

GEMMABRYUM

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Gemmabryum J.R.Spence & H.P.Ramsay, *Phytologia* 87: 63 (2005); the name refers to the importance of the three different types of asexual gemmae in the genus.

Type: *G. pachytecum* (Müll.Hal.) J.R.Spence & H.P.Ramsay

Dioicous or, rarely, synoicous. Plants perennial, small to robust, in ±dense tufts or turfs, or sometimes scattered among other mosses. Stems erect, mostly branched by perichaetial innovation, usually not markedly radiculose. Rhizoids usually pale or red to red-brown, rarely purple, papillose. Leaves usually crowded and imbricate on elongate stems, sometimes reddish, not especially enlarged above, usually not much altered when moist or dry, plane to weakly concave, mostly ovate, ovate-lanceolate or lanceolate, sometimes obtuse or rounded; margin smooth to serrulate, usually without a border; costa single, well developed, percurrent to long-excurrent as a stout point, prominent at back, with 1 layer of guide cells present above a single dorsal stereid band; upper laminal cells linear-vermicular to hexagonal, usually rather narrow and often thick-walled; lower cells quadrate to short-rectangular (1–2: 1), often broader than upper cells and usually with an abrupt transition; occasionally lower cells similar to upper cells, then all cells very thick-walled and often at an oblique angle to the costa. Gemmae commonly produced as rhizoidal tubers, stem tubers or axillary leaf bulbils.

Perigonial and perichaetial leaves not strongly differentiated from vegetative leaves. Setae flexuose, curved or hooked at tip, reddish. Capsules nodding, pendent or erect, smooth, clavate, pyriform or ovoid to subglobose, often with a thick corrugated neck; stomata superficial, numerous in neck; annulus large and revoluble; operculum hemispherical or convex, conical, umbonate or minutely apiculate. Peristome double; exostome teeth acuminate, fused at the extreme base, yellow to brown, hyaline at tip, generally densely papillose on outer surface, usually bordered; endostome extremely variable, pale, finely papillose; basal membrane well developed; segments keeled and perforate to poorly developed; cilia 0–4, nodulose or appendiculate, rudimentary or lacking in species with erect capsules. Spores small to medium, 8–20 (–25) µm diam. $n = 10, 11, 20, 21, 30$ in Australian species (see below).

A genus of c. 150 species; 25 species in Australia. Occurs in alpine, temperate to tropical regions, most common on soil (sometimes over rock), often in disturbed areas or on wet rocks near cliffs; rare in the polar regions.

Species of *Gemmabryum* have *Bryum*-like laminal areolation, but the genus is distinguished from the closely allied *Bryum* by a number of morphological features. Stems tend to be bud-like or, if elongate, they are not julaceous, and the costa is typically excurrent. Most species of *Bryum* are julaceous and the leaves have a weak costa not reaching the apex, except for the atypical *B. lanatum*. Three distinct types of gemmae are commonly produced in *Gemmabryum*: rhizoidal tubers, stem tubers and axillary bulbils; a few species have been reported with uniseriate, filiform rhizoidal gemmae. Some species do not produce gemmae but, based on other attributes, they are clearly referable to *Gemmabryum*; moreover, a few of these species are known to produce gemmae in culture. In cross-section the costa has a well-developed layer of guide cells, unlike *Bryum*. Four traditional sections of *Bryum* and *Brachymenium* belong to *Gemmabryum*: *Bryum* sections *Alpiniformia*, *Apalodictyon* and *Doliolidium* and *Brachymenium* sect. *Dicranobryum*. The sectional names above are not used in the current treatment because numerous nomenclatural problems exist (see Isoviita, *in*

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Ochi, 1992). Chromosome numbers are based on $x=10$ with many polyploids and aneuploids (see R.Fritsch, *Bryophyt. Biblioth.* 40: 1–326, 1991).

References

- Catcheside, D.G. (1980), *Mosses of South Australia* 248–278.
- Ochi, H. (1970), A revision of the subfamily Bryoideae in Australia, Tasmania, New Zealand and adjacent islands, *J. Fac. Educ. Tottori Univ. Nat. Sci.* 21: 7–67.
- Ochi, H. (1992), A revised infrageneric classification of the genus *Bryum* and related genera (Bryaceae, Musci), *Bryobrothera* 1: 231–244.
- Spence, J.R. & Ramsay, H.P. (1996), New and interesting species of Bryaceae from Australia, *J. Adelaide Bot. Gard.* 17: 107–118.
- Spence, J.R. & Ramsay, H.P. (2005), New genera and combinations in the Bryaceae (Bryales, Musci) for Australia, *Phytologia* 87: 61–71.

- 1 Leaves rather thick, somewhat fleshy; laminal areolation dense; cells thick-walled; upper laminal cells hexagonal, 2–4: 1, those in upper third of the leaf angled away from costa at 20–45°; lower cells similar in size, not oblique, rectangular, transition from upper to lower cells rather gradual; asexual gemmae usually lacking (rhizoidal tubers rarely present)2
- 1: Leaves thin, not fleshy; laminal areolation not noticeably dense; laminal cells thin- to somewhat thick-walled; upper cells linear-vermicular to hexagonal, 3–8: 1, not angled away from costa; lower cells typically abruptly shorter and broader than cells above, quadrate to short-rectangular, 1–2: 1 (at least in the alar region); asexual gemmae commonly present, of various kinds4
- 2 Plants large; stems usually more than 20 mm long; costa percurrent; leaf apex obtuse to broadly acute (1) **17. G. laevigatum**
- 2: Plants smaller; stems usually less than 20 mm long; costa excurrent as a short stout point; leaf apex acute3
- 3 Leaves unbordered, strongly concave; lower laminal cells quadrate; stems often consisting of one or more imbricate comal tufts of leaves; on damp to dry soil, sand and rock; not encrusted with carbonates (2:) **10. G. crassum**
- 3: Leaves bordered at least in lower half, only weakly concave; lower laminal cells mixed quadrate and short-rectangular; stems with equidistant leaves, not in comal tufts; on wet rock or soil over rock; often encrusted with carbonates **7. G. clavatum**
- 4 Gemmae present as rhizoidal tubers; leaf axil bulbils rare (1:)5
- 4: Gemmae present as leaf axil bulbils or stem tubers, sometimes lacking; rhizoidal tubers lacking 16
- 5 Tubers sparse, in tomentum on stem or clustered at stem base; leaves strongly imbricate when moist and dry, triangular to ovate, often reddish and glossy; upper and middle laminal cells somewhat incrassate; on damp or wet rock or on soil over rock near water (4)6
- 5: Tubers common to abundant, typically at stem base or on rhizoids in the substratum; leaves slightly twisted or contorted at tips when dry, erect-spreading when moist, ovate to ovate-lanceolate, rarely red near leaf base, glossy or not; upper and middle laminal cells mostly thin-walled; on damp or dry soil or around temporary pools, often in disturbed sites7
- 6 Plants golden-brown, glossy, usually lacking red tints; costa long-excurrent in a stiff hairpoint; leaves mostly triangular (5)..... **3. G. australe**
- 6: Plants red or red-green, dull or glossy; costa short-excurrent as a stout point; leaves ovate **5. G. cheelii**
- 7 Tubers small, mostly < 100 µm long, although a few larger tubers sometimes present (5:).....8
- 7: Tubers larger, mostly > 120 µm long; smaller tubers sometimes present..... 10
- 8 Median laminal cells elongate, 6: 1 or more; some cells > 100 µm long; alar cells differentiated, quadrate; justacostal cells elongate; bulbils sometimes present in leaf axils (7)..... **2. G. apiculatum**
- 8: Median laminal cells shorter, mostly 3–6: 1 and < 80 µm long; cells across leaf base differentiated, quadrate to short-rectangular, 1–2: 1; bulbils lacking in leaf axils9

- 9 Synoicous or dioicous; tubers brown, red-brown or golden-brown, pyriform, mostly 2 or 3 cells across; cells not protuberant (8:)
..... **22. G. sauteri**
- 9: Dioicous; tubers red, globose, mostly > 3 cells across; cells protuberant **16. G. klingraeffii**
- 10 Capsules erect; peristome reduced; cilia lacking; bulbils sometimes present in leaf axils (7:)
..... 11
- 10: Capsules inclined to nodding; peristome well developed; bulbils lacking in leaf axils 12
- 11 Synoicous; leaves ovate-lanceolate, slightly twisted when dry, green; costa excurrent into a long hairpoint (10)
..... **15. G. indicum**
- 11: Dioicous; leaves ovate, imbricate or folded along costa but not twisted when dry, golden-green; costa percurrent to excurrent in a short stout point **13. G. exile**
- 12 Leaves bordered; median laminal cells 10–16 µm wide; plants often with red tints; tubers red, mostly clustered at leaf bases (11:)
..... **21. G. rubens**
- 12: Leaves not bordered; median laminal cells 10–14 (–16) µm; plants mostly green or brown-green or golden; tubers on rhizoids in substratum or rarely in tomentum on stem 13
- 13 Costa strong, long-excurrent in a golden hairpoint; basal laminal cells mostly quadrate, at least in alar region, mixed with a few short-rectangular cells; tubers red, often on stem, some > 500 µm long, with cells distinctly protuberant at ×30–40 magnification (12:)
..... **6. G. chryseuron**
- 13: Costa short- or long-excurrent; basal laminal cells mostly either quadrate or short-rectangular; tubers < 300 µm long, yellow, brown or red; cells not protuberant 14
- 14 Tubers golden-yellow throughout, mostly < 200 µm long; internal cell walls red (13:)
..... **25. G. tenuisetum**
- 14: Tubers red to red-brown, of various sizes; cell walls concolorous..... 15
- 15 Costa long-excurrent in a long hairpoint; tubers brown to red, mostly < 200 µm long; basal laminal cells mostly quadrate; calcicolous (14:)
..... **20. G. radiculosum**
- 15: Costa weaker, short-excurrent in a short hairpoint; tubers red, many > 200 µm long; basal laminal cells mostly short-rectangular; calcifugous..... **23. G. subapiculatum**
- 16 Bulbils present in axils of upper leaves, mostly on sterile shoots (4:)
..... 17
- 16: Bulbils lacking 25
- 17 Median laminal cells elongate, 6: 1 or more, some cells > 100 µm long; alar cells differentiated, quadrate; justacostal cells elongate (16)
..... **2. G. apiculatum**
- 17: Median laminal cells shorter, mostly 3–6: 1, mostly < 80 µm long; cells across leaf base differentiated, quadrate to short-rectangular, 1–2: 1 18
- 18 Synoicous; capsules erect, with a reduced peristome; neck not inflated; leaves somewhat twisted when dry (17:)
..... **15. G. indicum**
- 18: Dioicous; capsules inclined to nodding, rarely erect; neck often distinctly inflated; leaves mostly imbricate when dry..... 19
- 19 Stems elongate (> 10 mm); leaves ovate, cucullate near tip of stem, strongly concave; costa percurrent or not reaching apex; bulbils present, with distinct leafy tips (18:)
..... **24. G. sullivanii**
- 19: Stems mostly short (< 10 mm); leaf shapes various, not cucullate, plane or weakly concave; costa generally short- to long-excurrent into a distinct hairpoint; bulbils various..... 20
- 20 Leaves ovate, widest in the middle (19:)
..... 21
- 20: Leaves ovate-lanceolate, lanceolate or triangular, widest below the middle 22
- 21 Costa long-excurrent into an often hyaline spinulose hairpoint; plants generally with a reddish tint; capsule neck corrugate, abruptly contracted to seta; stem tubers sometimes present (20)
..... **12. G. eremaum**
- 21: Costa percurrent to short-excurrent, golden-brown; hairpoint smooth; plants lacking red tints; capsule neck smooth to somewhat corrugate, tapered to seta; stem tubers lacking **13. G. exile**
- 22 Bulbils with distinct leafy primordia, generally 1 per axil; capsule neck thick and corrugate, or smooth to wrinkled and tapered to the seta (20:)
..... 23
- 22: Bulbils lacking leafy primordia, often many per axil; capsule neck thick, corrugate, abruptly contracted to seta..... 24

- 23 Capsule neck smooth or wrinkled, tapered; leaves ovate-lanceolate; leaf margin plane or recurved to midleaf (22)..... **11. G. dichotomum**
- 23: Capsule neck thick and corrugate and abruptly contracted to seta; leaves lanceolate or triangular; leaf margin strongly recurved to near apex..... **9. G. coronatum**
- 24 Hairpoint hyaline; bulbils with small peg-like primordia at tip; apex often irregularly grooved between tips; stem tubers often present (22:)..... **12. G. eremaicum**
- 24: Hairpoint usually golden-brown or red; bulbils lacking primordia; apex smooth; stem tubers absent ...
..... **18. G. pachythemum**
- 25 Median laminal cells elongate, 6: 1 or more, some > 100 µm; alar cells differentiated, quadrate; justacostal cells elongate; plants glossy yellow or silver-green, in thin mats; stems evenly foliate (16:) 26
- 25: Median laminal cells shorter, mostly 3–6: 1, mostly < 80 µm; cells across leaf base differentiated, quadrate to short-rectangular, 1–2: 1; plants dull or glossy green or red-green; stems mostly gemmiform to evenly foliate 27
- 26 Plants yellow-green; capsules inclined to nodding, tapering to a somewhat narrowed mouth; peristome well developed; cilia present; basal membrane high (25) **14. G. inaequale**
- 26: Plants green to silver-green; older leaves losing chlorophyll; capsules erect or suberect, widest at mouth; peristome reduced; cilia short or absent; basal membrane low **1. G. acuminatum**
- 27 Leaves strongly imbricate, not twisted or contorted when dry (although sometimes folded); margin plane or recurved near base; costa percurrent to excurrent as a short stout point (25:) 28
- 27: Leaves loosely imbricate, somewhat contorted or twisted when dry; margin recurved to mid-leaf or beyond; costa strong, long-excurrent as a long smooth to spinulose hairpoint..... 30
- 28 Leaves ovate-lanceolate to triangular; capsules common, tapered to a narrow mouth; operculum distinctly rostrate (27)..... **19. G. preissianum**
- 28: Leaves ovate; capsules rare, with a wide mouth; operculum short-conical..... 29
- 29 Leaves often smoothly folded along costa; capsules erect; peristome reduced; cilia short or absent; basal membrane low; bulbils sometimes present in leaf axils (28:) **13. G. exile**
- 29: Leaves imbricate, not folded; capsules nodding; peristome well developed; cilia present; basal membrane high; bulbils lacking in leaf axils..... **4. G. austrosabulosum**
- 30 Leaf tips hyaline; leaves bordered at least above; hairpoint hyaline at least at tip, spinulose; stem tubers often present; other gemmae lacking (27:)..... **8. G. coarctatum**
- 30: Leaf tips coloured; leaves unbordered; hairpoint coloured, mostly smooth; stem tubers absent; rhizoidal tubers and leaf axil bulbils sometimes present **15. G. indicum**

1. Gemmabryum acuminatum (Harv. ex Hook.) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 65 (2005)

Brachymenium acuminatum Harv. ex Hook., *Icon. Pl.* 1: 19 (1836). T: Nepal, *Wallich s.n.*; holo: BM.

Bryum multicaule Taylor, *London J. Bot.* 5: 53 (1846). T: Swan R., W.A., *J. Drummond* 27; holo: BM.

Brachymenium mielichhoferioides Müll.Hal., *Nuovo Giorn. Bot. Ital.* 4: 216 (1872). T: Africa; iso: H.

Illustrations: H.C.Gangulee, *Mosses of Eastern India and Adjacent Regions* 4: 951, fig. 457 (1974), as *Brachymenium acuminatum*; H.Ochi, *J. Fac. Educ. Tottori Univ. Nat. Sci.* 21: 11, fig. 2A–G (type of *Bryum multicaule*); 12, fig. 3 (isotype of *Brachymenium mielichhoferioides*) (1970); A.Eddy, *Handb. Malesian Mosses* 3: 170, fig. 446E–J (1996), as *Brachymenium acuminatum*.

Dioicous. Plants in dense mats, less than 5 mm tall, green, yellowish green or silvery, distinctly glossy, with tightly appressed leaves, matted with red tomentum below. Rhizoids red, papillose. Leaves lanceolate to ovate, acute to acuminate, concave, crowded, imbricate, to 2 mm long, erect with spreading apices; margin ±entire, plane, slightly revolute near base; costa excurrent but not forming a long hairpoint or arista, yellowish; upper laminal cells long and narrow, to 140 × 8–11 µm (6–8: 1), thick-walled, extending to leaf base along costa; cells in alar region quadrate, thin-walled, distinctly different to justacostal cells. Gemmae lacking.

Fertile stems short. Setae c. 40 mm long, pale brown to red-brown. Capsules erect to inclined, large in comparison to gametophyte, 2–3 mm long, broadly fusiform, widest at the

mouth; operculum conical, sometimes umbonate. Peristome reduced; exostome teeth 16, orange, faintly papillose, externally trabeculate; endostome reduced, essentially a high basal membrane and short blunt or rudimentary segments; cilia absent or as blunt traces only. Spores 10–16 µm diam. Chromosome number not known.

Occurs in north-eastern Qld and south-western W.A.; occurs on soil in open *Eucalyptus* woodland. A pantropical and highly variable species.

Qld: Herberton–Petford road, *H.Streimann 29935* (CANB); near Blencoe Falls, Kirrama area, *J.R.Spence 5136* (NSW).

Gemmabryum acuminatum is very similar to *G. inaequale*, but it can be distinguished by the reduced peristome, capsules that are broadest at the mouth and shoots that often become silvery with age due to loss of chlorophyll in their upper parts. In *G. inaequale* the peristome is not reduced, the capsule tapers towards the mouth, and the shoots tend to be yellow-green.

A report of *G. acuminatum* from Perth, W.A. by Ochi (1970) was based on a specimen of *G. inaequale*.

2. *Gemmabryum apiculatum* (Schwägr.) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 65 (2005)

Bryum apiculatum Schwägr., *Sp. Musc. Frond.*, Suppl. 1, 2: 102, t. 72 (1816). T: “In America meridionalis lectum, ni fallor, Richardus dedit”; holo: G.

Bryum nitens Hook., *Icon. Pl.* 1: 19 (1836). T: locality not known; BM?, *fide* H.Ochi, *J. Fac. Educ. Tottori Univ. Nat. Sci.* 21: 34–35 (1970).

Bryum plumosum Dozy & Molke., *Ann. Sci. Nat. Bot.*, sér. 3, 2: 301 (1844). T: locality not known; L, *fide* H.Ochi, *op. cit.* 36.

Bryum subpachypoma Hampe, *Linnaea* 36: 518 (1870). T: Rockingham’s Bay, Qld, *F.Mueller*; holo: BM; iso: BRI, H-BR, MEL, NSW.

Bryum baileyi Broth., *Oefvers. Förh. Finska Vetensk.-Soc.* 33: 100 (1891). T: Freshwater Creek, Trinity Bay, Qld, 1889, *F.M.Bailey 646*; holo: H-BR; iso: BRI, NSW.

Bryum pachypomatulum Broth., *Oefvers. Förh. Finska Vetensk.-Soc.* 42: 103 (1900). T: Richmond R., Ballina, N.S.W., *W.W.Watts 1962*; holo: H-BR; iso: BM, NSW.

Bryum micropachypomum Broth. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 136 (1906), *nom. nud.* (in synonym.). T: see *Bryum pachypomatulum*; based on the same specimen.

Bryum tenuicostatum Broth., in *W.W.Watts & T.Whitelegge, Proc. Linn. Soc. New South Wales* 30 (Suppl.): 143 (1906), *nom. nud.* (in synonym.). Based on: German Ck, N.S.W., July 1900, *W.W.Watts 4410* (NSW).

Bryum kurandae Broth. & Watts, *Proc. Linn. Soc. New South Wales* 43: 554 (1918). T: Kuranda, Qld, 1913, *W.W.Watts Q498*; holo: H-BR; iso: NSW.

Brachymenium watsii Broth., in *V.F.Brotherus & W.W.Watts, Proc. Linn. Soc. New South Wales* 43: 554 (1918). T: Millstream, Ravenshoe, Qld, 1913, *W.W.Watts 489, 527*; syn: H-BR; isosyn: NSW.

Illustrations: A.Eddy, *Handb. Malesian Mosses* 3: 125, fig. 413 (1996), as *Bryum apiculatum*; H.Streimann, *The Mosses of Norfolk Island* 20, fig. 6 (2002), as *Bryum apiculatum*.

Dioicous. Plants variable, mostly small. Stems to 20 mm long, glossy green or yellow-green, often red-tinged. Rhizoids red-brown. Leaves small, lanceolate to ovate, shallowly concave, to 1.5 mm long, widest at mid-leaf, slightly contorted when dry, somewhat imbricate; margin plane or slightly revolute near insertion, with a poorly defined border of 1 or 2 rows of elongate cells; costa strong, percurrent or occasionally very short-excurrent; upper laminal cells rhomboidal-rectangular, elongate, narrow and somewhat thin-walled, 80–100 µm long, 8–15 µm wide (6–8: 1); alar region differentiated, of fewer than 10 quadrate thin-walled often red-tinted cells; justacostal cells elongate. Gemmae usually present as red or brown pyriform to irregularly globose rhizoidal tubers, 40–100 µm; leaf axil bulbils sometimes present, with leafy primordia.

Perichaetia on short stems; leaves differentiated. Setae 25–30 mm long, reddish. Capsules cylindrical, 2–3 mm long, short-necked, widest at mouth; operculum conical. Exostome brown or yellow; endostome pale, well developed; basal membrane high; cilia 2 or 3, appendiculate. Spores 10–15 µm diam. *n* = 10 (extra-Australian), *fide* R.Fritsch, *Bryophyt. Biblioth.* 40: 124 (1991).

Occurs in subtropical and tropical regions of W.A., Qld and N.S.W.; also in Vic.; grows on damp soil over rock often along streams and rivers. A highly variable, mainly pantropical species, widespread in Asia and Polynesia; also in Norfolk Is. and New Zealand.

W.A.: King Creek Gorge, Kimberley, *A.C.Beaglehole* 53580 (MEL). Qld: Danbulla Rd, Tinaroo Dam, Atherton Tableland, *J.R.Spence* 5117 (NSW). N.S.W.: German Ck, Richmond R., *W.W.Watts* 4410 (NSW). Vic.: Cumberland Falls, 23 Mar. 1956, *C.B.Kay* (MEL).

This species is characterised by the unusual laminal areolation, small, pyriform tubers and a weak costa. It is closely related to *G. inaequale* and *G. acuminatum*, both of which can be distinguished by the absence of gemmae.

3. *Gemmabryum australe* (Hampe) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 65 (2005)

Bryum australe Hampe, *Icon. Musc.* t. 26 (1844). T: Swan R., W.A., *L.Preiss s.n.*; lecto: BM, *vide* H.Ochi, *J. Fac. Educ. Tottori Univ. Nat. Sci.* 21: 38 (1970); isolecto: MEL.

Bryum australe Hampe var. *minus* Hampe ex Sond., *Linnaea* 25: 714 (1853), *nom. nud.*

Bryum appressifolium Broth., *Oefvers. Förh. Finska Vetensk.-Soc.* 49: 175 (1898). T: New Zealand, *Bell s.n.*; syn: H-BR.

Illustrations: H.Ochi, *J. Fac. Educ. Tottori Univ. Nat. Sci.* 21: 39, fig. 21 (1970), as *B. appressifolium*; A.Eddy, *Handb. Malesian Mosses* 3: 133, fig. 419 (1996), as *B. australe*.

Dioicous. Plants in low golden or brown-green tufts. Stems to c. 15 mm tall. Rhizoids red-brown to brown. Leaves dense, suberect, rigid, triangular, more than 2 mm long and 0.8 mm wide, long-acuminate from a broad base, slightly plicate, rugose; margin strongly revolute from base to apex; marginal cells not strongly differentiated; costa stout, reddish, c. 100 μ m wide at insertion, excurrent in a stiff hairpoint; upper laminal cells rhomboidal, small and incrassate, 30–40 \times 10 μ m (3–4: 1), parallel to costa; basal cells thin-walled, quadrate, brownish across insertion. Gemmae as rhizoidal tubers, large, red, in leaf axils or clustered around stem base, mostly > 125 μ m long.

Perichaetial leaves similar to but slightly smaller than vegetative leaves. Setae 25–30 mm long, reddish. Capsules horizontal to pendulous, c. 3 mm long, to 1.5 mm wide, dark red-brown to purplish; urn short, wide-mouthed; neck tapering to seta, as long as urn; operculum high-domed, smooth. Peristome well developed; exostome teeth red, triangular, closely transversely barred internally, acute; endostome segments fully developed; basal membrane high, yellow; cilia 2 or 3, conspicuous, appendiculate. Spores 7–10 μ m diam. Chromosome number not known.

Rare in W.A., Vic. and Tas.; grows in silty soil or soil over rock in open sites, e.g. river flats. Also in South America, Malesia (alpine western New Guinea) and New Zealand.

W.A.: Rehabilitation Centre, W of Karnet, *D.H.Norris* 25365 (PERTH). Vic.: Eastern Victoria, *G.K.Thomson* (MEL). Tas.: Mt Wellington, *R.A.Bastow* 590 (MEL).

This species is characterised by the following suite of characters: stiffly erect, closely imbricate, setaceous leaves; incrassate upper cells; slightly plicate-rugose lamina; costa excurrent in a long hairpoint; leaf margins strongly recurved and lacking a border; and small, turgid, purple capsules with a large operculum.

4. *Gemmabryum austrosabulosum* (Catches. ex J.R.Spence & H.P.Ramsay) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 65 (2005)

Bryum sabulosum Catches. ex J.R.Spence & H.P.Ramsay, *J. Adelaide Bot. Gard.* 17: 114 (1996), *nom. illeg.* (later homonym). T: Porongorups, W.A., Oct. 1867, *F.Mueller*; holo: MEL.

Illustrations: D.G.Catcheside, *Mosses of South Australia* 268, fig. 157 (1980), as *Bryum* sp.; J.R.Spence & H.P.Ramsay, *op. cit.* 115, fig. 4 (1996), as *Bryum sabulosum*.

Dioicous. Plants minute, 4–5 mm tall, brown or golden-green, often solitary among other mosses. Rhizoids brown. Leaves broadly ovate, tightly imbricate, 0.5–1.2 mm long, golden-brown, concave, acute, not cucullate; margin revolute almost to apex, entire, not bordered; costa short-excurrent, golden-brown; upper laminal cells hexagonal, 30–40 \times 8–12 μ m (3–4: 1), thick-walled; basal cells quadrate. Gemmae absent.

Perichaetia on short basal shoots; perichaetial leaves somewhat larger than vegetative leaves. Setae long-exserted, 10–15 mm long, red, smooth. Capsules pendulous, small, 1.0–1.5 mm long, ovate, with a thick apophysis; neck smooth or somewhat corrugate when dry, abruptly contracting to the seta; operculum dome-shaped, short-apiculate. Peristome well developed; exostome teeth lanceolate, yellow-brown, smooth to papillose below; endostome segments c. 50–67% the length of the exostome, broadly perforated, with a high basal membrane; cilia 2, nodose. Spores 8–15 µm. Chromosome number not known.

Endemic to W.A., S.A. and Vic. In W.A. it occurs most commonly on dry rock outcrops or in dry soil pockets on exposed rocks; elsewhere it is found in a range of habitats including sand dunes.

W.A.: Yanchep Park, *G.G.Smith 285* (MEL); Petrunder Rocks, *J.R.Spence 4152* (NSW). S.A.: Eyre Hwy, 18 km NW of Kyancutta, *A.C.Beauglehole 14960* (MEL). Vic.: near Nigretta Falls, Wannon R., near Hamilton, *D.G.Catcheside 77.148* (AD); Leigh Creek Gorge, 29 Oct. 1978, *I.G.Stone* (MEL).

This moss has probably been overlooked in the past because of its small size and a tendency to grow as scattered individuals in turfs of other species. Its most distinctive features are the golden-brown, tightly imbricate leaves and the small ovate capsule with a thick, almost smooth apophysis that is somewhat corrugated when dry. When sterile, *G. austrosabulosum* can only be separated from *G. exile* by the latter's production of bulbils and rhizoidal tubers, and its somewhat folded leaves when dry.

5. *Gemmabryum cheelii* (Broth.) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 65 (2005)

Bryum cheelii Broth., *Proc. Linn. Soc. New South Wales* 41: 591 (1916). T: Shellharbour, N.S.W., 1 Oct. 1900, *E.Cheel 407*; holo: H-BR; iso: MEL, NSW.

[*Bryum muehlenbeckii* auct. non Bruch & Schimp.: H.Streimann & N.Klazenga, *Cat. Austral. Mosses* 34 (2002)]

Illustration: H.Ochi, *J. Fac. Educ. Tottori Univ. Nat. Sci.* 21: 40, fig. 22 (1970), as *Bryum cheelii*.

Dioicous. Plants medium-sized, red or with red tints, glossy, in tufts. Stems 10–25 mm tall. Rhizoids red to red-brown. Leaves medium or large, stiffly rigid and densely imbricate, ovate to oblong-lanceolate, 2.0–3.5 mm long, concave-carinate; apex acute, mucronate; margin recurved, serrulate at apex, unbordered; costa distinctly short-excurrent as a stout point; upper and middle laminal cells hexagonal-rhomboidal, 30–60 × 15–20 µm (3–4: 1), parallel to costa, incrassate; basal cells abruptly quadrate. Gemmae as rhizoidal tubers, rare, 100–400 µm wide, pale yellow-brown; cells not protuberant.

Setae c. 20 mm long, red. Capsules pendulous, red to red-brown, pyriform, 3–4 mm long; operculum conical, papillose. Peristome well-developed; exostome teeth linear-lanceolate, subulate-acuminate, red-brown; apex hyaline, densely lamellose; endostome segments yellow, papillose, lanceolate, fenestrate; basal membrane high; cilia 2 or 3, well developed, appendiculate. Spores 8–12 µm diam. Chromosome number not known.

Endemic to W.A., S.A., N.S.W., Vic. and Tas.; grows on rock, often near streams.

W.A.: Mt Frankland, Walpole-Nornalup Natl Park, *J.R.Spence 4221* (NSW). S.A.: Malinong, near Coomandook, *L.D.Williams 218* (AD). N.S.W.: Wombeyan Caves, *H.Streimann 1615* (CANB). Vic.: Mt Pilot, near Beechworth, *D.G.Catcheside 69.250* (AD). Tas.: 11.2 km E of Launceston, *D.H.Norris 31706* (ALTA).

Gemmabryum cheelii appears to be related to the Northern Hemisphere *Bryum muehlenbeckii* Bruch & Schimp., but differs in its excurrent costa and much broader laminal cells. It is characterised as follows: glossy red or reddish colour that is particularly obvious in the apical leaves; plants with medium-sized, stiffly rigid, densely imbricate, unbordered ovate leaves with the upper laminal cells parallel to the costa; acute leaf apex with a short, stout point; rhizoidal gemmae rarely produced.

6. *Gemmabryum chrysoneuron* (Müll.Hal.) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 66 (2005)

Bryum chrysoneuron Müll.Hal., *Bot. Zeitung (Berlin)* 9: 549 (1851). T: Swan R., W.A., *J.Drummond s.n.*; holo: BM.

Bryum duriusculum Hook.f. & Wilson, in J.D.Hooker, *Fl. Nov.-Zel.* 2: 84 ('1855') [1854]. T: New Zealand, *W.Wilson* 357, 358, 359; syn: BM.

Bryum suberythrocarpum Müll.Hal., *Bot. Zeitung (Berlin)* 14: 417 (1856). T: Porongorups, W.A., *F.Mueller*; holo: BM.

Bryum leptopelma Müll.Hal., *Hedwigia* 37: 88 (1898). T: Flat Rock Ck, North Shore, [Sydney], N.S.W., Aug. 1884, *T.Whitelegge* 149; holo: MEL; iso: H-BR, NSW.

Bryum lonchoneuron Müll.Hal., *Hedwigia* 37: 91 (1898). T: Richmond R., N.S.W., 1881, *Captain Stackhouse*; holo: MEL *n.v.*

Bryum microthecium Müll.Hal., *Hedwigia* 37: 95 (1898). T: Balls Head Bay, Sydney, N.S.W., Aug. 1884, *T.Whitelegge s.n.*; holo: MEL; iso: H-BR, NSW.

Bryum watsii Broth., *Oefvers Förh. Finska Vetensk.-Soc.* 42: 101 (1900). T: Pearce's Ck, Richmond R., N.S.W., *W.W.Watts* 1096, 1107; syn: H-BR (*Watts* 1096); isosyn: NSW (*Watts* 1096); *Watts* 1107 not seen. [originally published as *B. microthecium*, *nom. illeg.* (later homonym), republished as *B. watsii*].

Bryum subpilosum Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 143 (1906), *nom. nud.* (in synonym). Based on: Sealers Cove, Vic., *F.Mueller* (MEL).

Illustrations: H.Ochi, *J. Fac. Educ. Tottori Univ. Nat. Sci.* 21: 25, fig. 10N–R (isotype of *Bryum leptopelma*); 26, fig. 11D–K (isotype of *B. microthecium*); fig. 11L–R (syntype of *B. watsii*) (1970); D.G.Catcheside, *Mosses of South Australia* 274, fig. 162 (1980), as *Bryum chrysoneuron*.

Dioicous. Plants in loose or dense tufts, yellowish green to yellowish brown, often tinged red and glossy. Stems slender, 5–15 mm tall, with densely leafy innovations. Rhizoids red to red-brown. Leaves ovate-lanceolate to lanceolate, sometimes narrow, somewhat concave, 1.0–1.5 mm long, erect or suberect whether wet or dry; apex acute to acuminate; margin plane or revolute to mid-leaf, without a border, smooth to finely serrulate above; costa strong, long-excurrent, golden-yellow; laminal cells rhomboidal, mostly 40–60 × 10–15 µm wide (4–6: 1), rather incrassate, irregular in shape and often very long near margin; cells in lower quarter of leaf short-rectangular across leaf base but quadrate at margin. Gemmae as rhizoidal tubers, common, large, at least some > 500 µm long, red; cells protuberant.

Perichaetial leaves with a long-excurrent costa. Setae exserted, 15–40 mm long, purple-red. Capsules 2–3 mm long, cernuous or pendulous, brown or reddish when mature, clavate, long-tapered at base, widest at mouth; operculum convex, apiculate. Exostome and endostome of similar length; exostome of 16 yellow teeth with hyaline borders and numerous lamellae on inner face; endostome with a high basal membrane; segments gaping widely; cilia 2, sometimes joined, variably appendiculate. Spores 10–13 µm, smooth. Chromosome number not known.

Occurs in all States and Territories; rather common on rocks and on soil over rock, often near the sea. Also in New Caledonia, Fiji, New Zealand and Macquarie Is.

W.A.: road to Ranger Hut, Two Peoples Bay Nature Reserve, *J.R.Spence* 4194 (NSW). N.T.: Mt Giles, *P.K.Latz* 66146 *p.p.* (AD). Qld: Mt Bellenden Ker, *I.G.Stone* 12142 (MEL). N.S.W.: Cambewarra, *C.Harris* 296 (MEL, NSW). A.C.T.: near Uriara Crossing, *D.G.Catcheside* 64.83 (AD). Vic.: Eastern Victoria, *G.K.Thomson s.n.* (MEL 29852). Tas.: Mt Wellington, Oct. 1886, *R.A.Bastow* (MEL).

A distinctive and beautiful species characterised by glossy, golden-green leaves each with a long hairpoint, and exceptionally large red tubers with protuberant cells. The tubers resemble miniature red golfballs. Capsules are common.

7. *Gemmabryum clavatum* (Schimp.) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 66 (2005)

Pohlia clavata Schimp., *Ann. Sci. Nat. Bot.*, sér. 2, 6: 148 (1836); *Bryum clavatum* (Schimp.) Müll.Hal., *Syn. Musc. Frond.* 1: 292 (1848). T: New Zealand, *Logan H* 2813; syn: BM.

Bryum clavatum Hook.f. & Wilson, in J.D.Hooker, *Fl. Nov.-Zel.* 2: 84 ('1855') [1854], *nom. illeg.* (later homonym). T: New Zealand, *Logan s.n.*; syn: BM.

Bryum erythrocarpoides Müll.Hal. & Hampe, *Linnaea* 26: 495 (1853). T: Lofty Ra., S.A., Oct. 1850, *F.Mueller s.n.*; holo: BM; iso: MEL.

Bryum curvicollum Mitt., *Handb. New Zealand Fl.* 442 (1867). T: New Zealand, *Travers s.n.*; iso: K.

Bryum curvicollum Mitt. var. *extenuatum* Hook.f. & Wilson, *Handb. New Zealand Fl.* 442 (1867). T: New Zealand, *W.Wilson*; holo: BM.

Bryum laevigatum Broth., *Oefvers. Förh. Finska Vetensk.-Soc.* 40: 176 (1898). T: Tas., *W.A.Weymouth s.n.*; holo: H-BR.

Bryum filicaule Broth., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 132 (1906), *nom. nud.* (in synonym.). T: see *B. filarium* (below); the specimen cited there was named *B. filicaule in sched.*

Bryum suberythrocarpum Broth. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 139 (1906), *nom. nud.* (in synonym.). Based on: Shaws Bay, Richmond R., N.S.W., Oct 1896, *W.W.Watts 1044, 1047, 1057*; Wardell, Oct. 1896, *W.W.Watts 1154*; Wilsons Ck, Aug. 1898, *W.W.Watts s.n.* (all at NSW).

Bryum sublaevigatum Broth. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 143 (1906), *nom. nud.* (in synonym.). Based on: Weedallion Mtn, near Young, N.S.W., 19 Aug. 1903, *W.W.Watts 7237* (NSW).

Bryum filarium Broth., *Proc. Linn. Soc. New South Wales* 41: 590 (1916). T: Skinners Head, Richmond R., N.S.W., *W.W.Watts 4127*; holo: H-BR; iso: BM, NSW.

Bryum kiamae Broth., *Proc. Linn. Soc. New South Wales* 41: 592 (1916). T: Kiama, N.S.W., 1906, *W.Forsyth 381*; holo: H-BR; iso: NSW.

Bryum subcurvicollum Broth., *Proc. Linn. Soc. New South Wales* 41: 590 (1916). T: Apsley Falls, N.S.W., *W.Forsyth 749*; holo: H-BR; iso: MEL, NSW.

Illustrations: H.Ochi, *J. Fac. Educ. Tottori Univ. Nat. Sci.* 21: 29, fig. 13A–H (isotype of *B. erythrocarpoides*); fig. 13I–L (syntype *Watts 105*, as *B. diversinerve*); 30, fig. 14A–G (type of *B. kiamae*); 32, fig. 15A–G (type of *B. subcurvicollum*); fig. 15H–M (syntype of *B. clavatum*); 33, fig. 16 (type of *B. filarium*) (1970); R.D.Seppelt, *The Moss Flora of Macquarie Island* 99, fig. 37 (2004), as *Bryum clavatum*.

Dioicous. Plants small to comparatively robust, green to bronze or dull green to reddish brown, often tufaceous, sometimes in dense cushions, often mixed with other mosses, glossy, often tinged with crimson. Stems variable in height, usually less than 10 mm, but leafless stems can reach 5 cm or more in wet habitats. Rhizoids brown, forming tomentum. Leaves equidistant on stem, lanceolate, imbricate, to 2–3 mm long, weakly concave, acute, usually distinctly bordered by 1–3 rows of narrow incrassate cells that are often reddish or brown; border weak or absent above; upper margin \pm entire; costa strong, reddish or brown, short-excurrent as a rigid reddish or brownish arista; upper laminal cells narrowly rhomboidal, incrassate, $40\text{--}80 \times 10\text{--}15 \mu\text{m}$ (3–5: 1), oblique to costa; basal laminal cells short-rectangular to quadrate, usually with red walls, abruptly differentiated from upper cells. Tubers occasional on rhizoids, red-brown, irregularly globose, 150–400 μm long.

Perichaetia and perigonia on very short stems with comal tufts. Setae 10–20 (–40) mm long. Capsules large, elongate-clavate, subpendulous, 2–5 mm long, distinctly curved when mature, highly variable in shape, tapered to a slender apophysis, 2–4 mm long, red-purple; operculum conical. Peristome: basal membrane high; cilia variable from rudimentary to fully developed, appendiculate. Spores large, 19–25 μm diam., finely papillose. $n = 11$ (10 + m), *fide* H.P.Ramsay & J.R.Spence, *J. Hattori Bot. Lab.* 80: 255 (1996).

Occurs in S.A., Qld, N.S.W., A.C.T., Vic. and Tas.; grows in open situations, e.g. stream banks and wet, often calcareous rock or soil. Also in New Guinea, Lord Howe Is., the South Pacific, Macquarie Is., New Zealand and South America.

S.A.: Waterfall Gully, Adelaide, *D.G.Catcheside 77.254* (AD). N.S.W.: Oakey Ck, NNE of Boorowa, *H.Streimann 5678* (AD). A.C.T.: Paddys Ck, Mt Gibraltar, *D.G.Catcheside 64.25* (AD). Vic.: Lower Glenelg R., *A.C.Beauglehole 3000* (MEL). Tas.: Chimney Pot Rd, *D.A. & A.V.Ratkowsky B344* (MEL).

This moss is characterised by its mostly green colour, short-excurrent costa, bordered lower portions of leaves, and elongate purplish capsules. Rhizoidal tubers are only occasionally produced. It can be distinguished from *G. apiculatum* which has elongate, thin-walled leaf cells, distinctly quadrate alar cells, unbordered leaves and small pyriform tubers.

8. *Gemmabryum coarctatum* (Müll.Hal.) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 66 (2005)

Bryum coarctatum Müll.Hal., *Syn. Musc. Frond.* 1: 312 (1849); *Brachymenium coarctatum* (Müll.Hal.) Bosch & Sande Lac., *Bryol. Javan.* 1: 140, t. 115 (1860). T: Ost Java, bei Jogjakarta, [Indonesia], *Junghuhn*; holo: *n.v.*

Illustration: A.Eddy, *Handb. Malesian Mosses* 3: 171, fig. 446A–D (1996), as *Brachymenium coarctatum*.

Dioicous. Plants small, to 10 mm tall, highly glossy, green, yellowish green or silver-green (due to hyaline leaf tips), somewhat comose. Rhizoids brown to red-brown, sparse. Leaves small, 1–2 mm long, slightly contorted and twisted when dry, ovate or ovate-lanceolate; apex acute or somewhat rounded; margin finely serrulate above; costa excurrent, hyaline; comal leaves larger than lower stem leaves, with a longer arista; upper laminal cells rhomboidal, 20–50 × 10–12 µm, with thin or slightly thickened walls; marginal cells often longer and narrower, forming a rather distinct border in the upper half, weak or absent in the lower half; basal cells short-rectangular. Gemmae as pale brown irregularly shaped stem tubers; leaf axil bulbils and rhizoidal tubers unknown.

Setae 10–30 mm long, brown to red. Capsules narrowly oval-cylindrical, erect, 1.5–2.5 mm long; mouth wide; apophysis distinct, rugose; operculum tall, conical. Peristome reduced; exostome teeth 16, orange-brown; endostome 50–67% the height of the exostome teeth; segments often vestigial; cilia vestigial or absent. Spores 10–15 µm diam. Chromosome number not known.

Known from subtropical and tropical woodland in W.A., N.T. and Qld; grows on seasonally wet soil, or on soil over rocks or walls, often on calcareous substrata. Also scattered throughout Malesia and Polynesia.

W.A.: Drysdale River Natl Park, E Kimberley, *K.F.Kenneally 4205* (PERTH). N.T.: Cutta Caves, S of Katherine, *I.G.Stone 23332* (MEL). Qld: Wallenden Tower, Chillagoe, *I.G.Stone 21742* (MEL).

Australian collections lack sporophytes. However, the strong, long-excurrent, hyaline costa, recurved leaf margin, distinct upper leaf border, ovate-lanceolate, loosely set and somewhat shrunken leaves, rectangular basal laminal cells and dioicous sexuality are characteristic. Most Australian specimens have large and very unusual, irregularly shaped gemmae as pale brown stem tubers, a feature not previously reported for this species and only rarely reported for the family Bryaceae (El-Saadawi & Zanaty, *J. Hattori Bot. Lab.* 68: 285–291, 1990) and for *G. eremaeum* (J.R.Spence & H.P.Ramsay, *J. Adelaide Bot. Gard.* 17: 112, 1996). Although we have named the Australian collections based on gametophytic resemblances to specimens from elsewhere, it is possible that these represent a distinct species with a different sporophyte to *G. coarctatum*.

9. *Gemmabryum coronatum* (Schwägr.) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 66 (2005)

Bryum coronatum Schwägr., *Sp. Musc. Frond.*, Suppl. 1, 2: 103 (1816). T: “In Guiana, Jamaica”, *C.Richard*; syn: *n.v.*

Bryum brevicaulis Hampe, *Linnaea* 36: 518 (1870), *nom. illeg.* (later homonym). T: *n.v.*

Bryum subatropurpureum Müll.Hal., *Linnaea* 37: 147 (1871). T: Brisbane R., Qld, 1864, *A.Dietrich*; iso: BM.

Bryum macropelma Müll.Hal., *Linnaea* 37: 149 (1872). T: “Nova Hollandia occidentalis” [W.A.], *L.Preiss 2464*; Porongorups, W.A., *F.Mueller s.n.*; syn: BM.

Bryum angeiophyllum Müll.Hal., *Genera Musc. Frond.* 208 (1901), *nom. nud.* (in synonym.). Based on: Hamilton, Brisbane, Qld, Aug. 1887, Apr. 1888, *C.J.Wild* (BRI).

Illustrations: H.Crum & L.E.Anderson, *Mosses of Eastern North America* 1: 570, fig. 264 (1981); A.Noguchi, *Illustrated Moss Flora of Japan* 2: 483, fig. 212 (1988); A.Eddy, *Handb. Malesian Mosses* 3: 123, fig. 412A–G (1996), all as *Bryum coronatum*.

Dioicous. Plants in dense tufts, yellowish green, not blackish below. Stems 5–15 mm long. Rhizoids brown to red-brown. Leaves imbricate, erect-spreading when moist, not or slightly contorted when dry, triangular or lanceolate, to 2 mm long, plane or weakly concave; apex acute to acuminate, not cucullate; margin recurved in lower 50–67%, entire to weakly serrulate above; costa red-brown, excurrent into a long hairpoint; median laminal cells

rhomboidal to elongate-hexagonal, 30–50 × 8–12 µm (3–5: 1), thin-walled; marginal cells narrowly rectangular, thin-walled, forming an indistinct border; lower laminal cells quadrate. Gemmae as axillary bulbils, solitary, green or brown-green, with distinct leafy primordia.

Setae 10–20 mm long, reddish brown. Capsules cernuous to pendulous, oblong, 1.2–2.5 mm long, reddish brown at maturity, somewhat glossy; neck wider than urn, thickly corrugate to warty when dry, abruptly narrowed to the seta; operculum dome-shaped, minutely apiculate. Peristome well developed; exostome teeth c. 500 µm long, faintly bordered, orange-red below, hyaline with large papillae above; endostome segments with large perforations; cilia 2 or 3, well developed, strongly appendiculate, slightly shorter than segments. Spores 10–15 µm diam. Chromosome number not known for Australia; $n = 10, 11 (10 + m), 20$, *vide* R.Fritsch, *Bryophyt. Biblioth.* 40: 1–326 (1991).

Occurs in W.A., Qld and N.S.W. on damp soil, rock and old wood in disturbed places. A pantropical to subtropical species in North and South America, Africa, India, Malasia, Japan, New Caledonia, Lord Howe Is. and New Zealand.

Qld: Malanda, *W.W.Watts* Q505 (NSW); Old State Forest Rd, N from Builan, *I.G.Stone* 22788 (MEL). N.S.W.: Richmond R., *W.W.Watts* 5231 (NSW).

This moss can be separated from other Australian species with a thickly corrugated capsule neck by the presence of leafy primordia on the bulbils, and recurved leaf margins. However, in the absence of capsules, it is difficult to distinguish this from sterile *G. dichotomum*.

10. Gemmabryum crassum (Hook.f. & Wilson) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 66 (2005)

Bryum crassum Hook.f. & Wilson, in J.D.Hooker, *Fl. Nov.-Zel.* 2: 86 ('1855') [1854]. T: Manukau Bay, New Zealand, *W.Colenso* 136; iso: BM.

Bryum austroalpinum Müll.Hal., *Hedwigia* 37: 99 (1898). T: Ballarat, Vic., 1875, *G.Day*; holo?: MEL (not located); iso: BM, H.

Illustrations: G.O.K.Sainsbury, *Bull. Roy. Soc. New Zealand* 5: 280, pl. 40, fig. 1 (1955), as *Bryum crassum*; H.Ochi, *J. Fac. Educ. Tottori Univ. Nat. Sci.* 21: 41, fig. 23A–E (isotype of *B. crassum*), fig. 23F–H (isotype of *B. austroalpinum*) (1970).

Dioicous. Plants loosely tufted, green, yellow-green or brown-green, becoming brown or reddish brown below, dull or glossy, 5–20 mm tall. Stems simple or branched with short innovations, often in comal tufts. Rhizoids forming a brown or brick-red tomentum. Leaves comose, interrupted-comose on longer stems, appressed, closely imbricate, little-altered when dry, 1.5–2.0 mm long, rather thick, strongly concave, ovate-oblong, broadly acute; margin recurved to near apex, entire or slightly denticulate, unbordered; costa robust, yellow-brown, projecting dorsally, distinctly percurrent or short-excurrent with a smooth mucro; upper and sometimes median laminal cells oblique to costa, incrassate, 25–60 × 12–20 µm wide (2–4: 1), irregular in shape in upper part of lamina, somewhat rounded at ends; basal cells subquadrate. Gemmae absent.

Setae 20–25 mm long, curved at apex. Capsules horizontal to pendulous, oblong or clavate, to 2 mm long, brown; neck short and abruptly narrowed to the seta, with a very wide mouth when empty; operculum large, conical and apiculate. Exostome teeth distant, orange-red, hyaline above on dorsal face, finely papillose, with a zig-zag median line; endostome segments white, papillose, from a high basal membrane, widely split; cilia 1 or 2, long, appendiculate. Spores 8–12 µm diam. Chromosome number not known.

Occurs in N.S.W., Vic. and Tas.; grows on damp to dry sand or rock usually in open situations. Also in New Zealand.

N.S.W.: Yarrangobilly Caves, 1906, *W.W.Watts* (NSW). Vic.: Toorongo area, Mt Baw Baw, *S.Tilley s.n.* (MEL). Tas.: Derwent to Queenstown, *I.G.Stone* 3441, 3475 (MEL).

This moss is characterised by the strongly imbricate leaves in comal tufts, interrupted in longer stems, laminal cells arranged obliquely to the costa, these being markedly incrassate with rounded end walls, and a short-excurrent costa with a smooth mucro.

11. Gemmabryum dichotomum (Hedw.) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 66 (2005)

Bryum dichotomum Hedw., *Sp. Musc. Frond.* 183 (1801). T: New Zealand, *J.Banks*; n.v.

Bryum annulatum Hook.f. & Wilson, *Fl. Antarct.* 1: 134 (1844). T: Mt Ararat, Vic., July 1875, *D.Sullivan s.n.*; holo: MEL.

Bryum pimpamae Müll.Hal., *Hedwigia* 37: 90 (1898). T: Pimpama, Qld, Aug. 1887, *C.Wild*; syn: H-BR.

Bryum brachytheciella Müll.Hal., *Hedwigia* 37: 91 (1898). T: Mossmans Bay, Sydney, N.S.W., Sept. 1884, *T.Whitelegge s.n.*; holo: MEL; iso: H-BR, NSW.

Bryum argillicola Broth., *Oefvers. Förh. Finska Vetensk.-Soc.* 42: 118, 119 (1899). T: Port Cygnet, Lymington, Tas., *W.A.Weymouth 1846*; holo: H-BR.

Bryum balanoides Taylor ex Broth., *Nat. Pflanzenfam.* I, 3: 588 (1904). T: Swan R., W.A., *J.Drummond*; holo: MEL.

Bryum subcupulatum Müll.Hal. ex Rodway, *Pap. & Proc. Roy. Soc. Tasmania* 1913: 190 (1914). T: Tas., locality unknown; holo: n.v.; iso: H-BR.

Bryum coronatoaffine Müll.Hal. ex F.M.Bailey, *Syn. Queensland Fl. Suppl.* 1: 67 (1886), *nom. nud.* Based on: Brisbane R., Qld, *H.Tryon s.n.* (BRI, MEL).

Bryum viridissimum Broth. ex F.M.Bailey, *Queensland Bot. Bull.* 2: 24 (1891), *nom. nud.* Based on: Brisbane, Qld, *H.Tryon 802* (BRI).

Illustrations: A.Eddy, *Handb. Malesian Mosses* 3: 141, fig. 427 (1996), as *Bryum bicolor*; H.Streimann, *The Mosses of Norfolk Island* 31, fig. 10 (2002), as *Bryum dichotomum*; R.D.Seppelt, *The Moss Flora of Macquarie Island* 101, fig. 38 (2004), as *Bryum dichotomum*.

Dioicous. Plants in tufts, brown to yellowish green, often rather glossy. Stems short, erect, 5–20 mm tall. Rhizoids brown to red-brown. Leaves imbricate, 0.75–1.50 mm long, erectopatent, little-altered but somewhat folded lengthwise when dry, ovate-lanceolate to lanceolate, acuminate, weakly concave; margin plane, rarely recurved near the base, entire; costa percurrent or excurrent in a rigid point, yellow; laminal cells with firm to incrassate walls, hexagonal to rhomboidal in mid-leaf, 35–50 × 10–12 µm, becoming rhomboidal, then narrowly-rectangular, to 80 µm long at margin of upper half of leaf, but not forming a distinct border; basal cells quadrate or short-rectangular. Gemmae as bulbils, numerous in upper leaf axils (1 per axil), 0.3–1.0 mm long, 0.1–0.3 mm wide, bearing rudimentary leaves in upper 25–50%; red globose rhizoidal tubers sometimes present.

Setae exserted, 5–15 mm long, reddish. Capsules cernuous to pendulous, oblong-elliptical, 1.5–2.0 mm long, pale to dark brown, the apophysis tapering to the seta, wrinkled when dry; operculum low-conical. Peristome well developed; exostome teeth yellow; endostome with a basal membrane less than half the height of the exostome; segments with narrow slits; cilia (1–) 2 (–3), appendiculate. Spores 12–14 µm diam. *n* = 10, *fide* H.P.Ramsay & J.R.Spence, *J. Hattori Bot. Lab.* 80: 259 (1996).

Occurs in all States and Territories. A common species on damp and often clay soils, sometimes on rock, often forming extensive turfs over wet soil in the early stages of colonisation. Also widespread in the Southern Hemisphere, incl. South America, Antarctica, Lord Howe Is., Norfolk Is., Macquarie Is. and New Zealand.

W.A.: Petrunder Rocks, c. 30 km E of Pithara, *J.R.Spence 4144* (NSW). N.T.: Stanley Chasm, *D.G.Catcheside 76.318* (AD). S.A.: banks of Glenelg R., *D.G.Catcheside 55.118* (AD). Qld: Upper Mobray, *coll. unknown* (CANB 362206). N.S.W.: Barren Grounds, *D.G.Catcheside 16044* (NSW). A.C.T.: Australian National Botanic Gardens, Canberra, *R.G.Catcheside 17264* (NSW). Vic.: Annuello, *A.C.Beauglehole 57298* (MEL). Tas.: Mt Wellington, *A.V.Ratkowsky H557* (AD).

Bulbils with rudimentary leaves are usually abundant and conspicuous. The capsule has a slender, smooth or only slightly corrugated neck tapering to the seta, narrowly waisted below the mouth, with the neck concolorous with the rest of the capsule. By contrast, in *G. pachythecum* and *G. coronatum* the neck is strongly corrugated and darker. *Gemmabryum coronatum* differs from *G. dichotomum* in having the neck abruptly contracted to the seta; moreover, the leaves are more narrowly ovate-lanceolate to triangular with strongly recurved margins.

Gemmabryum dichotomum has been synonymised by Ochi (*J. Fac. Educ. Tottori Univ. Nat. Sci.* 34(2): 53, 1985) with *Bryum* [*Gemmabryum*] *bicolor*. The two taxa are widely

distributed in Europe, America, India, Malesia and Oceania, but there is much confusion in the synonymy.

This species includes *Bryum* “sp. E” of Catcheside (1980); see Spence & Ramsay (1996).

12. *Gemmabryum eremaeum* (Catches. ex J.R.Spence & H.P.Ramsay) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 66 (2005)

Bryum eremaeum Catches. ex J.R.Spence & H.P.Ramsay, *J. Adelaide Bot. Gard.* 17: 112 (1996). T: Mirra Mitta Bore, between Maree and Birdsville, S.A., Sept. 1978, *R.E.Grandison s.n.*; holotype: AD.

Illustrations: D.G.Catcheside, *Mosses of South Australia* 267, fig. 156 (1980), as *Bryum* sp. C; J.R.Spence & H.P.Ramsay, *op. cit.* 113, fig. 3 (1996), as *Bryum eremaeum*.

Dioicous. Plants in short dense tufts, reddish green, 4–6 mm tall, often appearing hoary due to hyaline hairpoints. Rhizoids red to red-brown. Leaves broadly ovate and weakly concave, 1.5–2.0 mm long; margin revolute at least to mid-leaf, entire to finely serrulate, unbordered; costa strong, red-brown; hairpoint relatively long, hyaline and toothed; upper laminal cells elongate, hexagonal-rhomboidal, 30–50 × 10–15 μm (3–4: 1); basal cells quadrate, often wider than long in alar region. Gemmae as bulbils and stem tubers; bulbils common in leaf axils of sterile shoots, often more than 1 per axil, broadly ellipsoidal, with 2 short peg-like primordia separated by a groove; stem tubers sometimes present, budding off from the base of underground portions of stems, white to pale tan.

Perichaetia on short basal shoots; perichaetial leaves larger than vegetative leaves. Setae long-exserted, c. 15 mm long, smooth, red-brown. Capsules ovate, 1.5–2.0 mm long, somewhat tapered to the seta, brown or red; apophysis wrinkled when dry, somewhat inflated, abruptly contracted to the seta; operculum dome-shaped, apiculate. Peristome well developed; exostome teeth lanceolate, yellowish brown, papillose below, hyaline near tips; endostome segments 67–75% the length of the exostome teeth, broadly perforated; cilia 2 or 3, appendiculate. Spores 8–15 μm diam. Chromosome number not known.

This endemic species occurs on soil in arid regions of S.A., south-western N.S.W. and north-western Vic. It should also be looked for in south-western W.A.

S.A.: Mirra Mitta Bore, *D.G.Catcheside B1, B4, B6* (AD). N.S.W.: near Euston, *D.G.Catcheside 74.86* (AD). Vic.: Kiata Lowan Sanctuary, *A.C.Beauglehole 57179* (MEL).

Documented by Catcheside (1980) as *Bryum* “species C”, this is related to the more widespread *G. pachythemum*. However, the bulbils of *G. eremaeum* have small, peg-like primordia at the apex, separated by a groove, while those of *G. pachythemum* are smooth and lack primordia. The distinctive, long, white and toothed leaf hairpoint of *G. eremaeum* is very different from the shorter, brown, golden or reddish hairpoint of *G. pachythemum*.

13. *Gemmabryum exile* (Dozy & Molk.) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 67 (2005)

Bryum exile Dozy & Molk., *Ann. Sci. Nat. Bot.*, sér. 3, 2: 300 (1844); *Brachymenium exile* (Dozy & Molk.) Bosch & Sande Lac., *Bryol. Javan.* 1: 139 (1860). T: Java; *n.v.*

Illustrations: D.G.Catcheside, *Mosses of South Australia* 249, fig. 144 (1980); A.Eddy, *Handb. Malesian Mosses* 3: 172, fig. 447 (1996); H.Streimann, *The Mosses of Norfolk Island* 16, fig. 4 (2002), all as *Brachymenium exile*.

Dioicous. Plants very small, to 4–10 mm tall, in dense tufts, green, yellowish or brownish, distinctly glossy; innovations string-like; female stems very short. Rhizoids pale brown to red-brown, sparse. Leaves imbricate to somewhat folded inward along costa, erect to suberect, very small, to 0.5–1.2 mm long, ovate, somewhat concave; apex acute; margin plane above, sometimes narrowly revolute on one or both sides below on large leaves, entire above or with a few inconspicuous teeth; costa stout, yellowish, excurrent as a short stiff or, rarely, long hairpoint; upper laminal cells rhomboidal-hexagonal, 20–50 × 8–10 μm, with thin to slightly thickened walls; marginal cells often longer and narrower, but not forming a distinct border; basal cells quadrate. Gemmae as leafy axillary bulbils, solitary on sterile stems; rhizoidal tubers occasionally present, small-pyriform, 100–200 μm, red-brown.

Setae 15–18 mm long, reddish. Capsules erect, obovoid to short-ovate, to 2 mm long, with a well-defined rugose apophysis; operculum red, low-conical. Exostome teeth 16, yellow to orange-brown, lanceolate, trabeculate on external face, transversely barred internally, finely uniformly papillose throughout; apices hyaline; endostome variable; basal membrane low; segments reduced, split at apex; cilia absent. Spores 8–10 µm diam. Chromosome number not known.

Occurs in W.A., N.T., Qld, N.S.W. and A.C.T.; usually on soil or rock, often calcareous. Also pantropical and subtropical in South America, Africa, SE Asia, Malesia, the Hawaiian Is., Norfolk Is. and New Zealand.

W.A.: Perth, *R.Wyatt & A.Stoneburner 3862* (PERTH). Qld: Tinaroo Perimeter Rd, NE of Atherton, *H.Streimann 16972* (CANB). A.C.T.: Australian National Botanic Gardens, Canberra, *H.Streimann 10681* (CANB).

The dioicous *G. exile* has imbricate, ovate leaves with predominantly plane margins. Some dry collections have the leaves regularly folded inward along the costa, giving the stem a very slender, string-like appearance. By contrast, the synoicous *G. indicum* has somewhat shrunken and contorted leaves with strongly revolute margins. *Gemmabryum austrosabulosum* is very similar, and sterile specimens cannot always be reliably separated in the absence of gemmae in *G. exile*. *Gemmabryum exile* produces leafy bulbils in leaf axils and often has rhizoidal tubers, whereas *G. austrosabulosum* always lacks gemmae. A few collections of *G. exile* from arid regions of northern Australia have a long-excurrent costa.

14. *Gemmabryum inaequale* (Taylor) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 67 (2005)

Bryum inaequale Taylor, *London J. Bot.* 5: 53 (1846). T: Swan R., W.A., 1843, *J.Drummond s.n.*; holo: BM; iso: H.

Bryum calodictyon Broth., *Proc. Linn. Soc. New South Wales* 41: 589 (1916). T: Green Gully, near Young, N.S.W., *W.W.Watts 7244*; lecto: H-BR, *fide* J.R.Spence & H.P.Ramsay, *Fl. Australia* 51: 411 (2006); back of cemetery, Young, N.S.W., *W.W.Watts 7244*; syn: NSW.

Illustrations: H.Ochi, *J. Fac. Educ. Tottori Univ. Nat. Sci.* 21: 34, fig. 17 (type of *B. inaequale*); 37, fig. 19 (as *Bryum calodictyon*) (1970).

Dioicous. Plants small, to 10 mm tall, glossy green or yellow-green, brownish and radiculose below. Rhizoids brown or red-brown. Leaves imbricate, comose, appressed when dry, erect-spreading when moist, triangular-lanceolate, 1–2 mm long, concave; apex acuminate; margin slightly recurved, entire or serrulate above, not bordered; costa slender, reddish below, percurrent or short-excurrent; laminal cells sublinear, > 100 µm long, 10–12 µm wide (6–8: 1), thin-walled; alar region clearly differentiated; cells quadrate, > 20. Gemmae absent.

Setae to 14 mm long, slender, red-brown. Capsules horizontal to nutant, 2–3 mm long, widest at middle, long-necked, tapering to seta; operculum low-conical. Exostome teeth yellow-brown; endostome of slender narrowly fenestrate segments; cilia 2 or 3, mostly well developed, occasionally blunt or reduced, nodulose or short-appendiculate. Spores 11–15 µm diam. Chromosome number not known.

Endemic to W.A., S.A., Qld, N.S.W. and Vic.; grows on soil, often on vertical banks. Map 173.

W.A.: Fitzgerald R. crossing, Fitzgerald River Natl Parl, *J.R.Spence 4168* (NSW). S.A.: Millicent, L. Leake, *L.D.Williams 3537* (AD). Qld: Granite Gorge, Mareeba, *I.G.Stone 21971* (MEL). N.S.W.: Wombat, near Young, *W.W.Watts 7857, 7864, 7856, 7800, 7843* (NSW). Vic.: Mt William, *D.Sullivan s.n.* (MEL).

Characterised by the glossy, yellowish green leaves and elongate, thin-walled laminal cells, *G. inaequale* has a habit reminiscent of a small, creeping pleurocarpous moss. It is closely related to *G. acuminatum*, from which it differs by the narrow capsule mouth and the well-developed peristome. These two species, as well as *G. apiculatum*, form part of a complex of poorly defined species that requires worldwide revision.

15. *Gemmabryum indicum* (Dozy & Molk.) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 67 (2005)

Bryum indicum Dozy & Molk., *Musci Frond. Ined. Archip. Ind.* 1: 22 (1845); *Brachymenium indicum* (Dozy & Molk.) Bosch & Sande Lac., *Bryol. Javan.* 1: 141 (1860). T: West Java, [Indonesia], *F.Korthals*; *n.v.*

Illustrations: H.C.Gangulee, *Mosses of Eastern India and Adjacent Regions* 2: 943, fig. 452 (1974); A.Eddy, *Handb. Malesian Mosses* 3: 173, fig. 448 (1996), both as *Brachymenium indicum*.

Synocious. Plants small, to 10 mm tall, densely tufted, dark green or yellowish, slightly glossy. Stems erect, red, branched by several subperichaetial innovations, matted with reddish tomentum. Rhizoids red to red-brown. Leaves closely set, small; upper leaves larger and forming a comal tuft, ovate or broadly lanceolate, c. 1 mm long, erect-spreading when moist, contorted and appressed to the stem when dry; apex acuminate; margin narrowly revolute below; costa excurrent in a short- or long-denticulate arista, brown or yellowish, occasionally hyaline; upper laminal cells elongate-rhomboidal, thin- or slightly thick-walled, $30\text{--}50 \times 10\text{--}15 \mu\text{m}$ (3–4: 1); basal cells quadrate to short-rectangular; marginal cells longer and a little narrower, forming an indistinct border. Gemmae as bulbils with leafy primordia; rhizoidal tubers occasionally present, small (100–200 μm), reddish brown, globose.

Perichaetial leaves larger than vegetative leaves, with a less excurrent costa and a revolute margin. Setae reddish, 10–19 mm long. Capsules fusiform, erect or very slightly inclined, 2–3 mm long, brown; apophysis somewhat rugose, tapered below; operculum umbonate. Peristome reduced; exostome teeth 16, yellow; endostome delicate, variable; segments the same length as exostome teeth but fragile; cilia apparently lacking. Spores 9–12 μm diam. Chromosome number not known.

Occurs in subtropical and tropical W.A., N.T. and Qld; grows on soil, occasionally over rock. Also in India and Malesia.

W.A.: Cockburn Ra., SW of Wyndham, *H.Streimann 39466* (CANB). N.T.: Kakadu Natl Park, *I.G.Stone 23427* (MEL). Qld: Mungana, *I.G.Stone 16739* (MEL); 20 km E of Chillagoe, *J.R.Spence 5116* (NSW).

Although *G. indicum* was reported by Dixon (1942: 31) for Australia, it was not listed by Ochi (1970, 1982). It is now known to be more widespread than previously thought.

Although closely related to *G. coarctatum*, *G. indicum* can be distinguished by its green, unbordered leaves lacking hyaline upper parts, quadrate basal cells (at least in the alar region), the absence of stem tubers, and synocious sexuality. Australian collections have bulbils with small laminate leaf primordia and rhizoidal tubers, characters not reported previously for the species.

16. *Gemmabryum klinggraeffii* (Schimp.) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 67 (2005)

Bryum klinggraeffii Schimp., in H.E.M. von Klinggraeff, *Höh Crypt. Preuss.* 81 (1858). T: Europe; *n.v.*

Illustrations A.J.E.Smith, *Moss Flora of Britain and Ireland* 424, fig. 202 (6–10) (1978); D.G.Catcheside, *Mosses of South Australia* 276, fig. 164b (tubers) (1980), both as *Bryum klinggraeffii*.

Dioicous. Plants small, 2–5 mm tall, variously coloured, not distinctly glossy. Rhizoids almost smooth, pale yellowish to red-brown. Leaves small to medium-sized, 1.0–1.5 mm long, somewhat contorted, loosely imbricate, ovate-lanceolate to lanceolate with an acute apex; margin plane or revolute to mid-leaf, finely serrulate near apex; costa short-excurrent; laminal cells mostly $45\text{--}60 \times 10\text{--}15 \mu\text{m}$ (4–6: 1), thin-walled to somewhat incrassate; cells in lower quarter short-rectangular across base; cells longer and narrower at margin but not forming a border. Gemmae rhizoidal tubers, abundant, never axillary, bright crimson, small, 60–100 μm , irregularly globose, mostly 3 or more cells wide; superficial cells protuberant; stem tubers rare, pale whitish tan.

Perichaetial leaves triangular, with strongly revolute margins. Setae thick, to 10 mm long, red-brown. Capsules broadly pyriform, 1–2 mm long, strongly contracted below mouth when dry and empty. Peristome well developed; exostome teeth yellow to brown, papillose; endostome with a high basal membrane; segments broadly perforate; cilia 2 or 3, well developed, appendiculate. Spores 8–12 μm diam. Chromosome number not known.

Occurs in W.A. and N.T.; grows on soil, often in disturbed areas. Also in Eurasia, North and South America, Lord Howe Is. and New Zealand.

W.A.: Osmund Valley, SE Kimberley, *coll. unknown* (AD). N.T.: Mt Palmer, NW of Alice Springs, 26 Aug. 1956, *J.B.Cleland* (AD).

This species can be confused with *G. sauteri* which has smaller, brown, pyriform tubers that are concolorous with the rhizoids. Remarkably, a collection from arid, central W.A. has small but well-developed stem tubers as in *G. coarctatum* and *G. eremaeum*.

17. *Gemmabryum laevigatum* (Hook.f. & Wilson) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 67 (2005)

Bryum laevigatum Hook.f. & Wilson, *London J. Bot.* 3: 546 (1844). T: Tas., locality unknown, *J.D.Hooker* 2856; holo: BM.

Bryum crassinerve Hook.f. & Wilson, in *J.D.Hooker, Fl. Nov.-Zel.* 2: 83 ('1855') [1854]. T: Munyang Mtns, Vic., 1855, *F.Mueller*; syn: BM; Alps, Tas., *Stirling*; syn: MEL.

Bryum incurvifolium Müll.Hal., *Bot. Zeitung (Berlin)* 9: 549 (1851). T: Qld, *Mossman s.n.*; iso: H.

Illustrations: J.Beever, K.W.Allison & J.Child, *Mosses of New Zealand*, 2nd edn 67, pl. 61 (1992); R.D.Seppelt, *The Moss Flora of Macquarie Island* 105, fig. 40 (2004), both as *Bryum laevigatum*.

Dioicous. Plants robust, 1–4 (–10) cm tall, in loose tufts or strands, simple or branched, green above, yellow-green, brown-green or blackish below, dull or glossy. Stems matted and radiculose below. Rhizoids purplish brown, strongly papillose. Leaves ±glossy, flat or weakly concave, oblong, ovate-oblong or elliptic, 2–3 mm long, only slightly crisped (incurved) when dry, erect and appressed; apex obtuse; margin recurved, serrulate towards the apex; costa strong, dark, percurrent on most leaves, strongly keeled along the abaxial side of the leaf when dry; upper laminal cells small and wide, mostly 25–50 × 12–25 µm (1.5–3: 1), elongated diagonally or obliquely to costa, strongly incrassate, porose; lower basal cells rectangular, with some quadrate cells present; lower margin sometimes with a strong border of narrow cells; leaf base green. Gemmae absent.

Setae 20–40 mm long. Capsules clavate, erect to horizontal or pendulous, 2.5–3.5 mm long, brown. Exostome teeth lanceolate, with hyaline margins and a straight to zig-zag median line; endostome segments widely split, appendiculate; basal membrane more than half the length of the segments; cilia 2 or 3. Spores 16–20 µm diam. Chromosome number not known.

Occurs in W.A., Qld, N.S.W., A.C.T., Vic. and Tas.; grows on soil or rock, mainly in boggy or marshy ground or creeks. Also known from southern South America, Macquarie Is. and New Zealand and its Subantarctic islands.

N.S.W.: Yarrangobilly Caves, *W.W.Watts* 8712 (NSW); Diggers Ck, 28 km NE of Mt Kosciuszko, *H.Streimann* 5449 (AD). Vic.: Bogong High Plains, *C.Skewes s.n.* (MEL). Tas.: L. Dobson, *H.P.Ramsay* R1635 (NSW).

Gemmabryum laevigatum is a distinctive species that superficially looks like some forms of *Ptychostomum pseudotriquetrum* from which it differs by the broad, non-decurrent, fleshy and ±rounded leaves, oblique areolation, and a lack of dense tomentum on the stem. This species grows in similar habitats to *Ochiobryum blandum*, but *G. laevigatum* has smaller, denser areolation, concave fleshy leaves that are never red-pink or silver-tinged, and stems that are not complanate.

18. *Gemmabryum pachythemum* (Müll.Hal.) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 64 (2005)

Bryum pachythemum Müll.Hal., *Syn. Musc. Frond.* 1: 307 (1848). T: York, W.A., 10 Sept. 1839, *L.Preiss* 2466; lecto: BM, *fide* J.R.Spence & H.P.Ramsay, *Fl. Australia* 51: 411 (2006); isolecto: MEL 30783; India Orientalis, Herb. Gottscheanum; syn: L.

Bryum suboeneum Hampe & Müll.Hal., *Linnaea* 26: 494 (1853). T: Yarra R., Vic., *F.Mueller*; holo: MEL; iso: BM.

Bryum pachytheca Müll.Hal. var. *inflatum* Wilson, in J.D.Hooker, *Fl. Tasman.* 2: 191 (1859). T: Tas., A.F.Oldfield; holo: n.v.

Bryum gambierense Müll.Hal., *Linnaea* 37: 148 (1871). T: Mt Gambir [Gambier], S.A., F.Mueller; iso: BM.

Bryum cupulatum Müll.Hal., *Linnaea* 37: 149 (1871). T: Brown Hill Creek, Vic., F.Mueller; holo: n.v.

Bryum pachythecioides Müll.Hal., *Fragm.* 11 (Suppl.): 48 (1881), *nom. nud.* [Name used for eastern Australian populations of *B. pachytheca*.]

Bryum ovicarpum Broth., *Oefvers Förh. Finska Vetensk.-Soc.* 42: 101 (1900). T: Hobert [Hobart], Tas., W.A.Weymouth 1834; holo: H-BR.

Bryum pachytheca Müll.Hal. var. *crassinerve* Wilson ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 137 (1906). T: Tas., R.C.Gunn; holo: n.v.

Bryum campbelliae Müll.Hal. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 142 (1906), *nom. nud.* (in synonym.). Based on: Vic., locality unknown, F.M.Campbell (BRI, MEL, NSW).

Bryum capillaripes Müll.Hal. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 143 (1906), *nom. nud.* (in synonym.). Based on: Sandy Desert, Dimboolshire [Dimboola Shire], Vic., Aug, 1886, F.M.Reader (MEL).

Bryum piligerum Müll.Hal. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 143 (1906), *nom. nud.* (in synonym.). Based on: Mt Arapiles, Vic., Aug. 1896, F.M.Reader (MEL).

Bryum pruinatum Müll.Hal. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 143 (1906), *nom. nud.* (in synonym.). Based on: Dimboolshire [Dimboola Shire], Vic., May 1897, F.M.Reader (MEL).

Bryum gambierense Müll.Hal. var. *nanum* Müll.Hal. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 143 (1906), *nom. nud.* (in synonym.).

Illustrations: H.Ochi, *J. Fac. Educ. Tottori Univ. Nat. Sci.* 21: 22, fig. 8A–H (1970), as *Bryum bicolor*; G.A.M.Scott & I.G.Stone, *The Mosses of Southern Australia* 286, pl. 52, (1976), as *Bryum pachytheca*; D.G.Catcheside, *Mosses of South Australia* 266, fig. 155 (1980), as *Bryum pachytheca*.

Dioicous. Plants in mats or tufts, golden-green to reddish green. Stems erect, 5–10 mm tall. Rhizoids brown to red-brown, common. Leaves elliptical to lanceolate, 0.6–1.5 mm long, weakly concave, tapering to an acute apex, erect to patent, not much altered when dry; margin plane, entire; costa strong, excurrent in a short coloured arista, denticulate at tip, yellow or red; upper and mid-laminal cells rhomboidal to obliquely rectangular, 20–45 × 9–15 µm (3–4: 1), smooth, with thin or thick walls; basal cells narrower, rectangular to quadrate. Gemmae as bulbils, axillary, oblong to obovate to ellipsoidal on sterile stems, often more than 1 per axil, without primordia or leaves or with minute peg-like rudiments of primordia at apex; stem tubers absent.

Perichaetial leaves similar to vegetative leaves. Setae 5–10 mm long, red. Capsules pendent, broadly ovate, c. 2 mm long, purplish to crimson-brown; apophysis wider than the urn when moist, narrower when dry, rugose to corrugate, abruptly expanded from the seta, somewhat inflated, much darker than the urn; operculum low-conical. Peristome well developed; exostome teeth lanceolate, yellow, minutely papillose, with hyaline apices; endostome with a high basal membrane, two-thirds the height of the exostome teeth; segments tapering, with broad perforations; cilia 2, appendiculate. Spores 8–13 µm diam., finely papillose. *n* = 10, *vide* H.P.Ramsay & J.Spence, *J. Hattori Bot. Lab.* 80: 259 (1996), as *Bryum pachytheca*.

A common species on damp or dry soil or rock in all States and Territories. Also in SE Asia, Melanesia, New Zealand and western Oceania.

W.A.: Hyden, *L.D.Williams 3920b* (AD). N.T.: Mt Riddock, Harts Ra., *A.C.Beauglehole 44657* (MEL). S.A.: Flinders Ra., *L.D.Williams 5659* (AD). N.S.W.: Warrumbungles Ra., *I.G.Stone 4080* (MEL). A.C.T.: Acton, Canberra, *D.G.Catcheside 68.132* (MEL). Vic.: Moyston, *D.Sullivan 19* (MEL).

In Australasia, *G. pachythemum* is a common species of sandy and loamy soils, and sometimes rock, and in urban habitats including gutters and crevices in walls. The species is very variable, but the capsules are distinctive. Bulbils differ from those of *G. dichotomum* in the absence of leafy primordia. It is distinguished from *G. eremaeum* by the red or brownish rather than hyaline arista and the absence of primordia on the bulbils.

19. Gemmabryum preissianum (Hampe) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 67 (2005)

Bryum preissianum Hampe, *Icon. Musc.* 25 (1844); *Brachymenium preissianum* (Hampe) A.Jaeger, *Ber. Tätigk. St. Gallischen Naturwiss. Ges.* 1873–74: 113 (1875). T: Freemantle [Fremantle], W.A., 14 Aug. 1823, *L.Preiss 2453*; lecto: BM, *fide* H.Ochi, *J. Fac. Educ. Tottori Univ. Nat. Sci.* 21(1): 13 (1970); isolecto: MEL; syn: BM (*Preiss 2451*); isosyn: MEL.

Brachymenium pilosithecium Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 121 (1906), *nom. nud.* (in synon.). Based on: Balls Head Bay (Mossmans Bay), N.S.W., Sept. 1884, *T.Whitelegge 146* (NSW).

Brachymenium chloroblastum Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 121 (1906), *nom. nud.* (in synon.). Based on: Moore Park, Sydney, N.S.W., Aug. 1891, *T.Whitelegge 368* (NSW).

Pohlia cuspidata E.B.Bartram, *Trans. Brit. Bryol. Soc.* 1: 468 (1951). T: Crawley, W.A., 10 Aug. 1945, *A.D.Banwell*; holo: MEL; iso: PERTH

Illustrations: H.Ochi, *J. Fac. Educ. Tottori Univ. Nat. Sci.* 21: 13, fig. 4 (1970); D.G.Catcheside, *Mosses of South Australia* 248, fig. 143 (1980); H.Streimann, *The Mosses of Norfolk Island* 18, fig. 5 (2002), all as *Brachymenium preissianum*.

Dioicous. Plants small, 3–8 mm tall, in dense green or yellow tufts. Stems short, branched by perichaetial innovations. Leaves imbricate, lanceolate or ovate-lanceolate, to 1 mm long, erect whether dry or moist; apex acuminate; margin plane, entire; costa strong and broad, excurrent in a stout cuspidate point, yellowish brown; upper laminal cells rhomboidal-hexagonal, 25–35 × 10–12 µm, pellucid, with firm or thick walls; 1 or 2 marginal rows narrower, short-rectangular, not forming a distinct border; basal cells rectangular. Gemmae absent.

Setae 5–15 mm long, slender, flexuose, yellow above, reddish below. Capsules inclined or horizontal, oblong-elliptical, 2.0–2.5 mm long, dark reddish brown; apophysis distinct; mouth narrow; operculum conical, short-rostellate. Peristome reduced; exostome teeth 16, narrowly lanceolate, subulate, to 400 µm long, yellow and finely papillose to smooth below, hyaline and papillose above; inner surface lamellate; endostome segments 16, narrowly linear, to 150 µm long, papillose, slightly rimose; basal membrane papillose, one-third the height of the exostome teeth; cilia absent. Spores 8–10 µm diam. *n* = 10, 22, 30, *fide* H.P.Ramsay & J.R.Spence, *J. Hattori Bot. Lab.* 80: 263 (1996), as *Bryum preissianum*.

Occurs in all States and Territories; grows on rock (especially limestone) and on soil over rock. Also in New Zealand.

W.A.: Busselton, Sept. 1917, *E.B.Bartram* (MEL). N.T.: Finke R., *H.Kempe 1882* (MEL). S.A.: Meningie, *L.D.Williams 112* (AD). Vic.: Moleside Ck, *A.C.Beauglehole 1356* (MEL).

This species is characterised by lanceolate or ovate-lanceolate leaves with a short, stout hairpoint, inclined to horizontal capsules with a narrow mouth, and a rostellate operculum.

Although this species is dioicous, capsules are frequently produced.

20. Gemmabryum radiculosum (Brid.) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 67 (2005)

Bryum radiculosum Brid., *Muscol. Recent.*, Suppl. 3: 18 (1817). T: Rome, Italy; holo: B? *n.v.*

Illustrations: A.J.E.Smith, *Moss Flora of Britain and Ireland* 424, fig. 202 (1–5) (1978); H.Streimann, *The Mosses of Norfolk Island* 32, fig. 11 (2002), both as *Bryum radiculosum*.

Dioicous. Plants densely tufted, 3–10 mm tall, pale green to reddish green. Rhizoids yellowish brown, coarsely papillose. Leaves ovate-lanceolate, 1–2 mm long, sharply acuminate, somewhat shrunk when dry; upper margin serrulate, unbordered, revolute below; costa strong, long-excurrent, yellow or sometimes reddish when old; mid-laminal cells 40–60 × 10–12 µm (3–5: 1), slightly longer and narrower at the margin; basal laminal cells quadrate. Gemmae usually present, sometimes sparse, as rhizoidal tubers 100–200 µm, brown or red, globose; cells not protuberant.

Perichaetial leaves triangular, with strongly revolute margins. Setae 10–20 mm long, reddish. Capsules ovate-cylindrical to ellipsoidal, narrowing to the mouth, 2–3 mm long; operculum low-conical. Peristome well developed; exostome teeth yellow to brown, papillose;

endostome with a high basal membrane; segments broadly perforate; cilia 2 or 3, well developed, appendiculate. Spores 10–14 µm diam. Chromosome number not known.

Occurs in W.A., N.T., S.A., Qld and Vic.; grows as dense tufts on old mortar and limestone and on dry calcareous soil; often on soil in arid regions. Also in central, southern and western Europe, Macaronesia, the Caribbean, Lord Howe Is. and New Zealand.

W.A.: Samin mining camp, E Osmund Valley, E Kimberley, *E.A.Chesterfield* 236 (MEL); Beverley Springs Stn, Kimberley, 1 May 1988, *G.A.M.Scott* (MEL). N.T.: Mt Giles, *P.K.Latz* 6614 p.p. (AD). Vic.: Trentham Falls, 16 km E of Daylesford, *H.Streimann* 38988 (CANB).

Gemmabryum radiculosum can be confused with *G. subapiculatum* from which it differs in the narrow, somewhat incrassate upper and middle laminal cells, the quadrate basal cells, the long-excurrent costa and its preference for calcareous substrata.

21. *Gemmabryum rubens* (Mitt.) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 68 (2005)

Bryum rubens Mitt., *Hooker's J. Bot. Kew Gard. Misc.* 8: 232 (1856). T: Europe; *n.v.*

Illustrations: A.J.E.Smith, *Moss Flora of Britain and Ireland* 429, fig. 206 (1978); D.G.Catcheside, *Mosses of South Australia* 276, fig. 164e (1980); A.Eddy, *Handb. Malesian Mosses* 3: 136, fig. 421 (1996), all as *Bryum rubens*.

Dioicous. Plants small, 10–20 mm tall, tufted and closely gregarious, rarely tufaceous, dull-green, olive or with reddish tints. Rhizoids deep reddish brown, papillose. Leaves erect-spreading, not closely imbricate, ovate-lanceolate to lanceolate, c. 2 mm long; apex acuminate; margin plane or revolute to mid-leaf, distinctly and remotely denticulate above; costa slender, short-excurrent; mid-laminal cells 40–60 × 16–20 µm, thin-walled, the 2 or 3 marginal rows longer, narrower with more incrassate and deeply pigmented walls, forming a distinct border. Gemmae often abundant, solitary as bulbils in leaf axils or as rhizoidal tubers on short rhizoids and clustered around stem base, crimson to red, conspicuous, globose, 150–300 µm diam.; cells distinctly protuberant across face.

Perichaetial leaves triangular, with strongly revolute margins. Setae c. 20 mm long, red-brown to brown. Capsules clavate to pyriform, 2–3 mm long, not distinctly curved when dry; operculum low-conical. Peristome well developed; exostome teeth yellow to brown, papillose; endostome with a high basal membrane; segments broadly perforate; cilia 2 or 3, well developed, appendiculate. Spores 8–12 µm diam. Chromosome number not known.

Known from disturbed soil in Qld, N.S.W. and Vic. Also in Europe, North America, India, Japan, Malesia and New Zealand.

Qld: Mt Baldy, *I.G.Stone s.n.* (MEL). N.S.W.: Royal Botanic Gardens, Sydney, *R.G.Coveny* 13189 (NSW); Jenolan Caves, *H.P.Ramsay* R34a (NSW). Vic.: White Bridge, Mt Buller, *I.G.Stone* 2496 (MEL).

This moss is characterised by the abundant, crimson, globose tubers 150–300 µm diam., the often reddish colour of the leaves, and the presence of a leaf border and broad laminal cells. It is often found on disturbed soils, and it may have been introduced.

22. *Gemmabryum sauteri* (Bruch & Schimp.) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 68 (2005)

Bryum sauteri Bruch & Schimp., in Bruch, Schimper & von Gumbel, *Bryol. Eur.* 4: 162 (1846). T: Europe; *n.v.*

Illustrations: A.J.E.Smith, *Moss Flora of Britain and Ireland* 426, fig. 203 (5–7) (1978); H.Streimann, *The Mosses of Norfolk Island* 34, fig. 12 (2002); R.D.Seppelt, *The Moss Flora of Macquarie Island* 111, fig. 43 (2004), all as *Bryum sauteri*.

Dioicous or synoicous. Plants small, to 5 mm tall, dull green. Rhizoids red-brown, finely papillose. Leaves ovate-lanceolate, c. 1.4 mm long and 0.4 mm wide, somewhat shrunken when dry, acuminate; margin ±entire above, recurved at base; costa strong, excurrent in a long hairpoint; laminal cells 40–70 × 10–14 µm (4–5: 1), incrassate, slightly narrower towards margin, not forming a border; cells in lower quarter short-rectangular across leaf base to costa. Gemmae as rhizoidal tubers, usually abundant, never axillary, brown to red-brown, pyriform, 60–100 × 40–60 µm, mostly with 2 or 3 cells across the face; cells not or slightly protuberant.

Perichaetial leaves triangular, with strongly revolute margins. Setae 10–20 mm long, brown. Capsules narrowly pyriform, inclined to nutant, 2–3 mm long, distinctly contracted just below the mouth; operculum low-conical. Peristome well developed; exostome teeth yellow to brown, papillose; endostome with a high basal membrane; segments broadly perforate; cilia 2 or 3, well developed, appendiculate. Spores large, 16–20 µm diam. $n = 10 + m$, *fide* H.P.Ramsay & J.R.Spence, *J. Hattori Bot. Lab.* 80: 255 (1996), as *Bryum sauteri*.

Occurs on roadsides and stream banks on soil or on soil over rock in W.A., Qld, N.S.W., Vic. and Tas. Also in Europe, North America, SE Asia, New Guinea, New Zealand, Lord Howe Is., Norfolk Is. and Macquarie Is.

Qld: below Aljon Falls, Carnarvon Gorge Natl Park, *J.R.Spence 5167* (NSW). N.S.W.: Wilsons Ck, Richmond R., *W.W.Watts 1633* (NSW). Vic.: Avon R., *F.Mueller* (MEL). Tas.: Hogan Is., Bass Strait, *G.K.Thomson* (MEL 29830).

A widespread and variable species, *G. sauteri* is most similar to *G. klinggraeffii* from which it differs by the small pyriform tubers, larger spores and often synoicous sexuality.

23. *Gemmabryum subapiculatum* (Hampe) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 68 (2005)

Bryum subapiculatum Hampe, *Vidensk. Meddel. Dansk. Naturhist. Foren. Kjøbenhavn*, ser. 3, 4: 51 (1872). T: Europe; *n.v.*

Bryum microerythrocarpum Müll.Hal. & Kindb., *Cat. Canad. Pl.* 6: 124 (1892). T: Canada?; *n.v.*

Bryum tryonii Broth., *Oefvers Förh. Finska Vetensk.-Soc.* 35: 49 (1893). T: South Brisbane, Qld, Aug. 1870, *H.Tryon 806*; holotype: H-BR; isotype: MEL, NSW.

Bryum caespiticioides Müll.Hal., *Hedwigia* 37: 89 (1898). T: Queens River Rd, Macquarie Harbour, West Coast, Tas., *W.A.Weymouth 565*; isosyn: H; Hobart Waterworks, Tas., *W.A.Weymouth s.n.*; isosyn: NSW.

Illustrations: H.Ochi, *J. Fac. Educ. Tottori Univ. Nat. Sci.* 21: 28, fig. 12A–H (1970), as *Bryum tryonii*; D.G.Catcheside, *Mosses of South Australia* 276, fig. 164f (1980), as *B. microerythrocarpum*; J.Beever, K.W.Allison & J.Child, *Mosses of New Zealand*, 2nd edn 93, fig. 40h (1992), as *B. microerythrocarpum*.

Dioicous. Plants small, green, in low tufts or colonies. Stems erect, to 4–8 mm tall, densely radiculose at the base. Rhizoids brownish, papillose. Leaves small, 0.6–1.4 mm long, broadly lanceolate, somewhat concave; apex acuminate; margin plane or slightly recurved below mid-leaf, remotely denticulate above; costa usually short-excurrent in a stiff projecting subula, brown; upper laminal cells with thin, firm or slightly thickened walls, 30–50 × 10 µm; marginal cells 1 or 2 rows, longer and narrower, forming an inconspicuous border; basal laminal cells short-rectangular, lax, with thin walls. Gemmae as tubers on long rhizoids, globose, bright orange-red, often 200–300 µm; walls not coloured; cells usually not protuberant.

Perichaetial leaves lanceolate or triangular, with revolute margins. Setae 16–20 mm long, brown to red-brown. Capsules inclined-pendulous, ovate-cylindrical, 2–4 mm long, narrow at mouth; operculum low-conical. Peristome well developed; exostome teeth red, with hyaline edges and apices, minutely papillose; endostome segments yellow, as tall as exostome, densely papillose; basal membrane high; cilia 2 or 3, appendiculate. Spores small, 8–10 µm diam. Chromosome number not known.

Found on acidic soils, decomposing litter and on rotting or burnt wood in W.A., Qld, N.S.W., Vic. and Tas. Also in Eurasia, North America, New Guinea and New Zealand.

W.A.: Porongorups, Oct. 1867, *F.Mueller* (MEL). Vic.: Mt Williams, Grampians Natl Park, *J.R.Spence 4399* (MEL).

This highly variable species is most likely to be confused with *G. rubens* which differs in having distinctly bordered leaves, broader laminal cells, and tubers with protuberant cells. *Gemmabryum radiculosum* is also similar, but differs in its longer leaf hairpoints, quadrate basal laminal cells, and in its ecology. The complex of species, including *G. subapiculatum*, *G. klinggraeffii*, *G. radiculosum*, *G. rubens*, *G. sauteri* and *G. tenuisetum*, is in need of a thorough revision.

24. Gemmabryum sullivanii (Müll.Hal.) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 68 (2005)

Bryum sullivanii Müll.Hal., in V.F.Brotherus, *Oefvers. Förh. Finska Vetensk.-Soc.* 35: 48 (1893). T: Mt William, Vic., Nov. 1887, *D.Sullivan* 22; holo: H-BR? n.v.; iso: MEL.

Illustrations: D.G.Catcheside, *Mosses of South Australia* 273, fig. 161 (1980), as *Bryum* sp. A; J.R.Spence & H.P.Ramsay, *J. Adelaide Bot. Gard.* 17: 108–109, fig. 1 (1996), as *Bryum sullivanii*.

Dioicous. Plants tufted, green, yellow-green, brownish green or blackish, glossy when moist. Stems erect, densely and evenly foliate, 2–3 mm tall, tomentose below. Rhizoids reddish brown, finely papillose. Leaves ovate, concave, cymbiform, 1.5–2.0 mm long, ±imbricate when dry to somewhat twisted at the tips; margin erect, plane, smooth; costa thin, percurrent or ending below the obtuse apex; upper laminal cells often more than 60–100 × 20–30 µm, irregularly hexagonal, narrower and longer near the margin (border indistinct), gradually wider and rectangular at base. Gemmae as bulbils, often 1 or 2 in leaf axils.

Perichaetial leaves ovate, acuminate. Setae 10–15 mm long, pale brown. Capsules pendulous, oblong, 2.0–2.5 mm long, abruptly contracted to the seta, symmetrical; mouth constricted, purple; apophysis thick, corrugate; operculum low-conical. Peristome well developed; exostome teeth yellow-brown, finely papillose; endostome segments pale, papillose; basal membrane c. half the height of the exostome; cilia 1–3, appendiculate, sometimes rather reduced. Spores 12–15 µm diam. Chromosome number not known.

Endemic to W.A., S.A., N.S.W., A.C.T., Vic. and Tas. A rare species mainly on damp soil or rock in or near streams, often on limestone.

W.A.: Beedelup Falls, Beedelup Natl Park, *J.R.Spence* 4249, 4255 (NSW). S.A.: Bellevue Heights, Adelaide, July 1988, *D.E.A.Catcheside* (AD). N.S.W.: Cascade, Wagga Wagga, *H.P.Ramsay* R1509 (NSW). A.C.T.: Australian National University, Canberra, *D.G.Catcheside* 68.136 (AD). Vic.: Grange Burn, near Hamilton, *D.G.Catcheside* 77.202 (AD). Tas.: Killafaddy Hill, near Launceston, *W.A.Weymouth* 2706 (NSW).

Gemmabryum sullivanii can be separated from related species by the longer and evenly foliate stems, and by the ovate, concave leaves with a weak costa.

25. Gemmabryum tenuisetum (Limpr.) J.R.Spence & H.P.Ramsay, *Phytologia* 87: 68 (2005)

Bryum tenuisetum Limpr., *Jahresber. Schles. Ges. Vaterl. Cult.* 74(2): 4 (1897). T: Europe; n.v.

Illustrations: A.J.E.Smith, *Moss Flora of Britain and Ireland* 427, fig. 204 (1–5) (1978); D.G.Catcheside, *Mosses of South Australia* 276, fig. 164d (1980), both as *Bryum tenuisetum*.

Dioicous or rarely synoicous. Plants erect, forming tufts, green to brown-green or rarely red-green. Stems 2–10 mm tall. Rhizoids pale, usually yellowish, papillose. Leaves small, narrowly lanceolate, 1–2 mm long; margin serrulate near apex, recurved below; costa usually short-excurrent, red-brown to dark red or purple with age; mid-laminal cells 50–80 × 12–14 µm (4–5: 1), incrassate; marginal cells somewhat longer, narrower and more incrassate but not forming a border; basal laminal cells short-rectangular. Gemmae common, as tubers on long rhizoids, mostly globose, golden-yellow with red walls, 100–200 µm diam.; cells distinctly protuberant.

Perichaetial leaves triangular, with revolute margins. Setae 10–20 mm long, brown to red-brown. Capsules narrowly ellipsoidal, 1.5–2.0 mm long, red; operculum low-conical. Peristome well developed; exostome teeth yellow to brown, papillose; endostome with a high basal membrane; segments broadly perforate; cilia 2 or 3, appendiculate. Spores 12–16 µm diam. Chromosome number not known.

Occurs on soil in Qld and Vic. Also in Eurasia, North America, New Guinea and New Zealand.

Qld: Broadwater Forest Park, 50 km W of Ingham, *I.G.Stone* 24831 & *M.Thorsborne* (MEL). Vic.: Rosanna, *I.G.Stone* 1719 (MEL); Bogong High Plains, *I.G.Stone* 9023 (MEL).

The yellow tubers with red walls are distinctive. This species is most similar to *G. subapiculatum*, but the latter has uniformly red tubers.