

The genus *Ptychomitrium* Fürnr. (Bryophyta: Ptychomitriaceae) in Australia

David Meagher

School of BioSciences, The University of Melbourne, Victoria, 3010
Australia dameag@unimelb.edu.au

Abstract

Five species of *Ptychomitrium* have been recognised in Australia: *P. acutifolium*, *P. australe*, *P. laxifolium*, *P. mittenii* and *P. muelleri*. Apart from *P. mittenii* these species have been confused in the literature and in herbarium identifications. Here *P. acutifolium*, *P. australe* and *P. mittenii* are accepted. *P. laxifolium* is synonymised under *P. acutifolium*, and *P. muelleri* is synonymised under *P. australe*.

Introduction

Five species of the moss genus *Ptychomitrium* Fürnr. have been reported from Australia: *P. acutifolium* Hook.f. & Wilson, *P. australe* (Hampe) A.Jaeger, *P. laxifolium* (Müll.Hal.) Paris, *P. mittenii* A.Jaeger and *P. muelleri* (Mitt.) A.Jaeger (Scott and Stone 1976, Cao et al. 2001, Cao et al. 2005, Streimann and Klazenga 2006). The Australian species have never been treated in their entirety. Instead, species have been gradually added, subtracted and synonymised, resulting in confusion about their identities, as Cao et al. (2005) noted in relation to *Ptychomitrium acutifolium*. Further confusion has arisen because some gatherings consist of two species growing together. The confusion has been worsened by a lack of accurate illustrations of the species and a consequent plethora of incorrectly identified specimens in herbaria and images on the internet.

The following treatment is intended to resolve these problems. In the listings of types, !d indicates that a high-resolution digital image has been seen. When identifying specimens it is essential that leaves are fully wetted so that the shoulders and also the cells of the upper lamina are clearly visible. In older specimens the cell contents may be dark, so that sectioning or clearing and staining leaves may be necessary in order to see the upper leaf cells clearly. Because peristomes are difficult to draw accurately and have been poorly illustrated in the past, photographs rather than drawings are provided (Fig. 4).

Taxonomic Treatment

Key to Australian species of *Ptychomitrium*

- 1 Upper margins of most leaves coarsely toothed *P. mittenii*
- 1: Margins of leaves entire throughout..... 2
- 2 Most leaves when fully wetted with a distinct shoulder and bluntly pointed apices; leaf lamina wholly bistratose above shoulder..... *P. australe*
- 2: Most leaves when fully wetted tapering gradually to the apex, without a distinct shoulder, apices acutely pointed; bistratose region of upper lamina confined to margins and apex and (if present) scattered longitudinal rows or patches of cells *P. acutifolium*

Ptychomitrium Fürnr., *Flora (Jena)* 12(2): 19 (1829)

Plants green to dark green in newer growth, brown to black in older growth, in cushions. Stems erect, often branched, with a well-developed central strand. Leaves contorted to strongly crisped when dry, spreading when wet, linear-lanceolate to broadly lanceolate or ovate-lanceolate, sometimes keeled; margins plane or recurved, entire to coarsely toothed in upper half; margins and all or part of leaf lamina often bistratose in upper half; cells thick-walled and densely chlorophyllose in upper leaf, larger and colourless in leaf base.

Autoicous, perigonia immediately below perichaetia. Perichaetial leaves similar to vegetative leaves. Seta smooth, length various, straight to flexuose. Capsule erect, symmetrically oblong-ovoid to ovoid, peristome of 16 deeply divided lanceolate to linear-lanceolate teeth, densely papillose; annulus of a single row of thick-walled cells, present or not. Operculum almost flat to conic with a short to long beak. Calyptra mitrate, split at the base into several lobes, covering the operculum and 1/3 to all of the urn. Spores spherical, papillose or smooth.

Ptychomitrium acutifolium Hook.f. & Wilson, *Fl. Tasman.* 2: 180 (1859).

Synonyms: *Brachysteleum acutifolium* (Hook.f. & Wilson) Hampe, *Frag. Suppl.* 119 (1881).

Glyphomitrium acutifolium (Hook.f. & Wilson) Mitt., *J. Proc. Linn. Soc., Bot.* 4: 73 (1859).

Type: Australia, Tasmania, 'On banks and trap rocks near the Derwent, Glen Leith', without date, *J.D. Hooker s.n.* (lectotype *vide* Cao et al. (2005): BM-575709!d; isolectotype: H not seen); 'On rocks: Port Sorrell', without date, *Archer s.n.*, (paralectotype *vide* Cao et al. (2005): BM not seen)

=*Ptychomitrium laxifolium* (Müll.Hal.) Paris, *Index. Bryol. Suppl.* 289 (1900) **syn. nov.**

Basionym: *Brachysteleum laxifolium* Müll.Hal., *Index Bryol. Suppl.* 289 (1900)

Synonyms: *Glyphomitrium laxifolium* Müll.Hal. (Broth.), *Nat. Pflanzenfam.* 1(3): 442 (1902)

Type: 'Australia, New South Wales, Parramatta, Decembri 1884: *Whitelegge* in *Hb. Melbourne*', *Whitelegge 209* (holotype: MEL-1002626A!).

Plants in dense cushions to about 10 mm tall, green to dark green above when fresh, commonly yellow-green or brownish yellow in herbarium specimens, dark brown to black below. Leaves strongly crisped when dry, spreading widely when moist, linear-lanceolate, mostly 3.0–3.5 × 0.4–0.5 mm, apex acute; margins plane, entire, bistratose in the upper half or more and usually across the extreme leaf apex; upper leaf lamina often also bistratose in longitudinal rows or patches; costa strong, failing just below the apex, narrowed slightly in the leaf base, often thickest in mid-leaf; cells in mid-leaf shortly rectangular, about 7–12 × 6–10 µm; smaller and ± quadrate towards the leaf apex, to about 7 × 7 µm with a rounded lumen; much longer and lacking chloroplasts towards the leaf base, 28–58 µm × 7–10 µm. Perichaetial leaves similar to vegetative leaves but slightly smaller. Seta straight to flexuose, 2.5–3.5 mm long. Capsule erect, oblong-ovoid; urn to about 1.7 mm long; operculum about 1 mm long, weakly convex at the base, with a long straight or slightly inclined beak; peristome single, pale yellow-brown, of 16 lanceolate to linear-lanceolate teeth split almost to the base; annulus present. Calyptra mitrate, split into lobes all around the base, covering the operculum and 1/3 to 1/2 of the urn.

Illustrations: Figs 1, 4a, 5a. Also Cao et al. (2005, figures 1–16, 29–40).

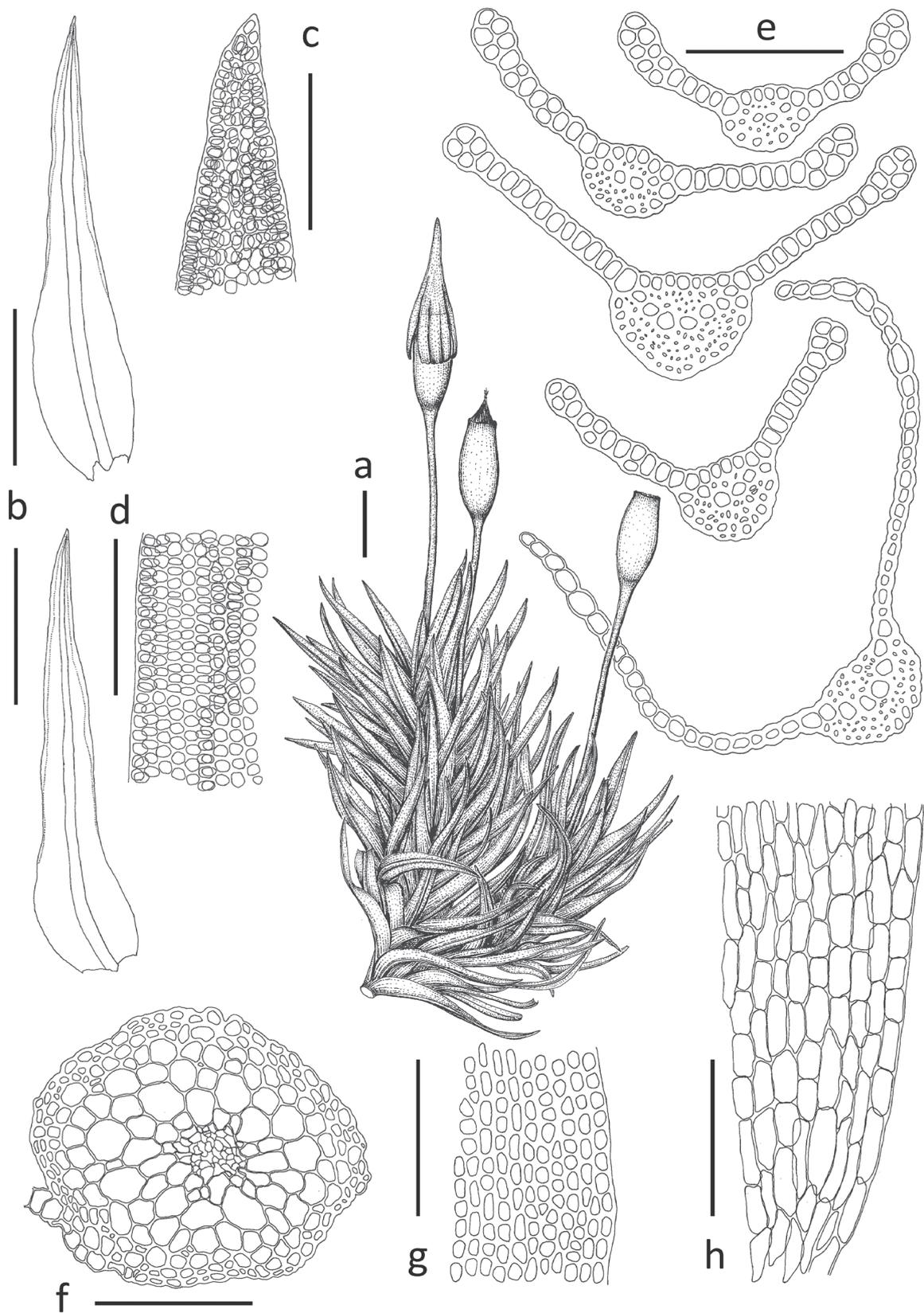


Fig. 1. *Ptychomitrium acutifolium*: **a**, whole plant, moist; **b**, typical leaves; **c**, leaf apex; **d**, upper leaf lamina; **e**, transverse sections of leaf; **f**, transverse section of stem; **g**, cells in lower leaf; **h**, marginal cells in leaf base. Drawn by R.D. Seppelt from Jarman s.n. (HO-511114). Scale bars: a = 1 mm, b–h = 100 μ m.

Habitat: Almost exclusively on calcareous or basaltic rock; sometimes also on bitumen; occasionally on siliceous rock close to mortar or concrete.

Distribution: WA, SA, Tas, Vic, ACT, NSW, Qld, LHI; also New Zealand. This species appears to be more common in cold-temperate areas, although it extends into warm-temperate regions. It may occur in the Queensland tropics at higher altitudes.

Discussion: The original description of *P. acutifolium* was based on material collected by J.D. Hooker near Hobart, and at The Hummocks by Archer (Wilson, in Hooker 1859). Sainsbury (1955a) suggested that this species was identical to *P. australe*. This view seems to have been accepted by Scott and Stone (1976), and Catcheside (1980) formalised the synonymy. However, Cao et al. (2005) recognised *P. acutifolium* and *P. australe* as separate species on the basis of their assessment of the types (see the discussion under *P. australe*). They did not mention that the margins in the upper half of the leaf in *P. acutifolium* are bistratose, and did not illustrate a transverse leaf section, but the thickened margins are readily observable in specimens cited by them, e.g. *Streimann* 10679, CBG-8008341; *Streimann* 35711, CBG-566523; *Streimann* 55838C, CBG-9708351. The shapes of the leaves illustrated in the main illustration by Cao et al. (2005) (Figs 10 and 11) are atypical for the species, although not unusual; those illustrated in their Figs 37–40 are more typical.

Müller (1898) described *Brachysteleum laxifolium* (= *Ptychomitrium laxifolium*) from a specimen collected by Thomas Whitelegge, citing the type material as 'Paramatta, December 1884: Whitelegge in Hb. Melbourne, cum fructibus senioribus deoperculatis.' The type material must therefore include that portion of the original material in MEL (MEL-1002626A). Müller presumably retained some of the original material (which would be an isotype) in B, but there is no record of it and it is likely to have been destroyed during the bombing of Berlin in the Second World War. Another specimen collected by Whitelegge in 1884 at Parramatta (NSW-779257) might be an isotype, but I have not seen it. Numerous other specimens identified as *P. laxifolium* are in NSW, but unfortunately I have not had the opportunity to examine them. Whether they are all *P. acutifolium* is uncertain.

The majority of specimens of *P. acutifolium* from Australia seen in this study have (as well as bistratose margins) occasional to frequent scattered bistratose lines or patches running longitudinally along the leaf (Figs 1d, e). When fresh leaves are viewed by transmitted light, these lines or patches often resemble lamellae because they are a darker green than the rest of the lamina, but the cells in these bistratose areas are much thinner than those in the unistratose parts, so that the leaf is hardly if at all thickened. There does not appear to be any geographical differentiation between specimens with and without these bistratose regions, or those with few and many bistratose regions. Occasional specimens referable to *P. acutifolium* because of the leaf shape have almost the whole upper lamina bistratose, but there are always some areas that are unistratose; in *P. australe* this is never the case. A more detailed study might provide evidence for the recognition of intraspecific taxa of *P. acutifolium*, perhaps at the varietal level.

Cao et al. (2005) suggested that the length of the calyptra (or more correctly, the proportion of the capsule urn that is covered) is a feature that can distinguish *Ptychomitrium acutifolium* from *P. australe*. This is partly true in that plants with very short calyptras will always be *P. acutifolium* (coinciding with long oblong-ovoid urns) and plants with calyptras more or less covering the whole urn will almost always be *P. australe* (coinciding with short ovoid urns). However, the calyptra length relative to the urn in both species is often intermediate because of the variability in the urn shape and length and also the maturity of the capsule. Young capsules naturally having the calyptra covering the urn in both species, and cannot always be relied upon to distinguish the species. Figures 35 and 36 in Cao et al. (2005) show two calyptras in *P. acutifolium* that are intermediate in length. Also, one specimen of *P. acutifolium* seen in this study (MEL-1002710A, from Tasmania) had calyptras more or less covering the capsules.

Cao et al. (2005) suggested that capsule shape could be used to distinguish the species because capsule urns in *Ptychomitrium acutifolium* are usually oblong-ovoid whereas in *P. australe* they are usually ovoid, but capsule shape is very variable in both species and cannot be used as a distinguishing character. Cao et al. (2005) treated *Ptychomitrium acutifolium* as an Australian endemic, but it is also in New Zealand, as evidenced by specimens in MELU (see representative specimens seen).

Ptychomitrium acutifolium has sometimes been confused with *Weissia controversa* Hedw., possibly because of the similar curling of the leaves and similar leaf shape. However, *W. controversa* is a smaller plant, the cells are distinctly papillose, the leaf margins are not bistratose, and the seta is much longer (6–8 mm).

Additional specimens examined: AUSTRALIA: WESTERN AUSTRALIA: track to Haywards Peak, Porongorup Range, 16 Sep 1994, *H. Streimann* 54449 (CBG-9504586); Serpentine Dam, Serpentine, 7 June 1970, *I. G. Stone* 4837 (MEL-2147941A). SOUTH AUSTRALIA: 23 Aug 1953, *Catcheside* 53.195 (MEL-1034289A); Mount Remarkable, 28 Sept 1965, *Beaglehole* 14984 (MEL-1041041A). TASMANIA: Chinese Creek, Schouten Island,

27 Feb 2002, *M. Duretto 1505b* (MEL-2068614A); south escarpment of The Nut, Stanley, 29 Jan 1984, *Willis s.n.* (MEL-1046594A). VICTORIA: Basalt Pinnacles near Byaduk, 4 Oct 1974, *I.G. Stone 9470* (MEL-2188862A); Wellington River, north of Licola, 31 Mar 1972, *Scott s.n.* (MUCV-1274). NEW SOUTH WALES: Cambewarra Mountain, 20 Aug 1972, *Scott s.n.* (MUCV-1741); Kiama, 19 Aug 1972, *Scott s.n.* (MUCV-2023). AUSTRALIAN CAPITAL TERRITORY: Paddys River, Cotter Reserve, 20 Apr 1975, *H. Streimann 1749* (CBG-57790); Glendale Crossing, Gudgenby River, 18 May 1980, *H. Streimann 10257* (CBG-8003946). QUEENSLAND: west side of Bunya Mountains, 26 Aug 2969, *I.G. Stone 4552* (MEL-2142562A); Caves Circuit, Lamington National Park, 9 June 2002, *N. Klazenga 6029* (MEL-2131778A). LORD HOWE ISLAND: Curio Point, Northern Hills, Nov 2009, *D. Meagher LH-128* (MELU (herb. D. Meagher)); Goathouse Cave, 7 Feb 1995, *H. Streimann 55838C* (CBG-9708351). NEW ZEALAND: Queenstown–Arrowtown road, 8 Dec 1966, *Scott s.n.* (MELU s.n. ex OTA).

Ptychomitrium australe (Hampe) A.Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1872–73: 105 (1874).

Basionym: *Brachysteleum australe* Hampe Linnaea 28: 209 (1856).

Synonym: *Glyphomitrium australe* (Hampe) Mitt. Transactions of the Royal Society of Victoria, n.s. 19: 57 (1882).

Type: Australia, Victoria, ‘In albis versus Buchan river’, without date, *von Mueller s.n.* (holotype: BM-867848!d (*fide* annotation by Cao Tong); isotypes BM-555232!d, BM-867849!d, BM-867848!d, BM-867850!d) = *Glyphomitrium adamsonii* Mitt., J. Proc. Linn. Soc., Bot. 4: 73 (1859).

Synonyms: *Brachysteleum adamsonii* (Mitt.) F.Muell., Frag. Suppl. 48 (1881), synonym *fide* Dixon (1926).

Ptychomitrium adamsonii (Mitt.) A.Jaeger, Ber. Thätk. St. Gallischen Naturwiss. Ges. 1872–73: 103 (1874)

Type: ‘Australia; common on trap-rocks, Melbourne, *Mr. Adamson, No. 60*’ (syntypes: NY-1162728!d, NY-1162729!d).

= *Ptychomitrium balansae* Besch., Mem. Soc. Sci. Math. Cherbourg 21: 261 (1877), synonym *fide* Cao et al. (2001) sub *P. muelleri*.

Type: Paraguay, ‘Yaguaron, sur les toits, mars 1877, no. 1235’ (syntypes: G-40453!d, G-40454!d, G-40455!d; isosyntypes: BM-555236!d, BM-575701!d, PC-135889!d, PC-694693!d, PC-694691!d, NY-1163078!d).

= *Ptychomitrium brevifolium* (Müll.Hal.) Kindb., Enum. Bryin. Exot. 94 (1889), synonym *fide* Cao et al. (2001) sub *P. muellerii*

Basionym: *Brachysteleum brevifolium* Müll.Hal., Linnaea 42: 357 (1879).

Type: ‘Argentina Cordobensis, ad rupes in sylva prope “der Calera”, Majo 1871. — Ad marginem rivuli prope Malagueña, Calera de Dn. Martin Ferreyra, 24. Aug. 1871. — In regione Ascoclingae etc. Aprili 1871.’ (syntypes: NY-1163122!d, NY-1163123!d; isosyntypes: PC-694727!d, BM-575696!d).

= *Ptychomitrium commutatum* (Müll.Hal.) Paris, Index Bryol. Suppl. 289 (1900), synonym *fide* Cao et al. (2001) sub *P. muelleri*.

Basionym: *Brachysteleum commutatum* Müll.Hal., Hedwigia 37: 157 (1898). Synonym: *Glyphomitrium commutatum* (Müll.Hal.) Broth., Nat. Pflanzenfam. 1(3): 442 (1902).

Type: ‘Australia tropica, Queensland, Brisbane River: Domina Amalie Dietrich 1864; Toowoomba [= Toowoomba]: *Hartmann* in Hb. Melbourne 1881; Bunya Mountains, Majo 1885, *F. M. Bailey* in Hb. Brotheri; New South Wales, Unter Hunter River: *Miss Carter* in Hb. Melbourne 1882’ (syntypes ?B not seen and presumably lost, ?MEL not located, ?H-Br not seen).

= *Ptychomitrium eurybasis* Dixon, S. African J. Sci. 18: 315 (1922), synonym *fide* Cao et al. (2001) sub *P. muelleri*.

Type: Zimbabwe, ‘Matopos, alt. 5,000 feet (Sim, 8851); Zimbabwe, alt. 3,000 feet (Sim, 8808); on granite rocks, Macheke, alt. 5,000 feet (Eyles, 1994)’ (cotypes: BM-870505!d [Sim 8851], BM-870506!d, PC-129577!d [Sim 8808], [Sim 8808], BM-870507!d [Eyles 1994]; ; see note at the end of the Discussion below).

= *Ptychomitrium howeanum* (Hampe) A.Jaeger, Ber. Thätk. St. Gallischen Naturwiss. Ges. 1877–78: 419 (1880), synonym *fide* Brotherus (1925) sub *P. muelleri*

Basionym: *Brachysteleum howeanum* Hampe, Linnaea 38: 662 (1874).

Synonyms: *Glyphomitrium howeanum* (Hampe) Broth., Nat. Pflanzenfam. 1(3): 442 (1902).

Ptychomitrium howei Hampe ex Kindb., Enum. Bryin. Exot. 73 (1888), *nom. inval.* (Art. 61, *orth. var.*).

Type: Australia, ‘Lord Howe’s Island, ad rupes’ (isotypes: BM-575703!d, BM-575704!d; NY-1225876!d).

=*Ptychomitrium microblastum* (Müll.Hal.) Paris, Index Bryol. Suppl. 289 (1900), synonym *fide* Cao et al. (2001) sub *P. muelleri*.

Basionym: *Brachysteleum microblastum* Müll.Hal., Hedwigia 37: 158 (1898) Synonym: *Glyphomitrium microblastum* (Müll.Hal.) Broth., Nat. Pflanzenfam. 1(3): 442 (1902).

Type: 'Australia, New South Wales, Sydney, *Domina Kaysser* in Hb. Geheeb' (location unknown, not seen).

=*Ptychomitrium muelleri* (Mitt.) A.Jaeger, Ber. Thätk. St. Gallischen Naturwiss. Ges. 1872–73: 104 (1874) **syn. nov.**

Basionym: *Glyphomitrium muelleri* Mitt., J. Proc. Linn. Soc., Bot. 4: 74 (1859).

Synonym: *Brachysteleum muelleri* (Mitt.) Müll.Hal., Linnaea 35: 614 (1868).

Type: 'Australia, Victoria, Rocky Mountains, called the Glass-houses, Moreton Bay, and Brisbane River, Dr. Ferd. Mueller' (isotypes: NY-1163054!d, NY-1163055!d; BM-555228!d, BM-1006973!d).

=*Ptychomitrium neocaledonicum* (Broth. & Paris) Card., Rev. Bryol. 40: 44 (1913), synonym *fide* Cao et al. (2001) sub *P. muelleri*.

Basionym: *Glyphomitrium neocaledonicum* Broth. & Paris, Öfvers. Finska Vetensk.-Soc. Förh. 51A(17): 13 (1909).

Type: New Caledonia, 'Mont Dzumac (*A. Le Rat*).' (lectotype, *fide* Guo & Cao (1999): H-Br not seen; isolectotypes PC-129553!d, PC-129554!d, PC-694748!d).

=*Ptychomitrium uruguense* (Müll.Hal.) Kindb., Enum. Bryin. Exot. 94 (1889), synonym *fide* Cao et al. (2001) sub *P. muelleri*

Basionym: *Brachysteleum uruguense* Müll.Hal., Linnaea 43: 446 (1882).

Type (*fide* Cao et al. 2001): Uruguay, 'Argentina Uruguensis (Entre Rios), in regionibus borealibus. 1879'; *P. G. Lorentz s.n.* (holotype: B not seen, presumably destroyed; isotypes BM-575697!d, BM-575698!d, PC-694755!d).

Plants in dense cushions to about 20 mm tall, green to dark green above (commonly yellow-green or brownish yellow in herbarium specimens), dark brown to black below. Leaves strongly crisped when dry and upper lamina involute, spreading widely when moist, lingulate-subulate from an ovate base, mostly 3.0–4.5 mm × 0.4–0.5 mm, apex usually obtusely pointed and often cucullate; margins plane, entire; lamina bistratose throughout the subula, giving it a much darker appearance than the leaf base in transmitted light; margin often tristratose; costa strong, failing just below the apex; cells in mid-leaf shortly rectangular, about 7–13 × 6–7 µm, becoming smaller and roundly subquadrate to quadrate towards the leaf apex and leaf margin (to about 7.0 µm wide and long) and much longer and lacking chloroplasts towards the leaf base (19–56 µm × 7–14 µm). Perichaetial leaves similar to vegetative leaves but slightly smaller. Seta straight to flexuose, 2–6 mm long. Capsule erect, urn oblong-ovoid, to about 1.7 mm long, operculum almost flat, with a long beak about 1 mm long; peristome single, of 16 lanceolate to linear-lanceolate teeth split almost to the base; annulus present. Calyptra mitrate, split into lobes all around the base, covering 1/2 to 2/3 of the urn.

Illustrations: Figs 2, 4b, 5b. Also Guo and Cao (1999: Figs 24–43) as *P. microblastum*, Cao et al. (2001: Figs 1–30) as *P. muelleri*.

Habitat: Almost exclusively on calcareous or basaltic rock; sometimes also on bitumen; occasionally on siliceous rock close to mortar or concrete; rarely on thin soil over rock.

Distribution: Circumglobal in south-temperate to tropical regions, including South Africa, New Zealand, New Caledonia, Vanuatu and South America. This species appears to be a largely tropical to warm-temperate species that extends into cold-temperate regions.

Discussion: The description and illustration of *Ptychomitrium australe* by Sainsbury (1955b), who did not see the type, matches that of *P. acutifolium* in all aspects except the size of the calyptra, which he described as 'covering the capsule'. His illustration also shows a very large calyptra relative to the capsule, but whether the scale given is correct is difficult to judge as it was clearly added (in set type) afterwards, all other scales being written by hand. It is noteworthy that he described only the leaf margin as being bistratose in the upper half of the leaf; that is, the entire upper lamina is not bistratose as in true *P. australe* (Figs 2c,e; also Cao et al. 2005, figure 27, as *P. muelleri*).

Scott and Stone (1976) described *Ptychomitrium australe* more or less as Sainsbury did, although noting that the leaf is bistratose also across the leaf tip. They pointed out that Sainsbury had suggested that *P. acutifolium* was the same species, but made no judgement themselves. Catcheside (1980) accepted Sainsbury's view.

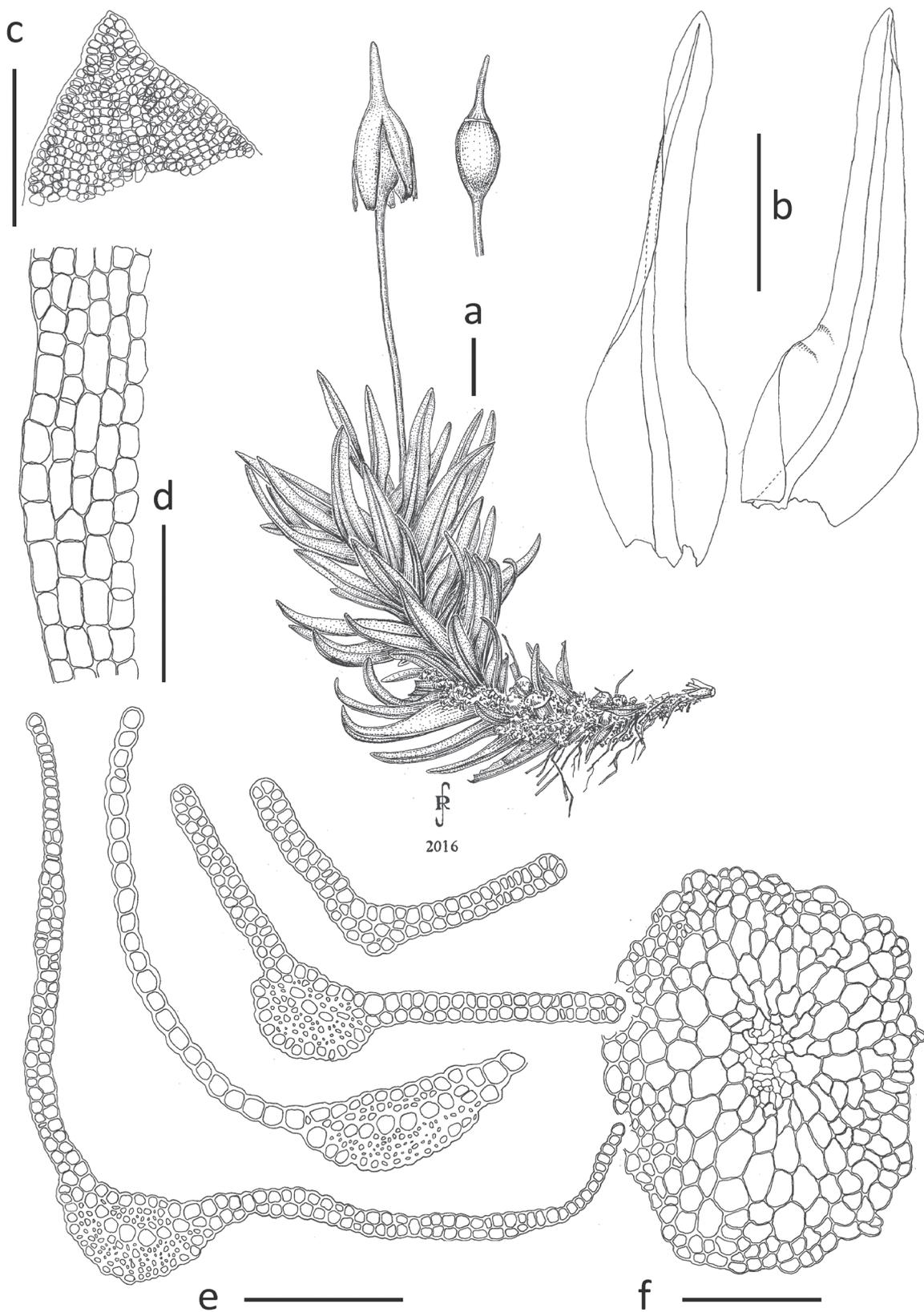


Fig. 2. *Ptychomitrium australe*: **a**, whole plant, moist; **b**, typical leaves; **c**, leaf apex; **d**, marginal cells near leaf base; **e**, transverse sections of leaf; **f**, transverse section of stem. Drawn by R.D. Seppelt from *Stone 22709* (HO). Scale bars: **a**, **b** = 1 mm, **c**–**f** = 100 µm.

Cao et al. (2005) demonstrated convincingly, by their examination of the types and other specimens, that *P. australe* and *P. acutifolium* are different species. Unfortunately they did not mention the most obvious difference, which is that the leaf lamina in *P. australe* is bistratose throughout the upper half of the leaf, whereas in *P. acutifolium* the bistratose region comprises only the margins and apex and (in most plants) scattered linear rows or patches of cells in the upper half of the leaf (compare Figs 2 and 4).

Cao et al. (2005) also did not compare either species with the widespread *P. muelleri*, which Cao et al. (2001) had described and illustrated in detail. I have examined numerous species cited by Cao et al. (2001) and Cao et al. (2005), and it is evident that these two species are the same. For example, Cao et al. (2005) identified six collections as *P. australe* (Streimann 15422, 27908, 50086, 52769 and Telford 5218), that Cao et al. (2001) had previously identified as *P. muelleri*. *Ptychomitrium muelleri* (being the later name) must become a synonym of *P. australe*. The protologue of *P. muelleri* contains a geographic confusion, since the localities mentioned (Glass-houses = Glasshouse Mountains, Moreton Bay, and Brisbane River) are in Queensland, not Victoria. It is noteworthy that NY-1163054 is annotated 'On the Rocky Mountains called the Glasshouses Moreton Bay Dr. F. Mueller', whereas NY-1153055 is annotated 'Brisbane River Victoria Dr. F. Mueller'.

My suggestion is that the collection from 'Brisbane River, Victoria' was actually from the Brisbane Ranges in Victoria, near Melbourne, and the coincidence of 'Brisbane' (the city where the Brisbane River runs into Moreton Bay) might have caused a mistaken transcription of the handwritten locality, especially if abbreviated to 'Brisbane Ra'. Whatever the case, the two specimens appear to be from different gatherings. If this is shown to be the case, a lectotype would need to be designated.

The report of *P. australe* from Tasmania by Scott and Stone (1976) was based on MUCV-1092 from Twisted Lake, Cradle Mountain National Park, according to an annotation on that specimen. However, that plant, which was growing as an epiphyte on *Nothofagus gunnii*, is *Ulota lutea* (Hook.f. & Wilson) Mitt.

Most reports of *P. australe* from New Zealand are likely to be *P. acutifolium*, judging from the description of *P. australe* by Sainsbury (1955b) and the slightly different geographic distributions of these species. However, genuine *P. australe* does exist there, as demonstrated by a specimen in MELU (see representative specimens seen).

Ptychomitrium australe has been commonly confused with *Holomitrium perichaetiale* (Hook.) Brid. when sterile, because the two species are very similar in size and leaf shape. However, *H. perichaetiale* can be distinguished by its unistratose leaf lamina, and by the costa, which is usually excurrent in a small colourless apiculus. When fertile, *Holomitrium perichaetiale* is further distinguished by its long, sheathing perichaetial leaves. Furthermore, *H. perichaetiale* is commonly epiphytic (although it also grows on rock), whereas *P. australe* appears to be confined to rock or soil over rock.

Brown (1902) described *Grimmia turneri* from New Zealand, based on material he collected from Mount Torlesse, and *G. barrii* based on material he collected from around Weston, near Oamaru. Dixon (1926) synonymised *G. turneri* and *G. nigra* (Brown MS, in herb.) under *Ptychomitrium australe* and transferred *G. barrii* to *Ptychomitrium*. However, it is not clear whether he had the correct concept of *P. australe* when this was done, so I have not included *G. turneri* in the list of synonyms for *P. australe*. I am unable to comment on the identity of *P. barrii* as I have not seen any material of this species.

Guo & Cao (1999) stated that 'Dixon published *P. eurybasis* based on a collection by Sim from Zimbabwe in 1922'. This is not correct, as seen from the type citation given in the list of synonyms above. (This error was repeated by Cao et al. (2001), who also gave the incorrect page number for the protologue.) Until a lectotype is selected, all type material (all of which are ex herb. Dixon) must therefore be considered to be syntypes.

Additional specimens examined: AUSTRALIA: WESTERN AUSTRALIA: Bunker Bay, 21 Aug 1971, *Stone 6246* (MEL-2157217A). VICTORIA: Murrindal –Buchan road, East Gippsland, 6 Dec 1969, *Stone 1912* (MEL-2121098); Genoa Gorge, East Gippsland, 20 Mar 1970, *Stone 2701* (MEL-2129395B). NEW SOUTH WALES: tributary gully of Spirey Creek, Warrumbungle National Park, 12 May 1980, *Willis s.n.* (MEL-1032411A); 'Darrowby', 3.5 km west of Broke, Hunter Valley, 7 June 1985, *Palmer 46* (CANB-356953). AUSTRALIAN CAPITAL TERRITORY: Murrumbidgee River, 28 Apr 1974, *Streimann 1056* (CBG-54129); Cotter River Reserve, 21 Oct 1962, *Burbidge 7318* (CANB-566596). LORD HOWE ISLAND: north face of Mount Gower, 12 Nov 2009, *Meagher LH-348B* (MELU (herb. D. Meagher)); along trail to Malabar, 18 Aug 1981, *Weber B-76996* & *Colson* (CANB-793739). QUEENSLAND: south end of Bunya Mountains, 5 Sept 1981, *Stone 17765* (MEL-2243058A); Cania Gorge National Park, 7 Aug 1984, *Stone 22709* (MEL-2264652A). NEW ZEALAND: SOUTH ISLAND: near Porters Pass, 29 Nov 1965, *Scott s.n.* (MELU s.n. ex OTA).

Ptychomitrium mittenii A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1872–73: 102 (1874).

Synonyms: *Brachysteleum mittenii* (A.Jaeger) Hampe, *Frag. Suppl.* 110 (1881).

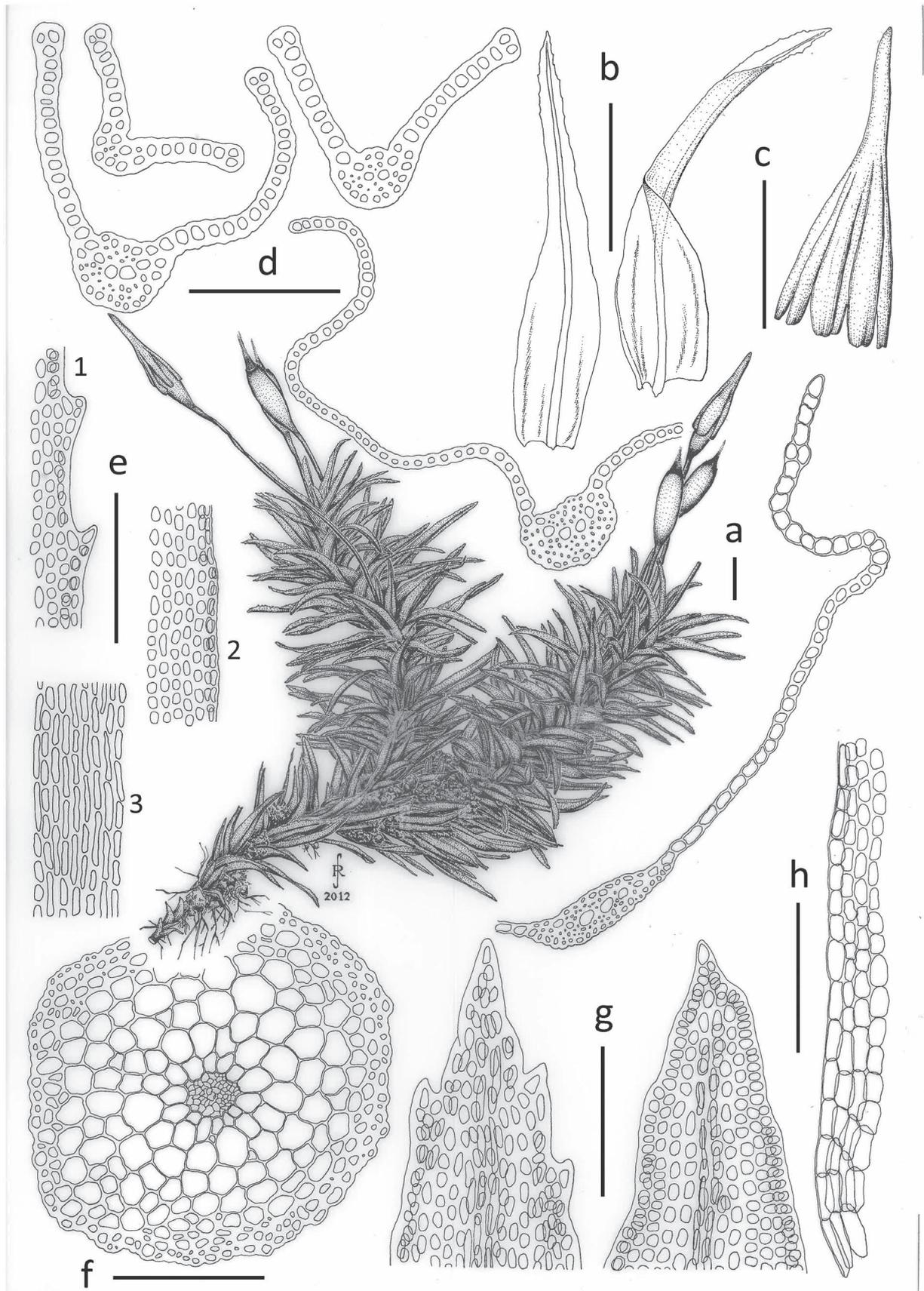


Fig. 3. *Ptychomitrium mittenii*: **a**, whole plant, moist; **b**, typical leaves; **c**, calyptra; **d**, transverse sections of leaf; **e**, cells in (1) upper leaf margin, (2) mid-leaf margin, (3) lower leaf; **f**, transverse section of stem; **g**, leaf apex (toothed and untoothed examples); **h**, marginal cells in leaf base. Drawn by R.D. Seppelt from *Seppelt 29172* (HO-566175). Scale bars: a–c = 1 mm, d–h = 100 μ m.

Glyphomitrium mittenii (A.Jaeger) Mitt., Trans. Proc. Roy. Soc. Victoria 19: 57 (1882).

Type: Australia, Tasmania, north side of the Cataract, Launceston, on rocks, date unknown, *Archer s.n.*, ? herb. Mitten in NY, not seen.

= *Ptychomitrium serratum* (Mitt.) Hook.f. & Wilson, Fl. Tasman. 181 (1859), synonym *fide* Jaeger (1874) *nom. illeg.* (Art. 53.1), later homonym of *Ptychomitrium serratum* Bruch & Schimp. (1837). Basionym: *Glyphomitrium serratum* Mitt., J. Proc. Linn. Soc., Bot. 4: 73 (1859).

Type: 'On rocks: north side of the Cataract, Launceston, *Archer*'

Plants in dense cushions to about 30 mm tall, in life green to olive above (becoming yellow-green to yellow-brown in herbarium specimens), reddish brown to black below; leaves moderately crisped when dry, spreading widely when moist. Leaves lingulate-subulate from an ovate base, mostly 2.2–3.2 mm × 0.6–0.8 mm, plicate, apex acute; margins usually weakly recurved in the lower half, coarsely serrate towards the apex (occasionally ± entire), bistratose to tristratose in the upper part of the leaf; lamina usually irregularly bistratose in longitudinal rows or patches in the upper leaf; costa strong, failing just below the apex; cells arranged in regular longitudinal rows, in mid-leaf quadrate to shortly rectangular, about 6–8 × 6–11 μm, thick-walled with a rounded lumen, becoming smaller and subquadrate to quadrate towards the apex, much longer and lacking chloroplasts towards the leaf base except at the margins (to about 60 μm long), those in the extreme leaf base usually porose.

Often polysetous. Perichaetial leaves similar to vegetative leaves but slightly smaller. Seta straight, 2.0–5.5 mm long. Capsule erect to slightly inclined; urn oblong-ovoid, 1.0–1.5 mm long; operculum to about 1.1 mm long, conical with a long beak; peristome single, of 16 finely and densely papillose teeth split almost to the base into pale to dark pink to orange filiform segments with paler tips; annulus present. Calyptra mitrate, split into lobes all around the base, covering 1/2 to 3/4 of the urn.

Illustrations: Figs 3, 4c, 5c. Also Wilson (in Hooker 1860, plate CLXXIII, figure 3) as *P. serratum*.

Habitat: Grows on rock in shaded situations; also occasionally on coarse-grained soil, and very rarely epiphytic.

Distribution: Tas, Vic, NSW, southern Qld; apparently endemic to south-eastern Australia.

Discussion: This species often grows with *P. acutifolium* or *Holomitrium perichaetiale*, or sometimes both, and can be easily overlooked when dry because the upper margins may be inrolled, hiding the marginal teeth. However, when wet the teeth are easily discernible under a hand lens. As in *P. acutifolium*, the upper leaf lamina in *P. mittenii* is usually bistratose in scattered longitudinal rows or patches. This character has not been reported previously.

Additional specimens examined: AUSTRALIA: TASMANIA: Mt Strzelecki, Flinders Island, 20 Oct 1996, *Scott s.n.* (MELU-2754); German Town, 5 km NNW of St Marys, 30 Nov 1988, *Curnow 2452* (CBG-8807819). VICTORIA: summit of Mount Oberon, Wilsons Promontory, 6 Apr 1994, *Meagher 0159* (MELU s.n.); Snowy River Gorge, Apr 1969, *Ashton s.n.* (MELU-7357B). NEW SOUTH WALES: Bains Gully, 3 km south of Majors Creek, 25 Apr 1983, *Streimann 27653* (CBG-8305729); Pipers Lookout, South East Forests National Park, 5 Sept 2012, *Karunajeewa s.n.* (MEL-2364217A). QUEENSLAND: Mt Maroon, 4 Oct 1974, *Streimann 372* (CBG-51236).

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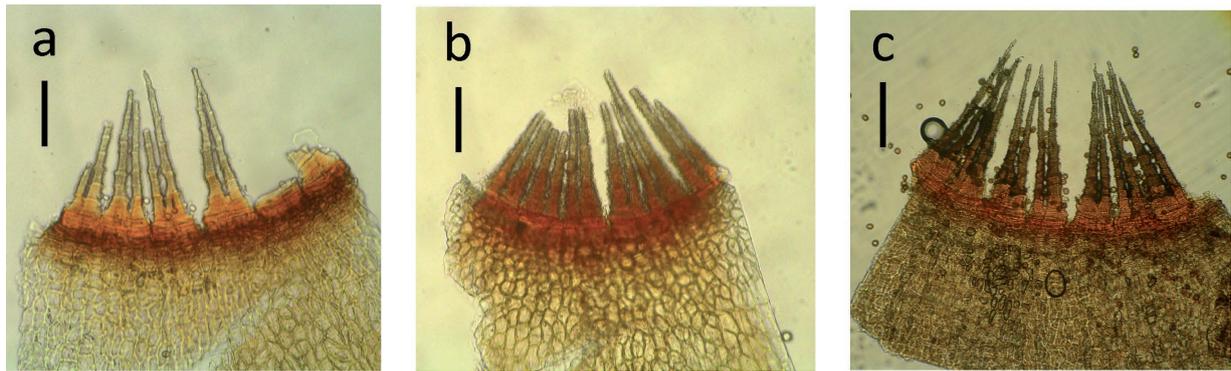


Fig. 4. Partial peristomes: **a**, *P. acutifolium* (Meagher LH-128); **b**, *P. australe* (Scott s.n., MELU-1741); **c**, *P. mittenii* (Scott s.n., MELU-2754). Scale bars: 100 μ m.



Fig. 5. **a**, *P. acutifolium* (Scott s.n., MUCV-1274, herbarium specimen); **b**, *P. australe* (Meagher LH-348B); **c**, *P. mittenii* (Meagher 0159, MELU, herbarium specimen). Scale bars: 5 mm.

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