associated with big granitic, adamellite, basaltic and other igneous outcrops on the New England Batholith and Nandewar Range, in heath and more open areas of dry sclerophyll forests. The isolated occurrence in the Pilliga Scrub is reported to be on sandstone and the other isolated collection from near Wallerawang is also likely to be on sandstone.

Conservation status: Listed as Vulnerable (Schedule 2) in New South Wales legislation (NSW Office of Environment and Heritage 2023); as Least Concern in Queensland (*Nature Conservation Act* (NCA) status). A listing as Endangered may be more appropriate, given its fragmented and spasmodic occurrence, but most known populations are protected in national parks.

Etymology: The specific epithet refers to the prominent longitudinal ribs on the fruit; from the Latin *costa*, a rib.

Common name: Scrambling Lignum (NSW Office of Environment and Heritage 2023).

Notes: A relatively widely distributed species but of restricted habitat. It behaves as a pioneer fire-ephemeral and an obligate seeder (Hunter 1995; Hunter and Clarke 1998; Hunter *et al.* 1998). It is abundant after fire, germinating from the seed bank and then persisting for up to three years (Hunter *et al.* 1998), but otherwise rarely emergent, surviving as diaspores in the soil seed bank. It produces abundant hard-coated seeds surrounded by the persistent enlarged, orange-coloured perianth. This probably indicates dispersal by birds and perhaps lizards (Hunter *et al.* 1998).

Male inflorescences tend to be laxer and more elongated (e.g., in *S.T. Blake 23714*) than female inflorescences.

This taxon was previously referred to *M. rhyticarya* F.Muell. ex Benth., which occurs in the same regions as *M. costata* although they are not sympatric. *M. rhyticarya* differs from *M. costata* in being an erect subshrub (occasionally decumbent) versus scrambling and climbing in *M. costata* and in having glaucous stems and leaves (less so when young) versus non-glaucous and yellow-green in *M. costata*, leaf margins usually smooth (strongly crisped in *M. costata*, and often reddish), and a nut that is trigonous, lacking prominent longitudinal ridges. Both species are most common after fire, but plants of *M. rhyticarya* often persist for more years than *M. costata*, which only persists for 2–3 years.

Selected specimens examined: Queensland: Darling Downs: Girraween National Park near Wallangarra, slopes of Mount Norman, *S.T. Blake 23714*, 4 Nov 1971 (♂, BRI 134103); S of Mount Norman, Girraween National Park, alt. 1230 m, *J.T. Hunter 3456*, 6 Aug 1995 (♀, BRI, NE 63992, NSW 470829); Border Trail between Girraween and Bald Rock National Parks, *J.T. Hunter 3847*, 16 Feb 1996 (♀, AD, B, CANB 697012, DNA D0135815, HO 329774, K, MEL 266330, NE 63690, NSW 500358, QRS 120413).

New South Wales: Northern Tablelands: Mount Lindesay, Nandewar Mtns, *R.H. Cambage 2391*, Nov 1909 (♂, NSW 1101934); Mount Kaputar, 38 km ENE of Narrabri, *R. Coveny 8870* & *S.K. Roy*, 20 Nov 1979 (♀, NSW 1101934); Bald Rock, Bald Rock National Park, alt. 1165 m, *J.T. Hunter 3209*, 31 May 1995 (♀, NE 63214, NSW 396849); West Kaputar Rocks, Mount Kaputar National Park, *P. Merrotsy s.n.*, 8 Feb 1987 (♀, NSW 1101926); Kaputar Road, c. 1.4 km W of intersection with Summit Road, Mount Kaputar National Park, *G.P. Phillips 1110* & *L.M. Copeland*, 23 Apr 2020 (♀, NSW 1098868); 200 m NW of Scott Trig. point, Compartment 211, Butterleaf State Forest, alt. 1320 m, *P.G. Richards 533*, *D. Moffatt* & *J. Hunter*, 18 Jun 1996 (vegetative, NE 72971, NSW 411135); Kaputar West Rock Lookout, Mount Kaputar National Park, *K.L. Wilson 6991*, 6992 & *R. Makinson*, 29 Nov 1986 (♀, NSW 1101933, 1101932); saddle between Crown Mountain and Nightcap Mountain, Warra State Forest, alt. 1330 m, *K.L. Wilson 9399*, *K.D. Hill*, *L.C. Stanberg* & *J. Hunter*, 23 Feb 1996 (♀, NSW 400541, 811742), 9401 *et al.* (♂, NSW 40052). Central Tablelands: Wallerawang, *J.L. Boorman*, Oct 1901 (♀, NSW 156204).

iNaturalist observations (<https://inaturalist.ala.org.au/>): [67741566](#), [143698210](#), [148551738](#).

Key to similar species

These two newly described species are moderately vigorous subshrubs or vines, scrambling or climbing in habit, like various other species in the genus. A key is provided to these and species of broadly similar habit in eastern and northern Australia.

1. Distal third of leaf with margins straight or concave in outline; apex of leaf long-acute to long-cuspidate (a 'drip tip') 2
- 1: Distal third of leaf with margins convex in outline; apex of leaf obtuse or emarginate (may be apiculate) or short-acuminate to acute..... 4
2. Fruiting perianth succulent, whitish to yellow-brown ***M. gunnii***
- 2: Fruiting perianth not succulent, greenish..... 3
3. Nut subglobose, 2–2.5 mm long, ± shining, finely granulate, scarcely to strongly rugose; petioles and veins on abaxial leaf surface usually white-scaberulous..... ***M. gracillima***
- 3: Nut broad-elliptical to ovate in outline, trigonous in cross-section, 3–3.5 mm long, dull, strongly transversely rugose; petiole and veins on abaxial leaf surface smooth..... ***M. zippelii***
4. Nut smooth or minutely granulate..... ***M. adpressa***
- 4: Nut transversely rugose or tuberculate..... 5
5. Fruiting perianth strongly succulent; leaves with fine secondary rugulose to linear ornamentation at least on adaxial surface (seen clearly at 25× magnification); leaf margin recurved or occasionally undulate..... ***M. gunnii***
- 5: Fruiting perianth ± fleshy but not strongly succulent; leaves without secondary ornamentation; leaf margin flat, not recurved..... 6
6. Nut trigonous in cross-section; strong climber to 10 m high ***M. zippelii***

- 6: Nut globose to broadly trigonous in cross-section; semi-erect subshrub, scrambler or climber to 4 m high7
- 7: Nut tuberculate with tubercles forming 6 longitudinal ridges; leaf margins strongly crisped; petiole and veins on abaxial surface of leaf white-scaberulous ***M. costata***
- 7: Nut strongly transversely rugose and granulate; leaf margins not or scarcely crisped; petiole and veins on abaxial surface of leaf smooth ***M. arnhemica***

Muehlenbeckia diclina (F.Muell.) F.Muell., *Fragmenta* 4: 131 (1864).

Muehlenbeckia stenophylla F.Muell. has sometimes been considered a synonym of *M. diclina* (F.Muell.) F.Muell. but morphological differences in habit (Figure 5), anther size and fruits (see Figure 6 for nut features and see key below), habitat differences and geographic separation led us to the conclusion that the former should be recognised as a subspecies of the latter. The relevant combination is made here and lectotypes are selected.

The two subspecies have discrete distributions (Figure 7): *M. diclina* subsp. *stenophylla* (F.Muell.) K.L.Wilson & Makinson occurs in the mountains of eastern Victoria and south-eastern New South Wales, while the typical subspecies is inland, from Pooncarie in south-western New South Wales to north-western Victoria and the northern Eyre Peninsula in South Australia, with a disjunct occurrence in southern Western Australia as far west as the Hyden area. Both subspecies are fire-ephemerals and have been observed to reshoot after fire, but the relative frequency of resprouting versus seed reproduction is unknown. The two subspecies can be distinguished as follows:

1. Nut broadly trigonous to subglobose; nut surface ± shining, smooth or with faint irregular transverse ridges; anthers 0.6–1.0 mm long; erect to spreading subshrub, stems spreading to erect, leaves ascending to spreading ***M. diclina*** subsp. ***diclina***
- 1: Nut trigonous to triquetrous; nut surface ± dull, irregularly but strongly rugose with both transverse and longitudinal ridges; anthers 0.7–1.5 mm long; virgate subshrub with stems and leaves usually more or less strongly erect ***M. diclina*** subsp. ***stenophylla***

Muehlenbeckia diclina (F.Muell.) F.Muell. subsp. ***diclina***

Polygonum diclinum F.Muell., *Trans. Philos. Soc. Victoria* 1: 23 (1855); *Hooker's J. Bot. Kew Gard. Misc.* 8: 203 (1856).

Muehlenbeckia diclina (F.Muell.) F.Muell., *Fragmenta* 4: 131 (1864).

Muehlenbeckia polygonoides F.Muell., *Fragmenta* 5: 73, 91 (1865); Ewart, *Pl. Indig. Victoria* 2: 17, t.80 (1910); *nom. illeg.*

Type citation: 'On shifting sandhills at the junction of the Murray and Murrumbidgee, and rarely at the Mitta Mitta.'

Type: Victoria or New South Wales?: Murray River, *F. Mueller*, 1853; lecto (here designated) ♂, MEL 1552392; possible isolecto K000831384, MEL 1550774 (♂, with nuts in packet), YU 068981 (image seen).

Typification: There is no specimen in MEL that bears full protologue details. The lectotype is chosen because it is annotated by Mueller, bears part of the protologue information,

and has a better specimen (leaves and flowers still attached to the branch) than MEL 1550774, in which most of the leaves and all of the flowers have become detached from the branch and are in a packet attached to the specimen (along with nuts presumably from another collection). The lectotype is annotated as 'unicum' by Sonder, indicating that it was a unique sheet in Sonder's herbarium. The possible isolectotypes may represent material kept by Mueller when he sent the specimen to Sonder.

We have not seen any *Muehlenbeckia* specimens labelled as coming from the Mitta Mitta area, which is in Gippsland. Specimens from that area would be the other subspecies.

The combining author for the combination under *Muehlenbeckia* has previously been taken as Druce. However, the statement by Mueller (1864: 131) is adequate to make the new combination. There is a printing mistake in that statement ('P' is substituted for 'M.' in the new combination), but Mueller's statement is unambiguous and his intention is supported by the index (Mueller 1864: 191), where the name is given as '*Muehlenbeckia diclina*'.

Distribution and habitat: This subspecies is found from Pooncarie in south-western New South Wales to north-western Victoria (the Lowan Mallee Bioregion; Walsh 1996) and the northern Eyre Peninsula in South Australia, with a disjunct occurrence in southern Western Australia as far west as the Hyden area (Figure 7). Associated with mallee woodland and mallee-heath on old, fixed sand dunes, on deep sandy or loamy soils; most obvious after fire disturbance.

Notes: Differs from subspecies *stenophylla* in the nut features mentioned in the key (also see Figure 6), and in being an erect (but not virgate) to spreading subshrub. The fruiting perianth is said to be less succulent in this subspecies (Moore & Betche 1893: p. 123), but more field observations are needed to confirm this.

Selected specimens seen: Western Australia: Hyden, A.E. Marsh *s.n.*, 10 June 1936 (vegetative, PERTH); Camp 68 near Fraser Range, R. Helms *s.n.*, Oct 1891 (♂, NSW 156410), Nov 1891 (♂, MEL 1550784, NSW 156411).

South Australia: Kyancutta, B. Copley 2601, 26 July 1969 (♂, AD 96937261, B n.v., G n.v.).

New South Wales: 50 km NE of Pooncarie, W.E. Mulham 811, Nov 1974 (♀, CANB 650214, MEL 1590218, NSW 234161); 6 miles [c. 10 km] E of Manfred on road to Manfred Range (SW of Ivanhoe), T.M. & J.L. Whaite 2073, 16 Nov 1956 (♀, NSW 252074).

Victoria: Northern Plains, Sunset Country, 3 km W of Gypsum Plant along abandoned railway line towards Rocket Lake, M.D. Crisp 3397 (♂, AD 97925320, CBG 7706509, MEL 560268), 3398 (♀, AD 97925328, CBG 7706510, MEL 560269).

iNaturalist observations (<https://inaturalist.ala.org.au/>): **New South Wales:** [179787720](#).

South Australia: [141494607](#), [62286380](#), [58931172](#).

Victoria: [157998107](#), [47717604](#), [47702792](#), [47700801](#).



Figure 5. *Muehlenbeckia declina*: subspecies *declina* (A, regrowth after fire; B, leaf with basal lobe on young regrowth; Murray-Sunset National Park, Victoria) and subspecies *stenophylla* (C, habit; D, leaves and male flowers; McKillops Road, Victoria). Photographs by Tanja Schuster (A, B) and Karen Wilson (C, D).

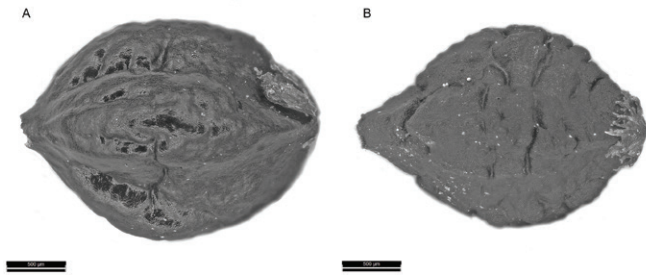


Figure 6. Fruits of A, *Muehlenbeckia diclina* subsp. *diclina* (NSW 252074); B, *M. diclina* subsp. *stenophylla* (NSW 667463), with flattened remnants of styles present. Scale bar = 500 μ m.

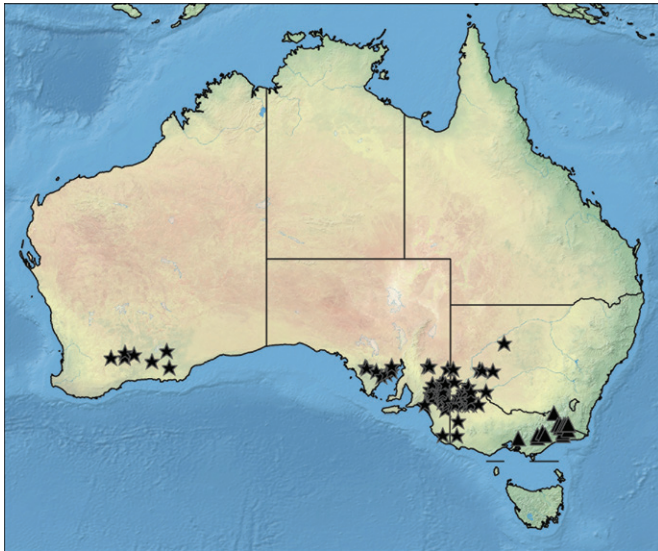


Figure 7. Distribution of *Muehlenbeckia diclina*: subsp. *diclina* (stars) and subsp. *stenophylla* (triangles).

Muehlenbeckia diclina* subsp. *stenophylla (F.Muell.) K.L.Wilson & Makinson, comb. et stat. nov.

Muehlenbeckia stenophylla F.Muell., *Fragmenta* 1: 138 (1859).

Type citation: ‘In rupibus montium ad flumen McAllister River terrae Gipps Land, altitudine circiter 3000’ [feet].’

Type: Victoria: Rocky summits of mountains 3000 ft [c. 1000 m] high on the McAllister [Macalister River], Gippsland, F. Mueller; lecto (here designated) ♀, MEL 1530776; probable isolecto B, E, FI, K 000831383, MEL 1550775.

Muehlenbeckia diclina subsp. Gippsland (R.O. Makinson 1007).

Typification: The lectotype is the only sheet in MEL that has a label with full locality information in Mueller’s script and is chosen for this reason (the specimen is rather depauperate but adequate, with a few flowers and leaves attached to the branch and others in a packet). Its label is annotated with a pencilled ‘B’ on the reverse, indicating that it was seen by Bentham. The probable isolectotype MEL 1550775 bears similar material to the lectotype and has a label with the same information but written in a very neat and large hand, suggesting that this may have been a sheet for public display. The other sheet, MEL 1550969, has a similar specimen but is merely labelled (in Mueller’s script) as coming from Gippsland.

Distribution and habitat: Occurs in montane areas of far south-eastern New South Wales and eastern Gippsland, Victoria, at least as far south as Licola (Figure 7). Associated with rocky outcrops or occasionally in forests, to an altitude of at least 1,200 m.

Notes: Differs from the typical subspecies in nut characters as given in the key (also see Figure 6), and in being a more strongly virgate subshrub. Both subspecies tend to be strongly glaucous when young but become less so with maturity. The typical subspecies may be less glaucous than subspecies *stenophylla*, but more field observation is needed to confirm this. Similarly, the fruiting perianth is said to be more succulent in subsp. *stenophylla* (Moore & Betche 1893: p. 123), but more field observations are needed to confirm this.

Selected specimens seen: New South Wales: Byadbo Range, A.B. Costin s.n., Aug 1949 (vegetative, NSW 156413); Merambego [Murrumbuco] 28 miles [45 km] from Delegate, W. Forsyth s.n., May 1908 (♂, NSW 156412); Merambego Fire Trail, c. 1 km E from ford over tributary of Byadbo Creek, J. Miles 1307, 4 Feb 2013 (♀, NSW 879966).

Victoria: Hanging Rock at escarpment of ridge running N from summit of World End spur, c. 2.9 km SE of Mount Hamilton, D.E. Albrecht 3233 & S.J. Forbes, 15 Feb 1986 (♀, AD 99119350, CBG 8906194, HO, MEL 1560695, NSW 667463); Buchan River Gorge below Native Dog Plain, A.C. Beaglehole 35946, 9 Jan 1971 (♀, MEL 2224743); Yarra Range, A.C. Beaglehole 78056, 7 Oct 1984 (MEL 1550971, NSW 667467); near McKillops Bridge, Upper Snowy River, L. Costermans s.n., 7 Jan 1977 (♀, MEL 599820); c. 6 km (direct) WNW of Dellicknora, c. 6.5 km NW along McKillops Bridge road from junction with Dellicknora road, R.O. Makinson 1007 & P. Carmen, 7 Dec 1991 (♂, CBG 9107031, K, MEL 275492, NE, NSW 453383, US); Reedy River valley, below Brumby Point, Nunniong Plateau area, J.H. Willis s.n., 13 Nov 1964 (♂, MEL 502526, NSW 667465); McKillops Road, c. 6.5 km NW of Dellicknora turn-off, K.L. Wilson 10497 & A. Wilson, 31 Dec 2008 (♂, CANB, K, MEL 2334144, NSW 785563, NY).

iNaturalist observations (<https://inaturalist.ala.org.au/>): **Victoria:** [139746193](#), [74115901](#), [73991868](#), [67563565](#), [66896237](#), [66649374](#).

Acknowledgements

The directors and staff of the following herbaria are thanked for access to their specimens, when either visiting or sent on loan to NSW: AD, B, BRI, CANB, CNS, DNA, E, FI, G, K, MEL, NE, NSW, PERTH. We thank Regine Classen-Bockhoff, Jeremy Bruhl, Ian Cowie, John Hunter, Tanja Schuster, Greg Steenbeeke, Ian Telford and Neville Walsh for helpful discussions and assistance with fieldwork, Tanja Schuster for her photographs, and Emily Butler for photographing the type specimens.

References

Brandbyge, J (1992) The genus *Muehlenbeckia* (Polygonaceae) in South and Central America. *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 114: 349–416.

- Classen-Bockhoff, R, and Bull-Hereñu, K (2013) Towards an ontogenetic understanding of inflorescence diversity. *Annals of Botany* 112: 1523–1542. [DOI](#)
- Endress, PK (2010) Disentangling confusions in inflorescence morphology: patterns and diversity of reproductive shoot ramification in angiosperms. *Journal of Systematics and Evolution* 48: 225–239. [DOI](#)
- Hunter, JT (1995) Some observations on the fire responses of two rare species in the Girraween and Bald Rock National Parks. *Queensland Naturalist* 33(5–6): 146–147.
- Hunter, JT, and Clarke, PJ (1998) The vegetation of granitic outcrop communities on the New England Batholith of eastern Australia. *Cunninghamia* 5: 547–618. [URL](#)
- Hunter, JT, Fallavollita, E, and Hunter, VH (1998) Observations on the ecology of *Muehlenbeckia costata* ms. (Polygonaceae), a rare fire ephemeral species occurring on the New England Batholith of north-eastern New South Wales and southern Queensland. *The Victorian Naturalist* 115(1): 9–17. [URL](#)
- Hunter, JT (2011) *Vegetation and floristics of the Pilliga East State Conservation Area, Willala Aboriginal Area, Pilliga Nature Reserve and the Ukerbarley addition*. Unpublished report to the NSW Department of Environment, Climate Change and Water. [DOI](#)
- IUCN (2022) 'IUCN Red List categories and criteria'. (International Union for Conservation of Nature: Gland, Switzerland)
- Mueller, FJH von (1864) *Fragmenta phytographiae australiae* 4. (Government Printer: Melbourne) [URL](#)
- NSW Office of Environment and Heritage (2013) *Willala Aboriginal Area plan of management*. (Office of Environment and Heritage: South Sydney)
- NSW Office of Environment and Heritage (2023) *Scrambling Lignum – profile*. [URL](#) (accessed 7 July 2023)
- Russell-Smith, J (1986) *The forest in motion: exploratory studies in western Arnhem Land, northern Australia*. PhD thesis (Australian National University: Canberra)
- Schuster, TM, Wilson, KL, and Kron, KA (2011) Phylogenetic relationships of *Muehlenbeckia*, *Fallopia*, and *Reynoutria* (Polygonaceae) investigated with chloroplast and nuclear sequence data. *International Journal of Plant Science* 172(8): 1083–1066. [DOI](#)
- Short, PS (2011) Polygonaceae. Pp. 1–6 in Short, PS, and Cowie, ID (eds), *Flora of Darwin region* vol. 1 (online edition). [URL](#) (accessed 26 April 2021)
- Shorthouse DP (2010) SimpleMappr, an online tool to produce publication-quality point maps. [Retrieved from [URL](#) (accessed 20 June 2023)]
- Walsh, NG (1996) Polygonaceae. Pp. 272–295 in Walsh, NG, and Entwisle, TJ (eds) *Flora of Victoria* vol. 3, *Dicotyledons Winteraceae to Myrtaceae*. (Inkata Press: Melbourne)
- Wilson, KL (1990) Polygonaceae. Pp. 278–293 in Harden, GJ (ed.), *Flora of New South Wales*, vol. 1. (University of NSW Press: Sydney)