

## MACROMITRIUM

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*Macromitrium* Brid., *Muscol. Recent.*, Suppl. 4: 132 ('1819') [1818]; from the Greek *macro* (large) and *mitre* (a headband or head-dress), in reference to the shape of the calyptra.

Type: *M. aciculare* Brid. [= *M. pallidum* (P.Beauv.) Wijk & Margad.]

Dioicous, pseudautoicous (phylloidioicous) with epiphytic dwarf males, or autoicous. Plants small to robust. Stems prostrate to ascending, with erect to ascending branches, forming spreading mats on trees, sometimes on rock, dull or glossy to lustrous, green to olive-green or rusty brown above, bright green, yellow-orange or golden-brown below, with a dark brown tomentum. Rhizoids smooth. Stem and branch leaves similar or different. Branch leaves variously crisped, twisted-contorted or spirally twisted around the branch when dry, spreading when moist, lanceolate to ovate-lanceolate, or ligulate to ligulate-lanceolate, or lingulate, usually unistratose, sometimes bistratose or multistratose in upper part of leaf; apex usually acute to acuminate; costa strong, reaching apex or failing just below apex, or excurrent, rarely with a piliferous hyaline point, the apex occasionally fragile, the abaxial surface with elongate cells exposed along its entire length; upper laminal cells rounded, uni- or pluripapillose, with bulging (mammillose) or smooth walls; mid-laminal cells variable; basal laminal cells often elongate, rectangular, smooth or with a single spiculate papilla. Gemmae rarely present.

Perigonial and perichaetial leaves differentiated or not. Calyptra large, not enclosing the capsule at maturity, mitrate, splitting around the base into one or many lobes, conical,  $\pm$ plicate, smooth, glabrous or hairy. Setae short to long, usually twisted to the left, smooth. Capsules on erect secondary branches, exserted or emergent, ovoid to oblong, cylindrical, ellipsoidal or contracted around the mouth, ribbed or smooth; exothecial cells variable; stomata few to many, superficial, basal on capsule; operculum conico-rostrate. Peristome single, double or absent. Spores unicellular, isomorphic or anisomorphic, papillose.

*Macromitrium* is a large genus of up to 350 species that are widely distributed in tropical and subtropical regions worldwide, but rarer at southern-temperate latitudes. It is represented by 21 species and an additional subspecies in Australia, occurring primarily in the eastern States; 11 species are endemic. One species (*M. archeri*) is known from Western Australia, and the genus is not known from South Australia and the Northern Territory.

*Macromitrium* occurs in lowland and upland rainforest from sea level to 1500 m and from northern Queensland to Tasmania. The genus is tolerant of dry microhabitats, being adapted to high light intensity and desiccation, with a number of species occurring in the canopy or on the fringes of rainforest. Two species, *M. brevicaulis* and *M. longirostre*, occur on coastal rocks, and several have adapted to urban environments being found on the bark of exotic trees in parks or at roadsides.

The genus was divided into five subgenera by Brotherus (*Nat. Pflanzenfam.*, 2nd edn, 11: 10–49, 1925). Subg. *Macrocoma* was raised to generic level by Grout (1946), and all remaining Australian species were placed, by Brotherus, in the very large subg. *Eumacromitrium* (sect. *Goniostoma* and sect. *Leiostoma*). Regional revisions have been provided for New Zealand (Vitt, 1983), Australia (Vitt & Ramsay, 1985a, b) and Papua New Guinea (Vitt *et al.*, 1995).

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Distinct 'species groups' can be recognised among the Australian representatives, although these have not been assigned formal taxonomic status.

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|----|--|---------------------------|
| 1  | Branch leaves ending in a piliferous hyaline point; upper parts of leaves bistratose to multistratose .....  | <b>6. M. diaphanum</b>    |
| 1: | Branch leaves ending in a non-hyaline cusp, apiculus or mucro, acute, obtuse or acuminate; upper parts of leaves usually unistratose .....                                     | 2                         |
| 2  | Branch leaves spirally twisted, erect-curved or erect-whorled around the branch when dry (1:).....   | 3                         |
| 2: | Branch leaves funiculate (rope-like) and arranged in spirals or not; individual leaves twisted-flexuous; apices decurved to recurved-twisted or tightly inrolled when dry..... | 7                         |
| 3  | Branch leaves spirally twisted around the branch, with apices twisted outward when dry; setae thick, twisted to the right (2).....   | <b>17. M. longirostre</b> |
| 3: | Branch leaves erect-curved or erect-whorled around the branch, with apices straight or incurved when dry; setae thin, twisted to the left .....                                | 4                         |
| 4  | Upper laminal cells smooth; branch leaves erect-curved when dry, with the leaf apex sharply contracted to a cusp; costa ending below apex (3:).....                            | <b>19. M. repandum</b>    |
| 4: | Upper laminal cells papillose; branch leaves tightly spirally twisted or erect-whorled when dry; leaf apex mucronate; costa excurrent.....                                     | 5                         |
| 5  | Basal laminal cells short, rounded to elliptical; fusiform gemmae frequent (4:).....   | <b>4. M. brevicaule</b>   |
| 5: | Basal laminal cells rectangular; gemmae absent .....   | 7                         |
| 6  | Branch leaves twisted-curved; basal laminal cells smooth; seta short (< 1.3 mm); capsule ±immersed in the perichaetium (5:).....   | <b>3. M. brachypodium</b> |
| 6: | Branch leaves erect-whorled; basal laminal cells papillose-tuberculate; seta longer (3–7 mm); capsules exserted .....  | <b>2. M. aurescens</b>    |
| 7  | Upper branch leaf cells smooth and flat, sometimes slightly bulging or mammillose, rarely with 1 or more small papillae (2:).....  | 8                         |
| 7: | Upper branch leaf cells uni- or pluripapillose; papillae large and obvious or, if small and inconspicuous, the walls strongly bulging.....                                     | 11                        |

- 8 Branches to 10 mm long; branch leaves 1.2–2.0 mm long; basal laminal cells evenly thickened, elongate-rectangular with straight lumina; all cells smooth; autoicous (7).....9
- 8: Branches to 32 mm long; branch leaves 1.5–3.0 mm long; basal laminal cells unevenly thickened and elongate; lumina rather irregularly curved; some cells with short or long papillae; dioicous, pseudautoicous or sex unknown ..... 10
- 9 Branch leaves gradually narrowed to a long decurved subulate arista entirely composed of costa (8) ..... **7. M. dielsii**
- 9: Branch leaves abruptly narrowed to an acute or short-acuminate apex (some leaves short-cuspidate); costa ending in the apex or short-excurrent ..... **18. M. microstomum**
- 10 Branch leaves gradually narrowed to a long-acuminate apex; costa excurrent and forming the acumen; pseudautoicous (8:)..... **9. M. funiforme**
- 10: Branch leaves abruptly narrowed to an acute or short-cuspidate apex; costa ending in the cusp or apex, rarely excurrent ..... **8. M. exsertum**
- 11 Branch leaves lanceolate (7:)..... 12
- 11: Branch leaves oblong to ligulate, sometimes with a broader ±ovate base ..... 16
- 12 Upper laminal cells bordering the costa flat, smooth and elongate, strongly differentiated from remainder of quadrate densely papillose upper cells (11)..... **21. M. subulatum**
- 12: Upper laminal cells bordering the costa quadrate, densely papillose, similar to remainder of upper cells ..... 13
- 13 Mid-leaf and basal cells smooth; calyptra glabrous or hairy; cells in upper half of leaf in distinct longitudinal rows (12:)..... 14
- 13: Mid-leaf cells bulging or unipapillose; many basal cells with a short or spiculose papilla; calyptra hairy; cells in upper half of leaf usually not in longitudinal rows ..... 15
- 14 Calyptra densely hairy; perichaetial leaves much shorter than vegetative branch leaves, lingulate, inconspicuous; cells at mid-leaf ±short-rectangular, with straight lumina (13)..... **12. M. incurvifolium**
- 14: Calyptra glabrous to sparsely hairy; perichaetial leaves much longer than vegetative branch leaves, erect, sheathing the seta; cells at mid-leaf rectangular with curved lumina ..... **14. M. leratii**
- 15 Upper branch leaf cells bulging, weakly pluripapillose; cells at mid-leaf short-rectangular, bulging; rusty brown tones evident in young growth; perichaetial leaves erect, sheathing, strongly differentiated (13:) ..... **20. M. stoneae**
- 15: Upper branch leaf cells densely pluripapillose; cells at mid-leaf rectangular, strongly unipapillose; golden tones evident in young growth; perichaetial leaves ±erect-curved, subsheathing, scarcely differentiated ..... **10. M. hemitrichodes**
- 16 Upper branch leaf cells strongly bulging-conical, unipapillose; marginal cells smaller than those near the costa; mid-leaf cells strongly unipapillose; basal cells elongate, those at the very base smooth; capsules 4–8-plicate on a very long slender seta; branch leaves twisted-decurved; peristome absent or fragmentary (11:) ..... **1. M. archeri**
- 16: Upper branch leaf cells bulging, smooth to low-pluripapillose; marginal cells similar in size to those near the costa; mid-leaf cells bulging and low-papillose; basal cells rectangular to elongate, those at the very base smooth; capsules 8-plicate or with a distinct darkened non-plicate often collapsed rim; setae short or long; branch leaves twisted-inrolled; peristome present or absent ..... 17
- 17 Capsules cylindrical, on short setae, emergent to short-exserted; plants robust; mature branches often detached from stem; calyptra densely hairy (16:) ..... **13. M. involutifolium**
- 17: Capsules ovate to elliptic-oblong, on long setae, long-exserted; plants slender; branches remaining attached to stem; calyptra glabrous or with a few hairs ..... 18
- 18 Peristome a low basal membrane; capsule rim 8-plicate (17:)..... 19
- 18: Peristome of 16 erect teeth; capsule rim collapsed or erect, never 8-plicate ..... 20
- 19 Autoicous; branch leaves broadly ligulate, the upper portions strongly inrolled, with most apices hidden in leaves, obtuse or broadly acute; costa usually ending below the apex (18)..... **5. M. caloblastoides**
- 19: Pseudautoicous; branch leaves narrowly ligulate, the upper portions somewhat inrolled; most apices rather exposed to one side of leaf, acute to apiculate; costa short-excurrent in most populations ..... **15. M. ligulaefolium**

- 20 Capsule mouth collapsed; exothelial cells of rim elongate; calyptra lobed at base to cucullate, usually with 1–4 slits (*18:*)..... **16. *M. ligulare***
- 20: Capsule mouth erect; exothelial cells of rim rounded-quadrate; calyptra deeply lobed to just below the rostrum, with 10–15 slits ..... **11. *M. hortoniae***

### 1. *Macromitrium archeri* Mitt., in J.D.Hooker, *Fl. Tasman.* 2: 183 (1859)

T: Cheshunt, Tas., [*W.*] *Archer*; lecto: NY, *fide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 406 (1985); isolecto: MEL; Kermadie Rivulet, Tas., *A.F.Oldfield*; syn: NY.

*Macromitrium pusillum* Mitt., in J.D.Hooker, *Fl. Tasman.* 2: 183 (1859). T: Cataract Hill, Tas., *W.Archer*; holo: NY.

*Macromitrium asperulum* Mitt., in J.D.Hooker, *Fl. Tasman.* 2: 376 (1859). T: locality unknown, Tas., [*R.W.?*] *Lawrence*; lecto: NY, *fide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 406 (1985); *loc. id.*, *R.C.Gunn*; syn: NY.

*Macromitrium muelleri* Hampe, *Linnaea* 30: 634 (1860). T: Sealers Cove, Vic., *coll. unknown*; lecto: BM, *fide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 406 (1985); isolecto: BM.

*Macromitrium fimbriatum* Hook.f. & Wilson ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 100 (1906), *nom. nud.* (in synonym.).

Illustrations: D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 407, figs 239–241; 408, figs 250–251, 253, 255–256 (1985).

Pseudautoicous. Plants small, dull, orange-green to dark golden-green above, darker below; branches slender, to 10 mm tall. Branch leaves irregularly twisted-curved to loosely curved around the branch, not inrolled or funiculate when dry, straight and spreading when moist, ligulate to linear-lanceolate, 1.4–1.8 mm long, weakly keeled; apex acute to apiculate-acuminate; margin plane or slightly reflexed, entire; costa excurrent, filling apiculus; upper laminal cells rounded-quadrate, 9–13  $\mu\text{m}$  wide near costa, elliptical and c. 7  $\mu\text{m}$  wide at margin, strongly bulging with a large conical central papilla, less bulging at margin; mid-laminal cells strongly bulging, rhomboidal to rectangular, 14–25  $\times$  10–12  $\mu\text{m}$ , thick-walled, with straight to  $\pm$ curved lumina, sometimes with a central papilla; basal cells flat, elongate, 12–40  $\times$  5–7  $\mu\text{m}$ , thick-walled, smooth.

Perichaetial leaves inconspicuous, erect, stiff, ovate, 1.4–1.6 mm long, with a short-acuminate apex; costa ending in apex or short-excurrent; laminal cells similar to those of vegetative leaves but less papillose and longer above. Calyptra narrowly conical, evenly lacerate below, faintly plicate, smooth, glabrous. Setae erect, slender, 2.8–8.0 mm long. Capsules long-exserted, ovoid, 1.2–2.0 mm long, 4-angled to slightly 8-plicate just below the mouth, smooth but with a long wrinkled neck. Peristome absent or fragmentary. Spores distinctly anisomorphic, 15–29  $\mu\text{m}$  diam.  $n = 9$ , *fide* H.P.Ramsay & D.H.Vitt, *J. Hattori Bot. Lab.* 61: 22–23 (1986).

This endemic moss is abundant only in Tas.; it also occurs in south-western W.A. (the only *Macromitrium* known from that State), eastern Qld, eastern N.S.W. and Vic. An epiphyte on tree trunks and canopy branches in tropical and cool-temperate rainforest.

W.A.: Castle Rock, Porongurup Natl Park, *R.Wyatt & A.Stoneburner 4354* (PERTH). Qld: E slope of Thornton Peak, *D.H.Norris 44008* (NSW). N.S.W.: Currembene Ck, *W.B.Schofield 79101* (NSW). Vic.: Gildberg, Feb. 1908, *J.R.Murdock* (NSW). Tas.: L. Barrington, near Forth Falls, *D.H.Norris 27308* (HO).

*Macromitrium archeri* is characterised by capsules that are 4-angled to slightly 8-plicate just below the mouth, upper and mid-laminal cells with single, strongly conical papillae, smooth basal cells, strongly apiculate branch leaves, orange-green colouration and the glabrous calyptra.

### 2. *Macromitrium aurescens* Hampe, *Linnaea* 30: 633 (1860)

T: Delabechiam, Keppel Bay, Qld, *F.Mueller*; holo: not located; iso: H-BR, MEL, NSW.

*Macromitrium sordide-virens* Müll.Hal., *Linnaea* 37: 153 (1872). T: Brisbane R., Qld, 1864, *A.Dietrich*; lecto: H-BR, *fide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 383 (1985); isolecto: MEL.

*Macromitrium cylindromitrium* Müll.Hal., *Hedwigia* 37: 146 (1898). T: Ennogera, Qld, *F.M.Bailey s.n.*, in Herb. Brotherus 1890; lecto: H-BR, *fide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 383 (1985); isolecto: MEL, NSW; Wide Bay, Gayndah, Qld, 1874, *E.Daemel s.n.*, in Herb. Godeffroy, Hamburg; syn: H-BR.

Illustrations: D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 384, figs 152–162; 386, figs 164–168 (1985).

Pseudautoicous. Plants medium-sized to large, robust, dull, pale green above, dark brown below. Stems with dense stout erect-curved branches to 10 mm tall. Branch leaves irregularly erect-curved to twisted-decurved, stiffly and spirally twisted to spirally whorled around the branches when dry, erect-spreading when moist, oblong, very strongly keeled, conduplicate, 2.0–2.6 mm long; apex stoutly mucronate; mucro hooked, cucullate; costa very conspicuous, strong, excurrent in the mucro; upper laminal cells bulging, rounded-quadrate, 7–13  $\mu\text{m}$  wide, papillose, with 3–5 small conical to forked papillae per cell; mid-laminal cells rounded to elliptical, more elongated towards the base, 9–11  $\mu\text{m}$  wide, with 1 or 2 conical to forked papillae per cell; basal laminal cells restricted to 3–7 tiers at insertion, flat, short-rectangular, 15–35  $\times$  10–15  $\mu\text{m}$ , smooth; marginal cells longer.

Perichaetial leaves short, inconspicuous. Calyptra slender-conical, evenly split 1/3–1/2, plicate, smooth, densely hairy with fine long-flexuose hyaline hairs. Setae flexuose-erect, slender, 3.2–7.0 mm long. Capsules short-exserted, cylindrical, 1.9–3.0 mm long. Peristome single; exostome teeth 16, well developed, erect-curved, linear-lanceolate, finely papillose; endostome absent. Spores anisomorphic, 15–34  $\mu\text{m}$  diam., finely papillose. Chromosome number not known.

Endemic to north-eastern Australia; common north of Townsville, but also extending south and inland from the coast into northern N.S.W. Frequent, especially on rough bark; occurs in gallery forests dominated by *Melaleuca* spp., *Grevillea robusta* and *Casuarina* species.

Qld: Coolum, *J.Windolf 1114* (BRI); Keppel Bay, *F.Mueller* (NSW); Ravenshoe, *D.H.Norris 42381* (NSW); Mt Lindesay, *P.I.Forster PIF 2405* (BRI). N.S.W.: 37 km S of Gloucester, *H.Streimann 43950* (CANB).

*Macromitrium aurescens* is closely related to *M. brevicaule*; both have leaves that are broad, oblong, conduplicate, mucronate with conspicuous costae, and have densely papillose upper laminal cells and short basal cells. It is readily distinguished from all other species by the conduplicate leaves that are whorled when dry, each leaf having a hooked, cucullate mucro. Unlike *M. brevicaule*, it lacks gemmae, and its distribution differs from that of *M. brachypodium*, a common species in Lord Howe Island, but known from only one collection in north-eastern Qld.

### 3. *Macromitrium brachypodium* Müll.Hal., *Bot. Zeitung (Berlin)* 15: 778 (1857)

T: Île des Pins, New Caledonia, *Cuming*; lecto: H-BR, *vide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 387 (1985).

Illustrations: D.H.Vitt & H.P.Ramsay, *op. cit.* 389, figs 171–180; 390, figs 181–186 (1985).

Dioicous (pseudautoicous with dwarf males). Plants small, in dense spreading mats. Stems slender, with branches to 5 mm long, simple or branched, olive-green above, dark brown below. Branch leaves twisted-contorted, somewhat curved around the branch when dry, straight and erect-spreading when moist, oblong-ligulate, 1.5–2.5 mm long; apex obtuse to mucronate; margin plane; costa strong, ending in the apex; upper laminal cells broad, rounded, somewhat bulging, 7–9  $\mu\text{m}$  wide, unistratose, with small low irregular papillae; basal laminal cells rectangular near insertion, 10–13  $\times$  5–7  $\mu\text{m}$ , smooth, flat, longer near the margin and forming a distinct border of 5–10 rows.

Perichaetial leaves ligulate-oblong, 2.5–2 mm long. Calyptra mitrate, short-conical, fimbriate-lacerate, smooth, plicate, glabrous. Setae short, to 1.3 mm long. Capsules emergent to short-exserted, oblong, 1.7–2.0 mm long, smooth. Peristome single; exostome teeth 16, linear-lanceolate; endostome absent. Spores anisomorphic, 14–29  $\mu\text{m}$  diam.  $n = 8$  (Lord Howe Is.), *vide* H.P.Ramsay & D.H.Vitt, *J. Hattori Bot. Lab.* 61: 41 (1986).

In mainland Australia, known only from a single collection near Townsville, north-eastern Qld. Also in Lord Howe Island and New Caledonia.

Qld: Mt Elliot, near Townsville, *coll. unknown* (BM).

*Macromitrium brachypodium* is distinguished from other Australian species by the densely papillose upper laminal cells, the short, smooth basal cells, short setae and capsules that are small, immersed to slightly emergent, smooth, non-plicate and with a gaping mouth when dry.

Its occurrence in mainland Australia has yet to be confirmed, and recent efforts to re-collect this species in the Townsville area have not been successful.

#### 4. *Macromitrium brevicaule* (Besch.) Broth., *Nat. Pflanzenfam.* I, 3: 486 (1903)

*Macromitrium brevicaule* Besch., *Ann. Sci. Nat. Bot.*, sér. 5, 18: 211 (1873). T: Balade, [New Caledonia], *Vieillard 1734*; lecto: BM, *vide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 381 (1985); Noumea, [New Caledonia], *Balansa 2563*; syn: BM.

*Macromitrium watsii* Broth., *Oefvers. Förh. Finska Vetensk.-Soc.* 40: 81 (1898). T: E of Balina [Ballina], N.S.W., *W.W.Watts 329*; lecto: H-BR, *vide* D.H.Vitt, *J. Hattori Bot. Lab.* 54: 65 (1983); isolecto: NSW; *loc. id.*, *W.W.Watts 719, 1041*; North Ck, N.S.W., *W.W.Watts 1108*; Wollongong, N.S.W., *W.W.Watts 109*; syn: H-BR, *vide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 406 (1985); isosyn: NSW (*W.W.Watts 719, 109*).

*Macromitrium mucronulatum* Müll.Hal., *Hedwigia* 37: 146 (1898). T: Burpengary, Qld, 1888, *C.Wild*, in *Herb. Brotherus*; holo: H-BR; iso: NSW.

Illustrations: D.H.Vitt, *J. Hattori Bot. Lab.* 54: 54, figs 145, 149–150; 66, figs 179–188 (1983); H.Streimann, *The Mosses of Norfolk Island* 115, fig. 51 (2002).

Pseudautoicous. Plants slender, pale yellow-green above, dull green below; branches to 3 (–7) mm tall. Stem leaves erect-twisted when dry, spreading when moist, ovate-lanceolate, 0.8–1.0 mm long, without a differentiated border; apex bluntly acute or obtuse; upper laminal cells low-papillose; basal laminal cells rounded, smooth, clear. Branch leaves conduplicate, spirally arranged, stiffly flexuose when dry, erect-spreading, straight with a reflexed apex when moist, oblong, strongly keeled, 1.0–1.8 mm long; apex obtuse, often mucronate; costa excurrent in a mucro or ending just below the apex, smooth; upper laminal cells bulging, subquadrate, 8–12 µm wide, thin-walled, obscured by low dense simple or forked papillae, with 1 or 2 rows of low-papillose or smooth marginal cells; mid-laminal cells similar; interior basal laminal cells flat, 16 × 4–6 µm; cells nearer margin 10–24 × 5–10 µm, ±hyaline, forming an indistinct border. Fusiform gemmae on leaves, cylindrical, 8–15 cells long; outer walls coarsely and irregularly papillose.

Calyptra covering c. half of urn, fimbriate, short-lacerate with age, smooth, glabrous. Perichaetial leaves undifferentiated. Setae 3–5 mm long. Capsules exserted, narrowly ovoid, 1.3–1.7 mm long, smooth, with 8 ribs below the small mouth. Peristome single; exostome teeth 16, erect to inflexed, irregular, 60–160 µm long, blunt, finely papillose; endostome absent. Spores slightly anisomorphic, 18–20 and 20–25 µm diam., thick-walled, finely papillose to smooth. *n* = 10 (Norfolk Is.), *vide* H.P.Ramsay & D.H.Vitt, *J. Hattori Bot. Lab.* 61: 19 (1986).

Occurs on the eastern coast of Australia from central Qld to south-eastern N.S.W.; also in Lord Howe Island, Norfolk Island, northern New Zealand and New Caledonia. Restricted to rocks and tree trunks subject to salt spray in coastal habitats; occurs as large populations on tree trunks in closed forest behind the sand dune-beach zone and on cliff faces in protected situations.

Qld: Burpengary Is., *C.J.Wild* (NSW). N.S.W.: East Ballina, *W.W.Watts 719* (NSW); Manly, Sydney, *W.W.Watts 4282* (NSW).

This moss is readily distinguished by the very short, erect branches, the stiff, flexuose, spirally arranged branch leaves that are broad and oblong with mucronate apices, and by the strong, conspicuous costae. The combination of low-pluripapillose upper laminal cells and short basal laminal cells distinguishes this from most Australian species, with the exception of *M. aurescens*. However, the latter has hairy rather than glabrous calyptrae as in *M. brevicaule*. Leaf gemmae are frequent on specimens of *M. brevicaule*; the only other Australian species having these structures (but only rarely) is *M. ligulaefolium*.

#### 5. *Macromitrium caloblastoides* Müll.Hal., *Hedwigia* 37: 151 (1898)

T: locality unknown, Qld, *F.M.Bailey*; holo: H-BR; iso: NSW.

*Macromitrium dimorphum* Müll.Hal., *Hedwigia* 37: 152 (1889). T: locality unknown, Qld, 1888, *F.M.Bailey*; holo: H-BR.

Illustrations: D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 358, figs 73–83; 359, figs 84–89 (1985).

Autoicous. Plants slender, very dull, pale green above, darker green-brown below. Stems with short erect branches to 5 (–10) mm tall. Branch leaves spreading-curved, upper portion strongly and tightly inrolled when dry with apices hidden, flexuose-spreading with cucullate incurved apices when moist, very strongly keeled, broadly ligulate to oblong, 1.5–2.5 mm long; apex bluntly and broadly acute; margin broadly reflexed, entire below, minutely crenulate above; costa ending in or just below apex; upper laminal cells strongly bulging, rounded, 9–12  $\mu\text{m}$  wide, thin-walled, with thickened corners, smooth or sometimes with 1–4 small papillae, the cells uniform across leaf, more than 18 cell rows from costa to margin; mid-laminal cells in longitudinal rows, strongly bulging, rounded to elliptical, 10–12  $\mu\text{m}$  wide, smooth; basal laminal cells smooth or somewhat bulging, elongate-rectangular, 14–35  $\times$  7–10  $\mu\text{m}$ , lumina rather irregularly curved, unevenly thickened, sometimes with a single low papilla.

Calyptra broadly conical, gradually contracted to the rostrum, plicate, divided into several fine lobes, glabrous. Perigonia on short branches near the perichaetia. Perichaetial leaves curved-erect to loosely but stiffly erect, ovate-lanceolate to oblong, 1.2–1.5 mm long, with an acuminate to acute apex. Setae stiffly flexuose to erect, thin, twisted to the left, 5–7 mm long. Capsules long-exserted, ovoid to oblong-ellipsoidal, 1.0–1.5 mm long, smooth, 8-plicate below the narrowed puckered mouth, darker below and at the rim. Peristome single, greatly reduced or absent; exostome a low papillose membrane 1–few cells high; teeth 16, inconspicuous; endostome absent. Spores isomorphic, 18–28  $\mu\text{m}$  diam., finely papillose.  $n = 11$ , *vide* H.P.Ramsay & D.H.Vitt, *J. Hattori Bot. Lab.* 61: 16–17 (1986).

Endemic to eastern Australia, from north-eastern Qld to south-eastern N.S.W.; most common in south-eastern Qld and north-eastern N.S.W. Never abundant, it occurs in drier gallery forest dominated by *Eucalyptus*, *Casuarina* and *Leptospermum*. In many areas it is ecologically isolated from its sister species *M. ligulaefolium* and is not part of the ravine rainforest vegetation.

N.S.W.: Ballina, *W.W.Watts* 4025 (NSW); Teven, *W.W.Watts* 4287 (NSW); Victoria Park, Alstonville, *H.P.Ramsay* 35/81 (NSW).

Distinguished by being autoicous, with branches to 10 mm tall, broadly ligulate to oblong, bluntly cucullate leaves that are tightly inrolled with hidden apices, capsules that are puckered at the mouth and distinctly 8-plicate, a peristome that is single, greatly reduced or absent, and isomorphic spores.

## 6. *Macromitrium diaphanum* Müll.Hal., *Linnaea* 37: 151 (1872)

T: Brisbane R., [Qld], 1861, *A.Dietrich*; neo: NY, *vide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 391 (1985).

*Macromitrium circinclidum* Müll.Hal., *Hedwigia* 37: 145 (1898). T: Richmond R., N.S.W., 1880, *Miss Hodgkinson*, in *Herb. Melbourne*; holo: (not located in MEL); iso: H-BR.

Illustrations: D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 393, figs 188–196; 408, figs 252, 254 (1985).

Pseudautoicous. Plants slender, dull, silvery green, darker below; branches short, simple, to 5 mm tall. Branch leaves erect-curved and somewhat curved around the branch when dry, stiffly spreading when moist, oblong-ovate to oblong-lanceolate, strongly keeled, 2.0–2.5 mm long, strongly reflexed, narrowing to an irregularly notched awned apex, the awn flexuose, broad below, sometimes broken off, hyaline; costa strong, excurrent, running the length of the awn, smooth; upper laminal cells uni-, bi- or tristratose, bulging, rounded, 10–14  $\mu\text{m}$  wide, thick-walled, irregularly papillose, the papillae pronounced, irregular, forked or simple; mid-laminal cells 8–10  $\mu\text{m}$  wide, unipapillose proximally; basal laminal cells rhomboidal-elongate to rectangular, to 35  $\mu\text{m}$  long, thick-walled, smooth or with occasional scattered tall spiculate papillae, with a basal border of 1 row of shorter broader thin-walled cells.

Perichaetial leaves erect, ovate, 2.3–2.5 mm long, ending in a slender awned hyaline apex; upper laminal cells rhomboidal, very thick-walled, smooth; basal cells elongate, continuing higher than in branch leaves. Calyptra 3–4 mm long, with numerous slits, smooth, densely hairy, the hairs slender and flexuose. Setae erect, twisted, 4–8 mm long. Capsules exserted, fusiform-elliptical, 2.0–2.6 mm long, 8-plicate in the upper third; rim darker and narrow. Peristome absent. Spores anisomorphic, 19–50  $\mu\text{m}$  diam., papillose. Chromosome number not known.

Endemic to eastern Qld and north-eastern N.S.W. (as far south as Taree). A rare species not known from ravine rainforest. It is thought to be xerotolerant, occurring with *M. aurescens* in gallery forest. In the border region of Qld and N.S.W. it often occurs as an epiphyte on *Casuarina cunninghamiana* along streams.

Qld: North Toohey Ck, *H.Flecker 3361* (CANB); Proserpine, *H.Streimann 37716* (CANB); Burpengary, Nov. 1887, *C.J.Wild* (BRI); Eungella Dam Rd, near Mackay, *D.H.Norris 38407* (NSW). N.S.W.: near Ballina, *W.W.Watts 4060* (NSW).

Extensive collections were made in north-eastern N.S.W. and south-eastern Qld in the early twentieth century, but it is likely that the destruction of habitat for agriculture may be responsible for its rarity today.

*Macromitrium diaphanum* is a very distinctive species with leaves ending in a hyaline awn. The awn varies considerably in size and shape, sometimes with 2 or 3 distal projections, sometimes with a principal awn and 1 or 2 accessory hyaline projections. Other diagnostic features are the papillose upper laminal cells, the densely hairy, elongate calyptra, the fusiform, non-peristomate capsule, the unistratose basal laminal cells mostly with a single, tall, spiculate papilla and the silvery green colouration of the plants.

#### **7. *Macromitrium dielsii* Broth. ex Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 339 (1985)**

T: Bellenden Ker Ra., Qld, *D.H.Vitt 27491*; holo: ALTA; iso: NSW.

Illustrations: D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 340, figs 4–14; 342, figs 15–21 (1985).

Autoicous. Plants small, very lustrous, pale golden-green above to dark rusty brown below. Stems creeping, with short erect branches to 5 mm tall. Branch leaves funiculate, in spirals, strongly twisted-contorted when dry, flexuose-spreading when moist, narrowly lanceolate, 1.5–1.7 mm long, with a long decurved arista; costa excurrent, filling apex; upper laminal cells unistratose,  $\pm$ flat, quadrate,  $8\text{--}13 \times 6\text{--}7 \mu\text{m}$ , smooth; mid-laminal cells  $\pm$ rectangular-elliptical,  $12\text{--}25 \mu\text{m}$  wide, smooth; basal laminal cells flat, narrow, rectangular,  $20\text{--}50 \mu\text{m}$  long, evenly thick-walled, smooth. Perichaetial leaves erect, loosely subsheathing, lanceolate, 2.7–3.1 mm long; upper portion flexuose; cells elongate; costa long-excurrent.

Calyptra indistinctly plicate, splitting by 1–several long slits, smooth, glabrous. Setae straight to flexuose, twisted to the left, thin, 12–16 mm long. Capsules long-exserted, oblong-elliptic to ovoid, 1.4–1.6 mm long, strongly 8-plicate below the small mouth, smooth. Peristome single; exostome teeth 16, well developed, erect,  $\pm$ flexuose, finely papillose, pale; endostome absent. Spores isomorphic,  $27\text{--}34 \mu\text{m}$  diam., coarsely papillose. Chromosome number not known.

Endemic to the Bellenden Ker Range, north-eastern Qld; grows on small twigs in elfin rainforest where it occurs with *M. microstomum*, *M. ligulaefolium*, *M. uniforme*, *M. leratii* and *M. involutifolium* subsp. *ptychomitrioides*.

Qld: Mt Bellenden Ker, 2 Nov. 1981, *H.P.Ramsay* (NSW).

The species was first collected by F.L.E.Diels around 1900 (H-BR), and we have accepted the herbarium name used by Brotherus. It is closely related to *M. microstomum*, being similar in size and sporophyte characters, but differing in the branch and perichaetial leaves, the latter with a distinctive, long-excurrent costa in *M. dielsii*.

#### **8. *Macromitrium exsertum* Broth., *Oefvers Förh. Finska Vetensk.-Soc.* 35: 35 (1893)**

T: Clyde Mtn, N.S.W., *W.Baeuerlen 120b*; lecto: H-BR, *fide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 345 (1985); isolecto: MEL, NSW; Sugarloaf, *W.Baeuerlen 120a*; syn: H-BR; isosyn: MEL, NSW.

Illustrations: D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 346, figs 25–35; 348, figs 39–41 (1985).

Dioicous; males somewhat smaller than females. Plants large, lustrous olive-green above, dark brown to dull green below; branches to 3.2 cm tall. Branch leaves irregularly funiculate, spirally arranged, incurved-twisted to twisted-decurved when dry, straight and erect-spreading when moist, lanceolate, keeled, 2–3 mm long, with an acute to acuminate-cuspidate apex, plane on one side, reflexed-recurved in lower portion; costa curving to one side above, ending below or in the apex; upper laminal cells unistratose, smooth, flat, rarely slightly



bulging, subquadrate-rounded, 5–7 µm long, thin-walled; mid-laminal cells flat, elongate-rhomboidal, 12–27 × 5–9 µm, ±thick-walled, smooth; basal laminal cells 35–50 × 6–8 µm, with a tall slender spiculate papilla; basal marginal border differentiated. Perichaetial leaves erect, straight, with a subsheathing lower portion, oblong to ligulate-lanceolate, 3.4–4.0 mm long; apex long and gradually acuminate; margin entire; costa slender, ending in the apex, the elongate lower cells continuing into apex.

Calyptra lobed near base, slender-conical, glabrous. Setae flexuose, twisted to the left, thin, 8–11 mm long. Capsules ovoid, 1.5–2.0 mm long, smooth, narrowed to a darker 8-plicate puckered mouth; exothecial cells 21–46 × 10–24 µm, thin-walled. Peristome single; exostome teeth 16, well developed, inflexed-erect, narrow, ligulate-lanceolate, pale, coarsely papillose; endostome absent. Spores anisomorphic, 24–55 µm diam., ±smooth to finely papillose. Chromosome number not known.

Endemic to eastern Qld, eastern and south-eastern N.S.W. and A.C.T.; most frequent at higher elevations in montane rainforest, particularly those dominated by *Nothofagus moorei*.

Qld: Nambani Rocks, SE of Binna Burra, Lamington Natl Park, *D.H.Norris 34361* (NSW). N.S.W.: Clyde Mtn, *W.W.Watts 5751* (NSW); Mt Budawang, Sept. 1982, *C.Helman 14* (NSW). A.C.T.: Capital Hill, *H.Streimann 38918* (CANB).

*Macromitrium exsertum*, one of the larger Australian species, is dioicous with larger, rather than dwarf, males plants. Although most laminal cells are smooth, each basal cell has a tall, spiculate papilla. While *M. stoneae* and *M. leratii* are similar in size and niche, the upper laminal cells of *M. leratii* are bulging and densely pluripapillose; these cells are only slightly bulging and densely pluripapillose with low branching papillae in *M. stoneae*. Moreover, the calyptreae of *M. stoneae* are hairy, but glabrous in *M. exsertum* and *M. stoneae*.

### 9. *Macromitrium funiforme* Dixon, *Proc. Roy. Soc. Queensland* 53: 30 (1941)

T: Mt Bartle Frere, Qld, 28 Oct. 1939, *H.Flecker 6411*; holo: BM; iso: CANB.

Illustrations: D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 354, figs 56–64; 356, figs 65–71 (1985).

Pseudautoicous. Plant robust, lustrous, red-brown to golden-green above, dark chestnut below; branches to 18 mm tall. Branch leaves distinctly funiculate, individually twisted-decurved to twisted-incurved with a flexuose apex, arranged in spirals when dry, spreading-incurved and funiculate when moist, ovate-lanceolate to lanceolate, 1.5–2.5 mm long; apex acuminate to acute; margin plane; costa forming an entire acumen, excurrent; upper laminal cells unistratose, subquadrate, rounded, 5–8 µm wide, smooth, flat, thick-walled; mid-laminal cells short- to long-rectangular, 6–9 µm wide, with straight to curved lumina, smooth, thick-walled; basal laminal cells rectangular, 19–48 × 7–8 µm, with straight lumina, smooth, sometimes with a few spiculate papillae, thick-walled. Perichaetial leaves erect, straight; lower portion subsheathing, lanceolate, 2.0–2.5 mm long, with a long acumen; costa filling apex.

Calyptra plicate with 1–3 major slits and several smaller ones, glabrous. Setae long, flexuose, twisted to the left, thin, 8–10 mm long. Capsules ovoid to oblong-ellipsoidal, 1.6–2.0 mm long, 8-plicate, smooth; mouth puckered. Peristome single; exostome teeth 16, ±well developed; endostome absent. Spores anisomorphic, 12–16 µm and 16–26 µm diam., coarsely papillose. *n* = 8, *fide* H.P.Ramsay & D.H.Vitt, *J. Hattori Bot. Lab.* 61: 15–16 (1986).

Endemic to the Cairns area of north-eastern Qld; grows on trunks and larger branches in elfin and montane rainforest.

Qld: Mt Bellenden Ker, *D.H.Vitt 27890* (ALTA); Kennedy Falls, *W.B.Schofield 90734* (NSW); Mt Bellenden Ker, *H.P.Ramsay 812112* (NSW).

*Macromitrium funiforme* is often found in association with *M. stoneae*, *M. leratii* and *M. exsertum*. It is distinguished from these species by its large size and chestnut colouration, branches more than 10 mm tall, branch leaves mostly more than 2 mm long, with a long-acuminate apex and an excurrent costa that fills the apex, and basal laminal cells that are smooth except for a few spiculate papillae.

**10. *Macromitrium hemitrichodes* Schwägr., *Sp. Musc. Frond.*, Suppl. 2, 2: 136 (1827)**

T: locality unknown, Tas., *H.Sieber*, lecto: G, *vide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 395 (1985); isolecto: NY.

*Macromitrium amoenum* Hornsch. ex Müll.Hal., *Syn. Musc. Frond.* 1: 740 (1849). T: locality unknown, Tas., *H.Sieber*, lecto: BM, *vide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 395 (1985); isolecto: H-BR, NY.

*Macromitrium intermedium* Mitt., *Trans. & Proc. Roy. Soc. Victoria* 19: 63 (1882). T: Brisbane R., Qld, *F.M.Bailey*; holotype: NY.

*Macromitrium baileyi* Mitt., *Trans. & Proc. Roy. Soc. Victoria* 19: 63 (1882). T: Brisbane R., Qld, *F.M.Bailey*; lecto: NY, *vide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 395 (1985).

*Macromitrium sieberi* Schwägr. ex Mitt., *Trans. & Proc. Roy. Soc. Victoria* 19: 63 (1882), *nom. nud.* (in synonymy).

Illustrations: D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 396, figs 199–208; 398, figs 209–215 (1985).

Pseudautoicous. Plants medium-sized, dull, golden-green to olive-green above, dark green to rusty brown below; branches short, to 15 mm tall. Branch leaves loosely and irregularly twisted-contorted, upper portion decurved to strongly inrolled when dry, loosely erect-spreading when moist, lanceolate, 1.7–2.2 mm long, narrowed to a strong apiculus or stout mucro; margin plane to reflexed; costa slender but distinct, excurrent, forming the apiculus; upper laminal cells rounded, 7–10 µm wide, bulging, with 2–4 irregularly branched low papillae per cell; mid-laminal cells elliptical-rectangular, 12–20 µm long, pluripapillose, unipapillose below; basal cells elongate with straight lumina, 25–33 µm long, thick-walled, smooth, some cells with a single tall spiculate papilla, the basal border a single row of thin-walled rectangular cells.

Perichaetial leaves erect, not extending much above vegetative leaves, lanceolate, 1.8–2.1 mm long, with an acute to acuminate apex; costa ending in the acumen, with pluripapillose upper cells, the lower cells elongate to mid-leaf. Calyptra slenderly conical, with numerous slits, sparsely hairy, the hairs straight and flexuose. Setae slender, 4–10 mm long. Capsules ovoid, 1.4–2.0 mm long, 8-plicate below the small mouth. Peristome single; exostome teeth 16, lacking in old capsules, lanceolate, short, blunt, coarsely papillose; endostome absent. Spores anisomorphic, 12–31 µm diam., finely papillose.  $n = 9$ , *vide* H.P.Ramsay & D.H.Vitt, *J. Hattori Bot. Lab.* 61: 21–22 (1986).

Endemic to eastern Qld and N.S.W., Vic. and Tas. This is the most common *Macromitrium* from south-eastern Qld to south-eastern N.S.W.; grows on rock and bark.

Qld: Ravenshoe, *W.W.Watts Q479* (NSW). N.S.W.: Bulladelah, *J.L.Boorman* (NSW); Stanwell Park, *W.W.Watts 8361* (NSW); Grays Is., Richmond R., *W.W.Watts 3061* (NSW); Zircon Ck, Mt Wilson, *H.P.Ramsay 11/80* (NSW).

Distinguished by the golden-green colour of the branches, long setae, lanceolate leaves and, especially, the densely papillose upper laminal cells with irregularly branched papillae giving the leaves a dull appearance. The leaves have a characteristic ‘crook’ when dry with the costa bending and the apex bent downwards and exposed to the side of the leaf.

**11. *Macromitrium hortoniae* Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 367 (1985)**

T: Lamington Natl Park, Qld, *D.H.Vitt 28150*; holotype: ALTA; iso: CANB, H, NSW, NY; para: ALTA (*Vitt 28183, 27457, 27460, 27466*).

Illustrations: D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 368, figs 100–108; 370, figs 110–117 (1985).

Pseudautoicous. Plants small, olive-green to dark green above, darker below; branches short, to 6 mm tall. Branch leaves spreading-curved to flexuose-decurved, upper portion strongly inrolled when dry, flexuose-spreading with an inflexed apex when moist, ligulate to lanceolate-ligulate, strongly keeled, 1.6–2.5 mm long; apex obtuse to broadly acute; margin plane to reflexed and entire below, minutely crenulate above; costa ending just below apex, glossy, smooth; upper laminal cells strongly bulging, rounded, 7–10 µm wide, thin-walled, with 1–3 small ±conical papillae per cell to ±smooth; basal laminal cells near costa short, quadrate-rounded to short-rectangular, 9–15 × 8–11 µm, near margins smooth, almost flat, rectangular, 12–22 × 5–6 µm. Stem leaves flexuose-erect when dry, wide-spreading-flexuose when moist,

lanceolate, c. 1 mm long; apex gradually acute; costa ending just below apex; laminal cells as in branch leaves.

Perichaetial leaves erect, stiff, inconspicuous, much shorter than vegetative leaves, lanceolate, 1.2–1.5 mm long, with an acute apex; laminal cells as in vegetative leaves. Calyptra covering capsule and upper seta, deeply and uniformly lacerate into 10–15 slits, deeply plicate, smooth, glabrous. Setae flexuose-erect, 2–4 mm long. Capsules short-exserted, cylindrical to oblong, 1.0–1.4 mm long, not ribbed, firm, dark brown, smooth; mouth small. Peristome single; exostome teeth 16, erect to inflexed, blunt, lanceolate-ligulate, smooth to papillose; endostome absent. Spores indistinctly anisomorphic, 13–28  $\mu\text{m}$  diam., finely papillose.  $n = 9$ , *vide* H.P.Ramsay & D.H.Vitt, *J. Hattori Bot. Lab.* 61: 17–18 (1986).

Endemic to south-eastern Qld and north-eastern N.S.W.; recorded from tree trunks in ravine and montane rainforest.

Qld: Binna Burra, *D.H.Norris 37524* (NSW); Lamington Natl Park, *D.H.Vitt 28183 sub. H.P.Ramsay 34/81* (NSW). N.S.W.: Myocum, *W.W.Watts 1526* (NSW); Belmore Falls, *W.W.Watts 9816* (NSW).

This, along with *M. caloblastoides*, is one of the smallest *Macromitrium* species in Australia, with branches to 6 mm tall and capsules 1.0–1.4 mm long. The leaves are the most slender in the *M. ligulare* group. Fertile material is readily distinguished by the glabrous calyptra that completely covers the capsule and has 10–15 slits nearly to the base of the rostrum, flaring outward and twisted to one side in its lower portion, the small, smooth capsules each with a small mouth and a firm, dark brown rim, the well-developed peristome with 16 erect teeth, and the anisomorphic spores.

## 12. *Macromitrium incurvifolium* (Hook. & Grev.) Schwägr., *Sp. Musc. Frond.*, Suppl. 2, 2: 144 (1827)

*Orthotrichum incurvifolium* Hook. & Grev., *Edinburgh J. Sci.* 1: 117 (1824). T: “Is. of Ternate, [Halmahera, Indonesia] and in King Georges Sound, received from Mr Dickson”; lecto: E, *vide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 415 (1985); Ternate; syn: BM.

Illustrations: D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 414, figs 268–269, 271–273; 417, figs 275–284 (1985); D.H.Vitt, T.Koponen & D.H.Norris, *Acta Bot. Fenn.* 154: 37, fig. 16 (1995).

Pseudautoicous. Plants moderately large, lustrous, rusty brown to dark olive-green above, darker below. Stems inconspicuous, with branches to 15 mm tall. Branch leaves irregularly twisted-contorted, the apex hidden when dry, spreading and upper portion erect when moist, slender, lanceolate, keeled, 1.8–2.2 mm long; apex acute to short-acuminate; margin plane, entire; costa ending in apex or short-excurrent; upper laminal cells  $\pm$ flat, rounded-quadrate to subquadrate, 5–8  $\mu\text{m}$  wide, densely pluripapillose; mid-laminal cells also in longitudinal rows, somewhat bulging, quadrate to short-rectangular, 7–15  $\times$  7–9  $\mu\text{m}$ , thick-walled, smooth; basal laminal cells flat, elongate-rectangular, 13–33  $\mu\text{m}$  wide, smooth, with irregular curved lumina, at margin the cells narrower and straight.

Perichaetial leaves erect, sheathing, shorter than branch leaves, ligulate, 1.3–1.5 mm long, narrowed to a stout cusp; upper laminal cells elongate with curved lumina, shorter than basal cells. Calyptra conical, split by numerous slits to half-way, strongly plicate, glossy, smooth, with dense thick straight hairs. Setae straight, slender, 5–8 mm long, smooth. Capsules exserted, ovoid, 1.3–1.5 mm long, smooth to slightly 8-plicate; rim firm, not plicate. Peristome single; exostome teeth 16, ligulate-lanceolate, broken when old; endostome absent. Spores anisomorphic, 16–27  $\mu\text{m}$  diam., finely papillose.  $n = 9$  (Papua New Guinea), *vide* H.P.Ramsay, H.Streimann & D.H.Vitt, *Tropical Bryol.* 11: 154 (1995).

In Australia this moss is known only from north-eastern Qld; also in Papua New Guinea, Indonesia and Tahiti.

Qld: Russell R., *W.A.Sayer* (NSW); Big Tableland, 26 km S of Cooktown, *H.Streimann 46281* (CANB); Mt Lewis State Forest, *H.Streimann 46083* (CANB).

*Macromitrium incurvifolium* is closely related to *M. leratii* and to the New Zealand species *M. gracile* (Hook.) Schwägr. Its smaller stature, the short and inconspicuous perichaetial

leaves and densely hairy calyptra separate it from *M. leratii*; the upper cells of the branch leaves being in longitudinal rows distinguish it from all other species except *M. leratii*.

**13. *Macromitrium involutifolium* (Hook. & Grev.) Schwägr., *Sp. Musc. Frond.*, Suppl. 2, 2: 144 (1827)**

*Orthotrichum involutifolium* Hook. & Grev., *Edinburgh J. Sci.* 1: 117 (1824). T: Paramata [Parramatta], N.S.W., *Hobson s.n.*; lecto: E, *fide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 372 (1985); isolecto: BM, NY; King Georges Sound, New Zealand, *Dickson s.n.*; syn: BM, E.

*Macromitrium daemelii* Müll.Hal., *Hedwigia* 37: 153 (1898). T: Gayndah, Wideboy [Wide Bay], Qld, 1874, [*E. J. Daemel*]; lecto: H-BR, *fide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 372 (1985).

*Macromitrium incurvulum* Müll.Hal., *Hedwigia* 37: 155 (1898). T: locality unknown, Qld, 1893, *Rev. B. Scortechini s.n.*, in Herb. Saharampur, *Dr E. Levier*; lecto: H-BR, *fide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 372 (1985); isolecto: H-BR.

*Macromitrium malacoblastum* Müll.Hal., *Hedwigia* 37: 150 (1898). T: Walcha, N.S.W., 1884, *A.R. Crawford s.n.* in Herb. Melbourne; Cambewarra, N.S.W., Oct. 1884, [*J.A. Thorpe* in Herb. Melbourne; Tilba [Tilba Tilba], N.S.W., 1880, *F.M. Reader s.n.* Herb. Melbourne; syn: H-BR; isosyn: NSW (*Thorpe 127*, Cambewarra) [no types located in MEL.].

Pseudautoicous. Plants medium to robust, dull, dark green to olive-green. Stems prostrate to ascending, with ascending to erect branches. Branch leaves loosely erect, upper portion strongly inrolled, not funiculate when dry, erect-incurved when moist, narrowly lanceolate to ligulate, 2.0–2.8 mm long; apex gradually and slenderly acute; margin plane or slightly reflexed, entire; costa slender, strong, usually ending just below apex; upper laminal cells unistratose, strongly bulging, rounded, 12–14 µm wide, smooth or rarely with 3 or 4 low papillae; mid-laminal cells similar to upper cells, 12–20 × 12–15 µm; basal laminal cells confined to a small area, rectangular-hexagonal, smooth or sometimes with a conical papilla.

Perichaetial leaves mostly inconspicuous, twisted-curved when dry, narrowly ovate to lanceolate, 1.9–2.1 mm long, with a gradually acuminate apex. Calyptra 2.5–3.0 mm long, divided by numerous slits, with dense straight hairs. Setae 1.5–5.0 mm long. Capsules short-exserted, cylindrical, 1.8–2.5 mm long, with a wrinkled neck and a non-plicate smooth darkened rim, rarely collapsed. Peristome single; exostome teeth 16, erect, lanceolate, short, very reduced or absent in some populations, striate with irregular papillae, pale. Spores anisomorphic, 17–31 µm diam., finely papillose.

This is the largest species in the *M. ligulare* group. The short setae, large cylindrical capsules with smooth non-plicate rims, densely hairy calyptrae as long as the capsules and the separation of older branches into distinct plants by breakdown of the stems characterise *M. involutifolium*. Sterile plants or those with immature capsules are difficult to determine to subspecies rank.

In Dorrigo National Park, N.S.W. the two subspecies grow mixed on branches and trunks of *Acacia*.

Peristome of 16 erect exostome teeth; capsule rim erect..... **13a.** subsp. ***involutifolium***  
Peristome very reduced or absent; capsule rim collapsed ..... **13b.** subsp. ***ptychomitrioides***

**13a. *Macromitrium involutifolium* (Hook. & Grev.) Schwägr. subsp. *involutifolium***

Illustrations: D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 374, figs 120–130; 376, figs 132–134, 136 (1985).

Plants medium-sized or, infrequently, robust; branches to 10 mm tall. Perichaetial leaves shorter than vegetative leaves. Capsules rim round, firm, erect, rarely collapsed; exothelial cells usually longer than broad, elongate-rectangular to nearly quadrate, 25–70 × 10–24 µm. Peristome of 16 erect exostome teeth, present even when old. *n* = 8, *fide* H.P.Ramsay & D.H.Vitt, *J. Hattori Bot. Lab.* 61: 18 (1986).

Occurs from north-eastern Qld to south-eastern N.S.W.; most common from south of Brisbane to Sydney; also in New Caledonia. Grows on cliff faces, boulders and tree trunks; in the Sydney area and around Nowra it is common on sandstone outcrops and ranges from

near the coast to mid-elevations in the Blue Mountains; it also occurs as an epiphyte in ravine rainforest and occasionally in montane rainforest.

Qld: Bunya Mtns, *D.H.Norris s.n.* (NSW); Ravenshoe, *W.W.Watts Q490* (NSW). N.S.W.: Cambewarra, *J.A.Thorpe 4363* (NSW); Rodriguez Pass, Blackheath, *W.Forsyth s.n.* (NSW).

**13b. *Macromitrium involutifolium* subsp. *ptychomitrioides* (Besch.) Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 378 (1985)**

*Macromitrium ptychomitrioides* Besch., *Ann. Sci. Nat. Bot.*, sér. 5, 18: 208 (1873). T: Canala, [New Caledonia], *Balansa 2540*; lecto: BM, *fide* D.H.Vitt & H.P.Ramsay, *loc. cit.*; isolecto: BM.

*Macromitrium carinatum* Mitt., *Trans. & Proc. Roy. Soc. Victoria* 19: 64 (1882). T: King Georges Sound, New Zealand, *Dickson*; holo: NY, *fide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 378 (1985).

*Macromitrium viridissimum* Mitt., *Trans. & Proc. Roy. Soc. Victoria* 19: 64 (1882). T: Burnett and Brisbane Rivers, Qld, *F.Mueller*; lecto: NY, *fide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 378 (1985); Toowoomba, Qld, [*C.H.*]Hartmann; syn: NY.

*Macromitrium platyphyllaceum* Müll.Hal., *Hedwigia* 37: 154 (1898). T: near Brisbane, Qld, 1898, *F.M.Bailey s.n.* in Herb. Brotherus; lecto: H-BR, *fide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 378 (1985).

Illustrations: D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 376, figs 131, 135, 137; 379, figs 139–149 (1985); H.Streimann, *The Mosses of Norfolk Island* 119, fig. 53 (2002).

Plants robust; branches to 25 mm tall. Perichaetial leaves narrowly lanceolate, gradually acuminate, mostly shorter than vegetative leaves. Capsules rim collapsed or very irregularly puckered, often with 3 or 4 indentations; exothecial cells quadrate or short-rectangular, 20–50 × 12–30 µm. Peristome usually completely absent, but some populations have a thickened basal rim. *n* = 9, *fide* H.P.Ramsay & D.H.Vitt, *J. Hattori Bot. Lab.* 61: 18 (1986).

Occurs in eastern Australia from north-eastern Qld to south-eastern N.S.W.; also known from Norfolk Island, New Caledonia and the Tubai Islands in French Polynesia. Most frequently found as an epiphyte on tree branches and trunks, occasionally on rock.

Qld: Eungella Natl Park, *D.H.Norris 38682* (NSW). N.S.W.: Bulgong Heights, *W.W.Watts* (NSW M12678); Tintenbar, *W.W.Watts 1942* (NSW); Hallidays Pt, *H.P.Ramsay 24/84* (NSW).

The absence of a peristome reliably separates subsp. *ptychomitrioides* from subsp. *involutifolium*, but there are some populations with a low, basal membrane which we have included in subsp. *ptychomitrioides*. The subspecific status is supported by the distribution, *ptychomitrioides* being found primarily at the north of the species range, and *involutifolium* southward, and also by the two subspecies maintaining their distinctiveness when growing together. Subspecific status is also supported by the chromosome number difference, but further counts are needed to confirm that this is true for a large number of populations. The lack of clear distinguishing features in the gametophore suggest that the differences are at the subspecific rather than the specific level.

**14. *Macromitrium leratii* Broth. & Paris, in V.F.Brotherus, *Oefvers. Förh. Finska Vetensk.-Soc.* 48: 12 (1906)**

T: Mount Dzumac and Mount Ouin, New Caledonia, *Le Rat*; lecto: H-BR ex PC, *fide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 421 (1985); Prony, [New Caledonia], *Etesse*; syn: H-BR, *fide* D.H.Vitt, T.Koponen & D.H.Norris, *Acta Bot. Fenn.* 154: 91 (1995).

Illustrations: D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 422, figs 288–297; 424, figs 298–304 (1985).

Pseudautoicous. Plants robust, lustrous, rusty brown to chestnut-brown, darker brown below, soft, with dull upper leaves; branches to 25 mm tall. Branch leaves loosely regularly and strongly twisted-flexuose, the apex decurved to incurved and exposed to one side when dry, indistinctly funiculate, wide-spreading and reflexed to erect-inflexed when moist, lanceolate from a broader basal area, 2–3 mm long; apex acute to short-acuminate; margin reflexed to plane, entire; costa ending in apex or short-excurrent, slender; upper laminal cells in distinct longitudinal rows, bulging, 6–7 (–9) µm wide, densely pluripapillose; mid-laminal cells similar, the transition to basal cells abrupt, the transitional cells flat, rectangular, 12–25 × 7–9 µm, with curved lumina, smooth; basal laminal cells flat, rectangular, 19–37 × 9–10 µm near

costa, with strongly curved to sigmoidal lumina, smooth, narrowly elongate,  $35\text{--}50 \times 7 \mu\text{m}$ , thick-walled and with narrow lumina near margins.

Perichaetial leaves erect, forming a stout plicate sheath around the vaginula and lower seta, as long as or longer than vegetative leaves, lanceolate, 2.8–3.5 mm long, gradually narrowed to an acuminate or stoutly cuspidate apex; costa excurrent or ending in a cusp; elongate cells sigmoidal, continuing into apex, all cells flat, smooth. Calyptra broadly conical, split half-way by numerous slits, strongly plicate, glossy, mostly glabrous, smooth. Setae straight, slender, 5–7 mm long, smooth. Capsules exserted, ovoid, 1.4–1.6 mm long, slightly 8-plicate; rim firm, not plicate. Peristome single; exostome teeth 16, well developed, inflexed-erect, coarsely papillose on both surfaces, easily broken off and absent when old, pallid to bone-white; endostome absent. Spores anisomorphic, 10–21  $\mu\text{m}$  diam., finely papillose.  $n = 8$ , *vide* H.P.Ramsay & D.H.Vitt, *J. Hattori Bot. Lab.* 61: 23 (1986).

Known from eastern Qld and north-eastern N.S.W.; also in Lord Howe Island and New Caledonia. Locally abundant in montane rainforest where it is a dominant canopy species on *Nothofagus moorei*; also on *Doryphora sassafras* and *Ceratopetalum apetalum* and in elfin rainforest in north-eastern Qld.

Qld: Hugh Nelson Ra., 15 km S of Atherton, *H.Streimann 29417* (CANB); Binna Burra, *D.H.Norris 37441* (NSW). N.S.W.: The Bulga, *W.W.Watts 10957* (NSW); Wilsons Ck, *W.W.Watts 1651* (NSW); Wiangaree State Forest, *H.P.Ramsay 19/81* (NSW).

One of the largest Australian species, *M. leratii* is distinguished by the rusty brown colouration, the large, bone-white exostome teeth, glabrous calyptrae, conspicuous perichaetial leaves, branch leaves with densely papillose upper laminal cells in longitudinal rows, and elongate, smooth, basal laminal cells with curved lumina.

**15. *Macromitrium ligulaefolium* Broth., Oefvers. Förh. Finska Vetensk.-Soc. 40: 82 (1898), as *ligulifolium***

T: Roseville, Sydney, N.S.W., 1896, *W.W.Watts 178*; holo: H-BR; iso: NSW.

*Macromitrium ligulatulum* Müll.Hal., *Hedwigia* 37: 151 (1898). T: Richmond R., N.S.W., *Miss Hodgkinson* in Herb. Melbourne 1881; lecto: H-BR, *vide* D.H.Vitt, *J. Hattori Bot. Lab.* 54: 74 (1983) [holotype not located in MEL].

*Macromitrium woollsonianum* Müll.Hal., *Hedwigia* 37: 156 (1898). T: locality unknown, N.S.W., *Harriott & Dr W.Woolls* in Herb. Melbourne 1881; lecto: H-BR, *vide* D.H.Vitt, *J. Hattori Bot. Lab.* 54: 74 (1983) [holotype not located in MEL].

Illustrations: D.H.Vitt, *J. Hattori Bot. Lab.* 54: 63, fig. 176; 76, figs 208–218; 78, figs 221, 224, 225 (1983).

Pseudautoicous. Plants slender to medium-sized, green above, dark brown below; branches short, 5 (–10) mm tall. Branch leaves spreading-curved, with a strongly inrolled apex when dry, the apex usually exposed to one side of the leaf, flexuose-spreading and with an inflexed apex when moist, linear-lanceolate to ligulate, strongly keeled, 2–3 mm long; apex acute-apiculate, variable on any branch; margin plane to reflexed, entire below, minutely crenulate above; costa ending below or in apex, glossy, smooth; upper laminal cells in 6–15 rows between costa and margin, the cells rounded, uniform in size across leaf, 8–12  $\mu\text{m}$  wide, strongly bulging with small papillae; mid-laminal cells similar to upper cells; transitional mid-leaf and basal cells rectangular, 12–20  $\times$  10–12  $\mu\text{m}$ , unevenly thickened, some with a prominent spiculate papilla.

Perichaetial leaves shorter than vegetative leaves, stiffly erect, lanceolate, 1.3–1.6 mm long, with a slenderly acute apex. Calyptra conical-rostrate to conical, approaching cucullate, divided by 1–5 long slits or with 1 conspicuous slit, weakly plicate, smooth, with delicate fine hairs above or glabrous. Setae twisted to the left, thin, 5–6 mm long. Capsules long-exserted, narrowly ovoid to ellipsoidal, 1.4–1.5 mm long, smooth, darker below rim; rim 8-plicate below the narrow mouth. Peristome single, greatly reduced or absent; exostome a low papillose membrane 1–3 cells high, inconspicuous or absent; endostome absent. Spores anisomorphic, 15–25  $\mu\text{m}$  diam., finely papillose.  $n = 9$ , rarely 8, *vide* H.P.Ramsay & D.H.Vitt, *J. Hattori Bot. Lab.* 61: 17 (1986).

Occurs in eastern Australia from northern Qld to Tas., abundant near Brisbane, common in N.S.W.; the most common *Macromitrium* in the Blue Mountains and from Sydney to Narooma, and in eastern and south-western Vic.; rare in New Zealand. The commonest species of ravine rainforests and on tree trunks and rocks around Sydney.

Qld: Malanda, *W.W.Watts Q491* (NSW). N.S.W.: Roseville Gully, *W.W.Watts 178* (NSW); Megalong Valley, *H.P.Ramsay 34/83* (NSW). Vic.: Strzelecki State Forest, 17 km NE of Foster, *H.Streimann 51724* (CANB). Tas.: track to Westmoreland Falls, 7 km SSW of Mole Creek, *R.G.Coveny 17369a* & *P.D.Hind* (NSW).

Fertile specimens of *M. ligulaefolium* are usually easily separated from all other species of *Macromitrium* by means of leaf and cell characters, except the closely related species of the *M. ligulare* group. Related species can be separated as follows: *M. ligulare* has collapsed capsule rims and 16 well-developed teeth; *M. hortoniae* has striking calyptrae, deeply split into 10–15 slits; *M. caloblastoides* has capsule rims 8-plicate below a narrow, puckered mouth, broadly ligulate to oblong leaves and isomorphic spores; *M. involutifolium* is a much larger species with cylindrical capsules that are never 8-plicate or puckered at the mouth. Sterile specimens of *M. ligulaefolium* are often difficult to distinguish from *M. ligulare* and *M. caloblastoides*.

#### 16. *Macromitrium ligulare* Mitt., *J. Proc. Linn. Soc., Bot.* 4: 78 (1860)

T: Waikaki, New Zealand, *Dr Sinclair*; lecto: NY, *fide* D.H.Vitt, *J. Hattori Bot. Lab.* 54: 74 (1983); syn: New Zealand, *Kerr*; NY.

*Macromitrium leuhmannianum* Müll.Hal., *Hedwigia* 37: 153 (1898). T: Gippsland, Vic., *V.Leuhmann* 1881 in Herb. Melbourne [holotype not located in MEL]; iso: H-BR.

Illustrations: D.H.Vitt, *J. Hattori Bot. Lab.* 54: 70, figs 190–200; 72, figs 201–206 (1983).

Pseudautoicous. Plants slender, yellow to olive-green above, darker below; branches short to medium, to 17 mm tall. Branch leaves flexuose-twisted, strongly inrolled, the apex hidden when dry, flexuose-spreading with an inflexed apex when moist, ligulate to lanceolate-ligulate, strongly keeled, 1.5–2.5 mm long; apex broadly acute or a short 1-celled apiculus; margin plane to reflexed and entire below, crenulate above; costa ending a few cells below the apex, glossy, smooth; upper laminal cells strongly bulging, rounded, 9–15 µm wide, thin-walled with ±thickened corners and 1–4 small strongly conical papillae; marginal cells elliptical to rounded, 7–12 µm long, 10–12 µm wide, similar in size to those near costa; mid-laminal transitional cells rounded-elliptical, 10–13 × 10–12 µm wide; basal laminal cells bulging to flat, short- to elongate-rectangular, 14–28 µm long, unevenly thickened, smooth, a few with a tall spiculate papilla.

Perichaetial leaves erect, shorter than vegetative leaves, ovate-lanceolate, with a gradually acuminate or acute apex; upper laminal cells bulging, elliptical-rounded, papillose. Calyptra mitrate-cucullate, conical, ±entire or lobed at the base only, divided by 1–3 longitudinal slits, ±plicate, smooth, glabrous. Setae flexuose-erect, twisted to the left, thin, 4–8 mm long. Capsules long-exserted, narrowly oblong-ovate to cylindrical-oblong, 1–2 mm long, the mouth not contracted or ribbed, often partly collapsed when old, with a long wrinkled neck; urn smooth; exothecial cells of rim elongate, 26–50 × 5–10 µm. Peristome single; exostome teeth 16, erect-inflexed, blunt, transversely striate, papillose, pale; endostome absent. Spores indistinctly anisomorphic, 14–34 µm diam., finely papillose. *n* = 8, rarely 9, *fide* H.P.Ramsay & D.H.Vitt, *J. Hattori Bot. Lab.* 61: 17 (1986).

Occurs in Qld with one disjunct locality near Mackay, and from the Bunya Mountains and Brisbane south to N.S.W. and Vic. Common on tree trunks and larger branches in the Blue Mountains near Sydney. It is most abundant in ravine rainforest, especially on *Ceratopetalum apetalum*; it has not been collected on rock. Widespread in New Zealand.

Qld: Bunya Mtns, *D.H.Norris 35308* (NSW). N.S.W.: Shoalhaven R., *W.Forsyth 328* (NSW); Blackheath, *W.W.Watts 10223* (NSW); Mt Wilson, *H.P.Ramsay 32/83* (NSW).

*Macromitrium ligulaefolium* replaces *M. ligulare* towards the northern end of its range, and from there into north-eastern Qld.

Distinguishing features are the tightly inrolled, short-apiculate leaves with the apex hidden in the inrolled part and the costa ending just below the apex, the strongly bulging upper laminal

cells with 1–4 small, conical papillae, the perichaetial leaves that are usually shorter than the vegetative leaves, the glabrous calyptrae, the long setae and the capsules that have a completely smooth mouth that collapses irregularly when mature, a peristome of 16 teeth, anisomorphic spores, and exothecial cells of the capsule mouth that are much longer than broad. In difficult cases this last feature is diagnostic for the species. Sterile specimens of the closely related *M. ligulare*, *M. ligulaefolium* and *M. caloblastoides* are often difficult to distinguish from one-another.

**17. *Macromitrium longirostre* (Hook.) Schwägr., *Sp. Musc. Frond.*, Suppl. 2, 1: 38, pl. 112 (1823)**

*Orthotrichum longirostre* Hook., *Musci Exot.* 1: pl. 25 (1818). T: “Dusky Bay” [Dusky Sound], New Zealand, 1791, A.Menzies; holo: BM; iso: E, H-BR.

*Orthotrichum acutifolium* Hook. & Grev., *Edinburgh J. Sci.* 1: 118 (1824); *Macromitrium acutifolium* (Hook. & Grev.) Brid., *Bryol. Univ.* 1: 735 (1826). T: Van Diemens Land [Tas.], Dr Spence & R.Neill; lecto: E, fide D.H.Vitt, *J. Hattori Bot. Lab.* 54: 8 (1983); isolecto: BM.

*Macromitrium pertorquescens* Müll.Hal. var. *torquatulum* Müll.Hal., *Hedwigia* 37: 148 (1898); *M. torquatulum* (Müll.Hal.) Müll.Hal. & Broth., *Abh. Naturwiss. Vereine Bremen* 16: 501 (1900). T: Henty R., West Coast, Tas., Feb. 1891, W.A.Weymouth; holo: probably lost in Berlin; iso: H-BR, M.

*Macromitrium rodwayi* Dixon, in W.A.Weymouth & L.Rodway, *Pap. & Proc. Roy. Soc. Tasmania* 1921: 174 (1922). T: entrance to Port Arthur, Tas.; holo: BM; iso: NSW.

Illustrations: D.H.Vitt, *J. Hattori Bot. Lab.* 54: 9, figs 1–15; 11, figs 47–50 (1983); R.D.Seppelt, *The Moss Flora of Macquarie Island* 205, fig. 81 (2004).

Dioicous; with males and females robust and of similar size. Stems with branches to 30 mm tall, olive-green to yellow-green above. Branch leaves spirally twisted around the branch, with the apex curved outwards when dry, erect and straight to twisted when moist, narrowly lanceolate, keeled above, 2.3–4.0 mm long; apex acuminate to long-cuspidate; margin plane, entire; costa ending below apex or forming a narrow cusp; upper laminal cells rounded to elliptical, 5–12 × 4–10 µm, smaller at margins, slightly bulging to smooth, partly bistratose in upper one-third of leaf near costa; mid-laminal cells in ±longitudinal rows, quadrate to oblong, 10–15 × 8–10 µm, thick-walled, smooth or slightly bulging; basal laminal cells elongate-rectangular, 20–40 × 8–10 µm, thick-walled, smooth or rarely slightly bulging, near margin ±thick-walled, smooth, hyaline, 0–60 µm long.

Perichaetial leaves similar to vegetative leaves. Calyptra deeply lacerate, strongly plicate, glabrous. Setae thick, twisted to the right, 3.5–8.0 mm long. Capsules exerted, fusiform-ovoid to cylindrical, 1.5–3.0 mm long, indistinctly broadly ribbed to smooth; exothecial cells elongate-sinuose to elliptical, 40–60 µm long, very thick-walled. Peristome double; exostome teeth 16, irregular, erect-curved when dry, incurved when moist, blunt to coarsely papillose, ±smooth below; endostome an irregular papillose membrane 1–3 cells high. Spores isomorphic, 25–30 µm diam., thick-walled, coarsely papillose. Chromosome number not known.

Most common in coastal Tas., also in King Island in Bass Strait and Wilsons Promontory, Vic.; elsewhere on Subantarctic islands, New Zealand and southern South America. Grows on exposed coastal rock and on tree trunks and branches in coastal areas.

Tas.: Safety Cove, Port Arthur, 18 May 1954, J.H.Willis (MEL); Woody Is., in narrows near Bramble Cove, Port Davey, M.Davis 1379i (MEL); L. Bellinger track, W.A.Weymouth 570 (NSW); Macquarie Head near Queenstown, J.R.Spence 4637 (NSW). Vic.: Wilsons Promontory, coll. unknown (MEL).

This species is characterised by: the robust habit; setae twisted to the right; plant size; narrowly lanceolate leaves that are spirally twisted around the branches and partly bistratose in their upper parts; leaf apices curved outwards when dry; laminal cells smooth and flat; the costa ending in a keeled, acuminate to cuspidate apex; the deeply lacerate, glabrous calyptra; and isomorphic spores.



**18. *Macromitrium microstomum* (Hook. & Grev.) Schwägr., *Sp. Musc. Frond.*, Suppl. 2, 2: 130 (1827)**

*Orthotrichum microstomum* Hook. & Grev., *Edinburgh J. Sci.* 1: 114 (1824). T: Van Diemens Land [Tas.], *Dr Spence*; lecto: E, *fide* D.H.Vitt, *J. Hattori Bot. Lab.* 54: 24 (1983) [1824, *Dr. Spence & W.R.Neill*]; isolecto: BM, MEL.

*Macromitrium scottiae* Müll.Hal., *Linnaea* 35: 618 (1868). T: Ash Is., N.S.W., *coll. unknown*; lecto: BM, *fide* D.H.Vitt, *J. Hattori Bot. Lab.* 54: 24 (1983).

*Macromitrium linearifolium* Müll.Hal., *Linnaea* 37: 154 (1872), *nom. illeg.* T: Mostland [probably Maitland], N.S.W., 1869, *Vickary*; lecto: BM, *fide* D.H.Vitt, *J. Hattori Bot. Lab.* 54: 24 (1983); isolecto: H-BR.

*Macromitrium prolixum* Bosw., *J. Bot.* 30: 97 (1892). T: Blue Mtns, N.S.W., *Roper*; holo: OXF.

*Macromitrium tasmanicum* Broth., *Oefvers Förh. Finska Vetensk.-Soc.* 37: 162 (1895). T: Circular Head, Tas., *W.A.Weymouth 846, 1040, 1041*; lecto: H-BR (*W.A.Weymouth 1040*), *fide* D.H.Vitt, *J. Hattori Bot. Lab.* 54: 24 (1983); syn: H-BR (*Weymouth 846, 1041*), “*nec non* Monte Wellington, f. *lutescens*. 121”.

*Macromitrium weymouthii* Broth., *Oefvers Förh. Finska Vetensk.-Soc.* 37: 161 (1895). T: Porteus Gully, Macquarie Harbour, Tas., *W.A.Weymouth 574*; lecto: H-BR, *fide* D.H.Vitt, *J. Hattori Bot. Lab.* 54: 24 (1983); *loc. id.*, *W.A.Weymouth 573, 575* (part); syn: H-BR; Henty R., Tas., *W.A.Weymouth 569*; syn: H-BR.

Illustrations: G.A.M.Scott & I.G.Stone, *The Mosses of Southern Australia* 235, pl. 44 (1976), as *M. weymouthii*; D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 54: 25, figs 52–61; 27, figs 63–68 (1983); D.H.Vitt, T.Koponen & D.H.Norris, *Acta Bot. Fenn.* 154: 49, fig. 21 (1995).

Autoicous. Plants slender, dull olive-green above. Stems with branches 4–6 mm tall. Branch leaves funiculate, in spirals, strongly twisted-contorted, ligulate to ligulate-lanceolate, strongly keeled, 1.2–2.0 mm long, with a single plica on one side; apex inrolled to incurved when dry, acute to short-acuminate, some short-cuspidate; margin entire; costa curving to one side, ending below apex or short-excurrent; upper laminal cells unistratose, to 9  $\mu$ m wide, flat, smooth; mid-laminal cells 10–20  $\times$  8–10  $\mu$ m, flat, smooth; basal laminal cells narrow, rectangular, 24–55  $\mu$ m long, smooth.

Perichaetial leaves slender, erect, straight, long and slenderly acuminate or with a sharply cuspidate apex, 1.5–2.1 mm long; upper margin sparsely serrulate, contracted to the apex; costa slender; laminal cells similar to those of vegetative leaves. Calyptra deeply lacerate, mitrate, sometimes cucullate, plicate, glabrous. Setae long, flexuose, thin, twisted to the left. Capsules exserted, narrowly ovoid to oblong, 1.0–1.7 mm long, smooth, abruptly narrowed to the darker 8-plicate mouth. Peristome single; exostome teeth 16, erect to inflexed, narrow, lanceolate, c. 180  $\mu$ m tall, papillose; endostome absent. Spores isomorphic, 30–54  $\mu$ m diam., coarsely papillose.  $n = 11$  (10 +  $m$ ), *fide* H.P.Ramsay & D.H.Vitt, *J. Hattori Bot. Lab.* 61: 13 (1986).

Common in N.S.W., A.C.T., Vic. and Tas., less frequent in Qld; rather widespread in New Zealand, the Pacific islands north to Hawai'i, and in Java, New Guinea, Borneo and the Philippines and east to Central America. In Australia found mostly on small branches especially in the forest canopy.

Qld: Hugh Nelson Ra., *H.Streimann 29489* (CANB). N.S.W.: Neates Glen, *W.W.Watts 6076* (NSW); Richmond R., *W.W.Watts 1377* (NSW). A.C.T.: Captains Flat, *H.Streimann 2517* (CANB). Tas.: Mt Montgomery, *D.H.Norris 33926* (NSW).

This is one of the most common and widespread species in Australia, and it is especially abundant on the canopy branches of temperate rainforest trees such as *Eucryphia moorei* and *Nothofagus moorei*. It is most likely to be confused with *M. dielsii* which is endemic to north-eastern Qld. However, *M. dielsii* has gradually narrowing leaves that end in a long, slender acumen completely filled by the excurrent costa, while *M. microstomum* has leaves ending in a narrowly acute to broadly acuminate tip, usually with the costa ending in or just below the apex. The perichaetial leaves also differ, having a long-excurrent costa in *M. dielsii*, while the apex is acuminate or cuspidate in *M. microstomum*.

The smooth upper and basal laminal cells distinguish this species from *M. ligulaefolium*, *M. hortoniae* and *M. ligulare*, all of which have bulging, papillose upper laminal cells. It is one of only four autoicous species in Australia (with *M. longirostre*, *M. dielsii* and *M. caloblastoides*).

## 19. *Macromitrium repandum* Müll.Hal., *Bot. Jahrb. Syst.* 5: 87 (1883)

T: locality unknown, Qld, *Naumann s.n.*; lecto: BM, *fide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 349 (1985); isolecto: E, H-BR.

*Macromitrium whiteleggei* Broth. & Geh., *Oefvers Förh. Finska Vetensk.-Soc.* 37: 161 (1895). T: Hurstville, near Sydney, N.S.W., *T.Whitelegge 301*; lecto: H-BR, *fide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 349 (1985); isolecto: H-BR, MEL, NSW; Bellenden Ker Range and Mt Bartle Frere, Qld, *S.Johnson s.n.*; syn: H-BR; isosyn: NSW.

*Macromitrium pugionifolium* Müll.Hal., *Hedwigia* 37: 145 (1898). T: Gosford, N.S.W., 1891, *T.Whitelegge*; lecto: H-BR, *fide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 349 (1985); isolecto: NSW; Richmond R., N.S.W., 1880, *Miss Hodgkinson*. "in Hb Melbourne"; syn: not located.

*Macromitrium pallidovirens* Müll.Hal., *Hedwigia* 37: 144 (1898). T: locality unknown, Qld, 1885, *F.M.Bailey & Kiaer*; lecto: MEL, *fide* D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 349 (1985); isolecto: H-BR, MEL.

Illustrations: D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 348, figs 36–38; 350, figs 43–54 (1985).

Pseudautoicous. Plants small, slender, olive-green to pale green above, dark below. Stems with dense short erect branches 5–8 mm tall, shorter near margins of mat. Branch leaves flexuose-curved to erect-curved and curved around the branch when dry, spreading and straight when moist, linguulate-lanceolate to oblong, 1.0–1.5 mm long, gradually narrowed to a long-cuspidate apex; margin entire; costa excurrent; upper laminal cells flat, rounded, 5–7  $\mu$ m wide, smooth; mid-laminal cells flat, narrow, short-rectangular, 5–7  $\times$  2–3  $\mu$ m, smooth; basal laminal cells elongate, 20–50  $\mu$ m long, straight, with the lumina flexuose to curved, mostly smooth, some scattered cells with a spiculose papilla, the basal marginal border differentiated.

Perichaetial leaves erect, subsheathing, lanceolate-ovate, 1.5–2.0 mm long, sharply contracted to an acuminate-cuspidate apex; costa ending in the acumen. Calyptra usually evenly lobed, with one slit longer, plicate, usually glabrous. Setae flexuose, twisted to the left, thin, 4–12 mm long. Capsules emergent, narrowly ovoid to oblong, 1.0–1.6 mm long, smooth, with an 8-plicate mouth. Peristome single; exostome teeth 16, well developed, bluntly lanceolate, finely and evenly papillose, white; endostome absent. Spores distinctly anisomorphic, 23–43  $\mu$ m diam., thick-walled, finely papillose.  $n = 9$ , *fide* H.P.Ramsay & D.H.Vitt, *J. Hattori Bot. Lab.* 61: 15 (1986).

Endemic to eastern Australia (Qld and N.S.W.), mostly at low to moderate elevations, although one syntype of *M. whiteleggei* was collected at 1525 m on Mt Bartle Frere in north-eastern Qld. Grows on tree trunks and rocks in mesophytic habitats; in N.S.W. occurs in gully forest or wet ravines.

Qld: Malanda, *W.W.Watts Q495* (NSW); Bribie Is., *H.P.Ramsay 14/75* (NSW). N.S.W.: E of Ballina, *W.W.Watts 5081* (NSW); Gosford, *T.Whitelegge 459* (NSW); Hurstville, *T.Whitelegge 30* (NSW).

Sporophytes are uncommon, and this species is distinguished by its small, pale green plants, erect-curved branch leaves, smooth, flat, upper laminal cells, basal laminal cells with a few, tall, spiculose papillae, elongate setae with 8-plicate, ovoid capsules, long-acuminate, differentiated, perichaetial leaves, glabrous calyptrae, anisomorphic spores and leaves ending in a retuse apex with the excurrent costa forming a stout cusp. This last feature distinguishes *M. repandum* from all other species. Species with which it appears superficially similar are *M. brevicaulis* and *M. aurescens*, but these have papillose upper laminal cells.

## 20. *Macromitrium stoneae* Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 400 (1985)

T: Wauchope, N.S.W., Nov. 1981, *D.H.Vitt 27483*; holo: ALTA; iso: BRI, C, CANB, FH, H, NSW, NY.

Illustrations: D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 402, figs 218–229; 404, figs 230–236 (1985).

Pseudautoicous. Plants robust, dull, rusty brown to chestnut-green, darker brown below, in loose spreading mats; branches erect, broad, to 17 mm tall. Stem leaves loosely flexuose when dry, upcurved and erect-spreading when moist, lanceolate from a lanceolate-ovate base, 1.6–2.0 mm long; upper laminal cells slightly bulging, rounded, each with a single low papilla; mid-laminal cells elliptical-rounded; basal laminal cells elongate, smooth or sometimes with a single low papilla. Branch leaves obscurely funiculate when dry, strongly flexuose-

twisted, keeled, lanceolate, 2.0–2.5 mm long; apex acuminate-apiculate, strongly twisted to one side when dry, wide-spreading and straight when moist; margin plane to slightly reflexed, entire above, infrequently crenulate along basal border; costa strong, ending in the apex; upper laminal cells only slightly bulging, rounded, 8–10  $\mu\text{m}$  wide, densely pluripapillose with low branched papillae; mid-laminal cells similar, in longitudinal rows, subelliptical to rounded, 10–13  $\mu\text{m}$  wide, thicker-walled, strongly bulging with several low  $\pm$ branched papillae per cell; cells rounded in upper two-thirds of mid-leaf, becoming elongate in lower third, 9–17  $\times$  9–11  $\mu\text{m}$ , with irregularly fusiform lumina and a central papilla; basal laminal cells flat, 24–41  $\times$  5–7  $\mu\text{m}$ , with mostly straight lumina, usually smooth, the basal margin differentiated, with thin-walled cells, 20–25  $\times$  9–11  $\mu\text{m}$ , some with laterally projecting central papillae.

Perichaetial leaves erect, stiff, distinctly sheathing, broadly lanceolate, 2.2–2.6 mm long, with a short and slender acuminate apex; costa ending in apex or short-excurrent; upper laminal cells bulging, long-elliptical to rounded, smooth; basal cells elongate, smooth. Calyptra narrowly to broadly conical, plicate, evenly lacerate below, smooth, with abundant thin flexuose hairs. Setae erect, slender, 4–6 mm long. Capsules long-exserted, ovoid to oblong-ellipsoidal, 1.3–1.7 mm long, smooth below, narrowing in upper portion to a puckered 4–8-plicate mouth with a short narrow neck. Peristome single; exostome teeth 16, well developed, erect, ligulate to lanceolate, coarsely papillose on inner surface, finely papillose on outer surface; endostome absent. Spores anisomorphic, 15–35  $\mu\text{m}$  diam., finely papillose. Chromosome number not known.

Known from the Cairns–Atherton area of north-eastern Qld, from Brisbane to Warwick (south-eastern Qld) and in Wauchope (N.S.W.). An uncommon epiphyte of trunks and larger branches in the canopy of montane rainforest; grows on *Nothofagus moorei* in N.S.W.

Qld: Boonah, *D.H.Norris 37123* (NSW); Lamington Natl Park, *D.H.Norris 34670* (CANB); Binna Burra, *D.H.Norris 34471* (NSW). N.S.W.: Wauchope, *C.J.Quinn sub. H.P.Ramsay S277* (NSW).

The most distinctive feature of this species is the pattern of cell shape and anatomy in the branch leaves. The upper laminal cells are densely pluripapillose with low branched papillae, while the rounded cells of the upper two-thirds of the mid-leaf area give way to elongate cells with irregularly fusiform lumina in the lower third. The basal laminal cells are elongate with straight lumina and are usually smooth. The basal leaf margin has broader, thinner-walled cells, often with laterally projecting, central papillae. The superficially similar *M. hemitrichodes*, *M. incurvifolium* and *M. exsertum* are readily separable from *M. stoneae* by their leaf cell structure.

## 21. *Macromitrium subulatum* Mitt., *Trans. & Proc. Roy. Soc. Victoria* 19: 64 (1882)

T: “Bass Straits” [Strait, most likely Flinders Is.], Tas., *W.Milne*; holo: NY.

Illustrations: D.H.Vitt & H.P.Ramsay, *J. Hattori Bot. Lab.* 59: 412, figs 258–266; 414, figs 267, 270 (1985).

Probably pseudautoicous (dwarf males not seen). Plants very robust, lustrous, golden-brown above, dark rusty brown below. Stems loosely creeping, with ascending to erect branches to 20 mm tall. Branch leaves irregularly funiculate, spirally contorted to contorted-flexuose when dry, flexuose-twisted, wide-spreading and with an inflexed incurved apex from an erect base when moist, gradually narrowed to a long slender subula from a broad lower portion, strongly keeled throughout, 4–5 mm long; margin plane to slightly reflexed below; costa narrow, excurrent from the subula; upper laminal cells bulging, rounded, 9–11  $\mu\text{m}$  wide, thick-walled, densely papillose with 4–6 conical papillae per cell; mid-laminal cells flat, rectangular, 14–25  $\times$  9–11  $\mu\text{m}$ , thick-walled, with straight to curved lumina, smooth, continuing distally along costa near margin and forming a border 2–5 cells wide; basal laminal cells flat, 35–60  $\times$  8–10  $\mu\text{m}$  near costa, very irregularly thick-walled, with variable lumina, smooth, becoming longer, straight and thinner near margin.

Perichaetial leaves erect, subsheathing, long and conspicuous, lanceolate, 5.0–5.2 mm long, with a subulate-aristate apex; laminal cells elongate-rectangular, 9–11  $\mu\text{m}$  wide, thick-walled, with straight lumina, smooth. Calyptra not seen. Setae straight, slender, 6–7 mm long, smooth. Capsules exserted, oblong, 1.3–1.8 mm long, not plicate at the mouth.

Peristome single; exostome teeth 16, erect, lanceolate, densely papillose; endostome absent. Spores anisomorphic, 11–36 µm diam., finely papillose. Chromosome number not known.

This moss is represented only by the type specimen, collected on an island in Bass Strait, Tas.

*Macromitrium subulatum* differs from all other Australian species in being robust, rusty brown and lustrous, with leaves that have a spirally contorted-flexuose, acuminate apex. The upper cells have 4–6 papillae per cell, and the basal cells are smooth.

While the type specimen may indeed have come from Flinders Island, it is possible that it was mislabelled and was not collected in Australia at all (D.Meagher, *Australas. Bryol. Newslett.* 48: 10, 2003).

### *Nomina nuda*

*Macromitrium baileyi* Mitt., *Fragm.* 11 (Suppl.): 114 (1881)

*Macromitrium caloblastum* Müll.Hal. ex Kindb., *Enum. Bryin. Exot.* 92 (1888)

*Macromitrium eucalyptorum* var. *brevipedicillatum* Müll.Hal. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 100 (1906)

*Macromitrium eucalyptorum* var. *gracile* Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 100 (1906)

*Macromitrium hartmannii* Müll.Hal. ex Kindb., *Enum. Bryin. Exot.* 66 (1888)

*Macromitrium indistinctum* Müll.Hal. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 101 (1906)

*Macromitrium macrophyllum* Mitt. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 102 (1906)

*Macromitrium microblastum* Broth. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 102 (1906)

*Macromitrium richmondiae* Broth. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 104 (1906)

*Macromitrium ruficola* Müll.Hal. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 104 (1906)

*Macromitrium rupicola* Müll.Hal. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 104 (1906)

*Macromitrium sayeri* Mitt. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 104 (1906)

*Macromitrium sheareri* Broth. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 105 (1906)

*Macromitrium spirale* Hampe, *Fragm.* 11 (Suppl.): 48 (1881)

*Macromitrium subhemitrichodes* Broth. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 104 (1906)