GEMMABRYUM

John R. Spence & Helen P. Ramsay

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. pachythecum (Müll.Hal.) J.R.Spence & H.P.Ramsay

Dioicus 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 Brachymeniun belong to Gemmabryum: Bryum sections Alpiniformia, Apalodictyon and Doliolidium and Brachymeniun 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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1 Glen Canyon National Recreation Area, 691 Scenic View Drive, P.O. Box 1507, Page, Arizona 86040-1507, U.S.A.
2 c/- National Herbarium of New South Wales, Royal Botanic Gardens and Domain, Mrs Macquaries Road, Sydney, New South Wales 2000, Australia.


References


1 Leaves rather thick, somewhat fleshy; laminal areolation dense; cells thick-walled; upper laminar 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

2 Plants large; stems usually more than 20 mm long; costa percurrent; leaf apex obtuse to broadly acute (1) ........................................................................................................... 17. *G. laevigatum*

3 Leaves unbordered, strongly concave; lower laminar 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*

4 Gemmae present as rhizoidal tubers; leaf axil bulbils rare (1) .................................................................................................................. 5

5 Tubers sparse, in tumescence on stem or clustered at stem base; leaves strongly imbricate when moist and dry, triangular to ovate, often reddish and glossy; upper and middle laminar cells somewhat incrassate; on damp or wet rock or on soil over rock near water (4) ........................................................................................................... 6

6 Plants golden-brown, glossy, usually lacking red tints; costa long-excurrent in a stiff hairpoint; leaves mostly triangular (5) .................................................................................................................. 3. *G. austrole*

7 Tubers small, mostly < 100 μm long, although a few larger tubers sometimes present (5) ........................................................................................................... 8

8 Median laminar 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*

9 Median laminar 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 axils .......................................................................................... 9
Synoicous or dioicous; tubers brown, red-brown or golden-brown, pyriform, mostly 2 or 3 cells across; cells not protuberant (8:)

G. sauteri

Dioicous; tubers red, globose, mostly > 3 cells across; cells protuberant ............... 16. G. klinggraeffii

Capsules erect; peristome reduced; cilia lacking; bulbils sometimes present in leaf axils (7:)

11. Synoicous; leaves ovate-lanceolate, slightly twisted when dry, green; costa excurrent into a long hairpoint (10:)

G. indicum

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

Leaves bordered; median laminal cells 10–16 μm wide; plants often with red tints; tubers red, mostly clustered at leaf bases (11:)

G. rubens

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

14. Tubers golden-yellow throughout, mostly < 200 μm long; internal cell walls red (13:)

G. tenuisetum

Tubers red to red-brown, of various sizes; cell walls concolorous ........................................ 15

Costa long-excurrent in a long hairpoint; tubers brown to red, mostly < 200 μm long; basal laminal cells mostly quadrate; calcicolous (14:)

16. Bulbils present in axils of upper leaves, mostly on sterile shoots (6:)

20. G. radiculosum

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

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. Synoicous; capsules erect, with a reduced peristome; neck not inflated; leaves somewhat twisted when dry (17:)

G. indicum

Dioicous; capsules inclined to nodding, rarely erect; neck often distinctly inflated; leaves mostly imbricate when dry

G. exile

Stems elongate (> 10 mm); leaves ovate, cuneate near tip of stem, strongly concave; costa percurrent or not reaching apex; bulbils present, with distinct leafy tips (18:)

24. G. sullivani

Stems mostly short (< 10 mm); leaf shapes various, not cuneate, plane or weakly concave; costa generally short- to long-excurrent into a distinct hairpoint; bulbils various ............................................. 20

Leaves ovate, widest in the middle (19:)

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):

G. exile

Bulbils with distinct leafy primordia, generally 1 per axil; capsule neck thick and corrugate, or smooth to wrinkled and tapered to the seta (20:)

22. Bulbils lacking leafy primordia, often many per axil; capsule neck thick, corrugate, abruptly contracted to seta

23.
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. eremaeum
24: Hairpoint usually golden-brown or red; bulbils lacking primordia; apex smooth; stem tubers absent ... ................................................................. 18. G. pachyblephum

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


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


Diocious. 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 zonate, plane, slightly revolute near base; costa excurrent but not forming a long hairpoint or arista, yellowish; upper laminal cells long and narrow, to 140 x 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.


Bryum baileyi Broth., Öfvers. Förh. Finska Vetensk.-Soc. 33: 100 (1891). T: Freshwater Creek, Trinity Bay, Qld, 1889; F.M.Bailey 646; holo: H-BR; iso: BRI, 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-tinted. 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 cells; justacostal cells elongate. Gemmae usually present as red or brown pyriform to irregularly globose rhizoidal tubers, 40–100 µm; leaf axil bulbs sometimes present, with leafy primordia.

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.


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 gemmee.


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


Diocious. 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 µm wide at insertion, excurrent in a stiff hairpoint; upper laminal cells rhomboidal, small and incrassate, 30–40 × 10 µm (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 µm 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 µm 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.


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.


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.

Diocious. 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 × 8–12 µm (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.


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.


Dioicus. 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 lamellate; 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.


Gemmabryum cheelii appears to be related to the Northern Hemisphere Bryum muehlenbeckii Bruch & Schimp., but differs in its excurrent costa and much broader laminar 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 laminar cells parallel to the costa; acute leaf apex with a short, stout point; rhizoidal gemmae rarely produced.


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

**Bryum lonchoneuron Müll.Hal., Hedwigia 37: 91 (1898).** T: Richmond R., N.S.W., 1881, Captain Stackhouse; holotype: 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.; holotype: MEL; isotype: H-BR, NSW.

**Bryum wattsii Broth., Oekr. 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); isosynonym: NSW (Watts 1096); Watts 1107 not seen. [originally published as B. microthecium, nom. illeg. (later homonym), republished as B. wattsii].


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. wattsii) (1970); D.G.Catcheside, Mosses of South Australia 274, fig. 162 (1980), as Bryum chrysoneuron.


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. wattsii) (1970); D.G.Catcheside, Mosses of South Australia 274, fig. 162 (1980), as Bryum chrysoneuron.


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


**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 curvicolium Mitt. Handb. New Zealand Fl. 442 (1867). T: New Zealand, Travers s.n.; isotype K.

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


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


Illustrations: H.Ochi, J. Fac. Educ. Tottori Univ. Nat. Sci. 21: 29, fig. 13A–H (isotype of B. erythrocarpoides); fig. 13I–L (syntype Watts 103, as B. diversisulcata); 30, fig. 14A–G (type of B. kiaumae); 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 zentire; costa strong, reddish or brown, short-excurrent as a rigid reddish or brownish arista; upper laminal cells narrowly rhomboidal, incrassate, 40–80 × 10–15 µm (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.


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.


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.


Dioicous. Plants in dense tufts, 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 bulbls 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.


Australian collections lack sporophytes. However, the strong, long-excurrent, hyaline costa, recurved leaf margin, distinct upper leaf border, ovate-lanceolate, loosely set and somewhat shrunkened 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*.


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

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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 bulbls, 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, fide 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, Malesia, Japan, New Caledonia, Lord Howe Is. and New Zealand.


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


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 nearly 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, papilllose, 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.


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.


 Dioicus. 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, erecto-patent, 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.


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. pachyphyllum* and *G. coronatum* the neck is strongly corrugated and darker. *Gemmabryum dichotomum* 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).


Dioicus. 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-ellipsoidal, 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; perichaetal 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.


Documented by Catcheside (1980) as *Bryum* “species C”, this is related to the more widespread *G. pachythecum*. However, the bulbils of *G. eremaeum* have small, peg-like primordia at the apex, separated by a groove, while those of *G. pachythecum* 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. pachythecum*.


Dioicus. 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.


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.


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 spreasting 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.


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.


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_.

Synoicous. Plants small, to 10 mm tall, densely tufted, dark green or yellowish, slightly glossy. Stem 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, 30–50 × 10–15 µm (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.


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 synoicous sexuality. Australian collections have bulbils with small laminate leaf primordia and rhizoidal tubers, characters not reported previously for the species.


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 45–60 × 10–15 µm (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.


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.


**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 Mts, Vic., 1855, F.Müller; syn: BM; Alps, Tas., Stirling; syn: MEL.


Diocicous. 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 incrisate, 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.


**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.


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

Dioicus. 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, fide 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.


In Australasia, G. pachythecum 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 the primordia on the bulbils.


*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 358 (NSW).

*T*: *Crawley*, W.A., 10 Aug. 1945, A.D.Banwell, holotype: MEL; iso: PERTH


Dioicus. 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.

S.A.: Meningie, *L.D.Williams* 112 (AD).  
Vic.: Moleside Ck, *A.C.Beaugleho* 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 dioicus, capsules are frequently produced.


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


Dioicus. 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 shrunken 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 laminar 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.


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.


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-spreadling, 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 bulbs 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.


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.


Dioicous or synoicoic. 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), incrasate, 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.


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.


Bryum caespiticosides Müll.Hal., Hedwigia 37: 89 (1898).


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 rotten or burnt wood in W.A., Qld, N.S.W., Vic. and Tas. Also in Eurasia, North America, New Guinea and New Zealand.


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.

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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 laminar 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.


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


Dioicus 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-laminar cells 50–80 × 12–14 µm (4–5: 1), incrassate; marginal cells somewhat longer, narrower and more incrassate but not forming a border; basal laminar 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.


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