

A revision of the Australasian species of *Dicranoloma* (Bryophyta, Dicranaceae)

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Abstract. A revision of the Australasian (Australian and New Zealand) species of *Dicranoloma* (Renauld) Renauld is presented. Fifteen species are accepted: *Dicranoloma austroscoparium* (Müll.Hal. ex Broth.) Watts & Whitel., *D. billarderi* (Brid. ex anon.) Paris, *D. braunii* (Müll.Hal. ex Bosch & Sande Lac.) Paris, *D. daymannianum* E.B. Bartram, *D. diaphanoneuron* (Hampe & Müll.Hal.) Paris, *D. dicarpum* (Nees) Paris, *D. eucamptodontoides* (Broth. & Geh.) Paris, *D. fasciatum* (Hedw.) Paris, *D. leichhardtii* (Hampe) Watts & Whitel., *D. menziesii* (Taylor) Renauld, *D. obesifolium* (R.Br.bis) Broth., *D. platycaulon* Dixon, *D. plurisetum* Dixon, *D. robustum* (Hook.f. & Wilson) Paris and *D. trichopodium* (Mitt.) Broth. Fifteen new synonymies were made. New lectotypifications have been made where necessary. Thirteen species occur in Australia and 10 in New Zealand. *D. austroscoparium*, *D. diaphanoneuron* and *D. leichhardtii* are endemic to Australia, while *D. plurisetum* and *D. obesifolium* are endemic to New Zealand. Moreover, *D. platycaulon*, *D. fasciatum* and *D. trichopodium* are endemic to the region. *D. daymannianum* and *D. fasciatum* are newly reported from Australia. All recognised species are described and illustrated and distribution maps and a key to the species have been provided.

Introduction

Dicranoloma (Renauld) Renauld is a genus of mosses with a mainly Southern Hemisphere distribution, extending through Malesia into the Northern Hemisphere. In its present circumscription it is estimated to contain 35–40 species after critical revision. *Dicranoloma* has the highest diversity in Malesia (15 species), followed by Australia (13), New Zealand (10) and the south-western Pacific Islands (9). High numbers of species have also been recorded from southern South America and sub-Antarctic Islands. However, for these areas the genus has not been revised yet and it is expected that after revision only a few closely related species will remain.

This is the second in a series of revisions of species of *Dicranoloma*. The first one (Klazenga 1999) dealt with the Malesian species.

For the purpose of this revision Australasia is considered to include Australia, including Lord Howe Island and Norfolk Island, and New Zealand, including Chatham Islands. *Dicranolomas* occurring on sub-Antarctic Islands belonging to Australia's or New Zealand's external territories, i.e. Macquarie Island, Auckland Islands and Campbell Island, were included in the revision as well, but this did not lead to extra species. *Dicranoloma* is not found in other Australian or New Zealand external territories. The

species of *Dicranoloma* from New Caledonia, which is considered part of the Australasian bryofloristic region by Tan and Pócs (2000), will be treated in a future publication, together with species from other south-western Pacific Islands (Vanuatu, Fiji, Samoa, Marquesas Islands, Society Islands and Tubuai Islands).

Phytogeography of Australasian *Dicranoloma*

Dicranoloma is represented in Australasia by 15 species. No infraspecific taxa are recognised in this revision. Australia and New Zealand have most of their species (8) in common. Only *D. austroscoparium* (Müll.Hal. ex Broth.) Watts & Whitel., *D. diaphanoneuron* (Hampe & Müll.Hal.) Paris and *D. leichhardtii* (Hampe) Watts & Whitel. are Australian endemics and *D. obesifolium* (R.Br.bis) Paris and *D. plurisetum* Dixon are New Zealand endemics. Three species, *D. fasciatum* (Hedw.) Paris, *D. eucamptodontoides* (Broth. & Geh.) Paris and *D. trichopodium* (Mitt.) Broth. are endemic to Australasia.

Australasia has three species in common with Malesia. Of these *Dicranoloma dicarpum* (Nees) Paris is a species with a mainly Australasian distribution that also occurs in Papua New Guinea (and Taiwan), *D. braunii* (Müll.Hal. ex Bosch & Sande Lac.) Paris has a continental South-East Asian, Malesian and Oceanic distribution and has been

found once in north-east Queensland, and *D. daymannianum* E.B. Bartram is widespread but scattered in Malesia and Vietnam and is newly reported from a few collections from Queensland and New South Wales. *Dicranoloma billardieri* (Brid. ex anon.) Paris has been excluded from the Malesian bryoflora (see under *D. billardieri*). The Malesian *D. assimile* (Hampe) Renault, the presence of which in 'subtropical Australia' was predicted to be hidden under a synonym by Tan (1989), has not been found among Australasian material.

Australia has two species in common with each of New Caledonia and Vanuatu in the Pacific, *Dicranoloma braunii* and *D. menziesii* (Taylor) Paris with New Caledonia and *D. braunii* and *D. dicarpum* with Vanuatu. *D. braunii* also occurs in other Pacific Islands as far east as Tahiti.

Three species, *Dicranoloma billardieri*, *D. menziesii* (Taylor) Paris and *D. robustum* (Hook. f. & Wilson) Paris also occur in southern South America. Of these three *D. billardieri* and *D. robustum* also occur in sub-Antarctic Islands and the former also in south-eastern Africa and Madagascar.

Systematic status of *Dicranoloma*

Dicranoloma belongs to the family Dicranaceae. Its relationship to the mainly Northern Hemisphere genus *Dicranum* Hedw. has been the subject of much discussion, which has been reviewed by Klazenga (1999). Norris and Koponen (1989) proposed to restrict *Dicranoloma* to six north-east Australian and New Caledonian species with a very well-developed limbidium and to transfer all other species traditionally placed in *Dicranoloma* to *Dicranum*. This delimitation of *Dicranoloma* was rejected by Klazenga (1999). From a cladistic analysis based on morphological characters (Klazenga 1999) both *Dicranum* and *Dicranoloma* in the traditional circumscription appear to be paraphyletic and *Dicranoloma* is nested in *Dicranum*. However, merging the two would not result in a monophyletic *Dicranum*. Moreover, the genera can be separated on morphological characters. *Dicranoloma* sensu Norris and Koponen (1989) turned out to be polyphyletic in this analysis. Evidence from chloroplast sequences (La Farge *et al.* 2002) indicates that *Dicranoloma* and *Dicranum* are not as closely related as they seem to be from morphological evidence.

In the present revision, as in the one of the Malesian species (Klazenga 1999), the traditional concept of *Dicranoloma* as circumscribed by Renault (1909) and Brotherus (1924) is employed. For two of the included species, *D. diaphanoneuron* (Hampe & Müll. Hal.) Paris and *D. trichopodium* (Mitt.) Broth., placement in *Dicranoloma* is dubious, but they fit even worse in other genera. In the absence of information on phylogenetic relationships no new monotypic genera have been described for these species and they have been maintained in *Dicranoloma*.

Margadant and Geissler (1995) correctly pointed out that *Megalostylium* Dozy & Molk., which is included in the current circumscription of *Dicranoloma*, antedates *Dicranoloma* and proposed to conserve *Dicranoloma* against *Megalostylium*. However, at the same time they unnecessarily proposed to conserve *Dicranoloma* with a conserved type that was selected by Norris and Koponen (1989) in a publication in which they advocated a much narrower circumscription of *Dicranoloma* of which *Megalostylium* is no part. Consequently, the proposal was recommended for rejection by the Committee for Bryophyta (Zijlstra 1999).

Although the merit of the Margadant and Geissler's (1995) proposal was somewhat concealed by their mixing up of two different concepts of *Dicranoloma*, rejection of the proposal to conserve *Dicranoloma* against *Megalostylium* does disrupt current usage of the name *Dicranoloma* and of *Megalostylium*. For instance, new combinations in *Megalostylium* will have to be made for all species included in this revision.

Since its publication *Megalostylium* has remained monotypic and has not been accepted in any taxonomic treatment. Eddy (1988) and later Norris and Koponen (1990) and Klazenga (1999), suggested that when it would be possible to break up *Dicranoloma* in smaller monophyletic units the name *Megalostylium* could be used for a small group of mosses characterised by the absence of a central strand in the stem, aggregated sporogones, short setae and outer peristome plates that are vertically striate, but lack cross-connections between the striae. Of the Australasian species only *D. braunii* is part of this group.

A proposal for the Committee for Bryophyta to reconsider is in preparation.

Dicranoloma (Renauld) Renault

Rev. Bryol. 28: 85 (1901)—*Leucoloma* subg. *Dicranoloma* Renault, Prodr. fl. bryol. Madagascar: 61 (1898). Lectotype: *Dicranum platyloma* Besch. fide Williams (1913: 109).

[Description pertains to Australasian material only]

Dioicous, nearly always pseudoautoicous. *Male plants* mostly dwarfed, 0.5–3.0 mm tall, growing in tomentum on stem of female plants. Protonema persistent. Leaves ovate-linear, gradually long acuminate, with or without costa. Perigonia one or more per dwarf male, terminal, laterally displaced. Perigonal leaves broadly ovate to suborbicular, mucronate. Antheridia 2–4 per perigonium, broadly ellipsoid. Paraphyses present or not. Free growing males very rarely found in some species, up to c. 2 cm tall, but still smaller than female plants, with larger perigonia containing around 10 larger antheridia and many filamentous paraphyses.

Female plants more or less robust, up to c. 13 cm tall, sometimes with longer stems if part of stem is creeping or

pendent, green to brown glossy to more or less dull, growing in turfs or cushions. *Stem* reddish to brown, simple or subflorally branched (sympodial) to with extensive lateral branching (monopodial); central strand present (except in *D. braunii*), cortical cells thin- to thick-walled. Stem epidermis cells elongate to linear, thick-walled. *Rhizoids* originating from 4–6 initials below leaf insertion. Paraphyllia and pseudoparaphyllia absent. *Axillary hairs* 4 or fewer per leaf, mostly 2 at either side of costa, deciduous, up to c. 0.8 mm long, filamentous, consisting of up to 12 cells; basal 1–3 cells isodiametric to oblong, often slightly brownish tinged when older; upper cells elongate to linear, colourless; walls smooth. *Rhizoidal gemmae* present in some species.

Leaves 3–24 mm long, ovate-lanceolate to ovate-linear or triangular-linear, gradually long acuminate to obtuse, smooth to plicate or rugose, flat to canaliculate below, canaliculate, subtubulous or V-shaped above, short decurrent, falcate-secund or erecto-patent to widely patent, frequently with falcate apices; apices fragile and often missing in some species. *Alar patches* well-defined, more or less triangular, separated from costa by linear, strongly pitted often yellowish or brownish coloured basal juxtacostal cells, passing into basal lamina cells through isodiametric to oblong, thick-walled and strongly pitted supra-alar cells. *Margin* entire throughout to serrate as far down as upper 3/4 of leaf length, plane. *Limbidium* present (except in *D. braunii*), sometimes ill-developed or absent in some specimens, consisting of one to several cell rows. *Costa* slender to relatively robust, subpercurrent to excurrent (except in *D. obesifolium*), abaxially smooth throughout or with scattered teeth or prorate cell ends or rows of teeth in upper part, guide cells 2–14, with one or more layers of stereids at either side, often with one or more cells with a distinct lumen among them, abaxially often divided into 3–5 bundles by cells with a large lumen; abaxial and/or adaxial epidermis only differentiated in species or specimens with multiple layers of stereids, consisting of cells with a distinct lumen.

Basal lamina cells elongate to linear, very variable in length within single leaf; walls incrassate, pitted. *Upper lamina cells* very variable, similar to very different from basal ones, isodiametric to linear, in regular longitudinal rows or not; walls incrassate, pitted or not pitted. *Alar cells* quadrate to rectangular, inflated or not; walls colourless or yellowish-brown to brown, thin- to thick-walled, collenchymatous in *D. eucamptodontoides*, mostly not pitted. *Limbidium cells* linear, with very thick, non-pitted walls and a very narrow, almost indiscernible lumen. *Teeth at leaf margin* minute to large, consisting of a single cell, lumen similar in size to conspicuously larger than that of adjacent cells.

Perichaetia mostly conspicuous, terminal, often laterally displaced, barrel-shaped to long conical. Perichaetial leaves strongly differentiated from stem leaves; outer perichaetial leaves above an expanded, ovate to broadly ovate, clasping basal part contracted into a long, often recurved subula; inner perichaetial leaves broadly elliptic to broadly ovate-lanceolate, sheathing, truncate to gradually long acuminate to with a long setaceous acumen. Archegonia up to 10 or more per perichaetium, up to c. 2 mm long, with a very long neck, intermingled with a few paraphyses.

Calyptra greenish transparent, cucullate, reaching halfway along theca.

Sporogones solitary or aggregated. *Seta* variable in length, yellowish, partly reddish when older, smooth; central strand present, inner cortical cells thin-walled, gradually passing into thick-walled outer cortical cells (except in *D. braunii*). *Capsules* exserted, cylindrical to narrowly ovoid, straight to curved, curved capsules sometimes distinctly strumose, green between calyptra intact stage* and maturity because of spore mass shining through theca wall, brown when old, reddish at orifice at late annulus-intact and later stages. *Theca wall* yellowish transparent, opaque when old, consisting of one layer of thick-walled exothelial cells and 3 or 4 layers of thin-walled amphithecial cells. *Exothelial cells* irregularly shaped, isodiametric to linear, not in a regular pattern or partly in a more or less regular pattern; in cross-section with longest axis perpendicular to theca wall. *Stomata* present in apophysis, phaneropore. *Annulus* differentiated, revoluble to more persistent. *Peristome* haplolepidious. Peristome teeth narrowly triangular, generally erect when dry, bent inward when moist, asymmetrically bifid in upper half; outer face striate with cross-connections (without cross-connections in *D. braunii*) in basal half or more, papillose above; inner face smooth below, papillose above; inner plates thicker and with trabeculae thicker and more strongly projecting than outer ones (peristome teeth completely different in *D. trichopodum*). *Operculum* obliquely rostrate above a conical base.

Spores spherical, finely papillose (coarser in *D. trichopodum*).

Dicranoloma can be diagnosed by its mostly robust plants, long often falcate leaves, well-differentiated alar patches, differentiated border and relatively narrow costa (when compared with, for instance, *Campylopus* Brid.). It can be separated from *Leucoloma* Brid. and *Sclerodontium* Schwägr., which share many of the above-mentioned features, by the smooth, non-papillose upper lamina cells. *Sclerodontium* also often has a hyaline hair-point. Australasian species of *Dicranum* can be distinguished from *Dicranoloma* by the absence of a limbidium and by the at least partly double-layered alar patches.

*Terminology for stages of sporogone development follows Greene (1960).

Morphology of *Dicranoloma* has been discussed in more detail by Klazenga (1999). Free growing male plants have been reported for *D. menziesii* and *D. dicarpum* by Ramsay

(1985) and have been found in *D. billardieri* (Whinray s.n. (MEL 1051052)) and in *D. fasciatum* (Beveridge s.n. (WELT M033789)).

Key to the Australasian species of *Dicranoloma*

1. Stem central strand absent 3. *D. braunii*
Stem central strand present 2
2. Leaves transversely undulate along the costa at least when dry; upper lamina at least partly with a very irregular cell pattern 12. *D. platycaulon*
Leaves smooth or plicate; cell pattern in upper lamina not highly irregular 3
3. Upper lamina cells not pitted, isodiametric to oblong, always shorter than 50 µm, mostly much shorter 4
Upper lamina cells pitted, elongate to linear, most cells, at least the longest ones, longer than 50 µm; if most cells shorter, then pitted 8
4. Leaf tips setaceous, the upper half of the leaf almost entirely consisting of the costa; lamina in upper half of leaf consisting of a single to a few cell rows 5
Leaves with a well-developed lamina throughout, the costa not comprising more than half of the leaf width in the upper part of the leaf ... 7
5. Costa relatively weak, in cross-section with 5–8 guide cells and 1–2 layers of stereids at either side, epidermis not differentiated; leaf tips curled and twisted when dry 5. *D. diaphanoneuron*
Costa wide, in cross-section with 9–15 guide cells and 2–4 layers of stereids at either side, at least abaxial epidermis differentiated; leaf tips mostly not much altered when dry 6
6. Margin in upper part of leaf serrulate; costa with differentiated adaxial epidermis; leaves > 0.9 mm wide; setae less than 10 mm long, the capsules exerted up to only c. 5 mm from the plants, tips of stem leaves often reaching the capsules; capsule cylindrical, curved. 10. *D. menziesii*
Margin in upper part of leaf entire to crenulate, serrulate only at apex; adaxial epidermis of costa not differentiated; leaves < 0.8 mm wide; setae more than 25 mm long, the capsules exerted far from the plant; capsule narrowly ovoid, straight 15. *D. trichopodium*
7. Margin serrate in upper half or more; limbidium narrow to absent, consisting, when present, of five or less cell rows 6. *D. dicarpum*
Margin serrate in upper fifth or less; limbidium mostly very well-developed, consisting of six or more, mostly many more, cell rows 9. *D. leichhardtii*
8. Leaf margin entire throughout or with a few minute teeth at extreme leaf apex only 9
Leaf margins serrulate to serrate in upper part 10
9. Leaf apex acuminate, flat to V-shaped, not hooded; walls of alar cells collenchymatous; costa subpercurrent to percurrent 7. *D. eucamptodontoides*
Leaf apex obtuse, hooded; alar cell walls firm, but not collenchymatous; costa ceasing well short of leaf apex to percurrent 11. *D. obesifolium*
10. Abaxial side of costa with scattered teeth or prorate cell ends in upper part; plants lustrous when fresh; sporogones solitary (sporogones of *D. daymannianum* unknown) 11
Abaxial side of costa with rows of teeth in upper part; plants dull when fresh; sporogones mostly aggregated 13
11. Stem densely tomentose; rhizoidal gemmae often present 4. *D. daymannianum*
Stem loosely to not tomentose; gemmae absent 12
12. Costa with 2 (–3) guide cells; leaves 4.7–8.8 × 0.9–1.7 mm; leaf apices generally twisted when dry; innermost perichaetial leaf with an obtuse to acute, or emarginate, apex or with a short cusp 2. *D. billardieri*
Costa with (2–) 4–8 guide cells; leaves 6.4–24.0 × 0.7–2.1 mm; leaf apices not or scarcely twisted; innermost perichaetial leaf with a hair-like acumen 14. *D. robustum*
13. Leaf margin serrate in upper half or more; juxtacosta cells at c. 1/3 of leaf length mostly clearly differentiated and shorter than the intramarginal cells; leaves distinctly plicate 6. *D. dicarpum*
Leaf margin serrulate in upper quarter or less; juxtacostal cells not differentiated; leaves smooth or sometimes very slightly plicate. 14
14. Leaves erecto-patent to patent; limbidium consisting of 15 or more cell rows; northern Queensland species 1. *D. austroscoparium*
Leaves falcate-second; limbidium consisting of 14 rows or less; New Zealand and south-east Australian species 15
15. Leaves longer than 8.0 mm; inner perichaetial leaves abruptly aristate, not reaching beyond halfway along the setae 13. *D. plurisetum*
Leaves shorter than 6.0 mm; inner perichaetial leaves gradually long acuminate, reaching the base of the capsules 8. *D. fasciatum*

Alphabetical treatment of the species

Note: types or authentic specimens for quite a few names were not located, most often those described by K. Müller Halle, whose herbarium was destroyed when the Berlin herbarium was bombed during the Second World War. Most of these names have been synonymised earlier, mainly by Dixon (1913). Where types could not be found and the name has been synonymised, the earlier synonymy has been accepted, rather than treating those names as doubtful taxa.

In these cases a question mark ('?') has been placed in front of the basionym.

1. *Dicranoloma austroscoparium* (Müll.Hal. ex Broth.) Watts & Whitel. Fig. 1

Proc. Linn. Soc. New South Wales 30 (Suppl.): 162 (1906)—*Leucoloma austroscoparium* Müll.Hal. ex Broth., *Öfvers. Förh. Finska Vetensk.-Soc.* 37: 150 (1895)—*Dicranum austroscoparium* (Müll.Hal. ex Broth.) Müll.Hal., *Genera musc. frond.*: 285 (1900). Syntypes: Australia. Queensland, Bellenden Ker Range, *F.M. Bailey* 609 (H-BR-lecto!, selected here; BM!), 617 (H-BR!).

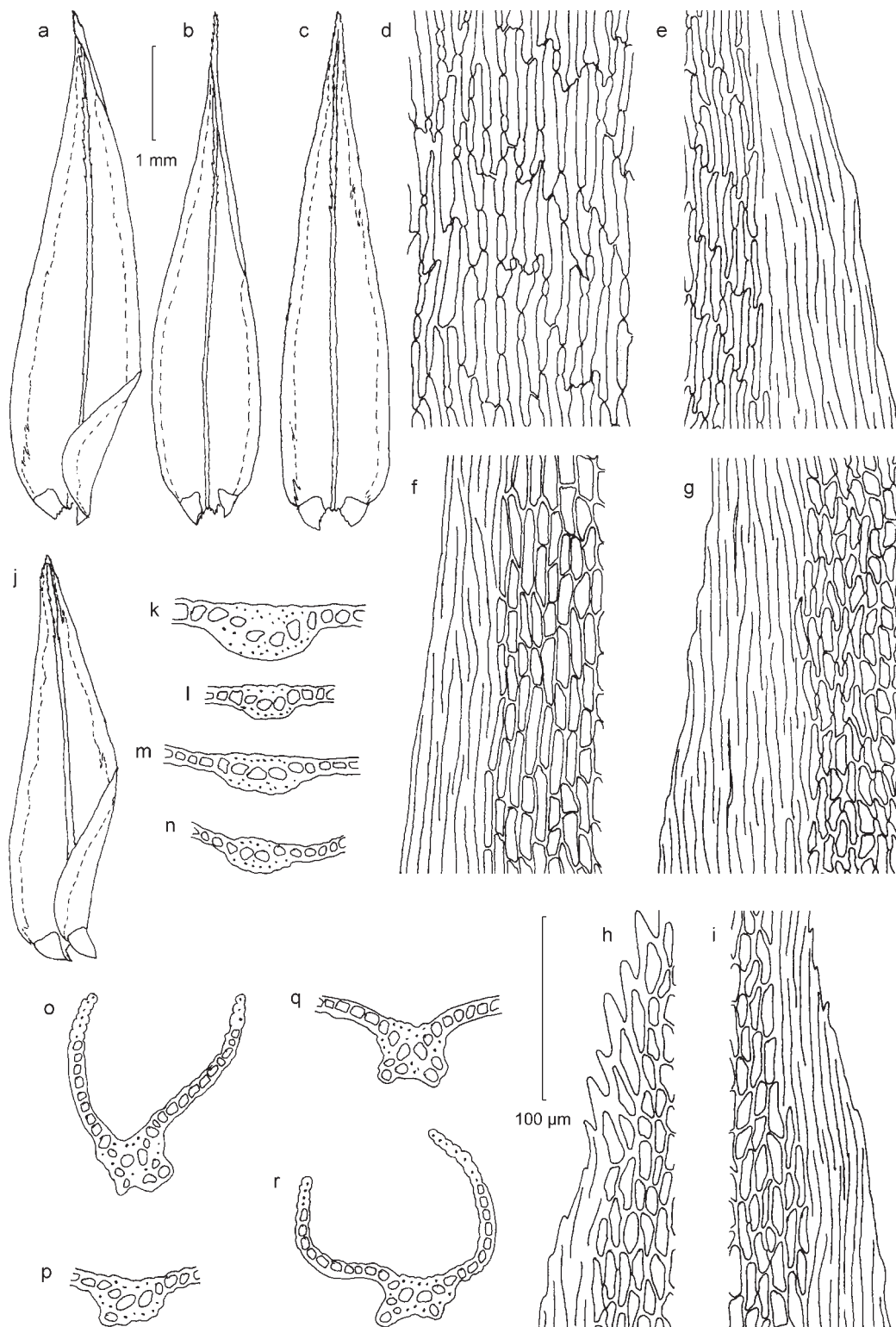


Fig. 1. *Dicranoloma austroscoparium*. *a–c, j*, leaves *d*, basal lamina cells; *e–g, i*, upper lamina cells; *h*, lamina cells at leaf apex; *k–n*, cross sections through costa, just above alar patches; *o–r*, cross sections through costa, upper 1/3. *a, f, k, o*, Bailey 617 (H-BR); *b, d–e, n, p*, Bailey 609 (H-BR); *c, i, m, q*, Streimann 29812 (CBG); *g–h, j, l, r*, Watts 534a (H-BR).

Dicranoloma wattsi Broth. in Broth. & Watts, *Proc. Linn. Soc. New South Wales* 43: 546 (1918), *syn. nov.* Type: Australia. Queensland, Ravenshoe, *W.W. Watts 534a* (H-holo!, BM!, NSW).

Plants 2.5–8.5 cm high, yellowish brown, growing in turfs. *Stem* reddish brown, sparsely subflorally branched, tomentose, densely foliose; central strand present, cortical cells thick-walled. *Leaves* 3.5–6.4 × 0.8–1.3 mm, ovate-lanceolate, gradually long acuminate, smooth, flat or slightly canaliculate below, V-shaped distally, often subtubulous at *c.* 2/3 of leaf length, widely patent to erecto-patent. *Alar patches* 0.22–0.35 × 0.16–0.31 mm. *Margin* serrate in extreme apical part, entire below, plane. *Limbium* consisting of 11–32 rows, reaching almost to leaf apex. *Costa* 20–45 µm wide, 15–25 (–31) µm thick just above alar patches, subpercurrent, abaxially with two rows of teeth in distal 1/5–2/5; in cross-section elliptic to semi-circular with adaxial side slightly concave to slightly convex and abaxial side convex, guide cells 2–4, with a single layer of stereids at either side, epidermis not differentiated. *Basal lamina cells* 38–150 (–172) × (6–) 9–13 µm, elongate to linear, not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 1.0–4.0. *Upper lamina cells* gradually shorter than basal ones (12–) 30–81 × 6–10 µm, elongate to short-linear, straight to oblique to slightly curved or vermiculate, not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 1.5–5.0. *Alar cells* 18–76 × 14–38 µm, quadrate to rectangular, not inflated; walls firm, 2–5 µm thick, not pitted, colourless to yellowish or orangish. *Teeth at leaf margin* 5–16 µm, consisting of a single cell, the lumen not much larger than that of adjacent cells. *Perichaetia* terminal, often laterally displaced. Outer perichaetial leaves with a clasping, ovate to broadly elliptic basal part, abruptly contracted into a reflexed subula. Inner perichaetial leaves elliptic, sheathing, with a hair-like point. *Calyptra* not found.

Sporogones 1–2 per perichaetium. *Seta* *c.* 10 mm long, smooth; in cross-section round to broadly elliptic, 0.16 mm, central strand present, inner cortex gradually passing into outer cortex, outermost 2–3 layers very thick-walled. *Capsule* *c.* 2.5 mm long, cylindrical, straight to slightly convex on one side, not strumose. *Exothecial cells* 32–99 × 18–30 µm, isodiametric to short-linear, irregularly shaped, not in orderly longitudinal rows; becoming isodiametric to oblong towards orifice. *Stomata* present in apophysis, evenly distributed, phaneropore. *Annulus* revoluble, consisting of 1–2 cell layers. *Peristome teeth* orange, 500–560 µm long, 66–76 µm wide at base, narrowly triangular, asymmetrically bifid in upper *c.* 2/3; outer face striate in basal *c.* 2/3, with cross-connections in basal *c.* 1/2, papillose above; inner face smooth in basal *c.* 1/2, papillose above; outer trabeculae thin; inner trabeculae thick, papillose. *Spores* 20–25 µm, spherical, finely papillose.

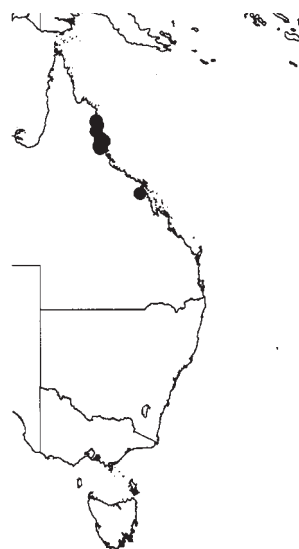


Fig. 2. Geographic distribution of *Dicranoloma austroscoparium*.

Distribution (Fig. 2): Australia, humid wet tropics in northern Queensland, between Mt Finnigan and Cairns and known from a single collection from Eungella National Park near Mackay farther south. Endemic to Australia.

Habitat: Rain forest between 750–1550 m altitude. Mostly epiphytic, sometimes on side of rocks.

Selected additional specimens examined: AUSTRALIA. QUEENSLAND, Tinaroo Range, Mt Haig, *M.M.J. van Balgooy 1583A* (L); Thornton Peak, on plateau of summit between Hilda Creek and summit, *J.R. Clarkson 5576* (CBG); Eungella National Park, NW of Mackay, Mt Dalrymple Rd-summit, *G. Ramboldt 4594* (CBG); Barron State Forest, Herberton Range, 11 km SSW of Atherton, *H. Streimann 27301* (CBG, H, L, NY); Mt Bellender Ker, South Peak, 23 km SSE of Gordonvale, *H. Streimann 27340* (CBG, L); Koombuloomba Dam Rd, 23 km SE of Ravenshoe, *H. Streimann 28881* (CBG); Lamb Range, 21 km NE of Atherton, *H. Streimann 29812* (CBG, H, NY); Lamb Range, near Mt Haig, 22 km SE of Mareeba, *H. Streimann 57713* (CBG); Cedar Bay National Park, Mt Finnigan Range, Mt Finnigan, *H. Streimann 57194* (CBG); Mt Misery, 46 km S of Cooktown, *H. Streimann 57380* (CBG); Cook District, Mt Lewis summit ridge, *D. Verdon 5373* (CBG).

Dicranoloma austroscoparium is easily distinguished from all other *Dicranolomas* that occur sympatrically by its wide, patent leaves and its very well-developed border. From *D. leichhardtii*, which often has an almost equally well-developed border, it can be separated by the leaf characters mentioned above and by the upper lamina cells which are isodiametric, not pitted and often prorate in *D. leichhardtii* and elongate, pitted and smooth in *D. austroscoparium*.

Brotherus (Brotherus and Watts 1918) described *D. wattsi* as similar to *D. austroscoparium*, but with wider leaves. Variation in this character was found to be continuous and the leaf width measured in the type of *D. wattsi* within the range measured for *D. austroscoparium*.

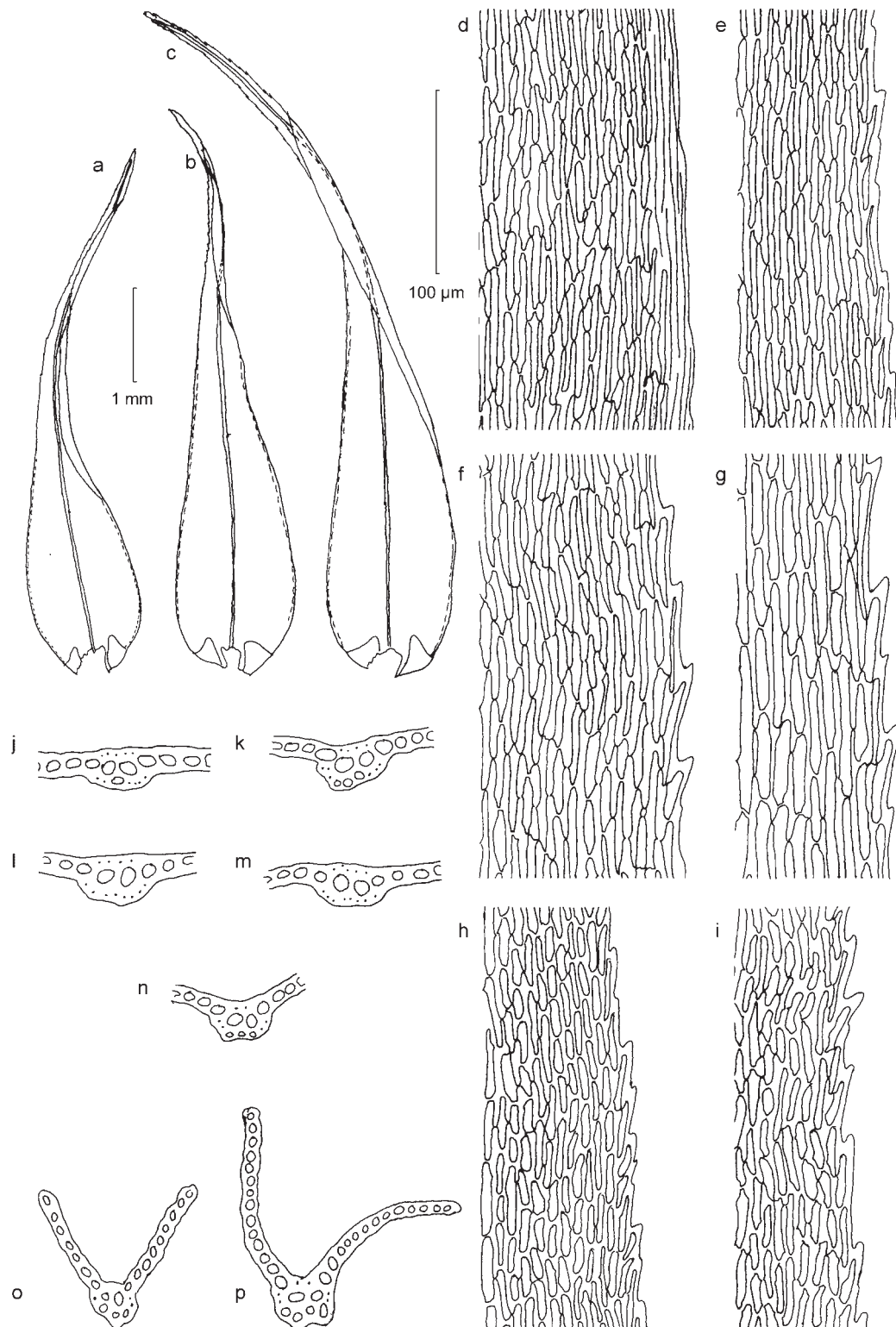


Fig. 3. *Dicranoloma billardieri*. a–c, leaves; d, basal lamina cells and marginal cells; e–i, upper lamina cells; j–m, cross sections through costa, just above alar patches; n, cross section through costa, at c. 1/3 of leaf length; o–p, cross sections through costa, distal 1/3. a, g, j, *Klazenga* 5338 (MEL); b, d–e, m–n, *Klazenga* 5340 (MEL); c, f, k, o, *Klazenga* 5342 (MEL); h, p, *Klazenga* 5344 (MEL); i, *Klazenga* 5359 (MEL); l, *Klazenga* 5339 (MEL).

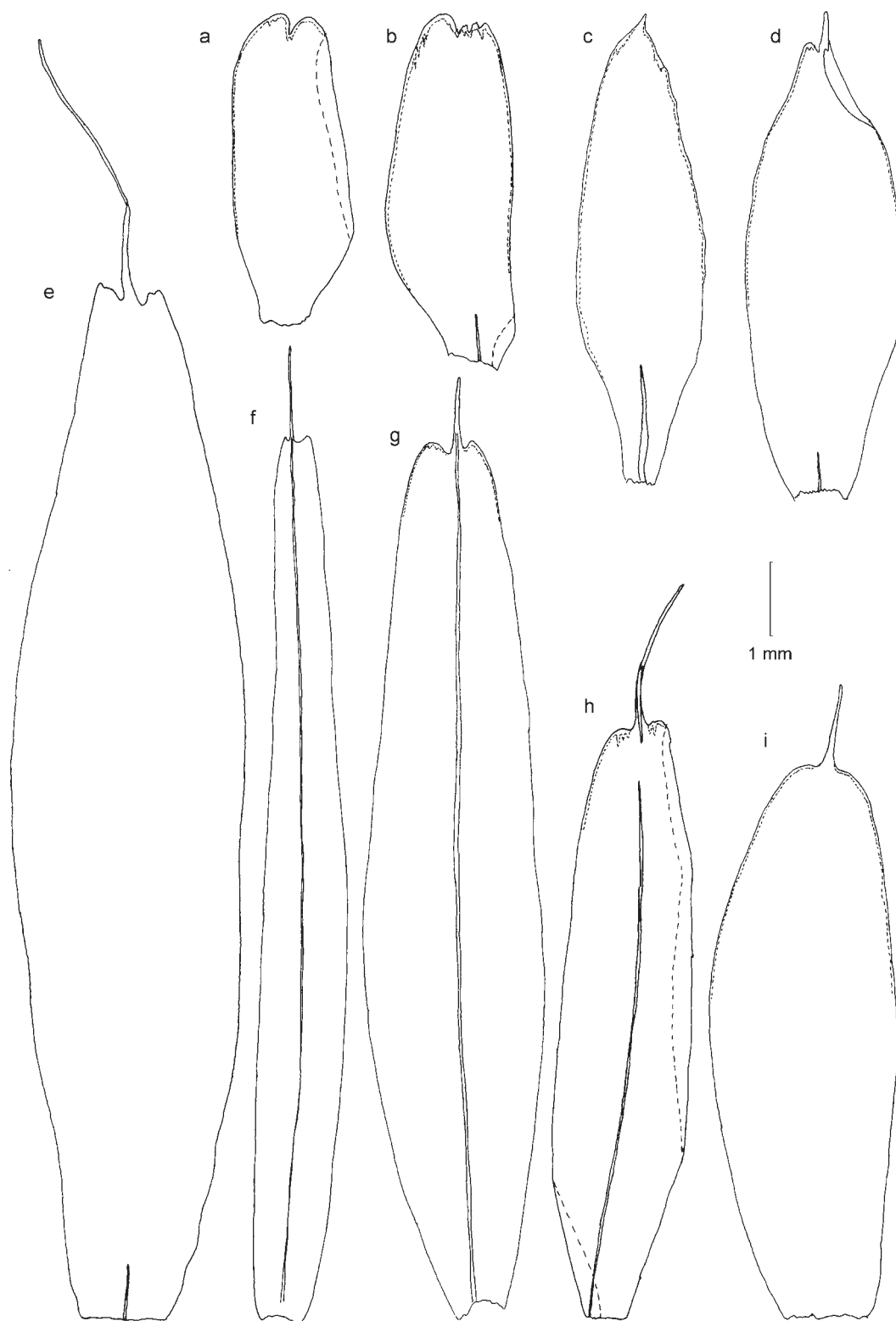


Fig. 4. Innermost perichaetial leaves of *a–d*, *Dicranoloma billarderi* and *e–i*, *D. robustum*. *a*, Klazenga 5496 (MEL); *b*, Klazenga 5344 (MEL); *c*, Brockie 4 (WELT); *d*, Klazenga 5551 (MEL); *e*, Vitt 8356 (CANB); *f*, Milligan s.n. (BM); *g*, Lewington & Polly s.n. (WELT M8830); *h*, Klazenga 5303 (MEL); *i*, Glenny 89-239 (WELT).

2. *Dicranoloma billarderi* (Brid. ex anon.) Paris Figs 3, 4a–d

Index bryol. ed. 2, 2: 24 (1904)—*Dicranum billarderi* Brid. ex anon., *Bot. Zeit.* (Regensburg) 1: 214 (1802), [*'Billarderii'*]*—Dicranum billarderi* Brid., *Muscol. recent.* 2: 181 (1798), *pre-Hedwigian name—Oncophorus billarderi* (Brid. ex anon.) Brid., *Bryol. univ.* 1: 401 (1826)—*Leucoloma billarderi* (Brid. ex anon.) Broth., *Nat. Pflanzenfam.* 1, 3: 323 (1901). Type: Australia. J.J.H. de Labillardière (B-holo, destroyed; BM-Bescherelle-lecto!, *selected here*; L!).

Dicranum billarderi var. *duriusculum* Hook.f. & Wilson in Wilson & Hook.f., *Fl. antarct.* 1: 129 (1845), *syn. nov.*—*Dicranoloma billarderi* var. *duriusculum* (Hook.f. & Wilson) Paris, *Index bryol.* ed. 2, 2: 24 (1904). Type: New Zealand. Lord Auckland's group; on the ground and dead trunks of trees in woods, J.D. Hooker [66] (BM-Hooker!; coll. no. not in protologue, only on collection).

Dicranum confine Müll.Hal. & Hampe in Hampe, *Linnaea* 28: 206 (1856)—*Leucoloma confine* (Müll.Hal. & Hampe) Broth., *Nat. Pflanzenfam.* 1, 3: 323 (1901)—*Dicranoloma confine* (Müll.Hal. & Hampe) Paris, *Index bryol.* ed. 2, 2: 25 (1904). Type: Australia. Victoria, Wilsons Promontory, Sealers Cove, F. Mueller [98] (B-holo, destroyed; MEL 33140-lecto!, *selected here*; BM! (not from Hampe's herbarium), MEL 33125!). Synonymised by Robinson (1975: 22).

Dicranum angustinerve Mitt., *J. Proc. Linn. Soc.* 4: 68 (1859)—*Leucoloma angustinerve* (Mitt.) Broth., *Nat. Pflanzenfam.* 1, 3: 323 (1901)—*Dicranoloma angustinerve* (Mitt.) Paris, *Index bryol.* ed. 2, 2: 24 (1904). Type: Australia. Tasmania, W. Archer (NY!). Synonymised by Dixon (1913: 23).

Dicranum austrocongestum Müll.Hal., *Hedwigia* 36: 356 (1897)—*Leucoloma austrocongestum* (Müll.Hal.) Broth., *Nat. Pflanzenfam.* 1, 3: 323 (1901)—*Dicranoloma austrocongestum* Paris, *Index bryol.* ed. 2, 2: 24 (1904). Type: Australia, New South Wales, near Mossvale, Fitzroy Falls, T. Whitelegge s.n. (B-holo, destroyed; MEL 29199-lecto!, *selected here*; MEL 33144!). Synonymised by Dixon (1913: 23).

?*Dicranum orthopyxis* Müll.Hal., *Hedwigia* 36: 362 (1897). Type: New Zealand, Auckland, G. Zürn (B-holo, destroyed; no isotype located). Synonymised by Dixon (1913: 23).

?*Dicranum pungentella* Müll.Hal., *Hedwigia* 36: 355 (1897)—*Leucoloma pungentella* (Müll.Hal.) Broth., *Nat. Pflanzenfam.* 1, 3: 323 (1901)—*Dicranoloma pungentella* (Müll.Hal.) Paris, *Index bryol.* ed. 2, 2: 29 (1904). Type: Australia. Tasmania, Mt Wellington, Hb. Melbourne misit (B-holo, destroyed; no isotype located). Synonymised by Sainsbury (1955a: 133).

?*Dicranum weymouthii* Müll.Hal., *Hedwigia* 36: 354 (1897)—*Leucoloma weymouthii* (Müll.Hal.) Broth., *Nat. Pflanzenfam.* 1, 3: 323 (1901)—*Dicranoloma weymouthii* (Müll.Hal.) Paris, *Index bryol.* ed. 2, 2: 31 (1904). Type: Tasmania, Southdale, W.A. Weymouth (B-holo, destroyed; no isotype located). Synonymised with *D. pungentella* by Dixon (1913: 26).

?*Dicranum scopelloides* Paris, *Index bryol.* Suppl. 1: 125 (1900)—*Dicranum subconfine* Müll.Hal., *Hedwigia* 36: 353 (1897), *nom. illeg.* (later homonym)—*Leucoloma scopelloides* (Paris) Broth., *Nat. Pflanzenfam.* 1, 3: 323 (1901)—*Dicranoloma scopelloides* (Paris) Paris, *Index bryol.* ed. 2, 2: 30 (1904). Type: New Zealand. South Island, Westland, Greymouth, R. Helms (B-holo, destroyed; no isotype located). Synonymised by Dixon (1913: 23).

?*Dicranum leucolomopsis* Müll.Hal. in Müll.Hal. & Broth., *Abh. Naturwiss. Vereine Bremen* 16 (3): 494 (1900), *nom. nud.* Synonymised with *Leucoloma pungentella* by Dixon (1912: 437).

?*Dicranum turgidum* Müll.Hal., *Genera musc. frond.*: 290 (1900), *nom. nud.* Synonymised by Dixon (1913: 23).

Plants 1.5–11.0 cm high, glossy yellowish or light green to dark green, often dull brown to blackish in the lower parts, growing in turfs. *Stem* simple or sparsely

subflorally branched with extensive intercalary innovations, tomentose, densely foliose; central strand present, cortical cells firm-walled. *Leaves* 4.7–8.8 × 0.9–1.7 mm, gradually tapering above an ovate base, smooth, canaliculate below, carinate above, falcate-secund. *Alar patches* 0.23–0.57 × 0.14–0.45 mm. *Margin* serrulate in upper 0.15–0.50, entire below, plane. *Limbium* consisting of (1–) 2–6 (–8) rows, reaching serrulate part of margin or just below or within. *Costa* 18–35 (–50) µm wide, 18–33 µm thick just above alar patches, subpercurrent, abaxially with scattered teeth in upper part; in cross-section semi-circular with adaxial side straight or slightly raised and abaxial side convex, guide cells 2 (–3), with a single layer of stereids at either side, epidermis not differentiated. *Basal lamina cells* 25–139 × 7–13 (–15) µm, elongate to linear, not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 0.6–2.0. *Upper lamina cells* 12–90 (–114) × 5–10 µm, oblong to linear; walls incrassate, pitted, lumen wall ratio 0.6–4.0. *Alar cells* 13–76 × 8–45 µm, quadrate to rectangular, sometimes slightly inflated; walls thin to firm, 1–3 µm thick, not pitted, colourless to yellowish-brown or brown. *Teeth at leaf margin* 5–18 µm, consisting of a single cell, the lumen of which is not conspicuously larger than that of adjacent cells. *Perichaetia* terminal, often laterally displaced. Outer perichaetial leaves with a clasping, ovate to broadly elliptic basal part, abruptly contracted into a reflexed subula. Inner perichaetial leaves with a broadly elliptic, sheathing basal part which is acute or obtuse or shouldered in innermost perichaetial leaves and with a short hair-like point in the lower ones. *Calyptra* 5.0–6.0 mm, reaching halfway along capsule, cucullate, greenish transparent, brown at apex, smooth, slightly rough above because of bulging cell ends; base entire.

Sporogones solitary or very rarely two per perichaetium. *Seta* 14.5–29.0 mm long, yellowish, smooth. *Capsule* 3.0–3.8 mm long, cylindrical, curved, strumose. *Exothecial cells* 30–120 × 15–30 µm, isodiametric to elongate, irregularly shaped to rectangular; cells at convex side of theca longer and in a slightly more regular pattern than ones at straight side; becoming isodiametric towards capsule mouth. *Stomata* present in apophysis, more or less evenly distributed, phaneropore. *Annulus* persistent, consisting of a single cell layer, in places 2 cells thick. *Peristome teeth* orangish in basal c. 1/2, yellowish above, 350–500 µm long, 90–100 µm wide at base, asymmetrically bifid in upper c. 1/2; outer face vertically striate with cross-connections in basal half, obliquely striate above, with papillae on striae in apical part; inner face smooth in lower c. 2/3, papillose above; outer trabeculae thin, not ornamented; inner trabeculae thick, strongly projecting, papillose, especially in lower half of teeth. *Operculum* 3.0–3.2 mm, obliquely rostrate above a conical base. *Spores* 17.0–22.0 µm, spherical, finely papillose.

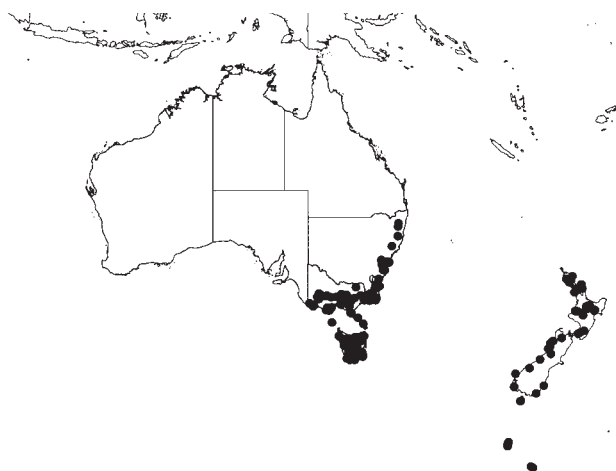


Fig. 5. Geographic distribution in Australasia of *Dicranoloma billardieri*.

Illustrations: Wilson (1859, pl. 171, fig. 9, as *Dicranum angustinerve*); Dixon (1912, pl. 20, figs. 12–14, as *Leucoloma pungentella*); Dixon (1913, pl. 4, figs. 12 & 19; pl. 4, fig. 14, as *Dicranoloma pungentella*); Sainsbury (1955a: 134, pl. 22, fig. 1); Catcheside (1980: 106, fig. 38); Magill (1981: 131, fig. 35, South African material); Beever *et al.* (1992: 46, figs. 24a–e).

Distribution (Fig. 5): Australia: coastal tablelands in New South Wales, southern Victoria, King Island, Flinders Island and Tasmania; also known from a single collection from south-western Western Australia (precise locality not given) and from the Lofty Ranges in South Australia (collections not seen). New Zealand: North Island, South Island, Stewart Island, Chatham Islands, Auckland Islands and Campbell Island. Outside the region also found in southern and eastern Africa, Madagascar, sub-Antarctic Islands, southern South America.

Habitat: Growing in various forest types from dry sclerophyll forest to temperate or warm rain forest; also in open vegetation above tree line and in sub-Antarctic Islands and in Button Grass sedgeland in Tasmania. Between sea level and c. 1500 m above sea level. Terrestrial or on rocks, logs or tree bases.

Selected additional specimens examined: AUSTRALIA. WESTERN AUSTRALIA, in SW of state, *D. Clyne* s.n. (MEL 1047071); NEW SOUTH WALES, Blue Mountains, Wentworth Falls, *M. Fleischer* 2572 (CANB, L, NY); Gloucester Tops, 42 km WSW of Gloucester, *H. Streimann* 1543 (CBG, L, MO). VICTORIA, Grampians National Park, top of Mt William, *A.C. Beauglehole* 21907 (MEL); Eastern Highlands, Kinglake National Park, near Wombelano Falls, *A.W. Thies* 1480H (MEL); East Gippsland, Errinundra Rd, 24 km SE of Bendoc, *H. Streimann* 39206 (CANB, NY). TASMANIA, Standerad Hill, 30 km WSW of Deloraine, *J.A. Curnow* 2181 (CANB, HO, NY); Mt Field National Park, Growling Swallet, *N. Klazenga* 5496 (MEL); Mt Field National Park, Lady Barron Walk, *N. Klazenga* 5551 (MEL); Central Highlands: Netherby Creek, 9 km S of Warath, *A. Moscal* 13649 (CANB, HO, MEL, NY). NEW ZEALAND. NORTH ISLAND, North Auckland, Great Barrier

Island, S of Port Fitzroy, Hirikamata Track to Mt Hobson, *P.J. Brownsey* s.n. (WELT 31510); Taranaki, Mt Egmont, *Klazenga* 5338, 5339, 5340, 5342, 5344, 5359 (MEL); Wellington, Tongariro Forest, Okupata Stream, Okupata Caves, *R.J. Lewington* s.n. (WELT 28897). SOUTH ISLAND, NELSON, Denniston Plateau, 16 km E of Westport, *H. Streimann* 51132 (CANB); Westland, NE of Greymouth, Blackball, end of Blackball Rd, star of Croesus Track, *P.J. Brownsey* s.n. (WELT 32394). STEWART ISLAND, Port Pegasus, *B.G. Hamlin* 2828 (WELT). AUCKLAND ISLAND, Camp Cove, Carnley Harbour, *P.N. Johnson* 21/29 (WELT). CAMPBELL ISLAND, *J.D. Hooker* s.n. (BM); Tucker Cove Valley, *Brockie* 4 (WELT).

Dicranoloma billardieri shares with *D. robustum* the glossy appearance, scattered teeth on the abaxial surface of the costa and solitary sporogones. *Dicranoloma billardieri* can be reliably distinguished from *D. robustum* by the number of rows of guide cells in the costa, 2 (–3) in *D. billardieri* v. (2–) 4–8 in *D. robustum* and by the apex of the perichaetial leaves which in *D. billardieri* are obtuse to with a short apiculus and in *D. robustum* mostly have a long setaceous acumen. The inner perichaetial leaves also tend to be longer in *D. robustum* and form a tighter sheath around the seta, the perichaetium mostly being narrowly conical, while in *D. billardieri* the perichaetium is more or less barrel-shaped. Moreover, leaf length in *D. billardieri* is at the lower end of the range of these two species, so specimens with leaves longer than 9 mm belong to *D. robustum*. Finally, in the field *D. billardieri* can often be easily recognised from *D. robustum* by its messier appearance, caused by its more twisted leaf apices. Other characters in which there is considerable variation, such as the length of the upper lamina cells and the extent of the marginal teeth do not differ consistently between the two species.

Because of the relatively few layers of stereids at either side of the guide cells the number of rows of guide cells can be determined both from cross-sections through the leaf and from surface view. From cross-sections cells on the transition from lamina to costa tend to be counted as guide cells (*cf.* Beever *et al.* 1992) while in surface view these cells are clearly lamina cells. This would not be a problem if the lamina cells closest to the costa would, in cross-section, always look like intermediates between lamina cells and guide cells and would always be counted as guide cells. But they do not and hence the lamina cell closest to the costa is sometimes counted as a guide cell and sometimes as a lamina cell, leading to a larger range of rows of guide cells in both *D. billardieri* and *D. robustum*, and to more overlap between the two species. This is made worse by the fact that the shape of the costa in cross-section differs between *D. billardieri* and *D. robustum*. In forms of *D. robustum* with a relatively narrow costa, the costa is straight and mostly not or not much thicker than the lamina, while in *D. billardieri* the costa is more convex at the abaxial side and the row of lamina cells closest to the costa lies slightly more abaxial than the other rows of lamina cells. Hence, the number of rows of guide cells in *D. billardieri*, which is almost always two, is often

counted as four, which is a number that often occurs in *D. robustum*. For these reasons only cells that are completely covered by stereids on one or both sides should be counted as guide cells.

In some Tasmanian and New Zealand specimens of *D. robustum* costae with only two rows of guide cells are found, but almost always leaves with a wider costa will be found on the same plant and otherwise the plants can be identified by the leaf length and the shape of the perichaetial leaves.

Apart from the morphological differences *D. billardieri* and *D. robustum* differ in chromosome numbers, $n = 12$ vs $n = 7$ (Ramsay 1985).

Scott and Stone's (1976) inclusion of *D. robustum* in *D. billardieri* and their surprise that Sainsbury (1955a) had not already done so is based on an, in my view, incorrect interpretation of the characters of the species and also on an incorrect interpretation of Sainsbury's discussion. Sainsbury (1955a) did not admit to having problems distinguishing between *D. billardieri* and *D. robustum*, but rather with distinguishing between forms of *D. robustum*. The inclusion of *D. robustum* in *D. billardieri* has led to the belief that these two species are very difficult to tell apart, which at least in Australia and New Zealand, in most cases they are not really.

Tan and Koponen (1983) synonymised three names based on Malesian types, among which *Dicranoloma brevicapsulare* Dixon, with *D. billardieri*. Eddy (1988) considered *D. billardieri* 'possibly not conspecific' with *D. brevicapsulare*, without mentioning distinguishing characters and also considered it possible that *D. brevicapsulare* occurs in northern Australia. Tan (1989), however, maintained his position that *D. brevicapsulare* and *D. billardieri* are conspecific claiming his concept of *D. billardieri* follows that of Sainsbury (1955a) and Dixon (1913). He was followed by Norris and Koponen (1990) and finally by Klazenga (1999) who also synonymised *D. novoguineense* (Broth. & Geh.) Paris, which was maintained as a species by all the previous authors.

The present study revealed that Malesian specimens do not belong to *Dicranoloma billardieri*. The Malesian specimens are actually more similar to *D. robustum*, sharing the long leaves and setaceous innermost perichaetial leaves with that species, while sharing the very narrow costa, consisting of only two guide cells, with *D. billardieri*. For the moment I consider the Malesian species as separate from both *D. billardieri* and *D. robustum*. New Caledonian reports of *D. billardieri*, as well as the types of a number of New Caledonia 'endemics' belong to the Malesian species. The available name with the oldest basionym seems to be *D. deplanchei* (Duby) Paris. The Malesian species has not been found in Australia.

Part of the confusion surrounding *Dicranoloma billardieri* and the Malesian species was caused by the fact that the holotype of *D. billardieri* could not be located, even though

the largest part of the Bridel herbarium has survived the bombing of the Berlin herbarium at the end of the Second World War. During the present study a collection was found in the Bescherelle herbarium (cited above), which I consider to be part of the type material of *D. billardieri* and hence have selected as the lectotype. Dixon's (1913) and Sainsbury's (1955a) concepts of *D. billardieri* agree with the lectotype.

No African, southern South American or sub-Antarctic specimens of *D. billardieri* were studied.

3. *Dicranoloma braunii* (Müll.Hal. ex Bosch & Sande Lac.) Paris

Index bryol. ed. 2, 2: 25 (1904)—*Dicranum braunii* Müll.Hal. ex Bosch & Sande Lac., *Bryol. jav.* 1: 69 (1858)—*Leucoloma braunii* (Müll.Hal. ex Bosch & Sande Lac.) Broth., *Nat. Pflanzenfam.* I, 3: 322 (1901). Syntypes: Indonesia. Sumatra, J.E. Teysmann s.n. (L-lecto!, fide Klazenga (1999: 71); H-BR!); Java, Gunung Gedeh, A. Zippelius s.n. (not located); comm. J.J. Rochussen (L!); comm. Holle (not located).

Dicranoloma spiniforme E.B. Bartram, *Farlowia* 4: 237 (1952). Type: Australia. Queensland, Mt Finnigan, L.J. Brass 20090 (FH-Bartram!). Synonymised by Klazenga (1999: 73).

Plants 2–15 cm high, glossy yellowish-green to yellowish-brown, growing in turfs. *Stem* simple or sparsely subflorally branched, tomentose, densely foliose; central strand absent, cortical cells thick-walled. *Gemmae* often present in apical part of stem, frequently in large clusters, at base of rhizoids and replacing them, reddish, filamentous, uniseriate. *Leaves* 3.0–13.0 × 0.5–1.3 mm, triangular-linear to ovate-linear, gradually tapering, or above a broadly ovate basal part rather abruptly contracted into a subula, plicate, flat to canaliculate below, carinate above, mostly widely patent throughout, occasionally falcate-secund or circinate. *Alar patches* 0.20–0.60 × 0.20–0.50 mm. *Margin* just above alar patches entire to serrulate, upwards becoming more strongly serrate, coarsely serrate in upper 0.65–0.75, plane. *Limbium* absent or rudimentary. *Costa* 50–100 µm wide, 20–50 (–60) µm thick just above alar patches, subpercurrent or percurrent, abaxially with 2 (–4) rows of teeth in distal 0.50–0.75; in cross-section semi-circular to crescent-shaped with adaxial side straight or convex and abaxial side convex, guide cells 4–6 (–8), adaxially with 1–3 (–3) layers of stereids, abaxially with 1–2 layers of stereids, mostly divided into (2–) 3 (–5) bundles, separated by cells with a larger lumen. *Basal lamina cells* (30–) 50–180 × 8–18 µm, elongate to linear; walls incrassate, pitted, lumen wall ratio 1.0–3.0. *Upper lamina cells* (30–) 40–150 (–190) × 5–10 µm, oblong to linear; walls incrassate, pitted, lumen wall ratio 1.0–3.0. *Alar cells* 20–100 × 15–50 µm, quadrate to rectangular, not inflated; walls firm, 2–7 µm thick, not pitted, colourless to yellowish to brown. *Teeth at leaf margin* 10–30 µm, consisting of a 1 (–2) cells; lumina not conspicuously larger than in adjacent cells. *Perichaetia* terminal, often laterally displaced. Perichaetial leaves above a clasping to sheathing, broadly ovate basal part abruptly contracted into a subula; outer perichaetial leaves resembling stem leaves.

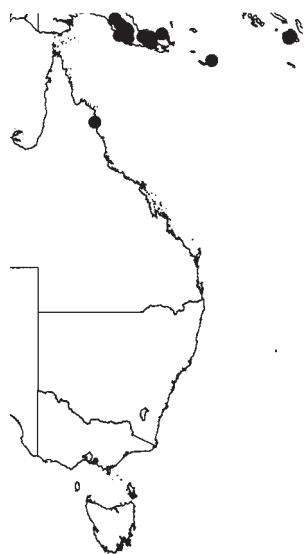


Fig. 6. Geographic distribution in Australia of *Dicranoloma braunii*.

Calyptra 2.0–3.0 mm, reaching halfway along capsule, cucullate, greenish transparent, brown at apex, smooth, slightly rough above because of bulging cell ends; base entire.

Sporogones (1–) 2 (–5) per perichaetium. *Seta* 1.5–2.5 mm long, yellowish, smooth; central strand present, inner cortex thin-walled, with abrupt transition to single-layered, thick-walled outer cortex. *Capsule* (0.8–) 1.0–2.0 mm long, cylindrical, straight, not strumose. *Exothecial cells* 30–110 × 10–50 µm, elongate, irregularly shaped, not in orderly longitudinal rows; becoming isodiametric towards capsule mouth. *Stomata* present in apophysis, more or less evenly distributed, phaneropore. *Annulus* persistent, consisting of 2–3 rows. *Peristome teeth* yellowish to reddish, 400–700 µm long, 50–90 (–140) µm wide at base, asymmetrically bifid in upper c. 1/2; outer face vertically to obliquely striate (no cross-connections) or striate and papillose in basal half, papillose above; inner face either papillose throughout or smooth in basal half; distal trabeculae densely papillose, inner ones thicker and more strongly ornamented than outer ones. *Operculum* 0.8–1.0 mm, obliquely rostrate above a conical base. *Spores* 18.0–30.0 µm, spherical, finely papillose.

Illustrations: Klazenga (1999: 72, fig. 17, plus see references on p. 74).

Distribution (Fig. 6): Australia: found once on Mt Finnigan, north-east Queensland. Widespread in continental South-East Asia, Malesia and Oceania.

Habitat: The Australian specimen was found at an altitude of 1100 m and said to be abundant in the undergrowth.

Dicranoloma braunii may be distinguished from all other Australian species of *Dicranoloma* by the absence of

a central strand in the stem. *D. braunii* has large teeth in the upper half or more of the leaf margin which among congeners occurring in Queensland are only found to that extent in *D. dicarpum*, from which it can be separated by the long upper lamina cells. The Australian specimen possesses a rudimentary limbidium, which has not been found in any specimens from other parts of the distribution area.

Dicranoloma braunii is known from Australia only from the type specimen of *D. spiniforme*. The above description is based on a large sample of Malesian, South-East Asian and Pacific specimens and the Australian specimen. Neither sporogones nor gemmae were found on the Australian specimen.

4. *Dicranoloma daymannianum* E.B. Bartram Fig. 7

Brittonia 9: 35 (1957) — *Dicranum daymannianum* (E.B. Bartram) D.H. Norris & T.J. Kop., *Acta Bot. Fenn.* 139: 40 (1990). Type: Papua New Guinea. Milne Bay, Maneau Range, north slope of Mt Dayman, L.J. Brass 22560a (FH-Bartram-holo!, FH!, H!)

Male plants unknown. *Plants* 1.3–2.0 cm high, yellowish-greenish-brown, growing in turfs. *Stem* reddish-brown, simple or scarcely subflorally branched, densely tomentose, densely foliose; c. 0.20 mm in diameter, central strand present, cortical cells thick-walled. *Rhizoidal gemmae* often present in lower part of shoot. *Leaves* 4.8–5.8 × 0.6–0.8 mm, ovate-linear, gradually long acuminate, smooth, canaliculate, erecto-patent to very slightly falcate; tips fragile, easily breaking off. *Alar patches* 0.23–0.27 × 0.16–0.19 mm. *Margin* serrulate in upper 3/4–4/5, entire below, plane. *Limbidium* absent or ill-developed, consisting of a single cell row in expanded basal part of leaf only. *Costa* 43–63 µm wide, 30–35 µm thick just above alar patches, subpercurrent, abaxially with scattered teeth in distal 2/3–3/4; in cross-section semi-circular with adaxial side plane and abaxial side convex, guide cells 6, with two layers of stereids at either side, epidermis not differentiated adaxially, abaxially often consisting of cells with a distinct lumen. *Basal lamina cells* 22–68 (–91) × 8–9 (–11) µm, elongate to short-linear, more or less in orderly longitudinal rows; walls incrassate, shallowly pitted, lumen wall ratio 2.0–2.5. *Upper lamina cells* gradually becoming shorter than basal ones, 18–46 × 7–8 µm, oblong to elongate, in orderly longitudinal rows; walls incrassate, scarcely and shallowly pitted, lumen wall ratio 1.5–2.0. *Alar cells* 13–43 × 15–28 µm, quadrate to rectangular, not inflated; walls thick, 4–5 µm thick, not pitted, colourless or brown. *Teeth at leaf margin* up to 15 µm, consisting of a single cell, lumen of same size as that of adjacent cells.

Sporogones unknown.

Illustrations: Klazenga (1999: 88, fig. 23, plus see references on p. 89).

Distribution (Fig. 8): Australia: humid wet tropics in north-eastern Queensland, between Atherton and

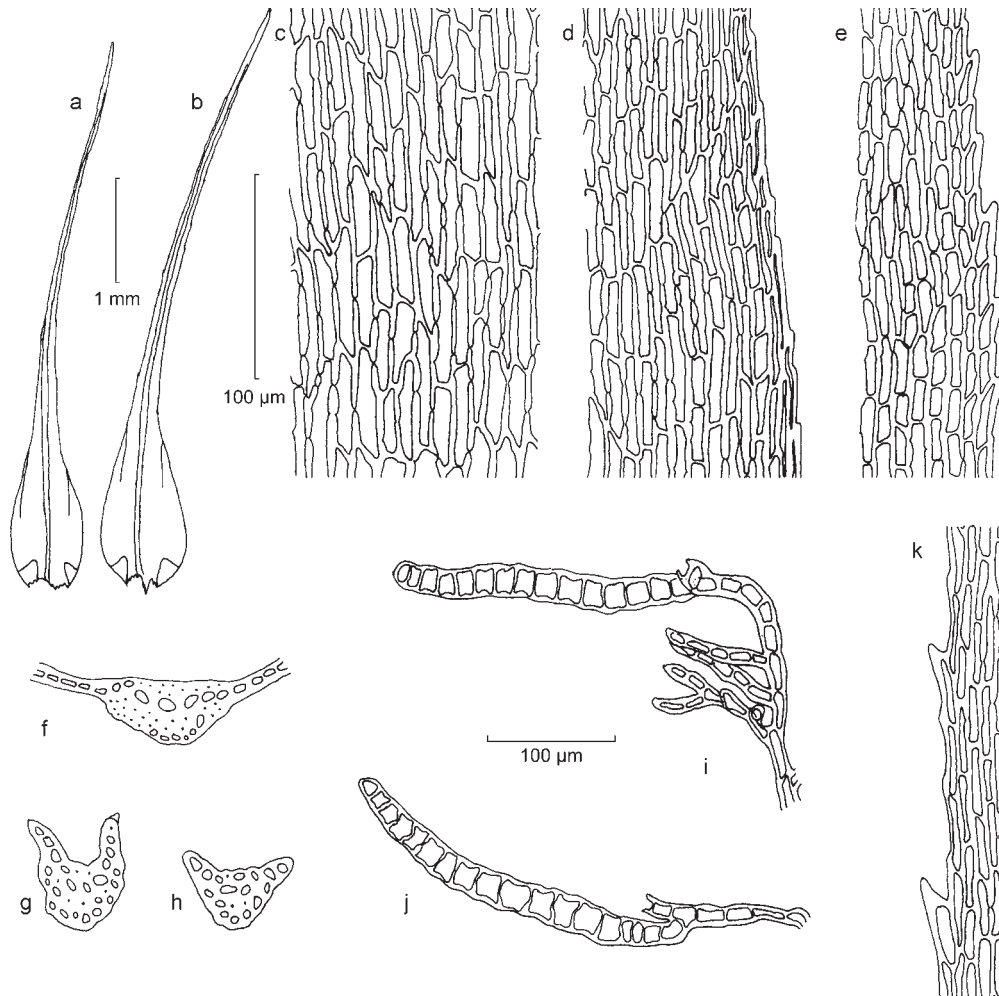


Fig. 7. *Dicranoloma daymannianum*. a–b, leaves; c, basal lamina cells; d, basal marginal and intramarginal cells; e, k, upper lamina cells; f, cross section through costa, just above alar patches; g–h, cross sections through costa, distal 1/3; i–j, rhizoidal gemmae. a–k, Streimann 36977 (CBG).

Townsville, also known from a single collection from near the Queensland–New South Wales border in New South Wales. Outside Australia also occurring in continental South-East Asia and Malaysia.

Habitat: The Australian specimens were found in rain forest between 780 and 1100 m above sea level on tree roots and trunks.

Selected additional specimens examined: AUSTRALIA. QUEENSLAND, Hugh Nelson Range, Crater State Forest, 19 km S of Atherton, *H. Streimann* 27048 (CBG, H, L); Koombooloomba Dam Rd, 23 km SE of Ravenshoe, *H. Streimann* 28879 (CBG); Mt Spec State Forest, Paluma Range, 6 km W of Paluma, *H. Streimann* 36977 (CBG, NY); Longlands Gap, junction of Herberton Rd/Kennedy Highway, 21 km S of Atherton, *H. Streimann* 54045 (CBG). NEW SOUTH WALES, Wiangaree State Forest, 30 km NNE of Kyogle, *H. Streimann* 6125 (CBG, L).

Not so long ago considered to be endemic to New Guinea, in a revision of the Malesian species of *Dicranoloma*, *D. daymannianum* was found to be fairly widespread

throughout Malaysia and reaching into continental South-East Asia (Klazenga 1999). Since then it has been reported from the Philippines (Tan and Mandia 2001) extending its distribution farther northwards and now it has been identified from collections made by H. Streimann from Queensland and north-easternmost New South Wales. The distribution of *D. daymannianum* is very scattered and it seems to be very rare everywhere, except perhaps in the central highlands of Papua New Guinea, from which a couple of collections are known to have been made by different people in different years. Although the number of known collections is over 20 now, sporogones have still not been found.

In Australia, *Dicranoloma daymannianum* is easily distinguished from all other species occurring in the same area. It may be distinguished from *D. austroscoparium*, *D. leichhardtii* and *D. dicarpum* by the much smaller teeth at the abaxial surface of the costa, from the former two also by the very weakly developed or absent border and from *D.*



Fig. 8. Geographic distribution in Australia of *Dicranoloma daymannianum*.

dicarpum by the lack of differentiated juxtacostal cells, among others. It differs from *D. menziesii* in a suite of features, most importantly by the much narrower costa and the lamina reaching all the way to the leaf apex.

The biggest problem is probably recognising *Dicranoloma daymannianum* as a *Dicranoloma* owing to the absence or near absence of a differentiated border, but its Dicranaceae-like appearance, together with the well-developed alar patches, its slightly falcate, non-crispate leaves and the lack of differentiated juxtacostal cells and of papillae on the upper lamina cells should aid identification as a *Dicranoloma*.

5. *Dicranoloma diaphanoneuron* (Hampe & Müll.Hal.) Paris Fig. 9

Index bryol. ed. 2, 2: 26 (1904)—*Dicranum diaphanoneuron* Hampe & Müll.Hal. in Hampe, *Linnaea* 36: 515 (1870)—*Leucoloma diaphanoneuron* (Hampe & Müll.Hal.) Broth., *Nat. Pflanzenfam.* I, 3: 322 (1901). Type: Australia. Western Australia, Stirling Range, F. Mueller (BM-holo!, MEL 1002542!).

Dicranum austrinum Mitt., *Trans. Proc. Roy. Soc. Victoria* 19: 53 (1882)—*Dicranoloma austrinum* (Mitt.) Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 162 (1906)—*Eudicranum austrinum* Mitt. in F. Muell., *Fragm.* 11 (Suppl.): 114 (1881), *nom. inval.* (as synonym). Syntypes: Australia. Western Australia, King George Sound, A. Cunningham s.n. (NY-lecto!, selected here; MEL 1059719!); interior of subtropical Australia, T.L. Mitchell s.n. (NY!). Synonymised by Catcheside (1980: 107).

Dicranum contortifolium E.B. Bartram, *Trans. British Bryol. Soc.* 1: 466 (1951). Type: Australia. West Australia, Nornalup, A.D. Banwell 55 (FH-Bartram-holo, not seen; MEL 28596!, MEL 28956!). Paratype: Australia. Western Australia, Pemberton, Karri Forest, G.G. Smith 80 (FH-Bartram, MEL 28528!). Synonymised by Catcheside (1980: 107).

Dicranum sphagni auct. non-Wahlenb.: Wilson in Hook.f., *Fl. Tasman.* 2: 171 (1859).

Dicranum elongatum auct. non-Schleich. ex Schwägr.: Streimann & J.A. Curnow, *Catalogue of mosses of Australia and its external territories*: 121 (1989).

Plants up to 3.0 cm high, yellowish-brown, growing in short turfs. Stem brown, simple or subflorally branched, tomentose, densely foliose; central strand present, cortical cells thick-walled. Leaves 3.5–5.3 × (0.4–) 0.5–0.8 mm, ovate-linear, gradually long attenuate, smooth, canaliculate, irregularly falcate-secund; tips crisped when dry. Alar patches 0.12–0.25 × 0.12–0.17 mm. Margin serrulate in upper 1/5–1/2, entire below, plane. Limbidium consisting of 1–4 rows, reaching up to c. 1/3 of leaf length, often ill-developed with cells not much longer than adjacent lamina cells. Costa 50–76 µm wide, 23–27 µm thick just above alar patches, percurrent to excurrent, abaxially with scattered teeth in distal part; in cross-section semi-circular to crescent-shaped or curved, with adaxial side straight to concave and abaxial side convex, guide cells 5–8, with 1–2 layers of stereids at either side, epidermis not differentiated. Basal lamina cells 28–130 × 7–11 µm, elongate to linear, in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 0.7–1.3. Upper lamina cells conspicuously shorter than basal ones, 12–30 (–35) × 6–9 µm, oblong to elongate; walls incrassate, not pitted, lumen wall ratio 0.7–2.0 (–3.0). Alar cells 11–50 × 12–28 µm, obrectangular to rectangular, not inflated; walls firm to thick, 3–6 µm thick, with angular thickenings, not pitted, brown, colourless in young leaves. Teeth at leaf margin 2–7 µm, consisting of a single cell, the lumen not conspicuously larger than that of adjacent cells. Perichaetia terminal. Outer perichaetial leaves above an ovate, clasping basal part contracted into a subula. Inner perichaetial leaves above a broadly ovate to elliptic, sheathing basal part abruptly contracted into a setaceous acumen. Calyptra 2.4–2.7 mm, reaching halfway along theca, cucullate, yellowish transparent, smooth, slightly rough above because of bulging cell ends; base entire.

Sporogones solitary. Seta 10.5–13.0 mm long, yellowish, smooth; in cross-section round, 0.11–0.13 mm, central strand present, outer 4 layers very thick-walled. Capsule 1.6–1.8 × 0.4–0.6 mm, ellipsoid to cylindrical, slightly curved, not strumose, sulcate when dry, with 5–6 ribs. Exothecial cells 18–66 × 14–30 µm, oblate to elongate, irregularly shaped, mostly in a very irregular pattern, but sometimes with areas with longitudinal rows of more or less rectangular cells, associated with furrows; becoming shorter towards orifice. Stomata present in apophysis, more or less evenly distributed, phaneropore. Annulus revoluble, consisting of 2 or 3 cell layers. Peristome teeth orangish below, yellowish above, 300–360 µm long, 40–56 µm wide at base, narrowly triangular, asymmetrically bifid in upper half; outer face vertically striate with cross-connections in basal 4/5 or more, sometimes with cross-connections almost as thick and high as striae, giving a reticulate or pitted

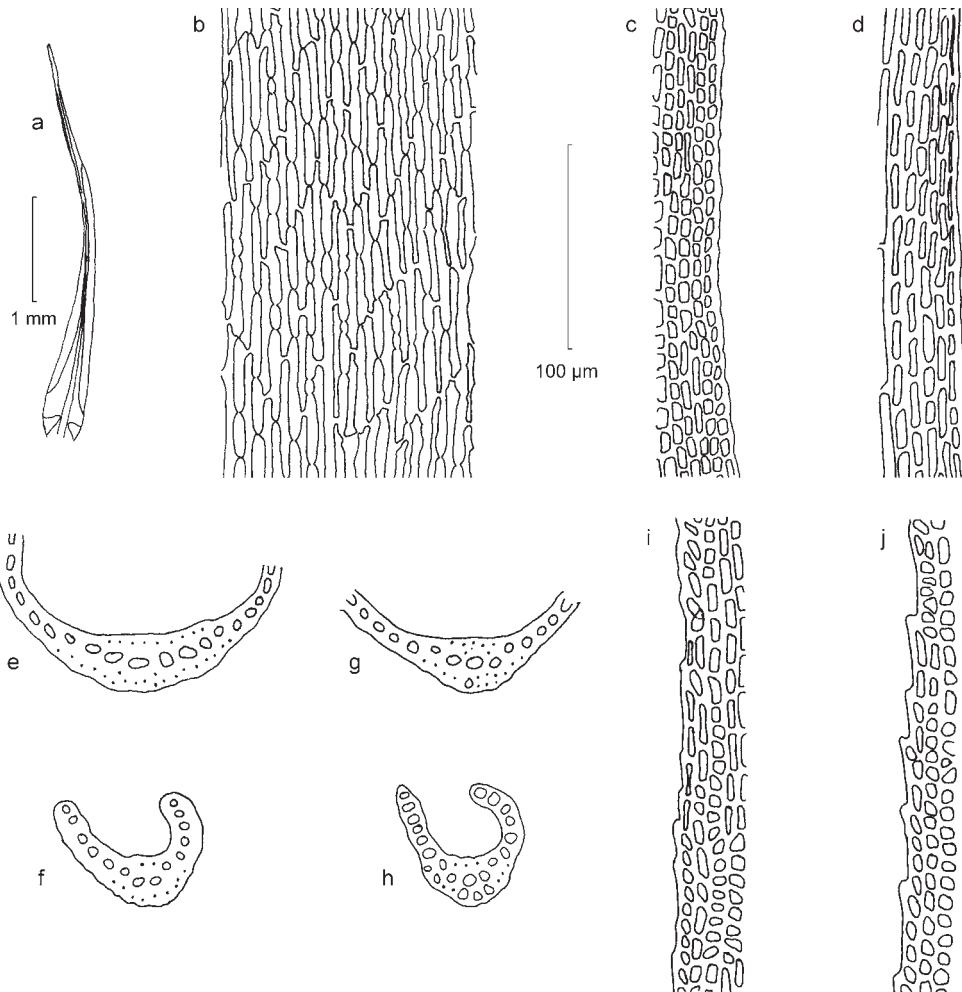


Fig. 9. *Dicranoloma diaphanoneuron*. *a*, leaf; *b*, basal lamina cells; *c–d, i–j*, upper lamina cells; *e, g*, cross section through costa, just above alar patches; *f, h*, cross section through costa, distal 1/3. *a–f*, *Banwell 55* (MEL, isotype of *Dicranum contortifolium*); *g–j*, *Filson 9065* (MEL).

appearance; upper few plates with striae oblique and more irregular; inner face smooth in lower half, papillose above; outer trabeculae thin; inner trabeculae thicker. *Operculum* 1.6–1.8 mm, obliquely rostrate above a conical base. *Spores* 18–24 µm, spherical, finely papillose.

Illustrations: Dixon (1913, pl. 3, fig. 9); Catcheside (1980: 107, fig. 39, pl. 3B).

Distribution (Fig. 10): Australia: coastal south-western Western Australia between Karridale and King George Sound, including the Stirling Ranges, and the Lofty Ranges in South Australia. Known from Victoria (Mt Ellery) and Tasmania from single records only. Endemic to Australia.

Habitat: Reported from Karri forest on rocks, logs, tree stumps and tree stems, but very little data available. No data on altitude.

Selected additional specimens examined: AUSTRALIA. WESTERN AUSTRALIA, Darling, Beedelup Falls, WNW of Pemberton, *A.C. Beaulehole 14518* (MEL); Castle Rock, Porongorup Range,

R.B. Filson 9065 (MEL); Irwin Inlet, Bow River, *S.W. Jackson s.n.* (MEL 28955); 4 miles E of Pemberton, Karri forest, *J.H. Willis 48* (MEL). SOUTH AUSTRALIA. Near Adelaide, Waterfall Gully, *D.G. Catcheside 55* (MEL 1034307). VICTORIA. East Gippsland, Mt Ellery, *Willis s.n.* (MEL 34054). TASMANIA. *R.C. Gunn s.n.* (NY).

Because of its relatively small size and crisped leaf apices, *Dicranoloma diaphanoneuron* is not likely to be confused with any other species of *Dicranoloma*, not to mention that it almost never grows sympatrically with other species of *Dicranoloma*. In fact, because of the crisped leaf apices *D. diaphanoneuron* may be reminiscent of *Weissia controversa* Hedw., but can be easily distinguished by its larger size and mostly well-developed alar patches, among many other characters.

Dicranoloma diaphanoneuron does not sit comfortably in *Dicranoloma*. This is not so much because any of its characters really do not fit in *Dicranoloma*, as only the crisped leaf apices are not found elsewhere in the genus, but because of its habit and its mainly Western Australian

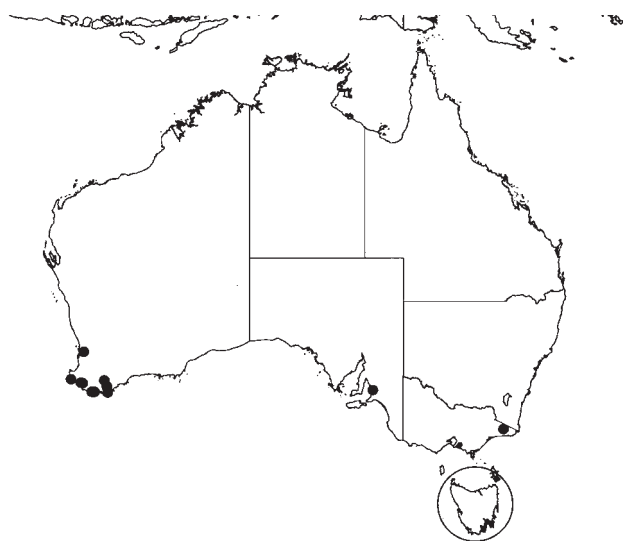


Fig. 10. Geographic distribution of *Dicranoloma diaphanoneuron*. The circle around Tasmania indicates that the species has been reported (and confirmed) from Tasmania, but that a more precise locality is unknown.

distribution. Because of the well-developed alar patches and the presence of a differentiated, albeit weak, border along the leaf margin, *D. diaphanoneuron* still fits better in *Dicranoloma* than in any other Dicranaceae genus. Unlike *D. trichopodium*, which is also only tentatively maintained in *Dicranoloma*, *D. diaphanoneuron* has the peristome structure and ornamentation typical of *Dicranoloma*.

Catcheside's (1980) tentative inclusion of both *Dicranoloma austrinum* and *Dicranum contortifolium* in *Dicranoloma diaphanoneuron* is accepted.

Dicranum austrinum was validly published without a diagnosis, but with reference to a description accompanying Wilson's (1859) report of *Dicranum sphagni* from Tasmania (cf. Art. 32.1, St Louis Code). The collection on which the latter report was based, R.C. Gunn s.n. (NY), was not cited in the protologue of *Dicranum austrinum*, which instead cited two Western Australian collections. Hence the latter two collections are considered syntypes of *D. austrinum*. The report of *Dicranum elongatum* Schleich. ex Schwägr. in Streimann and Curnow (1989) was based on the same report of *Dicranum sphagni*, for which *Dicranum elongatum* is the correct name.

Gunn's collection remains the only one of *Dicranoloma diaphanoneuron* for Tasmania. As doubts have been expressed whether Gunn's collections on which Wilson's (1859) Tasmanian reports of *Hypnodendron colensoi* (Hook.f. & Wilson) Mitt., *H. menziesii* (Hook.) Paris ssp. *menziesii* (Touw 1971) and *Catharomnion ciliatum* (Hedw.) Wilson (Kruijer 2002) were based indeed originated from Tasmania, it would be easy to assume that Gunn's collection of *D. diaphanoneuron* was also mislabelled. However, the

latter collection is mixed with *Leptostomum inclinans* R.Br., which makes it highly unlikely that this collection originated from either Western Australia or South Australia, where *D. diaphanoneuron* is more likely to be encountered, as *L. inclinans* has not been reported from these states.

Dicranoloma diaphanoneuron is known from Victoria from a single collection from East Gippsland (Willis s.n. (MEL 34054)). This collection is microscopically identical to other specimens of *D. diaphanoneuron*, but lacks the flexuose leaf tips.

6. *Dicranoloma dicarpum* (Nees) Paris Fig. 11

Index bryol. ed. 2, 2: 26 (1904)—*Dicranum dicarpum* Nees in Sprengel, *Syst. veg.* 4 (2): 322 (1827)—*Leucoloma dicarpum* (Nees) Broth., *Nat. Pflanzenfam.* I, 3: 322 (1901). Type: Australia. F.W. Sieber 10 (LE (Hb. Nees)-holo (A. Potemkin pers. comm.), not seen; L!, MO!, NY!).

Dicranum leucolomoides Müll.Hal., *Bot. Zeit.* (Berlin) 9: 549 (1851)—*Leucoloma dicranoides* Broth., *Nat. Pflanzenfam.* I, 3: 323 (1901), *nom. illeg.* (superfluous)—*Dicranoloma dicranoides* Paris, *Index bryol.* ed. 2, 2: 26 (1904), *nom. illeg.* (superfluous)—*Dicranoloma leucolomoides* (Müll.Hal.) Dixon, *Bull. New Zealand Inst.* 3: 20 (1913). Type: New Zealand, Kaipara, S. Mossman 715 (B-holo, destroyed; NY 267974-lecto!, *selected here*; MEL 1002504!). Synonymised by Mitten (1859: 68).

Dicranum dicarpum var. *spinosum* Wilson, *Fl. nov.-zel.* 2: 66 (1854)—*Dicranoloma dicarpum* var. *spinosum* (Wilson) Paris, *Index bryol.* ed. 2, 2: 26 (1904). Syntypes: New Zealand. South Island, Ship Cove, D. Lyall 26 (BM-Wilson-lecto!, *selected here*; BM-Hook!); New Zealand. 'East Coast', W. Colenso 157 (BM-Hooker!, BM-Wilson!). Synonymised by Dixon (1913: 14).

Dicranum argutum Hampe, *Linnaea* 36: 516 (1870), *syn. nov.*—*Leucoloma argutum* (Hampe) Broth., *Nat. Pflanzenfam.* I, 3: 322 (1901)—*Dicranoloma argutum* (Hampe) Paris, *Index bryol.* ed. 2, 2: 24 (1904). Type: Australia. New South Wales, Hook s.n. (BM-Hampe!).

Dicranum polychaetum Mitt., *Trans. Roy. Soc. Victoria* 19: 52 (1882)—*Dicranum polysetum* Hampe, *Linnaea* 30: 629 (1860), *nom. illeg.* (later homonym)—*Leucoloma polysetum* Broth., *Nat. Pflanzenfam.* I, 3: 322 (1901), *nom. illeg.* (superfluous)—*Dicranoloma polysetum* Paris, *Index bryol.* ed. 2, 2: 29 (1904), *nom. illeg.* (superfluous)—*Dicranoloma polychaetum* (Mitt.) Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 162 (1906). Syntypes: Australia. Victoria, Grampians, Victoria Ranges, F. Mueller [3] (MEL 1002531!); sources of the Yarra, F. Mueller s.n. (BM-lecto!, *selected here*; MEL 1040641!). Synonymised by Dixon (1913: 13).

Dicranum whiteleggei Müll.Hal. ex Broth., *Öfvers. Förh. Finska Vetensk.-Soc.* 37: 150 (1895)—*Leucoloma whiteleggei* (Müll.Hal. ex Broth.) Paris, *Index bryol.* Suppl. 1: 234 (1900)—*Dicranoloma whiteleggei* (Müll.Hal. ex Broth.) Paris, *Index bryol.* ed. 2, 2: 31 (1904). Type: Australia. New South Wales, Moss Vale, Fitzroy Falls, T. Whitelegge (H-BR-holo!, NSW 295114!). Synonymised with *D. argutum* by Dixon (1913: 14).

?*Dicranum chlorocladum* Müll.Hal. ex Geh., *Hedwigia* 36: 362 (1897)—*Leucoloma chlorocladum* (Müll.Hal.) Broth., *Nat. Pflanzenfam.* I, 3: 322 (1901)—*Dicranoloma chlorocladum* (Müll.Hal.) Paris, *Index bryol.* ed. 2, 2: 25 (1904). Type: Australia, New South Wales, Sydney, Mrs. Kaysser (not located). Synonymised with *D. argutum* by Dixon (1913: 14).

Dicranum novae-hollandiae Hornsch. ex Cardot, *Bull. Herb. Boissier*, sér. 2, 8: 173 (1908), *nom. illeg.* (later homonym), *syn. nov.* Type: Australia. F.W. Sieber 7 (PC!, no collection number on collection).

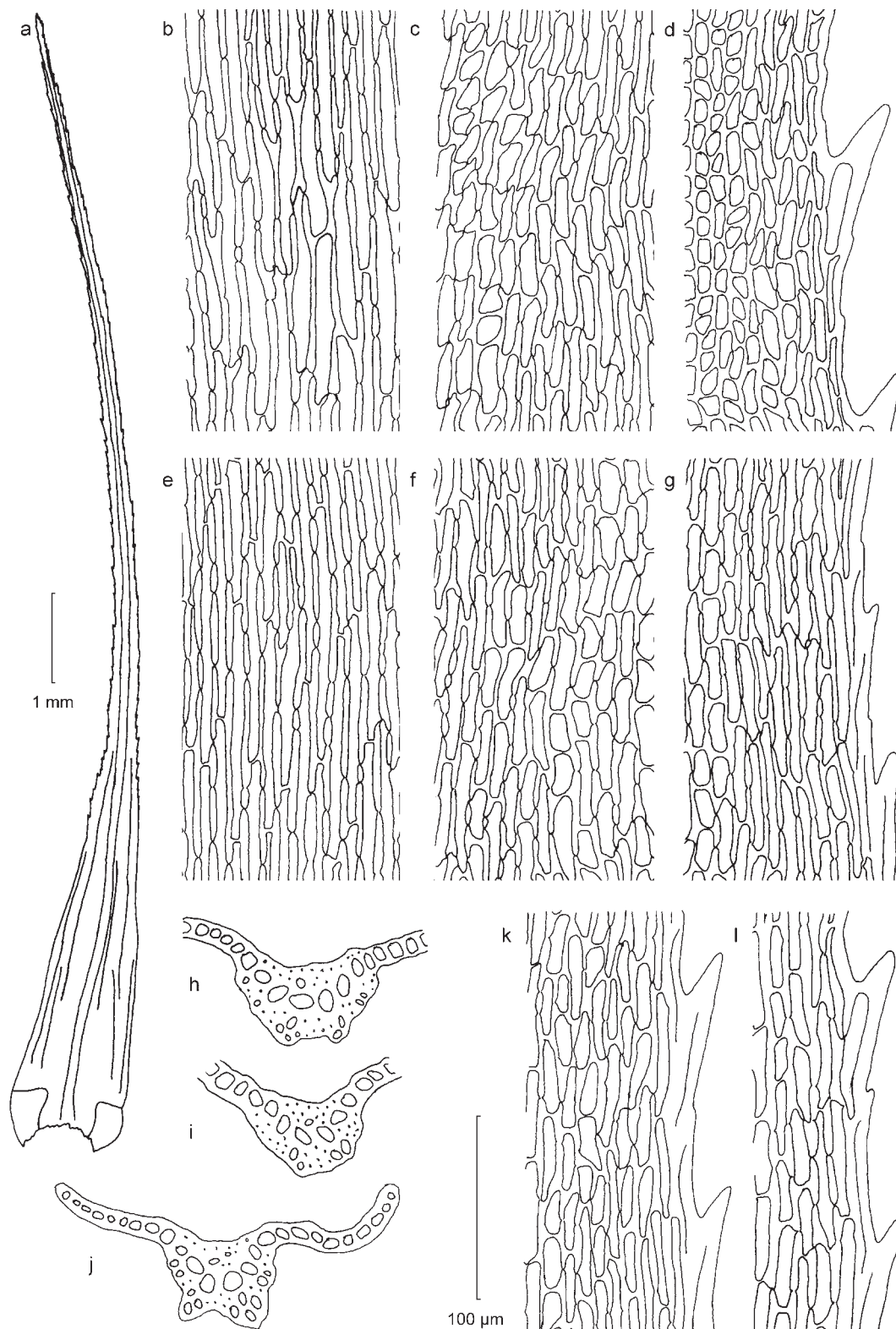


Fig. 11. *Dicranoloma dicarpum*. *a*, leaf; *b*, *e*, basal lamina cells; *c*, *f*, basal juxtacostal cells (costa to the left in *c* and to the right in *f*); *d*, *g*, *k-l*, upper lamina cells; *h-i*, cross sections through costa, just above alar patches; *j*, cross section through costa, distal 1/3. *a*, *Brownsey s.n.* (WELT 31854); *b-d*, *h, j*, *Klazenga 5320* (MEL); *e-g*, *i*, *k-l*, *Klazenga 5589* (MEL).

Dicranoloma elimbatum Dixon, *Proc. Roy. Soc. Queensland* 53(2): 26 (1942), *syn. nov.* Type: Australia. Queensland, Duma Creek, Ravenshoe, *T.V. Sherrin* 10 (BM!).

Dicranum subaggregatum R.Br.bis, *Sp. musc. frond.* Suppl. 3, 2(1): 3 (1829), *nom. inval.* (as synonym).

Plants 0.5–7.5 cm high, bright green to light green, growing in turfs. *Stem* reddish brown, simple or subflorally branched, densely tomentose, densely foliose; central strand present, cortical cells thin-walled. *Rhizoidal gemmae* sometimes present. *Leaves* (2.7–) 3.0–12.4 × 0.5–1.6 mm, ovate-linear to triangular-linear, gradually long acuminate, plicate, flat to canaliculate in basal half, V-shaped above, falcate-secund. *Alar patches* 0.17–0.52 × 0.13–0.37 mm. *Margin* serrate in upper 2/5–3/4, entire below, plane. *Limbium* consisting of 1–4 rows, reaching to or well within serrate part of margin, sometimes reduced or absent. *Costa* 35–101 µm wide, 28–60 µm thick just above alar patches, subpercurrent, abaxially with 2–4 rows of teeth in distal 1/2–4/5; in cross-section semi-circular to crescent-shaped, with adaxial side straight to slightly concave and abaxial side convex, often with two broad ribs, guide cells 5–8 (–11), adaxially with 2–3 layers of stereids and often with a cell with a distinct lumen adjacent to guide cells, abaxially with 3–5 bundles of stereids, separated by cells with a large lumen. *Basal lamina cells* (30–) 55–154 (–190) × 8–14 (–16) µm, elongate to linear, not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 1.0–5.0. *Upper lamina cells* conspicuously shorter than basal ones (8–) 10–95 (–115) × 7–11 µm, oblong to linear, straight, not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 1.1–5.0. *Alar cells* 30–105 × 15–58 µm, quadrate to rectangular, inflated; walls thin, 1–3 µm thick, not pitted, brown. *Teeth at leaf margin* 10–45 µm, consisting of a single cell, the lumen often conspicuously larger than that of intramarginal cells. *Perichaetia* terminal, laterally displaced. Outer perichaetial leaves above a broadly ovate, clasping base abruptly contracted into a long, often recurved subula. Inner perichaetial leaves broadly ovate to broadly elliptic, with a hair-like point, loosely sheathing the setae. *Calyptra* 4.0–5.2 mm, reaching halfway along theca, cucullate, greenish transparent, brown at apex, smooth, slightly rough at apex because of bulging cell ends; base entire.

Sporogones 1–10 per perichaetium. *Seta* 4.5–27.5 mm long, yellowish, smooth; in cross-section broadly elliptic, 0.22 × 0.19 mm, central strand present, medulla cells gradually passing into cortex, outer 2–3 layers very thick-walled. *Capsule* 2.0–3.2 mm long, cylindrical, curved, not strumose. *Exothecial cells* 25–114 × 13–25 µm, oblong to short-linear, irregularly shaped to rectangular, not in a regular pattern. *Stomata* present in apophysis, more or less evenly distributed, phaneropore. *Annulus* revoluble, consisting of 2 cell layers. *Peristome teeth* orange, 465–500 µm long, 78–96 µm wide at base, narrowly triangular, asymmetrically bifid in upper c. 1/2, sometimes

fenestrate below; outer face striate with cross-connections in basal c. 2/3, striate above and with striate papillae at apex; inner face smooth in basal c. 2/3, papillose above; outer trabeculae thin; inner trabeculae thick, strongly projecting, ones in upper half of teeth papillose. *Operculum* 2.0–3.0 mm, obliquely rostrate above a conical base. *Spores* 18–24 µm, spherical, finely papillose.

Illustrations: Dixon (1913, pl. 3; fig. 8, pl. 4, fig. 20); Brotherus (1924: 208, fig. 166); Jarman and Fuhrer (1995: 32, fig. 8); Klazenga (1999: 91, fig. 25; plus see references on p. 93).

Distribution (Fig. 12): Australia: south-eastern Queensland, coastal tablelands of New South Wales, Lord Howe Island, eastern and south-western Victoria as far west as Lower Glenelg National Park, Tasmania; apparently disjunct in the humid wet tropics in and around Mt Bellenden Ker National Park near Cairns. New Zealand: North Island and South Island. Outside the region also found in Taiwan, Papua New Guinea, Vanuatu.

Habitat: Growing in various forest types from wet sclerophyll forest to warm temperate or dry rain forest to submontane forest, seldom in drier forests, between sea level and c. 1550 m. Terrestrial or on rocks, logs, tree stumps or tree bases. In New Zealand *Dicranoloma dicarpum* tends to be able to grow in drier places than the related *D. platycaulon* and *D. plurisetum*.

Selected additional specimens examined: AUSTRALIA. QUEENSLAND, Forest Glen, 8 km SE of Nambour along Bruce Highway, *D. Verdon* 5210 (CANB, H, L, NY); Tumouline State Forest, 6 km N of Ravenshoe, *Streimann* 46122 (CANB, NY); McPherson Range, Springbrook, *R.G. Robbins* 2605 (CANB, L). NEW SOUTH WALES, Mt Warning, 14 km SW of Murwillumbah, *H. Streimann* 288 (CANB, L); New England National Park, c. 1 mile W of Point Lookout, *R.D. Hoogland* 8582 (CANB, L, MEL); Southern Tablelands, Tallaganda Shire, c. 1 m. SE of Major's Creek, *L.G. Adams* 1972 (CANB, L, MEL). LORD HOWE ISLAND, NE flank of Mt Lidgbird, *M.M.J. van Balgooy* 1105 (L, NY). AUSTRALIAN CAPITAL TERRITORY, Tidbinbilla Nature Reserve, 25 km SW of Canberra, *H. Streimann* 1414 (CANB, L, NY). VICTORIA, Grampians National Park, Bonjimmia Track, 5th Australasian Bryophyte Workshop *s.n.* (MEL 2053571); Errinundra Plateau, Gunmark Rd, 0.8 km from Errinundra Rd, *K.R. Thiele* 1046 (CANB, MEL). TASMANIA, Warners Sugarloaf, 18.5 km S of Deloraine, *J.A. Curnow* 1980 (CANB, HO, NY); Southwest National Park, Gordon River Rd, Wedge Trail, *N. Klazenga* 5589 (MEL); Mt Field, Lake Webster–Lake Seal, 4.5 km WSW of Mt Field East, *A. Moscal* 13559 (CANB, HO, MEL, NY). NEW ZEALAND. NORTH ISLAND. South Auckland, Whirinaki Forest, near Minginui, River Rd, Whirinaki River Track to gorge, *P.J. Brownsey s.n.* (WELT 31854); Taranaki, Mt Egmont National Park, Mountain House, Kamahi Walk, *N. Klazenga* 5320 (MEL); Gisborne, Mt Maungapohatu, *G.O.K. Sainsbury* 6813 (WELT). SOUTH ISLAND. Westland, Nelson Creek, Colls Dam Walk, c. 22 km E of Greymouth, *P.J. Brownsey s.n.* (WELT 32412); Canterbury, catchment of Waimakariri River, Bealey Spur, *A.J. Fife* 7561 (CANB). STEWART ISLAND. Kaipipi Track, *W. Martin* 284 (WELT). VANUATU. Aneityum, *Rietmann* 18 (NY).

Dicranoloma dicarpum can be distinguished from related species, i.e. those with abaxial teeth in rows and mostly aggregated sporogones, by the plicate leaves, the extent of the

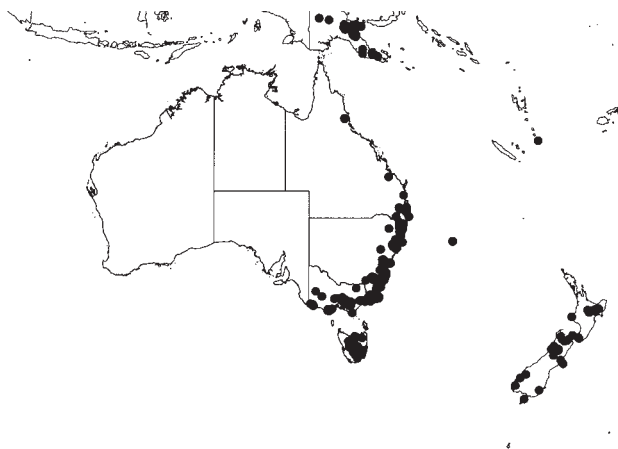


Fig. 12. Geographic distribution in Australasia of *Dicranoloma dicarpum*.

teeth along the leaf margin, the relatively narrow limbidium and the differentiated juxtacostal cells. Leaf margins of *D. dicarpum* are serrate in the upper half or more, while those of *D. austroscoparium* and *D. leichhardtii* are serrate in the apical part only and those of *D. fasciatum* and *D. plurisetum* in the upper one fourth or less. The limbidium consists of four or less rows in *D. dicarpum* and is sometimes even absent in Queensland specimens, but is wider and consists of more, mostly many more, rows in the other species. *D. fasciatum* and *D. plurisetum* may show a hint of plications near the leaf base, but those never extend far up and are not nearly as pronounced as in *D. dicarpum*. However, some specimens of *D. dicarpum*, especially in north-east Australia, may lack pronounced plications. Unlike in any other species of *Dicranoloma* in *D. dicarpum* the upper lamina cells descend along the costa, forming in the lower part of the leaf a band of differentiated juxtacostal cells that are conspicuously shorter than the intramarginal cells. However, this band is not always conspicuous or present at all.

New Zealand specimens of *Dicranoloma dicarpum* can furthermore be distinguished from *D. plurisetum* and *D. fasciatum* by the relatively narrower leaves. In *D. dicarpum* the stem plus tomentum is wider than the leaves, while in *D. fasciatum* and *D. plurisetum* the leaves are wider.

Dicranoloma dicarpum shows considerable geographically correlated variation in plant size, leaf length, number of sporogones per perichaetium, seta length and capsule shape. New Zealand specimens are mostly relatively large plants with long leaves (c. 8–12 mm), many (mostly 4–10) sporogones per perichaetium, long setae and curved capsules. In contrast, specimens from New South Wales (including Australian Capital Territory and Lord Howe Island) and Queensland are much smaller with short leaves (c. 3–8 mm), mostly one or two sporogones per perichaetium, relatively short setae and straight to slightly

asymmetrical capsules. Also, the upper lamina cells in the north-east Australian plants are consistently isodiametric or nearly so, while in New Zealand plants also longer cells may be present, especially close to the margin. Tasmanian and Victorian specimens are more variable in leaf length (c. 5–10 mm), many of them being intermediate between the New Zealand and north-east Australian specimens. They also tend to be intermediate in the sporogone characters. Interestingly, Papua New Guinean plants are again very similar to New Zealand plants. Rhizoidal gemmae have only been found in specimens from mainland Australia and Lord Howe Island and appear to be more common in the smaller plants, but have also been found in relatively large plants as far south as in Victoria. The reduction in leaf size going from south to north is not matched by a similar reduction in size of the perichaetial leaves. This, in combination with the shorter setae, often leads to relatively large perichaetia that reach the capsules and almost entirely sheath the setae in north-east Australian plants.

Although New Zealand and north-east Australian plants seem in isolation to be very different from each other, over the entire geographic range morphological variation seems to be more or less clinal and no well-demarcated groups can be recognised. Hence formally naming the geographic forms, even at the infraspecific level, is not justified.

Dixon (1913), recognising two species among what is here recognised as a single one, used the name *Dicranoloma dicarpum* for the New Zealand and south-east Australian plants with arcuate, strumose capsules and *D. argutum* for the north-east Australian plants with erect, symmetrical, non-strumose capsules. However, the type specimen of *Dicranum dicarpum* almost certainly originates from the Blue Mountains in New South Wales, where also the type of *Dicranum whiteleggei*, which Dixon (1913) synonymised with *Dicranoloma argutum*, was found and resembles the types of *Dicranum whiteleggei* and *Dicranum argutum* closely, including the almost straight, non-strumose capsule. Hence, if two species were to be recognised the name *D. dicarpum* should be reserved for the north-east Australian specimens and another name should be found for the south-east Australian and New Zealand specimens.

The isotypes of *Dicranum leucolomoides* in NY and MEL belong to *Dicranoloma dicarpum*. However, Dixon (1913) claimed that the type contained two species and that the duplicate in Mitten's herbarium (NY) contained only one of them, which was indeed *D. dicarpum* and that Müller's (1851) description was based on the other species. Instead, Dixon (1913) based his description of *Dicranoloma leucolomoides* on collections from Beckett's herbarium identified as such by K. Müller. What Dixon (1913) described as *D. leucolomoides* is a form of *D. robustum*. Dixon (1913) did not see the holotype either.

The holotype of *Dicranum novae-hollandiae* in J. Cardot's herbarium in PC belongs to *Dicranoloma*

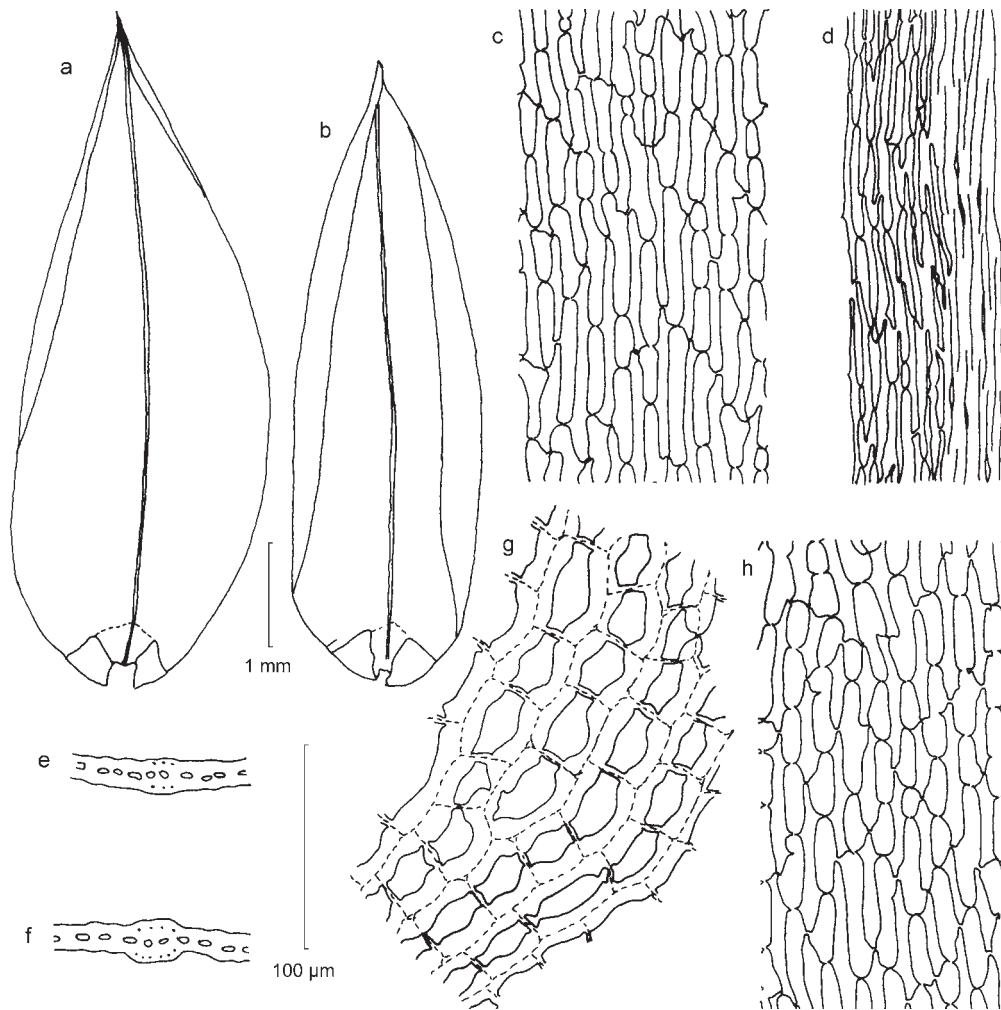


Fig. 13. *Dicranoloma eucamptodontoides*. *a–b*, leaves; *c*, basal lamina cells; *d*, basal marginal and intramarginal cells; *e*, cross section through costa, just above alar patches; *f*, cross section through costa, distal 1/3; *g*, alar cells; *h*, upper lamina cells. *a–h*, Moore 60 (H-BR).

dicarpum. All other Sieber collections under that name I have seen (G, L, PC) belong to *D. billarderi*. This may explain why *D. novae-hollandiae* was treated as a synonym of *Dicranum pungens* by Bastow (1887).

During the present study a collection of *Dicranoloma dicarpum* from Vanuatu (Rietmann 18 (NY)) was found.

7. *Dicranoloma eucamptodontoides* (Broth. & Geh.) Paris Fig. 13

Index bryol. ed. 2, 2: 26 (1904)—*Dicranum eucamptodontoides* Broth. & Geh. in Broth., *Öfvers. Förh. Finska Vetensk.-Soc.* 37: 152 (1895)—*Leucoloma eucamptodontoides* (Broth. & Geh.) Broth., *Nat. Pflanzenfam.* 1, 3: 323 (1901). Type: Australia. Tasmania, West Coast, Macquarie Harbour, Jones's Track, *T.B. Moore* 60 (H-BR-holo!, BM!, CBG!, HO 305619! (sub no. 66), JE, L!, NY!).

Plants 3.0–6.0 cm high, dark greenish brown, growing in turfs or creeping. *Stem* reddish-brown to brown, simple or with subfloral innovations, scarcely tomentose, densely

foliose; central strand present, cortical cells thick-walled. *Leaves* 4.5–6.0 × 1.5–3.0 mm, ovate-lanceolate, acuminate, occasionally with a short hyaline cusp, rugose when dry, smooth when wet, canaliculate, subtubulose at extreme apex, appressed to erecto-patent. *Alar patches* 0.30–0.55 × 0.25–0.44 mm. *Margin* entire throughout, apart from one or more minute teeth at extreme apex. *Limbium* consisting of 4–8 rows, reaching to just below leaf apex. *Costa* 15–42 µm wide, 18–35 µm thick just above alar patches, subpercurrent, abaxially smooth throughout; in cross-section straight to round, with both sides straight or convex, guide cells 2 (–5), with a single layer of stereids at either side, epidermis not differentiated. *Basal lamina cells* 40–135 × 10–20 µm, elongate to linear, not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 0.5–1.0 (–1.3). *Upper lamina cells* slightly shorter than basal ones, 35–95 × 12–23 µm, oblong to short-linear, not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 0.5–1.0. *Alar*

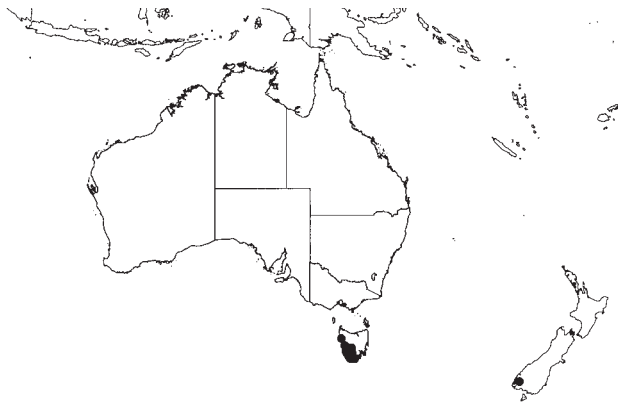


Fig. 14. Geographic distribution of *Dicranoloma eucamptodontoides*.

cells $15\text{--}100 \times 13\text{--}50 \mu\text{m}$, quadrate to rectangular, but lumina irregularly shaped because of wall-thickenings, not inflated; walls colourless or slightly yellowish to brownish, lateral walls thick, $6\text{--}28 \mu\text{m}$ thick, collenchymatous, transverse walls thin. *Perichaetia* terminal, sometimes laterally displaced, sheathing *c.* $2/3$ of seta. Outer perichaetial leaves suborbicular, acuminate. Inner perichaetial leaves broadly elliptic, shouldered, with a short mucro. *Calyptra* not found.

Sporogones solitary. *Seta* $11.0\text{--}12.0 \text{ mm}$ long, yellowish, smooth; central strand present, inner cortical cells thin-walled, gradually becoming thicker-walled going outward, outer 3 layers very thick-walled. *Capsule* $1.5\text{--}2.0 \text{ mm}$ long, cylindrical, curved, strumose. *Exothecial cells* $25\text{--}55 \times 12\text{--}17 \mu\text{m}$, straight and elongate to irregularly rhombic, in an irregular pattern to almost in longitudinal rows; walls thicker than lumen is wide. *Stomata* present in apophysis, evenly distributed, phaneropore. *Annulus* not found. *Peristome teeth* yellowish to orange at base, colourless above, *c.* $350 \mu\text{m}$ long, $68\text{--}88 \mu\text{m}$ wide at base, narrowly triangular, asymmetrically bifid in upper $1/2\text{--}2/3$; outer face vertically to obliquely striate with cross-connections in basal half, smooth to slightly papillose above; inner face smooth throughout to slightly papillose in upper part. *Operculum* $1.2\text{--}1.5 \text{ mm}$, obliquely rostrate above a conical base. *Spores* $15\text{--}22 \mu\text{m}$, spherical.

Illustrations: Scott and Stone (1976: 151, pl. 24).

Distribution (Fig. 14): Australia: south-western Tasmania. New Zealand: known from a single collection from Fiordland, South Island. Endemic to Australasia.

Habitat: In the south-western part of Tasmania *D. eucamptodontoides* is found in heath or sedgeland, often dominated by *Gymnoschoenus sphaerocephalus* (R.Br.) Hook.f., from sea level to *c.* 700 m above sea level,

terrestrial. The New Zealand specimen was found at an altitude of 1100 m on 'very damp soil overlying schistose rock near the edges of shallow tarns' (Bartlett and Frahm 1983).

Selected additional specimens examined: AUSTRALIA. TASMANIA, Southside of Giblin River, *c.* 2 km from mouth, A.M. Buchanan 7789 (HO); Southwest National Park, Mt Norold, J.S. Jarman s.n. (HO 513140); Huon River, about $1/2 \text{ mile}$ N of end of Scotts Peak Rd, D.H. Norris 30810 (CANB, HO); Mt Cullen, A.V. Ratkowsky H 200 (CANB, HO). NEW ZEALAND. SOUTH ISLAND, Fiordland, Lake Manapouri, Percy Saddle, J.K. Bartlett 23190 (CHR, WELT).

Dicranoloma eucamptodontoides is easily recognised from all Australian and New Zealand congeners by its wide, erecto-patent to patent leaves, almost entire margins and collenchymatous alar cells. *D. obesifolium*, which shares the wide, erecto-patent to patent leaves and entire leaf margins, does not have the collenchymatous alar cells. Moreover, in *D. obesifolium* leaf apices are obtuse and hooded, while in *D. eucamptodontoides* they are acuminate and channelled.

Scott and Stone (1976: 152) stated that 'sporophytes are unknown' for this species, although sporogones were described in the original diagnosis of *Dicranum eucamptodontoides* and are present on the type. During this revision some more collections with sporogones have been located and sporogones were observed in the field. However, there were still very few sporogones available for study and, moreover, they are either immature or very old. Therefore, microscopical characters of the sporogone were studied from only one collection, Buchanan 7789 (HO). In the capsule studied the annulus was already gone and only a few old spores were left. *Calyptrae* have not yet been found.

Dicranoloma eucamptodontoides was first reported from New Zealand by Bartlett and Frahm (1983: 371), the report hidden in a publication otherwise dealing with *Campylopus*. Their report is confirmed here. The New Zealand specimen, Bartlett 23190 (CHR, WELT), differs from Tasmanian specimens only in the slightly longer leaves.

8. *Dicranoloma fasciatum* (Hedw.) Paris Fig. 15

Index bryol. ed. 2, 2: 26 (1904)—*Dicranum fasciatum* Hedw., *Sp. musc. frond.* 127 (1801)—*Cecalyphum fasciatum* P.Beauv., *Prodr. aethéogam.*: 51 (1805)—*Leucoloma fasciatum* Broth., *Nat. Pflanzenfam.* I, 3: 322 (1901). Type: New Zealand (?). ['*Insula maris pacifici*'], unknown collector (G, not found; Hedwig, *Sp. musc. frond.* pl. 28. (1801)-lecto!, selected here). Note: in the absence of a type specimen the plate accompanying the protologue is selected as the lectotype, assuming that the plate is based on the specimen cited in the protologue. The plate and diagnosis leave no doubt as to the identity of the species.

Dicnemon obsoletinerve Müll.Hal. & Hampe, *Linnaea* 26: 496 (1855)—*Leucoloma obsoletinerve* (Müll.Hal. & Hampe) Broth., *Nat. Pflanzenfam.* I, 3: 322 (1901)—*Dicranoloma obsoletinerve* (Müll.Hal. & Hampe) Paris, *Index bryol.* ed. 2, 2: 28 (1904). Type: New Zealand [Nova Zeeland]. F. Mueller (?) s.n. (BM-Hampe-lecto!). Synonymised by Dixon (1913: 26). Note: there is no evidence that F. Mueller visited New Zealand before 1855, so it is most likely that the specimen was sent to him by someone else.

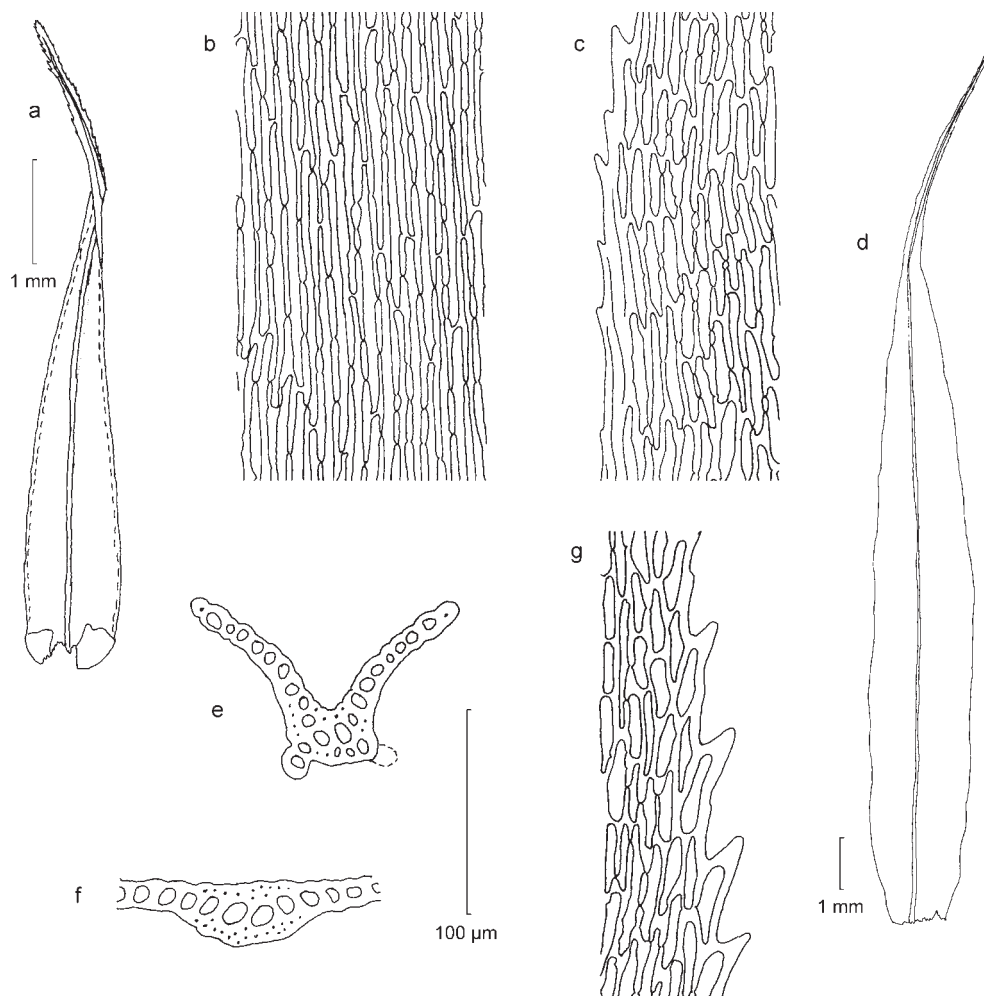


Fig. 15. *Dicranoloma fasciatum*. a, leaf; b, basal lamina cells; c, g, upper lamina cells; d, innermost perichaetial leaf; e, cross section through costa, just above alar patches; f, cross section through costa, distal 1/3. a–g, Klazenga 5363 (MEL).

Plants 2.0–5.0 cm high, yellowish-green to light green, growing in turfs. *Stem* reddish, simple or subflorally branched, densely tomentose, densely foliose; central strand present, cortical cells thin-walled. *Leaves* 3.7–6.0 × 0.8–1.1 mm, ovate-linear, gradually tapering, smooth, canalaculate in lower half, V-shaped above, falcate-secund. *Alar patches* 0.26–0.41 × 0.23–0.31 mm. *Margin* serrate in upper 1/6–1/4 (–1/3), entire below, plane. *Limbium* consisting of 3–6 rows, reaching serrate part of margin. *Costa* 38–76 µm wide, 23–33 µm thick just above alar patches, subpercurrent, abaxially with two rows of teeth in distal (1/3–) 2/5–1/2; in cross-section semi-circular, with adaxial side straight and abaxial side convex, guide cells (3–) 4 (–5), adaxially with one layer of stereids, abaxially with 1–2 layers of stereids, epidermis not differentiated. *Basal lamina* cells 51–187 × 8–15 µm, short-linear to linear, straight, not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 1.0–5.0. *Upper lamina cells* gradually shorter than basal ones, 25–99 × 7–14 µm,

elongate to linear, mostly slightly curved, not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 1.6–5.0 (–8.0). *Alar cells* 25–89 (–127) × 10–50 µm, quadrate to rectangular, inflated; walls thin, 1–3 µm thick, not pitted, yellowish brown or colourless. *Teeth at leaf margin* 15–30 µm, consisting of a single cell, the lumen not much larger than that of adjacent cells. *Perichaetia* terminal, sometimes laterally displaced, forming a conspicuous sheath around setae to somewhat below capsule and overtopping capsule. Outer perichaetial leaves with a broadly elliptic, clasping basal part, abruptly contracted into a recurved subula. Inner perichaetial leaves with a sheathing basal part, gradually passing into a subula, which is not recurved. *Calyptra* 4.5–5.5 mm, reaching almost to base of capsule, cucullate, greenish transparent, brown at apex, smooth, slightly rough above because of bulging cell ends; base entire.

Sporogones 1–3 per perichaetium. *Seta* 10.5–11.5 mm long, yellowish, smooth; central strand present, walls of

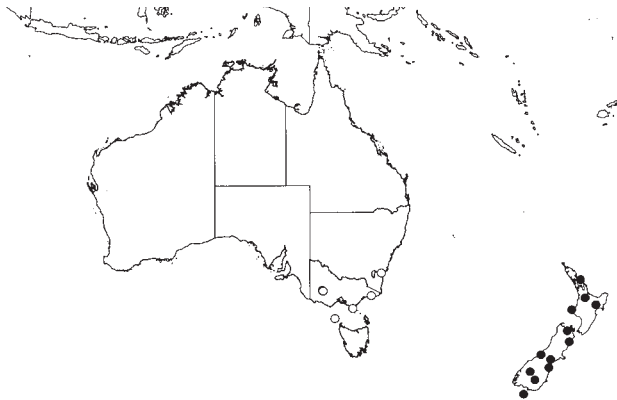


Fig. 16. Geographic distribution of *Dicranoloma fasciatum*. (●) New Zealand collections; (○) Australian collections considered to belong to *D. fasciatum*, but not with certainty as perichaetia and sporogones have not yet been found in Australian material.

cortical cells gradually becoming thicker towards periphery. *Capsule* 2.5–3.0 mm long, cylindrical, curved, slightly strumose. *Exothecial cells* 38–114 × 15–25 µm, irregularly shaped to rectangular; with longest cells and most regular cell pattern at the concave side; becoming smaller towards orifice, isodiametric to oblate at orifice. *Stomata* present in apophysis, evenly distributed, phaneropore. *Annulus* revoluble, consisting of 2 cell layers; annulus cells 20–25 × 18–20 µm, orbicular to short elliptic, with very thick, colourless walls. *Peristome teeth* 488–581 µm long, 94–101 µm wide at base, narrowly triangular, asymmetrically bifid in upper half; outer face striate throughout, with cross-connections between striae in basal *c.* 2/3 and papillae on striae in the upper *c.* 1/3; inner face smooth in the basal *c.* 2/3, papillose above; outer trabeculae thin, not ornamented; inner trabeculae thick, strongly projecting, papillose. *Operculum* 2.5 mm, obliquely rostrate above a conical base. *Spores* 11–16 µm, spherical, very finely papillose.

Illustrations: Hedwig (1801, pl. 28); Dixon (1913, pl. 4, fig. 13).

Distribution (Fig. 16): Australia: known from scattered collections from the Southern Tablelands in New South Wales, the Grampians, Otways, Wilsons Promontory and East Gippsland in Victoria and from King Island. New Zealand: North Island, South Island, Stewart Island. Endemic to Australasia.

Habitat: In New Zealand in wet forests between *c.* 400–650 m above sea level (very little data) on logs, tree stumps and tree bases, rarely on earth banks. In Australia in cool to warm temperate rain forest from sea level to *c.* 500 m above sea level on a variety of substrates.

Selected additional specimens examined: AUSTRALIA. NEW SOUTH WALES, [Southern Tablelands], Slopes of Mt Buddawang, near

Mongarlowe, *L.G. Adams 1423* (CANB, L). VICTORIA, [Grampians], Grampians National Park, Delleys Dell, above Silverband Falls, *K.W. Atkins s.n.* (MEL 1059712); Grampians National Park, Delleys Dell, *A.C. Beauglehole 73920* (MEL); East Gippsland, Cabbage Tree Flora Reserve, *N. Klazenga 5187* (MEL); Wilsons Promontory, Lilly Pilly Gully Track, *D.A. Meagher s.n.* (MEL 240111). TASMANIA, King Island, Yarra Creek Gorge, *J.H. Willis s.n.* (MEL 37923). NEW ZEALAND. NORTH ISLAND. Taranaki, Mt Egmont National Park, 18 km SE of Okato, end of Puniho Rd, Puniho Track, *N. Klazenga 5363* (MEL); Gisborne, Lake Waikaremoana, Wairou Moana, *E.A. Sainsbury [GOKS] 2519* (WELT); Wellington, Tararua Range, Otaki Forks, *P. Beveridge s.n.* (WELT M033789). SOUTH ISLAND. Marlborough, Mt Fyffe State Forest, *J. Lewinsky 1199* (L); Canterbury, Peel Forest, *T.W.N. Beckett s.n.* (MEL 643020, 643021, 643026); Westland, Fox Glacier, *Martin 848* (WELT). STEWART ISLAND. *W. Bell s.n.* (L).

In sterile condition *Dicranoloma fasciatum* is very similar to, although smaller than, *D. plurisetum*, but when perichaetia are present it is easily recognised by the long, gradually tapering perichaetial leaves that reach the base of the capsules. In contrast, the inner perichaetial leaves in *D. plurisetum* have a setaceous acumen and do not reach farther than halfway along the setae. Sterile collections of *D. fasciatum* from New Zealand were seldom encountered during the present revision and can be separated from *D. plurisetum* by the consistently shorter leaves.

During fieldwork in Victoria and later among the collections in MEL, specimens were encountered that are thought to belong to either *Dicranoloma fasciatum* or *D. plurisetum*, neither of which have been reported from Australia before. All Australian specimens so far are sterile and are considered to belong to *D. fasciatum* because the leaf length is the same as in New Zealand specimens of *D. fasciatum*. However, the identification is not definitive until perichaetia and sporogones are found or it can be confirmed by other data sources.

The Australian specimens look in the field a bit like *Dicranoloma leichhardtii*, because the limbidium is wide enough to be observed with a hand lens and because marginal teeth are present only in the apical part of the margin. *D. leichhardtii* differs, however, by the isodiametric and non-pitted upper lamina cells.

The 'type' sheet of *Dicnemum obsoletinerve* in Hampe's herbarium contains two specimens. One of them belongs to *Dicranoloma fasciatum*, but does not bear F. Mueller's name. The other collection, which bears F. Mueller's name, belongs to *D. billardieri*. From the description of the perichaetium in the protologue it is clear that at least part of the material described belongs to *D. fasciatum*, but from the rest of the description it is not clear whether it is based on a specimen of *D. fasciatum* only or on a mixed collection also containing *D. billardieri*. Following Dixon (1913), *Dicnemum obsoletinerve* is treated here as a synonym of *D. fasciatum* and hence the specimen belonging to *D. fasciatum* is selected as the lectotype. Nothing in Dixon's (1913) discussion indicates that he actually studied the type specimen of *Dicnemum obsoletinerve* and his conclusion was based on

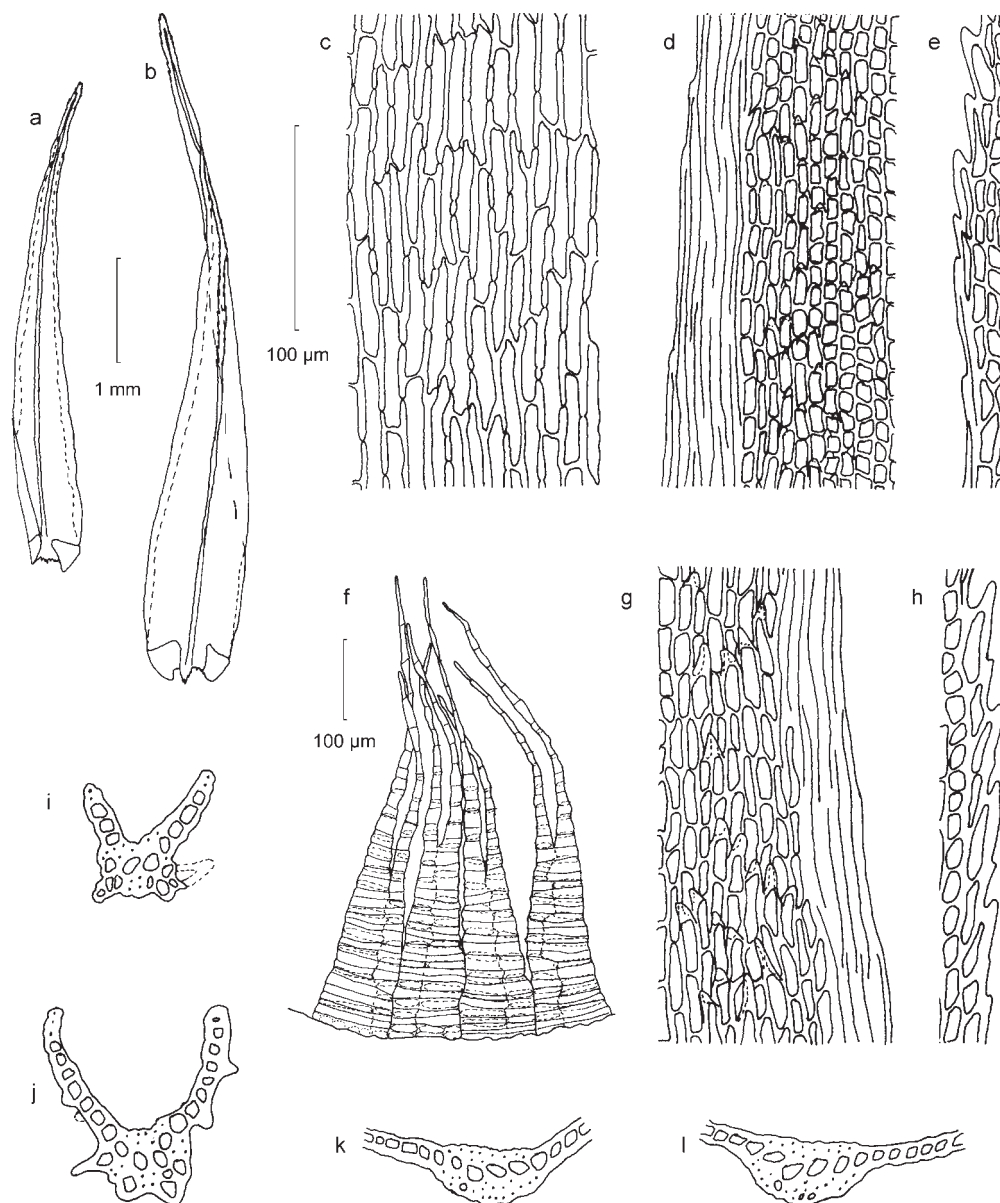


Fig. 17. *Dicranoloma leichhardtii*. a–b, leaves; c, basal lamina cells; d, g, upper lamina cells; e, h, lamina cells near leaf apex; f, peristome teeth, seen from outside; i–j, cross section through costa, distal 1/3; k–l, cross section through costa, just above alar patches; a, c–e, i, k, Bailey 219 (H-BR); b, g–h, j, l, Thies FN 1605 B (MEL); f, Streimann 47640 (CANB).

other collections identified as *D. obsoletinerve* by K. Müller Halle.

9. *Dicranoloma leichhardtii* (Hampe) Watts & Whitel.
Fig. 17

Proc. Linn. Soc. New South Wales 30 (Suppl.): 162 (1906)—*Dicranum leichhardtii* Hampe, *Linnaea* 36: 514 (1870)—*Leucoloma leichhardtii* (Hampe) A. Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1870–71: 411 (*Gen. sp. musc.* 1: 115) (1872)—*Poecilophyllum leichhardtii* (Hampe) Mitt., *Trans. Roy. Soc. Victoria* 19: 54 (1882). Type: Australia. New South Wales, *L. Leichhardt s.n.* (BM-holo!, MEL 33079!).

Leucoloma serratum Broth., *Öfvers. Förh. Finska Vetensk.-Soc.* 33: 92 (1891), *syn. nov.*—*Dicranoloma serratum* (Broth.) Renaud, *Rev.*

Bryol. 28: 69 (1901). Syntypes: Australia. Queensland, Mount Mistake, *F.M. Bailey 219* (H-BR-lecto!, selected here; BM!), 293 (H-BR!). Note: In Brotherus' herbarium *Bailey 219* and 293 are mixed and can not be distinguished.

Dicranum monocarpum Müll. Hal. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 27 (Suppl.): 52 (1902), *nom. nud.*—*Dicranoloma monocarpum* Paris ex Dixon, *Proc. R. Soc. Queensland* 53(2): 27 (1941), *nom. inval.* (as synonym). Original specimen: Australia. New South Wales, Blue Mountains, Lawson, *T. Whitelegge s.n.* (BM!, NSW 295379!). Synonymised with *Dicranoloma serratum* by Dixon (1942: 27).

Leucoloma harrisii Geh. ex Watts & Whitel., *Proc. Linn. Soc. New South Wales* 27 (Suppl.): 48 (1902), *nom. nud.*—*Dicranoloma harrisii* Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 162 (1906), *nom. nud.* Original specimen: Australia. New South Wales,

Cambewarra, *C. Harris s.n.* (BM!, H-BR!, NSW). Synonymised with *Dicranoloma serratum* by Dixon (1942: 27).

Plants 1.5–3.5 cm high, pale green, growing in turfs. *Stem* reddish brown, simple or subflorally branched, densely tomentose, densely foliose; central strand present, cortical cells thin-walled in centre, gradually becoming thicker-walled centrifugally. *Rhizoidal gemmae* often present. *Leaves* 4.5–6.0 × 0.6–1.0 mm, ovate-linear, gradually long acuminate, smooth, canaliculate below, carinate above, falcate-secund. *Alar patches* 0.16–0.37 × 0.10–0.30 mm. *Margin* serrate in extreme apical part only to in upper 1/5, entire below, plane. *Limbium* consisting of 8–21 rows, reaching to or within serrate part of margin. *Costa* 38–60 µm wide, 25–33 µm thick just above alar patches, subpercurrent, abaxially with 2–4 rows of teeth in distal 2/5–3/5; in cross-section semi-circular, with adaxial side straight to very slightly concave and abaxial side convex, guide cells 4, with 1 (–2) layers of stereids at either side, epidermis not differentiated, abaxial peripheral layer may contain one or more cells with distinct lumen. *Basal lamina cells* 25–130 (–160) × 7–13 µm, elongate to linear, mostly not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 1.3–3.0. *Upper lamina cells* conspicuously shorter than basal ones, 9–40 (–75) × 6–12 µm, quadrate to rectangular or with oblique end walls but straight side walls, more or less in orderly longitudinal rows; walls incrassate, not pitted, lumen wall ratio 2.0–4.0. *Alar cells* 17–100 (–135) × 13–43 µm, quadrate to rectangular, mostly not inflated; walls firm, 1–4 µm thick, not pitted, yellowish brown to brown, colourless in young leaves. *Teeth at leaf margin* 7–17 µm, consisting of a single cell, lumen often conspicuously longer than that of intra-marginal cells. *Perichaetia* terminal, often laterally displaced by innovations. Outer perichaetial leaves more or less abruptly contracted into a subula above an ovate to elliptic, clasping base. Inner perichaetial leaves elliptic to broadly elliptic, sheathing, abruptly contracting into a hair-like point. *Calyptra* c. 3.0 mm, reaching halfway along theca, cucullate, greenish transparent, smooth below, rough above because of bulging cell ends; base entire.

Sporogones solitary or occasionally two per perichaetium. *Seta* 5.3–6.5 mm long, yellowish, smooth; central strand present, outer 2–3 layers very thick-walled. *Capsule* 1.8–2.5 mm long, cylindrical, slightly curved, cernuous. *Exothecial cells* 18–90 × 15–40 µm, isodiametric to elongate, irregularly shaped to rectangular, in a more or less regular pattern of longitudinal rows, becoming shorter towards orifice. *Stomata* present in apophysis, more or less evenly distributed, phaneropore. *Annulus* revolvable, consisting of 2 cell layers. *Peristome teeth* orangish in lower c. 3/4, colourless to yellowish above, 450–770 µm long (50–) 70–108 µm wide at base, triangular, asymmetrically bifid in upper half; outer face striate in basal c. 2/3, with cross-connections in basal c. 1/2, papillose above; inner face

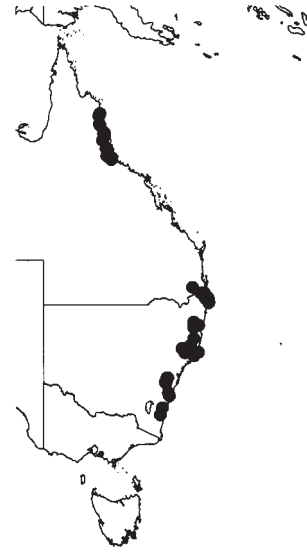


Fig. 18. Geographic distribution of *Dicranoloma leichhardtii*.

smooth in basal half, papillose above; outer trabeculae thin; inner trabeculae thick, often with scattered papillae. *Operculum* 1.4–2.0 mm, obliquely rostrate above conical base. *Spores* 16–25 µm, spherical to very slightly ellipsoid, finely papillose.

Distribution (Fig. 18): Australia: humid wet tropics in north-eastern Queensland, from Cooktown to Townsville and from south-eastern Queensland south into the coastal tablelands of New South Wales to as far south as Moruya. Endemic to Australia.

Habitat: Growing in warm temperate to subtropical rain forest or tropical montane forest from sea level to c. 1300 m above sea level, on a variety of substrates, but mostly on tree bases or lower tree stems.

Selected additional specimens examined: AUSTRALIA. QUEENSLAND. Mobo Creek, 21 km NE of Atherton, *H. Streimann* 16930 (CANB, H, L, NY); Mt Spec State Forest, Paluma Range, 6 km W of Paluma, *H. streimann* 36975 (CANB, NY); Lamington National Park, Mt Merino, *A.W. Thies* 1605B (MEL). NEW SOUTH WALES. Gibbergunyah Range, 30 km NNE of Lismore, *H. Streimann* 314 (CANB); Barrington Tops State Forest, Moppy Lookout, 40 km WNW of Gloucester, *H. Streimann* 44464 (CANB, NY); Marengo State Forest, Chaelundi Rd at Foamy Creek Rd, 36 km NW of Dor, *H. Streimann* 47640 (CANB); Blue Mountains, Lawson, *W.W. Watts s.n.* (L).

Dicranoloma leichhardtii used to be better known as *D. serratum*. Study of the type of the insufficiently known *Leucoloma leichhardtii* (as it was listed in Streimann and Curnow 1989) revealed it to be conspecific with *D. serratum*. As *Dicranum leichhardtii* is the older of the basionyms, *Dicranoloma leichhardtii* is the name that has to be accepted for the species.

Dicranoloma leichhardtii can be separated from *D. austroscoparium* by the narrower, mostly falcate leaves

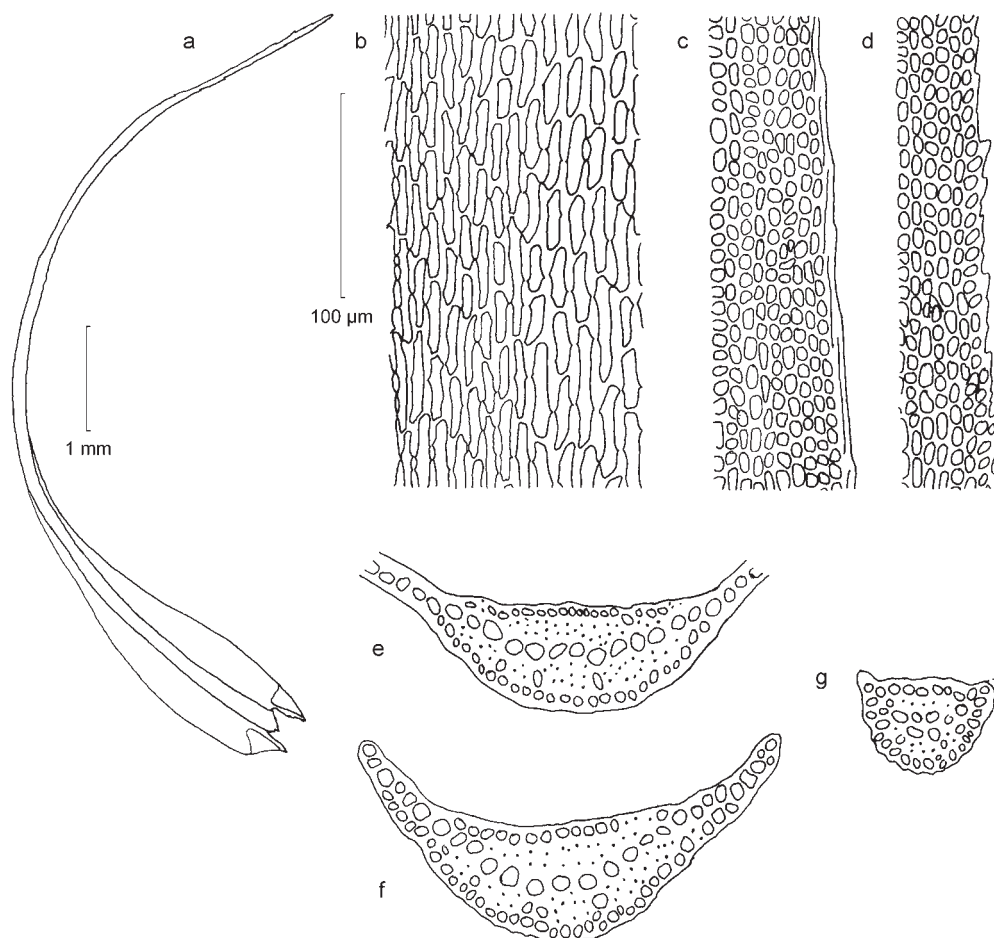


Fig. 19. *Dicranoloma menziesii*. a, leaf; b, basal lamina cells; c, upper lamina cells, at c. 1/3 of leaf length; d, upper lamina cells, at c. halfway along leaf length; e, cross section through costa, c. 1 mm above alar patches; f, cross section through costa, at c. 1/3 of leaf length; g, cross section through costa, at c. 2/3 of leaf length. a–g, Klazenga 5347 (MEL).

and by the isodiametric, non-pitted upper lamina cells and from *D. dicarpum* by the much wider limbidium, the margin which is serrate in the apical part only and the juxtacostal cells in the basal half of the leaf that are not different from the intra-marginal cells. It is not likely to be confused with any other species.

10. *Dicranoloma menziesii* (Taylor) Renauld Fig. 19

Rev. Bryol. 28: 69 (1901)—*Dicranum menziesii* Taylor, *Phytologist* 1: 1094 (Sept. 1844)—*Leucoloma menziesii* (Taylor) Broth., *Nat. Pflanzenfam.* I, 3: 322 (1901). Type: Australia. Norfolk Island, A. Cunningham s.n. (BM-holo!; L!).

Dicranum menziesii Hook.f. & Wilson, *London J. Bot.* 3: 541 (Oct. 1844), *nom. illeg.* (later homonym). Type: New Zealand. Auckland Islands, J.D. Hooker 69 (BM-holo!, NY!).

Dicranum brachypelma Müll.Hal., *Bot. Zeit.* 9: 550 (1851)—*Dicranum kaiparensense* Paris, *Index bryol.* 356 (1895), *nom. illeg.* (superfluous)—*Dicranoloma kaiparensense* Paris, *Index bryol.* ed. 2, 2: 27 (1904). Type: New Zealand. North Island, Kaipara, S. Mossman 714 (B-holo, destroyed; NY-Mitt.-lecto!, selected here). Synonymised by Mitten (1859: 68).

Dicranum menziesii var. *rigidum* Wilson, *Fl. nov.-zel.* 2: 67 (1854), *syn. nov.*—*Dicranoloma menziesii* var. *rigidum* (Wilson) Paris, *Index bryol.* ed. 2, 2: 28 (1904)—*Leucoloma menziesii* var. *rigidum* (Wilson) Dixon, *J. Linn. Soc., Bot.* 40: 436 (1912). Type: New Zealand. Dusky Bay, Menzies (BM, not located).

Dicranum nudum Hampe, *Linnaea* 30: 630 (1860) — *Campylopus nudus* (Hampe) A. Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1870–71: 420 (*Gen. Sp. Musc.* 1: 125) (1872). Type: Australia. Victoria, Tarwin, F. Mueller s.n. (BM-Hampe!). Synonymised by Dixon (1929: 364).

Dicranum suberectum Hampe, *Linnaea* 30: 629 (1860)—*Leucoloma suberectum* (Hampe) Broth., *Nat. Pflanzenfam.* I, 3: 322 (1901)—*Dicranoloma suberectum* (Hampe) Renauld, *Rev. Bryol.* 28: 69 (1901). Type: Australia, Victoria, Tarwin, F. Mueller s.n. (BM-holo!, MEL 29204!). Synonymised by Dixon (1913: 12).

Dicranum trichophyllum Hampe, *Linnaea* 37: 515 (1872)—*Leucoloma trichophyllum* (Hampe) Broth., *Nat. Pflanzenfam.* I, 3: 322 (1901)—*Dicranoloma trichophyllum* (Hampe) Paris, *Index bryol.* ed. 2, 2: 31 (1904). Type: New Zealand. Chatham Island, [sent by] F. Mueller (BM-Hampe!). Synonymised by Dixon (1913: 12).

Dicranum kroneanum Müll.Hal. in Hampe & Geh., *Rev. Bryol.* 8: 26 (1881)—*Leucoloma kroneanum* (Müll.Hal.) Broth., *Nat. Pflanzenfam.* I, 3: 322 (1901)—*Dicranoloma kroneanum* (Müll.Hal.) Paris, *Index*

bryol. ed. 2, 2: 27 (1904). Syntypes: Australia. Tasmania, Mt Wellington, *O. Beccari* 13 (L-lecto!, selected here); Victoria, near Fernshaw, *H. Krone s.n.* (not located). Synonymised by Dixon (1913: 12).

Dicranum bartramioides Broth., *Öfvers. Förh. Finska Vetensk.-Soc.* 35: 36 (1893), *syn. nov.*—*Leucoloma bartramioides* Broth., *Nat. Pflanzenfam.* I, 3: 322 (1901)—*Dicranoloma bartramioides* (Broth.) Paris, *Index bryol.* ed. 2, 2: 24 (1904). Type: Australia. Lord Howe Island, Mount Gower, *T. Whitelegge* 13 (H-BR!).

Dicranum oedithecium Müll.Hal., *Hedwigia* 36: 357 (1897)—*Leucoloma oedithecium* (Müll.Hal.) Broth., *Nat. Pflanzenfam.* I, 3: 322 (1901)—*Dicranoloma oedithecium* (Müll.Hal.) Paris, *Index bryol.* ed. 2, 2: 28 (1904). Type: Australia, New South Wales: Fitzroy Falls, near Moss Vale, *T. Whitelegge s.n.* (1884) (B-holo, destroyed; MEL 29210-lecto!, selected here; NSW 295378!). Synonymised by Dixon (1913: 12).

?*Leucoloma fulvum* Broth., *Nat. Pflanzenfam.* I, 3: 322 (1901)—*Dicranum fulvum* R.Br.bis, *Trans. Proc. New Zealand Inst.* 29: 462 (1897), *nom. illeg.* (later homonym)—*Dicranoloma fulvum* (Broth.) Paris, *Index bryol.* ed. 2, 2: 26 (1904). Type: not located. Synonymised by Dixon (1913: 12). Note: Dixon (1913) already could not find the type in R. Brown's herbarium.

Dicranodontium australe Dixon, *Bull. New Zealand Inst.* 3: 92 (1923). Syntypes: New Zealand. North Island, Great Barrier Island, *Hutton & Kirk* 63 (NY-lecto!, selected here; BM!); South Island, Lake Te Anau, South Fiord, *R. Brown (of Christchurch)* (BM!). Synonymised by Sainsbury (1946: 101). Note: The Brown collection belongs to *Dicranoloma trichopodum* (Mitt.) Broth.

Plants 2.5–10.0 cm high, yellowish-green to dark green, growing in turfs. *Stem* reddish-brown, extensively subflorally branched, densely tomentose, densely foliose; central strand present, cortical cells relatively thick-walled, gradually becoming thicker-walled centrifugally. *Leaves* 9.4–14.4 × 0.9–1.2 (–1.5) mm, ovate-linear, gradually to rather abruptly narrowed into a long setaceous point, smooth, canaliculate at base, often almost subtubulous at *c.* 1/3 of leaf length, carinate above, falcate-secund. *Alar patches* 0.38–0.44 × 0.27–0.35 mm. *Margin* serrulate in upper *c.* 2/3, entire below, plane. *Limbium* consisting of 1–2 rows, reaching to or within serrulate part of margin. *Costa* 106–139 µm wide, 46–57 µm thick just above alar patches, percurrent to long excurrent, abaxially with scattered teeth in distal part; in cross-section semi-circular to crescent-shaped, with adaxial side straight to slightly concave and abaxial side convex, guide cells 10–14, adaxially with 2 layers of stereids, abaxially with 2–3 layers of stereids with a few cells with a large lumen among them; epidermis differentiated adaxially as well as abaxially, consisting of cells with a distinct lumen. *Basal lamina cells* 18–76 × 5–12 µm, elongate to short-linear, not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 1.0–1.8. *Upper lamina cells* conspicuously shorter than basal ones, 6–20 × 6–12 µm, oblate to oblong, rounded, in orderly longitudinal rows; walls incrassate, not pitted, lumen wall ratio 2.5–3.0. *Alar cells* 15–53 (–70) × 13–30 µm, obrectangular to rectangular, not inflated; walls firm, 3–5 µm thick, not pitted, yellowish brown to brown, colourless in young leaves. *Teeth at leaf margin* 3–8 µm, lumen similar in size and shape to adjacent cells. *Perichaetia* terminal, laterally displaced.

Outer perichaetial leaves above an ovate, clasping basal part more or less abruptly narrowed into a long setaceous subula. Inner perichaetial leaves broadly elliptic to obovate, sheathing, with a hair-like point. *Calyptra* 2.5–2.8 mm, reaching *c.* halfway down theca, cucullate, yellowish transparent, brown at apex, smooth, slightly rough above because of bulging cell ends; base entire.

Sporogones 1 (–2) per perichaetium. *Seta* 4.5–8.0 mm long, reddish, getting darker towards capsule, smooth; in cross-section round, 0.15–0.16 mm, central strand present, walls of cortical cells gradually becoming thicker towards periphery, outer 4 layers very thick-walled. *Capsule* 2.0–2.3 × 0.7–0.8 mm, cylindrical, slightly curved, slightly strumose. *Exothecial cells* 23–78 × 15–23 µm, more or less quadrate to rectangular or irregularly shaped, mostly not in regular longitudinal rows, becoming smaller towards orifice, isodiametric to oblong, irregularly shaped and with relatively thin, nodose side walls. *Stomata* present in apophysis, evenly distributed, phaneropore. *Annulus* revoluble, consisting of 2 cell layers. *Peristome teeth* orangish in the basal half, yellowish above, 620–660 µm long, 86–109 µm wide at base, narrowly triangular, asymmetrically bifid in upper 3/5; outer face vertically striate with cross-connections between striae in basal half, vertically to obliquely striate to *c.* 2/3, papillose above; inner face smooth in basal half, papillose above; outer trabeculae thin, not ornamented; inner trabeculae thick, strongly projecting, papillose. *Operculum* 1.6–1.8 mm, obliquely rostrate above a conical base. *Spores* 16–19 µm, spherical, finely papillose.

Illustrations: Wilson and Hooker (1845, pl. 58, fig. 4); Dixon (1913, pl. 4, figs. 16–17); Dixon (1923, pl. 7, fig. 6, as *Dicranodontium australe*; pl. 7, fig. 11, as *Campylopus nudus*); Scott and Stone (1976: 155, pl. 25); Jarman and Fuhrer (1995: 33, fig. 9).

Distribution (Fig. 20): Australia: humid wet tropics in north-eastern Queensland, between Mt Finnigan and Mt Bellenden Ker National Park and from south-eastern Queensland through the coastal tablelands in New South Wales into southern Victoria as far west as the Grampians; Lord Howe Island, King Island and Tasmania. The report from Norfolk Island is doubtful (see below). New Zealand: North Island, South Island, Stewart Island, Chatham Islands, Auckland Islands. Outside the region also occurring in New Caledonia, southern South America and Juan Fernandez.

Habitat: Mostly in wet forest between sea level and *c.* 1550 m above sea level, mostly on rocks, logs, tree stumps, tree bases and lower tree stems.

Selected additional specimens examined: AUSTRALIA. QUEENSLAND. Mt Bellenden Ker South Peak, 23 km SSE of Gordonvale, *H. Streimann* 27474 (CANB, L); Tinaroo Range, Mt Haig, *M.M.J. van Balgooy* 1583B (L, NY); McPherson Range, Upper Coomera River, *H. Streimann* 333 (CANB, L, MEL, NY). NEW SOUTH WALES. Mt Warning, 14 km SW of Murwillumbah, *H. Streimann* 280 (CANB, L); Blue Mountains, Wentworth Falls, *M. Fleischer* B 2576

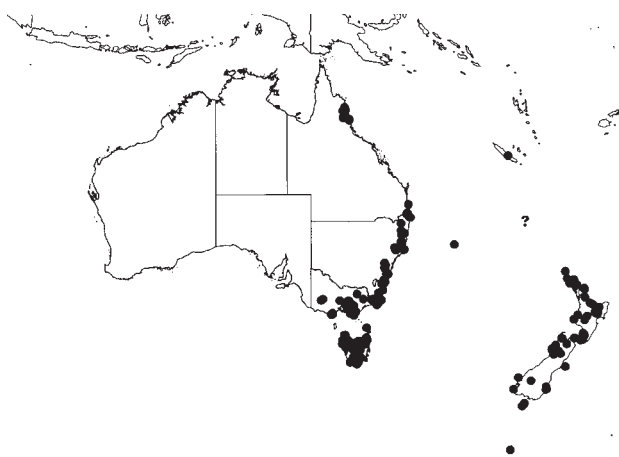


Fig. 20. Geographic distribution in Australasia of *Dicranoloma menziesii*. The question mark on Norfolk Island indicates that occurrence of *D. menziesii* there is doubtful.

(CANB, L, NY). LORD HOWE ISLAND. On ESE side of Lidgbird, A.C. Beauglehole 73544 (MEL). VICTORIA. Eastern Highlands, Mt Donna Buang, Cement Creek Track, A.W. Thies 1501 C (MEL); Errinundra National Park, Goonmirk Rocks, 14 km S of Bendoc, H. Streimann 39903 (CANB, NY). TASMANIA. Cradle Mtn-Lake St Clair National Park, Lake St Clair, D.H. Norris 27867 (CANB, HO, NY); Mt Field National Park, Lake Dobson Rd, just below nature trail, D.H. Vitt 29118 (CANB, NY). NEW ZEALAND. NORTH ISLAND. Taranaki, Mt Egmont National Park, Pembroke Rd, track to Potaema Swamp, N. Klazenga 5347 (MEL); Wellington, Tongariro National Park, Mt Ruapehu, Ohakune Mountain Rd, near 7 km road marker, R.J. Lewington s.n. (WELT 28832). SOUTH ISLAND. Canterbury, Mt Somers, Stevenson Hill, D.S. Glenny 89–418 (WELT); West Coast, Grey County, Croesus Track, ESE of Barrytown, Granite-Fagan Creek, A.J. Fife 4583 (CANB). STEWART ISLAND. S end of island at Port Pegasus, D.H. Vitt 10305 (L). AUCKLAND ISLANDS. Adam Island, Magnetic Station, P.N. Johnson 11/60 (WELT).

When not bearing sporogones *Dicranoloma menziesii* may be confused with *D. trichopodium*, differences with which will be discussed under that species. Moreover, some epiphytic forms of *D. robustum* may be confused with light-coloured forms of *D. menziesii*. *D. menziesii* can be distinguished from such forms by the isodiametric, non-pitted upper lamina cells and the wider costa. However, some specimens have been encountered that I think are young specimens of *D. menziesii*, and which combine isodiametric, non-pitted upper lamina cells with the narrower costa one would expect to find in *D. robustum*.

Dicranoloma menziesii can in a certain locality have a light-coloured form and a dark form, among which few intermediates are found. The light form tends to grow in more exposed places and has fewer chloroplasts per cell than the dark form (Milne 1997). Perichaetial leaves in *D. menziesii* are relatively short, shorter than the stem leaves, but the capsules are often reached or overtopped by stem leaves from below the perichaetia and from subfloral innovations.

Dicranum menziesii was described as a new species twice in the same year, apparently independently, both by Taylor and by Hooker and Wilson. *Dicranum menziesii* Taylor was published earlier and hence has priority. Dixon (1913) incorrectly cited J.D. Hooker & W. Wilson as authors of the basionym of *Dicranoloma menziesii* and has been followed in this by most subsequent workers on Australasian material.

Dicranum menziesii Taylor and *D. menziesii* Hook.f. & Wilson were based on different types. That the type of *D. menziesii* Taylor indeed originated from Norfolk Island is doubtful, as *Dicranoloma menziesii* has not been found there since or before. Similar doubts have been expressed with respect to reports of *Lopidium concinnum* (Hook.) Wilson (Kruijer 2002), *Hypnodendron arcuatum* (Hedw.) Lindb. ex Mitt., *H. comatum* (Müll. Hal.) Touw and *H. menziesii* (Hook.) Paris (Touw 1971) from Norfolk Island based on Cunningham collections. The occurrence of these species on Norfolk Island has not been confirmed since, as have a number of other reports of species from Norfolk Island based on Cunningham collections.

The type of *Dicranoloma menziesii* var. *rigidum* could not be located. Collections of *D. menziesii* from the Wilson herbarium with correct collector and locality data were seen, but they do not bear the name var. *rigidum*. Collections in Wilson's herbarium that are named *Dicranum menziesii* var. *rigidum* were collected by Colenso and have no locality data. The decision to sink the var. *rigidum* into *D. menziesii* has been made on the basis of those specimens. The collections listed by Dixon (1913: 12) are also not types.

11. *Dicranoloma obesifolium* (R.Br.bis) Broth. Fig. 21

Nat. Pflanzenfam. ed. 2, 10: 209 (1924) — *Dicranum obesifolium* R.Br.bis, Trans. Proc. New Zealand Inst. 29: 462 (1897) — *Braunfelsia obesifolia* (R.Br.bis) Dixon, Bull. New Zealand Inst. 3: 79 (1923). Type: New Zealand. Westland, Kelly's Hill, R. Brown (of Christchurch) s.n. (BM-Dixon-lecto!, selected here).

Eucamptodon petriei Broth., Öfvers. Förh. Finska Vetensk.-Soc. 40: 161 (1898) — *Braunfelsia petriei* (Broth.) Broth., Nat. Pflanzenfam. I, 3: 321 (1901). Type: New Zealand, Westland, Teremakan Valley, D. Petrie 641 (H-BR-holo!, BM!). Synonymised by Dixon (1923: 79).

Plants up to c. 10 cm high, dirty yellowish-green, growing in turfs. Stem reddish brown to dark brown, simple or scarcely subflorally branched, very scarcely tomentose, rather loosely foliose; central strand present, cortical cells moderately thick-walled. Leaves (5.0–) 7.5–10.3 × (1.7–) 2.4–3.0 mm, ovate, obtuse, hooded, smooth, strongly canaliculate below, subtubulose above, erecto-patent to widely patent. Alar patches 0.99–1.05 × 0.73–0.83 mm. Margin entire, plane. Limbium consisting of 1–3 rows, reaching to somewhat below leaf apex. Costa 25–57 µm wide, 30–35 µm thick just above alar patches, reaching to 2/3 of leaf length to somewhat below leaf apex, abaxially smooth throughout; in cross-section straight to elliptic with both sides straight or slightly convex, guide cells 3–4, with a single layer of stereids at either side, epidermis not

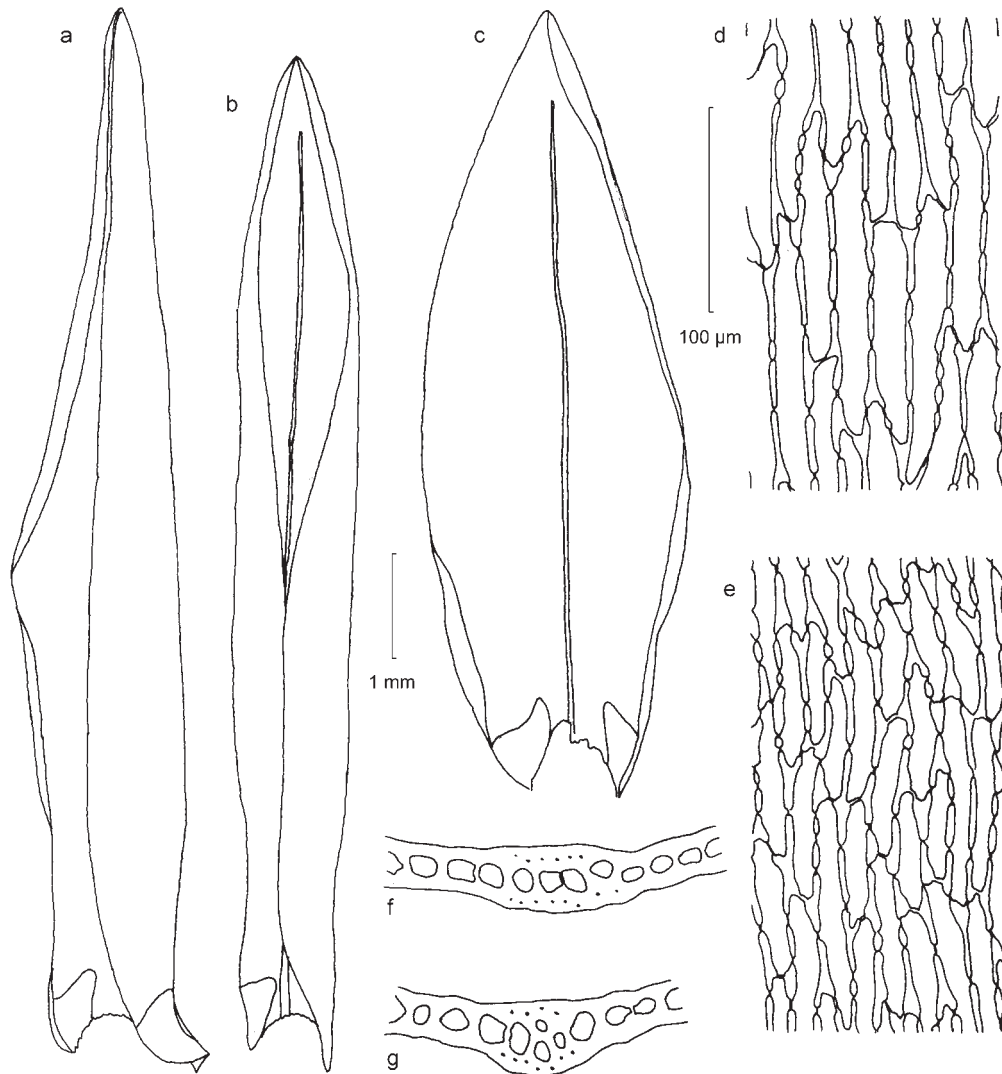


Fig. 21. *Dicranoloma obesifolium*. a–b, leaves; c, leaf, flattened; d, basal lamina cells; e, upper lamina cells; f, cross section through costa, just above alar patches; g, cross section through costa, distal 1/3. a–g, Fife 7525 (CBG).

differentiated. *Basal lamina cells* $73\text{--}185 \times 13\text{--}20 \mu\text{m}$, elongate to linear, not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio $3.0\text{--}6.0$. *Upper lamina cells* gradually shorter than, but otherwise very similar to basal ones, $25\text{--}129 \times 11\text{--}15 \mu\text{m}$, straight, oblong to short-linear, not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio $(1.0\text{--}) 1.4\text{--}2.0$. *Alar cells* $33\text{--}81 \times 23\text{--}51 \mu\text{m}$, quadrate to rectangular, not inflated; walls firm, $4\text{--}6 \mu\text{m}$ thick, often pitted, brown, colourless in young leaves. *Perichaetia* terminal, laterally displaced. Outer perichaetial leaves similar to stem leaves, but shorter and with clasping basal part. Inner perichaetial leaves broadly elliptic, truncate to slightly indented, tightly sheathing basal part of seta. *Calyptra* not found.

Sporogones solitary. *Seta* $28\text{--}31 \text{ mm}$, smooth; central strand present, cortical cells gradually becoming more

thick-walled centrifugally. *Capsule* $3.0\text{--}4.0 \text{ mm}$, cylindrical, curved, strumose. *Exothecial cells* $30\text{--}145 \times 20\text{--}30 \mu\text{m}$, isodiametric to oblong and in an irregular pattern at concave side of capsule, elongate to linear and in a more or less regular pattern at convex side of capsule; walls thick, not pitted. *Stomata* present in apophysis, more or less evenly distributed, phaneropore. *Annulus* persistent, consisting of two rows of flat, hexagonal cells. *Peristome teeth* $650\text{--}800 \mu\text{m}$ high, $100\text{--}130 \mu\text{m}$ wide at base, narrowly triangular, asymmetrically bifid in upper half. Outer face vertically to obliquely striate with cross-connections between striae in basal $c. 2/3$, papillose above, striate in between; inner face smooth in basal $c. 2/3$, papillose above. *Operculum* $2.5\text{--}3.0 \text{ mm}$, obliquely rostrate above a conical base. *Spores* $18\text{--}22 \mu\text{m}$, spherical, finely papillose.



Fig. 22. Geographic distribution of *Dicranoloma obesifolium*.

Distribution (Fig. 22): New Zealand: South Island, west of the Main Divide and known from a single collection from the Ruahine Ranges on the North Island. Endemic to New Zealand.

Habitat: Growing at high altitudes, above 1200 m, in alpine vegetation, sometimes in *Nothofagus* forest. Terrestrial.

Selected additional specimens examined: NEW ZEALAND. NORTH ISLAND. Ruahine Ranges, A.P. Druce 121 (WELT). SOUTH ISLAND. Nelson, Arthur Range, ridge on S flank of Hoary Head, A.J. Fife 7525 (CBG); Mt Arthur, L.B. Moore s.n. (WELT 29513, 29514, 28730, 28414). Westland, Northern Olivine Range, N of Dragon, D.S. Glenney 5772 (WELT); Westland, Klondyke Spur, Rahu Saddle, D.S. Glenney s.n. (WELT 9339); Westland, Otira, Kelly's Hill track, W. Martin 1 (WELT); Canterbury, Arthurs Pass National Park, Temple Basin, P.J. Brownsey s.n. (WELT 8288); *ibid.*, Cassidy Basin, A.J. Fife 6215 (CBG); *ibid.*, Bealey River, L.B. Moore 287 (WELT).

Dicranoloma obesifolium is not likely to be confused with any other species of *Dicranoloma* because of its wide, patent leaves with obtuse apices. Differences with *D. eucamptodontoides* with which it shares the wide leaves and entire margins are discussed under that species. The wide leaves and entire leaf margins, which are otherwise relatively uncommon in *Dicranoloma*, are also shared with two distantly related species of high altitudes from New Guinea, *D. bartramianum* (B.H.Allen) Klazenga and *D. geluense* (Herzog) B.H.Allen and with *Dicranum peruvianum* Robinson from Central and South America which also grows at high altitudes.

12. *Dicranoloma platycaulon* Dixon Fig. 23

Bull. New Zealand Inst. 3: 15 (1913)—*Dicranum platycaulon* Müll.Hal., *Trans. Proc. New Zealand Inst.* 31: 427 (1899), *nom. nud.* Syntypes: New Zealand. North Island, Taranaki, Jupp s.n. (not located); Mount Egmont, W. Gray 119 (BM!), 124 (BM!); South Island, Greymouth, R. Helms (not located); Mount Cargill, W. Bell s.n. (BM-lecto!, *fide* Tan (1989: 508)); Westland, A.R. Bloxam s.n. (not located); Stewart Island, Lee Bay, L. Cockayne 8234 (BM!).

Plants 3.0–12.0 cm high, pale green to light green, growing in turfs. **Stem** reddish brown, subflorally branched, densely tomentose, densely foliose; central strand present, cortical cells thin-walled. **Leaves** 7.0–14.0 (–15.7) × 1.3–2.0 (–2.3) mm, ovate-linear, gradually long acuminate, undulate along costa between c. 1/3 and 2/3 of leaf length when dry, smooth to very slightly undulate when wet, canaliculate, falcate second; leaf tips mostly fragile, often broken off. **Alar patches** 0.45–0.67 × 0.24–0.47 mm. **Margin** serrate in upper 1/2–3/5, entire below, mostly plane, occasionally slightly undulate. **Limbium** consisting of 6–16 rows, reaching serrate part of margin. **Costa** 38–67 (–81) µm wide, 25–41 µm thick just above alar patches, subpercurrent or percurrent, abaxially with two rows of teeth or scattered teeth in distal 2/5–3/5; in cross-section semi-circular, with adaxial side straight and abaxial side convex, guide cells 4–6, adaxially with 2 layers of stereids, abaxially with 1 or 2 layers of stereids, epidermis not differentiated. **Basal lamina cells** (35–) 50–157 × 8–13 µm, elongate to linear, not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 0.8–2.0. **Upper lamina cells** conspicuously shorter than basal ones, 10–65 × 6–15 µm, irregularly rounded, oblate to elongate, typically in an irregular pattern, but often almost regularly in longitudinal rows in parts of leaf, especially in apical, non-undulate part; walls incrassate, pitted or very scarcely and shallowly so, lumen wall ratio (1.3–) 2.0–4.0. **Alar cells** 13–103 (–114) × (14–) 20–46 µm, quadrate to rectangular, inflated; walls thin, 1–2 µm thick, not pitted, brown, colourless in young leaves. **Teeth at leaf margin** 8–25 (–30) µm, consisting of a single cell, lumen of teeth and non-dentiform marginal cells often conspicuously longer than that of intramarginal cells in serrate part of margin. **Perichaetia** terminal, laterally displaced. Outer perichaetial leaves above a clasping, ovate to broadly elliptic basal part contracted into a reflexed subula. Inner perichaetial leaves broadly elliptic, sheathing, with a hair-like point. **Calyptra** 5.5–6.0 mm, reaching c. halfway down theca, cucullate, greenish transparent, slightly rough above because of bulging cell ends; base entire.

Sporogones 1–3 per perichaetium. **Seta** 11.0–14.0 mm long, smooth; 0.20–0.26 mm in diameter, central strand present, cortical cells gradually becoming thicker-walled centrifugally. **Capsule** 3.0–4.0 × 0.7–0.8 mm, cylindrical, curved, very slightly strumose when wet, slightly sulcate when dry. **Exothecial cells** 41–127 × 15–20 (–25) µm, elongate to short-linear, irregularly shaped or with straight lateral walls and rounded ends. **Stomata** present in apophysis, more or less evenly distributed, phaneropore. **Annulus** revoluble, consisting of 2 cell layers. **Peristome teeth** orangish, 580–791 µm long, 86–109 µm wide at base, narrowly triangular, asymmetrically bifid in upper half; outer face vertically striate with cross-connections between striae in lower half, obliquely striate above, papillose in upper c. 1/3; inner face smooth in basal half, papillose above;

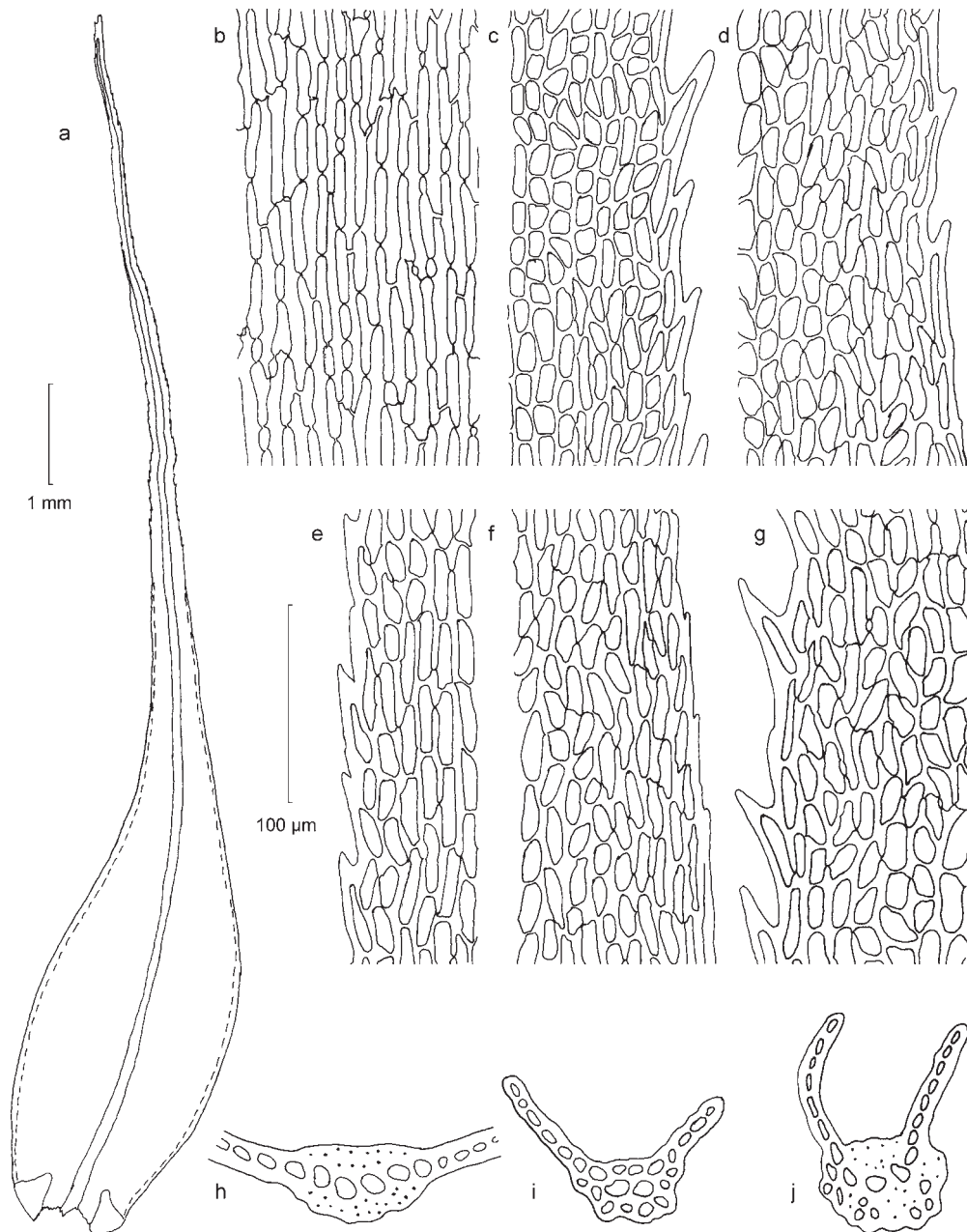


Fig. 23. *Dicranoloma platycaulon* Dixon. *a*, leaf; *b*, basal lamina cells; *c*–*g*, upper lamina cells; *h*, cross section through costa, *c.* 1 mm above alar patches; *i*–*j*, cross section through costa, upper 1/3. *a*–*c*, *h*–*i*, *Klazenga 5318* (MEL); *d*, *Klazenga 5310* (MEL); *e*, *Klazenga 5574* (MEL); *f*, *Klazenga 5416* (MEL); *g*, *Klazenga 5461* (MEL); *j*, *Brownsey s.n.* (WELT M9987)

outer trabeculae thin; inner trabeculae thick, strongly projecting, smooth or sparsely papillose. *Operculum* 2.8–3.2 mm, obliquely rostrate above a conical base. *Spores* 18–24 µm, spherical, very finely papillose.

Illustrations: Dixon (1913, pl. 3, fig. 10); Tan (1989: 509, figs. 15–18).

Distribution (Fig. 24): Australia: Yarra Ranges in Victoria, south-western Tasmania. New Zealand: North

Island, South Island and Stewart Island. Endemic to Australasia.

Habitat: Temperate rain forest. In Australia almost restricted to *Nothofagus cunninghamii*, where it mostly grows rather high up on the stem. In New Zealand found on a wider variety of substrates, including tree stems and bases, rotting logs, rocks, litter and soil. Between *c.* 400 and 1050 m above sea level, sometimes at lower altitudes.

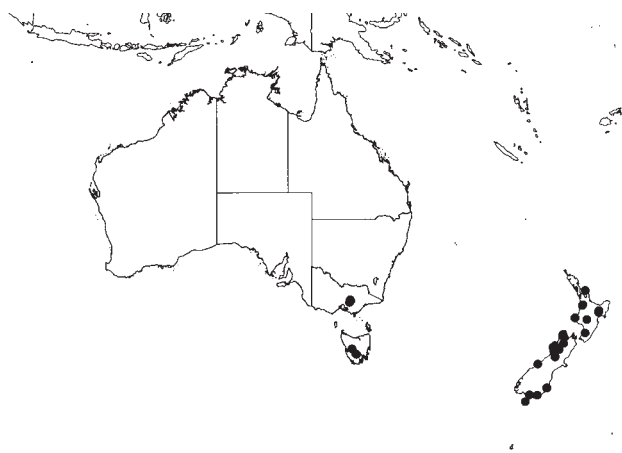


Fig. 24. Geographic distribution of *Dicranoloma platycaulon*.

Selected additional specimens examined: AUSTRALIA. VICTORIA. Eastern Highlands, Marysville, Keppel Falls Scenic Reserve, Whitehouse Creek, c. 1.8 km NNW of Keppel Falls, *N. Klazenga* 5461 (CHR, MEL); Yarra Ranges National Park, Marysville-Woods Point Rd, Cumberland Scenic Reserve, *N. Klazenga* 5876 (MEL). TASMANIA. South West National Park, Gordon River Rd, Five Rd, *N. Klazenga* 5574 (CHR, MEL); Lyell Highway, Franklin-Gordon River Wilderness Nature Walk, *N. Klazenga* 5810 (MEL). NEW ZEALAND. NORTH ISLAND, Taranaki, Mt Egmont National Park, Mountain House, Kamahi Walk, *Klazenga* 5310, 5316, 5318 (MEL); *ibid.*, Mangorei Track, *N. Klazenga* 5416 (MEL); Gisborne, Lake Waikaremoana, Hopuruahe River, *G.F. Jardine & G.O.K. Sainsbury* (BM, L). SOUTH ISLAND. Nelson, Boulder Lake, track to Lake Clara, *D.S. Glenn* s.n. (WELT 9120); Canterbury, Arthur's Pass National Park, Bealey Track, 1.5 km NW of Jack's Hut, *A.J. Fife* 6137 (CBG); West Coast, 15 km NE of Greymouth, Sewell Peak, start of track to Mt Davy from TV transmitter station, *P.J. Brownsey* s.n. (WELT 33387). STEWART ISLAND. *Mrs. J.D. Smith* [GOKS] 2587 (WELT).

Dicranoloma platycaulon is immediately recognised from all Australasian congeners by the whitish green, rugose leaves. The rugosity of the leaves is a result of an undulate lamina along the costa between c. 1/3 and 2/3 of leaf length and a more or less plane lamina at the margin. In *D. billardieri* and forms of *D. robustum* with wide leaves the leaves may be very weakly undulate when dry, but those undulations are along the margins and only in the basal part of the leaves. In the field the undulate leaves are not always easily observed when the plants are wet. Under the microscope *D. platycaulon* can furthermore be recognised by the cell pattern in the upper lamina with areas of isodiametric, quadrate to polygonal cells in an irregular pattern and areas of oblong to elongate cells in a more regular pattern.

Among the Australasian species *Dicranoloma platycaulon* is considered to be more closely related to *D. dicarpum*, *D. fasciatum*, *D. plurisetum*, *D. austroscoparium* and *D. leichhardtii* than to other species of *Dicranoloma*. Apart from the characters already mentioned in the above paragraph, *D. platycaulon* can be often be distinguished from those species by the more fragile leaf tips.

Among the examined specimens two different forms could be recognised. In the one form the abaxial teeth are in rows and the cross-section through the costa in the upper part of the leaf contains many stereids. This form occurs in Westland and farther south. In the other form the abaxial teeth may start in rows, but become scattered higher up and are scattered in the largest part of the serrate part of the costa and the cross-section through the costa in the upper part of the leaf contains cells with a large lumen only. In this form leaf apices or more drawn out and hence the leaves tend to be longer and the apices are fragile. This form has been found in the northern part of the South Island, the North Island, Tasmania and Victoria. Although no intermediate specimens were seen and the two forms seem not to occur together, these forms will not be formalised here as they were discovered only at the end of this study and only part of the available New Zealand collections have been studied.

In mainland Australia *Dicranoloma platycaulon* has been found only in the Yarra Ranges where it is locally abundant and from where it has been first reported as recently as 1997 (Milne 1997). Two earlier reports from other localities in Victoria (Meagher 1996; Meagher and Rankin 1997) were based on misidentified collections of other *Dicranoloma* species.

Dicranoloma platycaulon was first reported from Tasmania by Scott and Stone (1976), based on a specimen from Cradle Mountain, the identification of which was confirmed by K.W. Allison. Furthermore, the species has been collected from various localities on Tasmania by myself. Most collections identified as *D. platycaulon* in HO were misidentified. From the few specimens that are known from Tasmania it seems that the species is widespread in *Nothofagus* forest, but is uncommon everywhere. However, it is easily overlooked as it mostly grows rather high up on tree stems.

13. *Dicranoloma plurisetum* Dixon Fig. 25

Bull. New Zealand Inst. 3: 22 (1913)—*Dicranum plurisetum* (Dixon) Fife, *Bryologist* 98: 315 (1995)—*Dicranum plurisetum* Müll.Hal., *Genera musc. frond.*: 290 (1900), *nom. nud.* Syntypes: New Zealand. North Island, Poverty Bay, *T.F. Cheeseman* (not located); South Island, Westland, Kelly's Range, *ex herb. Beckett* [167] (BM!; CHR-Beckett!); South Island, Southland, Lake Te Anau, *D. Petrie* [*ex herb. Beckett* 644]. (BM-lecto!, *selected here*; CHR-Beckett!); Dunedin, Mount Cargill, *D. Petrie* (not located); Westland, Greymouth, Paparoa Range, Graftschaff Grey, *R. Helms* (not located); Pakihi, *R. Helms* (not located).

?*Dicranum pallidosplendens* Müll. Hal., *Genera musc. frond.*: 290 (1900), *nom. nud.* Original specimen: New Zealand. South Island, Westland, Greymouth, Paparoa Range, Graftschaff Grey, *R. Helms* (not located). Synonymised by Dixon (1913: 22). Note: the original specimen of *D. pallidosplendens* is one of the syntypes of *D. plurisetum*.

Plants 5–11 cm high, whitish green, growing in turfs. *Stem* reddish to dark brown, with subfloral and lateral innovations, densely tomentose, densely foliose; central strand present, cortical cells thin-walled. *Leaves* 8.0–9.8 ×

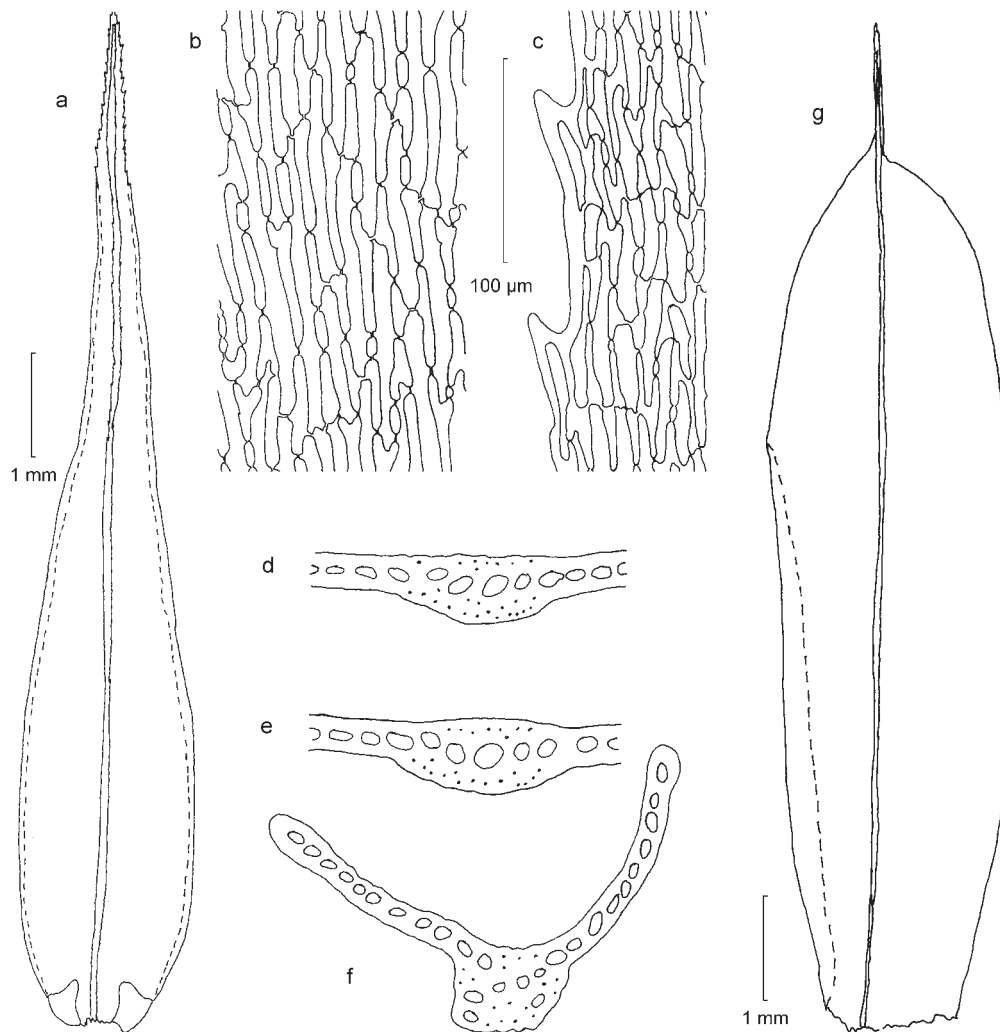


Fig. 25. *Dicranoloma plurisetum*. a, leaf; b, basal lamina cells; c, upper lamina cells; d–e, cross sections through costa, just above alar patches; f, cross section through costa, distal 1/3; g, innermost perichaetial leaf. a–g, *Klazenga 5415* (MEL).

1.3–1.6 mm, ovate-linear, gradually long acuminate, smooth, canaliculate below, carinate above, falcate-secund. *Alar patches* 0.40–0.64 × 0.23–0.48 mm. *Margin* serrate in upper 1/6–1/4, entire below, plane. *Limbium* consisting of 7–14 rows, reaching serrate part of margin. *Costa* 43–71 µm wide, 30–42 µm thick just above alar patches, subpercurrent to percurrent, abaxially with two rows of teeth in distal 2/5–3/5; in cross-section semi-circular, with adaxial side straight and abaxial side convex, guide cells 4, with a single layer of stereids at either side, epidermis not differentiated. *Basal lamina cells* 63–167 × 9–16 µm, elongate to linear, mostly not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 1.1–5.0. *Upper lamina cells* slightly shorter than basal ones (25–) 33–109 × 8–14 µm, elongate to short-linear, slightly curved to slightly vermiculate, not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 1.3–7.0. *Alar cells* 20–101 × 15–51 µm, quadrate to rectangular, inflated; walls thin, 1–2 µm thick, not pitted,

brown, colourless in young leaves. *Teeth at leaf margin* 10–33 µm, consisting of a single cell, lumen mostly larger, but not always conspicuously so, than that of adjacent cells. *Perichaetia* terminal, occasionally laterally displaced. Outer perichaetial leaves above a clasping, ovate to broadly elliptic base contracted into a reflexed subula. Inner perichaetial leaves sheathing, broadly elliptic to elliptic, with a hair-like point. *Calyptra* c. 5.5 mm, reaching c. halfway along theca, cucullate, yellowish transparent, brown near apex, slightly rough near apex because of bulging cell ends; base entire.

Sporogones 1–4, mostly 3, per perichaetium. *Seta* 14–18 mm long, yellowish, smooth; central strand present, walls of medulla cells gradually thickening centrifugally, outer 2 or 3 layers very thick-walled. *Capsule* 3.0–3.2 mm, cylindrical, curved, strumose. *Exothecial cells* 30–81 × 13–25 µm, oblong to short-linear, rectangular to irregularly shaped, mostly not in orderly rows; cells at the concave side of the capsule longer than those at the concave side;



Fig. 26. Geographic distribution of *Dicranoloma plurisetum*.

becoming shorter distally, to isodiametric and irregularly shaped at orifice. *Stomata* present in apophysis, more or less evenly distributed, phaneropore. *Annulus* revoluble, consisting of 2 or 3 cell layers. *Peristome teeth* reddish in the lower half, yellowish above, 480–650 µm long, 85–105 µm wide at base, narrowly triangular, asymmetrically bifid in upper half; outer face vertically striate with cross-connections between striae in lower c. 2/3, obliquely striate with papillae on striae above; inner face smooth in lower c. 2/3, papillose above; outer trabeculae thin; inner trabeculae thick, strongly projecting, smooth. *Operculum* 2.0–3.0 mm, obliquely rostrate above a conical base. *Spores* 13–21 µm, spherical, finely papillose.

Illustrations: Dixon (1913, pl. 2, fig. 7; pl. 3, fig. 7 (ctd.); pl. 4, fig. 18); Sainsbury (1955a: 134, pl. 22, fig. 2).

Distribution (Fig. 26): New Zealand: North Island, South Island, Stewart Island. Endemic to New Zealand.

Habitat: Growing in wet forest from sea level to c. 1400 m above sea level; terrestrial or on logs, tree stumps, tree bases or lower tree stems.

Selected additional specimens examined: NEW ZEALAND. NORTH ISLAND. North Auckland, Waipoua Forest, Mataraua Plateau, Waoku Rd, 2 km N of Tutamoe, *P.J. Brownsey s.n.* (WELT 30059). Taranaki, Mt Egmont National Park, Mangorei Track, *N. Klazenga 5415* (MEL); Gisborne, Lake Waikaremoana, above Aniwaniwa Falls, *E. Whitehouse 29265* (CANB, L). SOUTH ISLAND. Westland, Minnehaha Track, Fox Glacier, *J.A. Elix 80–22* (CANB, L); Canterbury, Woolshed Hill near Cass, *L. Visch 97* (CANB, L); Southland, Fiordland, Dusky Sound, mainland N of Cooper Island, site of Docherty's hut, *P.J. Brownsey s.n.* (WELT 7922). STEWART ISLAND. Port Pegasus, *N.M. Adams s.n.* (WELT 3500, 7679).

Dicranoloma plurisetum can only be confused with *D. dicarpum*, *D. fasciatum* and perhaps *D. platycaulon*. Differences have been discussed under those species.

14. *Dicranoloma robustum* (Hook.f. & Wilson) Paris Fig. 4e–i, 27

Index bryol. ed. 2, 2: 29 (1904)—*Dicranum robustum* Hook.f. & Wilson, *London J. Bot.* 3: 542 (1844)—*Leucoloma robustum* (Hook.f.

& Wilson) Broth., *Nat. Pflanzenfam.* I, 3: 323 (1901). Type: Chile. Hermite Island, *J.D. Hooker 100b* (BM!).

Dicranum pungens Hook.f. & Wilson, *London J. Bot.* 3: 541 (1844)—*Dicranum robustum* var. *pungens* (Hook.f. & Wilson) Hook.f., *Handb. N. Zeal. Fl.*: 412 (1867)—*Leucoloma pungens* (Hook.f. & Wilson) Broth., *Nat. Pflanzenfam.* I, 3: 323 (1901)—*Dicranoloma pungens* (Hook.f. & Wilson) Paris, *Index bryol.* ed. 2, 2: 29 (1904). Type: New Zealand. Auckland Islands, *J.D. Hooker* (BM-holo!, NY 267974!). Synonymised by Sainsbury (1955a: 129).

Dicranum setosum Hook.f. & Wilson, *London J. Bot.* 3: 541 (1844)—*Leucoloma setosum* (Hook.f. & Wilson) Broth., *Nat. Pflanzenfam.* I, 3: 541 (1901)—*Dicranoloma setosum* (Hook.f. & Wilson) Paris, *Index bryol.* ed. 2, 2: 30 (1904)—*Dicranoloma robustum* var. *setosum* (Hook.f. & Wilson) Sainsbury, *Bryologist* 34: 74 (1931). Syntypes: New Zealand. Auckland Island, *D. Lyall* (BM-lecto!, selected here); Campbell Island, *J.D. Hooker [Wilson 26b]* (BM!, MEL!, NY 267993!), *[Wilson 68]* (BM!). Synonymised by Fife (1995: 320).

Dicranum setosum var. *attenuatum* Hook.f. & Wilson, *Fl. antarct.* 1: 129 (1845), *syn. nov.*—*Dicranoloma setosum* var. *attenuatum* (Hook.f. & Wilson) Paris, *Index bryol.* ed. 2, 2: 30 (1904)—*Dicranoloma robustum* var. *attenuatum* (Hook.f. & Wilson) Wijk & Margad., *Taxon* 9: 50 (1960). Type: New Zealand. Campbell Island, *J.D. Hooker [Wilson 26]* (BM-Hooker-holo!, NY 267994!).

Dicranum punctulatum Hampe, *Linnaea* 30: 628 (1860), *syn. nov.*—*Leucoloma punctulatum* (Hampe) Broth., *Nat. Pflanzenfam.* I, 3: 323 (1901)—*Dicranoloma punctulatum* (Hampe) Renaud ex Paris, *Index bryol.* ed. 2, 2: 29 (1904). Type: Australia. 'in alpinis austral.', *F. Mueller 149* (BM-Hampe-holo!, MEL 33108!).

Dicranum subpungens Hampe, *Linnaea* 30: 629 (1860), *syn. nov.*—*Leucoloma subpungens* (Hampe) Broth., *Nat. Pflanzenfam.* I, 3: 323 (1901)—*Dicranoloma subpungens* (Hampe) Paris, *Index bryol.* ed. 2, 2: 30 (1904). Syntypes: Australia. Victoria, Grampians, Mt William, *F. Mueller* (BM-Hampe-lecto!, MEL 29208!); Victoria Range, *F. Mueller 8* (BM-Hampe!); Grampians, *F. Mueller s.n.* (BM-Hampe!, MEL 1002480!, MEL 1002475!). Note: the type cited in the protologue, '... Grampians, William et Victoria Ranges' is a composite type, consisting of several collections by *F. Mueller* made in the Grampians. They are treated here as syntypes.

Dicranum integerrimum Broth. & Geh. in Broth., *Öfvers. Förh. Finska Vetensk.-Soc.* 37: 152 (1895), *syn. nov.*—*Leucoloma integerrimum* (Broth. & Geh.) Broth., *Nat. Pflanzenfam.* I, 3: 323 (1901)—*Dicranoloma integerrimum* (Broth. & Geh.) Paris, *Index bryol.* ed. 2, 2: 27 (1904). Type: Australia. Tasmania, Sprent River, Jones Track, *T.B. Moore 58* (H-BR-holo!; possible isotype (sub no. 65) in HO!).

Dicranum calymperaceum Müll.Hal., *Hedwigia* 36: 357 (1897), *syn. nov.*—*Leucoloma calymperaceum* (Müll.Hal.) Broth., *Nat. Pflanzenfam.* I, 3: 323 (1901)—*Dicranoloma calymperaceum* (Müll.Hal.) Paris, *Index bryol.* ed. 2, 2: 39 (1904). Type: Australia. Queensland, *F.M. Bailey s.n.* (B-holo, destroyed; H-BR-lecto!, selected here).

Dicranum sullivanii Müll.Hal., *Hedwigia* 36: 360 (1897), *syn. nov.*—*Leucoloma sullivanii* (Müll.Hal.) Paris, *Index bryol.* Suppl. 1: 234 (1900)—*Dicranoloma sullivanii* (Müll.Hal.) Paris, *Index bryol.* ed. 2, 2: 31 (1904). Type: Australia. Victoria, Mt William, *D. Sullivan s.n.* (B-holo, destroyed; MEL 33109-lecto!, selected here; MEL 2053314!).

Dicranum burchardtii Paris, *Index bryol.* Suppl. 1: 121 (1900), *syn. nov.*—*Dicranum rigens* Müll.Hal., *Hedwigia* 36: 354 (1897), *nom. illeg.* (later homonym)—*Leucoloma rigens* Broth., *Nat. Pflanzenfam.* I, 3: 323 (1901), *nom. illeg.* (superfluous)—*Dicranoloma burchardtii* (Paris) Paris, *Index bryol.* ed. 2, 5: 150 (1906)—*Dicranum rigens* Burchardt & Broth. ex Weymouth, *Pap. Proc. Roy. Soc. Tasmania* 1894–1895: 107 (1896), *nom. nud.* Syntypes: Australia. Tasmania, Mount Wellington, Ploughed Field, *W.A. Weymouth 767* (not located); Lauriston gully, Kangaroo Point, 1889, *W.A. Weymouth 160*. (NY-lecto!, selected here; HO 69087!).

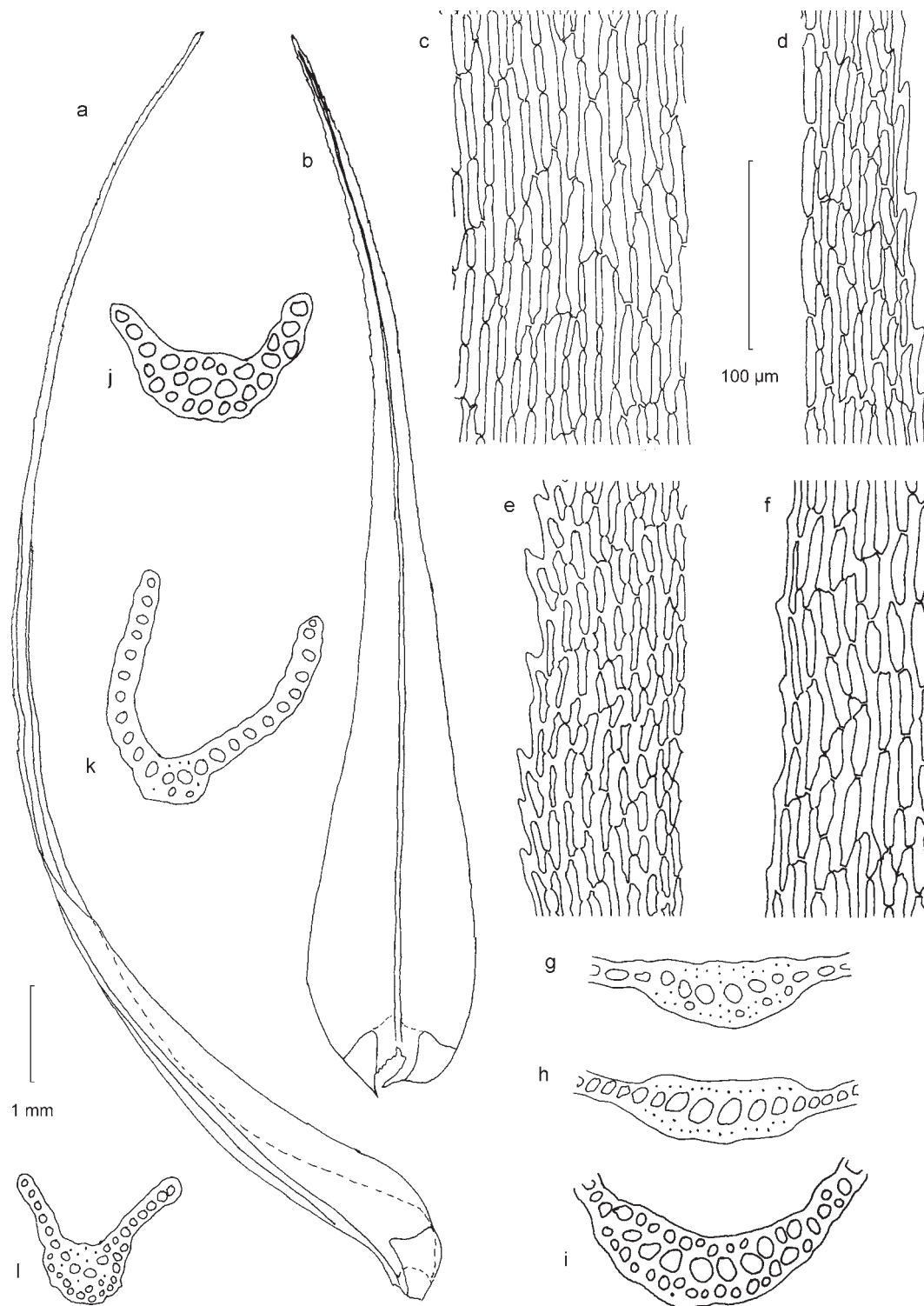


Fig. 27. *Dicranoloma robustum*. *a–b*, leaves; *c*, basal lamina cells; *d–f*, upper lamina cells; *g–h*, cross sections through costa, just above alar patches; *i*, cross section through costa, at c. 1/3 of leaf length (in 'setosum' form); *j–l*, cross sections through costa, distal 1/3. *a, d, g*, *Klazenga* 5308 (MEL); *b, k*, *Klazenga* 5305 (MEL); *c*, *Klazenga* 5401 (MEL); *e*, *Vitt* 8356 (MEL); *f, i–j*, *Klazenga* 5412 (MEL); *h*, *Klazenga* 5308 (MEL); *l*, *Klazenga* 5311 (MEL).

Dicranoloma chrysodrepaneum Dixon, *Bull. New Zealand Inst.* 3: 19 (1913)—*Dicranum chrysodrepaneum* Müll.Hal. ex Kindb., *Enum. bryin. exot.*: 55 (1888), *nom. nud.* Syntypes: New Zealand. South Island, Greymouth, *R. Helms s.n.* (not located); Near Lake Wakatipu, *J. Meiklejohn s.n.* (L-lecto!, *selected here*). Synonymised by Sainsbury (1955a: 129).

Dicranoloma cylindropyxis Dixon, *Bull. New Zealand Inst.* 3: 21 (1913)—*Dicranum cylindropyxis* Müll.Hal. in Kindb., *Enum. bryin. exot.*: 55 (1888), *nom. nud.* Syntypes: New Zealand, [Westland], Paparoa Range (Grafschaft Grey), *R. Helms* 62 (NY-lecto!, *selected here*; CHR!, JE!); [Westland], Kelly's Range, *Herb Beckett '166'* (B-Herb. K. Müller Halle, destroyed; no duplicate located); Westland, Kelly's Creek, *D. Petrie s.n.* (not located); Otago, Mt Cargill, near Dunedin, *D. Petrie s.n.* (JE!); New Zealand. *W. Colenso s.n.* (NY!). Synonymised by Fife (1995: 320).

Dicranoloma angustiflorum Dixon, *Bull. Torrey Bot. Cl.* 42: 93 (1915), *syn. nov.* Type: Australia. Tasmania, Gordon River, *J. Milligan* (BM!).

Dicranoloma integrifolium Dixon, *Bull. New Zealand Inst.* 3: 362 (1919). Type: New Zealand. South Island, *R. Brown (of Christchurch)*. (BM-Dixon!). Synonymised by Sainsbury (1955a: 129).

Dicranoloma perichaetiale Sainsbury, *Victorian Naturalist* 70: 30 (1953), *syn. nov.* Type: Australia. Tasmania, Zeehan, *L. Rodway* 63a [*Herb. Sainsbury. No. 16722*] (WELT 33521!).

?*Dicranum calymperidium* F.M. Bailey, *Syn. Queensl. fl. Suppl.* 1: 66 (1886), *nom. nud.* Synonymised with *D. setosum* by Dixon (1913: 16).

Plants 2.0–12.0 cm high, yellowish brown, growing in cushions or turfs. *Stem* simple or with subfloral and/or lateral innovations, tomentose, densely foliose; central strand present, cortical cells firm- to thick-walled. *Leaves* 6.4–24.0 × 0.7–2.1 mm, ovate-linear, gradually long acuminate, often in upper part almost entirely consisting of costa, smooth, canaliculate, erecto-patent to falcate-secund; leaf tips often fragile, in certain forms mostly broken off. *Alar patches* 0.26–0.95 × 0.17–0.67 mm. *Margin* serrulate in upper 1/10–2/3, entire below, plane. *Limbidium* consisting of 1–5 (–7) rows, reaching to between *c.* 1/4 of leaf length and serrulate part of margin. *Costa* 32–128 µm wide, 18–50 µm thick just above alar patches, subpercurrent to excurrent, abaxially mostly with scattered teeth in distal part, occasionally smooth; in cross-section straight to semi-circular, with adaxial side slightly concave to straight and abaxial side straight to convex, guide cells (2–) 3–9, with 1–2 layers of stereids at either side, epidermis not differentiated or abaxially with a peripheral layer of cells with a distinct lumen. *Basal lamina cells* 35–180 × 6–20 µm, elongate to linear, not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 1.8–2.2. *Upper lamina cells* gradually slightly to conspicuously shorter than basal ones, 13–140 × 5–16 µm, mostly in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 0.5–4.2 (–10.0). *Alar cells* 15–93 × 10–51 µm, quadrate to rectangular to polygonal, not inflated; walls mostly firm, 1–6 µm thick, not pitted, yellowish to orangish-brown. *Teeth at leaf margin* 5–20 µm, consisting of a single cell, lumen not conspicuously larger than that of adjacent cells. *Perichaetia* terminal, often laterally displaced. Outer perichaetial leaves with a broadly ovate to broadly elliptic, clasping basal part,

abruptly contracted into a reflexed subula. Inner perichaetial leaves elliptic, sheathing, mostly with a hair-like point, sometimes with merely a short cusp. *Calyptra* 4.7–5.0 mm, reaching halfway along the capsule, cucullate, greenish transparent, brown at apex, smooth, slightly rough above because of bulging cell ends; base entire.

Sporogones solitary. *Seta* 13.5–33.5 mm long, reddish, smooth; central strand present, cortical cells gradually getting more incrassate from centre outwards, outer 2–3 layers very thick-walled. *Capsule* 1.5–4.0 mm long, cylindrical, curved, slightly strumose. *Exothecial* cells 20–90 × 18–23 µm, isodiametric to elongate, irregularly shaped to rectangular; cells at convex side of theca longer and in a slightly more regular pattern than ones at straight side; becoming isodiametric towards orifice. *Stomata* present in apophysis, more or less evenly distributed, phaneropore. *Annulus* persistent, consisting of 1–2 layers. *Peristome teeth* orangish in basal *c.* 1/2, yellowish above, 600–700 µm long, 71–119 µm wide at base, asymmetrically bifid in upper half; outer face vertically striate with cross-connections in basal half, obliquely striate above, with papillae on striae in apical part; inner face smooth in lower *c.* 2/3, papillose above; outer trabeculae thin, not ornamented; inner trabeculae thick, strongly projecting, papillose, especially in lower half of teeth. *Operculum* 3.0–3.2 mm, yellowish, obliquely rostrate above a conical base. *Spores* 17.5–22.5 µm, spherical, finely papillose.

Illustrations: Wilson and Hooker (1845, pl. 58, fig. 5, as *Dicranum setosum*); pl. 59, fig. 1, as *Dicranum pungens*); Wilson and Hooker (1847, pl. 152, fig. 8, as *Dicranum*, South America); Dixon (1913, pl. 1, fig. 1; pl. 1, fig. 2, as *D. setosum*; pl. 1, fig. 3, as *D. pungens*; pl. 2, fig. 5, as *D. chrysodrepaneum*; pl. 6, fig. 6, as *D. cylindropyxis*; pl. 3, fig. 11, as *D. leucolomoides*); Beever *et al.* (1992: 46, fig. 24f); Jarman and Fuhrer (1995: 33, fig. 10).

Distribution (Fig. 28): Australia: southern highlands in New South Wales and the Australian Capital Territory, south- and westwards into Victoria as far west as the Grampians, Flinders Island, Tasmania, Macquarie Island; apparently disjunct in Barrington Tops National Park and known from single historical collections from Mt Bellenden Ker in north-eastern Queensland and King George Sound in south-western Western Australia. New Zealand: North Island, South Island, Stewart Island, Auckland Islands, Campbell Island. Outside the region also occurring in sub-Antarctic Islands and southern South America.

Habitat: Growing in wet forest and above tree line or on sub-Antarctic Islands also in shrubs, heath, grass land and bog. In south-east Australia also in drier forest types. Between sea level and *c.* 2100 m above sea level. Terrestrial or on rocks, logs, tree stumps, tree bases and tree stems. A very spiky form with patent to erecto-patent, very fragile leaves is often found as a canopy epiphyte in wet forest, but mainly on logs at higher altitudes.

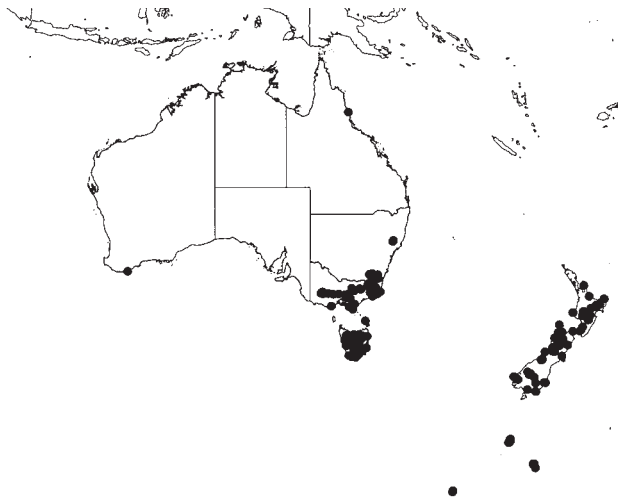


Fig. 28. Geographic distribution in Australasia of *Dicranoloma robustum*.

Selected additional specimens examined: AUSTRALIA. WESTERN AUSTRALIA. [Darling], King George's Sound, J.R. Muir s.n. (MEL 29203). QUEENSLAND. Mt Bellenden Ker, *Anonymus* s.n. (BM). NEW SOUTH WALES. Mt Kosciuszko National Park, Sawpit Creek, 9 km NW of Tindabyne, H. Streimann 3988 (CANB, L, NY); South Coast area, upper E slopes of Brown Mountain, P.J. Darbyshire 1225 (BM, CANB, L, MEL). AUSTRALIAN CAPITAL TERRITORY. Brindabella Range, Head of Gingera Creek, 43 km SW of Canberra, H. Streimann 4194 (CANB, L, NY); VICTORIA. Eastern Highlands, Rubicon State Forest, N side of Boundary Trail (West), 1.5 km from Blue Range Rd junction, near boundary of Marysville State Forest, N.H. Sinnot 2783 (MEL); East Gippsland, Mt Delegate, 4.5 km NNE of Bendoc, H. Streimann 36724 (CANB). TASMANIA. Allum Cliffs State Reserve, 19 km E of Deloraine, J.A. Curnow 2087 (CANB, HO, NY); Cradle Mtn-Lake St Clair National Park, SW of Dove Lake, track to Cradle Mtn plateau, R.D. Seppelt 5709 (HO, NY). MACQUARIE ISLAND. Gadget Gully, J.R. Croft 10420 (CANB). NEW ZEALAND. NORTH ISLAND. S Auckland, 20 km W of Te Awamatu, Mt Pirongia, Hihikiwi Track, B. Polly s.n. (WELT 27000); Taranaki, Mt Egmont National Park, N. Klazenga 5303, 5305, 5308, 5311, 5412 (MEL); Gisborne, Lake Waikeremoana, B.O. van Zanten 1244 (L, WELT). SOUTH ISLAND. Nelson, Mt. Richmond State Forest Park, track from Top Valley Stream to Mt. Richmond, R.J. Lewington & B. Polly s.n. (WELT 8830); 4.7 miles E of Springs Junction on Highway 7, D.H. Vitt 8356 (MEL); Canterbury, 10 km S of Lewis Pass on SH 7, Nina River, Nina Valley Track, P.J. Brownsey s.n. (WELT 33468); Winterslow basin, Taylors Stream, D.S. Glennie 89–239 (WELT); Otago, Swampy Summit, P.J. Brownsey s.n. (WELT 32776). STEWART ISLAND. Port Pegasus, N.M. Adams s.n. (WELT 3499). AUCKLAND ISLANDS. Auckland Island, Erebus Cove, Port Ross, P.N. Johnson 8/5 (WELT). CAMPBELL ISLAND. North slope, Mt Honey, D.S. Horning SA 1157 (WELT).

Differences between *D. robustum* and *Dicranoloma billardieri* have been discussed under the latter species. Some epiphytic forms of *D. robustum* may be confused with *D. menziesii*. Differences have been discussed under *D. menziesii*.

Dicranoloma robustum is the most variable of the Australasian species of *Dicranoloma* with great variation in plant size, leaf length and width, extent to which the costa is

excurrent, ornamentation of the leaf margin and in size and shape of the upper lamina cells. Although it is hard to accept that some of the extremes belong to a single species, so many forms with different combinations of characters and so many intermediates between all forms are found that it has proven impossible to split up this protean species into smaller units. Especially in New Zealand the number of different forms encountered defies description, which is only partly reflected in the number of names under which it has been described. This great variability has forced researchers to adopt an increasingly wider concept of *D. robustum*. Although Dixon (1913) in the first critical revision of the New Zealand species of *Dicranoloma* was able to recognise most of the previously published names in this complex at the species level and even described or validated a few new ones, Sainsbury (1955a) reduced the number of species to three (and one variety) between which he already found intermediates. The present revision merely mops up the last few New Zealand names that prove not to be tenable when more collections become available and a slightly higher number of Australian ones that never have been the subject of critical study. It is expected that the broad concept of *D. robustum* adopted here will include some of the not yet revised species of sub-Antarctic Islands and southern South America.

The great morphological variability may hide true species boundaries that can not be revealed by traditional taxonomic methods. Perhaps it is best in any case to define the taxonomic boundaries of the *D. robustum* complex before even more detailed analyses are undertaken.

The earliest names, *Dicranum robustum*, *D. pungens* and *D. setosum* were all described in the same paper by J.D. Hooker and Wilson (1844) prior to the publication of the results of Hooker's Antarctic voyage. *D. robustum* was described as a robust species, much resembling the holarctic *D. majus*, but with longer leaves. *D. pungens* was described as a smaller species with narrower leaves, narrower costa and longer perichaetial leaves. *D. setosum* was not compared with the previous two species in the original publication, but from the latin diagnosis its most diagnostic feature was its fragile leaf apices. Since then different authors have emphasised different characters to separate the three species. Dixon (1913) separated them on the basis of the width of the costa: wide throughout in *Dicranoloma robustum*, narrow throughout in *D. pungens* and narrow at base, but wider above in *D. setosum*.

No New Zealand or Australian specimens really closely resemble the type of *Dicranum robustum* from Hermit Island, Cape Horn, Chile. This type consists of large, up to 12 cm tall, plants with long and rather wide (c. 15×1.5 – 1.7 mm), erecto-patent, only slightly falcate leaves. The costa contains 7–9 rows of guide cells with two layers of stereids at either side and an epidermis is not differentiated. Equally tall forms, sometimes with even longer leaves are found in New Zealand, but they mostly have strongly falcate leaves.

Most Australasian specimens are more similar to the types of either *Dicranum pungens* or *D. setosum*. Hooker (1867) already reduced *D. pungens* to a variety of *D. robustum*, but *Dicranoloma pungens* was recognised at the species level again by Dixon (1913) although he admitted that he had felt very doubtful to do so because he had seen forms of *D. pungens* 'from the most slender, with distant erect small leaves resembling *D. leucolomoides*' (in Dixon's concept an even more slender species than *D. pungens*, see discussion under *D. dicarpum*) 'up to the most robust, with densely crowded falcate leaves like strong states of *D. robustum*'. Nevertheless, Dixon (1913) maintained that *D. pungens* is 'definitely' separated from *D. robustum* by the 'character of the nerve'. According to Dixon (1913) *D. pungens* always has a costa of the 'heteroneuron' type (cf. Renauld 1909), while in *D. robustum* the costa is of the 'toxoneuron' type. However, breaking up basically quantitative characters or combinations of quantitative characters into discrete types makes those types seem more distinct than they really are.

Dicranoloma setosum sensu Dixon (1913) or *D. robustum* var. *setosum* sensu Sainsbury (1955a) are characterised by fragile leaf apices that almost entirely consist of the costa. This is correlated with a costa that in the upper part of the leaf in cross-section shows many cells with a large lumen and very few or no stereids and relatively short lamina cells at leaf shoulder. Under *D. robustum* var. *setosum* are hidden various forms that seem not to be more closely allied to each other than to other forms of *D. robustum* (s.l.), for instance forms from the sub-Antarctic Islands (incl. the type) that mostly grow in open vegetation, forms from dry forests in the Grampians and Victoria's volcanic plain that have been described as *Dicranum subpungens* and *D. sullivanii* and very spiky forms with erecto-patent leaves with very fragile tips that grow epiphytically or, at higher altitudes, on logs in wet forests in Australia and New Zealand. Although all these forms look very different from more typical *D. robustum* the distinguishing characters are all basically quantitative and are found in different combinations and with various intermediates. Leaf tips in most specimens of *D. robustum* are fragile, much more so than in for instance *D. billardieri*, but in more typical forms of *D. robustum* they break off closer to the apex than in the var. *setosum*. Likewise, the upper part of the leaf consists almost entirely of the costa in many specimens of *D. robustum*, but in specimens that have been classified under the var. *setosum* this is in a larger part of the leaf.

Typical specimens of *Dicranoloma cylindropyxis* consist of robust plants with a strong costa with a differentiated abaxial epidermis and very short upper lamina cells. Again, several specimens have been found that are intermediate between these specimens and specimens more typical of *D. robustum*. Nothing in Dixon's (1913) description of *D. grossialare* distinguishes it from *D. robustum*. According to

Sainsbury (1955a) this is as robust a species as *D. cylindropyxis*, but that is not borne out by the specimens in his herbarium, which are more like *D. pungens*. In the present revision *D. grossialare* is treated as a doubtful species because the type could not be located.

Dicranoloma robustum shows great variation in its perichaetial leaves, from almost as short as in *D. billardieri* and with only a short point to very long with a long setaceous acumen. In many Tasmanian specimens of *D. robustum* the perichaetia are extremely long, reaching the capsule and so tightly sheath the seta that it is often difficult to see where the perichaetium ends and the seta begins. These forms also have a relatively thin costa, mostly consisting of four guide cells, but sometimes less. Sainsbury (1953) described such a form as *Dicranoloma perichaetiale* and very similar plants have earlier been described as *D. angustiflorum* and *Dicranum burchardtii*.

A collection in Mitten's herbarium indicated as the holotype of *Dicranoloma angustiflorum* and with similar collection data as in the protologue belongs to *D. menziesii*. I do not believe this is a type, as Dixon (1915) described *D. angustiflorum* as a species similar to *D. grossialare*, but with a costa almost as narrow as in *D. billardieri*. Dixon's (1915) description and illustration, especially of the perichaetium, leave no doubt that the specimen he described belongs to a Tasmanian form of *D. robustum*. A collection more likely to be the type has been located in BM.

Dicranum integerrimum was synonymised with *Dicranoloma billardieri* by Sainsbury (1955a). The costa in the holotype of *D. integerrimum* has 2 or 3 guide cells in cross-section which indeed points towards *D. billardieri* rather than *D. robustum*. However, in Tasmania many specimens of *D. robustum* with narrower costae are found and because of the rather long leaves and easily breaking off leaf tips *D. integerrimum* is treated here as a synonym of *D. robustum*. Both in the holotype and in the possible isotype of *D. integerrimum* the lateral walls of the alar cells are strongly thickened and collenchymatous. This character state is not encountered to this degree in other specimens of either *D. robustum* or *D. billardieri*, but is shared with *D. eucamptodontoides* which with the type of *D. integerrimum* also shares margins that are entire almost to the apex. However, in *D. eucamptodontoides* the lamina cell pattern is quite different and the leaves are much shorter and wider.

In notes on the type sheet Dixon compared *Dicranoloma integrifolium* with *D. platycaulon*, on the basis of irregular upper lamina cells. In the original publication however, Dixon (1929) compared *D. integrifolium* with species of the 'robustum group'. Some of the characters that differentiate *D. integrifolium* from other species of this group, such as shorter upper lamina cells and smaller basal lamina cells, are, as Dixon (1929) admitted, also present in *D. chrysodrepaneum*, which is considered a synonym of

D. robustum and is intermediate between *D. integrifolium* and more typical *D. robustum*.

15. *Dicranoloma trichopodum* (Mitt.) Broth. Fig. 29

Nat. Pflanzenfam. ed. 2, 10: 209 (1924)—*Dicranum trichopodum* Mitt. in Hook.f., *Handb. N. Zeal. Fl.*: 411 (1867). Type: New Zealand. South Island, Otago. *Hector and Buchanan* (NY!).

?*Dicranum pulvinatum* Müll.Hal., *Hedwigia* 36: 363 (1897), *nom. illeg.* (later homonym) Type: New Zealand. South Island, Westland, Paparoa Range, *R. Helms s.n.* (not located). Synonymised by Dixon (1923: 82).

?*Dicranum pulvinatum* var. *arcuatipes* Müll.Hal., *Hedwigia* 36: 363 (1897). Type: New Zealand, South Island, Westland, Paparoa Range, *R. Helms s.n.* (not located).

Holomitrium milligani Mitt. ex Dixon, *Bull. New Zealand Inst.* 3: 82 (1923), *nom. inval.* (as synonym). Original specimen: Australia. Tasmania, Gordon River, *J. Milligan 790* (BM!, NY!).

Plants up to *c.* 5.0 cm high, light green when fresh, yellowish brown when dried, growing in turfs. Stem reddish brown, subflorally branched, tomentose, densely foliose; central strand present, cortical cells thin-walled. Leaves 4.0–11.2 × 0.4–1.1 mm, ovate-linear, smooth, canaliculate, falcate-secund; subula almost entirely consisting of costa. Alar patches 0.18–0.28 × 0.12–0.19 mm. Margin serrulate at extreme apex to upper 1/5, crenulate or entire below in upper 1/2–2/3, entire below, plane. Limbium consisting of 1–4 rows, reaching 1/5–1/3 of leaf length. Costa 89–200 µm wide, 28–58 µm thick just above alar patches, excurrent, abaxially smooth or with some scattered teeth in extreme distal part; in cross-section crescent-shaped with adaxial side concave and abaxial side convex, guide cells 7–14, with (1–) 2–3 layers of stereids at either side, epidermis not differentiated; abaxial epidermis differentiated, consisting of cells with a distinct lumen, in upper part of leaf. Basal lamina cells 38–125 × 9–15 (–18) µm, elongate to linear, mostly not in orderly longitudinal rows; walls incrassate, pitted, lumen wall ratio 0.5–1.0. Upper lamina cells conspicuously shorter than basal ones, 10–35 × 5–10 µm, isodiametric to oblong, rectangular to irregularly shaped, mostly with rounded cell ends, mostly in orderly longitudinal rows; walls incrassate, not pitted, lumen wall ratio 1.0–3.5. Alar cells 13–70 × 13–30 µm, obrectangular to rectangular, inflated or not; walls firm, 2–5 µm thick, not pitted, brown, colourless in young leaves. Teeth at leaf margin 5–18 µm, consisting of a single cell, lumen similar in size to that of adjacent cells. Perichaetia terminal, laterally displaced. Outer perichaetial leaves more or less abruptly contracted into a subula above an ovate to elliptic, clasping base. Inner perichaetial leaves above an elliptic, sheathing base abruptly contracted into a long subula. Calyptra not found.

Sporogones solitary. Seta 20.0–39.0 mm long, yellowish, smooth; central strand present, thin-walled inner cortex cells gradually passing into thick-walled outer cortex cells, outer 4–5 layers very thick-walled. Capsule 1.5–3.3 mm, narrowly long ovoid, straight, not strumose. Exothecial cells 20–105 × 15–35 µm, oblong to elongate, irregularly shaped, relatively

thin-walled, in an irregular pattern; becoming isodiametric towards orifice. Stomata present in apophysis, more or less evenly distributed, phaneropore. Annulus persistent, consisting of 1–2 cell layers. Peristome teeth reduced, orangish in lower 3/4, yellowish to colourless above, 128–225 µm long, 30–55 (–70) µm wide at base, narrowly triangular, asymmetrically bifid to or almost to base; outer face slightly papillose throughout or smooth in lower part; inner face slightly papillose around trabeculae and side margins, otherwise smooth below, papillose at extreme upper part; outer trabeculae very thin; inner trabeculae thick, papillose. Operculum *c.* 2 mm, rostrate above a conical base. Spores 12–16 (–28) µm, spherical, relatively coarsely papillose.

Illustrations: Sainsbury (1955a: 122, pl. 21, fig. 2, as *Dicranum*).

Distribution (Fig. 30): Australia: western Tasmania. New Zealand: North Island, South Island, Stewart Island. Endemic to Australasia.

Habitat: Growing in wet forest between sea level and *c.* 1400 m above sea level; mostly relatively high on tree stems.

Selected additional specimens examined: AUSTRALIA. TASMANIA. Hartz Mountains Rd, Arve River area, W of Geeveston, *P.J. Brownsey [WELT] M 26063b* (HO); Cradle Mtn-Lake St Clair National Park, near Pelion Plains, *J.S. Jarman s.n.* (HO 513156); Southwest National Park, Red Knoll, 0.5 km west of Scotts Peak Dam, *A. Moscal 28138A* (HO). NEW ZEALAND. NORTH ISLAND. N Auckland, Little Barrier Island, *L.B. Moore [GOKS] 8966* (WELT); Uriwera Country, Mt Maungapohatu, *G.O.K. Sainsbury 6281* (MEL); Wellington, Tributary of Bull Stream, 2 km S of Akatarawa Saddle, Waikanae-Upper Hutt Rd, *P.J. Brownsey s.n.* (WELT 7766). SOUTH ISLAND. Nelson, Cobb Valley, track from Trilobite Hut to Chaffey Hut, *c.* 150 m N of Mytton Creek, *R.J. Lewington s.n.* (WELT 26903); Westland, Lake Hochstetter, Bywash Creek, *D.S. Glenny s.n.* (WELT 9340); Croesus Track, Blackball end, *c.* 3 km NNW of Blackball, *N. Klazenga 5626* (MEL); Southland, Fiordland, Dusky Sound, Facile Harbour, *H.H. Allan [GOKS] 13819* (WELT). STEWART ISLAND. Tin Range (summit), *W. Martin 728* (WELT).

When not bearing sporogones *Dicranoloma trichopodum* may be confused with *D. menziesii*. Vegetatively the two species can be separated by the following characters. The leaves are shorter and narrower in *D. trichopodum*. In *D. menziesii* the leaf margin in the subula is serrulate, while in *D. trichopodum* it is serrulate only at the apex and entire to crenulate below. Also, the abaxial surface of the costa is smooth throughout in *D. trichopodum*, but with teeth in the upper part in *D. menziesii*. Finally, *D. menziesii* possesses a differentiated adaxial epidermis, consisting of cells with lumina that are distinctly larger than those in the adjacent stereid layers, which is lacking in *D. trichopodum*, although in the apical part of the subula all cells of the costa may have a distinct lumen. In surface view this difference can be observed by the adaxial cells of the costa being linear in *D. trichopodum* while isodiametric to oblong in *D. menziesii*.

The sporogones of *Dicranoloma trichopodum* are not likely to be confused with those of any other species of

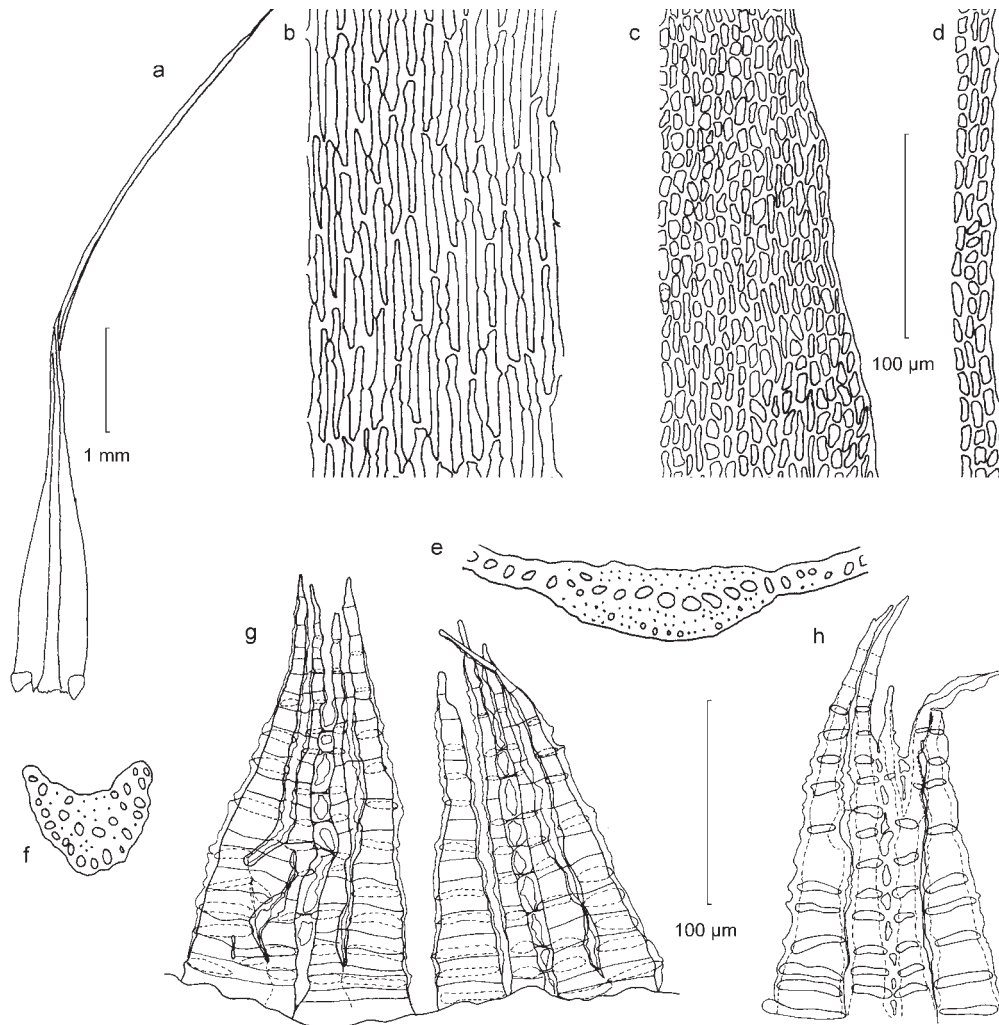


Fig. 29. *Dicranoloma trichopodum*. a, leaf; b, basal lamina cells; c, lamina cells at leaf shoulder; d, upper lamina cells; e, cross section through costa, just above alar patches; f, cross section through costa, distal 1/3; g, peristome teeth (4), seen from outside; h, peristome teeth (2), seen from inside. a–f, Sainsbury 6281 (MEL); g–h, Klazenga 5626 (MEL).

Dicranoloma. However, they are superficially quite similar to those of *Holomitrium* Brid. and sometimes even *Ditrichum* Hampe, so one should be beware of mixed collections or colonies of vegetative *D. menziesii*, *D. robustum* or even *Campylopus* with fertile *Holomitrium* or *Ditrichum*.

The peristome teeth of *Dicranoloma trichopodum* are very fragile and in mature and old capsules they are mostly broken off halfway, split to the base and covered with large, irregular ‘papillae’. However, when the operculum is removed from an almost ripe capsule, by soaking the capsule in a weak solution of KOH, a more complete peristome may be observed. The sesquilepideous cell pattern of three IPL cells for every two PPL cells in cross-section is clearly present. However, in other *Dicranolomas* and in *Dicranum* each of the 16 peristome teeth contains a single PPL plate and 1.5 IPL plates in

cross-section, two teeth of a pair sharing an IPL plate and the teeth may be asymmetrically split in the upper part along the line between the IPL plates (Fig. 17e). In contrast, in *D. trichopodum* a split along the longitudinal line between the IPL cells occurs first. Hence in immature peristomes of *D. trichopodum* there are 24 ‘teeth’, each tooth consisting of one IPL cell in cross-section and the outer two ‘teeth’ of each triplet (homologous with a pair of teeth in other *Dicranolomas*) comprising two-thirds of one PPL plate and the middle one two one-thirds of adjacent PPL plates (Figs 29 g–h; note larger scale). The IPL plates of these ‘middle teeth’ are not evenly thickened, being thinner and fenestrate along the longitudinal line between adjacent PPL cells. In mature and old peristomes the ‘middle teeth’ are mostly split again to the base along these lines and, moreover, the peristome teeth are so fragile that most teeth will have partly or completely broken off.

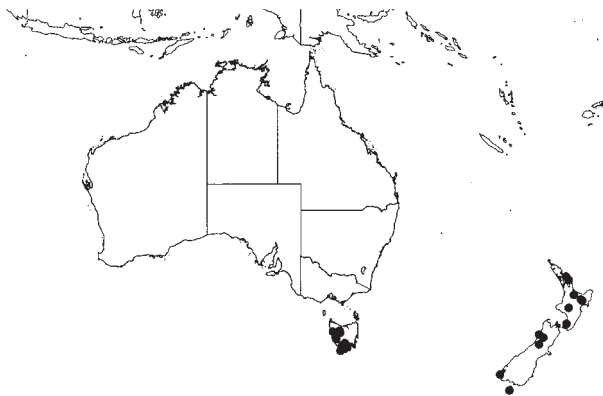


Fig. 30. Geographic distribution of *Dicranoloma trichopodium*.

Because of the entirely different features of the sporogone, *Dicranoloma trichopodium* does not sit comfortably in *Dicranoloma*, which is reflected in its classification since its establishment. When established, *D. trichopodium* was placed in *Dicranum* like most other species currently in *Dicranoloma* that were described around that time. However, when other species were transferred first to *Leucoloma* subg. *Dicranoloma* and then to *Dicranoloma*, *D. trichopodium* remained in *Dicranum*. Only in the second edition of 'Die natürlichen Pflanzenfamilien' (Brotherus 1924), when the last few species were transferred, was *D. trichopodium* transferred from *Dicranum* to *Dicranoloma*. However, Sainsbury (1955a) transferred the species back to *Dicranum* where it has remained ever since.

Because of the presence of a limbidium, albeit mostly very ill-defined, and the very narrow lumina of the stereids in the costa (cf. Renauld 1909), not to mention its geographic distribution, *Dicranoloma trichopodium* fits even worse in *Dicranum* than in *Dicranoloma*. Also the sporogone is not more similar to anything encountered in *Dicranum* than in *Dicranoloma*. In fact, on the basis of its sporogone, in particular the peristome, *D. trichopodium* does not fit in any recognised genus of the Dicranaceae, while on the basis of the gametophore, which is very similar to that of *D. menziesii*, it is best accommodated in *Dicranoloma*.

Doubtful names

Dicranum baileyana Müll.Hal., *Hedwigia* 36: 356 (1897)—*Leucoloma baileyana* (Müll.Hal.) Broth., *Nat. Pflanzenfam.* I, 3: 323 (1901)—*Dicranoloma baileyana* (Müll.Hal.) Paris, *Index bryol.* ed. 2, 2: 24 (1904). Type: Australia. Queensland, F.M. Bailey (B-holo, destroyed; no isotype located).

Dixon (1913: 23) synonymised this name with *Dicranoloma billardieri*. However, *D. billardieri* is otherwise unknown from Queensland.

Dicranum billardieri var. *latifolia* Rodway, *Pap. Proc. Roy. Soc. Tasmania* 1912: 102 (1913). Type: Australia. Tasmania. Cradle Mountain. (not located in Rodway's herbarium).

Dicranum billardieri var. *rigens* Rodway, *Pap. Proc. Roy. Soc. Tasmania* 1912: 102 (1913). Type: No type given.

Dicranum billardieri var. *angustinerve* Rodway, *Pap. Proc. Roy. Soc. Tasmania* 1912: 102 (1913)—*Dicranoloma billardieri* var. *angustinerve* (Rodway) Sainsbury ex Wijk, Margad. & Florsch., *Regnum Veg.* 26: 43 (1962). Type: No type given.

No specimens under these names have been found among Rodway's herbarium (HO) and from the descriptions it is not clear to what species they may belong. These names cannot be accommodated in *D. billardieri* just because they were described as varieties of that species, as especially Tasmanian plants of *D. billardieri* and *D. robustum* tend to get confused. Sainsbury (1953, 1955b) thought that *Dicranum billardieri* var. *angustinerve* might be the same as his *Dicranoloma perichaetiale*, but could not find a specimen of the former in Rodway's herbarium and found Rodway's (1913) description inadequate to make a decision.

Dicranum billardieri var. *enervosum* Bosw., *J. Bot. Brit. For.* 32: 81 (1894). Type: New Zealand. South Island, R. Helms (not located).

Dicranoloma grossialare Dixon, *Bull. New Zealand Inst.* 3: 18 (1913)—*Dicranum grossialare* Müll.Hal., *Genera musc. frond.*: 290 (1900), *nom. nud.* Type: New Zealand. South Island, Mount Arthur Plateau, T.F. Cheeseman 66 (B-Herb. K. Müller Halle, destroyed; no duplicates located).

Illustrations: Dixon (1913, pl. 1, fig. 4).

The type of *Dicranoloma grossialare* was destroyed with Müller's herbarium and no duplicates have been found. All specimens identified as *D. grossialare* seen in this study belong to *D. robustum*. *Dicranoloma grossialare* was synonymised with *D. robustum* by Fife (1995: 320, as *Dicranum*).

Dicranum calymperoideum Müll.Hal., *Hedwigia* 36: 359 (1897). Type: New Zealand. Titirangi Range near Auckland, O. Beccari s.n. (not located).

According to Index Muscorum (Van der Wijk *et al.* 1962) *Dicranum calymperoideum* was synonymised with *Dicranoloma menziesii* by Dixon (1913), but this reference does not check. Dixon (1913) does not mention *D. calymperoides* neither on the page cited by Index Muscorum, nor under *D. menziesii*. On the page cited in Index Muscorum *D. calymperidium* F.M.Bailey, which is a different name, is mentioned as a synonym of *D. setosum*. However, from the description in the protologue *D. calymperoides* is indeed most likely a synonym of *D. menziesii*.

Dicranum nelsonii Müll.Hal., *Hedwigia* 36: 355 (1897)—*Leucoloma nelsonii* (Müll.Hal.) Broth., *Nat. Pflanzenfam.* I, 3: 323 (1901)—*Dicranoloma nelsonii* (Müll.Hal.) Paris, *Index bryol.* ed. 2, 2: 28 (1904). Type: Tasmania, Mt Nelson, Facy's Gully, W.A. Weymouth s.n. (not located).

The diagnosis points to either *Dicranoloma billardieri* or *D. robustum*, but without studying the type no decision can be made.

Dicranum speightii R.Br.bis, *Trans. Proc. New Zealand Inst.* 38: 461 (1896)—*Dicranoloma speightii* (R.Br.bis) Paris, *Index bryol.* ed. 2, 2: 30 (1904). Type: not located.

Dixon (1913), already, could not locate the type for this name.

Invalid names for which no original specimens were located

Dicranum sordideviride Müll.Hal. ex Geh., *Rev. Bryol.* 3: 3 (1876), *nom. nud.*—*Dicranoloma sordideviride* Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 162 (1906), *nom. inval.* (basionym invalid). Authentic specimens: Australia. Nr. Sydney, Mrs. Kayser. Note: a specimen in MEL identified as *Dicranum sordideviride* by K. Müller Halle (NSW, Blue Mountains, Blackheath, Mermaids Glen, T. Whitelegge s.n. (MEL 29211)) belongs to *Dicranoloma menziesii*.

Dicranum antipodum Hampe in F. Muell., *Fragm.* 11 (Suppl.): 47. (1881), *nom. nud.* (as synonym).

Dicranum chlorocaulon Müll.Hal. ex F. Muell., *Fragm.* 11 (Suppl.): 108 (1881), *nom. nud.*

Dicranum flavifolium Müll.Hal. ex F. Muell., *Fragm.* 11 (Suppl.): 108 (1881), *nom. nud.*

Dicranum geheebii Müll.Hal. ex F. Muell., *Fragm.* 11 (Suppl.): 108 (1881), *nom. nud.*

Dicranum subviride Mitt., *Trans. Proc. Roy. Soc. Victoria* 19: 52 (1882), *nom. nud.* Original specimen: Australia. Near Sydney, Sieber. Note: a collection from Mitten's herbarium (NY 577930) with '*Dicranum subviride* Mitt.?, Australia, Sieber coll.' written in pencil on the envelope has two other labels with different names and different localities inside the envelope: '*D. novae-hollandiae* Hsch., Nov. Holland. Sieber, = barren *D. pungens* and fertile stems of *D. billardieri*' and '*Dicran. confine* C.M. & Hpe., Sealers Cove, *D. billardieri*'. The specimen is glued to the former label, but belongs to a single species, *Dicranoloma robustum* and bears no sporogones.

Dicranum walteri Hampe ex Mitt., *Trans. Proc. Roy. Soc. Victoria* 19: 53 (1882), *nom. nud.*—*Dicranoloma walteri* Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 162 (1906), *nom. nud.* Original specimen: Australia. Victoria, C. Walter. Note: a collection by Walter from East Gippsland, Victoria bearing this name is present in MEL (MEL 29194) and belongs to *D. billardieri*.

Dicranum limbatum Broth. ex Müll.Hal., *Genera musc. frond.*: 285 (1900), *nom. nud.*—*Leucoloma limbatum* Broth. in Watts & Whitel., *Proc. Linn. Soc. New South Wales* 27 (Suppl.): 49 (1902), *nom. nud.*—*Dicranoloma limbatum* Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 162 (1906), *nom. nud.* Original specimen: Australia. 'S.A.: teste C.M. op cit., p. 285; Vic.: Blacks' Spur: Miss Campbell.' (Original specimens cited from Watts & Whitelegge, *Proc. Linn. Soc. N.S. Wales* 27 (Suppl.): 49 (1902)).

Excluded taxa

Dicranum angustifolium Hook.f. & Wilson, Fl. Tasman. 2: 170 (1859)—*Dicranoloma angustifolium* (Hook.f. & Wilson) Watts & Whitel., *Proc. Linn. Soc. New South Wales* 30 (Suppl.): 16 (1906). Type: Australia. Tasmania. Mount Wellington, Gunn (BM!); Oldfield (BM!, MEL!).

The syntypes most likely belong to *Blindia robusta* Hampe. If this is indeed the case a new combination is necessary, as *Dicranum angustifolium* is the older name.

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