



NEW ZEALAND MOSSSES

AN ILLUSTRATED KEY

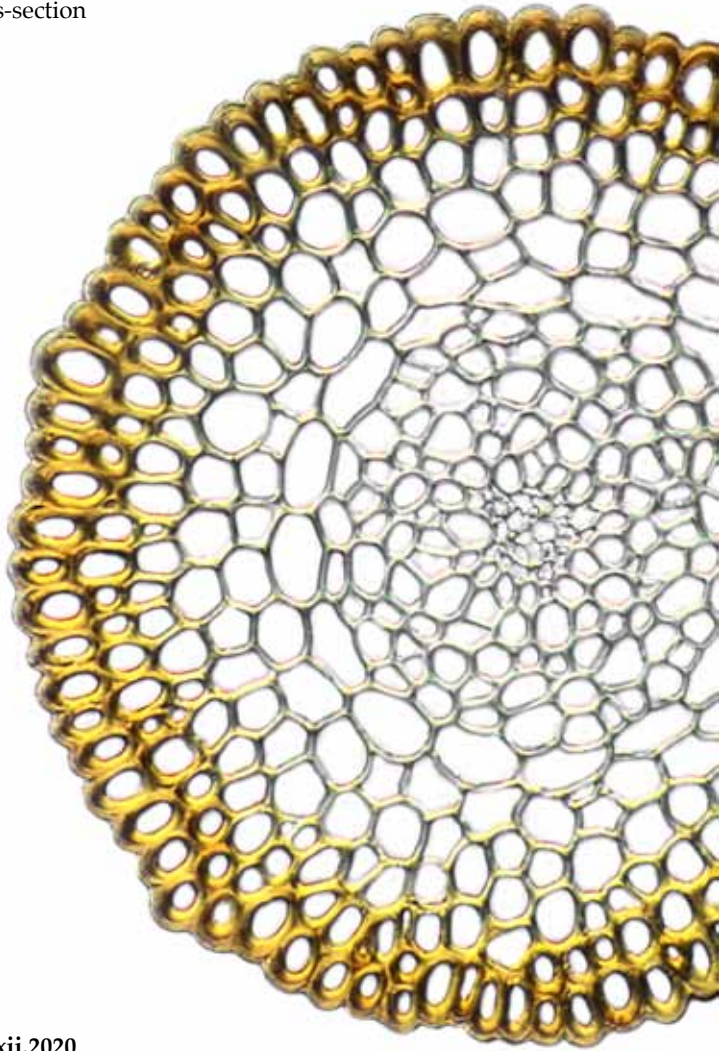
BILL & NANCY MALCOLM AND JIM SHEVOCK

Version xii.2020



NEW ZEALAND
MOSSES

Ptychomnion aciculare
stem cross-section



Version xii.2020

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Notoligotrichum australe
capsule and calyptra

Using the key

Keys are handy tools for identifying things. They've been used by botanists for more than three centuries, and by now they come in a variety of formats, each with its own advantages. This one is said to be dichotomous because it offers you a series of choices between two yes-no, either-or traits in the form of numbered *couplets*. Each couplet has two *leads* (both those leads are labelled with the same number, but the number of the second lead in this key is followed by a colon).

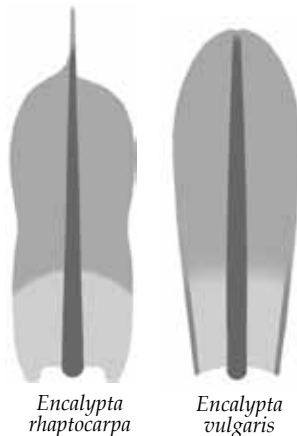
You work your way through the key by choosing the lead in each couplet that better describes the specimen you're trying to identify. With each choice you make, you steadily reject more and more of the genera that your specimen *might* belong to until you finally get down to just the one genus that it *must* belong to. If you get lost, you can retrace your original path through the key by using the backtracking numbers in parentheses at the beginning of each couplet. If you're not sure of the meaning of a term in the key, you can look it up in either the glossary that starts on page 1331 or our illustrated glossary *Mosses and Other Bryophytes* (second edition, 2006).

You can call up illustrations of the species in a genus by commanding your computer to search for the generic name elsewhere in this .pdf file. If a genus has more than one species in New Zealand, the plate is preceded by a page with a key to those species plus black-and-white diagrammatic outlines of their leaves. A species in the genus that's illustrated with a full-page colour plate is labelled with a red dot.

For example, if you've decided after working through the key that your specimen is most likely to be a species of *Encalypta*, searching for that name will call up on-screen a key to the two species of *Encalypta* that are found in New Zealand, plus black-and-white outlines of their leaves (*see below*).

Key to New Zealand species of *Encalypta*

- 1 Some or all vegetative leaves distinctly long-awned..... ● *Encalypta rhamnifolia*
 1: Vegetative leaves not long-awned..... ● *Encalypta vulgaris*



The pages following the key will have descriptions and illustrations of *Encalypta rhamnifolia* and *Encalypta vulgaris* (*see next page for the plate of E. vulgaris*).

Encalypta vulgaris Hedw.

form: tufted, erect, simple or branched, densely foliate, yellowish
habitat: soil or calcareous rock

leaf: *size:* 2.5–3.0 × 1.0–1.2 mm

shape: oblong to subobovate, concave above

tip: rounded to obtuse or retuse

base: lower cells rectangular, hyaline, the transverse walls thickened

costa: failing below the apex to shortly excurrent

border: several rows of narrow cells in lower third of the margin

margin: entire but papillose, plane

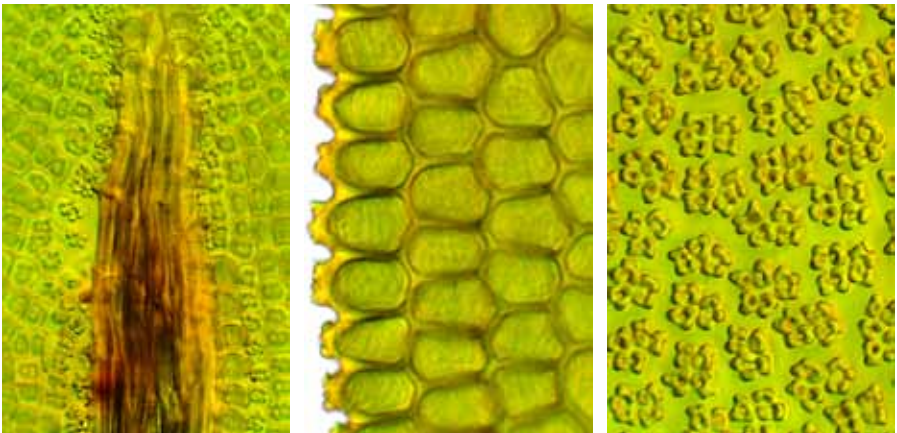
cells: 12–18 μm, isodiametric, firm-walled, densely papillose

capsule: 3–4 mm; narrowly cylindric, erect, ± striate; seta 10 mm, smooth;
 calyptra large, resembling an old-fashioned candle-snuffer and entirely
 covering the capsule; peristome none

notes: readily recognized by its large, campanulate calyptrae



fertile shoot (2) (dry), calyptra, leaf outline, and leaf apex showing costa terminus
 1 mm, 1 mm, 0.5 mm, 0.5 mm, 50 μm

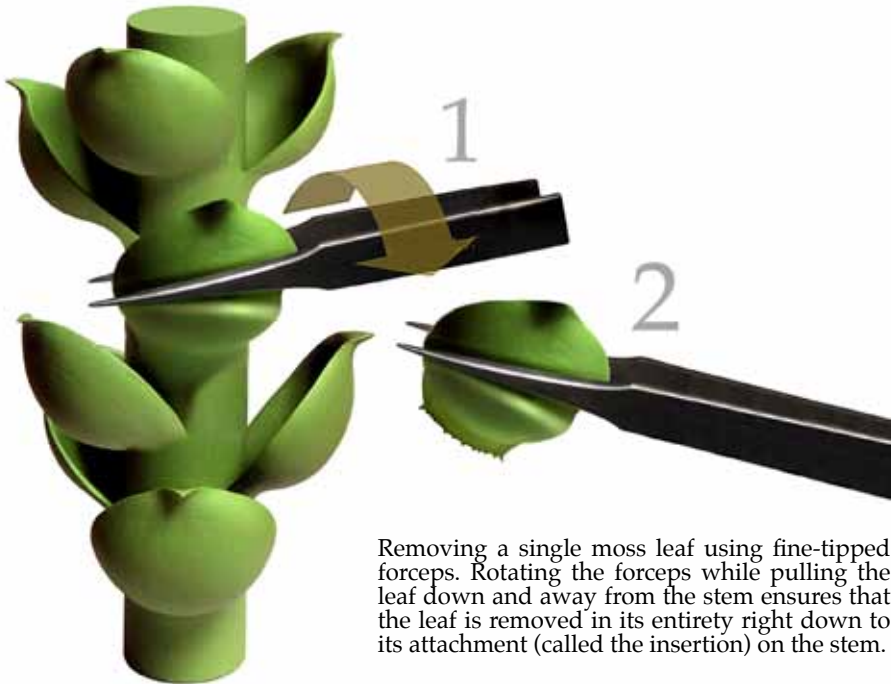


costa near apex, margin midleaf, and leaf papillae
 50 μm, 10 μm, 10 μm

continued next page

Getting a good look at your specimen

Because the key depends primarily on leaf traits, you'll have to pull one or more leaves off your specimen for viewing under a microscope. How to do that is illustrated below. Mosses typically have two or three kinds of leaves that differ in size and/or shape. One kind (called vegetative leaves) clothes much of the stem, and is usually by far the most abundant. A more specialized kind (called perichaetial leaves) surrounds the female sex organs, and in some mosses still another specialized kind (called perigonial leaves) surrounds the male sex organs. As well, branched mosses often have markedly different leaves on their main stems and branches, and a few mosses even have two or more kinds of leaf on their main stems, usually in separate rows. If the stem leaves come in two sizes, choose only the larger size. And, if your specimen has more than one kind of leaf, choose only ordinary stem leaves, with one exception—for the peat mosses (*Sphagnum*), you'll need *both* the stem leaves and branch leaves.



Removing a single moss leaf using fine-tipped forceps. Rotating the forceps while pulling the leaf down and away from the stem ensures that the leaf is removed in its entirety right down to its attachment (called the insertion) on the stem.

Because we all have a sharp memory for images, the more often you flip through the illustrations on the pages following the key, the better your chances will be of recognizing any new specimens that you've collected and want to identify. You might not remember the name that goes with the illustration, but by trolling through the pages you should be able to find it again quickly.

KEY TO THE GENERA OF NEW ZEALAND MOSSES

(family names end in **-aceae**; keys to the genera in families follow the main key)

1 Plants leafless, growing on bark or living leaves; capsules arising from a dense, persistent, orange-red protonemal mat	Ephemeropsis
1: Plants otherwise	2
2 Leaves slotted on the forward edge, clasping the stem and often dovetailing with the leaf above	Fissidens
2: Plants otherwise	3
3 (2:) Lamellae on the adaxial costa	4
3: Plants otherwise	5
4 (3:) Plants < 5 mm tall; leaf not sheathing, ending in a hyaline hair-point; guide cells plus one stereid band in costa xs.....	Pterygoneurum
4: Plants > 10 mm tall; leaf sheathing, not ending in a hyaline hair-point; guide cells plus two stereid bands in costa xs	Polytrichaceae
5 (3:) Walls of cells below midleaf distinctly wavy (sinuose)	Grimmiaceae
5: Plants otherwise	6
6 (5:) Plants frondose-dendroid <i>and</i> ventral leaves present <i>and</i> propagula absent	Hypopterygiaceae
6: Plants otherwise	7
7 (6:) Upper leaf cells oval and arranged diagonally <i>and</i> plants pleurocarpous <i>and</i> capsules immersed.....	Cryphaeaceae
7: Plants otherwise	8
8 (7:) Leaf with large empty cells (hyalocysts) on one or both surfaces.....	9
8: Leaf lacking hyalocysts	11
9 (8) Hyalocysts on the adaxial leaf surface	Campylopus
9: Hyalocysts on both leaf surfaces.....	10
10 (9:) Small green cells (chlorocysts) in a central layer surrounded by hyalocysts; leaf costate; peristome dicranoid	Leucobryum
10: Chlorocysts alternating with hyalocysts; leaf ecostate; peristome none.....	Sphagnum
11 (8:) Capsule opening by four valves; plants mostly on alpine rock.....	Andreaea
11: Plants otherwise	12
12 (11:) Midleaf cell shape linear or vermicular.....	13
12: Midleaf cell shape not linear or vermicular	83
13 (12) Costa none or short and double	14
13: Costa reaching to at least midleaf.....	43
14 (13) Alar cells absent or weak.....	15
14: Alar cells otherwise.....	26
15 (14) Shoots distichous (two-ranked).....	16
15: Shoots not distichous.....	20
16 (15) Leaf plane	17
16: Leaf conduplicate	18

17 (18) Leaf symmetric, plane, ovate, straight, entire	Isopterygiopsis
17: Leaf asymmetric, inflexed on one side below, oblong, ± falcate, serrulate toward the apex.....	Pseudotaxiphyllum
18 (16:) Leaf falcate, rounded or obtuse	Orthorrhynchium
18: Leaf straight or nearly so, not rounded or obtuse.....	19
19 (18:) Shoots complanate; leaf tip a reflexed mucro.....	Catagonium
19: Shoots not complanate; leaf tip acute, ± recurved.....	Cryptogonium
20 (19:) Shoots frondose; filamentous propagula on stem apex.....	Trachyloma
20: Shoots not frondose; propagula absent or otherwise	21
21 (20:) Shoots complanate; dorsal leaves present; apex rounded...	Dichelodontium
21: Shoots not complanate; dorsal leaves absent; apex not rounded	22
22 (21:) Leaves papery, translucent, rugose, and glossy	Ptychomnion
22: Leaves otherwise.....	23
23 (22:) Leaf hair-pointed; peristome endostome only and rudimentary.	Lepyrodon
23: Leaf not hair-pointed; peristome absent or double.....	24
24 (23:) Stem and branch leaves different; decurrent.....	Ctenidium
24: Stem and branch leaves similar, not decurrent.....	25
25 (24:) Plant on soil; leaves asymmetric, ± falcate, plane, entire; midleaf cells > 75 μm long, firm-walled	Austrohondaella
25: Plant on bark or rock; leaves symmetric, straight, recurved, serrulate above; midleaf cells < 60 μm long, thick-walled and porose	Orthothecium
26 (14:) Leaf apex rounded or obtuse	27
26: Leaf apex not rounded or obtuse.....	30
27 (26) Shoots frondose and complanate; leaves papery, translucent, and glossy	Neckera
27: Shoots and leaves otherwise.....	28
28 (27:) Shoots long-pendent, julaceous when dry; stem creeping; leaves rugose, not decurrent; alar cells quadrate and thick-walled	Weymouthia
28: Plants otherwise	29
29 (28:) Leaf ± orbicular, not sheathing; midleaf cell walls thick and porose.....	Acrocladium
29: Leaf ovate, sheathing; midleaf cell walls firm	Calliergonella
30 (26:) Long-pendent; capsule immersed to emergent, endostome rudimentary	Alleniella
30: Not long-pendent; capsule exerted or none; endostome otherwise	31
31 (30:) Leaves papery, translucent, and glossy; tip strongly reflexed ...	Cladomnion
31: Leaves otherwise	32
32 (31:) Shoots distichous (two-ranked); leaves oblong to linear; dorsal and ventral leaves present; filamentous propagules in leaf axils; capsule long-necked, strongly 8-ribbed when dry.....	Hampeella
32: Plants otherwise	33
33 (32:) Alar cells quadrate and thick-walled.....	34
33: Alar cells inflated and thin-walled	37

34 (33) Stem and branch leaves similar; margin \pm recurved below	Hypnum
34: Stem and branch leaves different; margin plane	35
35 (34:) Shoots frondose; stem projections none; basal leaf cells thick-walled and porose; plant known from only Raoul Island	Symphysodontella
35: Plants otherwise	36
36 (35:) Shoots \pm complanate; leaves secund; alar cells not auriculate..	Isopterygium
36: Shoots not complanate; leaves radial; alar cells \pm auriculate....	Campyliadelphus
37 (33:) Plants frondose	Wijkia
37: Plants not frondose	38
38 (37:) Midleaf cells prorulose; capsule inclined to pendent.....	Ectropothecium
38: Plants otherwise	39
39 (38:) Stem and branch leaves different	Drepanocladus
39: Stem and branch leaves similar	40
40 (39:) Stem projections none; leaf tip \pm apiculate; margin incurved; operculum conic; capsule mouth strangulate when dry	Scorpidium
40: Plants otherwise	41
41 (40:) Midleaf cell surface \pm rugulose when dry; alar cells auriculate; capsule curved when dry; endostome of segments only	Entodon
41: Plants otherwise	42
42 (41:) Midleaf cell walls not porose; capsule inclined to horizontal; exothelial cells strongly trigonous.....	Rhaphidorrhynchium
42: Midleaf cell walls porose; capsule erect or nearly so; exothelial cells otherwise..	Sematophyllum
43 (13:) Costa long and double.....	44
43: Costa otherwise	47
44 (43) Plants dendroid.....	45
44: Plants not dendroid	46
45 (44) Plants single-tiered; leaves plane or conduplicate	Camptochaete
45: Plants two- or more tiered; leaves plicate	Hylocomium
46 (44:) Leaves papery, translucent, and glossy, > 2.5 mm long; stem and branch leaves different; ventral and dorsal leaves absent.....	Rhytidadelphus
46: Leaves not papery, < 2.5 mm long; stem and branch leaves similar; ventral and dorsal leaves present	Plagiothecium
47 (43:) Costa single and reaching to about midleaf	48
47: Costa otherwise	64
48 (47) Alar cells inflated and thin-walled.....	49
48: Alar cells otherwise.....	51
49 (48) Nematogons in upper leaf.....	Warnstorfia
49: Nematogons absent	50
50 (49:) Leaves falcate, often secund, the apex acuminate; stem and branch leaves different	Drepanocladus
50: Leaves straight, radial, the apex rounded; stem and branch leaves similar	Straminogon

51 (48:) Alar cells quadrate and thick-walled.....	52
51: Alar cells otherwise.....	59
52 (51) Leaf hair-pointed	Lepyrodon
52: Leaf otherwise	53
53 (52:) Leaf tip abruptly apiculate.....	Pesudoscleropodium
53: Leaf tip otherwise.....	54
54 (53:) Leaves asymmetric.....	55
54: Leaves symmetric or nearly so.....	56
55 (54) Ventral and dorsal leaves present; stem projections none; operculum conic; capsule ridged when dry	Plagiothecium
55: Ventral and dorsal leaves absent; stems tomentose; operculum rostrate; capsule not notably ridged when dry	Rhynchostegium
56 (54:) Leaf margins entire; alar cells auriculate; capsule mouth strangulate when dry	Campyliadelphus
56: Plants otherwise	57
57 (56:) Shoots julaceous when dry	Brachythecium and Brachytheciastrum
57: Shoots not julaceous when dry	58
58 (57:) Stems pseudoparaphylliate; costa ending with an abaxial spicule; midleaf cell surface smooth; capsule inclined to horizontal, curved.....	Eurhynchium
58: Stems tomentose; costa not spiculose; midleaf cell surface striolate or rugulose; capsule \pm erect, straight.....	Palamocladium
59 (51:) Shoots complanate; leaves asymmetric, bordered; midleaf cells thin-walled; dorsal leaves present	Epipterygium
59: Shoots not complanate; leaves symmetric, not bordered; midleaf cells firm- walled; dorsal leaves absent.....	60
60 (59:) Plants long-pendent; midleaf cell surface unipapillose; capsule emergent....	Meteoriopsis
60: Plants not long-pendent; midleaf cell surface smooth; capsule exerted	61
61 (60:) Alar cells quadrate and thin-walled, in a distinct block that's higher toward the margin; stem tomentose; peristome single, exostome only	Ischyrodon
61: Alar cells absent or weak; stem projections none or pseudoparaphyllia; peristome double.....	62
62 (61:) Leaves sheathing and decurrent; costa often ending in an abaxial spicule....	Platyhypnidium
62: Leaves not sheathing or decurrent; costa not spiculose	63
63 (62:) Leaf margin serrulate; capsule erect, straight, long-necked, red-mouthed; operculum rostrate.....	Eriodon
63: Leaf margin entire; capsule inclined to horizontal, curved, short-necked, not red- mouthed; operculum conic.....	Leptodictyum
64 (47:) Costa single, subpercurrent to percurrent	65
64: Costa otherwise	78
65 (64) Plants dendroid.....	66
65: Plants not dendroid	67

- 66 (65) Plants on bark; shoots complanate; papillose filamentous brood bodies on upper stem among the leaves; alar cells distinct; capsule erect **Braithwaitea**
66: Plants on soil, rotting wood, or acidic rock; shoots not complanate; alar cells weak or absent; capsule inclined to pendent..... **Hypnodendron** and **Mniodendron**
- 67 (65): Leaves five-ranked (pentastichous) **Conostomum**
67: Leaves not five-ranked 68
- 68 (67:) Leaf apex rounded..... **Ochiobryum**
68: Leaf apex not rounded 69
- 69 (68:) Leaf bordered 70
69: Leaf not bordered 71
- 70 (69) Stems tomentose; alar cells absent or weak; hyalocysts on midleaf adaxial surface; costa xs guide cells plus one stereid band; capsule straight; peristome teeth lanceolate..... **Campylopus**
70: Stems not tomentose; alar cells well-developed; hyalocysts absent; costa xs guide cells plus two stereid bands; capsule curved; peristome teeth forked, striate below .
..... **Dicranoloma**
- 71 (69:) Leaves subulate..... **Blindia**
71: Leaves not subulate 72
- 72 (71:) Alar cells well-defined 73
72: Alar cells absent or weak 74
- 73 (72) Leaves falcate, often secund; midleaf cell surface smooth; alar cells inflated and thin-walled; capsule inclined to pendent; operculum conic..... **Sanionia**
73: Leaves straight, not secund; midleaf cell surface striolate; alar cells quadrate and thick-walled; capsule erect; operculum rostrate..... **Palamocladium**
- 74 (72:) Plants whitish; leaves strongly keeled; capsule strangulate when dry; peristome single, exostome only, the teeth forked and papillose **Saelania**
74: Plants otherwise 75
- 75 (74:) Midleaf cells thin-walled..... **Pohlia**
75: Midleaf cells firm-walled 76
- 76 (75:) Plants about 20 mm tall; leaves < 2 mm long; peristome single, endostome segments only **Schizymenium**
76: Plants < 10 mm tall; leaves > 3 mm long; peristome double 77
- 77 (76:) Stems tomentose; midleaf cells > 80 μm long; capsule cylindrical, short-necked, erect, straight; operculum rostrate **Orthodontium**
77: Stems not tomentose; midleaf cells < 80 μm long; capsule pyriform, long-necked, inclined to pendent, curved; operculum conic..... **Leptobryum**
- 78 (64:) Costa single, forked above **Calliargon**
78: Costa not forked 79
- 79 (78:) Plant aquatic; leaf bistratose, < 2 mm long; alar cells absent or weak; midleaf cells prurulose..... **Hypnobartlettia**
79: Plants on soil, bark, or rock; leaf unistratose, > 3 mm long; alar cells distinct; midleaf cells smooth or nearly so 80

80 (79:)	Stems < 10 mm tall; leaves < 4 mm long, cells firm-walled; capsule inclined, curved, red-mouthed.....	Kiaeria
80:	Stems > 20 mm tall, leaves > 4 mm long, cells incrassate; capsule none or erect, straight, not red-mouthed.....	81
81 (80:)	Stem with sclerodermis, no projections; alar cells auriculate..	Holodontium
81:	Stem with central strand, tomentose; alar cells not in auricles	82
82 (81:)	Leaves keeled, sheathing; margin plane	Holomitrium
82:	Leaves not keeled, not sheathing; margin incurved	Dicranum
83 (12:)	Transverse walls of leaf angle cells thickened.....	84
83:	Transverse walls of leaf angle cells not thickened.....	85
84 (83)	Leaf with bistratose patches, costa excurrent, margin laxly denticulate above; base sheathing; midleaf cell surface smooth; capsule not ridged when dry; calyptra glabrous	Cyrtopus
84:	Leaf unistratose throughout, costa subpercurrent; margin entire; base sheathing; midleaf cell surface papillose; capsule ridged when dry; calyptra hairy	Ulota
85 (83:)	Midleaf cell lumina circular or oval.....	86
85:	Midleaf cell lumina otherwise.....	106
86 (85)	Dorsal leaves present	87
86:	Dorsal leaves absent	88
87 (86)	Leaf hair-pointed; margin serrate above; plants not frondose; leaves two-ranked (distichous): > 1 mm long; ventral leaves absent; plants not frondose.....	Racopilum
87:	Leaf rounded; margin entire; plants frondose; leaves radially arranged, < 1 mm long; ventral leaves present; plants frondose.....	Leptodon
88 (86:)	Shoots frondose; branch primordia on stem covered by foliose embryonic leaves.....	Pendulothecium
88:	Shoots not frondose; embryonic leaves absent.....	89
89 (88:)	Plants long-pendent; leaves papery, translucent, and glossy	Lembophyllum
89:	Plants not long-pendent; leaves not papery.....	90
90 (89:)	Leaf ± orbicular; midleaf cells thin-walled	Plagiomnium
90:	Leaf not orbicular; midleaf cells firm- or thick-walled	91
91 (90:)	Calyptra ciliate-fringed.....	92
91:	Calyptra not ciliate-fringed	93
92 (91)	Leaf margin bordered; endostome of segments only.....	Crosbya
92:	Leaf margin not bordered; endostome none or rudimentary.....	Macromitrium
93 (91:)	Shoots julaceous when dry	94
93:	Shoots not julaceous when dry	95
94 (93)	Midleaf cell surface papillose, walls thick; leaf margin plane; costa reaching to about midleaf;	Haplohymenium
94:	Midleaf cell surface smooth, walls firm; leaf margin recurved; costa failing just below the apex.....	Pseudoleskea
95 (93:)	Midleaf cell surface smooth	96
95:	Midleaf cell surface bulging or papillose	100

- 96 (95) Leaf margin bordered (intramarginal), incurved **Tridontium**
96: Leaf margin not bordered, plane or recurved 97
- 97 (96:) Leaf oblong to lingulate; peristome none **Hyophila**
97: Leaf ovate to lanceolate; peristome single (exostome only) or double 98
- 98 (97:) Leaf bistratose in patches; stem not tomentose; propagules absent; leaf margin plane **Ptychomitrium**
98: Leaf unistratose throughout; stem tomentose; propagules present; leaf margin recurved or undulate 99
- 99 (98:) Leaf margin entire; leaf keeled; operculum rostrate; endostome of segments only; propagules short filaments **Codonoblepharon**
99: Leaf margin coarsely toothed near the apex; leaf plane; operculum conic; endostome of segments plus cilia; propagules long filaments **Leptotheca**
- 100 (95:) Leaf margin bordered 101
100: Leaf margin not bordered 102
- 101 (100) Border intramarginal; gemmae on adaxial costa surface; leaf strongly keeled, straight; margin undulate; costa excurrent as a cusp; alar cells absent or weak; exostome teeth filiform **Calyptopogon**
101: Border marginal; propagules absent; leaf plane, ± falcate; margin plane; costa failing below the apex; alar cells distinct; exostome teeth forked, striate below **Sclerodontium**
- 102 (100:) Propagula on stem apex; alar cells distinct, pigmented; mature capsule curved; endostome of segments plus cilia **Aulacomnium**
102: Propagula absent; alar cells absent or weak; mature capsule straight; endostome segments only or rudimentary or none 103
- 103 (102:) Leaf apex hair-pointed; peristome of endostome only **Hymenodon**
103: Leaf apex not hair-pointed; peristome double or of exostome only 104
- 104 (103:) Shoots acrocarpous; midleaf cell surface smooth; filamentous propagula on adaxial costa surface; mature capsule mouth flaring **Orthotrichum**
104: Shoots pleurocarpous; midleaf cell surface bulging or pluripapillose; propagula absent; mature capsule mouth not flaring 105
- 105 (104:) Midleaf cell surface mammillose; mature capsule mouth narrowed; calyptra hairy; exostome teeth rudimentary **Macrocoma**
105: Midleaf cell surface pluripapillose; mature capsule mouth not narrowed; calyptra glabrous; exostome teeth lanceolate **Zygodon and Leratia**
- 106 (85:) Midleaf cells hexagonal or rhombic 107
106: Midleaf cells quadrate to rectangular 205
- 107 (106) Costa none or short and double 108
107: Costa otherwise 125
- 108 (107) Shoots and capsules arising from a persistent protonemal mat 109
108: Plants otherwise 110
- 109 (108) Capsule exerted, inclined to horizontal, flattened vertically, stegocarpous, oval **Buxbaumia**
109: Capsule emergent, erect, not flattened, cleistocarpous, globose.. **Micromitrium**

110 (108:) Capsule cleistocarpous, discoid (flattened vertically), red at maturity; shoots julaceous when dry.....	Pleurophascum
110: Plants otherwise	111
111 (110:) Leaves papery, translucent, and glossy	112
111: Leaves not papery	114
112 (111) Plants growing on bark; shoots complanate; stem and branch leaves different; leaves asymmetric, oblong, rounded, decurrent on the trailing edge	Neckeropsis
112: Plants growing on soil, rotting wood, or rock; shoots not complanate; stem and branch leaves similar; leaves symmetric, orbicular to ovate or lanceolate, acuminate or hair-pointed, not decurrent.....	113
113 (112:) Shoots < 5 mm tall; leaves < 1 mm long, plane, acuminate; midleaf cells thin-walled	Gigaspermum
113: Shoots > 10 mm tall; leaves > 4 mm long, undulate, hair-pointed; midleaf cell walls thick and porose	Pulchrinodus
114 (111:) Leaf margin bordered.....	115
114: Leaf margin not bordered	116
115 (114) Plants growing on bark; leaf plane or incurved, apex acute; cell walls thick and porose, surface smooth; capsule immersed to emergent, curved, not grooved when dry, the mouth oblique; peristome exostome only; teeth forked, striate below; spores > 50 μm in diam.	Dicnemon
115: Plants growing on rock or in water; leaf recurved, apex hair-pointed; cell walls thin, surface rugulose; capsule exerted, straight, grooved when dry, the mouth flaring when dry; peristome none; spores < 40 μm in diam.....	Rhacocarpus
116 (114:) Leaves conduplicate; capsule turbinate, wide-mouthed when empty; calyptra hairy.....	Orthorrhynchium
116: Plants otherwise	117
117 (116:) Ventral leaves present; shoots two-ranked (distichous).....	Erpodium
117: Ventral leaves absent; shoots not distichous	118
118 (117:) Peristome teeth four; thalloid protonemal flaps present	Tetrodontium
118: Peristome teeth none or more than four; protonemal flaps absent.....	119
119 (118:) Leaf tips distinctly hyaline; capsules immersed, globose; operculum conic; peristome none	Hedwigia
119: Leaf tips not hyaline; capsules exerted, oval or elliptic to cylindrical; operculum rostrate; peristome double.....	120
120 (119:) Midleaf cells thin-walled	121
120: Midleaf cells firm- or thick-walled	122
121 (120) Plants growing on soil or rotting wood; stem and branch leaves different; leaves asymmetric, margin plane; alar cells absent or weak; dorsal leaves present; shoots complanate, pseudoparaphylliate; endostome of segments plus cilia	Vesicularia
121: Plants growing on bark or rock; stem and branch leaves similar; leaves symmetric, margin recurved; alar cells distinct; dorsal leaves absent; shoots not complanate, tomentose; endostome of segments only	Sauloma
122 (120) Leaf margin entire; midleaf cells > 60 μm long.....	Campyliadelphus
122: Leaf margin toothed; midleaf cells < 40 μm long.....	123

- 123 (122:) Filamentous propagula in leaf axils; midleaf cell walls porose; capsule erect, ribbed when dry **Glyphothecium**
 123: Propagula absent; midleaf cell walls not porose; capsule inclined to pendent, not ribbed when dry 124
- 124 (123:) Leaf widest above midleaf; midleaf cells thick-walled; mature capsule curved **Fallaciella**
 124: Leaf not widest above midleaf; midleaf cells firm-walled; mature capsule straight **Pendulothecium**
- 125 (107:) Costa long and double **Cyclodictyon**
 125: Costa not long and double 126
- 126 (125:) Costa single, forked above 127
 126: Costa not forked above 129
- 127 (126) Plants < 10 mm tall, acrocarpous; leaves < 1 mm long, strongly decurrent on trailing edge; exostome teeth filiform **Mittenia**
 127: Plants > 10 mm tall, pleurocarpous; leaves > 2 mm long, not decurrent; exostome teeth lanceolate 128
- 128 (127:) Shoots not distichous; leaf margin bordered, apex apiculate to acuminate; endostome of segments only **Calyptrochaeta**
 128: Shoots two-ranked (distichous); leaf margin not bordered, apex not apiculate or acuminate; endostome rudimentary **Achrophyllum**
- 129 (126:) Costa single, reaching to about midleaf 130
 129: Costa otherwise 147
- 130 (129) Plants long-pendent 131
 130: Plants not long-pendent 132
- 131 (130) Leaves plane; midleaf cell surface unipapillose; capsule emergent
 **Meteoriopsis**
 131: Leaves plicate; midleaf cell surface pluri- to multipapillose; capsule exerted ...
 **Papillaria**
- 132 (130:) Shoots frondose 133
 132: Shoots not frondose 134
- 133 (130) Leaf margin plane, the apex rounded to mucronate; sclerodermis in stem cross-section **Pendulothecium**
 133: Leaf margin incurved, the apex acute to acuminate; central strand in stem cross-section **Thamnobryum**
- 134 (132:) Brood bodies clustered at stem apex 135
 134: Brood bodies absent or not at stem apex 136
- 135 (134) Plants growing on soil, rotting wood, or rock; shoots pseudoparaphylliate, complanate; leaves not five-ranked; midleaf cells thin-walled; dorsal and ventral leaves present; capsule not ribbed when dry **Beeveria**
 135: Plants growing on bark; shoots tomentose, not complanate; leaves five-ranked (pentastichous); midleaf cells firm-walled; dorsal and ventral leaves absent; capsule strongly 8-ribbed when dry **Tetraphidopsis**
- 136 (134:) Stems < 3 mm tall; capsule cleistocarpous, emergent, globose
 **Physomitrella**
 136: Plants otherwise 137

137 (136:) Leaves papery, translucent, and glossy; ventral leaves present	Distichophyllum
137: Leaves not papery; ventral leaves absent	138
138 (137:) Shoots julaceous when dry; leaf margin recurved	Bryum
138: Plants otherwise	139
139 (138:) Alar cells quadrate and thin-walled; capsule mouth flaring when dry; peristome single, exostome only	Fabronia
139: Plants otherwise	140
140 (139:) Mature capsule mouth strongly oblique	Funaria
140: Capsule mouth not oblique	141
141 (140:) Plants growing on tree fern trunks or basic rock; dorsal leaves present; shoots two-ranked (distichous); midleaf cell length < 10 μm	Calomnion
141: Plants growing on soil, bark, or acidic rock; dorsal leaves absent; shoots not distichous; midleaf cell length > 15 μm	142
142 (141:) Leaf widest above midleaf; midleaf cells thin-walled; plants acrocarpous; capsule pyriform, long-necked	Entosthodon
142: Leaf widest below midleaf; midleaf cells firm- or thick-walled; plants pleurocarpous; capsule not pyriform, short-necked	143
143 (142:) Plants < 10 mm tall; branch leaves < 1 mm long; alar cells marginal	Scorpiurium
143: Plants > 10 mm tall; branch leaves > 1 mm long; alar cells not marginal	144
144 (143:) Leaf margin entire	145
144: Leaf margin serrulate or denticulate or coarsely toothed	146
145 (144) Stem and branch leaves different; stems pseudoparaphylliate; alar cells auriculate, quadrate and thick-walled; mature capsule strangulate when dry; operculum rostrate	Campyliadelphus
145: Stem and branch leaves similar; stem projections absent; alar cells absent or weak; mature capsule not strangulate; operculum conic	Leptodictyum
146 (144:) Stem and branch leaves different; leaves symmetric, plicate, decurrent; midleaf cells thick-walled, striolate; capsule erect, straight; endostome of segments only	Palamocladium
146: Stem and branch leaves similar; leaves asymmetric, plane, not decurrent; midleaf cells firm-walled, smooth; capsule inclined to pendent, curved; endostome of segments plus cilia	Rhynchostegium
147 (129:) Costa subpercurrent, percurrent, or excurrent	148
147: Costa otherwise	191
148 (147) Midleaf cell surface mammillose, unipapillose, or prorulose	149
148: Midleaf cell surface otherwise	154
149 (148) Plants growing on dung or bone; leaf widest above midleaf; capsule long- necked; operculum conic	Tayloria
149: Plants otherwise	150
150 (149:) Leaves three-ranked (tristichous), strongly keeled, decurrent; capsule erect; peristome single, exostome only	Triquetrella
150: Plants otherwise	151

151 (150:) Dorsal leaves present; leaves two-ranked (distichous); capsule strumose, curved when dry; calyptra hairy	Racopilum
151: Plants otherwise	152
152 (151:) Leaf margin entire; apex widely mucronate; basal cells thick and porose; basal lobes of calyptra abruptly flared; endostome of segments only ..	Schlotheimia
152: Plants otherwise	153
153 (152:) Plants growing on soil, rotting wood, or acidic rock; shoots dendroid, complanate; brood bodies none; stem and branch leaves different; leaves > 1.5 mm long; midleaf cells > 25 μm long	Hypnodendron
153: Plants growing on coastal rock; shoots not dendroid; not complanate; brood bodies (surculi) in leaf axils; stem and branch leaves similar; leaves < 0.6 mm long; midleaf cells < 10 μm long	Lindbergia
154 (148:) Midleaf cell surface pluri- or multipapillose.....	155
154: Midleaf cell surface otherwise.....	162
155 (154) Plants long-pendent, pleurocarpous; leaf plicate; peristome double; endostome of segments only	Papillaria
155: Plants not long-pendent, apocarpous; leaf not plicate; peristome none or single (exostome only); endostome none or rudimentary.....	156
156 (155:) Calyptra completely covering the capsule; capsule ribbed when dry	Encalypta
156: Calyptra only partly covering the capsule; capsule not ribbed when dry	157
157 (156:) Leaf base abruptly hyaline in a V-shape	Tortella
157: Leaf base otherwise.....	158
158 (157:) Leaf base abruptly hyaline in the shape of a lower-case letter m	159
158: Leaf base otherwise.....	160
159 (158) Leaves keeled, reacting red in 2% KOH.....	Syntrichia
159: Leaves plane, reacting yellow in 2% KOH.....	Tortula
160 (158:) Leaf apex rounded; leaf base not sheathing; midleaf cells thick-walled; exostome teeth lanceolate; spores > 50 μm in diam.....	Orthotrichum
160: Leaf apex not rounded; leaf base sheathing; midleaf cells thin- or firm-walled; exostome teeth filiform or absent; spores < 40 μm in diam.	161
161 (160:) Leaves reacting yellow in 2% KOH; leaf margin not bordered, entire; costa cross-section guide cells plus two stereid bands; endostome rudimentary ...	Barbula
161: Leaves reacting red in 2%KOH; leaf margin bordered, toothed; costa cross-section guide cells plus one stereid band; endostome none.....	Hennediella
162 (154:) Midleaf cell surface smooth	163
162: Midleaf cell surface otherwise.....	232
163 (162) Leaf margin entire	164
163: Leaf margin toothed	181
164 (163) Midleaf cells thin-walled	165
164: Midleaf cells firm- or thick-walled	170
165 (164) Leaf widest above midleaf	166
165: Leaf widest below midleaf.....	167

- 166 (165) Plants growing on soil; hyalodermis in stem xs; leaf decurrent; capsule pyriform, cernuous to pendent, curved, sulcate when dry; peristome double, the exostome teeth fused at their tips into a lace-like disc **Funaria**
 166: Plants growing on dung or bone; central strand in stem xs; leaf not decurrent; capsule fusiform, erect, straight, not sulcate when dry; peristome single **Tayloria**
- 167 (165:) Leaf oblong or ligulate, apex rounded **Plagiobryum**
 167: Leaf ovate to lanceolate, the apex not rounded 168
- 168 (167:) Shoots < 3 mm tall; alar cells quadrate, thin-walled; capsule globose, cleistocarpous, erect; calyptra covering the entire capsule **Goniomitrium**
 168: Shoots > 3 mm tall; alar cells absent or weak; capsule not globose, stegocarpous, inclined to pendent; calyptra covering only part of the capsule 169
- 169 (168:) Shoots comose, not julaceous when dry **Ptychostomum**
 169: Shoots not comose, julaceous when dry **Bryum**
- 170 (169:) Leaf base abruptly hyaline in the shape of a lower-case letter **m** 171
 170: Leaf base otherwise 172
- 171 (170) Leaves keeled, reacting red in 2% KOH **Syntrichia**
 171: Leaves plane, reacting yellow in 2% KOH **Tortula**
- 172 (170:) Leaf bistratose above, the apex rounded **Orthotrichum**
 172: Leaf unistratose throughout, the apex not rounded 173
- 173 (172:) Protonemal flaps present; peristome teeth four; calyptra covering the entire capsule **Tetrodontium**
 173: Protonemal flaps absent; peristome teeth none or more than four; calyptra covering only part of the capsule 174
- 174 (173:) Plants < 3 mm tall; capsule globose, cleistocarpous **Acaulon**
 174: Plants > 3 mm; capsule not globose, stegocarpous 175
- 175 (174:) Capsule immersed to emergent, mouth oblique; peristome exostome only, teeth forked, striate below; spores > 50 μm in diam. **Dicnemon**
 175: Plants otherwise 176
- 176 (175:) Stem and branch leaves different **Amblystegium**
 176: Stem and branch leaves similar 177
- 177 (176:) Capsule 8-ribbed when dry; basal lobes of calyptra abruptly flared
 **Schlotheimia**
 177: Plants otherwise 178
- 178 (177:) Plants growing on bark; shoots < 10 mm tall; leaf keeled **Daltonia**
 178: Plants growing on soil or rock; shoots > 10 mm tall; leaf plane 179
- 179 (178:) Alar cells quadrate and thick-walled; stem not tomentose **Archidium**
 179: Alar cells absent or weak; stem tomentose 180
- 180 (179:) Propagula in leaf axils or underground **Gemmabryum**
 180: Propagula usually absent **Ptychostomum**
- 181 (106:) Thalloid protonemal flaps present; calyptra covering the entire capsule; exostome teeth four **Tetrodontium**
 181: Protonemal flaps absent; calyptra covering only part of the capsule; exostome teeth none or more than four 182

- 182 (181:) Leaf base abruptly hyaline in the shape of a lower-case letter **m**; exostome teeth filiform **Syntrichia**
 182: Plants otherwise 183
- 183 (182:) Dorsal leaves present; calyptra hairy **Racopilum**
 183: Plants otherwise 184
- 184 (183:) Shoots < 3 mm tall **Bryobeckettia**
 184: Shoot > 4 mm tall 185
- 185 (184:) Capsule cleistocarpous 186
 185: Capsule stegocarpous 187
- 186 (185) Leaf widest above midleaf, apex sharply apiculate, not clasping, midleaf cells < 30 μm long; capsule elliptic **Chenia**
 186: Leaf widest below midleaf, apex acuminate, clasping, midleaf cells > 50 μm long; capsule globose **Pseudephemerum**
- 187 (185:) Leaf orbicular or nearly so **Plagiomnium**
 187: Leaf not orbicular 188
- 188 (187:) Plants dendroid 189
 188: Plants not dendroid 191
- 189 (188) Leaf apex obtuse; base decurrent; alar cells inflated and thin-walled, auriculate; endostome of segments only **Climacium**
 189: Leaf apex acute to acuminate; base not decurrent; alar cells absent or weak; endostome of segments plus cilia 190
- 190 (189:) Stem projections absent; stem and branch leaves different; leaf margin plane; midleaf cells > 25 μm long; capsule ribbed when dry **Hypnodendron**
 190: Stems tomentose and pseudoparaphylliate; stem and branch leaves similar; leaf margin incurved; midleaf cells < 20 μm long; capsule not ribbed **Thamnobryum**
- 191 (188:) Plants growing on dung or bone **Tayloria**
 191: Plants not growing on dung or bone 192
- 192 (191:) Marginal teeth paired and made up of more than one cell... **Goniobryum**
 192: Marginal teeth absent or otherwise 193
- 193 (192:) Plants pleurocarpous 194
 193: Plants acrocarpous 196
- 194 (191) Shoots complanate; capsule mouth reddish **Rhizogonium**
 194: Shoots not complanate; capsule mouth not reddish 195
- 195 (194:) Stem and branch leaves different; leaf base decurrent; midleaf cells firm-walled, > 20 μm long; alar cells inflated and thin-walled, auriculate; capsule curved when dry, long-necked, the mouth strangulate **Cratoneuron**
 195: Stem and branch leaves similar; leaf base not decurrent; midleaf cells thick-walled, < 12 μm long; alar cells absent or weak; capsule not curved when dry, short-necked, the mouth not strangulate **Echinodium**
- 196 (193:) Alar cells distinct; midleaf cells porose; peristome exostome only, the teeth forked and striate below 197
 196: Alar cells absent or weak; midleaf cells not porose; peristome none or double or endostome only 198

197 (196) Reduced branchlets (surculi) on upper stem; leaf keeled, sheathing, the margin incurved; mature capsule not curved.....	Dicranum
197: Propagula absent; leaf not keeled, not sheathing, the margin plane; mature capsule curved.....	Dicranoloma
198 (196:) Propagula in leaf axils and/or on rhizoids.....	199
198: Propagula absent.....	200
199 (198) Gemmoid propagules in leaf axils or on rhizoids; leaves mostly widest below midleaf; capsule short-necked.....	Gemmabryum
199: Filamentous propagules in leaf axils and tubers on rhizoids; leaves mostly widest above midleaf; capsule long-necked	Rosulabryum
200 (198:) Leaves widest below midleaf	201
200: Leaves widest above midleaf	203
201 (200) Leaf strongly keeled; midleaf cell surface pluripapillose; capsule erect; peristome none	Ardeuma
201: Leaf not keeled; midleaf cell surface smooth; capsule inclined to pendent; peristome double or endostome only	202
202 (200:) Costa excurrent; midleaf cells > 80 μ m long; mature capsule straight, not wide-mouthed; peristome double	Ptychostomum
202: Costa failing below the apex; midleaf cells < 50 μ m long; mature capsule curved, wide-mouthed; peristome of endostome segments only.....	Schizymenium
203 (200:) Capsule immersed, straight, short-necked	Physcomitrium
203: Capsule exerted, curved, long-necked	204
204 (203:) Stems tomentose; capsule cernuous to pendent, the mouth oblique; exostome teeth fused at their tips into a lace-like disc	Funaria
204: Stems not tomentose; capsule erect, the mouth not oblique; exostome teeth not fused at their tips.....	Entosthodon
205 (106:) Midleaf cell surface striolate or rugulose.....	206
205: Midleaf cell surface otherwise.....	207
206 (179) Leaf tip hyaline; costa none; alar cells quadrate and thin-walled; capsule immersed, erect, not furrowed when dry; peristome none	Hedwigia
206: Leaf tip not hyaline; costa single, subpercurrent to excurrent; alar cells absent or weak; capsule exerted, inclined to horizontal, furrowed when dry; peristome double	Plagiopus
207 (205:) Midleaf cell surface smooth	208
207: Midleaf cell surface not smooth.....	232
208 (207) Primary stem fleshy and underground.....	Aloina
208: Primary stem none or not fleshy and underground	209
209 (208:) Capsule flattened vertically; endostome of segments only.....	Buxbaumia
209: Plants otherwise	210
210 (209:) Leaf base cancellinate; filamentous propagula on costa apex; leaf margin bordered (intramarginal); calyptra covering the entire capsule.....	Calymperes
210: Plants otherwise	211
211 (210:) Leaf papery, translucent, and glossy; alar cells marginal, inflated and thin-walled.....	Breutelia
211: Plants otherwise	212

212 (211:) Midleaf cells thin-walled	213
212: Midleaf cells firm- or thick-walled	215
213 (212) Shoots arising from persistent protonemal mat; capsule immersed.....	
.....	Ephemerum
213: Plants otherwise	214
214 (212:) Leaves five-ranked (pentastichous); leaf apex acuminate or hair-pointed; capsule stegocarpous, exerted	Conostomum
214: Leaves radially arranged; leaf apex acute; capsule cleistocarpous, emergent.....	
.....	Eccremidium
215 (145:) Midleaf cells firm-walled	216
215: Midleaf cells thick-walled	228
216 (215) Leaf margin bordered	Pyrrhobryum
216: Leaf margin not bordered	217
217 (216:) Capsule cleistocarpous	Pleuridium
217: Capsule stegocarpous.....	218
218 (217:) Margin toothed, the teeth paired and each made up of more than one cell; capsule immersed	Cryptopodium
218: Plants otherwise	219
219 (218:) Leaves two-ranked (distichous)	Distichium
219: Leaves not distichous	220
220 (219:) Leaves five-ranked (pentastichous); spores > 50 μm in diam.....	
.....	Conostomum
220: Plants otherwise	221
221 (220:) Plants pleurocarpous; stem and branch leaves different... Cratoneuropsis	
221: Plants apocarpous; stem and branch leaves similar	222
222 (221:) Leaf apex hair-pointed, margin incurved; filamentous propagula on adaxial costa surface	Crossidium
222: Plants otherwise	223
223 (222:) Peristome teeth filiform; propagula rhizoidal tubers.....	Didymodon
223: Peristome teeth not filiform; propagula none.....	224
224 (223:) Leaf apex rounded, base decurrent; peristome double.....	Meesia
224: Plants otherwise	225
225 (224:) Shoots < 10 mm tall	226
225: Shoots > 10 mm tall.....	227
226 (225) Plants growing on basic rock; leaf base sheathing; capsule straight, mouth flaring when dry	Seligeria
226: Plants growing on soil or rotting wood; leaf base not sheathing; capsule curved, not flaring when dry	Trematodon
227 (225:) Peristome teeth lanceolate; capsule mouth unchanged when dry.....	
.....	Campylopodium
227: Peristome teeth forked, striate below; capsule mouth flaring or oblique when dry	Dicranella

- 228 (215:) Leaf apex hair-pointed; peristome endostome only, rudimentary (low membrane) **Leptostomum**
 228: Leaf apex not hair-pointed; peristome exostome only 229
- 229 (228:) Leaf strongly keeled 230
 229: Leaf not keeled 231
- 230 (229) Leaf < 2 mm long, not sheathing, recurved; alar cells absent or weak; capsule 4–6-angled when dry; operculum conic; exostome teeth lanceolate **Ceratodon**
 230: Leaf > 3 mm long, sheathing, incurved, ± undulate; alar cells quadrate and thick-walled, pigmented; capsule not angled when dry; operculum rostrate; exostome teeth forked, papillose throughout **Holomitrium**
- 231 (229:) Alar cells quadrate and thick-walled; leaf base not sheathing; capsule straight when dry; exostome teeth lanceolate **Dicranoweisia**
 231: Alar cells absent or weak; leaf base sheathing; capsule curved when dry, exostome teeth forked, papillose throughout **Ditrichum**
- 232 (207:) Midleaf cell surface mammillose, unipapillose, or prorulose 233
 232: Midleaf cell surface pluri- or multipapillose 243
- 233 (232) Paraphyllia papillose **Thuidium** and **Thuidiopsis**
 233: Paraphyllia absent or not papillose 234
- 234 (233:) Leaf base cancellinate, margin spinose/ciliate **Syrrophodon**
 234: Leaf base not cancellinate, margin not spinose/ciliate 235
- 235 (234:) Leaves five-ranked (pentastichous) **Conostomum**
 235: Leaves not pentastichous 236
- 236 (235:) Leaf apex hyaline; costa absent **Hedwigia**
 236: Leaf apex not hyaline; costa present 237
- 237 (236:) Transverse walls of angle cells markedly thickened **Ulota**
 237: Transverse walls of angle cells not thickened 238
- 238 (237:) Leaves papery, translucent, glossy, plicate; alar cells inflated, thin-walled, and marginal **Breutelia**
 238: Leaves not papery, not plicate; alar cells absent or weak 239
- 239 (238:) Reduced branches (surculi) in upper leaf axils; endostome of segments plus cilia **Philonotis**
 239: Propagula absent or filamentous; endostome otherwise 240
- 240 (239:) Leaf margin toothed, each tooth made up of more than one cell; costa prorulose on the back above; endostome of cilia only, 64 in 2's and 4's **Timmia**
 240: Leaf margin entire or toothed, each tooth part of only a single cell; costa not prorulose 241
- 241 (240:) Shoots < 3 mm tall; not tomentose; leaf margin plane; midleaf cells firm-walled; exostome teeth forked, papillose throughout **Trichodon**
 241: Shoots > 3 mm tall; tomentose; leaf margin reflexed or undulate; midleaf cells thick-walled; exostome teeth absent or lanceolate 242
- 242 (241:) Propagula absent; midleaf cells mostly > 15 µm long; capsule inclined to horizontal, curved, the mouth oblique; operculum conic **Bartremia**
 242: Filamentous propagula on adaxial costa surface; midleaf cells < 15 µm long; capsule erect, straight, the mouth flaring; operculum rostrate **Orthotrichum**

243 (241:) Leaf apex hyaline; alar cells quadrate and thick-walled	Hedwigia
243: Plants otherwise	244
244 (243:) Paraphyllia papillose	Thuidium and Thuidiopsis
244: Paraphyllia absent or not papillose	245
245 (244:) Leaf subulate	Tetracoscinodon
245: Leaf not subulate	246
246 (245:) Leaf ovate to lanceolate or elliptic	247
246: Leaf oblong, lingulate, ligulate, or linear	256
247 (246) Costa none; stem pseudoparaphylliate; capsule globose	Braunia
247: Plants otherwise	248
248 (247:) Midleaf cells multipapillose	Hennediella
248: Midleaf cells prorulose or uni- or pluripapillose	249
249 (248:) Pinwheel-like in top view when dry	Mesotus
249: Plants otherwise	250
250 (249:) Lamina bistratose; capsule curved when dry	Chrysoblastella
250: Plants otherwise	251
251 (250:) Shoots < 3 mm tall; midleaf cells firm-walled; operculum conic	Microbryum
251: Shoots > 3 mm tall; midleaf cells thin- or thick-walled; operculum rostrate .	252
252 (251:) Filamentous brood-bodies on the upper stem	Leptodontium
252: Propagula absent or on the adaxial costa surface	253
253 (252:) Transverse walls of angle cells thickened	Ulota
253: Transverse walls of angle cells not thickened	254
254 (253:) Plants growing on soil or rotting wood; costa excurrent in an awn; exostome teeth filiform	Pseudocrossidium
254: Plants growing on bark or rock; costa; subpercurrent or percurrent; exostome teeth lanceolate	255
255 (254:) Calyptra mitrate or campanulate, ± plicate, often hairy; brood bodies laminal if present	Orthotrichum
255: Calyptra cucullate, not plicate, rarely hairy; brood bodies never laminal	Zygodon
256 (246:) Transverse walls of angle cells thickened; calyptra hairy; endostome of segments only	Ulota
256: Plants otherwise	257
257 (256:) Capsule curved when dry; exostome teeth forked, papillose throughout .	Bryoerythrophyllum
257: Capsule straight when dry; exostome none, rudimentary, or lanceolate	258
258 (257:) Leaf strongly keeled	259
258: Leaf plane	260
259 (258) Leaf margin recurved; capsule pyriform, 8-grooved, wide-mouthed when dry, short-necked;	Amphidium
259: Leaf margin plane; capsule cylindric, not grooved, not wide-mouthed when dry, long-necked	Anoetangium

- 260 (258:) Midleaf cells firm-walled 261
 260: Midleaf cells thick-walled 262
- 261 (260) Plants growing on soil, rotting wood, or rock; stems tomentose; midleaf cells multipapillose **Trichostomum**
 261: Plants growing on bark or coastal rock; stems not tomentose; midleaf cells pluripapillose **Willia**
- 262 (260:) Costa xs of guide cells plus one stereid band; capsule 8-ribbed when dry **Zygodon**
 262: Costa xs of guide cells plus two stereid bands; capsule not ribbed when dry 263
- 263 (262:) Plants growing on basic rock; stems tomentose; leaves < 1 mm long, the apex variably obtuse to acute **Gymnostomum**
 263: Plants growing on soil or rotting wood; stems not tomentose; leaves > 2 mm long, the apex aristate **Weissia**

KEY TO THE GENERA OF NZ POLYTRICHACEAE (9)

- 1 Plants dendroid **Dendroligotrichum**
 1: Plants not dendroid 2
- 2 (1:) Plants > 250 mm tall; peristome a brush-like tuft of filiform papillose teeth **Dawsonia**
 2: Plants < 150 mm tall; peristome not a brush-like tuft of filiform teeth 3
- 3 (2:) Calyptra naked or nearly so 4
 3: Calyptra densely hairy 7
- 4 (3) Lamellae few or indistinct 5
 4: Lamellae numerous 6
- 5 (4) Leaves shortly dentate, bordered **Atrichum**
 5: Leaves entire, not bordered **Oligotrichum**
- 6 (4:) Distal leaf sheath deep orange; capsule 2-angled, convex or plane on one side and concave on the other **Polytrichadelphus**
 6: Distal leaf sheath not coloured; capsule terete **Notoligotrichum**
- 7 (3:) Capsule stomatose 8
 7: Capsule not stomatose **Pogonatum**
- 8 (7) Capsule apophysate, sharply angled; peristome teeth keeled on the back **Polytrichum**
 8: Capsule not apophysate, bluntly angled; peristome teeth not keeled **Polytrichastrum**

KEY TO THE GENERA OF NZ GRIMMIACEAE (4)

- 1 Columella remaining attached to the operculum after capsule dehiscence.....**Schistidium**
**Schistidium**
- 1: Columella separating from the operculum at capsule dehiscence **2**
- 2 (1:) Calyptra covering the capsule to the base, fringed **Coscinodon**
- 2: Calyptra covering only part of the capsule, not fringed **3**
- 3 (2:) Plants < 25 mm tall, usually in small, dense, hoary cushions.....**Grimmia**
- 3: Plants > 25 mm tall, usually in tufts or extensive turves **Racomitrium**

KEY TO THE GENERA OF NZ HYPOPTERYGIACEAE (6)

- 1 Stems not differentiated into a stipe and rachis; capsules on the shoot's underside **Cyathophorum**
 1: Stems differentiated into a stipe and rachis; capsules on the shoot's upperside... 2
- 2 (1:) Rudimentary branches present; stem leaves at least partly ciliate 3
 2: Rudimentary branches absent; stem leaves never ciliate 4
- 3 (2) Stipe > 15 mm tall; stolon and stipe leaves 8-ranked; exostome present;
 endostomial cilia present **Canalohypopterygium**
 3: Stipe < 15 mm tall; stolon and stipe leaves 3-ranked; exostome absent;
 endostomial cilia absent **Catharomnion**
- 4 (2:) Lamina cells collenchymatous; costa of lateral frond leaves percurrent
 **Lopidium**
 4: Lamina cells not collenchymatous; costa of lateral frond leaves failing well below
 the apex 5
- 5 (4:) Lateral and underleaves not bordered; apex of basal and middle stipe leaves
 obtuse, rounded, truncate, or eroded **Dendrohypopterygium**
 5: Lateral and underleaves bordered; apex of stipe leaves acute or acuminate
 **Hypopterygium**

KEY TO THE GENERA OF NZ CRYPHAEACEAE (3)

- 1 Plants terrestrial, on bark, never contaminated with silt**Cryphaea**
 1: Plants aquatic or occasionally inundated, on rock or bark, often silty 2
- 2 (1:) Leaf base small-auriculate; alar cells subquadrate, brown; lamina cell corners lifted; perichaetial branches shorter than the sterile branches; annulus deciduous; exostome teeth 350–450 μm long, erect when wet**Dendrocryphaea**
 2: Leaf not auriculate; alar cells not differentiated; lamina cell corners flattened; perichaetial branches as long as the sterile branches; annulus none; exostome teeth 150–200 μm long, horizontal when wet **Cyrtodon**

KEY TO THE GENERA OF NZ MEESIACEAE (2)
constructed from a DELTA database

- 1** Plants > 10 mm tall; stems tomentose; leaf decurrent, the apex rounded or obtuse; margin reflexed in midleaf; cells rectangular, < 30 μm long; capsule not flaring when dry; spores 45–54 μm in diam. **Meesia**
- 1:** Plants < 10 mm tall; stem projections absent; leaf not decurrent, the apex acute; margin plane; cells linear, > 80 μm long; capsule flaring when dry; spores 10–13 μm in diam. **Leptobryum**

KEY TO THE GENERA OF NZ HEDWIGIACEAE (2)

constructed from a DELTA database

- 1** Leaf plicate, the margin plane; transverse walls of basal angle cells distinctly thickened; alar cells quadrate and thick-walled; capsule deeply grooved when dry. **Braunia**
- 1:** Leaf plane, the margin reflexed; basal angle cells undifferentiated; alar cells quadrate and thin-walled; capsule not deeply grooved when dry **Hedwigia**

KEY TO WEYMOUTHIA AND NEW ZEALAND METEORACEAE (2)
constructed from DELTA database

- 1 Lamina cells smooth **Weymouthia**
 1: Lamina cells papillose 2 (Meteoraceae)
- 2 (1:) Leaves plane; midleaf cell surface unipapillose; capsule emergent.....
 **Meteoropsis**
 2: Leaves plicate; midleaf cell surface pluri- to multipapillose; capsule exerted.....
 **Papillaria**

KEY TO THE GENERA OF NEW ZEALAND CALYMPERACEAE (2)
constructed from a DELTA database

- 1** Costa excurrent, its apex bearing propagula; leaf apex acute to acuminate, margin toothed, border well-developed, intramarginal below; capsule emergent; peristome none; calyptra covering the entire capsule, persistent, clasping the seta below the capsule **Calymperes**
- 1:** Costa percurrent, its adaxial surface bearing propagula; leaf apex rounded, margin spinose-ciliate, border weak, not intramarginal; capsule exerted; peristome single, exostome only; calyptra covering only part of the capsule, readily falling, not clasping the seta **Syrhodon**



Two of New Zealand's most familiar mosses growing together. *Hypnum cupressiforme* (green) has been exploited for centuries as pillow stuffing, inspiring the common name of feather moss. *Polytrichum juniperinum*'s (red) hairy spore capsules (not shown) have inspired the common names of Goldilocks and hair-caps. 5 mm

Arrangement of the genera (following Goffinet, Buck & Shaw (2008) in Goffinet & Shaw, *Bryophyte Biology* (2nd ed.), Cambridge University Press, New York, pp. 100–126)

Sphagnaceae		Erpodiaceae	
<i>Sphagnum</i>	39–60	<i>Erpodium</i>	385
Andreaeaceae		Rhabdoweisiaceae	
<i>Andreaea</i>	61–84	<i>Amphidium</i>	386–390
Polytrichaceae		<i>Dicranoweisia</i>	391–395
<i>Atrichum</i>	85–89	<i>Holodontium</i>	396
<i>Dawsonia</i>	90	<i>Kiaeria</i>	397
<i>Dendrologotrichum</i>	91–94	Dicranaceae	
<i>Notoligotrichum</i>	95–104	<i>Campylopodium</i>	398–401
<i>Oligotrichum</i>	105–106	<i>Dicnemon</i>	402–408
<i>Pogonatum</i>	107–108	<i>Dicranella</i>	409–416
<i>Polytrichadelphus</i>	109–112	<i>Dicranoloma</i>	417–436
<i>Polytrichastrum</i>	113–122	<i>Dicranum</i>	437
<i>Polytrichum</i>	123–129	<i>Holomitrium</i>	438–442
Tetraphidaceae		<i>Mesotus</i>	443–445
<i>Tetradontium</i>	130	<i>Pseudephemerum</i>	446
Buxbaumiaceae		<i>Sclerodontium</i>	447–448
<i>Buxbaumia</i>	131–133	Leucobryaceae	
Timmiaceae		<i>Campylopus</i>	449–460
<i>Timmia</i>	134	<i>Leucobryum</i>	461–463
Gigaspermaceae		Calymperaceae	
<i>Gigaspermum</i>	135–138	<i>Calymperes</i>	464–469
Encalyptaceae		<i>Syrrophodon</i>	470
<i>Encalypta</i>	139–144	Pottiaceae	
Funariaceae		<i>Acaulon</i>	471–472
<i>Bryobckettia</i>	145	<i>Aloina</i>	473–478
<i>Entosthodon</i>	146–154	<i>Anoetangium</i>	479
<i>Funaria</i>	155–157	<i>Ardeuma</i>	480
<i>Goniomitrium</i>	158	<i>Barbula</i>	481–495
<i>Physcomitrella</i>	159	<i>Bryoerythrophyllum</i>	496–498
<i>Physcomitrium</i>	160–168	<i>Calyptopogon</i>	499–500
Grimmiaceae		<i>Chenia</i>	501–507
<i>Coscinodon</i>	196	<i>Crossidium</i>	508–512
<i>Grimmia</i>	197–216	<i>Didymodon</i>	513–531
<i>Racomitrium</i>	169–195	<i>Ephemerum</i>	532–534
<i>Schistidium</i>	217–222	<i>Gymnostomum</i>	535–537
Ptychomitriaceae		<i>Hennediella</i>	538–550
<i>Ptychomitrium</i>	223	<i>Hyophila</i>	551–555
Seligeriaceae		<i>Leptodontium</i>	556–557
<i>Blindia</i>	224–240	<i>Microbryum</i>	558–560
<i>Seligeria</i>	241–244	<i>Micromitrium</i>	561–562
Archidiaceae		<i>Pseudocrossidium</i>	563–569
<i>Archidium</i>	245–248	<i>Pterygoneurum</i>	570–571
Fissidentaceae		<i>Syntrichia</i>	572–600
<i>Fissidens</i>	249–340	<i>Tetracoscinodon</i>	601
Ditrichaceae		<i>Tortella</i>	602–613
<i>Ceratodon</i>	341–345	<i>Tortula</i>	614–631
<i>Chrysoblastella</i>	346–350	<i>Trichostomum</i>	632–640
<i>Distichium</i>	351–352	<i>Tridontium</i>	641–643
<i>Ditrichum</i>	353–368	<i>Triquetrella</i>	644–648
<i>Eccremidium</i>	369–371	<i>Weissia</i>	649–656
<i>Pleuridium</i>	372–378	<i>Willia</i>	657
<i>Saelania</i>	379	Pleurophascaceae	
<i>Trichodon</i>	380	<i>Pleurophascum</i>	658–659
Bruchiaceae		Mitteniaceae	
<i>Trematodon</i>	381–384	<i>Mittenia</i>	660

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Splachnaceae	
<i>Tayloria</i>	661–665
Meesiaceae	
<i>Leptobryum</i>	666
<i>Meesia</i>	667–669
Pulchrinodaceae	
<i>Pulchrinodus</i>	670–672
Bryaceae	
<i>Bryum</i>	673–684
<i>Gemmabryum</i>	685–712
<i>Plagiobryum</i>	713
<i>Ptychostomum</i>	714–719
<i>Rosulabryum</i>	720–739
Mniaceae	
<i>Epipterygium</i>	740
<i>Ochiobryum</i>	741–743
<i>Plagiomnium</i>	744–748
<i>Pohlia</i>	749–769
<i>Schizymenium</i>	770
Leptostomataceae	
<i>Leptostomum</i>	771–778
Bartramiaceae	
<i>Bartramia</i>	779–786
<i>Breutelia</i>	787–797
<i>Conostomum</i>	798–804
<i>Philonotis</i>	805–814
<i>Plagiopus</i>	815
Orthotrichaceae	
<i>Condonoblepharum</i>	816–821
<i>Leratia</i>	822
<i>Macrocoma</i>	823–826
<i>Macromitrium</i>	827–855
<i>Orthotrichum</i>	856–876
<i>Schlotheimia</i>	877–881
<i>Ulotia</i>	882–894
<i>Zygodon</i>	895–903
Hedwigiaceae	
<i>Braunia</i>	904–907
<i>Hedwigia</i>	904–908
Rhacocarpaceae	
<i>Rhacocarpus</i>	909–911
Rhizogoniaceae	
<i>Calomnion</i>	912–916
<i>Cryptopodium</i>	917–918
<i>Goniobryum</i>	919
<i>Pyrrohobryum</i>	920–928
<i>Rhizogonium</i>	929–934
Aulacomniaceae	
<i>Aulacomnium</i>	935–939
Orthodontiaceae	
<i>Hymenodon</i>	940–941
<i>Leptotheca</i>	942
<i>Orthodontium</i>	943
Braithwaiteaceae	
<i>Braithwaitea</i>	944
Racopilaceae	
<i>Racopilum</i>	945–953
Hypnodendraceae	
<i>Cyrtopus</i>	954

<i>Hypnodendron</i>	955–964
<i>Mniodendron</i>	965–972
<i>Sciadocladus</i>	973–980
Ptychomniaceae	
<i>Cladomnion</i>	981–983
<i>Dichelodontium</i>	984
<i>Glyphothecium</i>	985–987
<i>Hampeella</i>	988–992
<i>Ptychomnion</i>	993–1000
<i>Tetraphidopsis</i>	1001–1002
Hypopterygiaceae	
<i>Canalohypopterygium</i>	1003–1005
<i>Catharomnion</i>	1006–1009
<i>Cyathophorum</i>	1010–1013
<i>Dendrohypopterygium</i>	1014
<i>Hypopterygium</i>	1015–1027
<i>Lopidium</i>	1028–1029
Saulomataceae	
<i>Sauloma</i>	1030–1031
Daltoniaceae	
<i>Achrophyllum</i>	1032–1037
<i>Beeveria</i>	1038
<i>Calypstrochaeta</i>	1039–1050
<i>Crosbya</i>	1051–1055
<i>Daltonia</i>	1056
<i>Distichophyllum</i>	1057–1066
<i>Ephemeropsis</i>	1067
Pilotrichaceae	
<i>Cyclodictyon</i>	1068
Trachylomataceae	
<i>Trachyloma</i>	1069–1073
Climaciaceae	
<i>Climacium</i>	1074–1076
Amblystegiaceae	
<i>Amblystegium</i>	1077–1081
<i>Campyliadelphus</i>	1082–1085
<i>Cratoneuron</i>	1086
<i>Cratoneurospis</i>	1087–1089
<i>Drepanocladus</i>	1090–1093
<i>Hypnobartlettia</i>	1094–1095
<i>Leptodictyum</i>	1096–1097
<i>Sanionia</i>	1098
<i>Scorpidium</i>	1099
Calliergonaceae	
<i>Calliergon</i>	1100
<i>Straminergon</i>	1101
<i>Warnstorfia</i>	1102–1106
Leskeaceae	
<i>Lindbergia</i>	1107
<i>Pseudoleskea</i>	1108–1110
Thuidiaceae	
<i>Thuidiopsis</i>	1111–1116
<i>Thuidium</i>	1111, 1117–1122
Brachytheciaceae	
<i>Brachytheciastrum</i>	1123–1128
<i>Brachythecium</i>	1123–1138
<i>Eriodon</i>	1139
<i>Eurhynchium</i>	1140–1148
<i>Palamocladium</i>	1149

Arrangement of the genera (cont'd)

<i>Platyhypnidium</i>	1150
<i>Pseudoscleropodium</i>	1151–1154
<i>Rhynchostegium</i>	1155–1160
<i>Scleropodium</i>	1161
<i>Scorpiurium</i>	1162–1163

Meteoriaceae

<i>Meteoriopsis</i>	1164–1165
<i>Papillaria</i>	1166–1177

Fabroniaceae

<i>Fabronia</i>	1178–1180
<i>Ischyrodon</i>	1181–1183

Hypnaceae

<i>Calliergonella</i>	1184–1186
<i>Ctenidium</i>	1187
<i>Ectropothecium</i>	1188
<i>Hypnum</i>	1189–1195
<i>Isopterygiopsis</i>	1196
<i>Orthothecium</i>	1197
<i>Pseudotaxiphyllum</i>	1198–1202
<i>Vesicularia</i>	1203–1205

Catagoniaceae

<i>Catagonium</i>	1206–1207
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Hylocomiaceae

<i>Hylocomium</i>	1208–1209
<i>Rhytidiadelphus</i>	1208–1211

Plagiotheciaceae

<i>Plagiothecium</i>	1212–1214
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Entodontaceae

<i>Entodon</i>	1215
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Pylaisiadelphaceae

<i>Austrohondaella</i>	1216–1218
<i>Isopterygium</i>	1219
<i>Wijkia</i>	1220–1224

Sematophyllaceae

<i>Rhaphidorrhynchium</i>	1225–1226
<i>Sematophyllum</i>	1227–1240
<i>Warburgiella</i>	1241–1242

Cryphaeaceae

<i>Cryphaea</i>	1243–1253
<i>Cyptodon</i>	1254–1255
<i>Dendrocryphaea</i>	1256–1257

Pterobryaceae

<i>Cryptogonium</i>	1258–1259
<i>Symphysodontella</i>	1260

Orthorrhynchiaceae

<i>Orthorrhynchium</i>	1261
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Lepyrodontaceae

<i>Lepyrodon</i>	1262–1266
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Neckeraceae

<i>Alleniella</i>	1267–1268
<i>Neckera</i>	1267–1270
<i>Neckeropsis</i>	1271–1272
<i>Pendulothecium</i>	1273–1280
<i>Thamnobryum</i>	1282–1285

Echinodiaceae

<i>Echinodium</i>	1286–1292
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Leptodontaceae

<i>Leptodon</i>	1293–1294
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Lembophyllaceae

<i>Acrocladium</i>	1295–1300
<i>Camptochaete</i>	1301–1312
<i>Fallaciella</i>	1314–1318
<i>Fifea</i>	1313
<i>Lembophyllum</i>	1319–1325
<i>Weymouthia</i>	1326–1329

Anomodontaceae

<i>Haplohymenium</i>	1330
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Sphagnum sp., vegetative shoot apex
1 mm

Key* to the New Zealand species of *Sphagnum* (9)

- 1 Branch leaves inrolled and cucullate at the apex2
 1: Branch leaves not inrolled and cucullate at the apex.....4
- 2 (1) Pores of the abaxial branch leaf hyalocysts arranged over the entire cell surface ● ***Sphagnum compactum***
 2: Pores of the abaxial branch leaf hyalocysts arranged mostly at the cell angles or along the commissures (where the hyalocysts and chlorocysts adjoin)3
- 3 (1) Pores of the abaxial branch leaf hyalocysts numerous and conspicuous along the commissures and at the cell angles; branch leaves in cross-section plane on the adaxial surface, convex on the abaxial surface..... ● ***Sphagnum cristatum***
 3: Pores of abaxial branch leaf hyalocysts few, most or all of them at the cell angles; branch leaves in cross-section convex on both leaf surfaces
 ***Sphagnum perichaetiale***
- 4 (1:) Stem leaves 0.6–1.4 mm long, pendent; pores on the adaxial surface of the branch leaves arranged in groups of three at the cell angles; cortical cells of branch stems uniform with a single pore at the upper end..... ● ***Sphagnum australe***
 4: Stem leaves absent or longer than 1.5 mm, erect or erect-spreading; pores on the adaxial surface of the branch leaves not arranged in groups of three; cortical cells of branch stems of two kinds, either porose or eporose and enlarged and retort-shaped.....5
- 5 (3:) Branch leaves sheathing below and ± spreading above; walls of branch leaf chlorocysts often finely papillose in cross-section ● ***Sphagnum squarrosom***
 5: Branch leaves not sheathing below, not spreading above; walls of branch leaf chlorocysts smooth in cross-section6
- 6 (5:) Plants iridescent when dry; branch leaf chlorocysts in cross-section more exposed on their adaxial surface ● ***Sphagnum subnitens***
 6: Plants not iridescent when dry; branch leaf chlorocysts in cross-section equally exposed on their two surfaces or more exposed on their abaxial surface7
- 7 (6:) Branch leaf chlorocysts in cross-section equally exposed on their two surfaces; stem and branch leaves varying in size and shape, much smaller or larger than the branch leaves8
 7: Branch leaf chlorocysts in cross-section more exposed on their abaxial surface; stem leaves smaller than the branch leaves ● ***Sphagnum falcatum***
- 8 (7) Stems fascicled; stem leaves not resembling branch leaves.....
 ● ***Sphagnum novozelandicum***
 8: Stems not fascicled; stem leaves resembling branch leaves.....
 ● ***Sphagnum simplex***

* based on Fife, AJ (1996): A synopsis of New Zealand *Sphagna*, with a description of *S. simplex* sp. nov. *New Zealand Journal of Botany* 34, 311, plus Crum, HA; Anderson, LE (1981): *Mosses of Eastern North America*. Columbia University Press, New York. 22.

pendent branch leaves



*Sphagnum
cristatum*



*Sphagnum
perichaetiale*



*Sphagnum
australe*



*Sphagnum
simplex*



*Sphagnum
subnitens*



*Sphagnum
compactum*



*Sphagnum
squarrosum*



*Sphagnum
novo-zelandicum*



*Sphagnum
falcatulum*

Sphagnum australe Mitt.

form: robust, erect, sparingly branched, whitish; branches in fascicles of 4–5, 2 spreading and 2–3 pendent

habitat: soil, usually in boggy sites

leaf: size: stem: 1.4 mm; branch: 2.5–3.3 mm

shape: stem: lingulate; branch: ovate-lanceolate, concave

tip: stem: rounded; branch: acute to obtuse, ± eroded

base: not differentiated

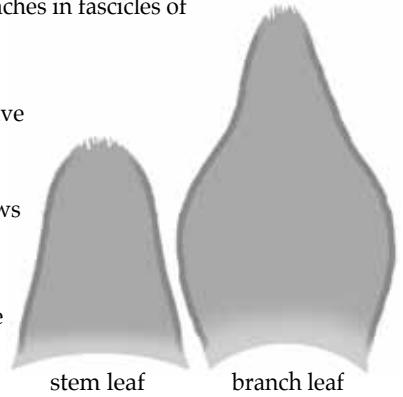
costa: none

border: stem: 1–2 rows of narrow cells; branch: 2–4 rows

margin: stem: entire; branch: inrolled to ± cucullate

cells: hyalocysts 100–150 × 24–30 μm, sigmoid, thin-walled, fibrillose, pored

capsule: 1 mm, globose, erect, dark, glossy, peristome none; pseudopodium 10–15 mm



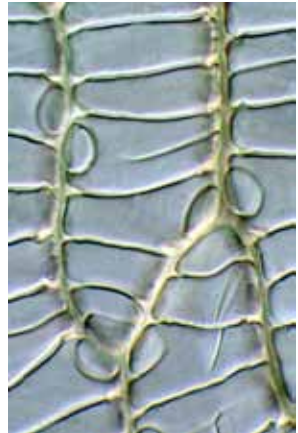
stem leaf

branch leaf



vegetative shoot (2), branch leaf outline, and branch leaf apex (eroded)

5 mm, 5 mm, 0.5 mm, 10 μm



margin midleaf, and pored cells midleaf (2)

50 μm, 10 μm, 10 μm

continued next page

Sphagnum compactum DC.

form: small, dense cushions of erect stems to 40 mm long, red-brown to purplish below; leaves \pm squarrose

habitat: on poorly drained peat, sand, or siliceous rock, to 1500 m elev.

leaf: stem leaves 0.3–0.8 mm, branch leaves $1.4\text{--}3 \times 0.8\text{--}1.0$ mm

shape: stem leaves \pm triangular; stem leaves ovate

tip: stem leaves rounded; branch leaves \pm toothed, appearing \pm cucullate

base: not differentiated

costa: none

border: 2–5 rows of linear, thick-walled cells

margin: stem leaves entire, plane; branch leaves entire, involute above

cells: hyalocysts $75 \times 30 \mu\text{m}$, sigmoid, fibrillose, thin-walled, 8–15-ring-and-pseudopored abaxially, 3–5-pored adaxially

capsule: about 1 mm in diam., globose, erect, brown-black; spores 25–35 μm in diam.



branch
leaf



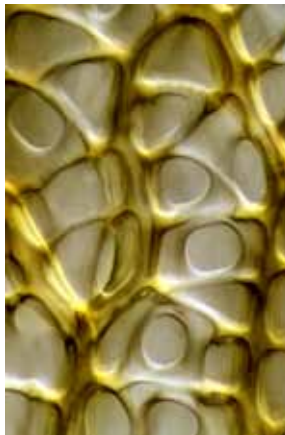
vegetative shoot, branch leaf outline, apex, and margin midleaf

1 mm,

1 mm,

0.5 mm,

50 μm



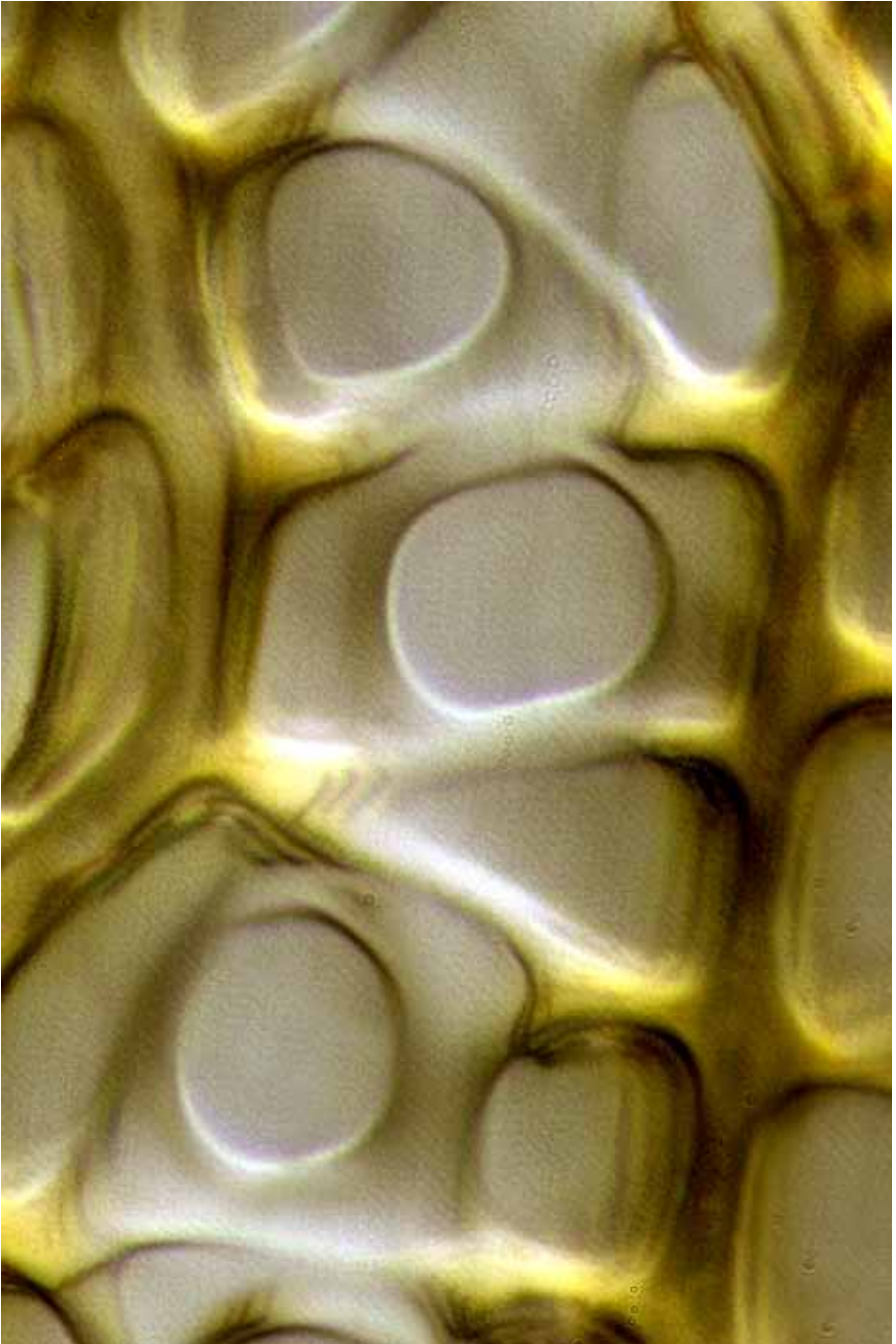
hyalocyst pores, pore detail, and leaf basal angle

50 μm ,

50 μm ,

50 μm

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Sphagnum compactum hyalocyst showing pores (detail)
10 μm

Sphagnum cristatum Hampe

form: loose turfs or mounds of erect pale green to brownish stems;
branches in 4–6 fascicles, 2–3 spreading and 2–3 pendent

habitat: moist to boggy sites, mostly subalpine

leaf: *size:* stem: 1 mm; branch: 1.6 mm

shape: stem: lingulate; branch: broadly ovate

tip: stem: rounded, eroded; branch: obtuse, cucullate, ± resorbed

base: not differentiated

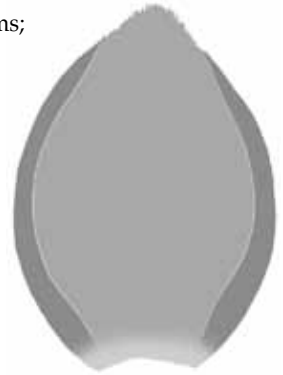
costa: none

border: stem: none; branch: 1 row of narrowly elongate cells

margin: entire below, serrulate above, cucullate above,
± incurved below

cells: hyalocysts 100–140 × 20–30 μm, sinuose, thin-walled,
smooth, strongly fibrillose, pored

capsule: 1 mm, globose, erect, dark, glossy, no peristome;
pseudopodium 10–15 mm

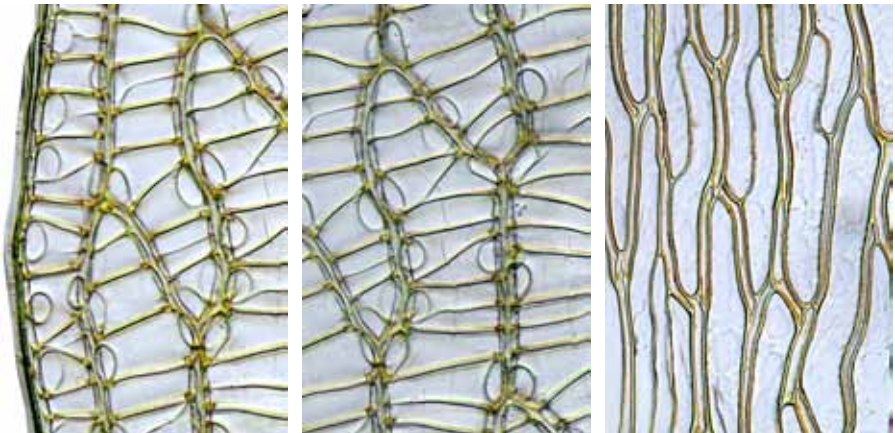


branch leaf



vegetative shoot, capitulum (top view), branch detail, and branch leaf outline

■ 5 mm, ■ 1 mm, ■ 1 mm, ■ 0.5 mm



margin midleaf, branch leaf pores and fibrils, and stem leaf e fibrillose cells

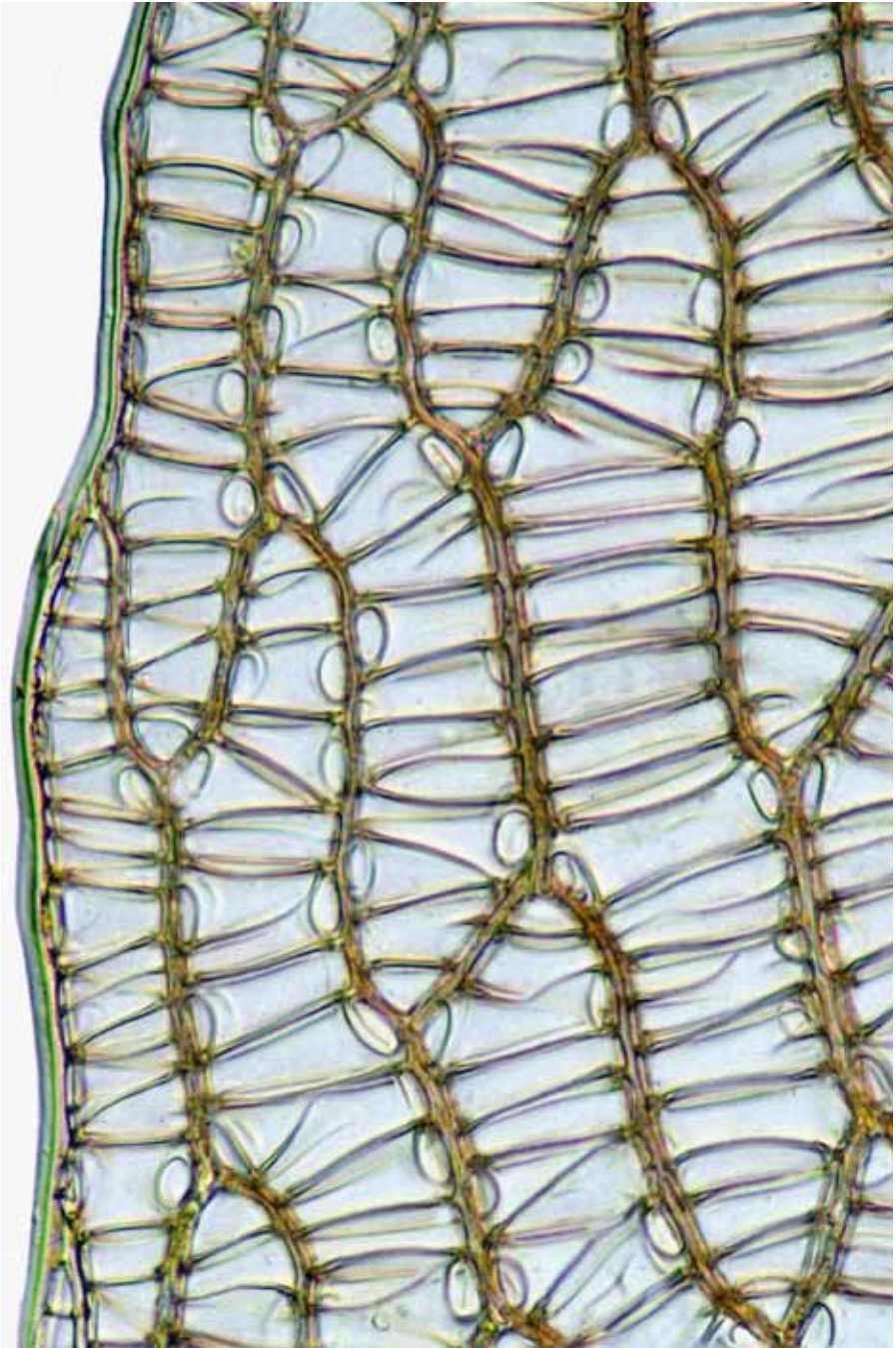
■ 50 μm, ■ 50 μm, ■ 50 μm

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Sphagnum cristatum, vegetative habit
5 mm

continued next page



Sphagnum cristatum branch leaf
50 μ m

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Sphagnum falcatum Besch.

form: robust, erect, branches in fascicles of 3–4, 1–2 spreading and 1–2 pendent
habitat: soil, usually in well-drained sites

leaf: *size:* stem: 1.5 mm; branch: 2 mm

shape: stem: lingulate; branch: ovate-lanceolate

tip: stem: rounded, eroded; branch: acute

base: basal cells of stem leaves efibrillose

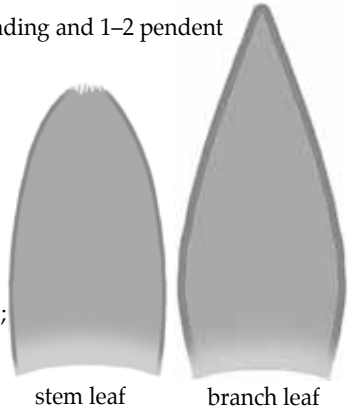
costa: none

border: stem: 3–4 rows of linear cells; branch: 3–6 rows

margin: stem: entire, plane; branch: entire, inrolled above

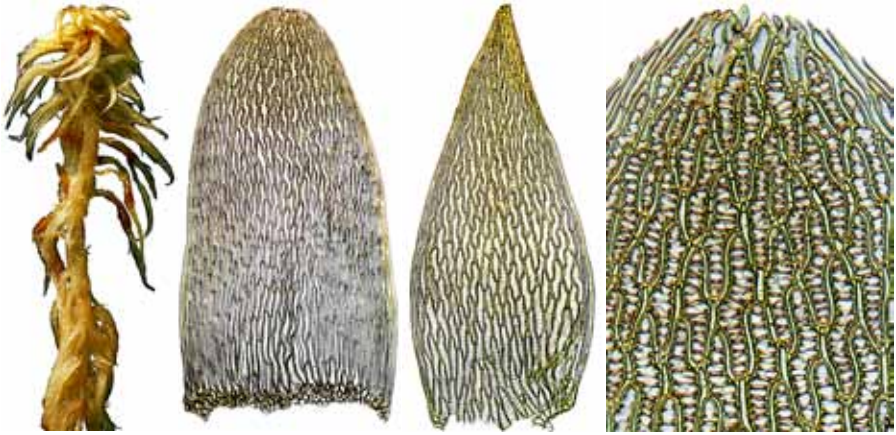
cells: hyalocysts $120\text{--}160 \times 20\text{--}40 \mu\text{m}$, sigmoid, fibrillose, thin-walled, pored

capsule: 1 mm; globose, erect, dark, glossy, no peristome; pseudopodium 10 mm

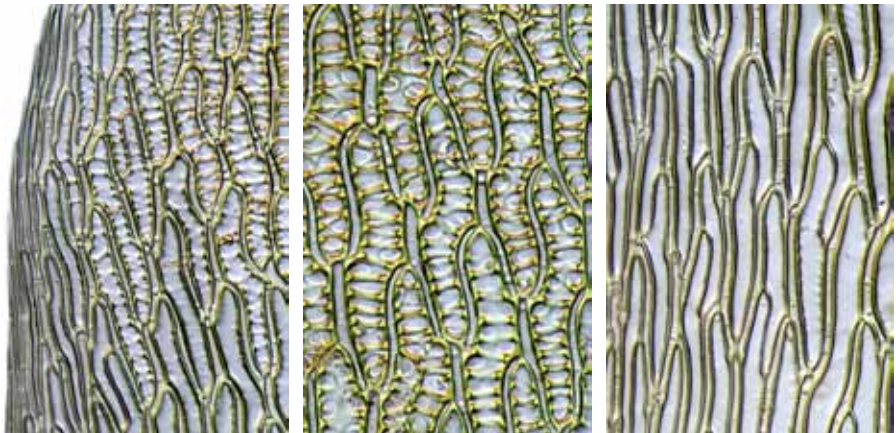


stem leaf

branch leaf



vegetative shoot (dry), stem and branch leaf outlines, and stem leaf apex (eroded)
 10 mm, 0.1 mm, 0.1 mm, 50 μm



stem leaf margin, stem leaf cells (upper leaf), and stem leaf cells (lower leaf)
 50 μm , 50 μm , 50 μm

continued next page

Sphagnum novo-zelandicum Mitt.

form: cushions; branches in fascicles of 3–5, 2–3 spreading, 1–2 pendent
habitat: wet habitats in forest, scrub, and roadside ditches, to subalpine

leaf: *size:* stem: 1.5–2.0 mm; branch: 1.8–2.3 mm

shape: stem: lingulate, adaxial pores few; branch: ovate to ovate-

lanceolate, abaxial pores 8–16 along commissures, adaxial pores sparse

tip: stem: rounded or obtuse, ± eroded; branch: 3–4-toothed by resorption

base: basal cells less fibrillose than the other lamina cells

costa: none

border: stem: 3–5 rows of narrow cells; branch: 1–3 rows of narrow cells

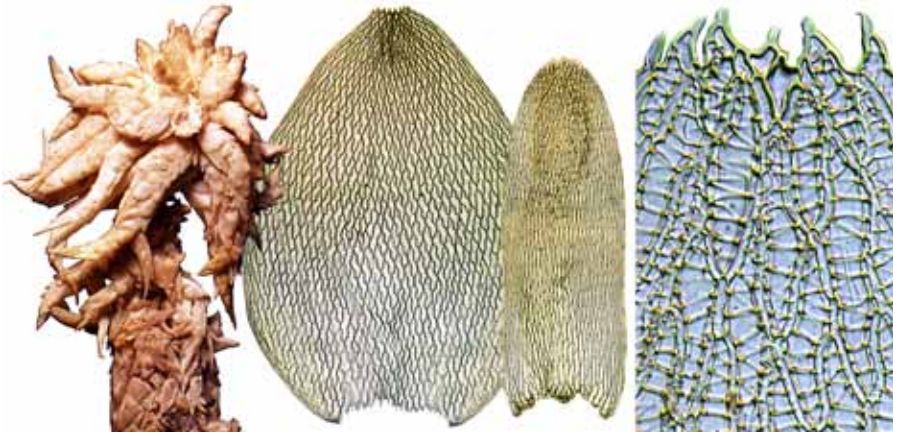
margin: entire, plane

cells: hyalocysts 150–200 × 30–50 μm, sigmoid, fibrillose, thin-walled, 8–16-ring-pored abaxially; chlorocysts exposed equally adaxially and abaxially

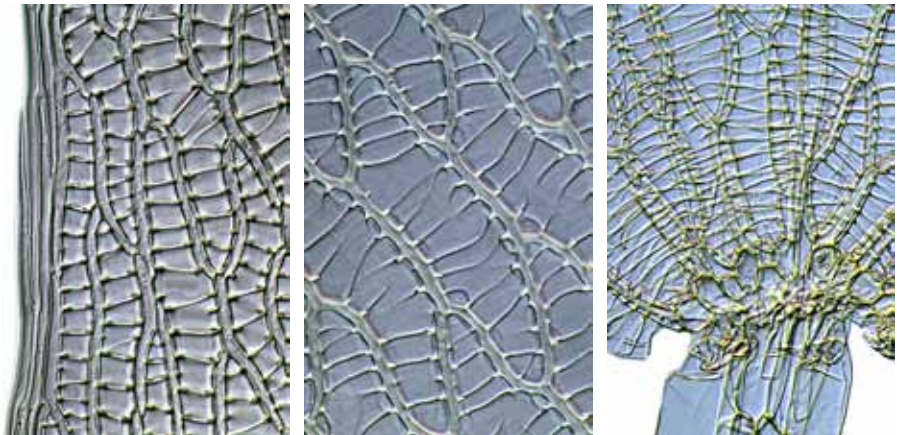
capsule: 1 mm, globose, erect, dark, glossy, no peristome; pseudopodium 10 mm long



branch leaf

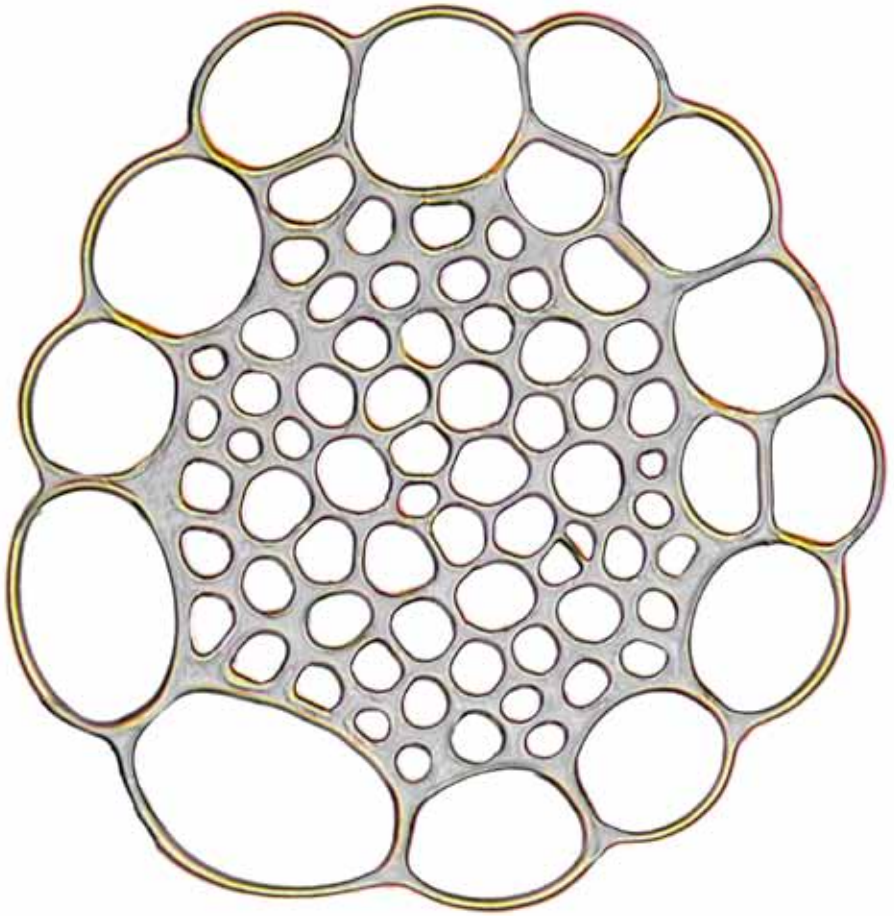


vegetative shoot (dry), branch and stem leaf outlines, and branch leaf apex
 1 mm, 0.5 mm (2), 50 μm



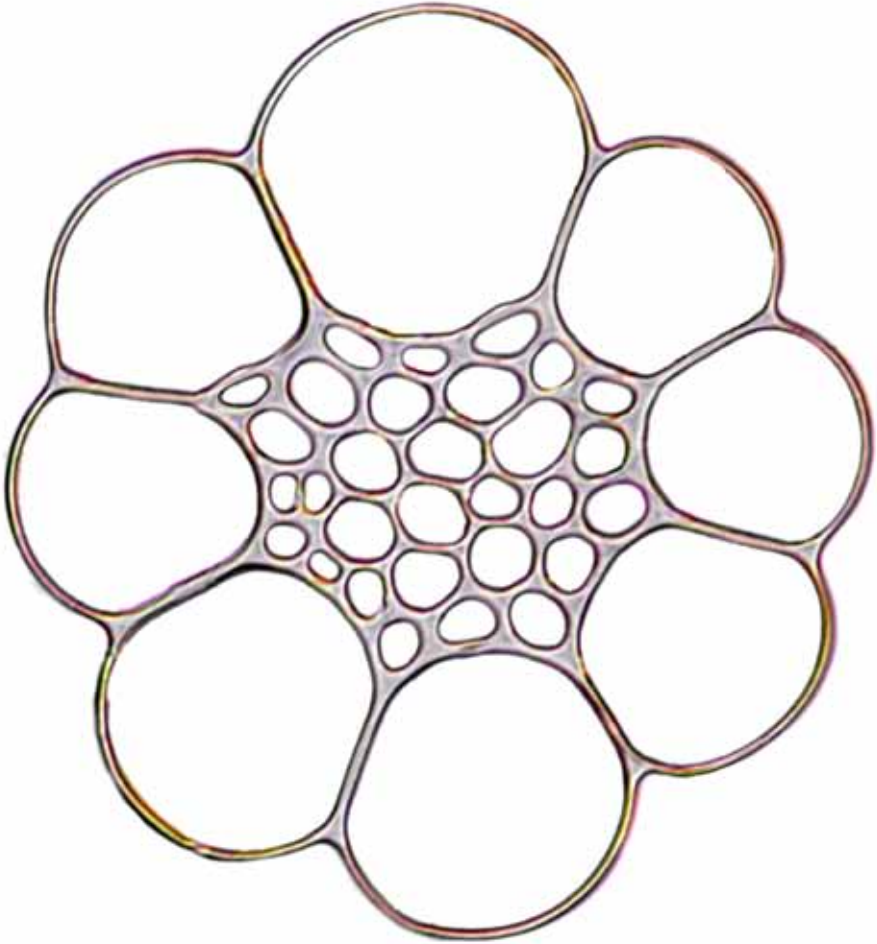
branch leaf margin, branch leaf cells, and branch leaf base
 50 μm, 50 μm, 50 μm

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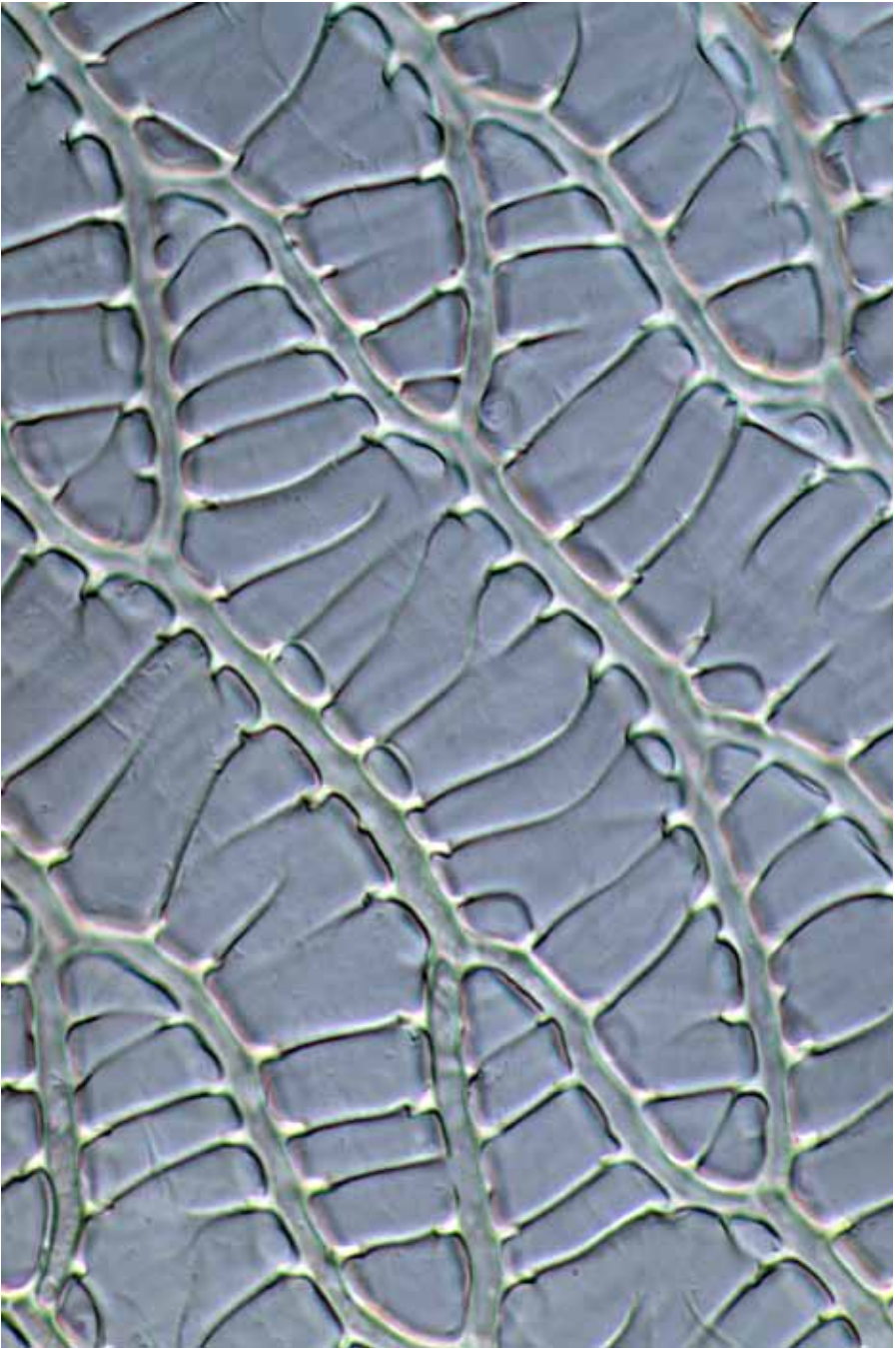
Sphagnum novozelandicum stem xs
10 μ m

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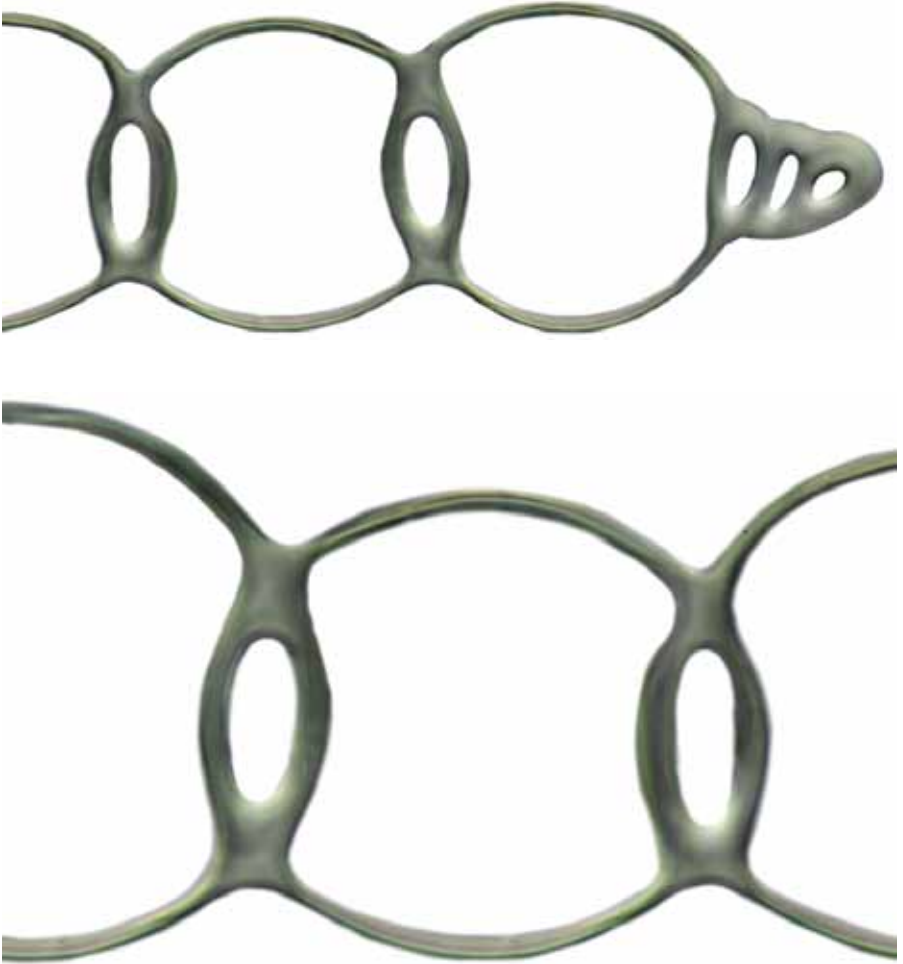
Sphagnum novozelandicum branch xs
10 μ m

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Sphagnum novozelandicum branch leaf cells
10 μm

continued next page



Sphagnum novozelandicum branch leaf cells showing margin and chlorocysts
— 10 μm (upper), — 10 μm (lower)

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Sphagnum simplex Fife**form:** ± unbranched stems 10–100 mm long, leaves julaceous**habitat:** acidic soil of edges of subalpine and alpine bogs, to 1600 m elev.**leaf:** size: 3.4 × 1.2 mm*shape:* ovate, strongly concave*tip:* broadly rounded, ± toothed at the apex*base:* not differentiated*costa:* none*border:* 1–3 rows of narrowly linear cells*margin:* entire, concave*cells:* hyalocysts 90–150 × 15–36 μm, 10–16-pored (and pseudopored) abaxially, 0–1-pored adaxially**capsule:** sporophytes unknown**notes:** thought to be a New Zealand endemicbranch
leaf

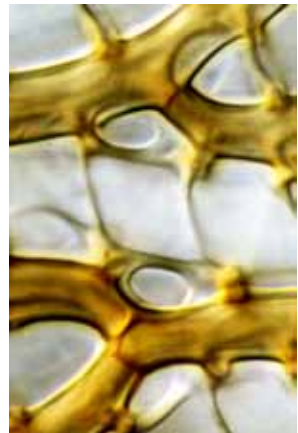
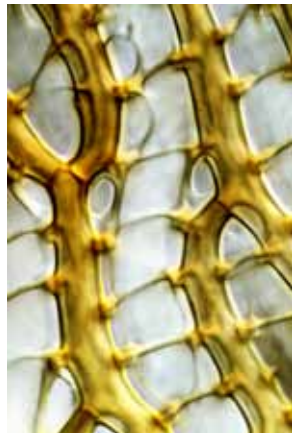
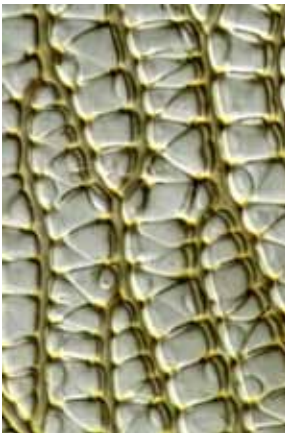
vegetative shoots (dry) (2), leaf outline, and margin midleaf

1 mm (2),

1 mm,

1 mm,

50 μm



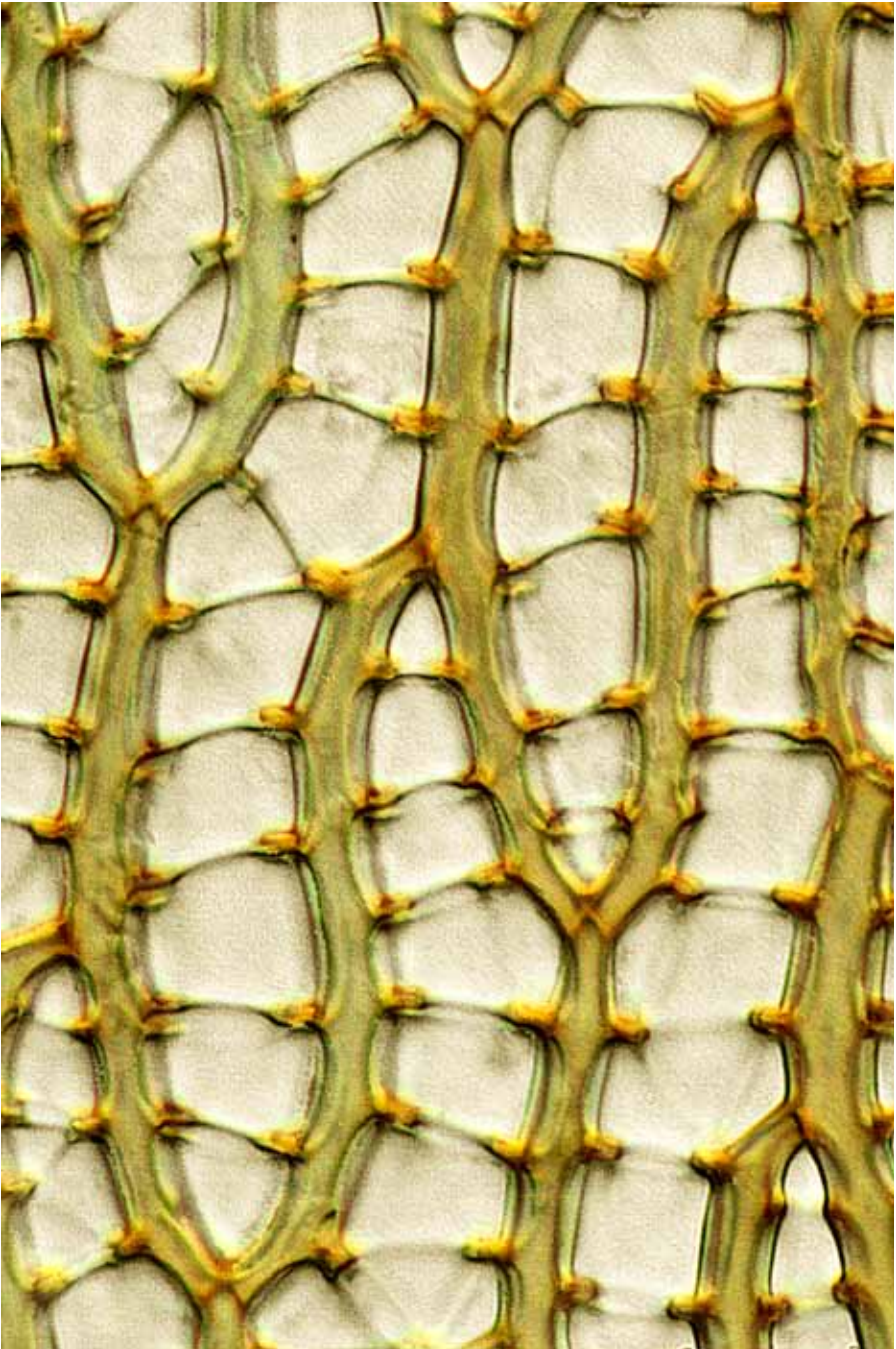
lamina cells, hyalocyst pores and detail

50 μm,

50 μm,

10 μm

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Sphagnum simplex lamina cells
10 μm

Sphagnum squarrosum Crome in Hoppe

form: densely matted, erect, branched, with squarrose leaf-tips; branches in 4–5 fascicles, 2 spreading, 2–3 pendent

habitat: moist soil or humus in fens and meadows, often calciphilic

leaf: size: stem: 1.6–1.8 mm; branch: 2.0–3.5 mm, tips squarrose wet or dry

shape: stem: oblong-ligulate; branch: ovate-hastate narrowed from base

tip: stem: rounded; branch: acute to narrowly truncate, ± erose

base: undifferentiated

costa: none

border: stem: none; branch: 2–3 rows of linear cells

margin: entire, plane

cells: branch: chlorocysts trapezoidal, > abaxial exposure; hyalocysts not bulging; pores large, 1/3 hyalocyst width; 90–120(–150) μm

capsule: 1 mm; globose, erect, dark, glossy, no peristome; spores 17–30 μm , proximal surface papillose, distal surface bifurcate protuberances; pseudopodium 10 mm



branch leaf



vegetative shoots (dry) (2), stem and branch leaf outlines

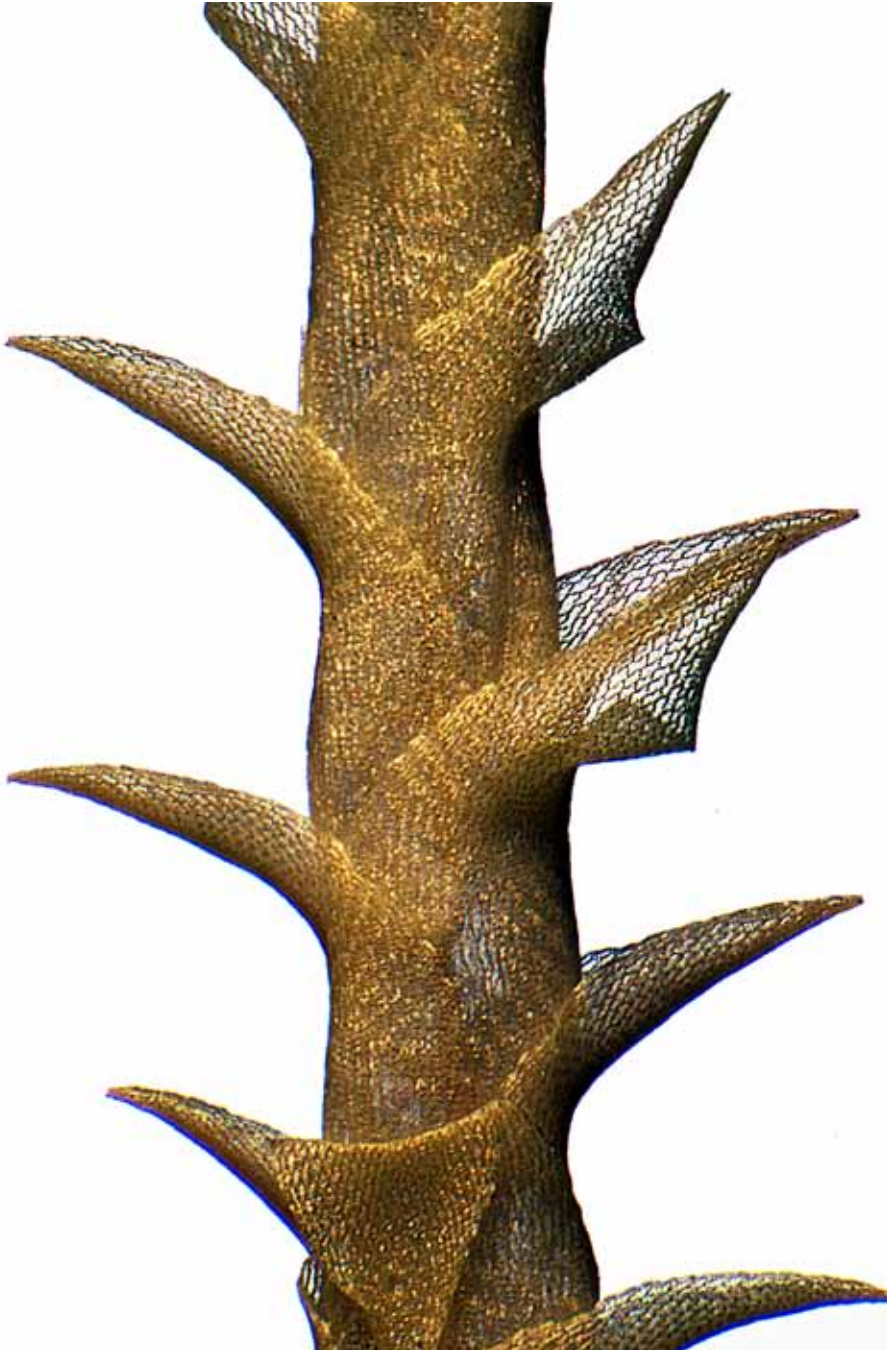
■ 5 mm, ■ 5 mm, ■ 0.1 mm, ■ 0.5 mm



branch leaf margin, branch leaf hyalocysts, and branch leaf cross-section (diagrammatic)

■ 50 μm , ■ 50 μm , ■ 50 μm

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Sphagnum squarrosum branch leaves
1 mm

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Sphagnum squarrosum branch leaf cells
100 μm

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Sphagnum subnitens Russow & Warnst.

form: iridescent when dry; branches in fascicles of 3, 2 spreading, 1 pendent
habitat: soil in boggy sites, Nelson and Westland (adventive)

leaf: *size:* stem: 1.5–1.7 mm; branch: 1.5 mm

shape: stem: triangular-lingulate; branch: ovate to ovate-lanceolate

tip: stem: acute to short-cuspidate; branch: truncate, toothed

base: basal cells $240 \times 27 \mu\text{m}$, fibrillose

costa: none

border: stem: 3–6 rows of narrow, porose cells; branch: 1–2 rows of narrow cells

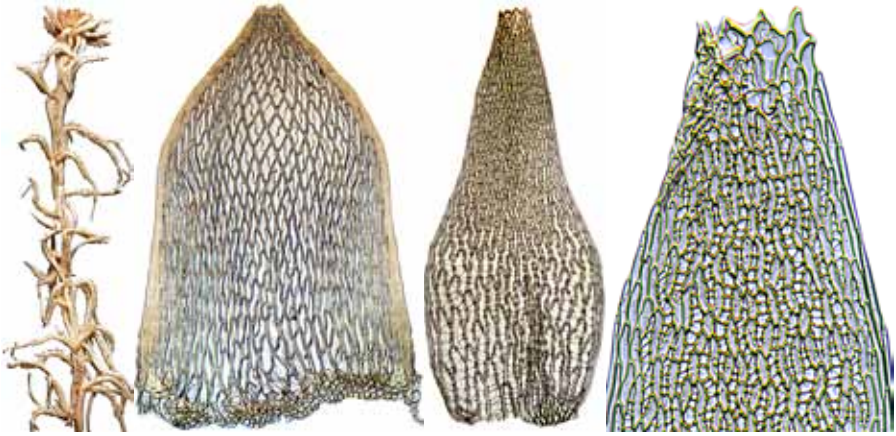
margin: stem: entire, plane; branch: entire, inrolled above

cells: hyalocysts $90\text{--}105 \times 18\text{--}24 \mu\text{m}$, sigmoid, fibrillose, thin-walled, 3–5-ring-pored abaxially, convex and projecting abaxially; chlorocysts triangular, exposed adaxially broadly, abaxially narrowly

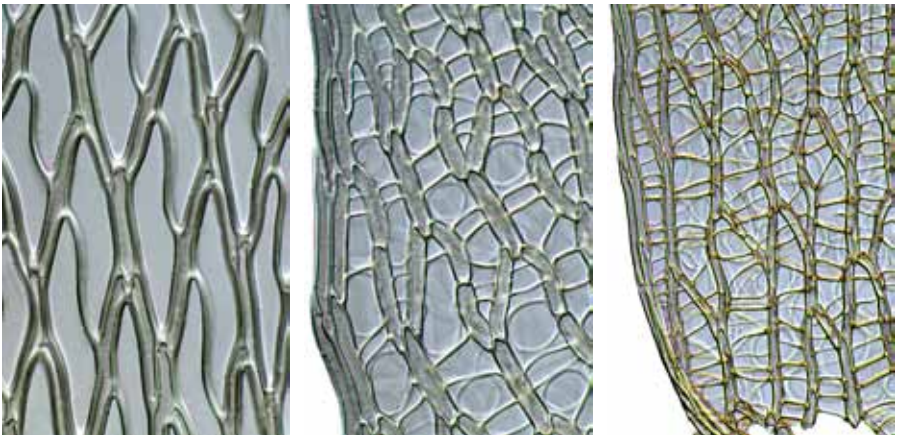
capsule: 1 mm; globose, erect, dark, glossy; pseudopodium 10 mm; no peristome



branch leaf



vegetative shoot (moist), stem and branch leaf outlines, and branch leaf apex
 5 mm, 0.5 mm, 0.5 mm, 50 μm



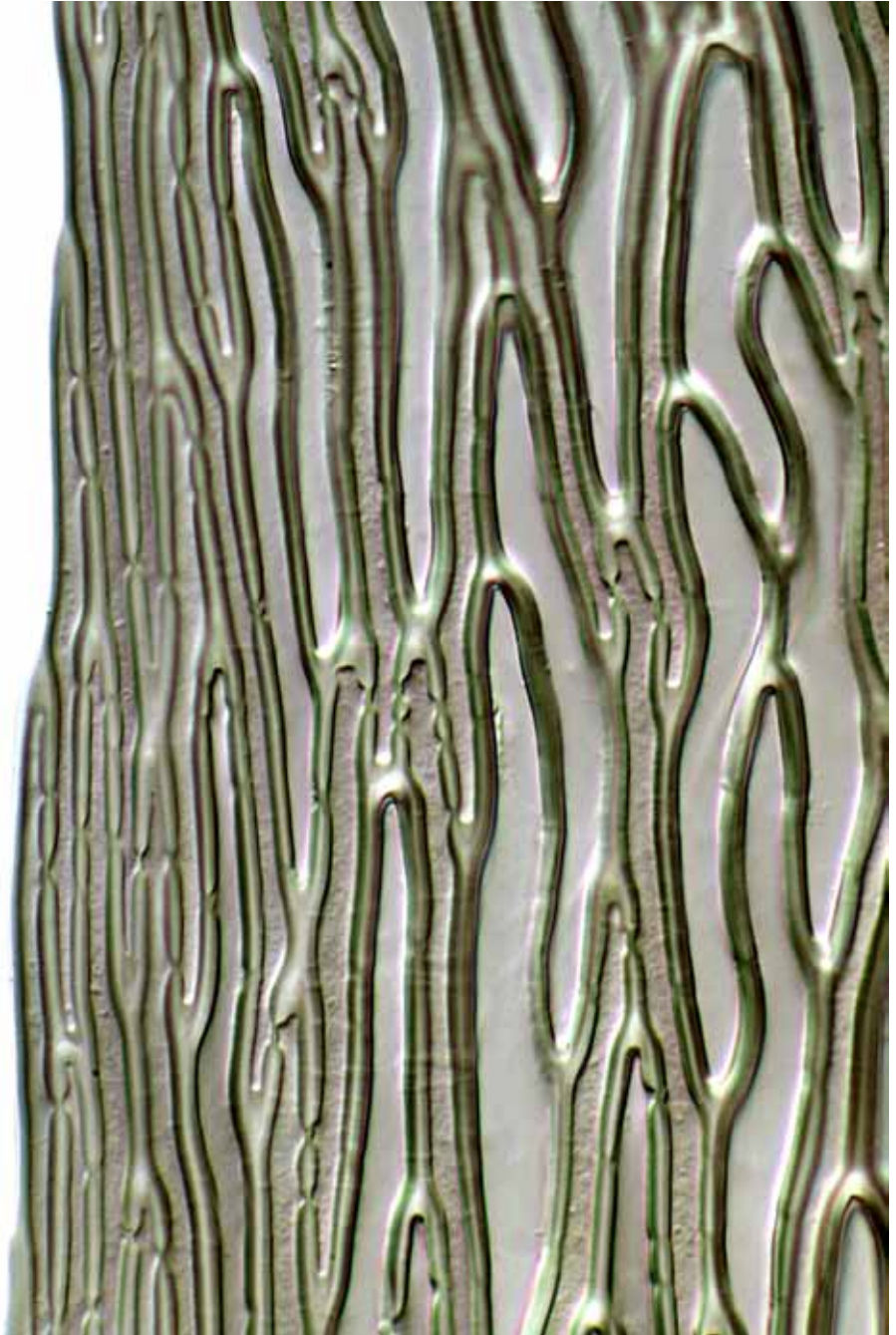
stem leaf eifibrillose cells, branch leaf margin, and branch leaf basal angle
 50 μm , 50 μm , 50 μm

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Sphagnum subnitens vegetative shoot (dry)
1 mm

continued next page



Sphagnum subnitens stem leaf margin
50 μm

continued next page

Key* to the New Zealand species and subspecies of *Andreaea* (12)

- 1 Leaves costate 2
 1: Leaves ecostate 5
- 2(1) Costa reaching to about midleaf; leaves broadly oval to oblong ● ***Andreaea nitida***
 2: Costa percurrent or subpercurrent; leaves lanceolate or the blade tapering from the shoulder of an oblong base 3
- 3(2): Leaves lanceolate; costa well-defined, not filling the blade; perichaetial bracts not convolute, not or only slightly sheathing ● ***Andreaea australis***
 3: Leaves tapering from an oblong base; costa indistinct, filling much of the blade; perichaetial bracts convolute and sheathing 4
- 4(3): Marginal cells in leaf base mostly isodiametric; base of capsule shorter than the valves; costa usually conspicuous in the leaf base ● ***Andreaea subulata***
 4: Marginal cells in leaf base mostly rectangular; base of capsule equal to or longer than the valves; costa weak or disappearing in the leaf base ***Andreaea heinemannii***
- 5(1): Margins of leaf base partly toothed or crenate from the projecting ends of cells 6
 5: Margins of leaf base entire 9
- 6(5) Turgid spores mostly larger than 35 μm in diam. 7
 6: Turgid spores mostly smaller than 30 μm in diam. 8
- 7(6) Leaves mostly 3–4 times as long as wide; leaf blade usually falcate and secund; distal leaf apex unistratose throughout; perigonal paraphyses absent ● ***Andreaea acutifolia* subsp. *acutifolia***
 7: Leaves less than 3 times as long as wide; leaf blade straight, not or only rarely secund; distal leaf apex bistratose only in patches; perigonal paraphyses present ● ***Andreaea alpina***
- 8(6): Leaves \pm panduriform, 2–3 times as long as wide; sinus strongly contracted; base distinctly sheathing ● ***Andreaea acutifolia* subsp. *acuminata***
 8: Leaves linear to oblong-lanceolate, 4–7 times as long as wide; sinus not or only barely contracted; base only weakly sheathing ● ***Andreaea flabellata***
- 9(5): Marginal cells in the leaf base all isodiametric; leaf base not sheathing; sinus absent ● ***Andreaea mutabilis***
 9: At least some marginal cells in the leaf base \pm sheathing; sinus well-defined 10
- 10(9:) Leaf apex strongly cucullate 11
 10: Leaf apex not cucullate 12
- 11(10) Turgid spores mostly 44–50 μm in diam.; leaves widest above and below the sinus ● ***Andreaea amblyophylla***
 11: Turgid spores mostly 16–29 μm in diam.; leaves widest in the base ● ***Andreaea huttonii***
- 12(10): Leaf apex narrowly acute or acuminate, not rounded; margin incurved, appearing channelled; distal lamina cells unistratose, \pm papillose in patches ● ***Andreaea flabellata***
 12: Leaf apex acute, often rounded; margin plane; distal lamina cells bistratose here and there, smooth, \pm bulging but not papillose ● ***Andreaea flexuosa***

* based on Murray, BM (2006): *Andreaea*. *Flora of Australia* 51, 109.



*Andreaea
nitida*



*Andreaea
alpina*



*Andreaea
acutifolia*
subsp. *acuminata*



*Andreaea
amblyophylla*



*Andreaea
huttonii*



*Andreaea
flabellata*



*Andreaea
flexuosa*



*Andreaea
subulata*



*Andreaea
microvaginata*



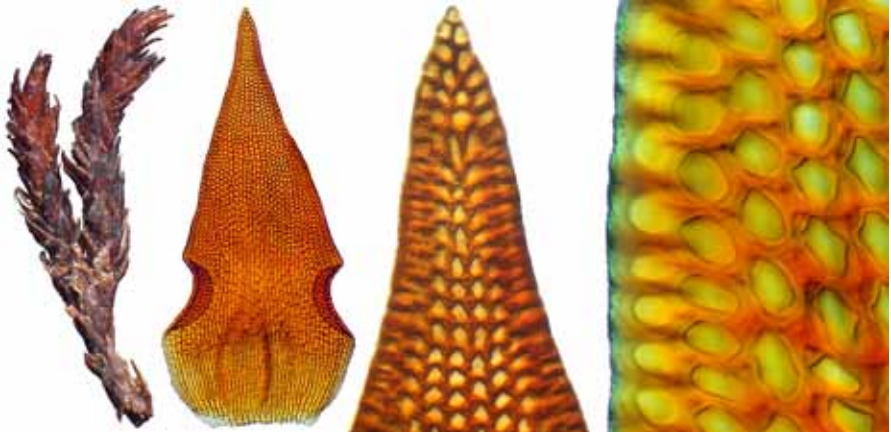
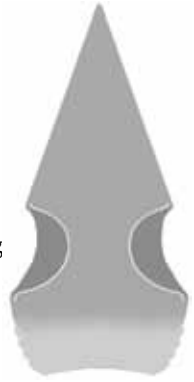
*Andreaea
acutifolia*
subsp. *acutifolia*



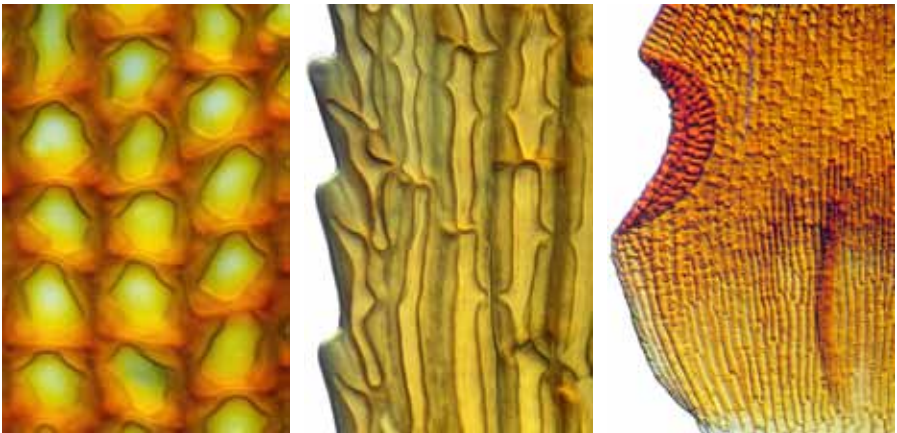
*Andreaea
mutabilis*



*Andreaea
australis*

Andreaea acutifolia subsp. **acuminata** (Mitt.) Vitt**form:** cushions or turves of erect, sparsely branched, blackish red stems**habitat:** acidic rock at high elevations**leaf:** size: 0.5–1.2 mm**shape:** straight, strongly panduriform, widest at or above the sinus**tip:** acute to acuminate**base:** sheathing**costa:** none**border:** not differentiated**margin:** entire above, bluntly toothed near leaf base, plane to incurved**cells:** 10–15 μm , irregular, thick-walled, distal cells often wider than long**capsule:** 0.5 mm; oval, dark, opening by four valves that bulge outward when dry; pseudopodium undeveloped; spores 16–25 μm in diam.**notes:** subsp. *acutifolia* has mostly falcate, weakly panduriform leaves with distal cells longer than wide, and spores 32–50 μm in diam.

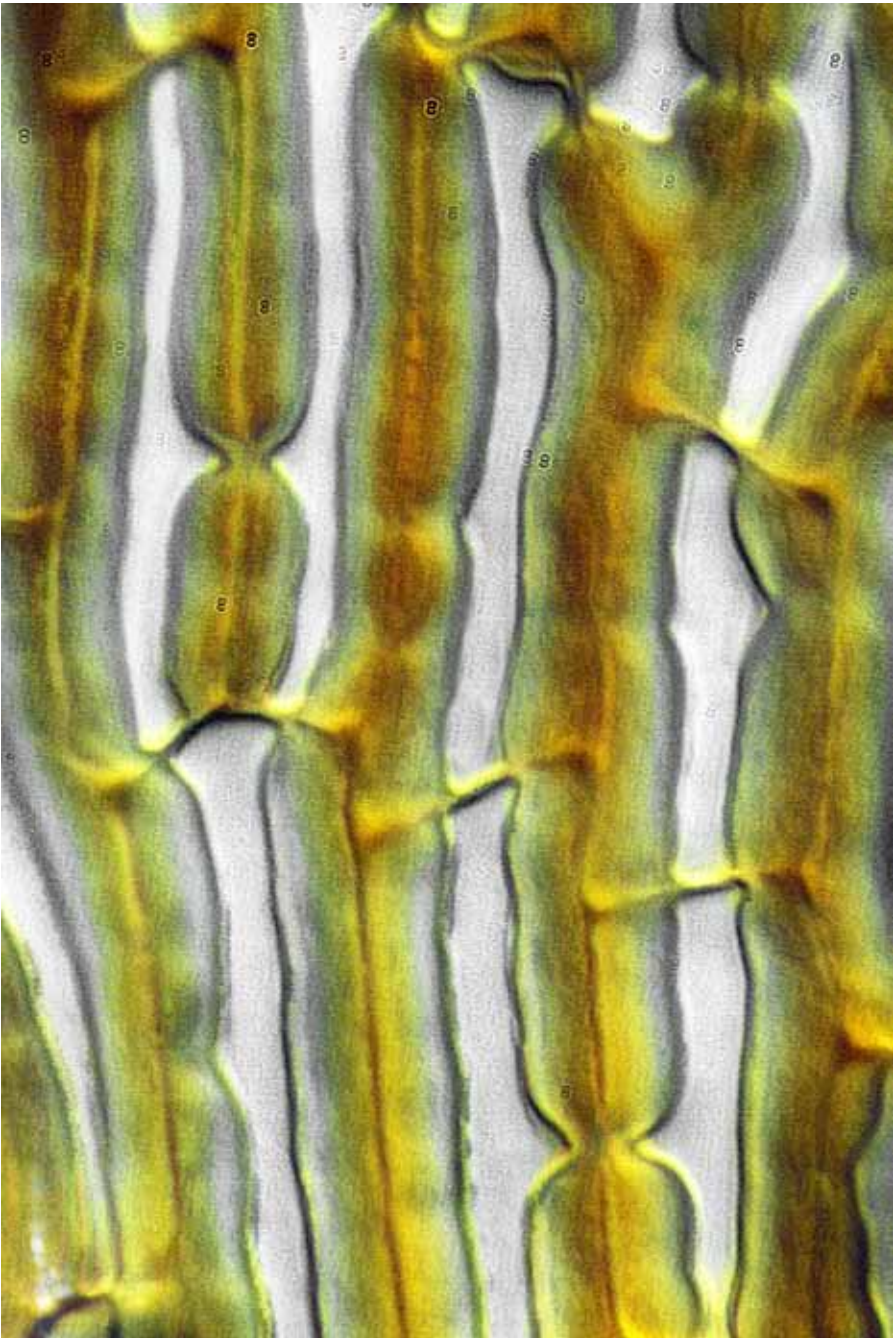
vegetative shoot (dry), panduriform leaf outline, leaf apex, and margin midleaf

 1 mm, 0.1 mm, 50 μm , 10 μm


distal leaf cells, leaf margin near base, and leaf basal angle

 10 μm , 10 μm , 50 μm

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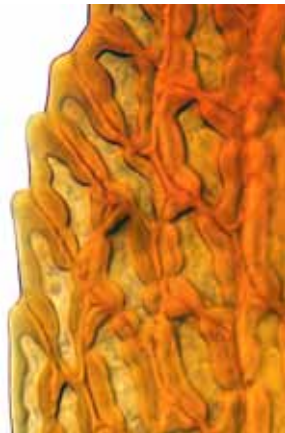
Andreaea acutifolia subsp. *acuminata* cells near the leaf base
10 μm

continued next page


Andreaea acutifolia Hook.f. & Wilson subsp. **acutifolia****form:** cushions or turves of erect, sparsely branched, blackish red stems**habitat:** acidic rock at high elevations**leaf:** size: 0.6–1.2 mm*shape:* falcate, weakly panduriform, widest near the insertion*tip:* acute to acuminate*base:* sheathing*costa:* none*border:* not differentiated*margin:* entire above, bluntly toothed near leaf base, plane to incurved*cells:* 10–15 μm , irregular, thick-walled, distal cells often longer than wide**capsule:** 0.5 mm, oval, dark, opening by four valves that bulge outward when dry; pseudopodium undeveloped; spores 16–25 μm in diam.**notes:** *Andreaea acuminata* has mostly straight, strongly panduriform leaves with distal cells wider than long, and spores 16–25 μm in diam.

vegetative habit, vegetative shoots (2), leaf outline, and leaf apex





margin above shoulder, margin at shoulder, and margin below shoulder



continued next page

Andreaea alpina Hedw.

form: tufted erect stems 10–80 mm long, often dark reddish, blackish below
habitat: wet acidic rocks or cliffs in alpine heath and grassland, to 1600 m

leaf: size: 1.0–1.3 × 0.4–0.5 mm

shape: ± panduriform, straight, upper third to half broadly triangular

tip: acuminate

base: sheathing, cells rectangular / oblique

costa: none

border: not differentiated

margin: entire above, crenulate or toothed below, plane to ± incurved

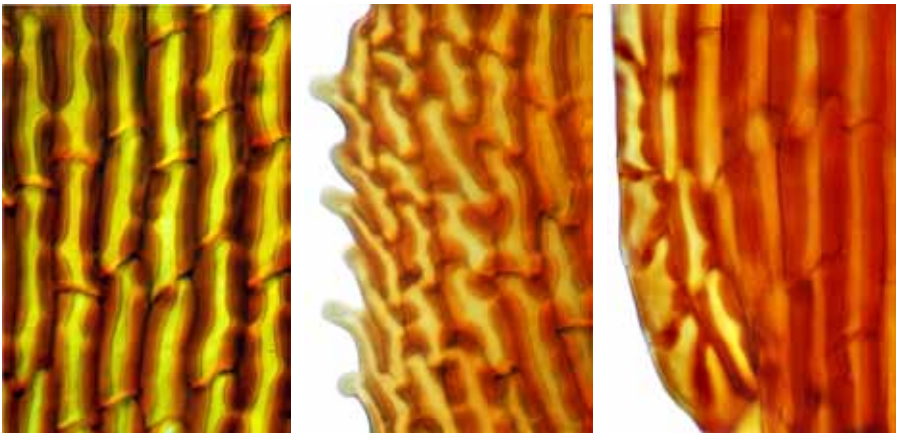
cells: 20 × 10 μm above, elsewhere heterogeneous (marginally isodiametric, basally linear, midleaf rectangular), thick-walled, smooth

capsule: 1 mm, elliptic to ovate, emergent to excurrent, opening by 4 dark-pigmented valves, fused at their apices, that bulge outward upon drying



vegetative shoots (dry) (5), leaf outline, and leaf apex

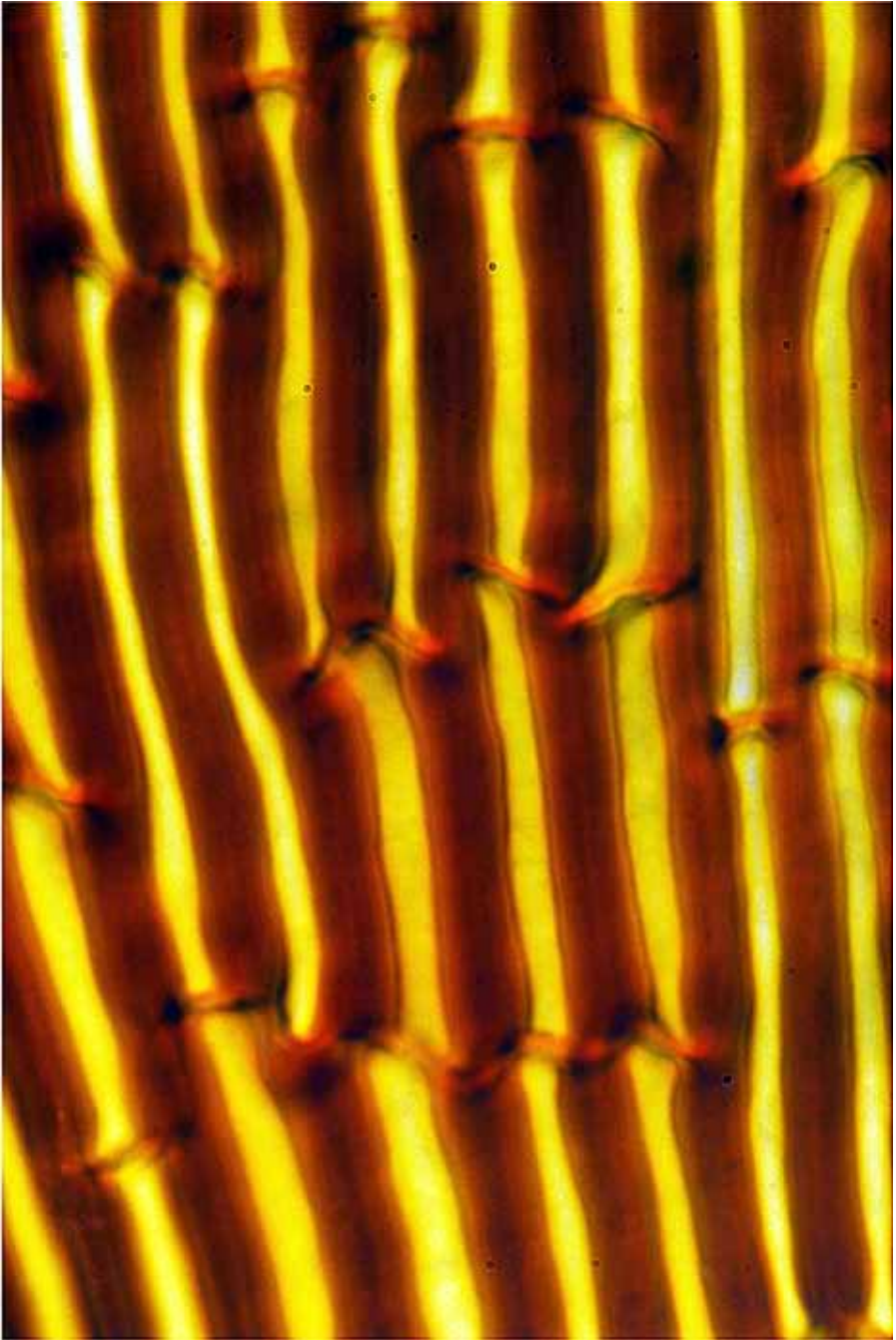
■ 5 mm, ■ 1 mm (3), ■ 1 mm, ■ 0.1 mm, ■ 10 μm



basal lamina cells, toothed-crenulate margin below midleaf, and leaf basal angle

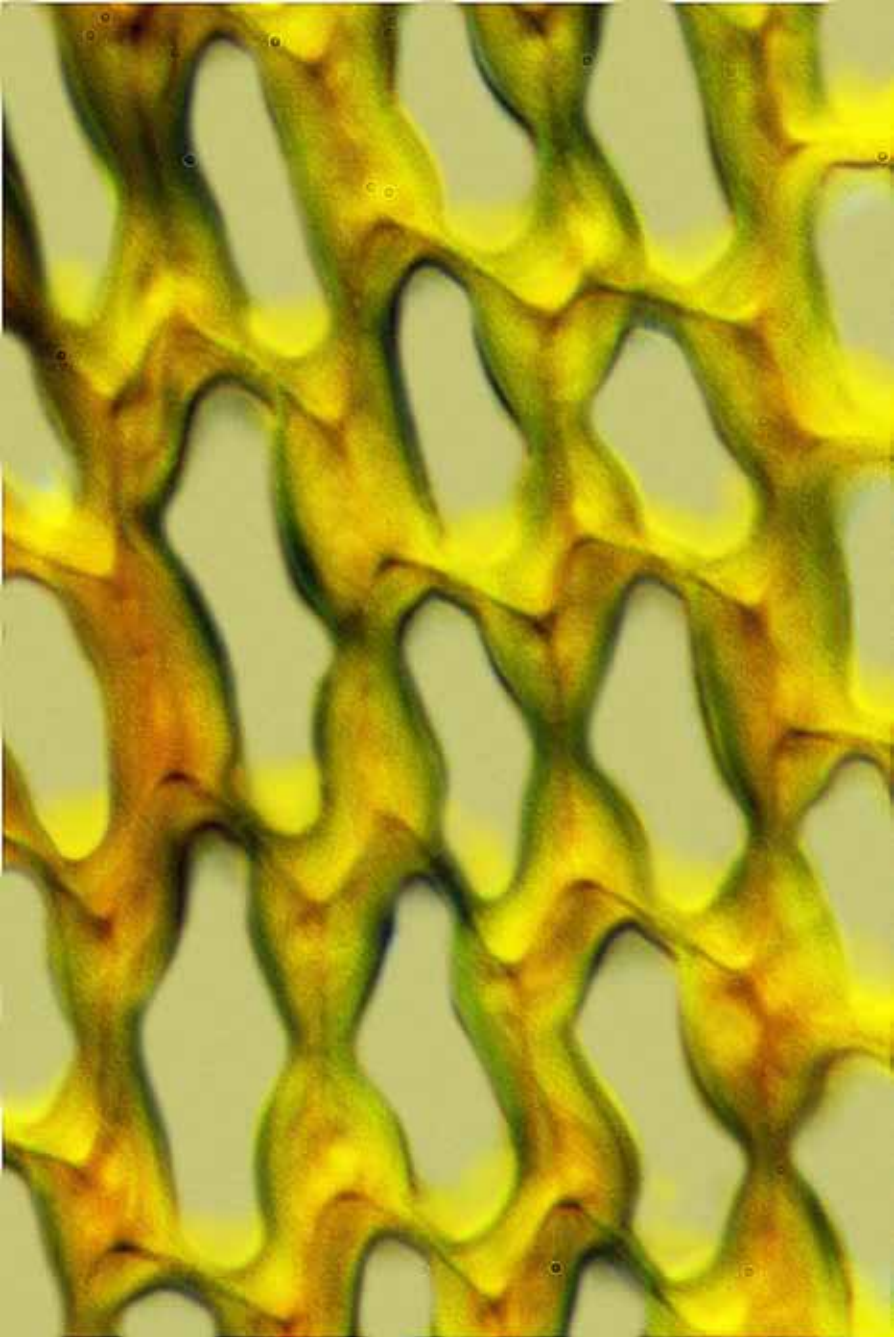
■ 10 μm, ■ 10 μm, ■ 10 μm

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Andreaea alpina cells in midbase
10 μm

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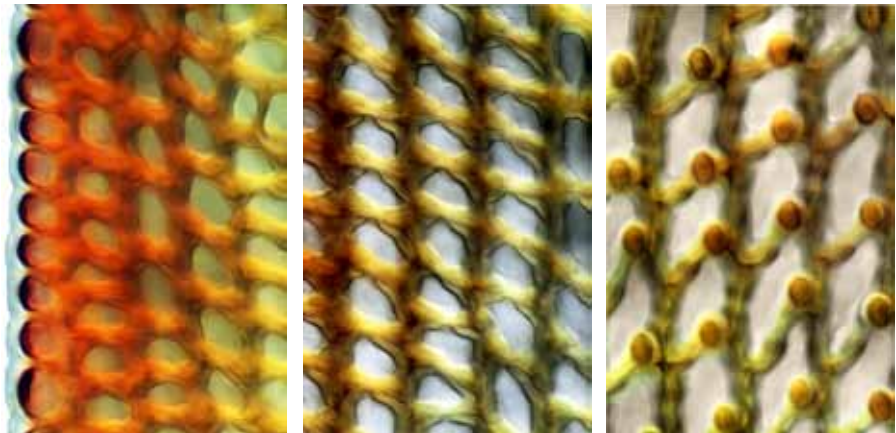


Andreaea alpina upper lamina cells
10 μm

Andreaea amblyophylla Müll.Hal. ex Broth.**form:** tufts or mats of erect stems, to 10 mm tall, dark red, blackish below**habitat:** siliceous rock in alpine scrub and grassland, to 1600 m elevation**leaf:** size: 0.6–1.4 × 0.2–0.4 mm, distally unistratose**shape:** lanceolate, oblong-lanceolate, or panduriform, straight, ± cucullate**tip:** acute to ± rounded, usually cucullate**base:** sheathing, alar cells not differentiated**costa:** none**border:** not differentiated**margin:** entire, incurved**cells:** 20 × 10 μm above, irregular, thick-walled, distal cells unipapillose**capsule:** 1 mm, elliptic to ovate, emergent to excurrent, opening by 4 dark-pigmented valves, fused at their apices, that bulge outward upon drying; spores 44–50 μm in diam.

vegetative and fertile shoots (dry), leaf outline, leaf apex, and leaf subapex

1 mm, 1 mm (2), 0.1 mm, 50 μm, 50 μm



margin midleaf, lamina cells midleaf, and surface papillae midleaf

10 μm, 10 μm, 10 μm

continued next page



Andreaea amblyophylla mature capsules showing valves (dry)
0.5 mm

Andreaea australis F.Muell. ex Mitt.**form:** dense cushions, erect, little branched, purple or blackish red**habitat:** acidic alpine rock, usually damp or wet, sometimes aquatic**leaf:** size: 0.5–2 mm*shape:* lanceolate, widest below midleaf, ± curved*tip:* acute, sometimes ± mucronate*base:* basal cells rectangular*costa:* wide but not filling the blade, projecting abaxially, excurrent*border:* not differentiated*margin:* entire, narrowly reflexed*cells:* 10–15 μm , subquadrate, thick-walled, smooth to ± papillose**capsule:** 0.5 mm, oval, opening by four valves that bulge outward when dry; pseudopodium short

vegetative shoots (dry) (2), leaf outline, leaf apex, and margin midleaf

 1 mm, 1 mm, 0.1 mm, 50 μm , 10 μm


cells midleaf, costa midleaf, and leaf basal angle

 10 μm , 10 μm , 50 μm

continued next page

Andreaea flabellata Müll.Hal.

form: dense cushions of erect, branched, dark red stems, to 15 mm tall
habitat: exposed rock in heath-, grass-, and open woodland, to 1900 m

leaf: size: 0.8–1.5 × 0.2–0.3 mm

shape: linear to oblong-lanceolate, ± flexuose, concave or channelled

tip: acute to narrowly acuminate, not broadly rounded

base: not or only weakly sheathing

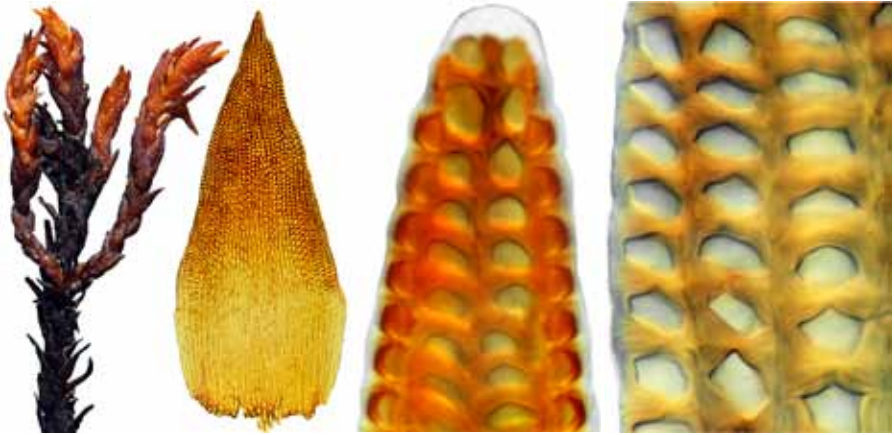
costa: none

border: not differentiated

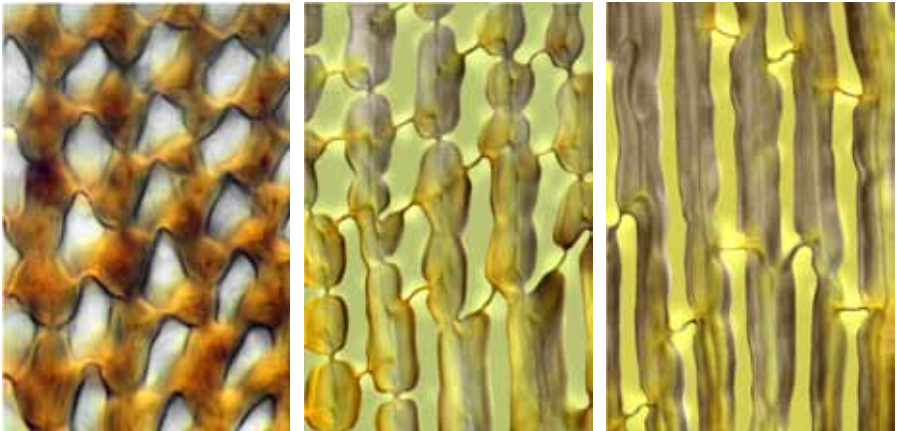
margin: entire to ± crenulate, ± incurved on both sides

cells: 10 μm, distally isodiametric-irregular, thick-walled and smooth or weakly papillose; proximally rectangular, thin-walled and smooth

capsule: 1 mm, elliptic to ovate, excurrent, opening by 4 dark-pigmented valves, fused at their apices, that bulge outward upon drying; viable spores 21–35 μm in diam.



vegetative shoot, (dry), leaf outline, leaf apex, and margin midleaf
 ■ 1 mm, ■ 0.1 mm, ■ 10 μm, ■ 10 μm



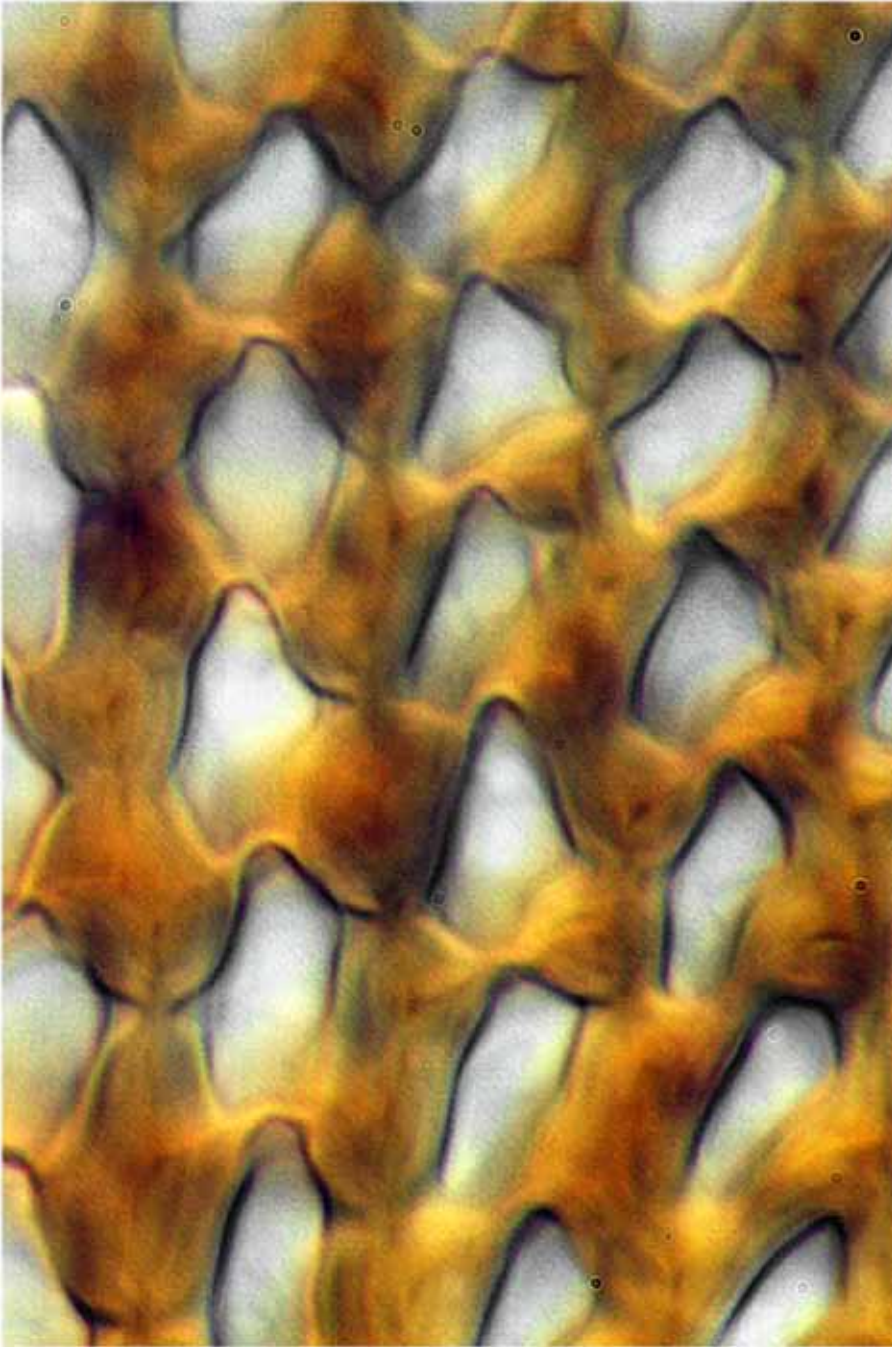
cells of upper leaf, midleaf, and basal leaf (partly diagrammatic)
 ■ 10 μm, ■ 10 μm, ■ 10 μm

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Andreaea flabellata vegetative shoot (dry) and leaf whole-mount
1 mm, 0.1 mm

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Andreaea flabellata upper leaf cells
10 μm

Andreaea flexuosa R.Br.bis

form: dense velvety turfs of erect, dark red, sparsely branched stems, to 9 mm
habitat: rock in exposed heath-, shrub- and grassland, to 1800 m elevation

leaf: size: 1.0–2.4 × 0.2–0.3 mm

shape: lanceolate to narrowly lanceolate, ± flexuose when moist

tip: acute, ± rounded, often broken off

base: not or only weakly sheathing

costa: none

border: not differentiated

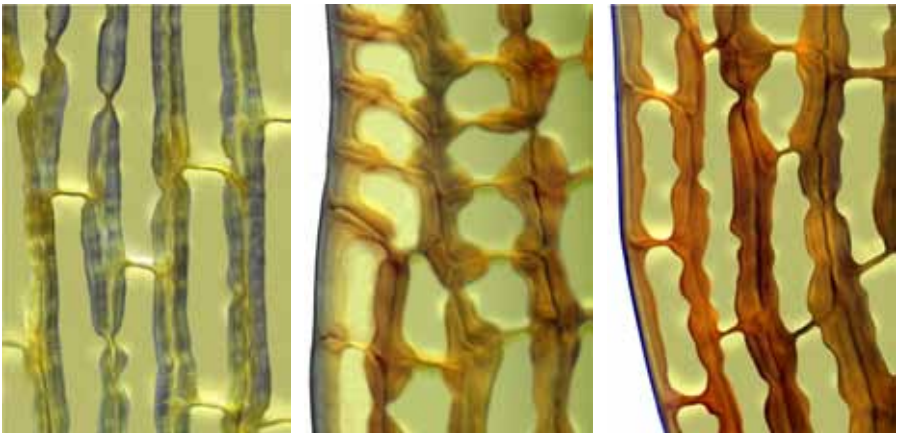
margin: entire, plane above, ± incurved below

cells: 10 μm, irregular-isodiametric above, rectangular and porose below, thick-walled, smooth

capsule: 1 mm, elliptic to ovate, excurrent, opening by 4 dark-pigmented valves, fused at their apices, that bulge outward upon drying; spores 18–22 μm in diam.



vegetative and fertile shoot (tips only, dry), leaf outlines (3), and lamina cells at midleaf
 1 mm, 1 mm, 0.5 mm (3), 10 μm



cells near leaf base, margin just above basal angle, and cells of basal angle
 10 μm, 10 μm, 10 μm

continued next page



Andreaea flexuosa margin near the leaf base
10 μm

Andreaea huttonii R.Br.bis

form: tufts or mats of erect stems, to 12 mm tall, dark red, blackish below
habitat: siliceous rock in alpine scrub and grassland, to 1600 m elev.

leaf: size: 0.6–2.0 × 0.2–0.4 mm, distally unistratose

shape: linear-lanceolate, straight, cucullate

tip: acute to ± rounded, strongly cucullate

base: sheathing, alar cells not differentiated

costa: none

border: not differentiated

margin: entire, incurved

cells: 20 × 10 μm above, irregular, thick-walled, distal cells unipapillose

capsule: 1 mm, elliptic to ovate, emergent to excurrent, opening by 4 dark-pigmented valves, fused at their apices, that bulge outward upon drying; spores 13–18 μm in diam.

notes: similar to *Andreaea amblyophylla*, but differs in having much smaller spores, fewer papillae, and glossier leaves; an Australasian endemic



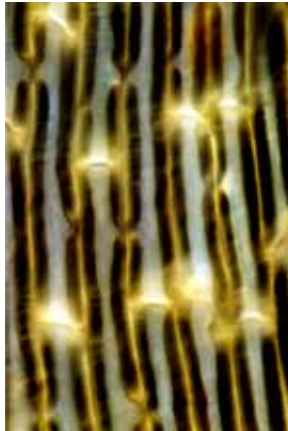
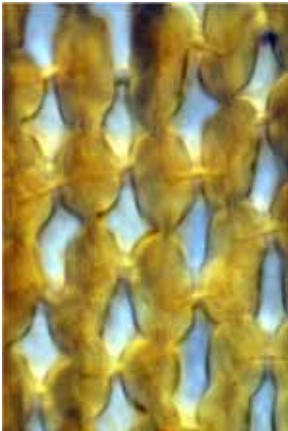
vegetative shoot, leaf outline, leaf apex, and margin at midleaf

1 mm,

1 mm,

50 μm,

10 μm



cells of upper leaf, cells near middle of leaf base, and leaf basal angle

10 μm,

10 μm,

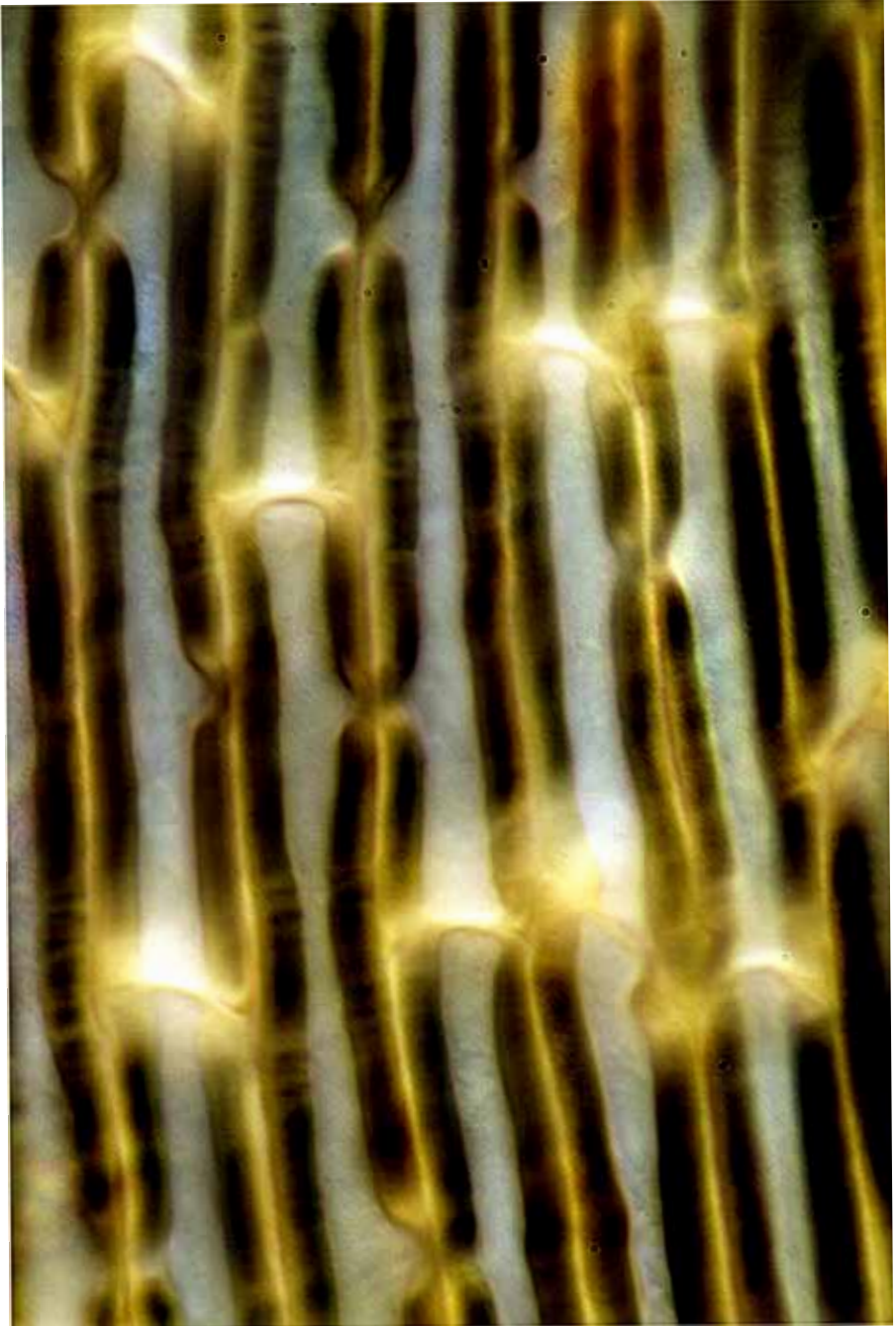
10 μm

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Andreaea huttonii vegetative shoots (dry)
1 mm

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Andreaea huttonii cells near leaf base
10 μ m

Andreaea microvaginata Müll.Hal.

form: dense cushions of erect, red-orange, falcate-secund shoots, to 20 mm
habitat: soil or acidic rock in heath-, shrub-, grassland, or forest to 1800 m

leaf: size: 0.8–1.2 × 0.2–0.3 mm

shape: an oblong/ovate base tapering gradually to a falcate tip

tip: acute, minutely rounded

base: sheathing

costa: distally ± filling the lamina, proximally weak or absent

border: not differentiated

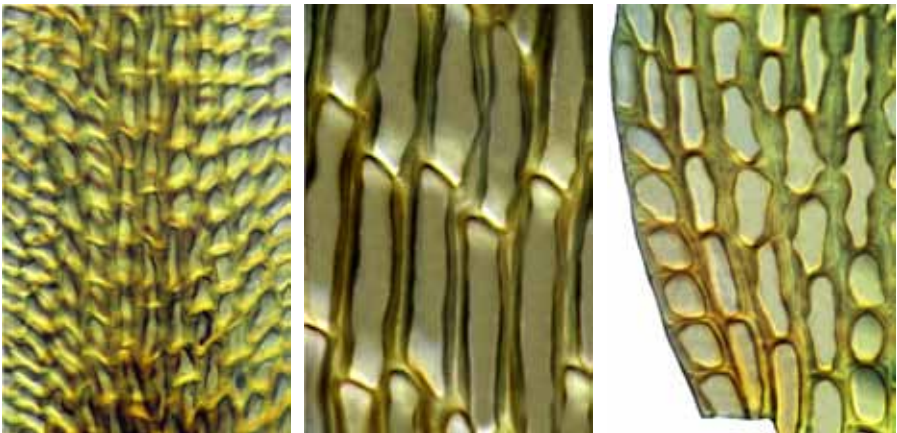
margin: ± crenulate/toothed proximally, entire distally, plane to incurved

cells: 10–60 × 10 μm, heterogeneous, mostly thick-walled, smooth

capsule: 1 mm, elliptic to ovate, emergent to excurrent, opening by 4 dark-pigmented valves, fused at their apices, that bulge outward upon drying; spores 20–35 μm in diam.



falcate-secund vegetative shoots (3), leaf outline, leaf apex, and margin at mid-sheath
 1 mm (3), 0.1 mm, 50 μm, 10 μm



cells near base of weak costa, cells at midbase, and leaf basal angle
 50 μm, 10 μm, 10 μm

Andreaea mutabilis Hook.f. & Wilson

form: dark-pigmented or blackish cushions or turfs at high elevation
habitat: acidic rock

leaf: size: 0.8–1.2 × 0.4 mm

shape: ovate or oblong-lanceolate to ± panduriform, straight or falcate

tip: acute or obtuse, not cucullate

base: undifferentiated, not sheathing

costa: absent

border: not differentiated

margin: entire to ± toothed, incurved, plane at only the tip

cells: 10 μm, isodiametric, irregular (elongated toward base), thick-walled, papillose to smooth

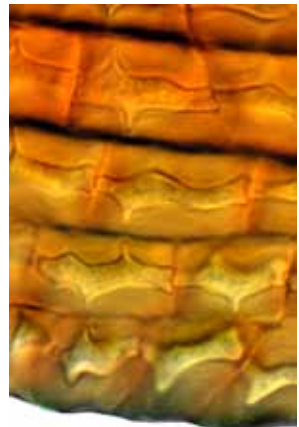
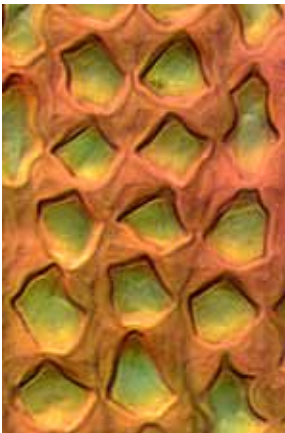
capsule: 0.5 mm, opening by four valves that bulge outward when dry; pseudopodium 0.5 mm

notes: common in alpine areas; *Andreaea acutifolia* var. *acutifolia* too is ecostate, but has long (not short) cells along the basal margin of its leaf



fertile habit, capsules wet and dry, leaf outline, and leaf apex

0.5 mm, 0.5 mm (2), 0.1 mm, 10 μm



cells midleaf, margin midleaf, and margin lower leaf

10 μm, 10 μm, 10 μm

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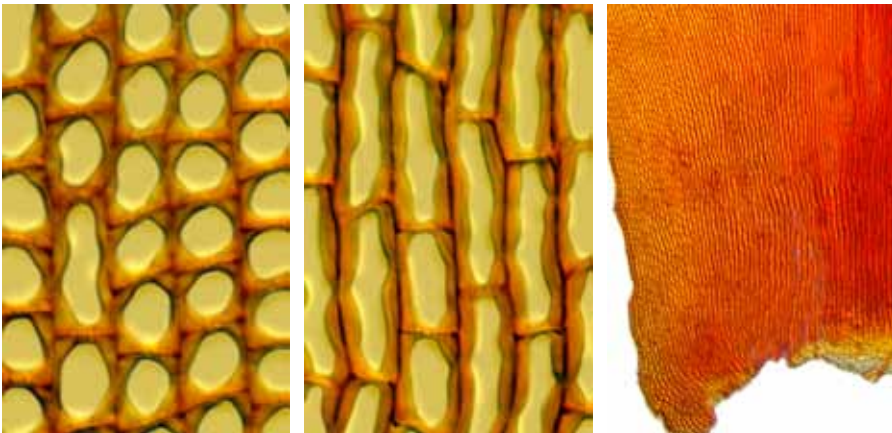


Andreaea mutabilis capsules moist and closed (left) and dry and open (right)
0.1 mm

continued next page

Andreaea nitida Hook.f. & Wilson**form:** tufted, erect stems, the leaves dark red to nearly black**habitat:** shaded, moist to dripping rock, montane to subalpine**leaf:** size: 1.0–4.0 mm long*shape:* oblong, obovate, orbicular or lingulate*tip:* broadly acute to obtuse, sometimes mucronate*base:* sheathing, alar region not differentiated; juxtacostal cells elongate*costa:* broad, reaching to midleaf, irregularly forked, spurred, or branched*border:* not differentiated*margin:* entire, plane to broadly reflexed; marginal cells isodiametric*cells:* marginal and upper cells 10 μm , isodiametric, thick-walled, smooth**capsule:** 0.5 mm, oval, opening by four valves that bulge outward when dry; capsule base shorter than the valves; pseudopodium short

vegetative shoot (dry), leaf outline, leaf apex, and margin midleaf

 1 mm, 1 mm, 10 μm , 10 μm


cells upper leaf, lower juxtacostal cells, and leaf basal angle

 10 μm , 10 μm , 100 μm

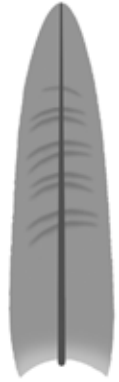
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Andreaea subulata Harv.**form:** dense tufts or cushions of crowded, erect, dark red stems**habitat:** rock at montane to subalpine elevation**leaf:** size: 1.5–2.0 × 0.3–0.4 mm*shape:* subulate from an oblong base, with no sinus, straight to falcate*tip:* narrowly acute or acuminate, not rounded*base:* sheathing; basal cells longer than the laminal cells, up to $50 \times 10 \mu\text{m}$ *costa:* ± filling the subulate distal half of the leaf*border:* not differentiated*margin:* entire, plane to incurved*cells:* $15 \times 10 \mu\text{m}$, ± isodiametric, thick-walled, smooth**capsule:** 0.5 mm, oval, opening by four valves that bulge outward when dry;
capsule base shorter than the valves; pseudopodium short

vegetative shoots (moist) (3), leaf outlines (2), leaf apex, and leaf subapex
 1 mm, 1 mm (2), 0.1 mm (2), 10 μm , 50 μm



margin midleaf, costa midleaf, and leaf basal angle
 50 μm , 50 μm , 50 μm

Atrichum androgynum (Müll.Hal.) A.Jaeger**form:** robust, loose tufts, dull yellow-green or brown**habitat:** soil in damp forests, often near streams**leaf:** size: 7–10 × 1–2 mm*shape:* lingulate to lanceolate, undulate, crisped when dry, toothed abaxially*tip:* obtuse*lamellae:* 3–6, sinuose, 2–5 rows of cells, the uppermost row entire*base:* basal cells rectangular and thick-walled, otherwise little differentiated*costa:* reaching the apex, spinose on the back above*border:* narrow*margin:* bistratose and the teeth often double, undulate*cells:* 18–20 μm, isodiametric, thick-walled, smooth**capsule:** 3–7 × 0.5–1.0 mm; slightly curved, subcylindric; seta 15–20 mm, sometimes multiple**notes:** readily separated from other austral Polytrichaceae by its leaves that are crisped when dry and have only 3–4 low lamellae

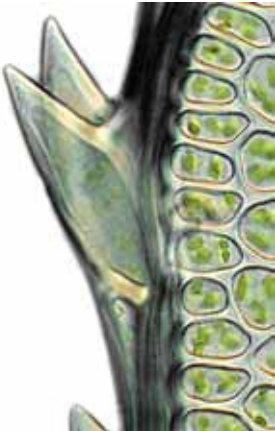
vegetative habit, fertile shoot, leaf outline, and toothed leaf apex

5 mm,

5 mm,

1 mm,

50 μm



double marginal teeth, lamellae (top view and upended whole-mount), capsule (dry) (2)

50 μm,

50 μm,

10 μm,

1 mm,

0.5 mm



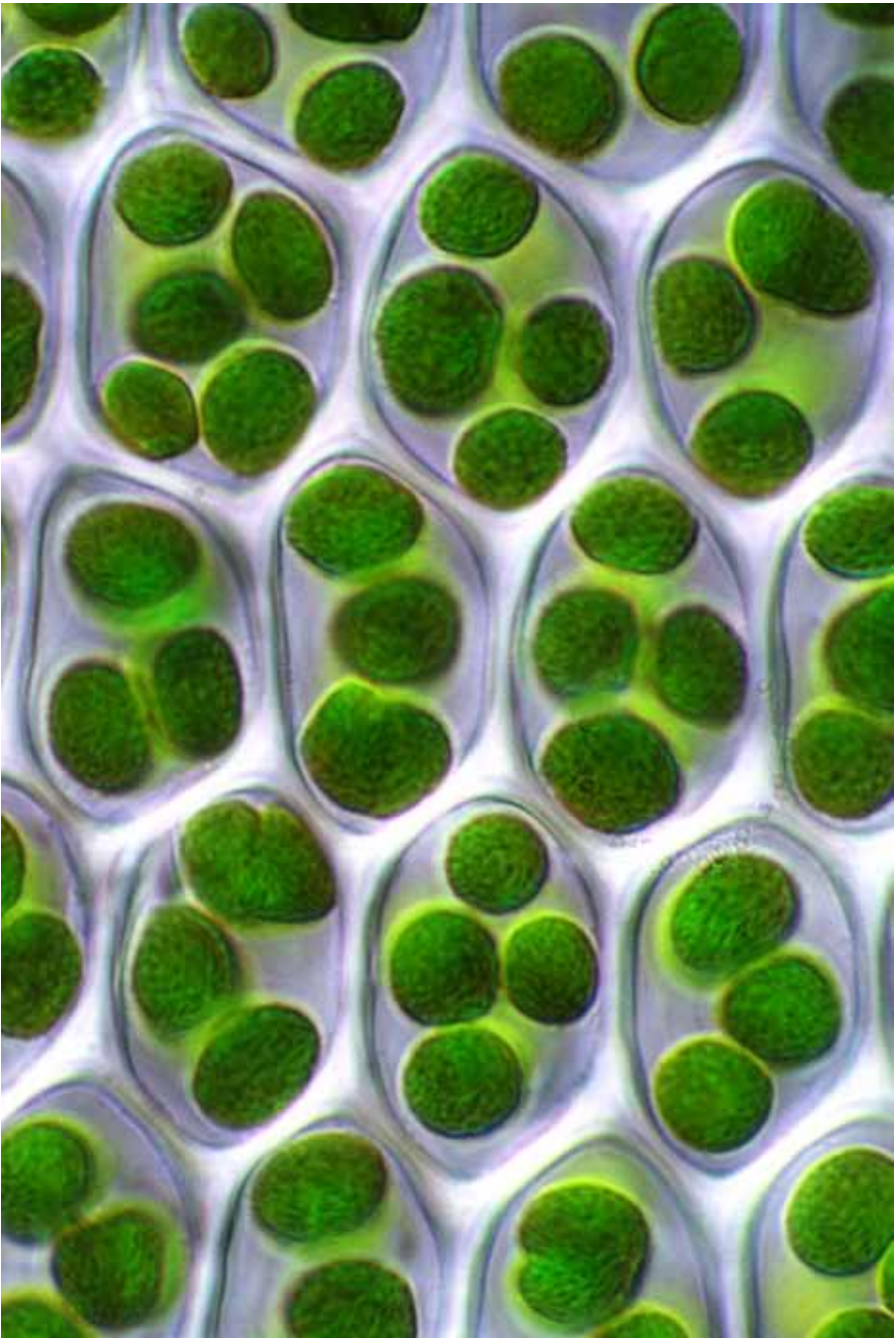
Atrichum androgynum vegetative habit
5 mm

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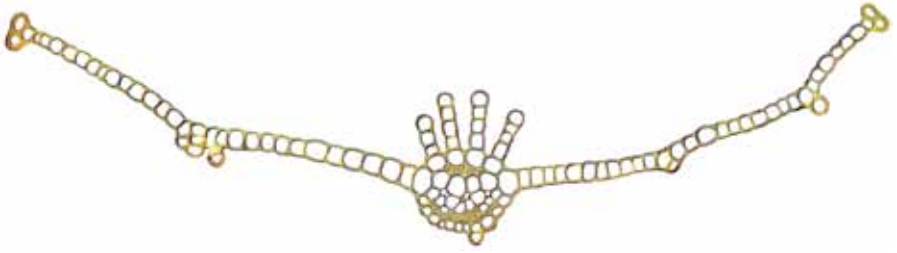
Atrichum androgynum vegetative shoot (moist)
— mm

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Atrichum androgynum leaf cells with chloroplasts
10 μ m

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Atrichum androgynum leaf, costa, and margin cross-sections
50 μm (top), 10 μm (middle), 10 μm (bottom)

continued next page

Dawsonia superba var. **pulchra** (Wijk) Zanten**form:** tall (to 400 mm), gregarious, tomentose below, the stems 3-ribbed**habitat:** soil in shaded forests, especially damp clay banks along tracks and roads**leaf:** size: 25–35 × 2.5–3.5 mm*shape:* linear-subulate*tip:* acute arista*lamellae:* 60–90, each 3–6 cells high*base:* of sheathing base narrowly linear, thin-walled*costa:* excurrent as a toothed arista*border:* not differentiated*margin:* spinulose-serrate, plane but incurved when dry*cells:* 25–80 μm , rectangular, firm-walled, smooth**capsule:** 7–8 mm, ellipsoid, horizontal, flattened when mature; seta 10–35 mm, stout; peristome of densely tufted hairs**notes:** large enough to be mistaken for a pine seedling

vegetative habit, leaf insertions, leaf outline, and immature and mature capsules

30 mm, 1 mm, 1 mm, 1 mm, 1 mm



spinose margin midleaf, marginal spine midleaf, and leaf lamella

 0.5 mm, 100 μm , 10 μm

Dendrologotrichum tongariroense (Colenso) Tangney

form: solitary to tufted, erect, branched, dendroid stems, tomentose below
habitat: soil in montane forest

leaf: size: 5–12 mm

shape: lanceolate-subulate from a wide oblong sheathing base

tip: blunt, strongly toothed

lamellae: 30–40 rows, each 3–4 cells high

base: sheath cells narrowly linear

costa: narrow below, widened above, toothed at the back

border: not differentiated

margin: bistratose and sharply toothed, plane

cells: 8–10 μm , subquadrate, thick-walled, smooth

capsule: 5–6 mm, subcylindric, \pm curved, erect to inclined, smooth, brown; seta 30–50 mm, \pm flexuose, red; operculum rostrate; calyptra cucullate, slightly hairy; peristome teeth 32, red, darker toward the centre, on a tall basal membrane



vegetative habit, vegetative shoot, leaf outline, and leaf apex
 10 mm, 5 mm, 1 mm, 50 μm

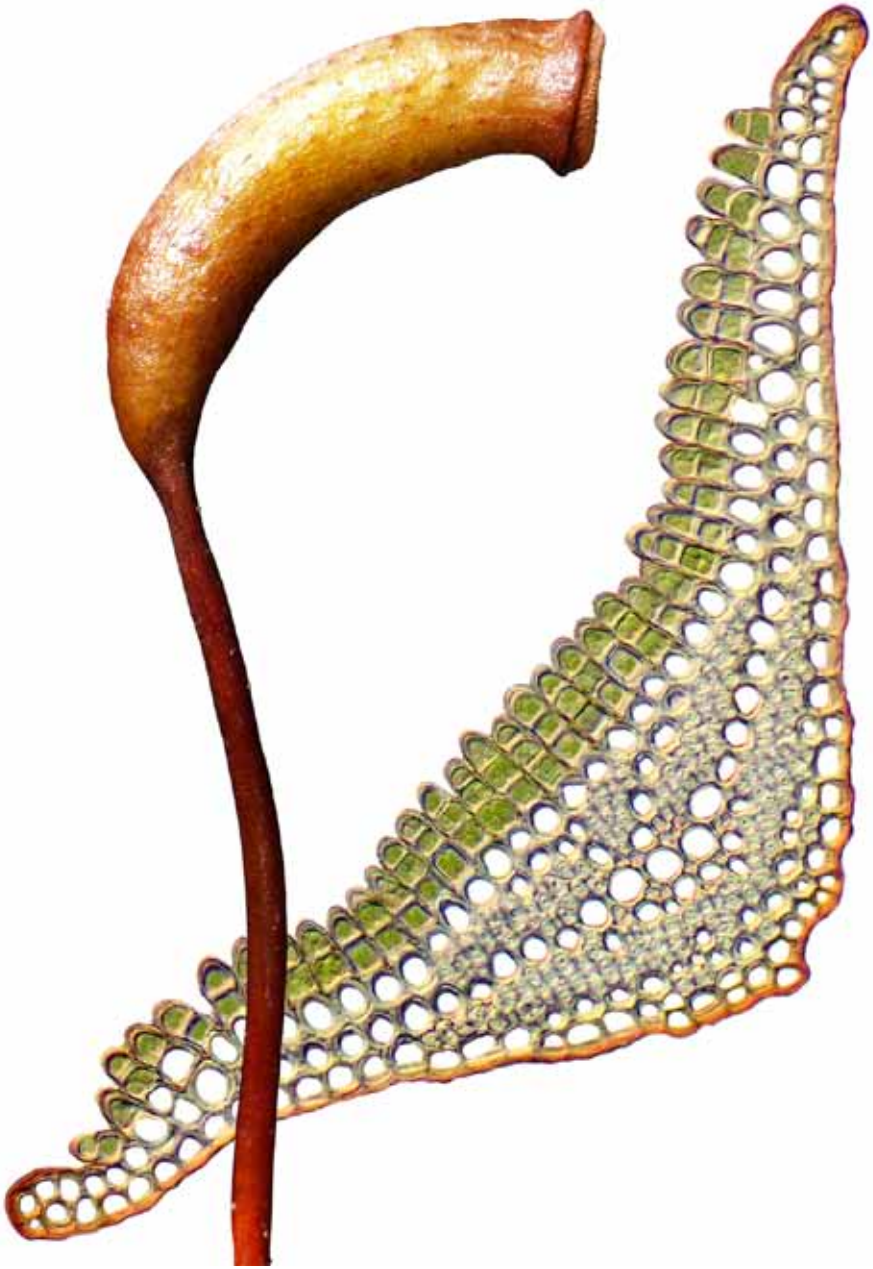


capsule epiphragm, margin midleaf, leaf xs, and lamella wm (upended)
 1 mm, 50 μm , 10 μm , 10 μm



Dendroligotrichum tongariroense vegetative habit
10 mm

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Dendroligotrichum tongariroense leaf cross-section and mature capsule
50 μ m (section), 1 mm (capsule)

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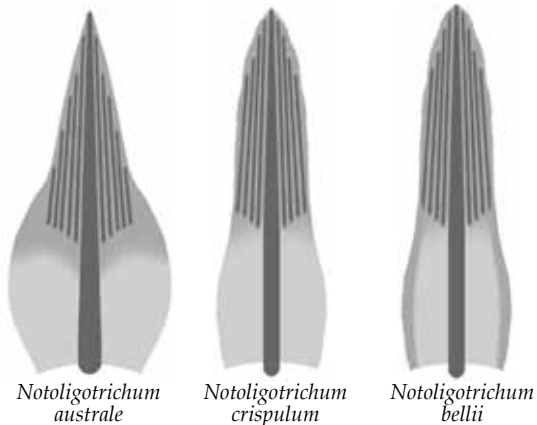
Dendroligotrichum tongariroense perigonium
1 mm

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Key* to the New Zealand species of *Notoligotrichum* (3)

- 1 Leaf margin undulate above; lamellae 40 or fewer; peristome absent..... ● ***Notoligotrichum bellii***
- 1: Leaf margin not undulate above; lamellae 40–70; peristome present 2
- 2(1:) Leaf margin mostly entire; lamellae 40–45, of 5–10 rows of cells..... ● ***Notoligotrichum australe***
- 2: Leaf margin mostly toothed; lamellae 60–70, of 3 rows of cells..... ● ***Notoligotrichum crispulum***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 36.



Notoligotrichum australe (Hook.f. & Wilson) G.L.Sm.

form: cushion-forming, erect, comose, simple, radiculose below

habitat: soil, usually in exposed scrub above tree-line

leaf: size: 4–5 × 2.0–2.5 mm

shape: narrowly triangular from an ovate sheath

tip: acute, incurved

base: sheath cells short-rectangular

lamellae: 40–45, crowded, 4–5 rows tall, the terminal cell papillose

costa: excurrent in a short, red point

border: a few rows of hyaline cells on the margin of the sheath

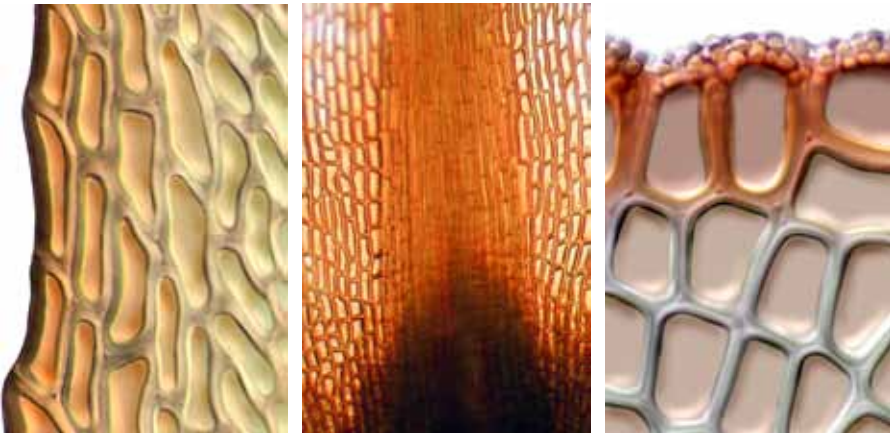
margin: entire, plane

cells: 12 μm long, rectangular, firm-walled, smooth

capsule: 3–4.5 mm, ovoid, symmetrical, small-mouthed, pale brown;
seta 18–25 mm, straw-coloured, ± flexuose; operculum rostrate;
calyptra smooth, inflated, bristle-tipped; peristome of 16 long teeth
alternating with 16 short or rudimentary teeth



vegetative shoot (dry), leaf outline, capsule, epiphragm loss, and margin with lamellae
 1 mm, 1 mm, 1 mm, 0.5 mm (2), 10 μm



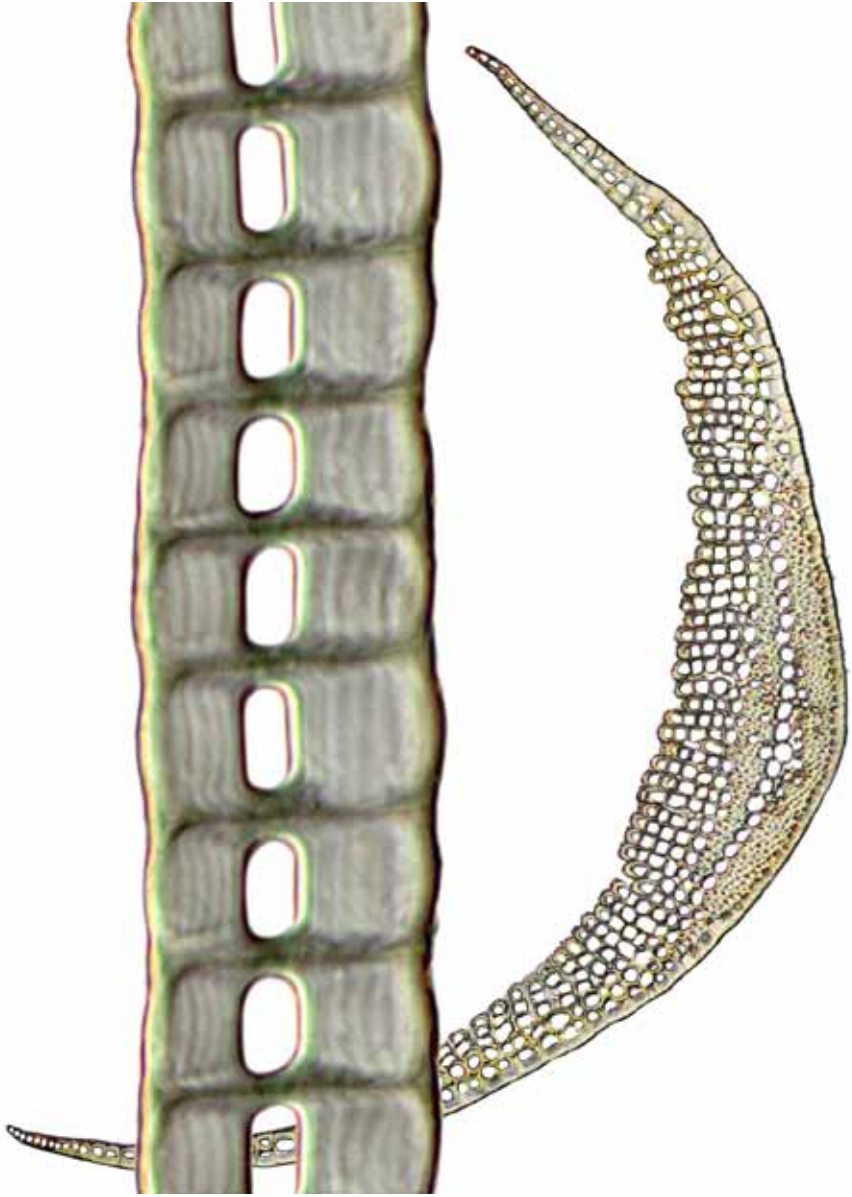
margin midleaf, costa near leaf base, and papillose margin of lamella
 10 μm, 50 μm, 10 μm

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Notoligotrichum australe capsules with calyptrae
1 mm

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Notoligotrichum australe leaf cross-sections, without lamellae (left) and with (right)
10 μm , 10 μm

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Notoligotrichum bellii (Hook.f. & Wilson) G.L.Sm.

form: scattered, erect, unbranched stems, brownish, to 50 mm tall

habitat: soil in moist sites

leaf: size: 4–5 × 2.0–2.5 mm

shape: oblong from a weakly sheathing base, unistratose, crisped when dry

tip: obtuse

base: basal cells short- to long-rectangular, not hyaline at the margin

lamellae: 30–40, ± sinuose, 2–3 rows of cells, the terminal cell ± papillose

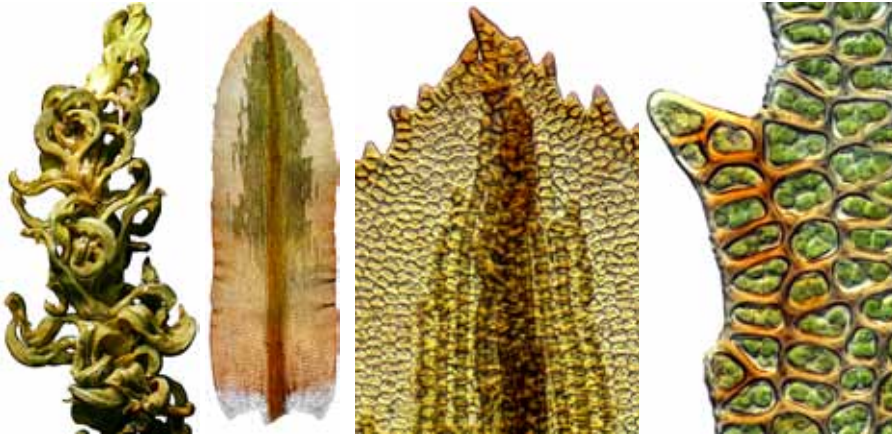
costa: percurrent to failing below the apex, ± toothed on the back above

border: not differentiated

margin: irregularly serrulate above, entire below, ± undulate

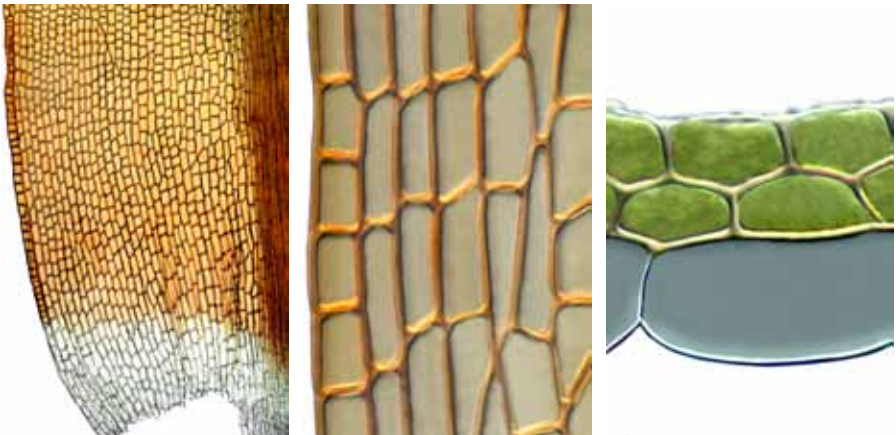
cells: 20–25 μm, subquadrate or oval, variably thick-walled, smooth

capsule: 4 mm, ovoid, symmetric or nearly so, short-necked, erect, exserted, brown; mouth wide and oblique; seta to 15 mm, stout, curved; peristome none



vegetative shoot (dry), leaf outline, leaf apex, and margin midleaf

■ 1 mm, ■ 1 mm, ■ 50 μm, ■ 10 μm



leaf basal angle, margin near leaf base, and lamella

■ 100 μm, ■ 50 μm, ■ 10 μm

continued next page



Notoligotrichum bellii leaf outline
1 mm

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Notoligotrichum crispulum (Hook.f. & Wilson) G.L.Sm.

form: gregarious to loosely tufted, dull green or brown, simple or branched
habitat: soil in shaded sites

leaf: size: 5–8 × 1.7–2.7 mm

shape: oblong-lanceolate from an oblong, ± sheathing base

tip: acute

lamellae: 60–70, 2–5 rows high, the uppermost row papillose

base: sheath cells short-rectangular to subquadrate

costa: percurrent to excurrent, toothed at the back

border: not differentiated

margin: ± toothed throughout, plane

cells: lamina cells 12–15 μm, isodiametric, thick-walled, smooth

capsule: 4.5–7 mm, oblong-ovate, erect to inclined, narrow-mouthed; no apophysis; seta 20–35 mm, stout, straw-coloured; calyptra smooth, inflated, reddish, bristle-tipped; operculum finely curved-rostrate; peristome teeth 32, short



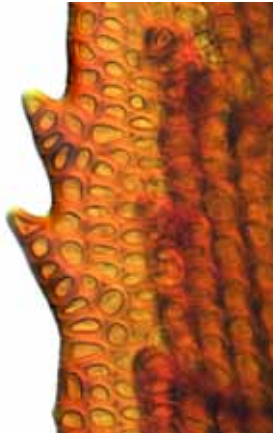
male gametophores, vegetative shoot (moist), capsule, and leaf outline

10 mm,

10 mm,

1 mm,

1 mm

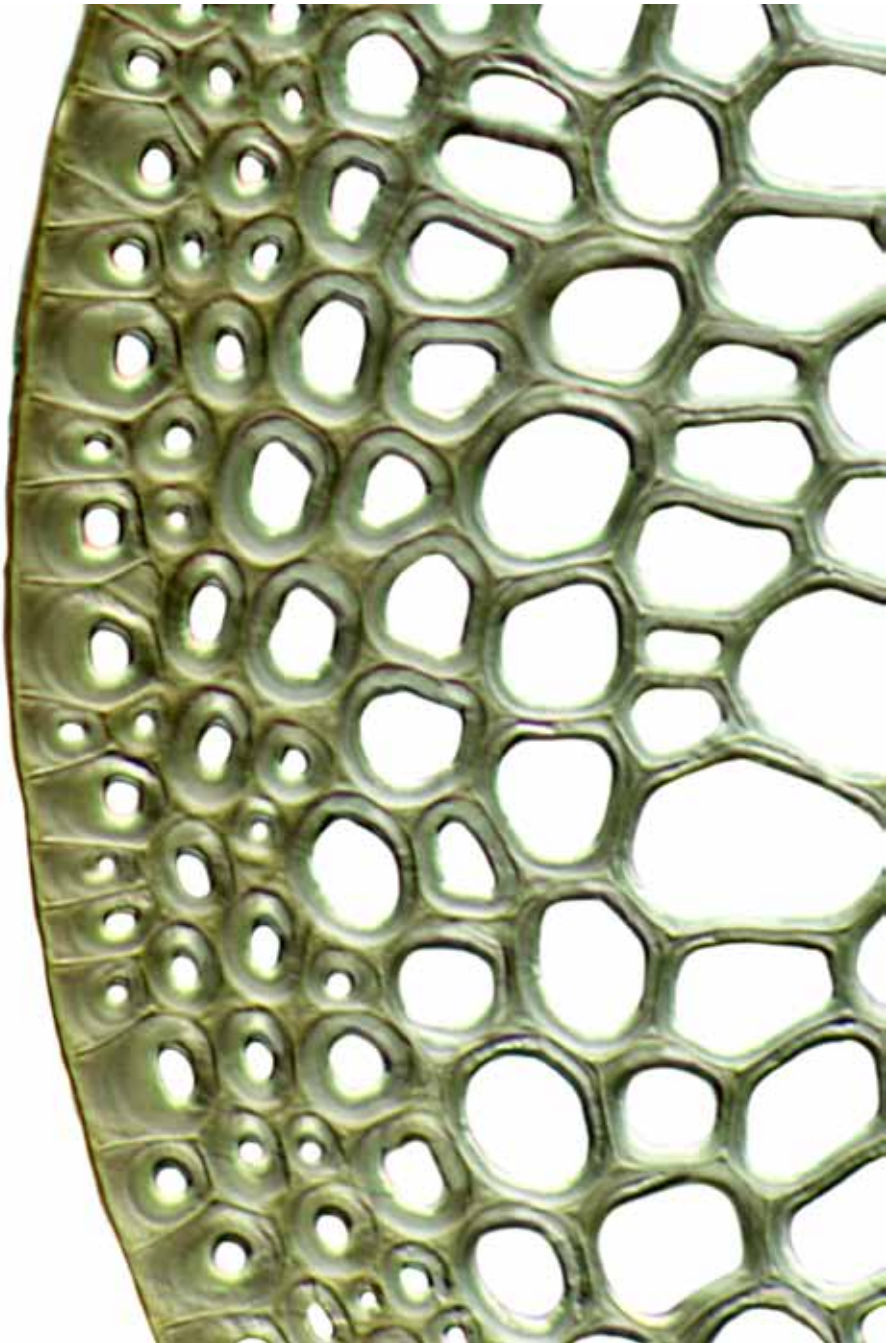


leaf apex, margin upper leaf, and papillose margin of lamella

0.1 mm,

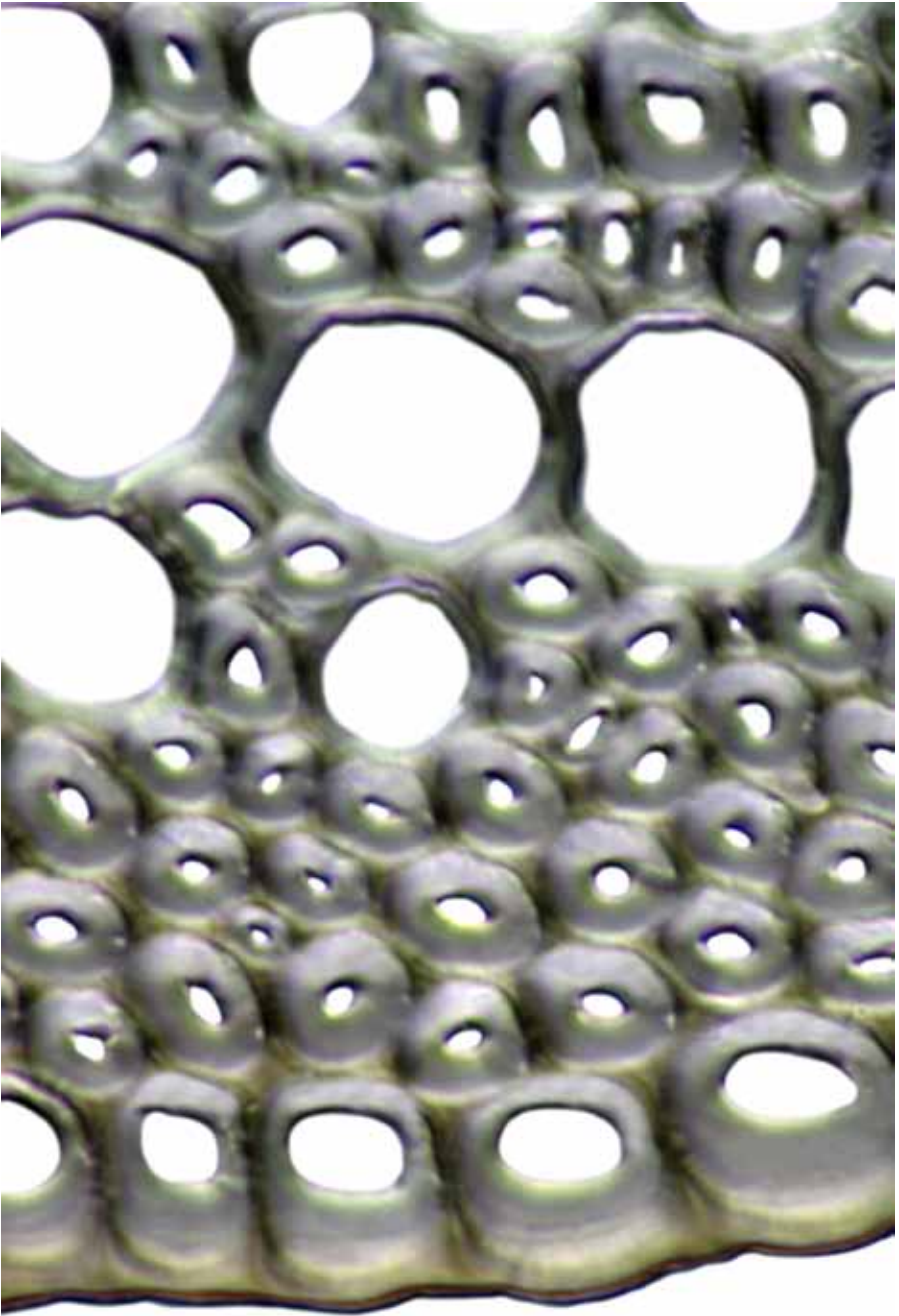
50 μm,

10 μm



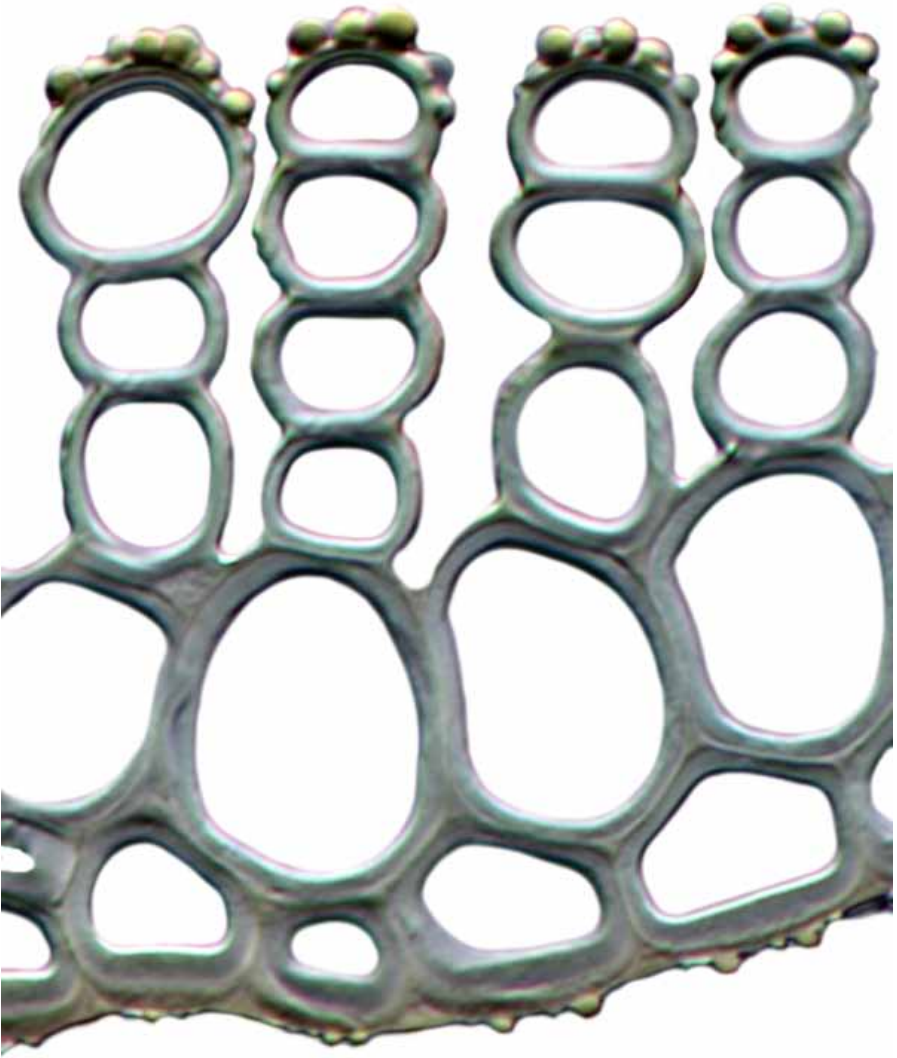
Notoligotrichum crispulum seta cross-section
1 μm

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Notoligotrichum crispulum abaxial leaf surface, cross-section
10 μm

continued next page



Notoligotrichum crispulum leaf cross-section, showing papillose lamellae
10 μm

Oligotrichum tenuirostre (Hook.) A. Jaeger

form: tufted or gregarious, yellow-brown, erect, unbranched stems
habitat: soil

leaf: size: 4–6 mm

shape: lanceolate to oblong-lanceolate, concave, ± bistratose above

tip: acute

lamellae: about 10, with 4 rows of cells each, the marginal cells smooth

base: basal sheath ill-defined; sheath cells rectangular

costa: percurrent

border: not differentiated

margin: entire, plane

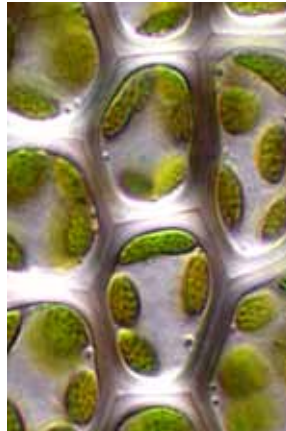
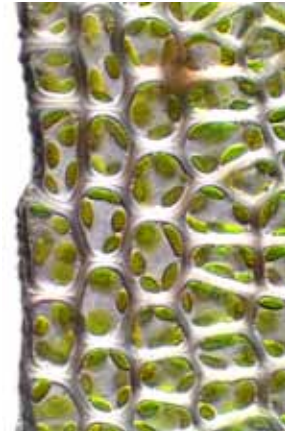
cells: lamina cells 11–13 μm , subsodiametric, firm-walled, smooth

capsule: 2–4 mm, oblong or ovate-oblong, ± gibbous, terete or obscurely angled, erect, with numerous stomata; seta 30–40 mm, yellow-brown, ± curved; calyptra cucullate, bristle-tipped; operculum slender-rostrate; peristome teeth 32, irregular, pale; spores 14–16 μm in diam.



vegetative shoots (moist), capsule, leaf outline, and leaf apex

■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 10 μm



margin midleaf, cells midleaf, and leaf base

■ 10 μm , ■ 10 μm , ■ 100 μm



Oligotrichum tenuirostre capsule and epiphragm
1 mm (capsule), 100 μm (epiphragm)

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Pogonatum subulatum (Brid.) Brid.

form: gregarious, slender, simple stems, dark green above, to 25 mm tall
habitat: clayey soil or rarely rock, in disturbed sites such as road cuttings

leaf: size: 6–8 × 1.5–2.0 mm

shape: oblong-lanceolate, narrowed from a slightly wider sheath

tip: acute

lamellae: 40–50, 3–5 rows tall, the uppermost row of cells smooth, entire

base: sheath cells subquadrate above, rectangular below

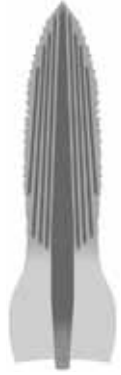
costa: percurrent or subpercurrent, serrate on the back above

border: not differentiated

margin: sharply toothed, plane

cells: 10–12 μm in 3–6 rows, \pm isodiametric, firm-walled, smooth

capsule: 2.5–3.5 mm, calyptra covering the capsule, felted with long, pale, reflexed hairs, cylindric, symmetric, erect to \pm inclined, light brown, lacking stomata or apophysis; seta 25 mm, dark red or brown; calyptra felted, covering the capsule; peristome teeth narrow



fertile shoot (dry and moist) (3), capsules (3), leaf outline, and lamella (upended)
 10 mm, 10 mm, 1 mm, 1 mm (3), 1 mm, 10 μm



leaf apex, margin midleaf with lamellae, and leaf base cells
 50 μm , 10 μm , 10 μm



Pogonatum subulatum leaf outline
1 mm

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Polytrichadelphus magellanicus (Hedw.) Mitt.

form: gregarious, erect, simple or dichotomously branched stems, to 80 mm tall
habitat: soil, usually clay along tracks or roads, to subalpine elevations

leaf: size: 6–9 × 1.5–2.2 mm

shape: lanceolate-subulate, abruptly narrowed from an oblong sheathing base
tip: acute

lamellae: 40–50, 5–8 rows tall, the uppermost cells enlarged, thick-walled

base: sheathing

costa: percurrent or excurrent in a toothed, reddish arista

border: not differentiated

margin: serrate, plane

cells: 12 μm, in 1–2 rows, subquadrate, thick-walled, smooth

capsule: 3–4 mm, oblong, ± erect, no apophysis, 2-angled, semi-lunar in xs;
 seta 40–70 mm, stout, pink; peristome teeth 64; calyptra smooth below,
 with a tuft of dark bristles at the apex

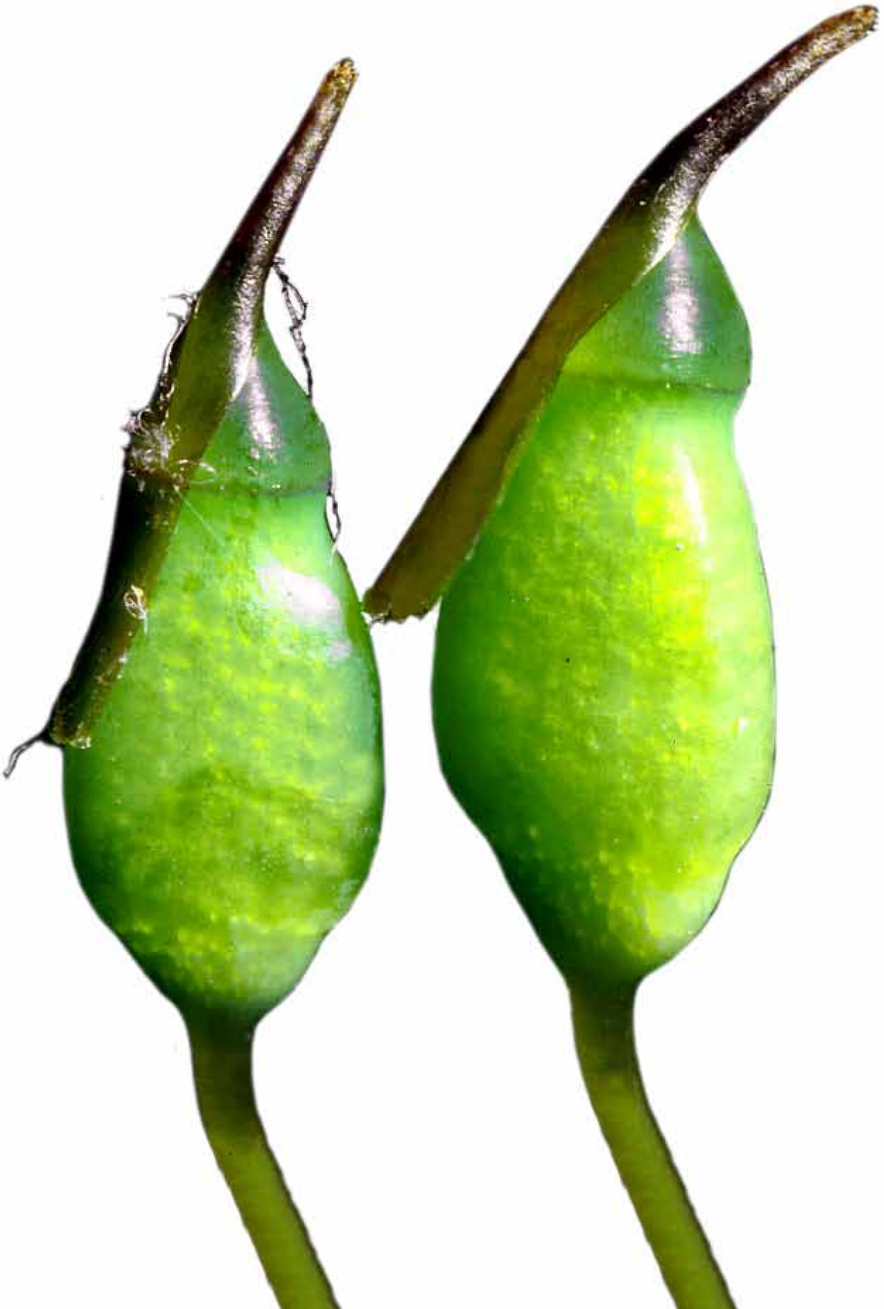
note: the stacked older inflorescences of male plants often look pagoda-like



vegetative shoots (moist), capsule with calyptra, epiphragm, leaf outline, and leaf apex
 5 mm (2), 1 mm, 0.1 mm, 1 mm, 50 μm



perigonia (male), margin midleaf, and lamella (upended)
 5 mm, 10 μm, 10 μm



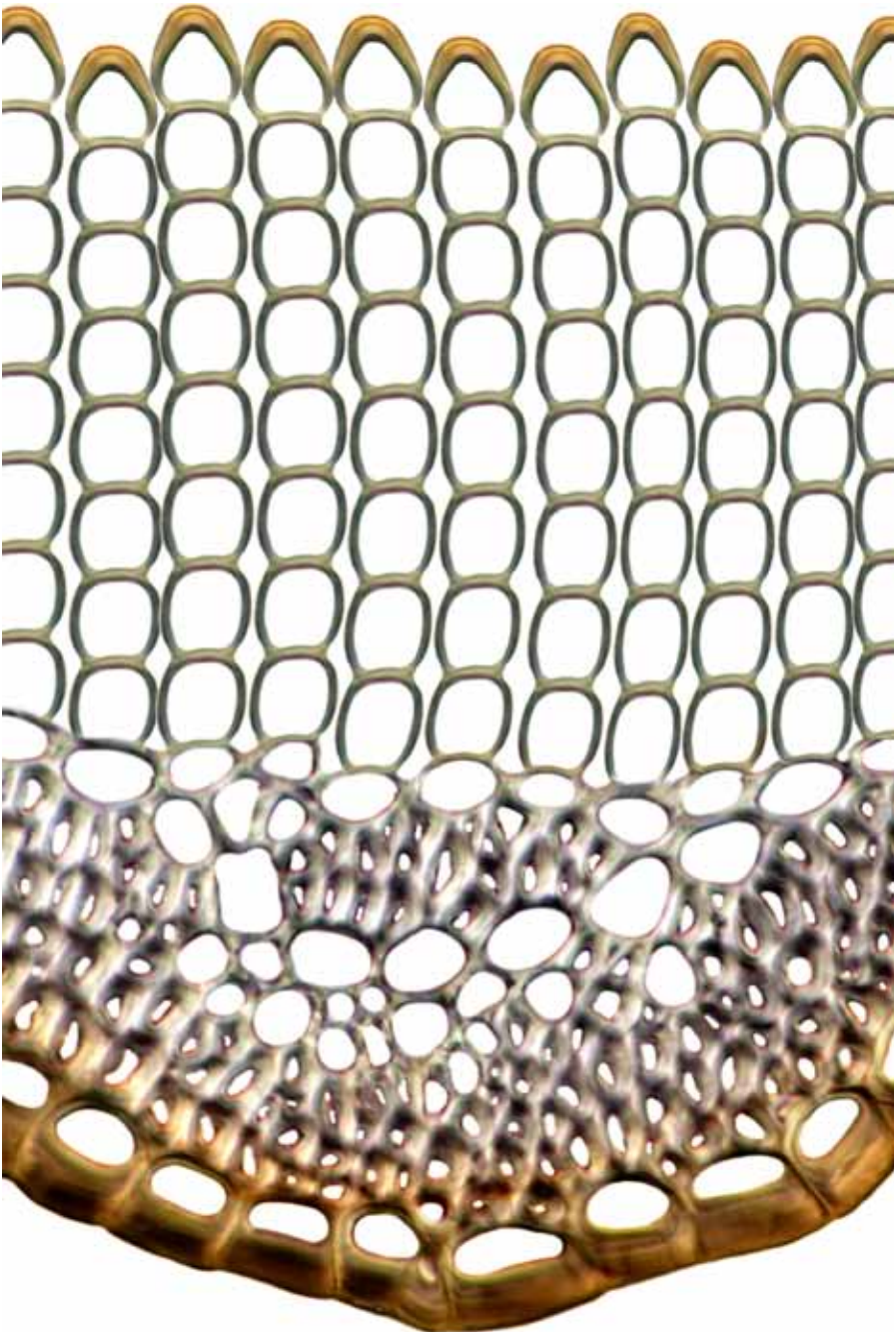
Polytrichadelphus magellanicus immature capsules with calyptrae
0.5 mm

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Polytrichadelphus magellanicus leaf cross-section
50 μm

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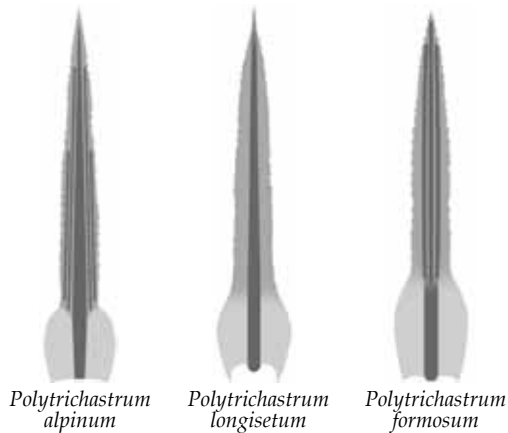
Polytrichadelphus magellanicus leaf cross-section (partly diagrammatic)
10 μm

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Key* to the New Zealand species of *Polytrichastrum* (3)

- 1 Lamellae papillose; capsules terete ● ***Polytrichastrum alpinum***
 1: Lamellae not papillose; capsules 4–6-angled 2
- 2(1:) Marginal lamina 5–9(–20) cells wide; median sheath cells 3–5:1.....
 ● ***Polytrichastrum longisetum***
 2: Marginal lamina 2–5 cells wide; median sheath cells 5–9:1.....
 ● ***Polytrichastrum formosum***

* based on Smith Merrill, GL (2007): *Polytrichastrum*. *Flora of North America* 27, 125.



Polytrichastrum alpinum (Hedw.) G.L.Sm.

form: robust, loosely tufted, erect, dull or glaucous, forked, radiculose below
habitat: rock, soil, or humus, usually in damp and shaded sites near streams

leaf: size: 7–10 × 1.4–2.0 mm

shape: linear-lanceolate, abruptly narrowed from a broadly oval sheathing base

tip: acute to acuminate

lamellae: 15–25, 3–7 rows tall, the uppermost cells thick-walled, papillose

base: cells of the sheath ± linear, the margin involute

costa: ending in a short toothed awn

border: not differentiated

margin: coarsely toothed throughout, plane

cells: 10–15 μm, ± isodiametric, thick-walled, smooth

capsule: 3–6 mm, erect to inclined, cylindrical, stomatose at the base, 3-angled toward the tip; seta 15–50 mm, yellowish; operculum long-rostrate; peristome teeth 32, irregularly divided; spores 14–16 μm in diam., smooth



habit (moist), fertile shoot (3), capsule (dry), leaf outline, and leaf apex

5 mm, 5 mm, 5 mm, 1 mm, 0.5 mm, 50 μm



margin midleaf (2) and papillose margin of lamella

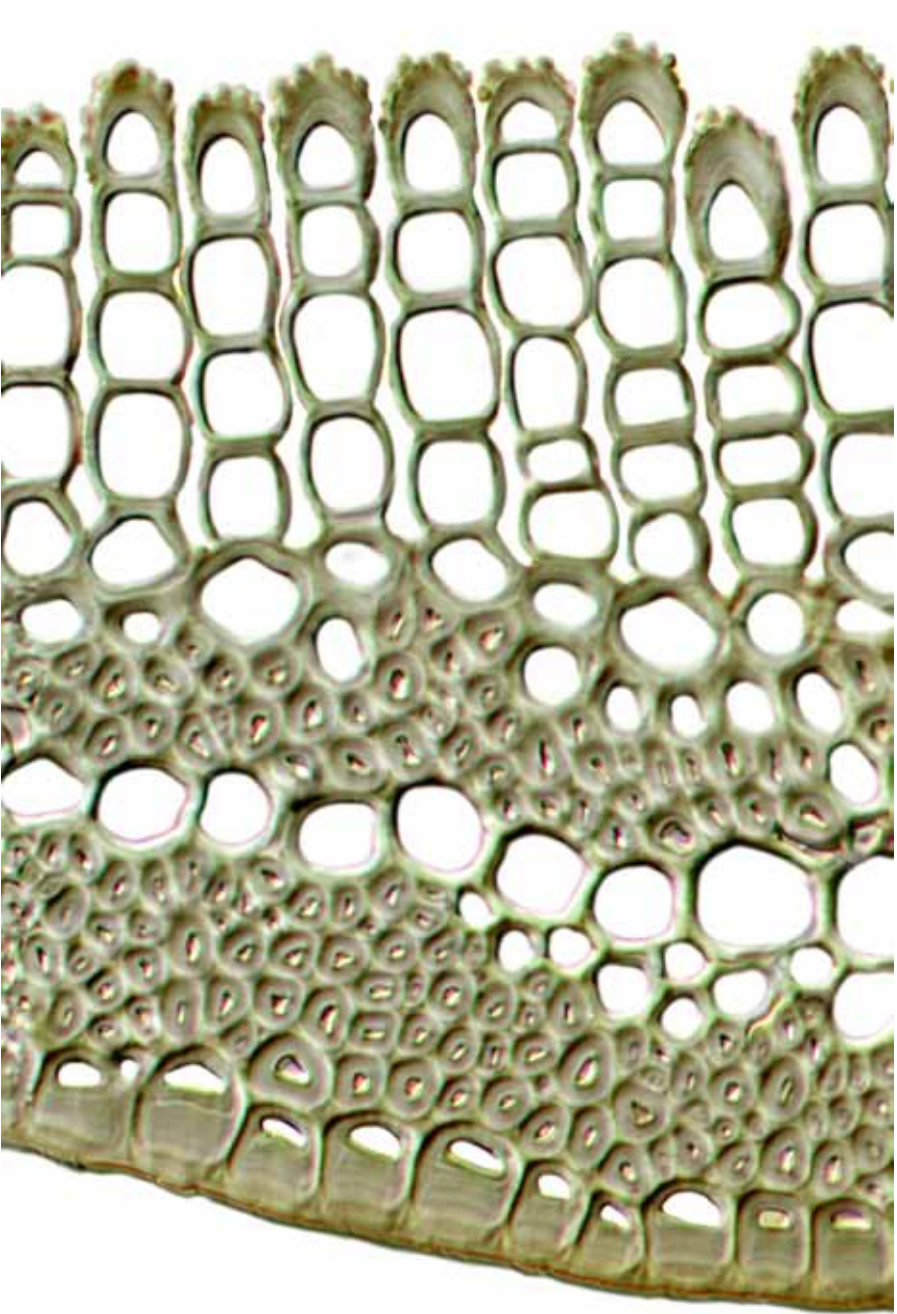
10 μm, 10 μm, 10 μm

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Polytrichastrum alpinum vegetative shoot (fully hydrated)
1 mm

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Polytrichastrum alpinum leaf cross-section
10 μm

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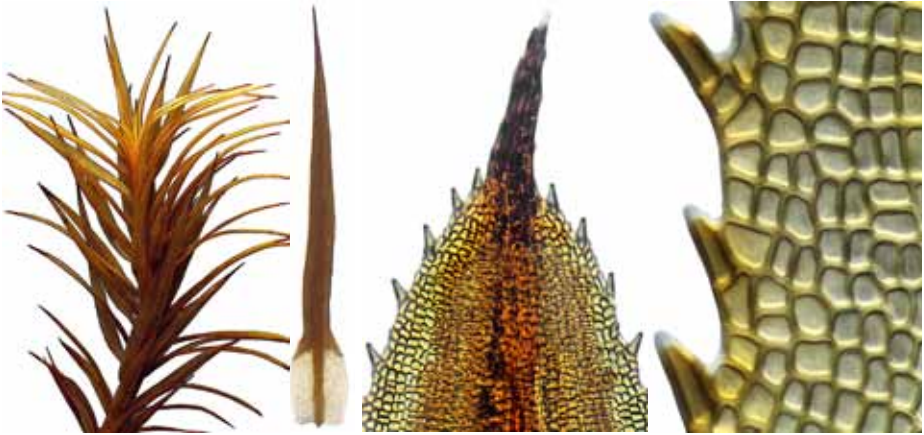
Polytrichastrum alpinum seta cross-section
50 μm

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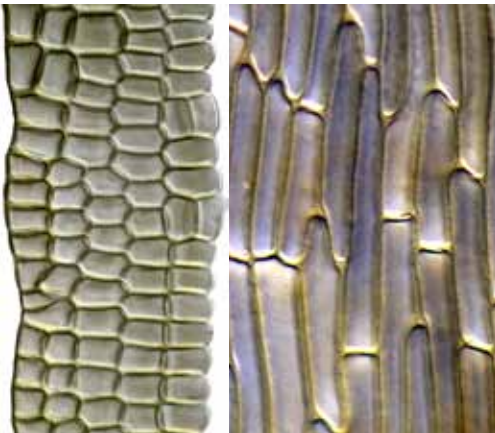


Polytrichastrum alpinum seta cross-section (detail)
10 μm

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Polytrichastrum formosum (Hedw.) G.L.Sm.**form:** scattered, erect stems, green above, reddish below**habitat:** damp to wet peat in open sites**leaf:** size: 6–12 x 0.7–1.2 mm*shape:* linear from a wide, oblong, sheathing base*tip:* long-acuminate, toothed*lamellae:* 40–65, each 3–7 cells tall, the uppermost not papillose*base:* sheath of long-rectangular (5–9:1) hyaline, thin- to firm-walled cells*costa:* long-excurrent, with abaxial teeth*border:* not differentiated*margin:* sharply dentate, unistratose, 3–10 cells wide*cells:* lamina cells 15–20 x 10–15 μm , short-rectangular, thick-walled, smooth**capsule:** 4.5–6.5 mm, 4-angled, the ridges rounded, cylindric, horizontal, long-exserted, brown; seta 30–50 mm; spores 15–20 μm in diam.

vegetative shoot (moist), leaf outline, leaf apex, and margin midleaf

 5 mm, 1 mm, 100 μm , 10 μm


lamella (upended), sheath cells, and calyptra hair-cross-section

 10 μm , 10 μm , 10 μm


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Polytrichastrum formosum mature capsule and detached calyptra
1 mm

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Polytrichastrum formosum dentate leaf margin plus lamellae (flattened)
10 μm

Polytrichastrum longisetum (Brid.) G.L.Sm.**form:** tufts or turves of dark green stems, to 100 mm tall**habitat:** well-drained acidic soil or humus in scrub or forest**leaf:** size: 5–8 mm*shape:* narrowly lanceolate*tip:* acuminate*lamellae:* 25–35, 3–7 cells tall, the marginal row smooth*base:* sheath cells rectangular*costa:* excurrent in a brown, denticulate arista*border:* not differentiated*margin:* toothed, erect, inflexed when dry, recurved when moist*cells:* 15–18 μm , quadrate, firm- to thick-walled, smooth**capsule:** 2.5–5 mm, yellow above, reddish below, oblong, obscurely 5–6-angled, erect when young, inclined when mature, the apophysis well-developed; seta 15–70 mm, flexuose; operculum long-rostrate; spores 20–26 μm in diam.

vegetative shoot (moist), leaf outline, leaf apex, and margin near leaf base
 ■ 1 mm, ■ 1 mm, ■ 10 μm , ■ 100 μm

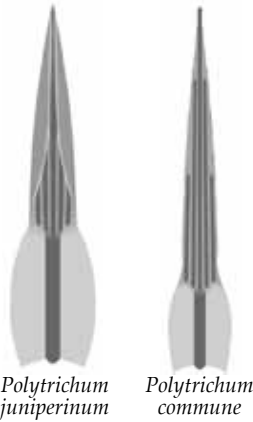


margin upper leaf, margin lower leaf, and leaf lamella
 ■ 10 μm , ■ 10 μm , ■ 10 μm

Key* to the New Zealand species of *Polytrichum* (2)

- 1 Leaf margin inflexed, entire..... ● ***Polytrichum juniperinum***
 1: Leaf margin not inflexed, serrate..... ● ***Polytrichum commune***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 28.



Polytrichum commune Hedw.

form: robust, tufted, erect, simple, ± flexuose stems, radiculose below
habitat: soil or humus in fens and bogs

leaf: size: 6–15 × 1.2–3.0 mm

shape: narrowly lanceolate from a glossy, sheathing base

tip: acuminate, tapering to a spinulose apex

lamellae: 30–60, 4–10 cells tall, the uppermost row thick-walled, ± notched

base: sheath cells long-linear, distally prorate on the abaxial surface

costa: excurrent, toothed at the back

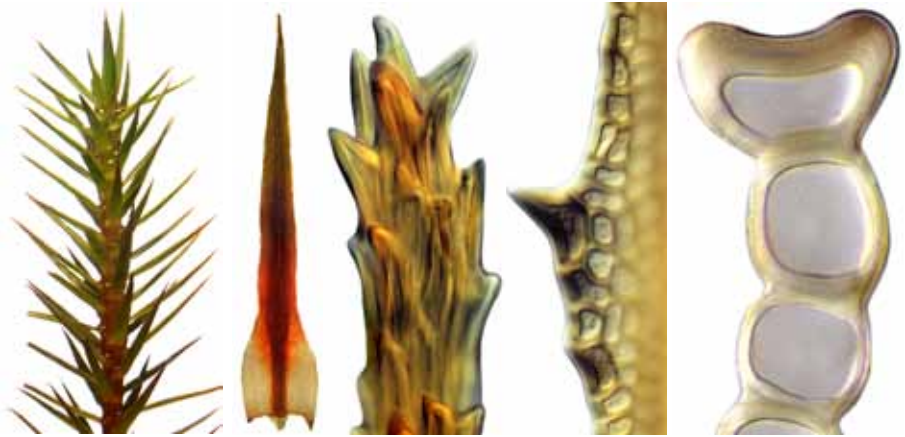
border: not differentiated

margin: entire in the sheath, sharply serrate to dentate above, plane

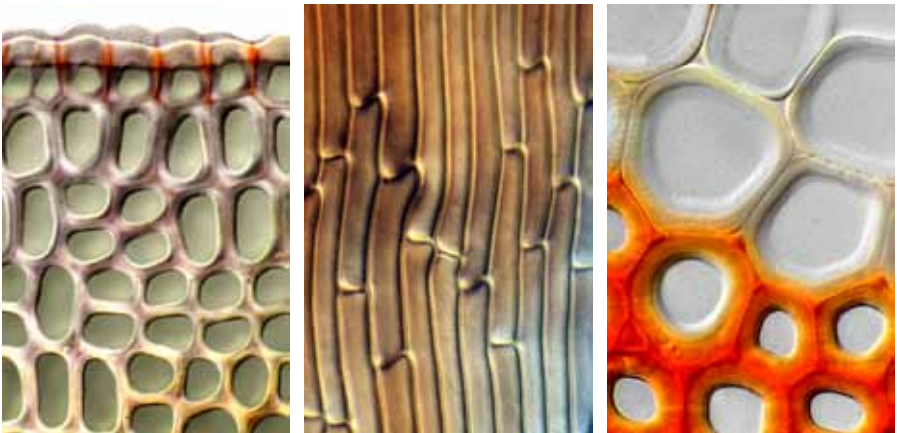
cells: blade cells 30 μm, irregularly quadrate, thick-walled, smooth

capsule: 3–6 mm, wide-cylindric, 4-angled, hypophysate, inclined to horizontal;
 seta 50–90 mm; peristome teeth 64; calyptra cucullate, densely long-pilose,
 covering the capsule

notes: nearly cosmopolitan; recognized by the notched uppermost lamella cells



vegetative shoot (moist), leaf outline, leaf apex, margin midleaf, and lamella xs
 10 mm, 1 mm, 10 μm, 50 μm, 10 μm



lamella, notched upper cells, sheath cells (abaxial view), and seta cross-section (detail)
 50 μm, 50 μm, 10 μm

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Polytrichum commune capsules with calyptrae, and a single calyptra hair in cross-section
0.5 mm, 1 μm

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Polytrichum commune mature 4-angled capsule
1 mm

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Polytrichum juniperinum Hedw.

form: robust, loosely tufted, often bluish stems, radiculose below, to 130 mm

habitat: soil, humus, or soil over rock, common on tracksides in dry, open sites

leaf: size: 5–8 × 1.2–2.0 mm

shape: lanceolate, abruptly narrowed from a broad oval sheathing base

tip: acuminate

lamellae: 23–40, 6–7 rows tall, the uppermost cells thick-walled, strongly crenate

base: sheath cells narrowly rhombic, yellowish

costa: excurrent, toothed on the back, ending in a reddish toothed awn

border: not differentiated

margin: entire, broadly infolded, hyaline

cells: margin cells 40 × 12 μm, rectangular, incrassate, smooth

capsule: 2.5–5 mm, cylindric, erect to horizontal, 4-angled, deeply constricted at apophysis; seta 20–60 mm; calyptra hairy, covering the capsule; operculum stoutly rostrate

note: widespread in both hemispheres



vegetative habit (sun form), capsule with hairy calyptra, leaf outline, and leaf apex
 ■ 10 mm, ■ 1 mm, ■ 1 mm, ■ 10 μm



shoot apex showing infolded leaves, cells of infolded margin, and crenate lamella margin
 ■ 1 mm, ■ 10 μm, ■ 10 μm



Polytrichum juniperinum mature 4-angled capsule
0.5 mm

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Polytrichum juniperinum (with *Hypnum cupressiforme*) male shoots
1 mm

continued next page

Tetradontium brownianum (Dicks.) Schwägr.

form: gregarious, minute (< 0.5 mm), erect, linear to spatulate protonemal flaps present and usually persistent, 2–3-stratose; basal flagelliform shoots 2–5 mm long, with 3-ranked linear leaves

habitat: damp, shaded crevices and overhangs in siliceous rock at high elev.

leaf: size: flaps 70–100 × 0.8–1.5 mm; stem leaves 3-ranked, to 1.2 mm

shape: ovate to ovate-lanceolate

tip: obtuse to acute or ± mucronate, concave

base: basal cells little differentiated

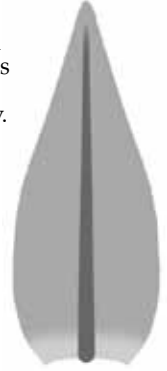
costa: none or faint, spinose above abaxially

border: not differentiated

margin: obscurely denticulate above, plane

cells: 20–30 × 10 μm, irregularly oblong, firm-walled, smooth

capsule: 0.8–1.3 mm, oblong-cylindric, straight, erect, dark brown; seta 5–8 mm, brown, flexuose; calyptra covering capsule; operculum conic; peristome teeth 4, erect wet or dry, ± triangular; spores multicellular, 14–16 μm



fertile shoots, capsule (dry) (3), persistent protonematal flaps (2), leaf outline, leaf apex
 1 mm, 0.1 mm, 1 mm, 1 mm (2), 0.1 mm, 10 μm



margin upper leaf, margin midleaf, and margin lower leaf
 10 μm, 10 μm, 10 μm

Key* to the New Zealand species of Buxbaumia (2)

- 1 Capsule 3–7 mm long, flattened above; seta coarsely papillose; stomata immersed.....
 ● **Buxbaumia aphylla**
- 1: Capsule 6–9 mm long, not flattened above; seta smooth; stomata superficial
 ● **Buxbaumia novae-zelandiae**

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 26.

Buxbaumia aphylla Hedw.

form: loose patches of capsules on tall stalks; usually no gametophytes visible

habitat: mineralized soil or soil over rock, rotting logs or tree stumps in open scrub, to 1100 m

capsule: 3–7 mm, broadly ovoid, chestnut brown with a glossy outer rim, inclined to horizontal; seta 4–11 mm, ± straight; stomata immersed (cryptopore), 1–2-celled; spores 5–12 μm in diam.

note: seemingly rare, but probably just overlooked



mature capsule
1 mm

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Buxbaumia novae-zelandiae Dixon

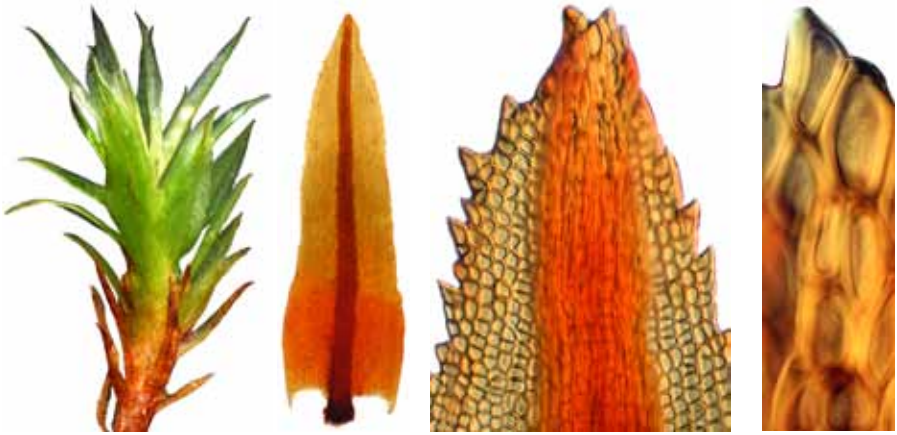
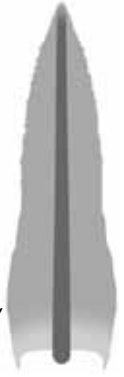
form: solitary to gregarious capsules on tall stalks with \pm persistent basal leaves

habitat: shaded rock or gravel in open scrub or forest, often growing among other bryophytes, to 600 m

capsule: 6–9 mm, ovoid, pale brown, suberect to inclined; stomata superficial (phaneroporose), 2-celled, sometimes absent; seta 10–24 mm, \pm straight, reddish, smooth; spores 10–12 μ m in diam.

note: seemingly rare but probably just overlooked



Timmia norvegica J.E.Zetterst.**form:** curves of erect, yellowish, sparsely branched stems, radiculose**habitat:** calcareous soil in forests at high altitude, 1200–1800 m**leaf:** size: 3–10 × 0.8–1.1 mm*shape:* linear-lanceolate, base sheathing, ± crisped when dry*tip:* acute or acuminate*base:* cells of sheath long-rectangular, 60–100 × 10–17 μm, incrassate, ± porose*costa:* failing just below the apex, strongly prorate on the back above*border:* not differentiated*margin:* coarsely dentate above, entire below, plane, incurved when dry*cells:* 9–16 × 7–9 μm, irregularly quadrate, firm-walled, mammillose adaxially**capsule:** 2.5–3.0 mm including the weak neck, oblong-oval, horizontal to pendent, brownish, stomatose; seta 15–20 mm, smooth; operculum high-conic, mammillate; annulus large and revoluble; peristome double; exostome teeth 16, yellow, pale above, perforated centrally, to 100 μm long, papillose above; endostome yellow, 64 ± apically fused cilia; spores 17–20 μm in diam.

vegetative shoot (moist), leaf outline, and leaf apex (2)

1 mm, 1 mm, 50 μm, 10 μm



margin upper leaf (2), and prorate abaxial costa cells

50 μm, 10 μm, 10 μm

Gigaspermum repens (Hook.) Lindb.

form: gregarious, bud-like, erect stems from a fleshy, creeping, perennial, underground primary stem

habitat: soil, bare and often calcareous, to 360 m

leaf: size: 2.5(-3.5) × 1 mm, wrinkled when dry

shape: ± orbicular, abruptly narrowed to a long acumen, papery

tip: acuminate, ± hyaline

base: not differentiated

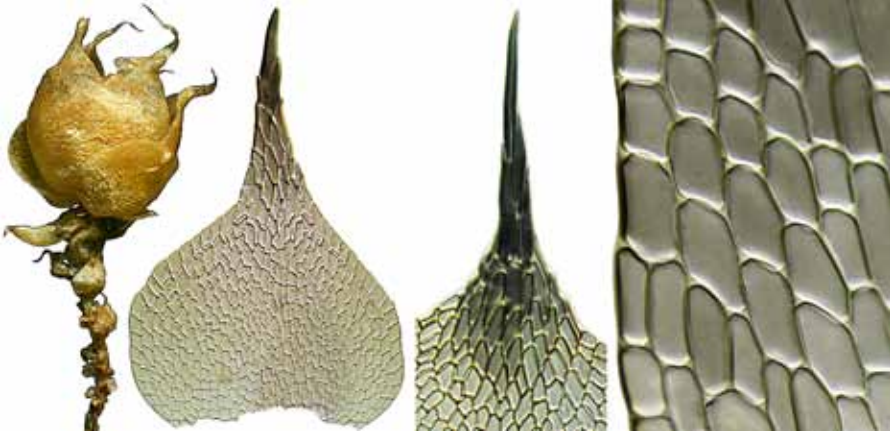
costa: none or single

border: not differentiated

margin: entire, plane

cells: 50–120 × 18–25 μm, rhombic, thin-walled, smooth

capsule: 1 mm; hemispherical when open, wide-mouthed, immersed among the perichaetial bracts, stomatose below; seta 0.2 mm; calyptra small, falling early; operculum conic, apiculate; peristome absent; spores to 190 μm in diam.



fertile shoot, leaf outline, leaf apex, and margin midleaf

1 mm, 0.1 mm, 50 μm, 50 μm



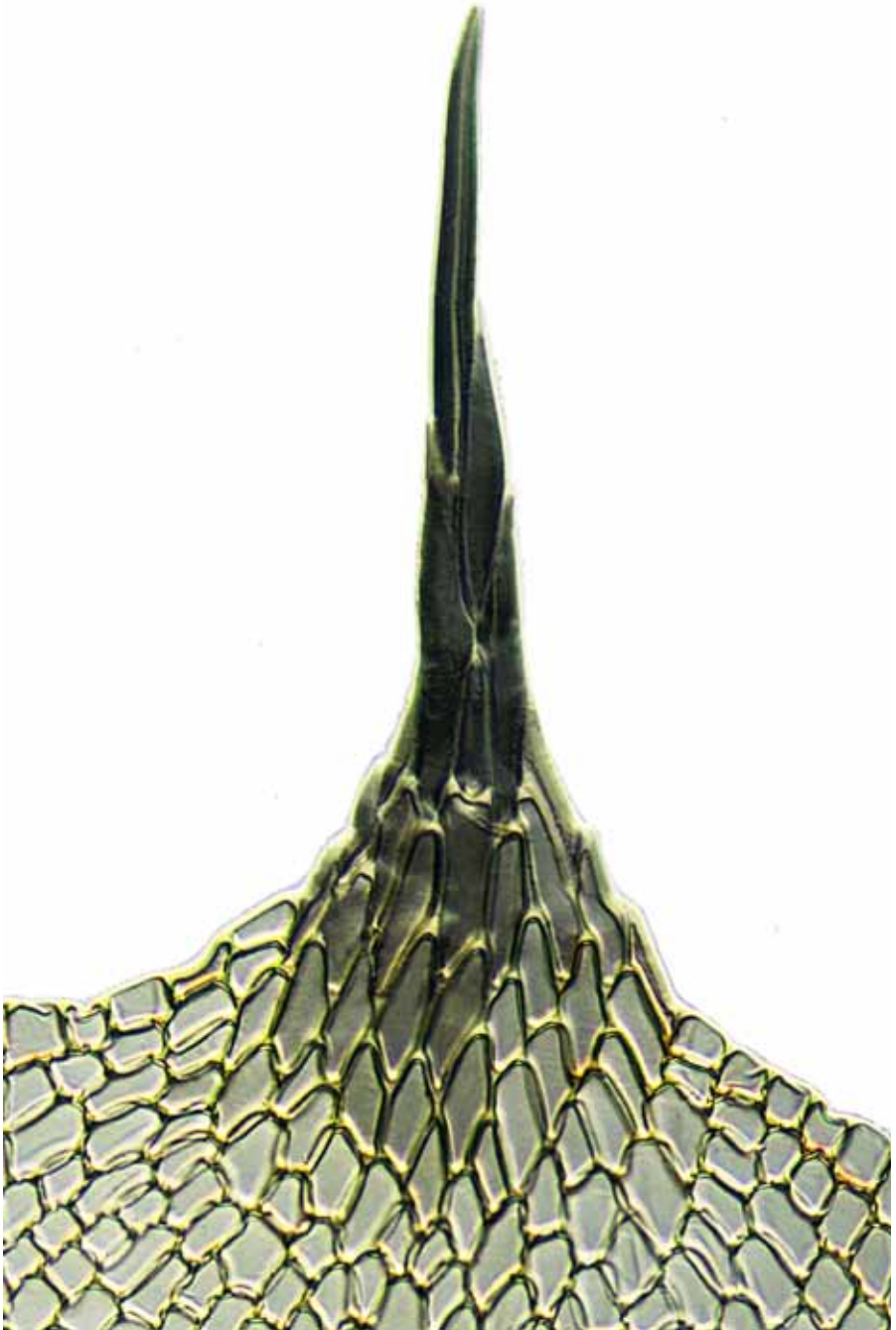
subapex leaf cells, midleaf cells, and leaf basal angle

50 μm, 50 μm, 50 μm



Gigaspermum repens habit (dry)
10 mm

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Gigaspermum repens leaf apex (interference optics)
50 μm

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Gigaspermum repens leaf subapex (interference optics)

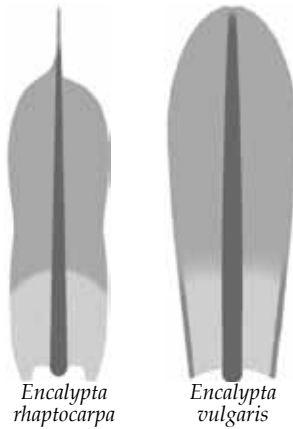
10 μm

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Key* to the New Zealand species of *Encalypta* (2)

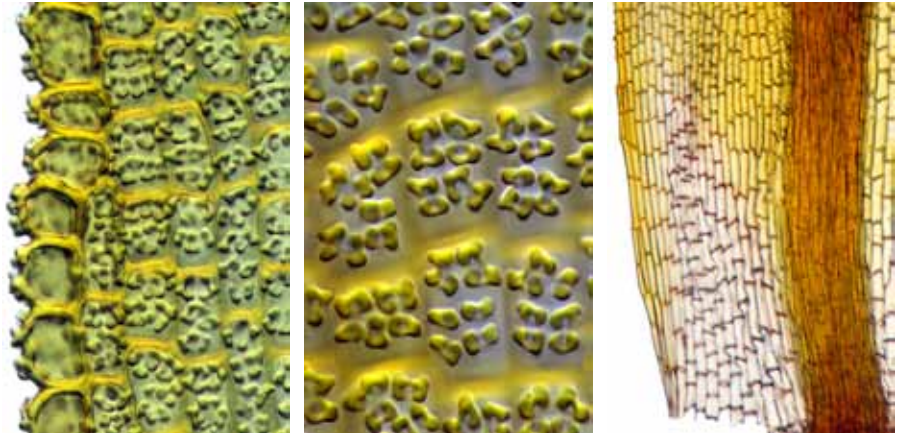
- 1 Some or all vegetative leaves long-awned; costa smooth abaxially ● ***Encalypta raptocarpa***
 1: Vegetative leaves not awned; costa prorate abaxially ● ***Encalypta vulgaris***

* based on Magill, RE (2007): Encalyptaceae. *Flora of North America* 27, 173.



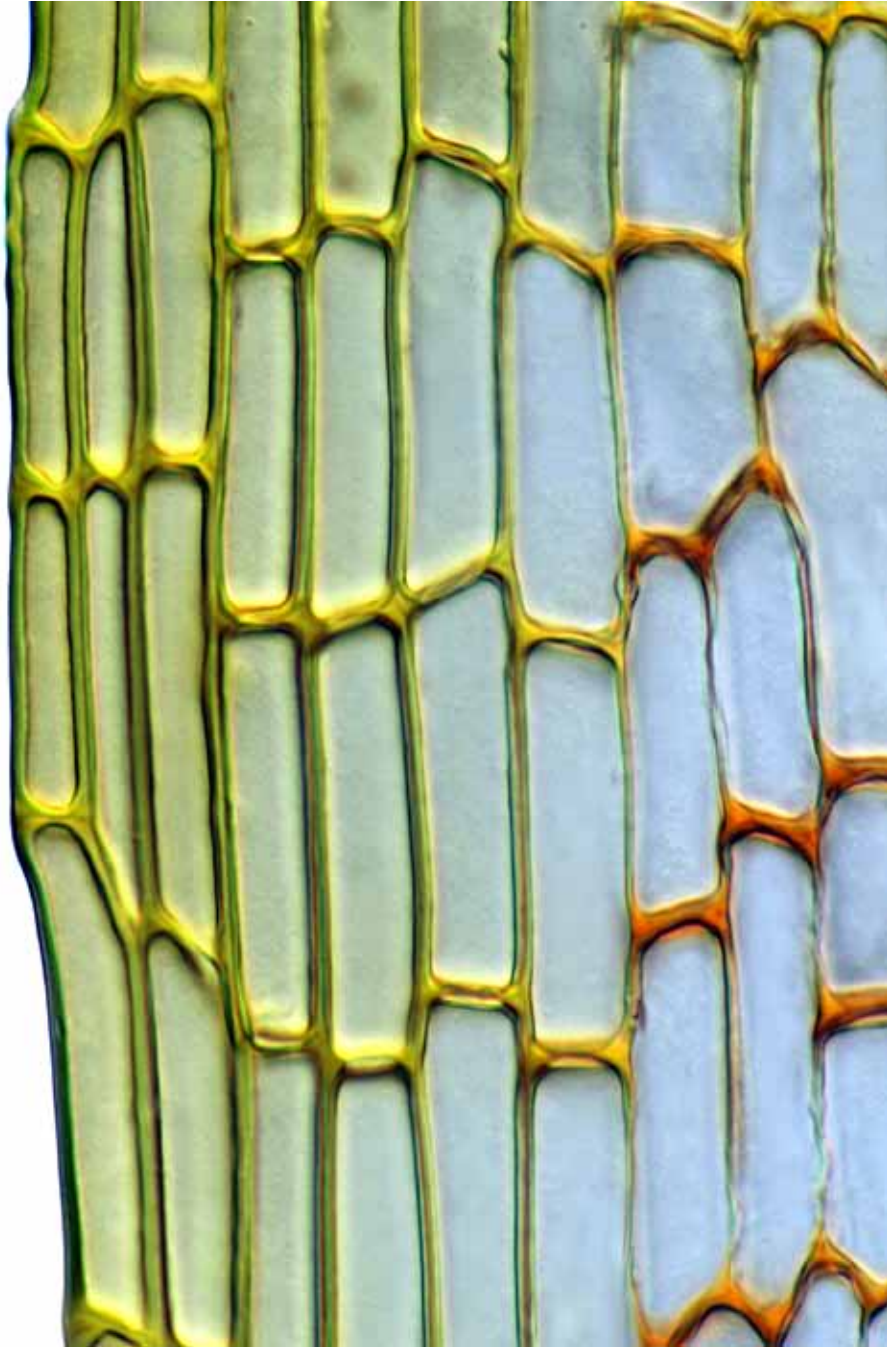
Encalypta raptocarpa Schwägr.**form:** tufted, erect, branched stems, to 8 mm tall, dull, brownish above**habitat:** limey soil and rock in open forests or scrub, to subalpine elevations**leaf:** size: 2.2–3.5 × 1.0 mm (including awn)*shape:* oblong-lanceolate to lingulate, unistratose, contorted when dry*tip:* acute, ending in a stout awn*base:* basal cells long-rectangular, smooth; no distinct alar region*costa:* strong, percurrent to excurrent in the awn, prominent abaxially, red*border:* not differentiated*margin:* entire to crenulate, plane*cells:* upper cells 12–21 × 11–16 μm, subquadrate, firm-walled, pluripapillose**capsule:** 2–3 mm, cylindric, erect, exserted, ribbed when dry, dark brown; seta 3–6 mm, reddish brown, smooth; peristome single; operculum 1–2 mm, long-rostrate; calyptra up to 5.0 mm long, completely covering the capsule, smooth below, dark and scabrous above; spores to 40 μm in diam., ± reniform, coarsely warty-papillose

fertile shoot (dry), calyptra, mature capsule, leaf outline, awn (2), and base of awn



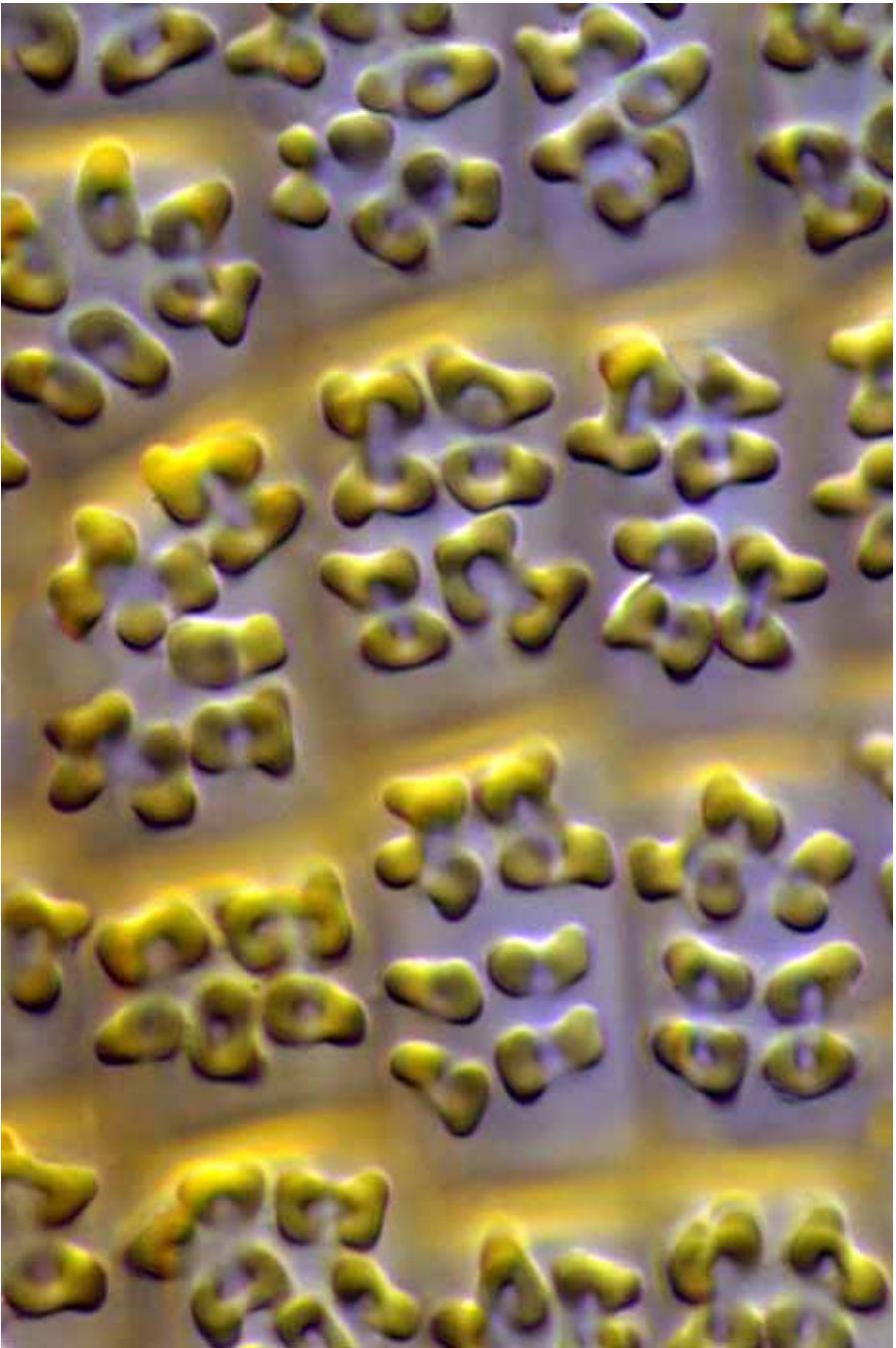
margin midleaf, leaf surface papillae, and leaf basal angle

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Encalypta rhamnoides margin near leaf base
10 μm

continued next page



Encalypta rhamnifolia leaf surface papillae
10 μm

continued next page

Encalypta vulgaris Hedw.

form: tufted, erect, ± simple stems, densely foliate, yellowish, to 20 mm
habitat: soil or calcareous rock in open forest or scrub, to 2400 m

leaf: size: 2.5–3.5 × 1.0–1.2 mm

shape: oblong to lingulate, concave above

tip: rounded to obtuse, or broadly acute and mucous

base: lower cells rectangular, hyaline; transverse walls coloured, thickened

costa: failing below the apex, prominent abaxially

border: several rows of narrow cells in lower third of the margin

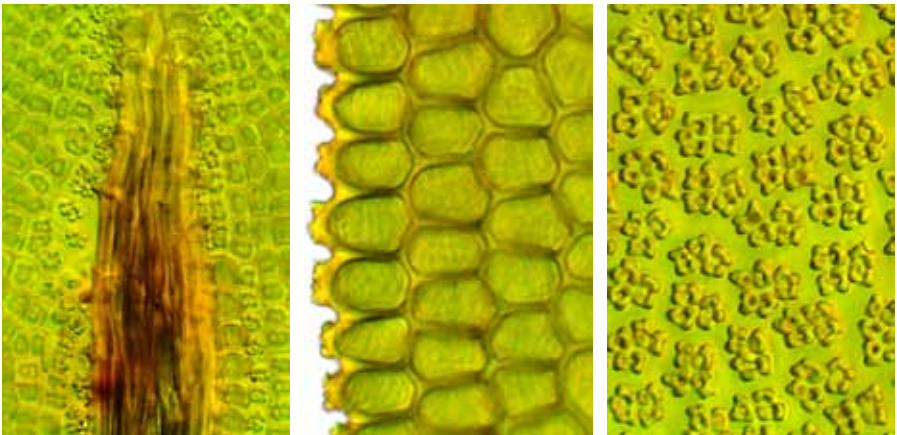
margin: entire except for papillae, plane to weakly recurved

cells: 12–17 × 10–12 μm, isodiametric, firm-walled, bulging, distal cell ends projecting abaxially, papillose, the papillae branched

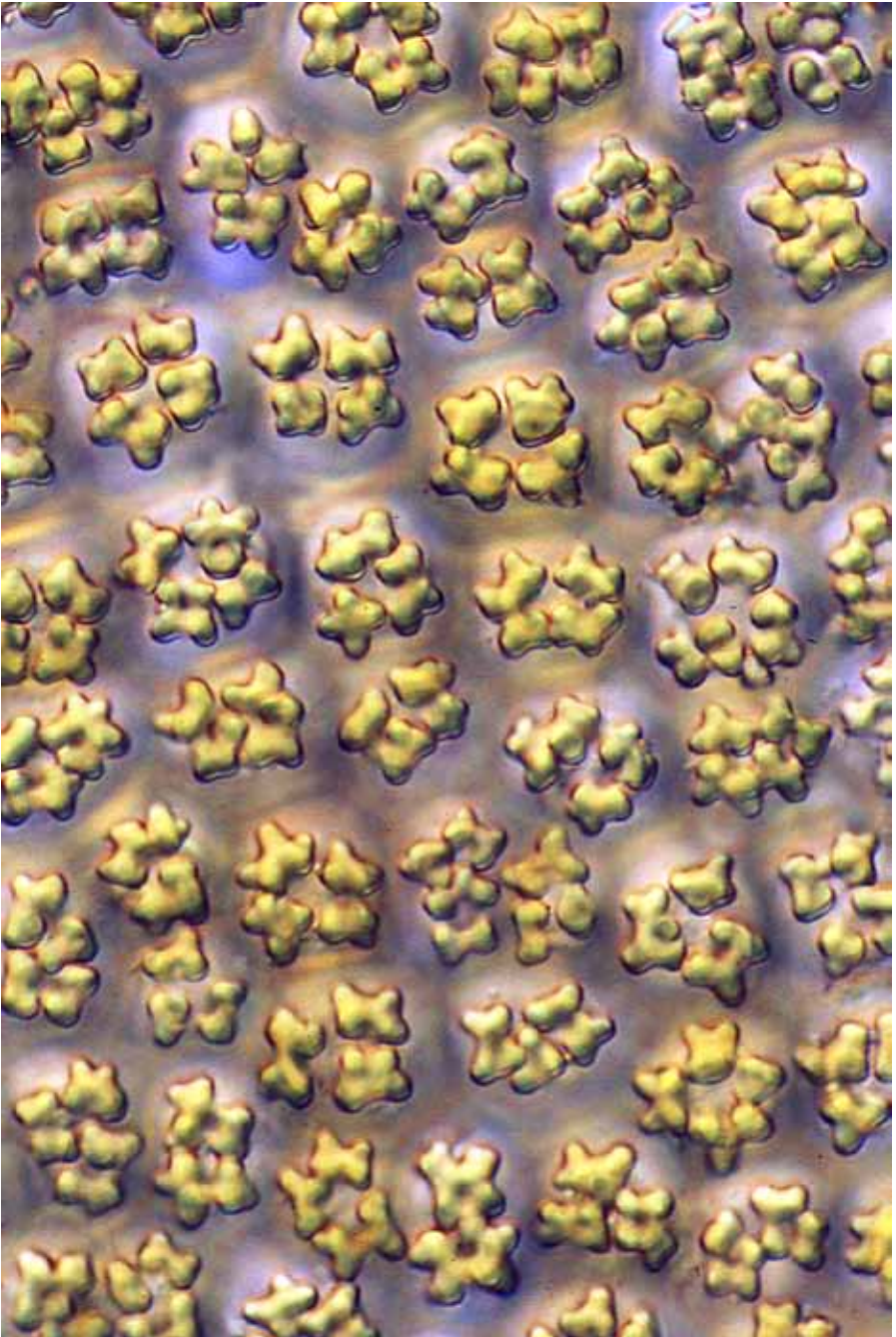
capsule: 2.5–3.0 × 10–12 mm; narrowly cylindrical, erect, ± striate; calyptra large, resembling an old-fashioned candle-snuffer and completely covering the capsule; seta to 10 mm, yellow, smooth; peristome none; operculum long-rostrate; spores to 39 μm in diam.



fertile shoot (dry) (2), calyptra, leaf outline, and leaf apex showing costa terminus
 1 mm, 1 mm, 0.5 mm, 0.5 mm, 50 μm



costa near apex, margin midleaf, and leaf papillae
 50 μm, 10 μm, 10 μm



Encalypta vulgaris leaf papillae
10 μ m

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Bryobeckettia bartlettii (Fife) Fife**form:** gregarious, unbranched, erect, radiculose stems, to 4 mm**habitat:** damp, disturbed silt or clay, streams or ditches, to 200 m**leaf:** size: 1.5–2.8 × 0.6–1.6 mm, contorted when dry*shape:* obovate or spatulate*tip:* obtuse or rounded*base:* basal cells rectangular and longer than the other blade cells*costa:* failing below the apex*border:* not differentiated*margin:* entire to toothed toward the apex, plane*cells:* 30–80 × 20–40 μm, subhexagonal, thin-walled, smooth**capsule:** 2 mm, reddish, oval, apiculate, erect, slightly exserted,

cleistocarpous, brown; seta to 1.5 mm; calyptra mitriform,

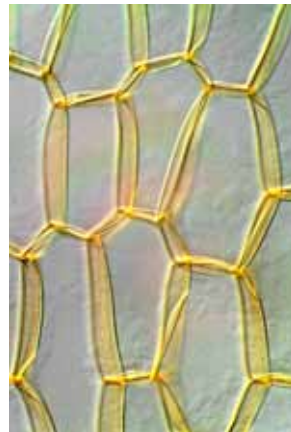
covering only a small part of the capsule; operculum none;

spores 30–37 μm, dark, finely spiny

note: differs from *Physcomitrella* in having ± immersed stomata

fertile shoot, leaf outline, and leaf apex

1 mm, 0.5 mm, 25 μm



margin midleaf, cells midleaf, and costa midleaf

10 μm, 10 μm, 10 μm

Key* to New Zealand species and varieties of *Entosthodon* (8)

- 1 Capsule gymnostomous..... 2
 1: Capsule peristomate 3
- 2(1) Leaves ovate to obovate; seta shorter than capsule... ● ***Entosthodon apophysatus***
 2: Leaves lanceolate, subulate; seta much longer than capsule.....
 ● ***Entosthodon jamesonii* subsp. *productus***
- 3(1): Capsule neck well-developed..... 4
 3: Capsule neck only weakly developed 5
- 4(3) Leaf apex slenderly acuminate; capsule curved-asymmetric
 ● ***Entosthodon muhlenbergii***
 4: Leaf apex acute; capsule symmetric ● ***Entosthodon laxus***
- 5(3): Leaf ± obovate, incurved above, the apex acute to acuminate; capsules straight.... 6
 5: Leaf lingulate, plane, the apex acute to shortly apiculate; capsules arcuate.....
 ● ***Entosthodon radians***
- 6(5) Seta > 9 mm long ● ***Entosthodon subnudus* var. *gracilis***
 6: Seta < 6 mm long..... 7
- 7(6): Spores 39–45 µm in diam..... ***Entosthodon subnudus* var. *subnudus***
 7: Spores 22–25 µm in diam. ***Entosthodon subnudus* var. *subcuspidatus***

* based on Catcheside, DG (1980): *Mosses of South Australia*. Government Printer, Adelaide. 219, and Fife, AJ; Seppelt, RD (2001): A revision of the family Funariaceae (Musci) in Australia. *Hikobia* 13, 473–490.



*Entosthodon
subnudus* var.
gracilis



*Entosthodon
subnudus* var.
subnudus



*Entosthodon
subnudus* var.
subcuspidatus



*Entosthodon
jamesonii* subsp.
productus



*Entosthodon
laxus*



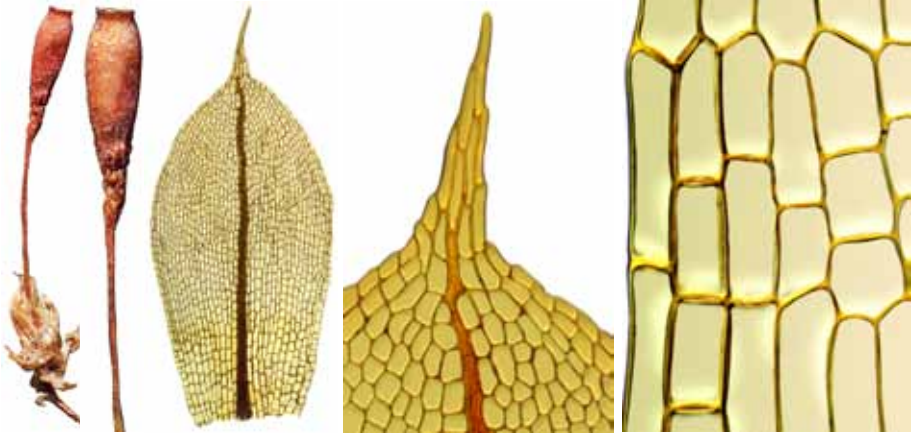
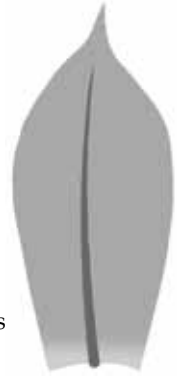
*Entosthodon
apophysatus*



*Entosthodon
muhlenbergii*



*Entosthodon
radians*

Entosthodon apophysatus (Taylor) Mitt.**form:** gregarious, erect, radiculose, comose shoots, to 7 mm**habitat:** damp silt or clay in disturbed sites, to 300 m**leaf:** size: 1.5–3.5 × 0.8–0.9 mm*shape:* oblong to obovate, concave*tip:* acuminate, ending with an arista*base:* alar cells ± inflated, 2–4 on each side*costa:* disappearing in the arista, or failing just below it*border:* not differentiated*margin:* entire to faintly crenate*cells:* 20–60 × 20–30 μm, irregularly hexagonal, thin-walled, smooth**capsule:** 3–4 mm, clavate, erect, exserted, reddish brown, apophysis as long as the spore sac; seta 2–4(–7) mm; peristome usually none; operculum convex; calyptra inflated, with a long, oblique beak; spores 27–43 μm in diam.

fertile shoot and capsule (dry), leaf outline, leaf apex, and margin midleaf



costa midleaf, costa detail, and leaf basal angle

continued next page



Entosthodon apophysatus undehiscent capsules
1 mm

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Entosthodon jamesonii subsp. **productus** (Mitt. in Wilson) Fife

form: gregarious, minute, erect, mostly simple stems, to 4 mm tall
habitat: shaded clayey soil in damp grassland or scrub, to 250 m

leaf: size: 0.7–2.0 × 0.2–0.5 mm

shape: ovate-lanceolate, ± curved, concave

tip: tapering to a subula; apical cell 30–50 μm long

base: basal cells rectangular, thin-walled; alar cells not differentiated

costa: failing in the subula

border: weak, 1–2 rows of narrow cells

margin: entire, plane

cells: 25–70 × 12–15 μm, oblong-hexagonal to rhombic, thin-walled, smooth

capsule: to 1.3 mm, oblong-pyriform, erect, exserted, brown; peristome none; annulus none; seta 3–9 mm; operculum convex; calyptra inflated, cucullate; spores 32–36 μm in diam., wrinkled

note: an ephemeral species



fertile shoots (dry) (2), capsule (dry), leaf outline, leaf apex, and leaf subapex
 1 mm (2), 1 mm, 0.5 mm, 10 μm, 10 μm



costa midleaf, margin near leaf base, and leaf basal angle
 50 μm, 50 μm, 50 μm

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Entosthodon laxus (Hook.f. & Wilson) Mitt.

form: gregarious, erect, radiculose, forked stems, yellow-green, to 15 mm
habitat: waterlogged, shady soil in forest or scrub, to 1900 m

leaf: size: 1.5–3.5 × 0.6–1.0 mm, slightly concave

shape: lingulate

tip: acute to obtuse, the apical cell 25–50(–100) μm long

base: alar cells little differentiated

costa: failing 5–10 cells below the apex

border: not differentiated

margin: entire to ± crenulate above, ± plane

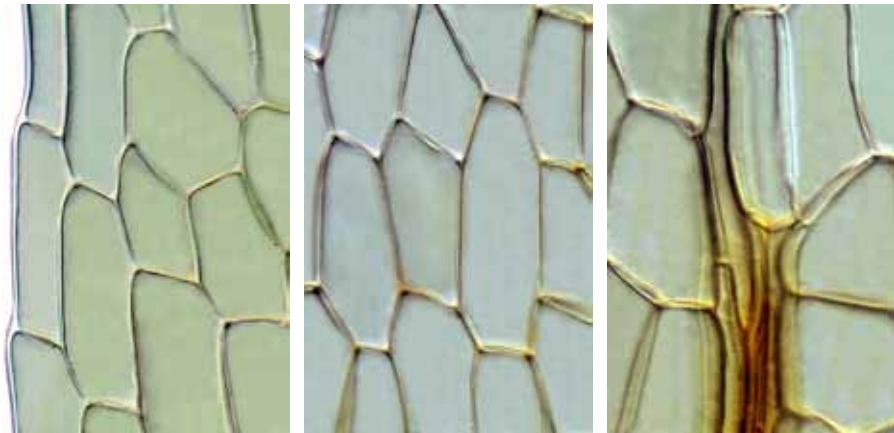
cells: 70–100 × 25–40 μm, oblong-hexagonal, thin-walled, smooth

capsule: 1.5–2.5 mm, oblong-obovoid, with a distinct neck, erect, symmetric, strangulate when dry; seta 10–20 mm; calyptra mitrate or cucullate; operculum convex to mammillate; peristome double, the exostome teeth red, to 300 μm long, weakly striate, falling away quickly, the endostome rudimentary; spores 25–35 μm in diam.



fertile and vegetative shoots, capsule (dry), leaf outline, and leaf apex

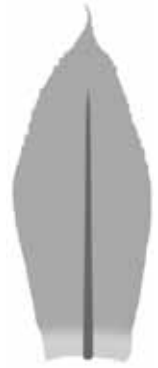
5 mm, 1 mm, 0.5 mm, 1 mm, 10 μm



margin midleaf, cells midleaf, and costa terminus

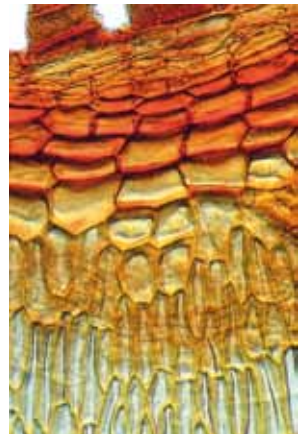
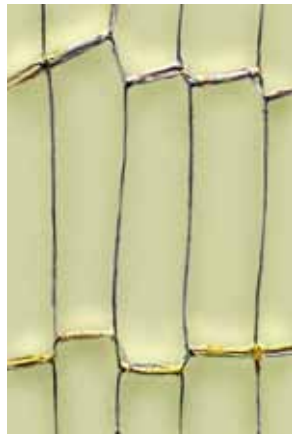
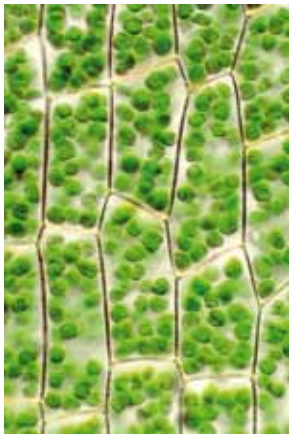
10 μm, 10 μm, 10 μm

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Entosthodon muhlenbergii (Turner) Fife**form:** loose tufts of erect, radiculose, comose, ± branched stems, to 4 mm**habitat:** on exposed, seasonally damp soil and rock underhangs, to 2700 m**leaf:** size: 2.0–2.9 × 0.7–1.0 mm*shape:* ovate to obovate-lanceolate, concave*tip:* acuminate, ending in a filiform point; apical cell 100–200 μm long*base:* basal cells rectangular, ± hyaline; alar cells weakly differentiated*costa:* failing below the acumen*border:* weakly differentiated*margin:* entire below, bluntly toothed above, plane*cells:* 40–90 × 20–30 μm, ± hexagonal, often with oblique end walls, thin-walled, smooth**capsule:** 2(–3) mm, pyriform, not ribbed, asymmetric, curved, erect to inclined, sulcate at the neck, narrowed below the mouth when dry; seta 5–7 mm; calyptra inflated, cucullate; operculum high-conic; peristome double, exostome teeth sigmoid, red; spores 24–27 μm in diam.

shoot (dry), mature capsule (dry), leaf outline, leaf apex, and margin midleaf

1 mm, 0.5 mm, 0.1 mm, 50 μm, 10 μm

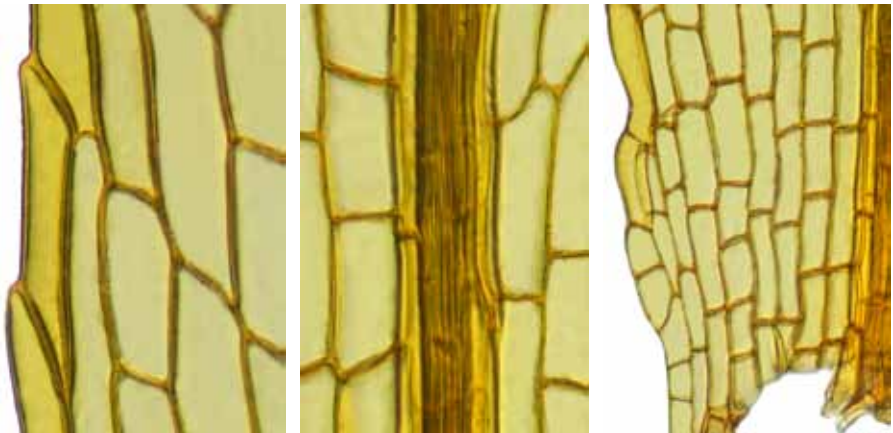


cells midleaf, basal cells, and exothelial cells

10 μm, 10 μm, 50 μm

Entosthodon radians (Hedw.) Müll.Hal.**form:** scattered, erect, light green, comose stems**habitat:** steep, acidic silt and clay banks, to 1500 m**leaf:** size: to 3 mm*shape:* lanceolate-spathulate, widest above midleaf, concave*tip:* acute to short-apiculate; apical cell 30–90 μm long*base:* basal cells rectangular*costa:* failing below the apiculus*border:* weak, 1–3 rows of narrow, elongate cells*margin:* entire to weakly toothed above, plane*cells:* 45–90 \times 30–36 μm , irregularly hexagonal, thin-walled, smooth**capsule:** 1.5–2.3 mm, obovoid, the neck weakly developed ($< 1/3$ the length of the capsule), exerted, reddish brown, inclined to horizontal, strongly curved when dry and empty; seta 5–14 mm; operculum convex; peristome double; spores 24–35 μm in diam.

fertile shoot (2), capsule (dry), leaf outline, and leaf apex

 1 mm, 1 mm, 0.5 mm, 0.1 mm, 50 μm


margin midleaf, costa midleaf, and leaf basal angle

 10 μm , 10 μm , 10 μm

Entosthodon subnudus var. **gracilis** (Hook.f. & Wilson) Fife

form: scattered to gregarious, erect, sparsely branched, bulb-like shoots, yellow-green, to 5 mm

habitat: silt or clay in open scrub, to 1000 m

leaf: size: 1.3–2.1 × 0.6–0.8 mm

shape: ovate to obovate, the uppermost leaves broadest, concave

tip: short-cuspidate or aristate; apical cell 60–150 μm long

base: alar cells ± inflated; basal cells rectangular and ± red-pigmented

costa: failing below apex, to percurrent or excurrent as a cusp or arista

border: not differentiated

margin: entire to weakly crenulate above, plane

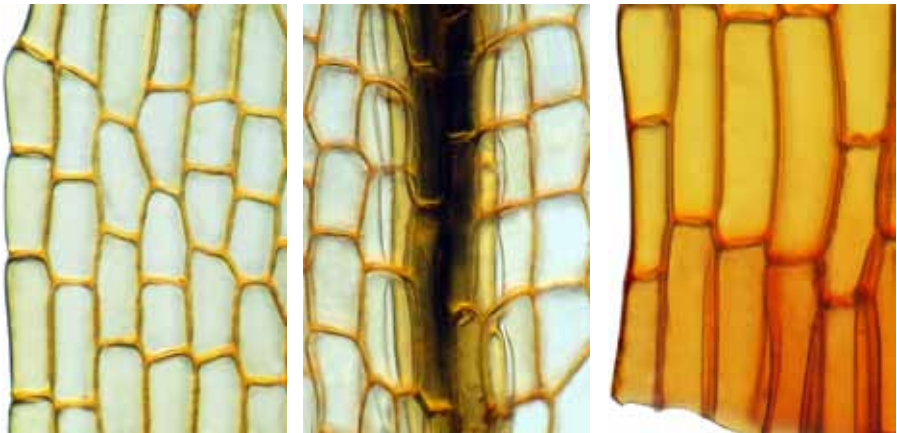
cells: 24–70 × 15–18 μm, oblong to rectangular, thin-walled, smooth

capsule: 1.5–2 mm, cylindrical to obovoid, erect, symmetric, long-exserted, red-brown, necked; annulus none; seta 9–22 mm, reddish; peristome double; teeth lanceolate, papillose above; spores 30–45 μm in diam.



fertile shoot (dry) (2), capsules (dry) (3), leaf outline, and leaf apex

■ 0.5 mm, ■ 0.5 mm, ■ 0.5 mm, ■ 0.5 mm, ■ 0.1 mm, ■ 0.1 mm, ■ 10 μm



margin midleaf, costa midleaf, and leaf basal angle

■ 50 μm, ■ 50 μm, ■ 50 μm

Funaria hygrometrica Hedw.

form: greagious, bulb-like, yellowish green, simple or branched stems
habitat: soil, often in burnt or otherwise disturbed sites, to 2100 m

leaf: size: 2–4 × 1.0–2.0 mm

shape: oblong-ovate to broadly obovate, deeply concave

tip: acute to mucronate

base: basal cells longer and narrower than the other blade cells

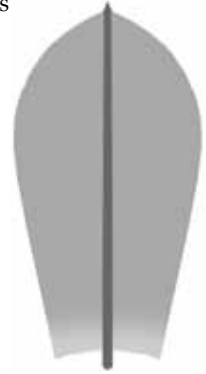
costa: thin, subpercurrent to shortly excurrent in the mucro

border: 1–2 rows of cells narrower and longer than nearby lamina cells

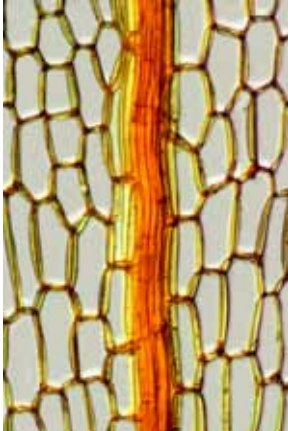
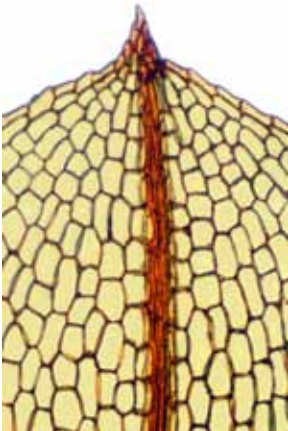
margin: entire to ± serrulate above, plane

cells: 40–90 × 30–36 μm, hexagonal to oblong, thin-walled, smooth

capsule: 2–4.5 mm, pyriform, asymmetric, inclined to cernuous, the mouth oblique, sulcate when dry, orange to reddish brown; seta 10–60 mm, straight at first, later arcuate or flexuose; peristome double, the exostome teeth trabeculate, spirally arranged, united at their apices in a disc; spores 10–40 μm long, ± reniform



habit (cutaway view) capsules (young and mature), and leaf outline
 1 mm, 1 mm, 1 mm, 1 mm

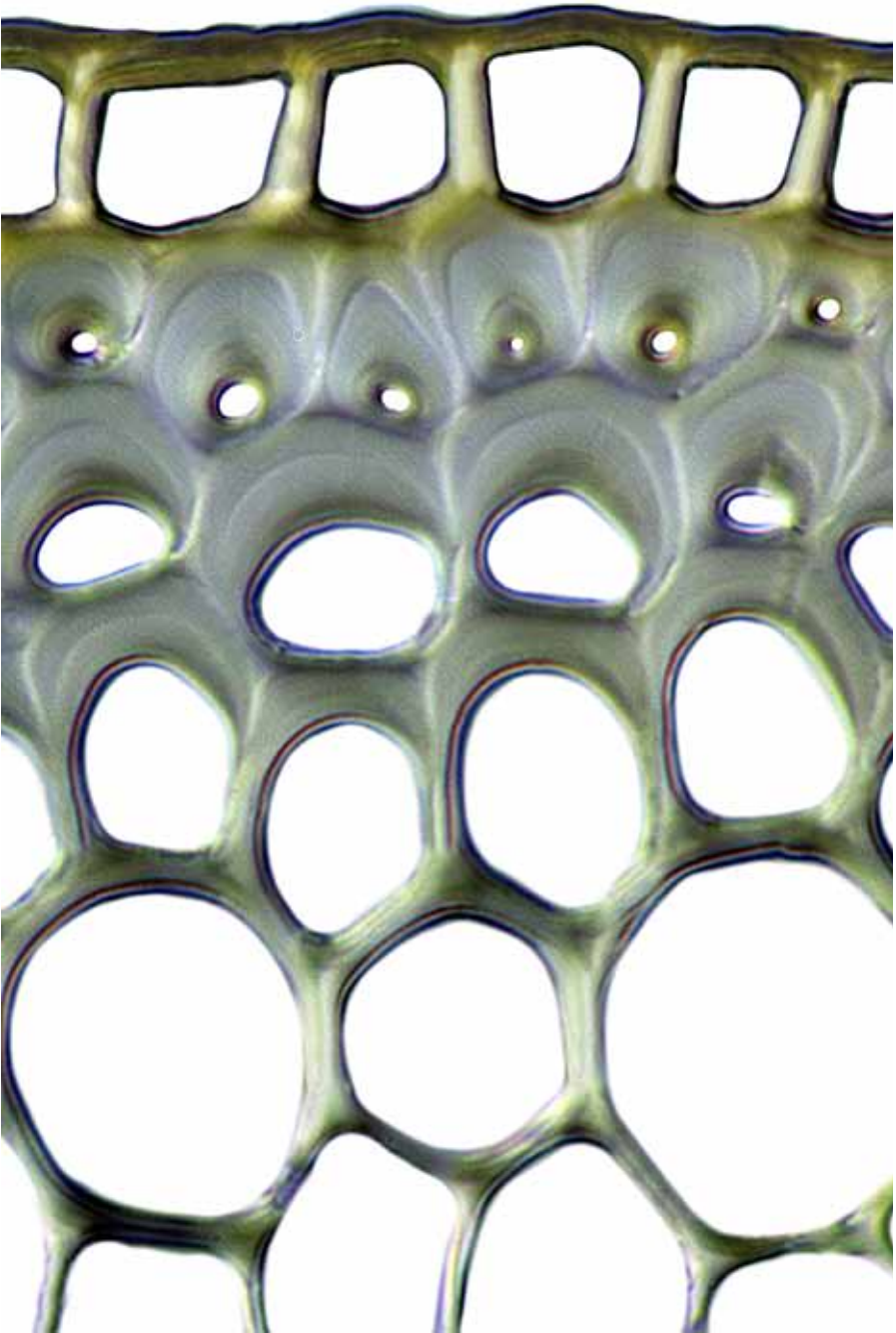


leaf apex, costa, costa midleaf, and leaf basal angle
 100 μm, 50 μm, 100 μm



Funaria hygrometrica immature capsule
0.5 mm

continued next page



Funaria hygrometrica stem cross-section showing surface hyaloderm
10 μm

Goniomitrium acuminatum Hook. & Wilson

form: gregarious, pale to yellow-green, radiculose stems, leaves in low rosettes, to 2 mm

habitat: bare damp soil

leaf: size: 1.0–2.2 × 0.3–0.8 mm

shape: ovate to ovate-lanceolate, strongly concave

tip: tapering to a short acumen

base: outer 1–2 rows of basal cells quadrate

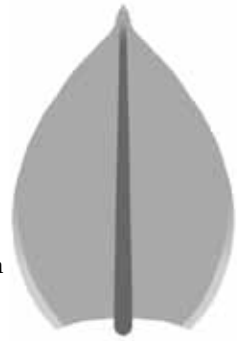
costa: failing below the apex to excurrent in the acumen

border: 1–2 rows of smaller cells

margin: entire to minutely serrulate, plane

cells: 20–100 × 15–27 μm, irregularly hexagonal, firm-walled, smooth

capsule: 1 mm, globose to obovoid, orange, erect, cleistocarpous, immersed; seta to 1 mm; calyptra campanulate, plicate, naked; operculum low-conic; peristome absent; spores to 80–100 μm in diam., the surface reticulate



vegetative habit (2) and leaf outline

5 mm, 1 mm, 0.5 mm



leaf apex, costa midleaf, and leaf basal angle

50 μm, 50 μm, 50 μm

Physcomitrella readeri (Müll.Hal.) Stone & Scott

form: gregarious, minute, radiculose, unbranched stems, with terminal rosettes, to 1.5 mm

habitat: damp, exposed silt or clay, low elevation

leaf: size: 1.5–1.8 × 0.4–0.5 mm

shape: oblong-lanceolate to spatulate

tip: acute

base: alar cells ± inflated, basal cells longer than the blade cells

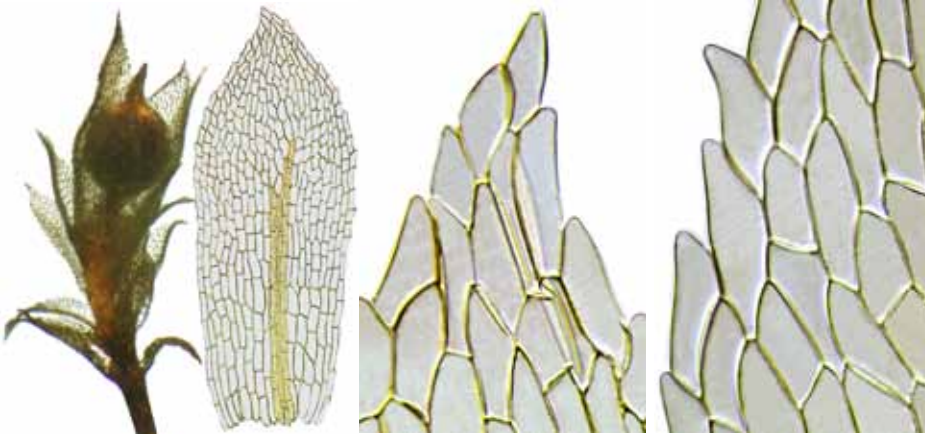
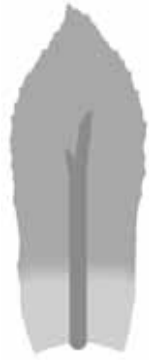
costa: weakly branched above, failing well below the apex

border: not differentiated

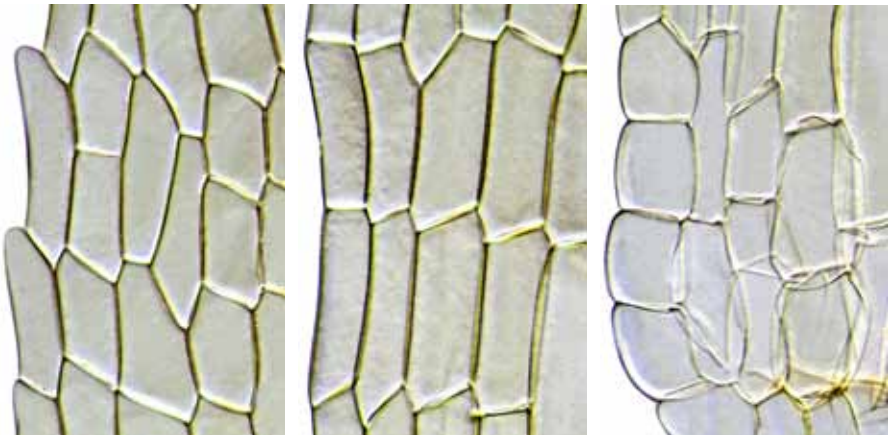
margin: entire below, serrulate toward the apex, plane

cells: 40–60 × 18–27 μm, subhexagonal above, rectangular below, thin-walled, smooth

capsule: 0.5 mm, subglobose, erect, apiculate, emergent, light brown, cleistocarpous; seta 0.1 mm; calyptra minute; operculum none; spores 30–40 μm in diam.



fertile shoot (hydrated), leaf outline, leaf apex, and margin of upper leaf
 ■ 1 mm, ■ 50 μm, ■ 10 μm, ■ 10 μm

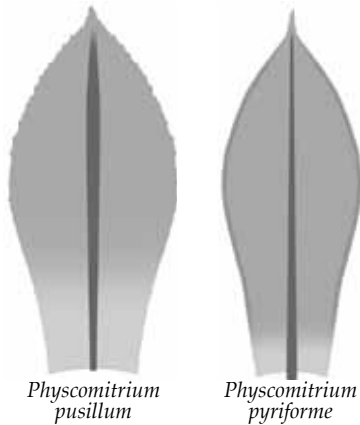


margin midleaf, margin lower leaf, and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 10 μm

Key* to New Zealand species and varieties of *Physcomitrium* (2)

- 1 Seta < 1 mm; capsule mouth 1/3 of capsule diam.; capsule subglobose.....
 ● ***Physcomitrium pusillum***
- 1: Seta > 3 mm; capsule mouth as wide as the capsule; capsule pyriform
 ● ***Physcomitrium pyriforme***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 247:



Physcomitrium pusillum Hook.f. & Wilson

form: scattered, minute (to 4 mm), sparsely branched, radiculose, bulb-like, pale green

habitat: silt or clay in open stream edges, in damp, lowland sites, to 100 m

leaf: size: 2.0–3.1 mm

shape: spatulate, obovate, or ovate-oblong

tip: acute

base: basal cells rectangular, thin-walled

costa: failing below the apex

border: not differentiated

margin: bluntly serrulate above, entire below, plane at margins

cells: 25–50 × 18–25 μm, irregularly rhombic to rectangular, thin-walled, smooth

capsule: 0.9–1.5 mm, subglobose, erect, immersed, reddish brown, glossy; seta to 0.5 mm; peristome none; operculum conic; calyptra mitriform, covering only the operculum; spores 37–49 μm in diam., spinose



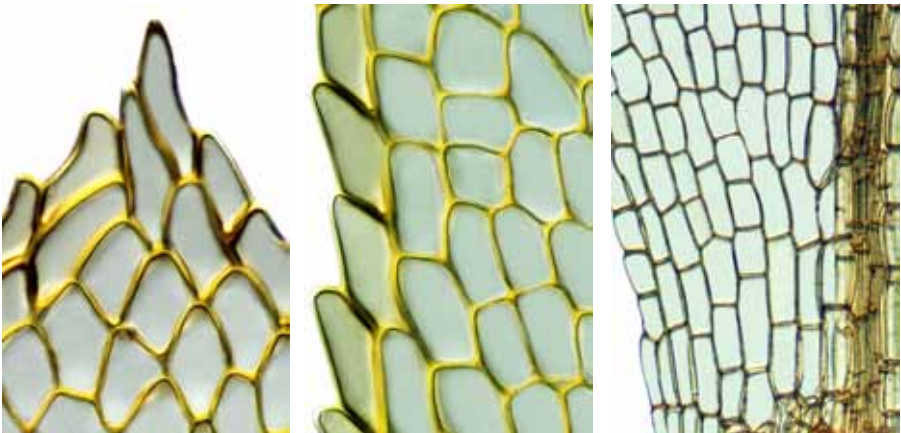
fertile shoot (moist), capsule, leaf outline, and leaf apex

1 mm,

0.5 mm,

0.5 mm,

50 μm



leaf apex detail, margin midleaf, and leaf basal angle

50 μm,

50 μm,

50 μm

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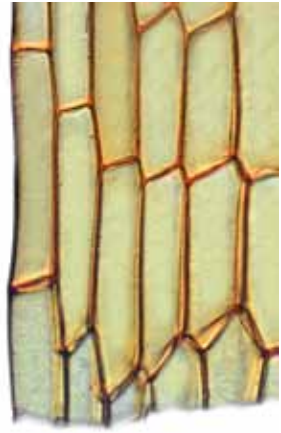
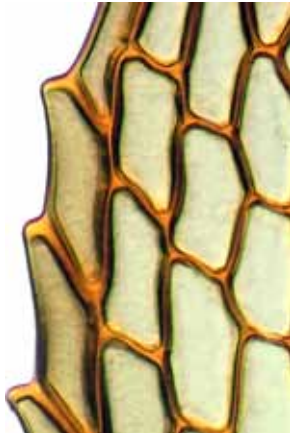


Physcomitrium pusillum margin midleaf
10 μm

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Physcomitrium pyriforme (Hedw.) Hampe**form:** gregarious or tufted, comose, radiculose, ± simple stems, to 11 mm**habitat:** bare silt or clay on exposed streambanks or along drains, often in disturbed sites, to 400 m**leaf:** size: 2.0–3.8 × 0.7–1.5 mm*shape:* oblong-lanceolate to oblong-obovate*tip:* acute*base:* basal cells longer and thinner-walled than the other lamina cells*costa:* subpercurrent to shortly excurrent*border:* faint, 1–2 rows of elongate cells*margin:* entire below, serrulate above, plane*cells:* 40–70 × 26–30 μm, oblong-hexagonal, thin-walled, smooth**capsule:** 1–2 mm, globose-pyriform, short-necked, the mouth flaring when dry; annulus narrow and persistent; seta 4–14(–30) mm; peristome none; spores 25–50 μm in diam., spinose

fertile shoots (2), leaf outline, leaf apex, and costa midleaf
 ■ 1 mm (2), ■ 0.5 mm, ■ 10 μm, ■ 10 μm

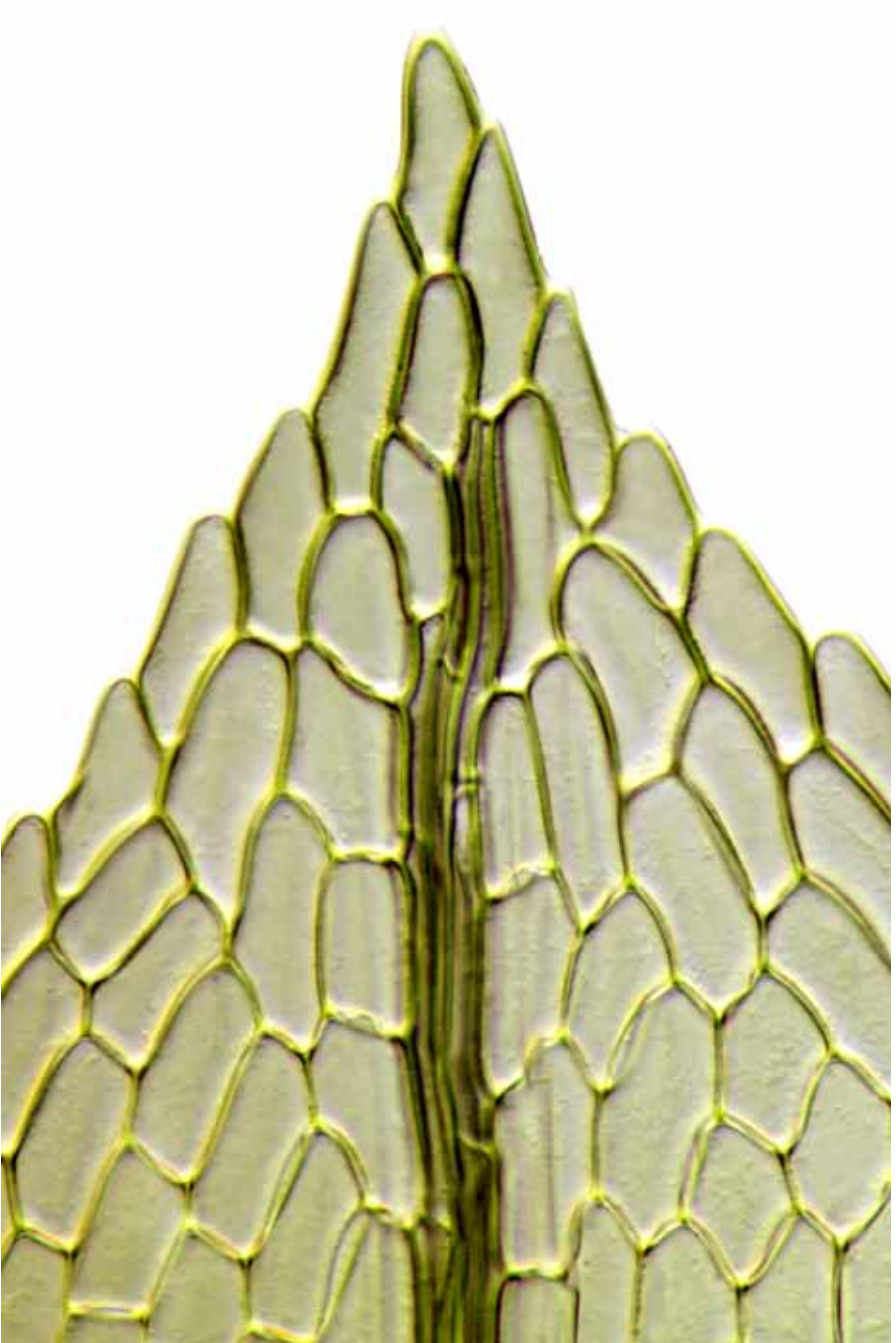


border midleaf (2), and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 10 μm



Physcomitrium pyriforme fertile habit
1 mm

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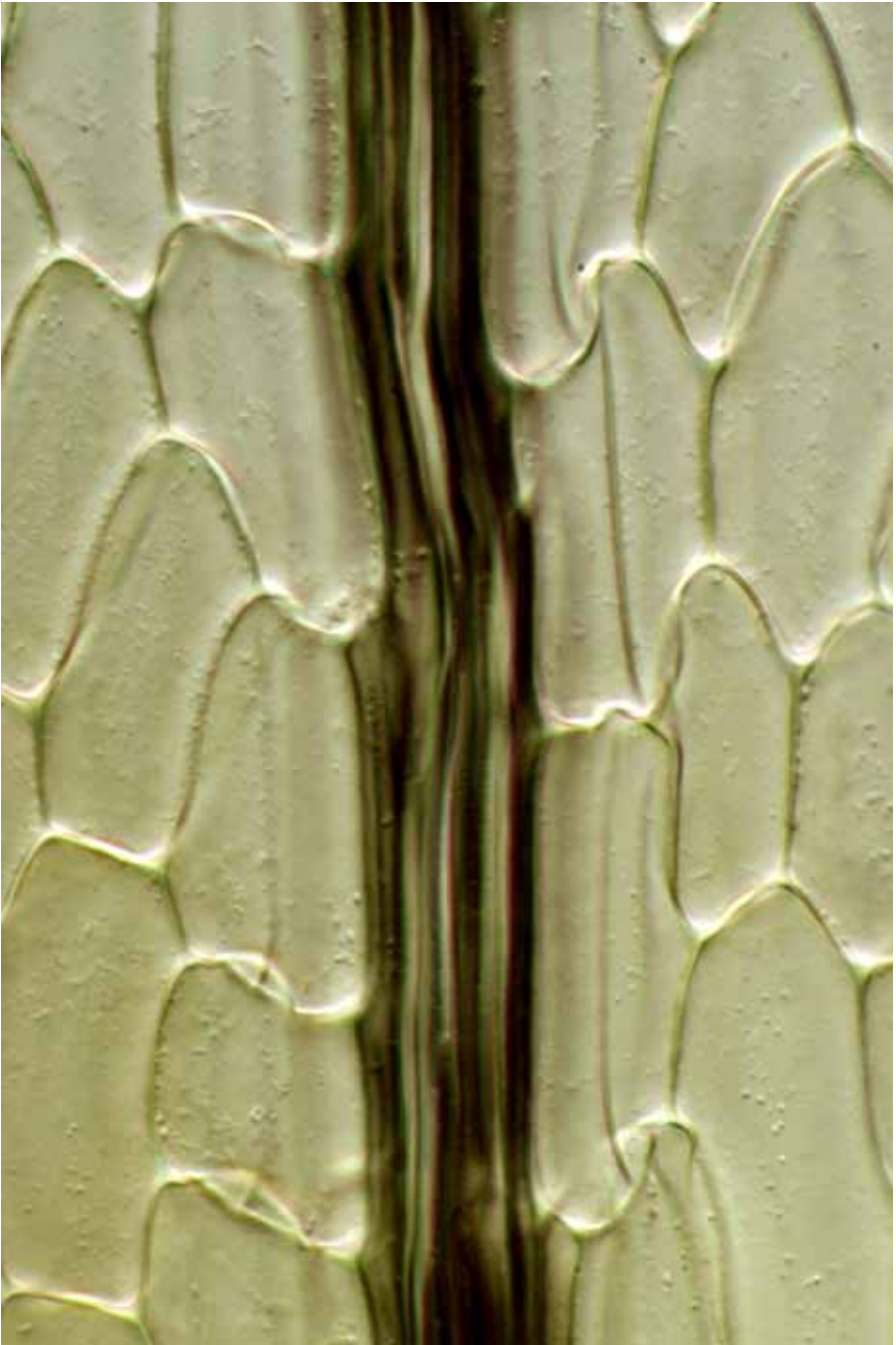
Physcomitrium pyriforme leaf apex
10 μm

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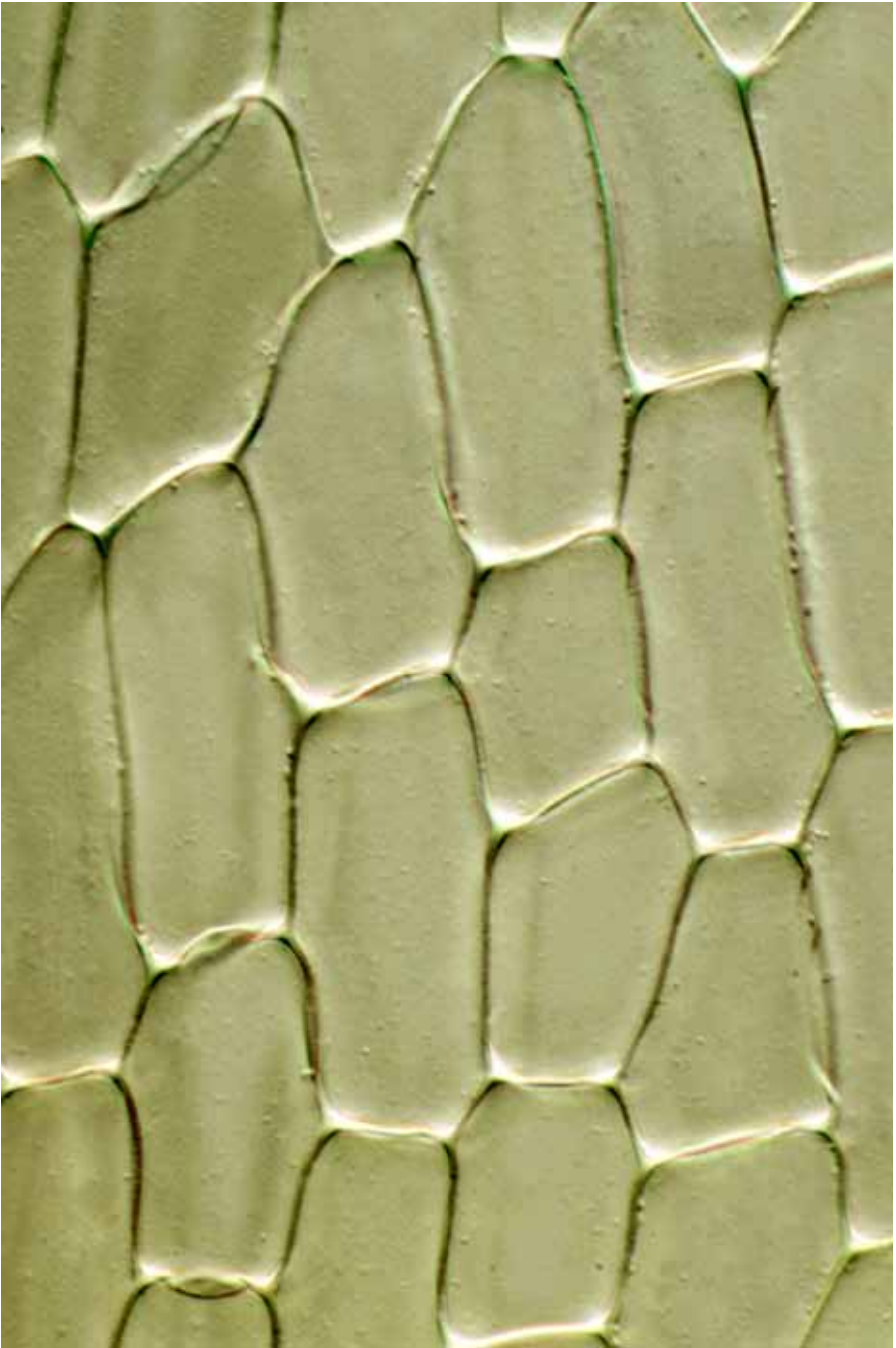
Physcomitrium pyriforme margin midleaf
10 μm

continued next page



Physcomitrium pyriforme costa midleaf
10 μm

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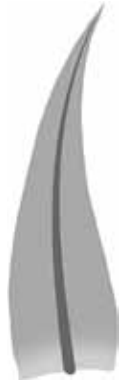


Physcomitrium pyriforme cells midleaf
10 μm

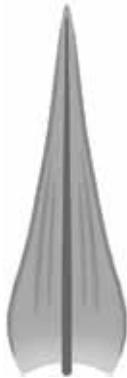
Key* to New Zealand species of *Racomitrium* (9)

- 1 Leaf tip ending in a hyaline, toothed hair-point 2
 1: Leaf tip not hyaline 6
- 2(1) Hair-point short, striate below ● ***Racomitrium striatipilum***
 2: Hair-point long, not striate below 3
- 3(2:) Alar region triangular, composed of 3–6 rows of quadrate to short-rectangular,
 firm-walled, nodulose, ± pigmented cells ● ***Racomitrium elongatum***
 3: Alar region otherwise 4
- 4(3:) Alar cells decurrent; hair-point short-spinose ● ***Racomitrium curiosissimum***
 4: Alar cells not forming decurrencies; hair-point coarsely dentate 5
- 5(4:) Hair-point teeth perpendicular to the margin, bluntly pointed, and densely papill-
 ose ● ***Racomitrium lanuginosum***
 5: Hair-point teeth curved toward the apex, sharply pointed, and only sparsely or not at
 all papillose ● ***Racomitrium pruinosum***
- 6(1:) Leaf curved ● ***Racomitrium crispulum***
 6: Leaf straight 7
- 7(6:) Leaves plicate on only one side, with a single fold 8
 7: Leaves 4-plicate ● ***Racomitrium ptychophyllum***
- 8(7) Leaf-tips fragile; basal border cells straight-walled, swollen and elongate
 ● ***Racomitrium crumianum***
 8: Leaf-tips not fragile; basal border cells sinuose-walled, not swollen or elongate
 ● ***Racomitrium didymum***

* based partly on Beever, J; Allison, KW; Child, J (1992): *The Mosses of New Zealand*. University of Otago Press, Dunedin, 107.



*Racomitrium
crispulum*



*Racomitrium
ptychophyllum*



*Racomitrium
didymum*



*Racomitrium
crumianum*



*Racomitrium
striatipilum*



*Racomitrium
curiosissimum*



*Racomitrium
lanuginosum*



*Racomitrium
pruinatum*



*Racomitrium
elongatum*

Racomitrium crispulum (Hook.f. & Wilson) Hook.f. & Wilson

form: tufted or matted, creeping or decumbent, much-branched

habitat: rock or thin soil over rock

leaf: size: 1.8–2.3 mm

shape: lanceolate to narrowly triangular, ± curved

tip: acuminate

base: pigmented, not differentiated except for 1–2 marginal rows of ± straight- and firm-walled cells

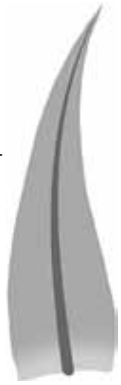
costa: percurrent

border: not differentiated

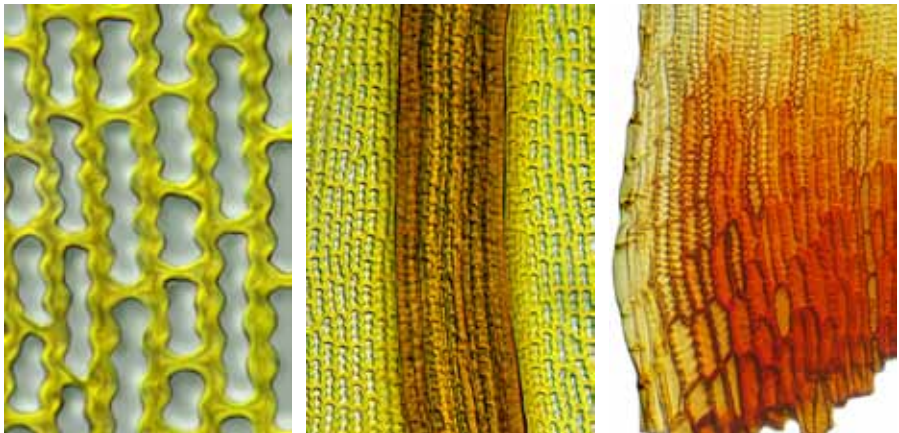
margin: entire, ± revolute on one or both sides

cells: 8–32 × 5 μm, short- to long-rectangular, incrassate, sinuose, smooth

capsule: 2 mm, cylindric, long, erect, exserted, lateral, brown; seta 4–5 mm, smooth; peristome tall (up to 0.5 mm), cleft into two papillose, filiform prongs



shoots (dry), capsule (dry), exostome tooth, leaf outline, leaf apex, and margin midleaf
 ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 50 μm, ■ 0.1 mm, ■ 10 μm, ■ 5 μm



cells midleaf, costa midleaf, and leaf basal angle
 ■ 5 μm, ■ 50 μm, ■ 50 μm

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Racomitrium crispulum vegetative shoot and mature capsule with peristome
1 mm, 1 mm

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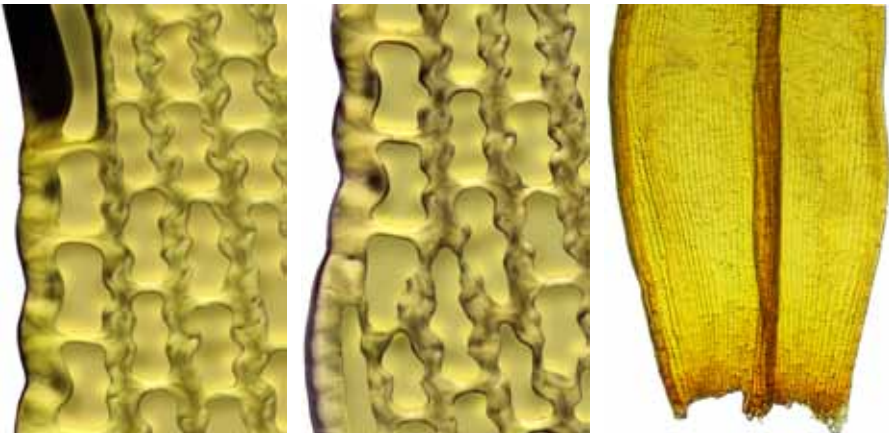


Racomitrium crispulum cells near leaf base
10 μm

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Racomitrium crumianum Fife**form:** tufts of ± upright sparsely branched stems, to 20 mm tall**habitat:** moist rock (granite)**leaf:** *size:* to 3 mm long, imbricate, fragile at the tips, lamina unistratose*shape:* lanceolate, carinate, 1-plicate from base to apex*tip:* acuminate, the acumen bistratose*base:* not differentiated except for 1–2 marginal rows of ± straight- and firm-walled cells*costa:* failing a few cells below the apex*border:* one row of elongate, thick-walled cells from about midleaf to the apex;
one row of straight- and thin-walled cells near the leaf base*margin:* entire, recurved*cells:* 20–40 × 10 μm, ± rectangular, walls thick and strongly sinuose, smooth**capsule:** fertile plants not known

vegetative shoots (dry), leaf outline, leaf apex, and margin above and at about midleaf
 1 mm (2), 1 mm, 0.1 mm, 50 μm, 50 μm, 10 μm



marginal cells transition, margin below about midleaf, and leaf base
 10 μm, 10 μm, 0.1 mm

continued next page



Racomitrium crumianum vegetative shoot (dry)
1 mm

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Racomitrium curiosissimum Bednarek-Ochyra & Ochyra

form: in cushions or tufts, hoary, erect, laterally branched stems, ± olive-green
habitat: gravel in riverbeds, tussockland, and dune slacks

leaf: size: 3–4 mm including the hair-point

shape: lanceolate to ovate-lanceolate, unistratose, deeply plicate

tip: acuminate, ending in a hyaline, decurrent, spinose, 1.2–1.8 mm hair-point

base: alar cells orange, quadrate to rectangular, ± inflated, decurrent, and

auriculate, cells above the alars in 1–4 rows of esinuose, firm-walled cells

costa: narrow (60 μm), prominent abaxially, bistratose above, tristratose below

border: 1–4 rows of esinuose, hyaline cells in basal margins above alar cells

margin: entire, narrowly recurved on one or both sides

cells: 20–80 × 6–10 μm, short- to long-rectangular, thick-walled, strongly

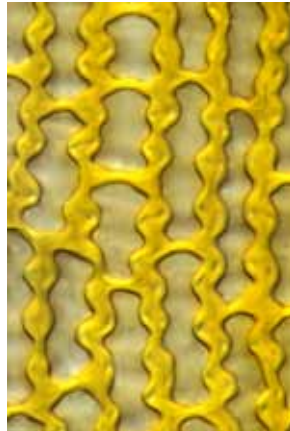
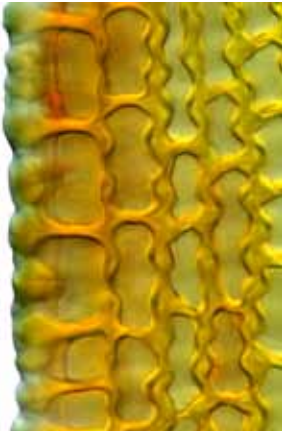
sinuose, smooth to pseudopapillose

capsule: to 1.3–1.5 mm, ovoid to oblong-cylindric, erect, long-exserted, brown;
 seta 4–5 mm; calyptra mitrate, 4–6-lobed, plicate below; operculum beak
 straight, 1 mm; peristome teeth 16, orange, forked to mid-tooth, coarsely
 papillose



fertile shoots (2), capsule (dry) (2), leaf outline, and base of hair-point

■ 1 mm, ■ 0.5 mm, ■ 0.5 mm, ■ 1 mm, ■ 0.5 mm, ■ 50 μm



margin midleaf, cells midleaf, and leaf basal angle

■ 5 μm, ■ 5 μm, ■ 50 μm

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Racomitrium curiosissimum shoot (re-wetted herbarium specimen)

1 mm

continued next page



Racomitrium curiosissimum shoot (dry)

1 mm

continued next page



Racomitrium curiosissimum hair-point apex and margin (interference optics)
10 µm (left), 10 µm (middle), 10 µm (right)

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Racomitrium didymum (Mont.) Lorentz

form: loosely tufted, branched dichotomously, yellowish or brownish
habitat: rock

leaf: size: 1.3–3.0 × 0.4–0.8 mm

shape: oblong-lanceolate from a widened base, keeled above

tip: gradually tapered to a narrow apex and variable hair-point

base: 1–3 rows of hyaline, rectangular cells along the margin

costa: reaching the apex

border: not differentiated

margin: entire, variably revolute on one side

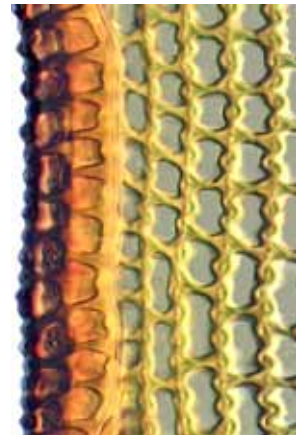
cells: 9–22 μm, thick-walled, sinuose, incrassate, smooth

capsule: 1.5–2 mm, erect, narrowly oblong to cylindric, pale, smooth; seta 2–5 mm, slender; peristome of 16 red, papillose teeth divided nearly to the base

notes: highly variable in habit; resembles *Racomitrium ptychophyllum*, but differs in being only weakly plicate, with a single fold on one side



habit (with *Polytrichum juniperinum*), shoot (dry), capsule, peristome, and leaf outline
 ■ 5 mm, ■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 0.25 mm



leaf base, revolute margin midleaf, and leaf basal angle showing sinuose walls
 ■ 0.25 mm, ■ 10 μm, ■ 10 μm

continued next page

Racomitrium elongatum Frisvoll

form: tufts or mats, creeping, procumbent to erect, \pm branched, hoary when dry
habitat: dry sandy or gravelly soil, lowland to subalpine

leaf: size: $2-3.2 \times 0.8-1.2$ mm

shape: ovate-lanceolate to subtriangular, \pm curved

tip: subulate, denticulate, hair-point long-decurrent and papillose

base: basal cells quadrate to short-rectangular, $20-50 \times 20$ μm , \pm nodulose; alar cells hyaline, firm-walled, in a triangular group of 3-6 rows

costa: percurrent, channeled, $85-120$ μm wide at the base

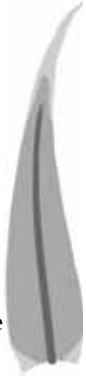
border: not differentiated

margin: entire, broadly recurved throughout

cells: $6-20 \times 5-8$ μm , rectangular, sinuose, thick-walled, pluripapillose

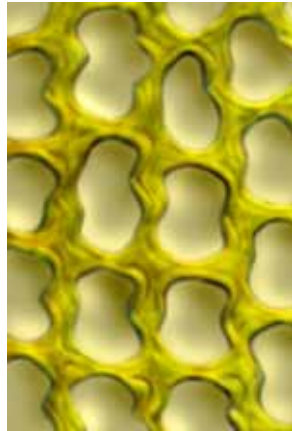
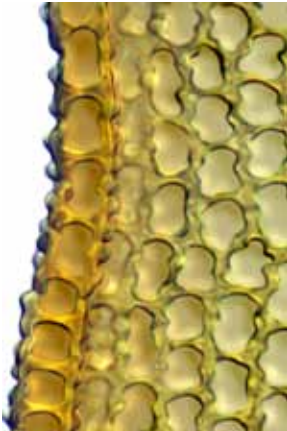
capsule: 1.4-1.8 mm, long-cylindric, erect, exserted, rust-red, sulcate when dry; seta 10-15 mm, brown, glossy; peristome teeth to 0.8 mm long, split to the base into two filiform, papillose prongs

note: capsules not seen in New Zealand



habit (moist), vegetative shoots (dry) (2), leaf outline, and leaf apex

■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 50 μm



recurved margin midleaf, cells midleaf, and leaf basal angle

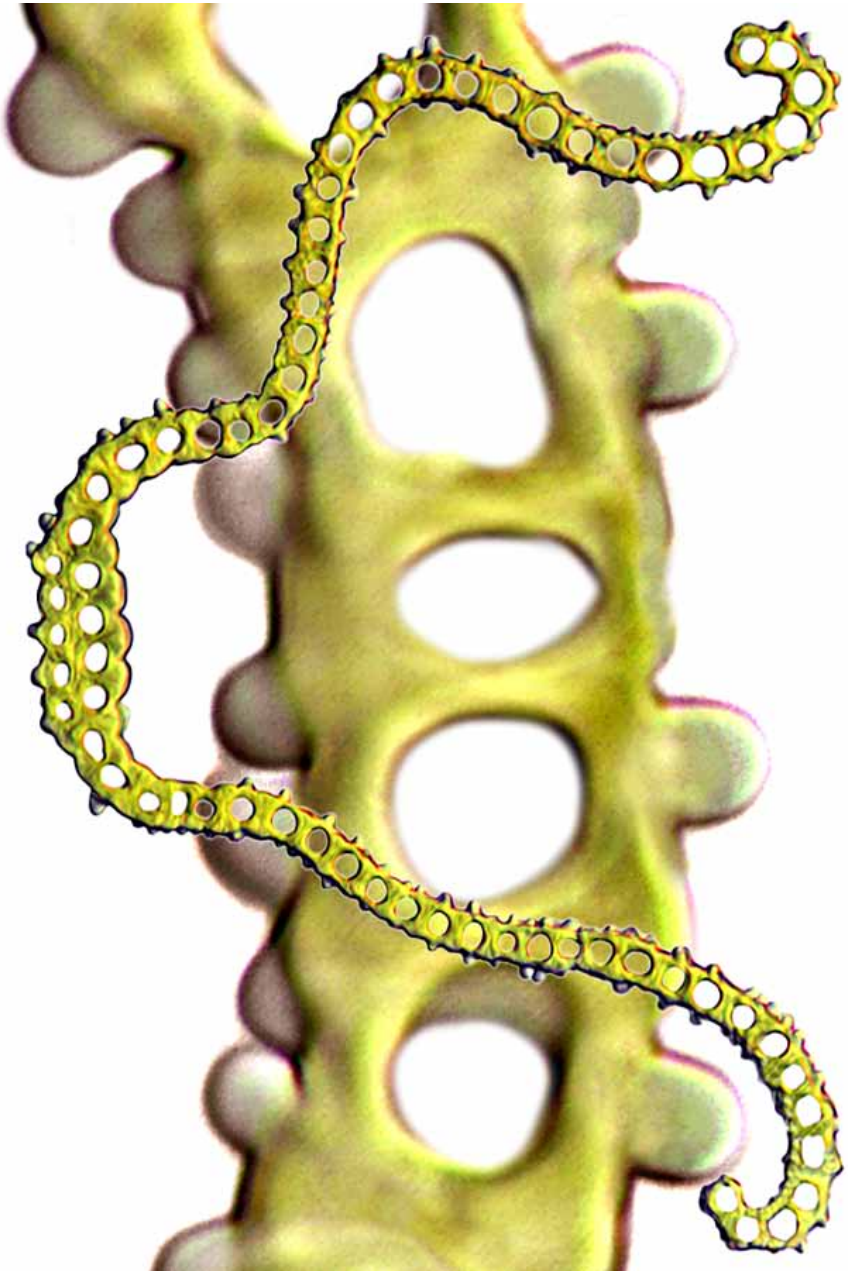
■ 10 μm , ■ 10 μm , ■ 10 μm

continued next page



Racomitrium elongatum vegetative shoot (dry)
1 mm

continued next page



Racomitrium elongatum leaf cross-sections

50 μm (whole leaf),

10 μm (detail)

continued next page

Racomitrium lanuginosum (Hedw.) Brid.

form: robust, in cushions or carpets, hoary when dry, grey-green to yellowish, with many short, tufted, horizontal branches

habitat: soil or rock, often in dry sites

leaf: size: 3.5–4.0 × 0.6–1.0 mm

shape: narrowly lanceolate

tip: long-acuminate, ending in a decurrent, hyaline, papillose acumen tipped by a hyaline decurrent hair-point that reflexes 90° when dry

base: not differentiated

costa: ending in the hyaline acumen

border: not differentiated

margin: hyaline acumen coarsely dentate and papillose, ± revolute below

cells: 35–40 × 4–5 μm, linear, incrassate, sinuose, smooth, papillose in acumen

capsule: 1–1.7 mm, ovoid-cylindric, truncate at the base, smooth, red-brown;

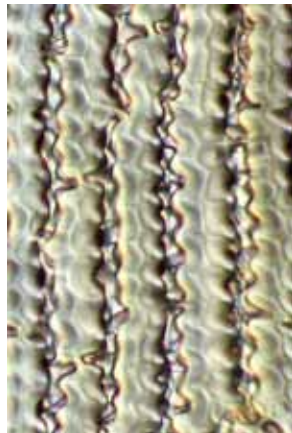
seta 4–8 mm, flexuose, papillose, often paired

note: often forming extensive carpets on scree or in fell-fields



vegetative habit, vegetative shoot (dry), leaf outline, and leaf apex

100 mm, 5 mm, 0.25 mm, 10 μm



upper leaf margin and costa, marginal papillae midleaf, and sinuose cells in leaf base

50 μm, 10 μm, 5 μm

continued next page



Racomitrium lanuginosum habit on Mt Ruapehu

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Racomitrium lanuginosum xs of leaf hyaline decurrency (above) and lamina margin (below)
5 μm (above), 5 μm (below)

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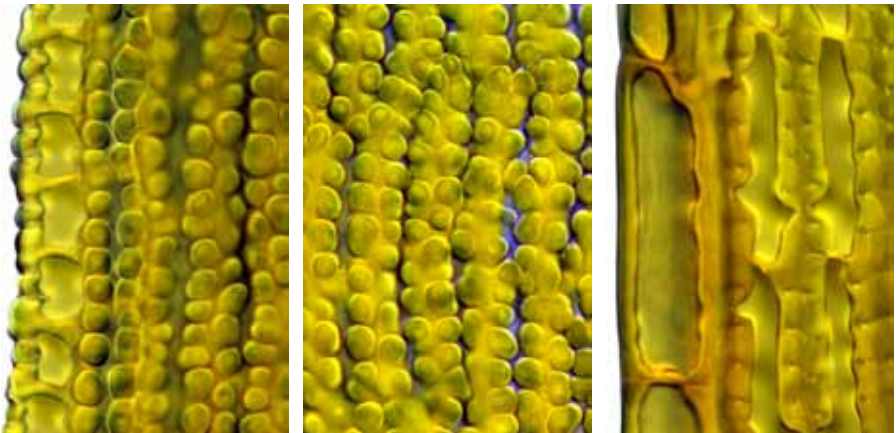


Racomitrium lanuginosum decurrent margin of hair-point (midleaf)
10 μm

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Racomitrium pruinosum (Hook.f. & Wilson) Müll.Hal.**form:** loose tufts, hoary, with short, pinnate, recurved lateral branchlets**habitat:** exposed soil or rock, sometimes dominating subalpine vegetation**leaf:** size: 3.5–4.0 mm*shape:* narrowly lanceolate, with two folds below*tip:* long-acuminate, ending in a long-decurrent hyaline hair-point*base:* basal cells less papillose than the other laminal cells*costa:* broad, continuing through the hyaline hair-point, ending below the apex*border:* a single row of oblong, thin-walled cells in only the basal margin*margin:* entire below, ± dentate above, variably recurved or revolute*cells:* 30–50 × 4–5 μm, linear, incrassate, sinuose, papillose throughout**capsule:** 1.0–1.7 mm, ovoid, erect, smooth, excurrent, brown; seta 4–8 mm, papillose; calyptra mitriform; operculum subulate-rostrate; peristome teeth divided to the base into two long, filiform, papillose segments; spores 7–10 μm in diam., smooth

vegetative shoot (dry) (2), leaf outline, leaf apex, and margin of hair-point
 1 mm, 1 mm, 0.1 mm, 10 μm, 10 μm



margin midleaf, papillose cells midleaf, and margin near leaf base
 10 μm, 10 μm, 10 μm

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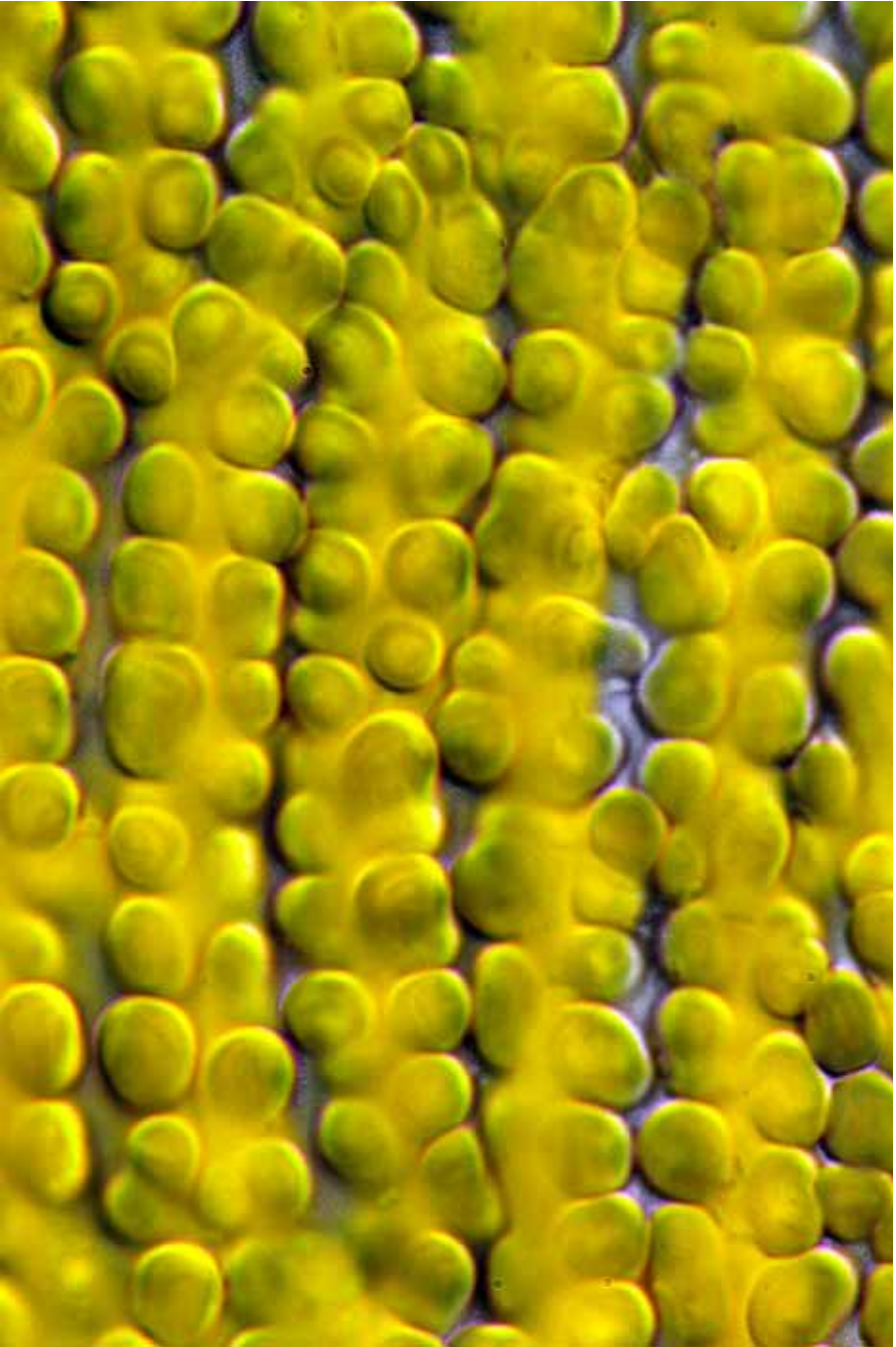


Racomitrium pruinosum leaf cross-sections

10 μm (above),

5 μm (below)

continued next page



Racomitrium pruinatum papillose cells midleaf
10 μm

continued next page

Racomitrium ptychophyllum (Mitt.) Hook.f.

form: tufted, yellow-brown, erect, sparsely branched, highly variable
habitat: rock in subalpine vegetation

leaf: size: 3–3.5 mm

shape: lanceolate, long-plicate, with two folds on each side of the costa

tip: gradually tapered, bluntly pointed, without a hair-point

base: cells in the basal angles not or only weakly differentiated

costa: robust, failing just below the apex

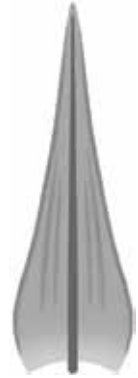
border: not differentiated

margin: entire to minutely crenulate, recurved to nearly the apex

cells: 20–40 × 10 μm, rectangular to linear, incrassate, sinuose, smooth

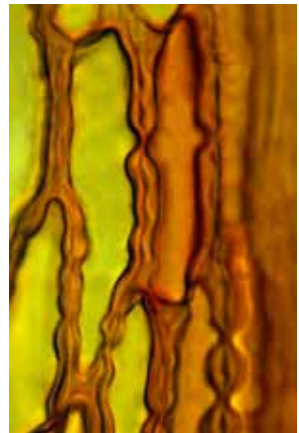
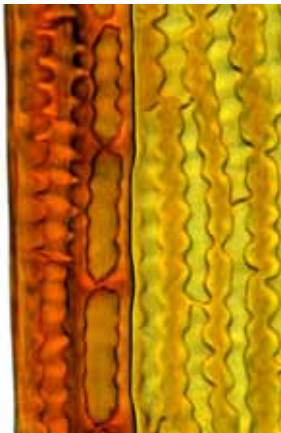
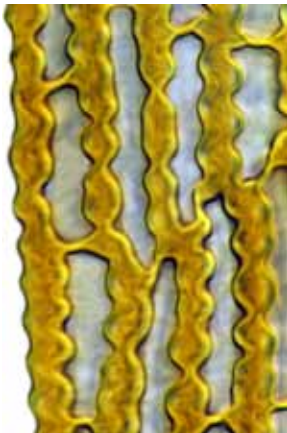
capsule: 2 mm, narrowly oblong to cylindrical, erect, exserted, pale brown;
 seta 2–5 mm; peristome of 16 dark red, coarsely papillose teeth divided
 nearly to their base

notes: resembles *Racomitrium crispulum*, but differs in lacking a hyaline
 hair-point and (usually) having 1–2 plications on both sides of the costa



habit (on left with *Celmisia sessiliflora*) (2), leaf outline, and leaf apex

10 mm, 1 mm, 0.5 mm, 10 μm



margin midleaf, reflexed margin of lower leaf, and cells of leaf basal angle

10 μm, 10 μm, 10 μm

continued next page

Racomitrium striatipilum Cardot

form: matted to tufted, prostrate to erect stems, densely branched, often hoary
habitat: exposed rock, mostly at 1200–1600 m in grassland or shrubland

leaf: *size:* 1.5–2.1 (excluding hair-point) × 0.4–0.6 mm

shape: narrowly lanceolate to ovate-lanceolate, unistratose throughout

tip: long-acuminate, ending in a hyaline, non-decurrent 1.5 mm hair-point

base: basal cells long-rectangular, 40–60 × 6–10 μm

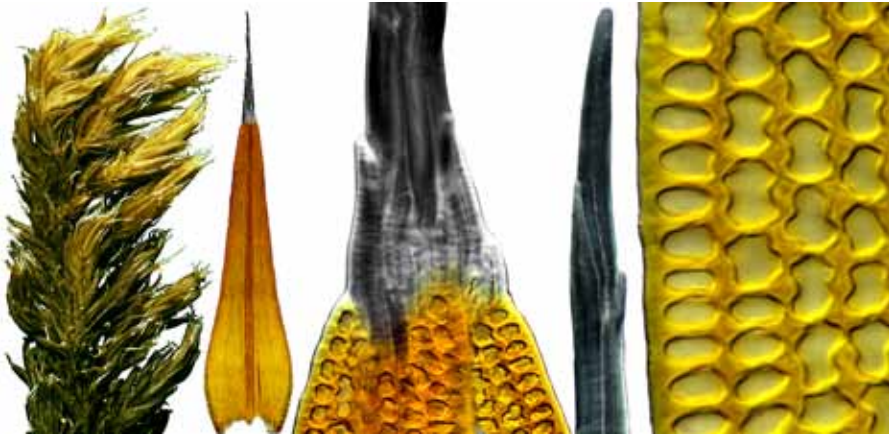
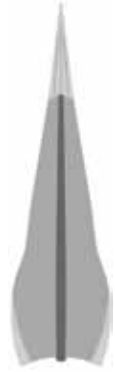
costa: percurrent

border: not differentiated

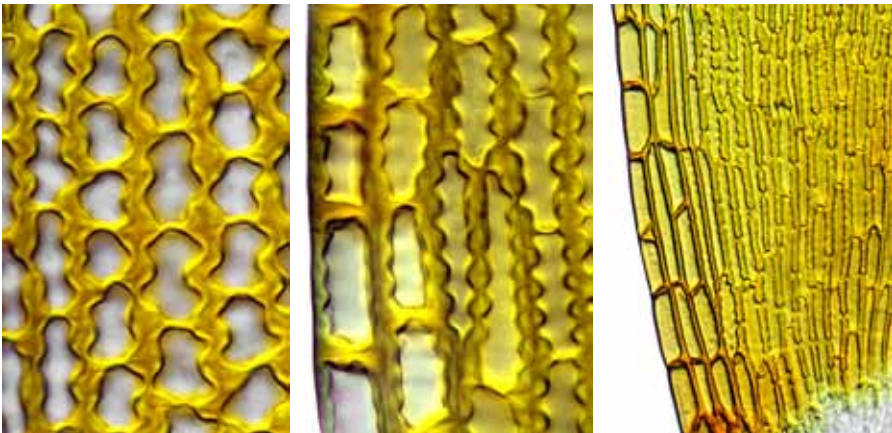
margin: entire, plane on one side, ± recurved on the other in the lower 2/3

cells: 6–10 μm, isodiametric above, thick-walled, sinuose, ± striate

capsule: 1.5–2.0 mm, ellipsoid to cylindric, erect, shortly exserted, dark brown; seta 2.5–6.0 mm, yellowish to pale brown; peristome single, 16 yellowish, deeply cleft, narrowly lanceolate teeth; operculum beaked; stomata superficial; calyptra smooth, naked, 5-lobed at base



vegetative shoot (dry), leaf outline, hair-point junction and tip, and margin midleaf
 1 mm, 1 mm, 50 μm, 10 μm, 10 μm



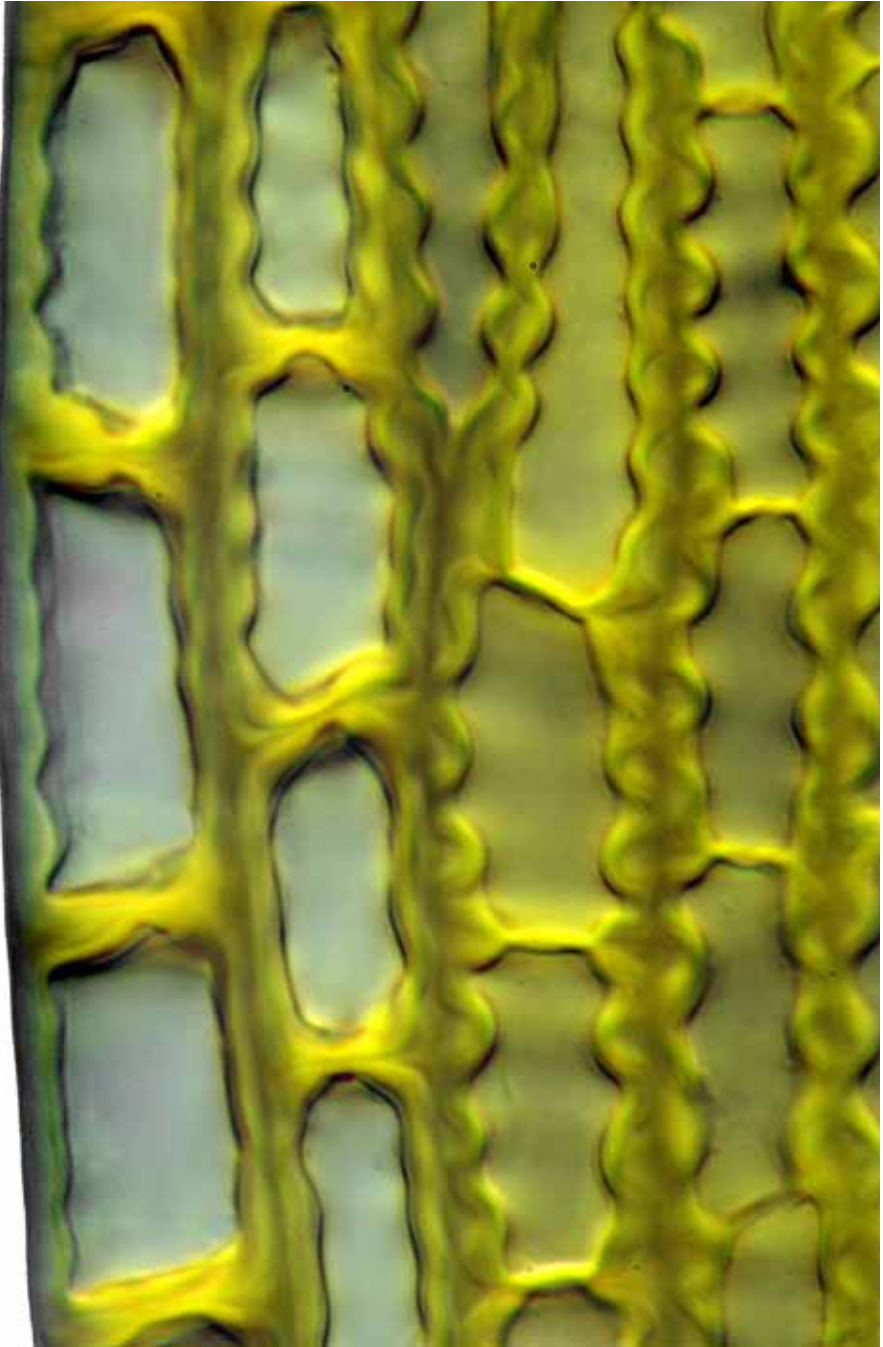
cells midleaf, margin near leaf base, and leaf basal angle
 10 μm, 10 μm, 50 μm

continued next page



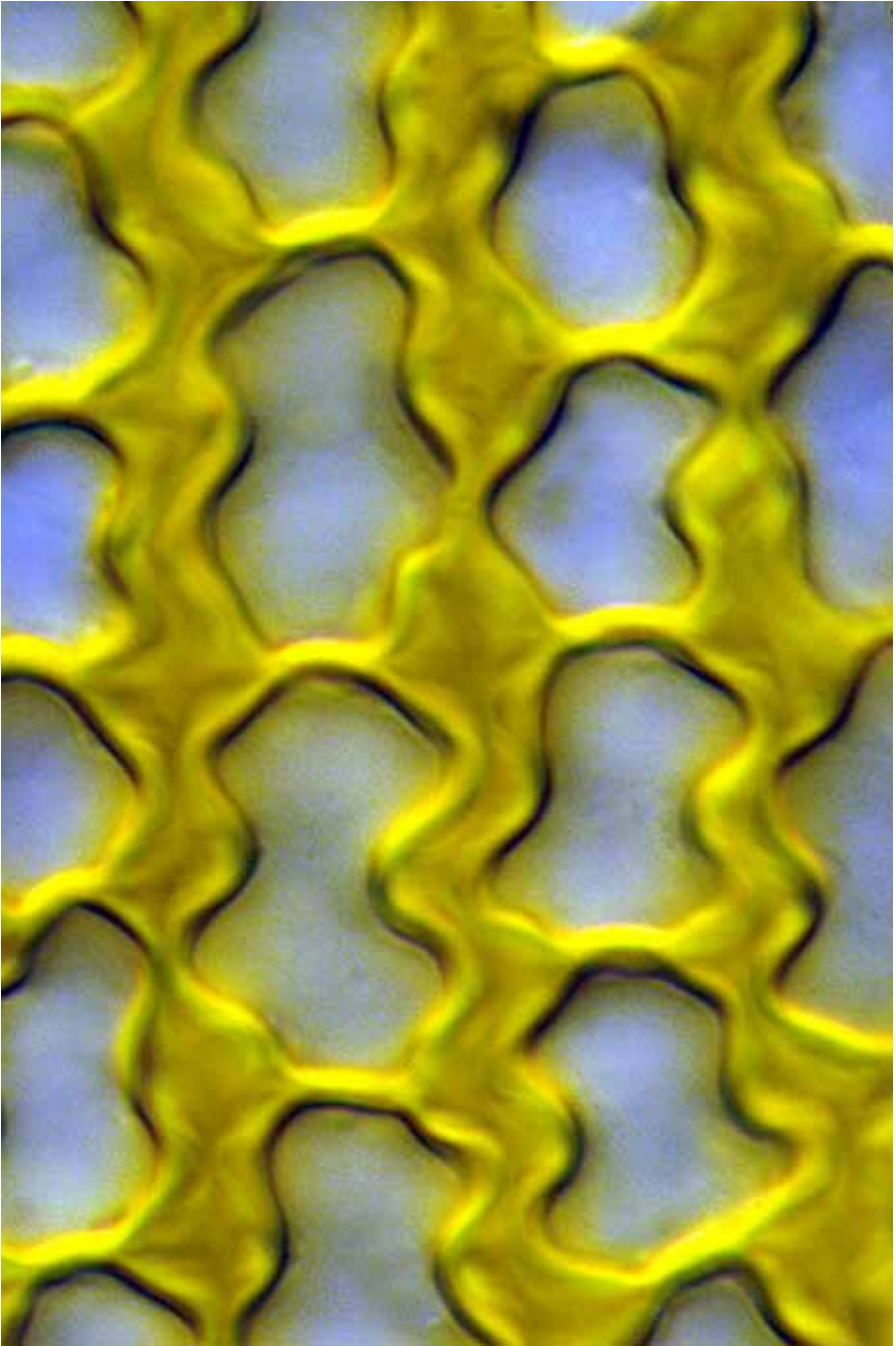
Racomitrium striatipilum vegetative shoot (dry), and an immature and mature capsule
1 mm (left), 1 mm (right) (2)

continued next page



Racomitrium striatipilum margin near leaf base
10 μm

continued next page



Racomitrium striatipilum lamina cells midleaf
10 μm

Coscinodon calyptratus (Hook.) C.Jens.

form: hoary cushions of erect, branched, dark olive-green stems, to 25 mm tall
habitat: dry, exposed rock or soil-covered rock to high elevations

leaf: size: 1.5–2.5 mm

shape: ligulate to lanceolate-ligulate, keeled above, ± bistratose, ± mucicous

tip: gradually to abruptly contracted to a hair-point

base: basal cells oblong to quadrate; alar cells little differentiated

costa: long-excurrent in a hair-point

border: not differentiated

margin: entire, plane or recurved on one side, bistratose

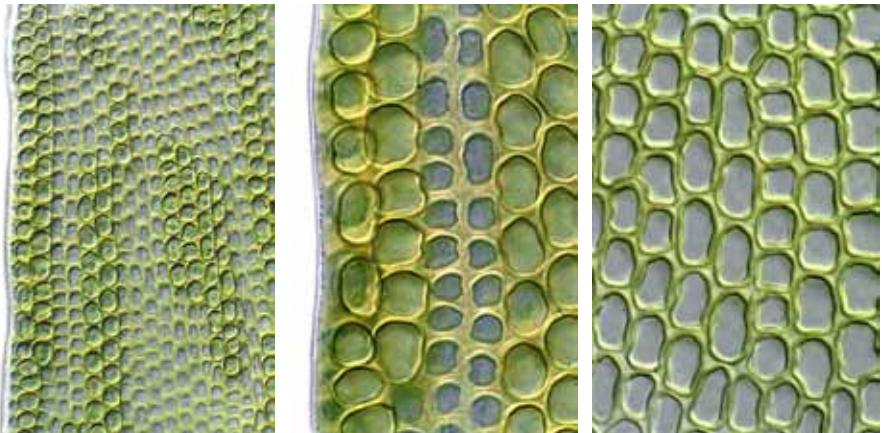
cells: 6–8 μm , ± rounded, firm-walled, ± sinuose, smooth

capsule: 1–1.7 mm, oblong-elliptic, immersed to shortly exserted, reddish brown, smooth to ribbed when dry; seta 2–3 mm, straight; calyptre straw-coloured, later darkening at the tip, covering the entire capsule, fringed at the base; annulus none; stomata none; operculum rostrate; peristome teeth reddish; spores 12–14 μm in diam., granular



fertile shoots (dry) (2), leaf outlines (2), and base of hair-point

1 mm, 1 mm, 1 mm (2), 100 μm



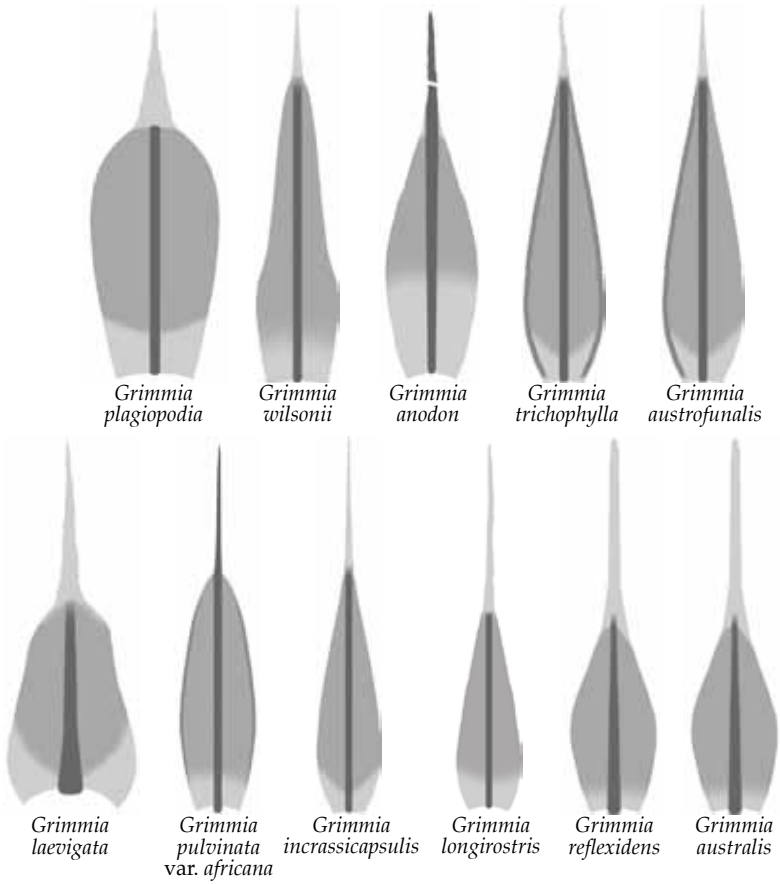
upperleaf bistratose patches, bistratose upper leaf margin, and unistratose lamina cells

50 μm , 10 μm , 10 μm

Key* to New Zealand species and varieties of *Grimmia* (11)

- 1 Leaves unistratose throughout..... 2
 1: Leaves at least partly 2–3-stratose distally 8
- 2(1) Leaves lacking awns, or only distal leaves with very short awns or hyaline tips
 ● *Grimmia trichophylla*
 2: At least distal or perichaetial leaves with distinct awns 3
- 3(2:) Awns up to or longer than the lamina; margin plane; seta straight to flexuose 4
 3: Awns shorter than the lamina; margin recurved; seta arcuate to cygneous..... 6
- 4(3) Hair-points rough to sharply denticulate 5
 4: Hair-points smooth or nearly so ● *Grimmia reflexidens*
- 5(4) Plants hoary-white, on limestone..... ● *Grimmia plagiopodia*
 5: Plants not hoary-white, not on limestone ● *Grimmia australis*
- 6(3:) Lamina abruptly narrowed to the awn; apex rounded.....
 ● *Grimmia pulvinata* var. *africana*
 6: Lamina gradually narrowed to the awn; apex acute 7
- 7(6:) Margin recurved on only one side; hair-point smooth.. ● *Grimmia austrofunalis*
 7: Margin usually recurved on both sides; hair-point denticulate to spinulose
 ● *Grimmia trichophylla*
- 8(1:) Costa prominent abaxially 10
 8: Costa not prominent abaxially 9
- 9(8:) Basal marginal cells quadrate to rectangular ● *Grimmia wilsonii*
 9: Basal marginal cells oblate (wider than long)..... ● *Grimmia laevigata*
- 10(8) Capsule immersed, seta < 1 mm long 11
 10: Capsule emergent to exserted, seta 1–4 mm long ● *Grimmia longirostris*
- 11(10) Exothecial cells thin-walled; seta arcuate; midleaf cell walls straight.....
 ● *Grimmia anodon*
 11: Exothecial cells incrassate; seta straight; midleaf cell walls sinuose
 ● *Grimmia incrasscapsulis*

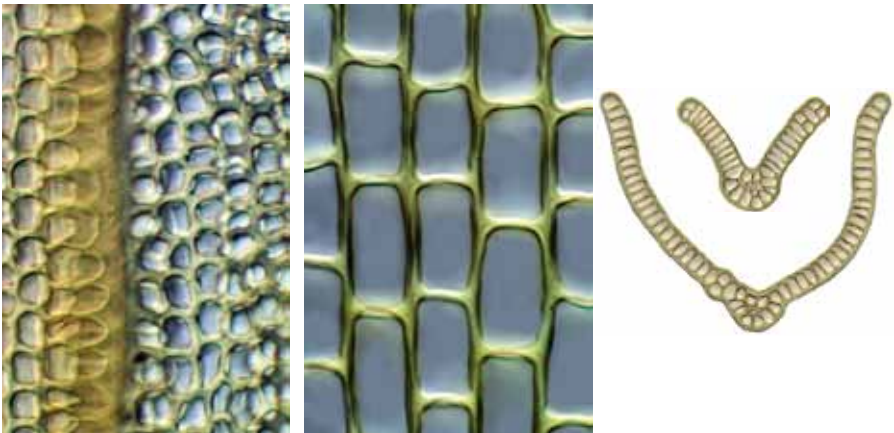
* based on Hastings, RI; Greven, HC (2007): *Grimmia*. *Flora of North America* 27, 226, and Greven, HC (1998): Synopsis of *Grimmia* Hedw. in New Zealand, including *Grimmia wilsonii* sp. nov. *Journal of Bryology* 20, 389–402.



Grimmia anodon Bruch & Schimp.**form:** tufts or cushions of dark green, branched, hoary stems, to 12 mm tall**habitat:** exposed soil or soil over rock, usually in full sun, to high elevations**leaf:** size: 1.0–1.8 mm, awn to 1.2 mm*shape:* ovate-lanceolate, with bistratose streaks, concave, ± keeled near the apex*tip:* acuminate, upper leaves piliferous, lower leaves mucicose, much smaller*base:* basal cells rectangular to linear, thin-walled, hyaline; the transverse walls are thicker than the lateral walls in cells near the margins*costa:* in lower leaves percurrent; in upper leaves excurrent in a hair-point*border:* absent*margin:* entire, plane to at least slightly recurved at the base*cells:* 6–12 μm , \pm quadrate, firm-walled, smooth**capsule:** urn 1 mm, globose, immersed, stomatose below; seta short and bent, hidden by the perichaetial leaves; calyptra small, mitrate; peristome absent; operculum convex; annulus a single row of cells

fertile shoot, leaf outline, leaf apex, hair-point detail, and margin midleaf

0.5 mm,
 0.1 mm,
 0.1 mm,
 10 μm ,
 10 μm



costa midleaf, cells just below midleaf, and xs of upper leaf (above) and midleaf (below)

10 μm ,
 10 μm ,
 50 μm (2)

continued next page

Grimmia australis (Dixon & Sainsbury) J.M. Muñoz & Ochrya

form: compact hairy cushions of erect stems, dark brown below, to 20 mm tall
habitat: exposed acidic rock in dry sites

leaf: size: 2.5–3.5 mm, including hair-point

shape: narrowly lanceolate, vegetative leaves strongly crisped when dry

tip: denticulate, hyaline hair-point

base: basal cells \pm rectangular; transverse walls of the outer 3–6 rows of basal cells thickened

costa: strong, reaching the base of the hair-point

border: not differentiated

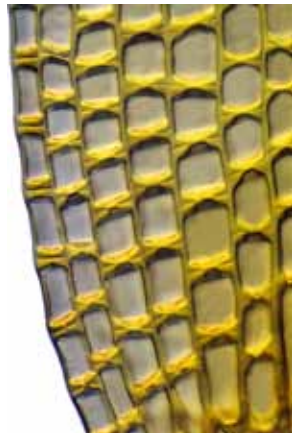
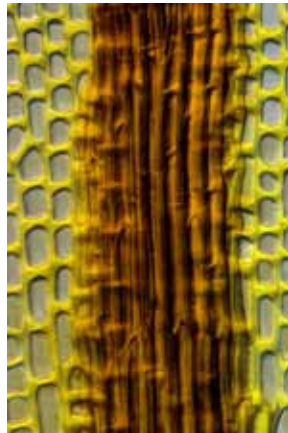
margin: entire, \pm recurved on both sides

cells: 9–12 μm , rounded-quadrate, thick-walled, \pm sinuose, smooth

capsule: to 2 mm, cylindrical, erect, immersed, brown, not stomatose, annulus a single row of quadrate, thick-walled cells; seta very short; operculum mammillate to rostrate; peristome teeth split and perforate toward the apex, papillose



fertile shoot (dry) (2), leaf outline, leaf apex, leaf subapex, and margin midleaf
 ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 50 μm , ■ 50 μm , ■ 10 μm



cells midleaf, costa midleaf, and leaf basal angle
 ■ 10 μm , ■ 10 μm , ■ 10 μm



Grimmia australis leaf basal angle
10 μm

continued next page

Grimmia austrofunalis Müll.Hal.**form:** loosely to densely tufted, blackish green stems, hoary when dry**habitat:** exposed acidic rock, at subalpine to alpine elevations**leaf:** size: 2–2.8 mm*shape:* lanceolate, sharply keeled above*tip:* acuminate, ending in a smooth, hyaline, slightly denticulate hair-point*base:* basal cells longer and thinner-walled than other lamina cells*costa:* reaching the base of the hair-point*border:* not differentiated*margin:* entire, recurved on one side*cells:* 10–20 × 10 μm, subquadrate to rectangular, incrassate, sinuose, smooth**capsule:** 1.5 mm, ovoid, erect, exserted, brown; seta 3–5 mm, flexuose when dry; operculum rostrate; columella not attached; calyptra irregularly lobed at the base; peristome teeth papillose

vegetative shoots (3, moist on right), mature capsule, peristome, and leaf apex (3)

■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 0.1 mm, ■ 0.1 mm, ■ 50 μm, ■ 50 μm, ■ 50 μm



margin midleaf, cells midleaf, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 10 μm

continued next page

Grimmia incrasscapsulis B.G.Bell

form: compact hoary cushions 5–15 mm deep, of \pm unbranched stems, the leaves nearly identical, erect wet or dry, crowded, imbricate

habitat: on exposed rock

leaf: *size:* 2.0–2.7 \times 0.3–0.4 mm plus a hair-point up to 5 mm long

shape: narrowly oblong-lanceolate

tip: acute, with a smooth to denticulate, hyaline hair-point

base: basal cells long-rectangular, thin-walled, lax, 40–70 \times 9–12 μ m

costa: channelled above, ending at the base of the hair-point

border: not differentiated

margin: entire, plane, often bistratose from midleaf to apex

cells: 8 \times 10, \pm isodiametric, incrassate, sinuose in midleaf, smooth

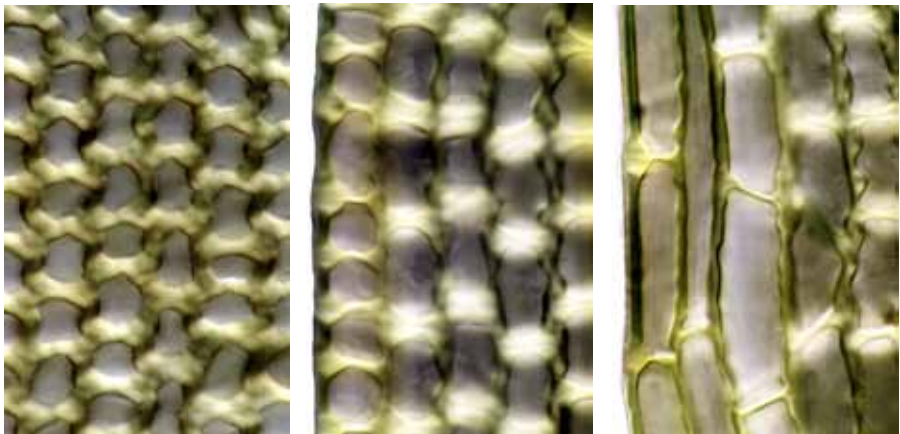
capsule: ovoid, immersed, 0.9–1.2 \times 0.8–0.9 mm, asymmetric on the seta; seta 0.3–0.4 mm; columella persistent

notes: widespread but rare New Zealand endemic



vegetative shoots (2), leaf outline, leaf apex, tip of awn, and margin above midleaf

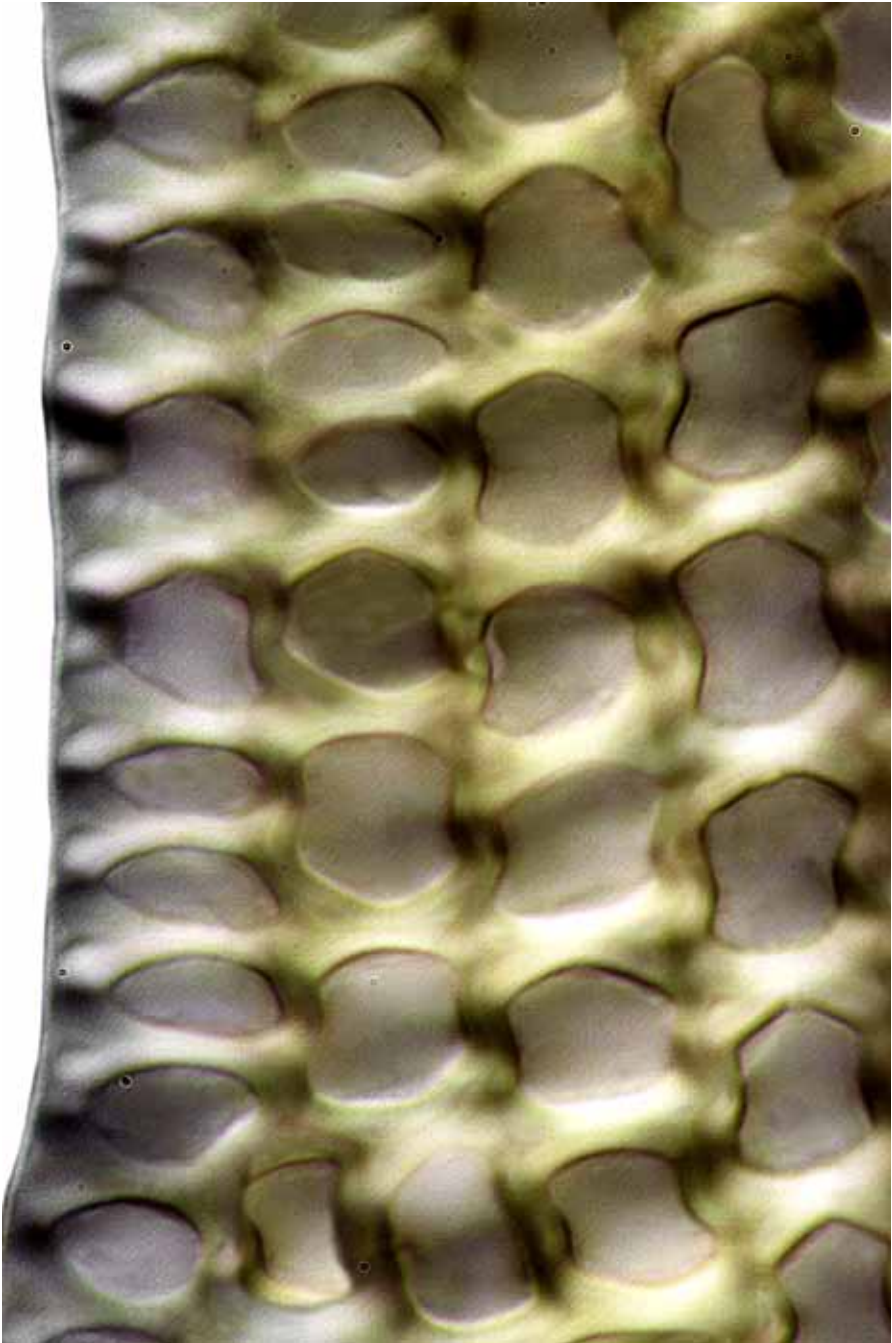
1 mm, 1 mm, 1 mm, 100 μ m, 100 μ m, 10 μ m



lamina cells, lower leaf margin, and margin close to base showing elongate basal cells

10 μ m, 10 μ m, 10 μ m

continued next page



Grimmia incrassicapsulis margin midleaf and sinuose lamina cells
10 μm

Grimmia laevigata (Brid.) Brid.

form: tufted, erect, dark green to brown stems with hoary tips, to 15 mm tall
habitat: exposed, dry acidic rock in forests and scrub to moderate elevations

leaf: size: 1.5–3.0 × 0.7–1.3 mm excluding the awn

shape: oblong-ovate to ± triangular; bistratose except at margins and base

tip: acute, ending in a denticulate, hyaline, decurrent, broad-based awn

base: basal cells oblate to rectangular, with thick transverse walls

costa: flattened from base to midleaf

border: not differentiated

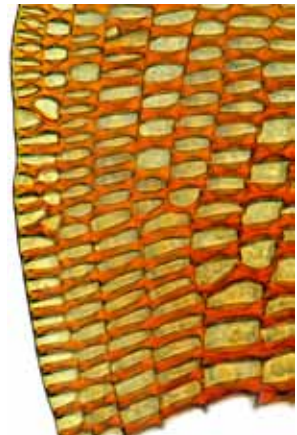
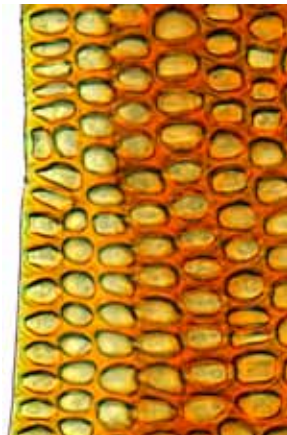
margin: entire, plane to erect

cells: 6–10 μm, ± quadrate, thick-walled, smooth

capsule: to 3 mm, oblong-ovoid to cylindric, emergent, erect, stomatose;
 annulus of 2–3 rows of quadrate, incrassate cells; seta 1.5–3 mm, straight;
 calyptra mitrate; operculum short-rostrate; peristome teeth irregularly
 split and perforate above



habit (dry), sterile shoot (dry), leaf outline, awn tip, and awn decurrency
 ■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm, ■ 10 μm



margin midleaf and leaf basal angle (2)
 ■ 10 μm, ■ 50 μm, ■ 10 μm

continued next page

Grimmia longirostris Hook.

form: cushions of erect, branched, yellow- to olive-green stems, to 30 mm tall
habitat: exposed, dry, acidic granite and quartzite rock to high elevations

leaf: size: 1.5–3.0 mm

shape: ovate-lanceolate, keeled, distal half of leaf bistratose

tip: hyaline hair-point 1/6 to 1/2 the blade length

base: basal juxtacostal cells long-rectangular, sinuose, incrassate; transverse walls of basal marginal cells thickened

costa: reaching to the base of the hair-point

border: not differentiated

margin: entire, plane or one side recurved below

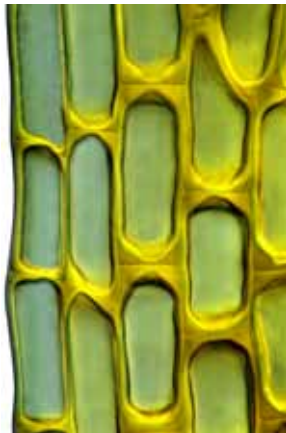
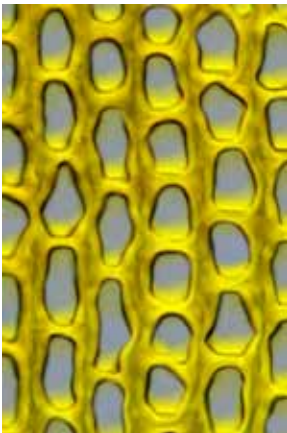
cells: 8–12 μm , isodiametric to short-rectangular, incrassate, \pm sinuose, smooth

capsule: to 1.5 mm, oblong-ovoid, erect, emergent to exerted, brown; seta 1–4 mm; 2–3 rows of stomata; operculum long-rostrate; calyptra cucullate; peristome teeth perforate and split in their upper half



fertile shoots (dry) (2), leaf outline, hair-point apex (2), and margin midleaf

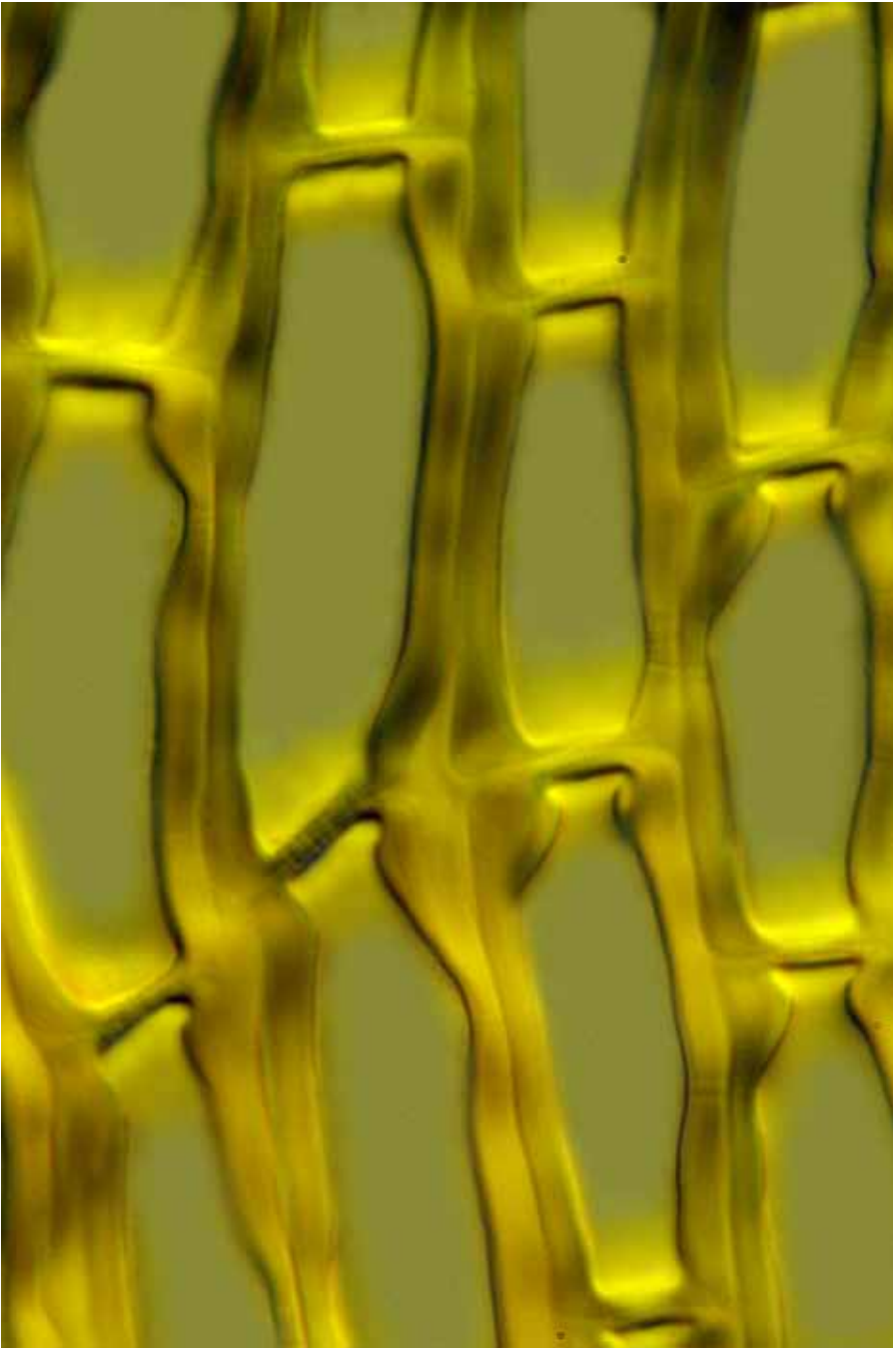
1 mm, 1 mm, 1 mm, 10 μm , 10 μm , 10 μm



cells upper leaf, margin near leaf base, and leaf basal angle

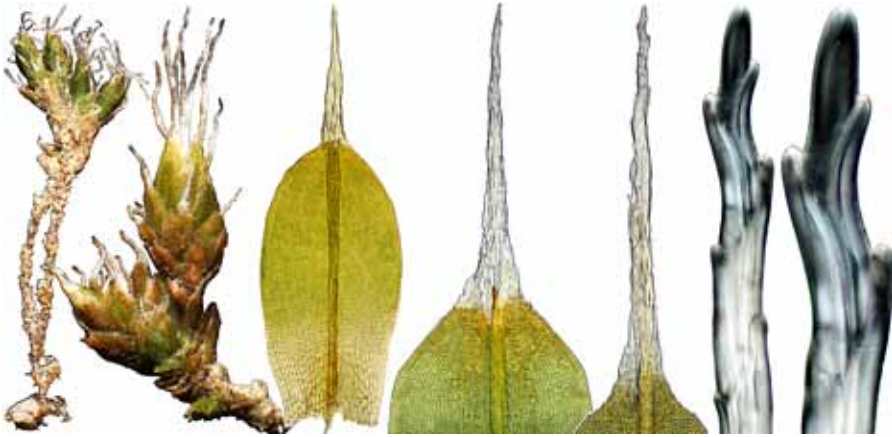
10 μm , 10 μm , 50 μm

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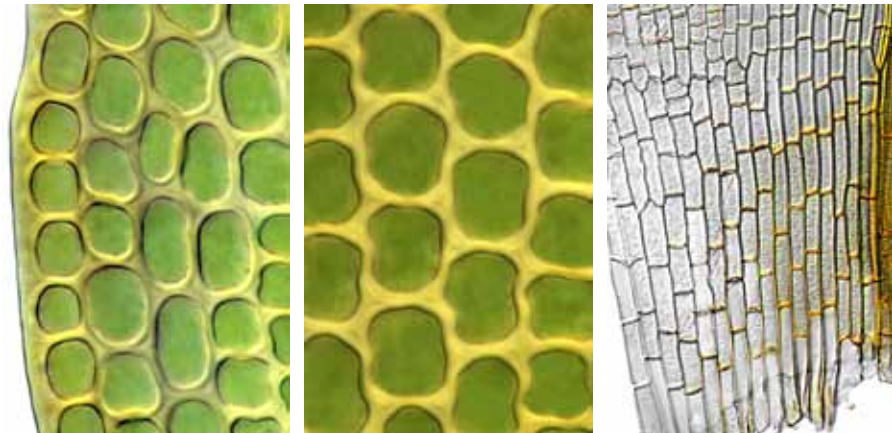
Grimmia longirostris basal juxtacostal cells
10 μm

continued next page

Grimmia plagiopodia Hedw.**form:** tufts or cushions of erect stems, green above, reddish below, to 20 mm**habitat:** rock, usually limestone**leaf:** size: 1.2–2 mm*shape:* oblong to ovate-lanceolate, unistratose throughout*tip:* obtuse to mucicous or hair-pointed, the hair-point sometimes broad-based*base:* basal cells quadrate to short-rectangular, thin-walled, ± hyaline*costa:* slender above, weak below, percurrent*border:* not differentiated*margin:* entire, plane to ± incurved*cells:* 10–12 μm, quadrate to rounded, ± sinuose, firm-walled, smooth**capsule:** 1 mm, ovoid to subglobose, ± gibbous, inclined, immersed, brown;
seta < 1 mm, curved to sigmoid, yellowish; calyptra mitrate, barely covering
the operculum; operculum short-rostrate; peristome teeth reddish, perforate
and 2–5-cleft

vegetative shoot (dry) (2), leaf outline, leaf apex (2), and hair-point apex (2)

1 mm, 1 mm, 0.1 mm, 50 μm, 50 μm, 10 μm, 10 μm



margin midleaf, cells midleaf, and leaf basal angle

10 μm, 10 μm, 10 μm

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Grimmia pulvinata (Hedw.) Sm. var. **africana** (Hedw.) Hook.f. & Wilson

form: densely tufted, soft, hoary, olive-green, erect stems, to 25 mm tall
habitat: exposed acidic rock (less often calcareous rock or concrete)

leaf: size: 1.5–2 × 0.3–0.4 mm plus 1.5 mm hair-point, ± concave, keeled

shape: oblong-lanceolate

tip: hyaline, denticulate hair-point

base: undifferentiated

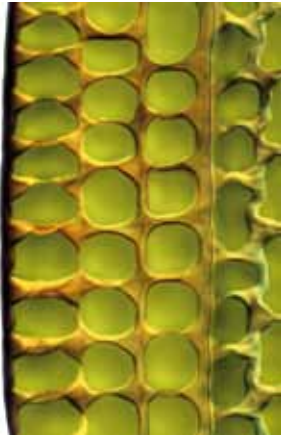
costa: prominent at the back, excurrent in a hyaline hair-point

border: not differentiated

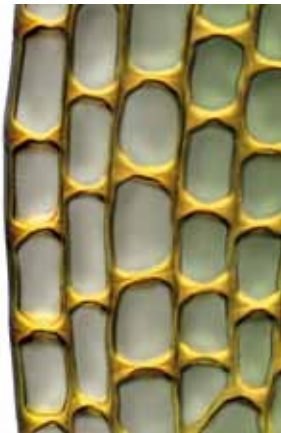
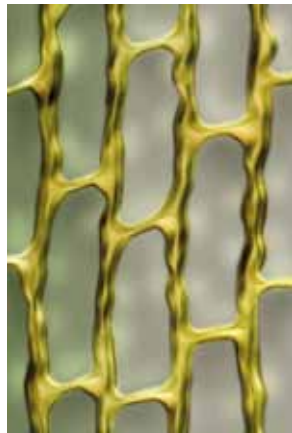
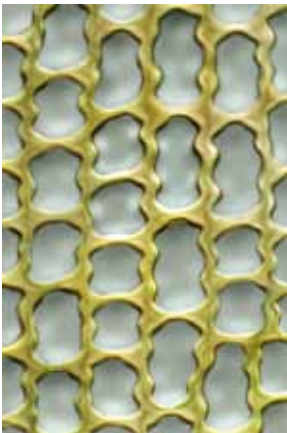
margin: entire, variably recurved in midleaf, bistratose above

cells: 6–11 μm, rounded-quadrate, incrassate, sinuose, smooth

capsule: 1–1.6 mm, oblong-cylindric, symmetric, wrinkled-striate when dry, erect, immersed to exerted, brown, stomatose below; seta 3–6 mm, twisted when dry; annulus well-developed; calyptra cucullate, smooth; operculum stout, long-rostrate; peristome teeth spreading when dry, reddish, split and perforate; spores 9–10 μm in diam., smooth



fertile habit, mature capsule, leaf outline, leaf apex, and recurved margin
 1 mm, 1 mm, 0.1 mm, 50 μm, 10 μm



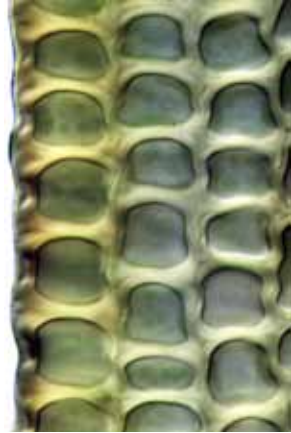
patchy sinuose cells midleaf, juxtacostal cells near base, and leaf basal angle
 10 μm, 10 μm, 10 μm

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Grimmia pulvinata var. *africana* fertile habit
1 mm

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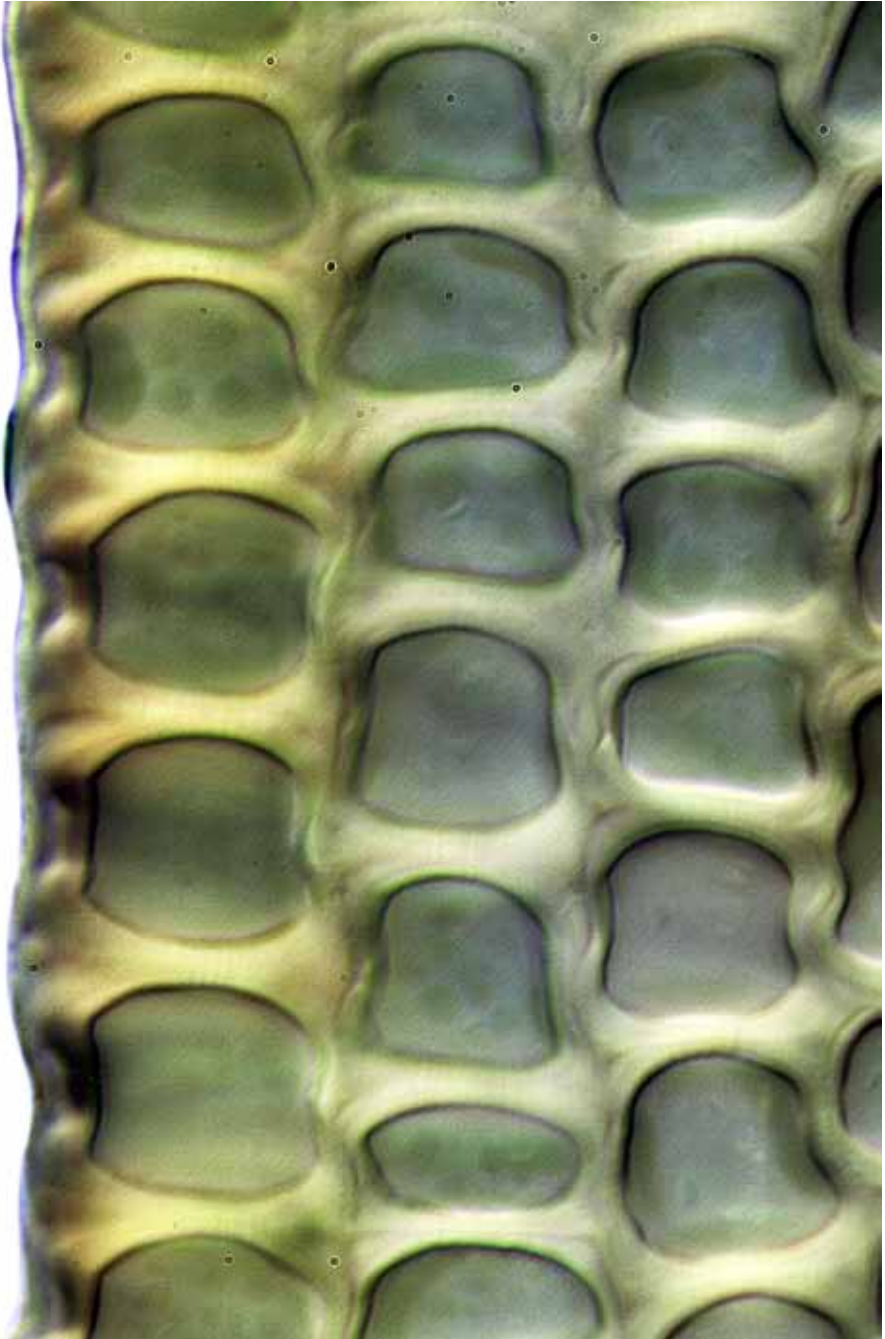
Grimmia reflexidens Müll.Hal.**form:** dense, hairy cushions of erect stems, gray-green, to 20 mm tall**habitat:** siliceous rock in dry sites**leaf:** size: 1–2 mm, plus 1–2 mm awn*shape:* ovate to oblong-lanceolate, keeled, plane, unistratose distally*tip:* acute, ending with a narrow, usually smooth, ± flexuose, decurrent, hyaline awn*base:* 2–4 rows of pellucid marginal cells, short-rectangular, with thickened transverse walls*costa:* failing at the base of the awn*border:* not differentiated*margin:* entire, plane, ± bistratose*cells:* 8–12 μm in diam., rounded-quadrate, thick-walled, ± sinuose, smooth**capsule:** 1–2 mm, wider than long, brownish, emergent to short-exserted, lacking stomata; seta straight, 1.5–2 mm long; operculum bulging to rostrate; peristome teeth papillose, split-perforate toward the tip

vegetative shoot (dry), leaf outline, awn, base of awn, and margin midleaf



costa midleaf, cells below midleaf, and leaf basal angle with transverse wall thickenings

continued next page



Grimmia reflexidens leaf margin
10 μm

Grimmia trichophylla Grev.

form: densely tufted, erect stems, radiculose below, separating easily, to 35 mm
habitat: exposed acidic rock

leaf: size: 2.5–4.0 × 1.0–2.0 mm

shape: narrowly lanceolate, carinate

tip: gradually tapering to a short or long, hyaline, entire to denticulate hair-point

base: basal cells rectangular, smooth to sinuose, ± pellucid

costa: prominent at the back, excurrent in a hair-point of variable length

border: not differentiated

margin: entire, recurved on one or both sides, 2–3 cell rows often bistratose

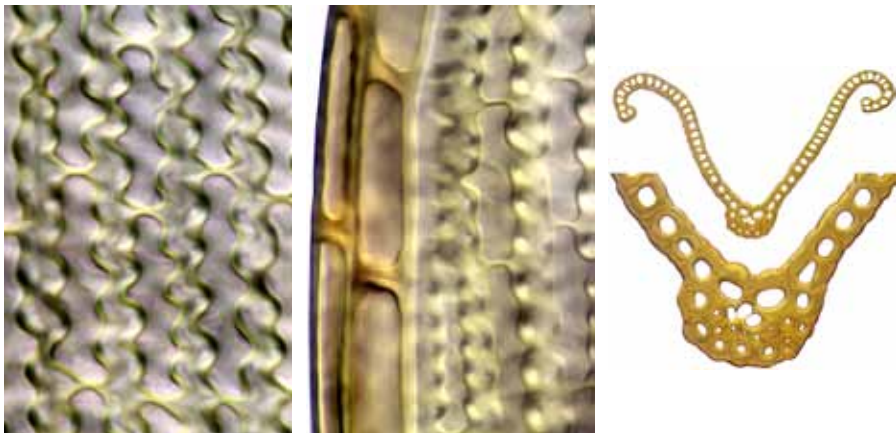
cells: 8–10 μm, quadrate, incrassate, sinuose, smooth

capsule: 1.3 mm, oval-oblong, striate when dry, yellow-green to stramineous;
 operculum red, rostrate; annulus wide; seta 3–4 mm, cygneous or flexuose
 wet or dry, yellow; calyptra mitriform; peristome teeth pale red, papillose,
 irregularly 2–3-split

note: capsules common; the adaxial costa width of only two cells is diagnostic

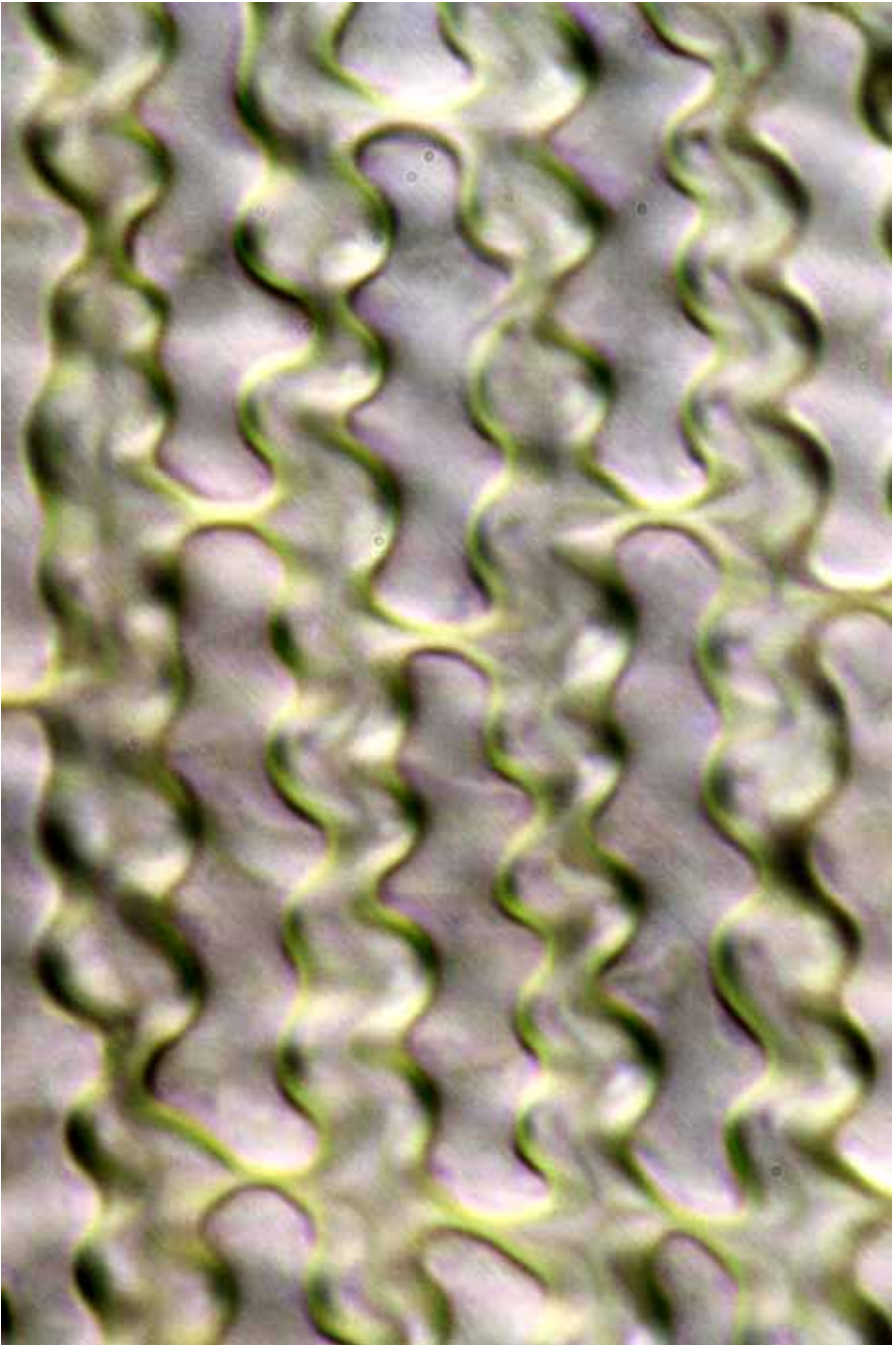


fertile shoot, capsule (dry), vegetative shoot (moist), leaf outline, leaf apex, upper cells
 1 mm, 0.5 mm, 1 mm, 0.1 mm, 50 μm, 10 μm, 10 μm



sinuose cells below midleaf, margin near leaf base, and leaf and costa cross-sections
 10 μm, 10 μm, 50 μm (upper), 10 μm (lower)

continued next page



Grimmia trichophylla sinuose cells in lower leaf
10 μm

continued next page

Grimmia wilsonii H.Greven

form: round patches of erect, \pm branched stems, dark green, black when dry
habitat: rock (greywacke and diorite) in exposed alpine sites, 800–1200 m

leaf: size: about 2 mm

shape: linear-lanceolate, bistratose in the subula

tip: hair-point short, smooth to bluntly denticulate, brittle

base: marginal cells elongate, thin-walled; paracostal cells $10 \times 40 \mu\text{m}$, incrassate

costa: not prominent abaxially

border: not differentiated

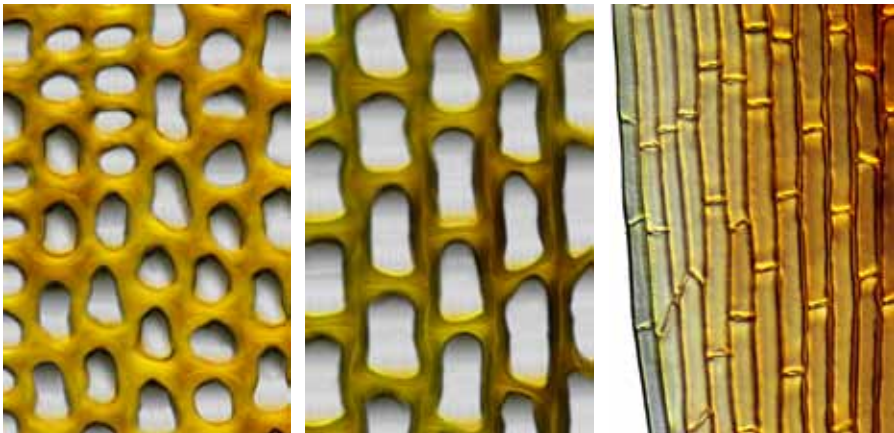
margin: entire, plane below, slightly incurved above

cells: 4–6 μm , rounded, thick-walled, smooth

capsule: 1.0 mm, rare, ovoid, emergent to exserted, erect, yellowish; seta about 1 mm, straight; operculum rostrate; peristome teeth lanceolate, orange, finely papillose, irregularly perforate above; spores 14–18 μm in diam.

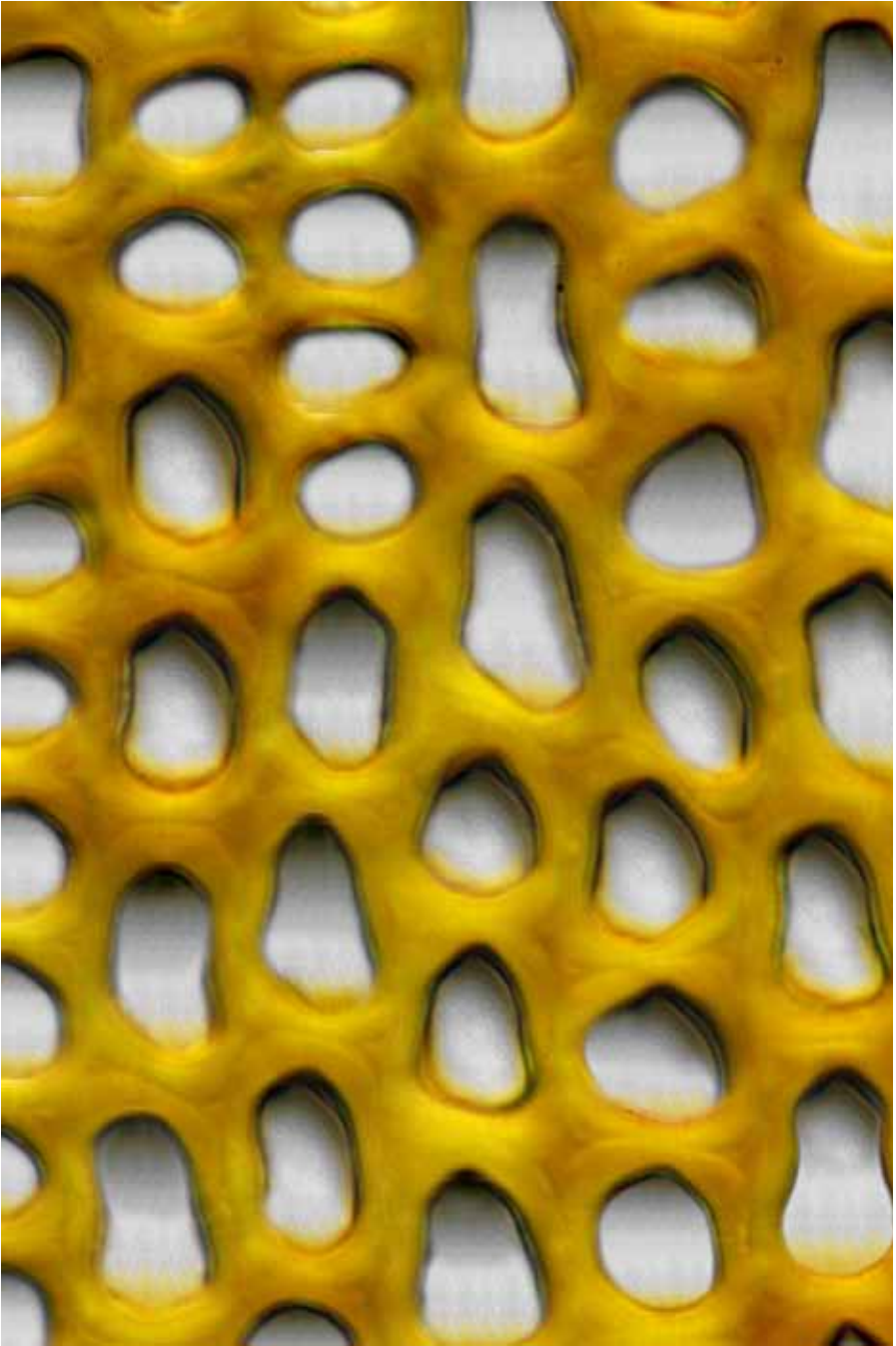


vegetative shoot (moist), leaf outline, leaf hair-point (2), and margin midleaf
 1 mm, 0.1 mm, 0.1 mm, 50 μm , 10 μm



cells midleaf, juxtacostal cells midleaf, and leaf basal angle
 10 μm , 10 μm , 10 μm

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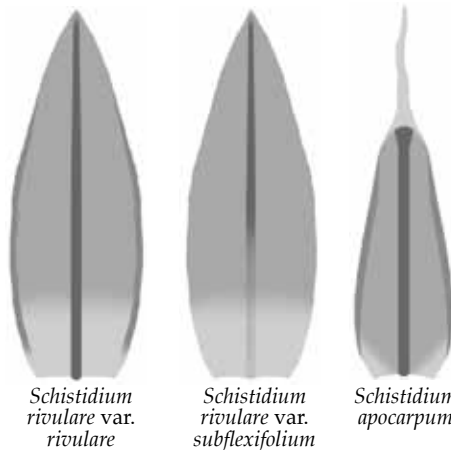


Grimmia wilsonii midleaf cells
10 μm

Key to New Zealand species and varieties of *Schistidium* (3)

- 1 Leaf usually ending in a hyaline awn; spores < 15 μm in diam ● ***Schistidium apocarpum***
 2
- 1: Leaf not usually ending in an awn; spores > 15 μm in diam. 2
- 2(1:) Leaves ovate-lanceolate, keeled above; margins 2–3-stratose; upper lamina mostly bistratose; costa well-defined in lower half ● ***Schistidium rivulare* var. *rivulare***
 2: Leaves oblong-lingulate, broadly U-shaped above; margins unistratose; upper lamina mostly unistratose; costa ill-defined in lower half ● ***Schistidium rivulare* var. *subflexifolium***

* based on McIntosh, TT (2007): *Schistidium*. *Flora of North America* 27, 208; and Fife, AJ (2000): A synopsis of the New Zealand species of *Schistidium* (Grimmiaceae; Musci), with observations on a little-known species of *Racomitrium*. *New Zealand Journal of Botany* 38, 191–204:



Schistidium apocarpum (Hedw.) Bruch & Schimp.

form: tufts or mats of erect, rigid, branched stems, olive-green, to 60 mm tall
habitat: mostly dry rock but sometimes semi-aquatic, to alpine elevations

leaf: size: 1.5–2 × 0.5–0.7 mm

shape: ovate to lanceolate

tip: tapering to an acute apex, usually with a hyaline hair-point

base: basal cells longer and more sinuose than the other blade cells

costa: failing just below the hair-point

border: absent

margin: ± entire to bluntly toothed near the apex, bistratose above, recurved on one or both sides below

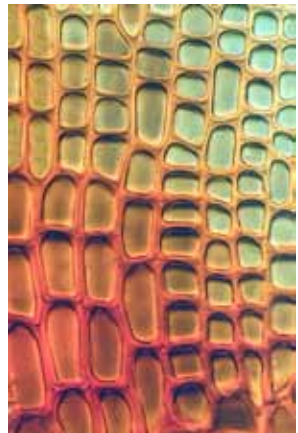
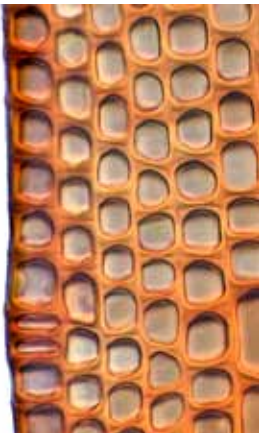
cells: 7–10 μm, quadrate, incassate, sinuose, smooth to low-papillose

capsule: 1.2–1.6 mm, oblong-ellipsoid, erect, immersed, systylious; seta 0.5 mm; peristome teeth inserted below the capsule rim, red; operculum rostrate; calyptra mitrate

note: nearly cosmopolitan, widespread in New Zealand



fertile shoot, dehisced capsules (top view), systylious capsule, and leaf outline
 0.5 mm, 1 mm, 0.25 mm, 0.25 mm



margin midleaf, cells midleaf, and leaf base cells
 10 μm, 10 μm, 10 μm

Schistidium rivulare (Brid.) Podp. var. **rivulare**

form: loosely matted, well-branched stems, dark above, to 80 mm long
habitat: wet rock, subalpine to alpine

leaf: size: 1.5–3.0 × 0.6–1.0 mm

shape: lanceolate to ovate-lanceolate, ± decurrent

tip: bluntly acute, lacking a hair-point

base: juxtacostal basal cells long-rectangular; alar cells not differentiated

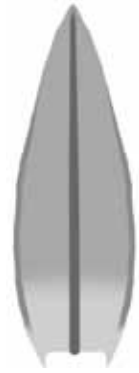
costa: well-defined, percurrent

border: not differentiated

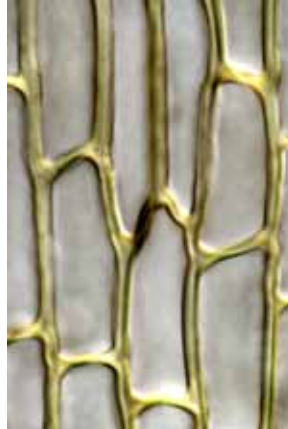
margin: entire to faintly denticulate above, 2–3-stratose, plane to recurved

cells: 5–10 μm, irregularly subquadrate, thick-walled, sinuose, smooth

capsule: 1.3–2.0 mm, cylindric to obovoid, erect, immersed, brown; seta short, to 0.5 mm; peristome single, red, perforate, papillose; strongly recurved when dry, incurved when wet; columella attached to and shed with the operculum; calyptra mitrate to weakly cucullate

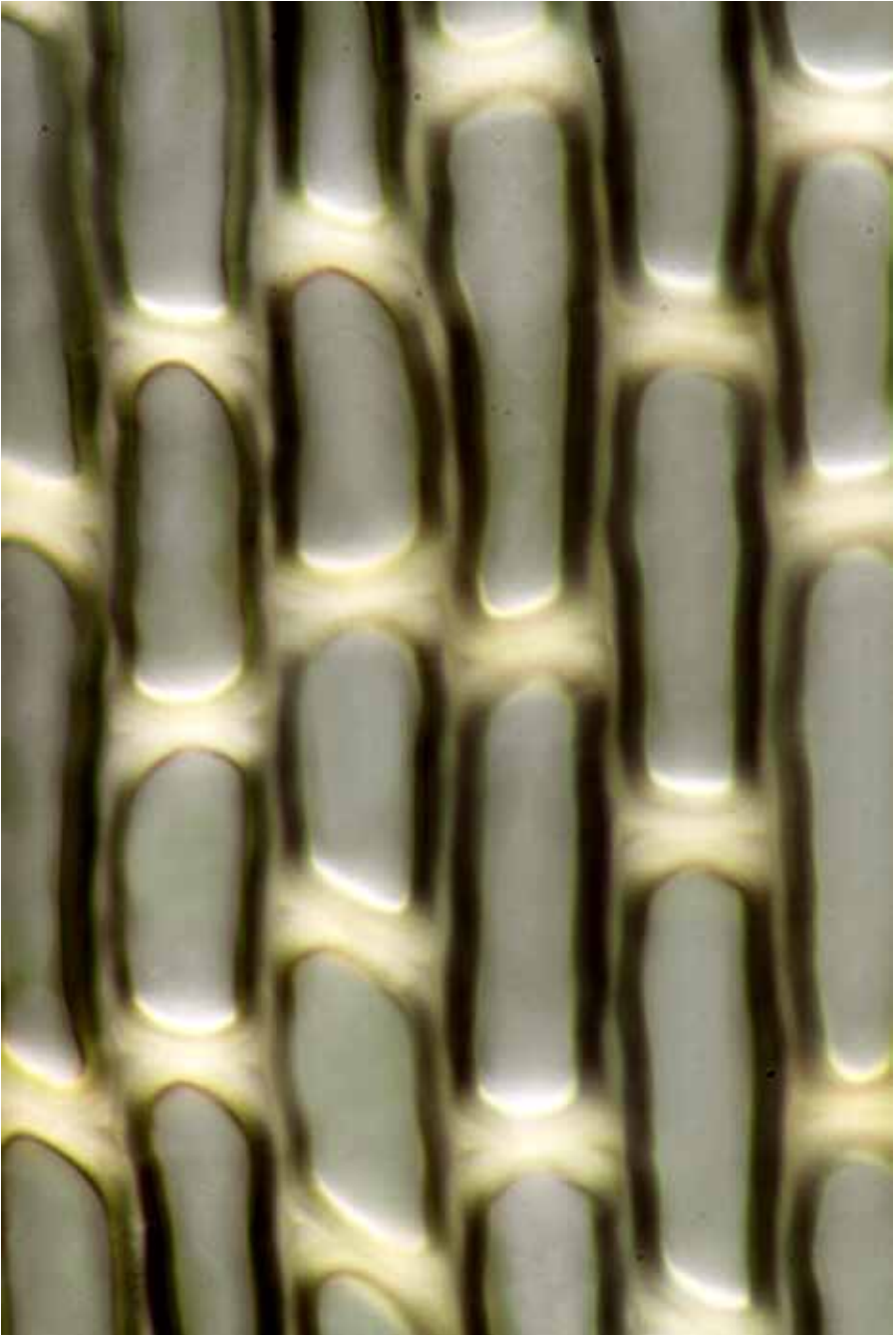


fertile shoots (dry), leaf outline, leaf margin and leaf xs, leaf apex with bistratose patches
 1 mm, 1 mm, 0.5 mm, 10 μm (upper), 10 μm, 50 μm



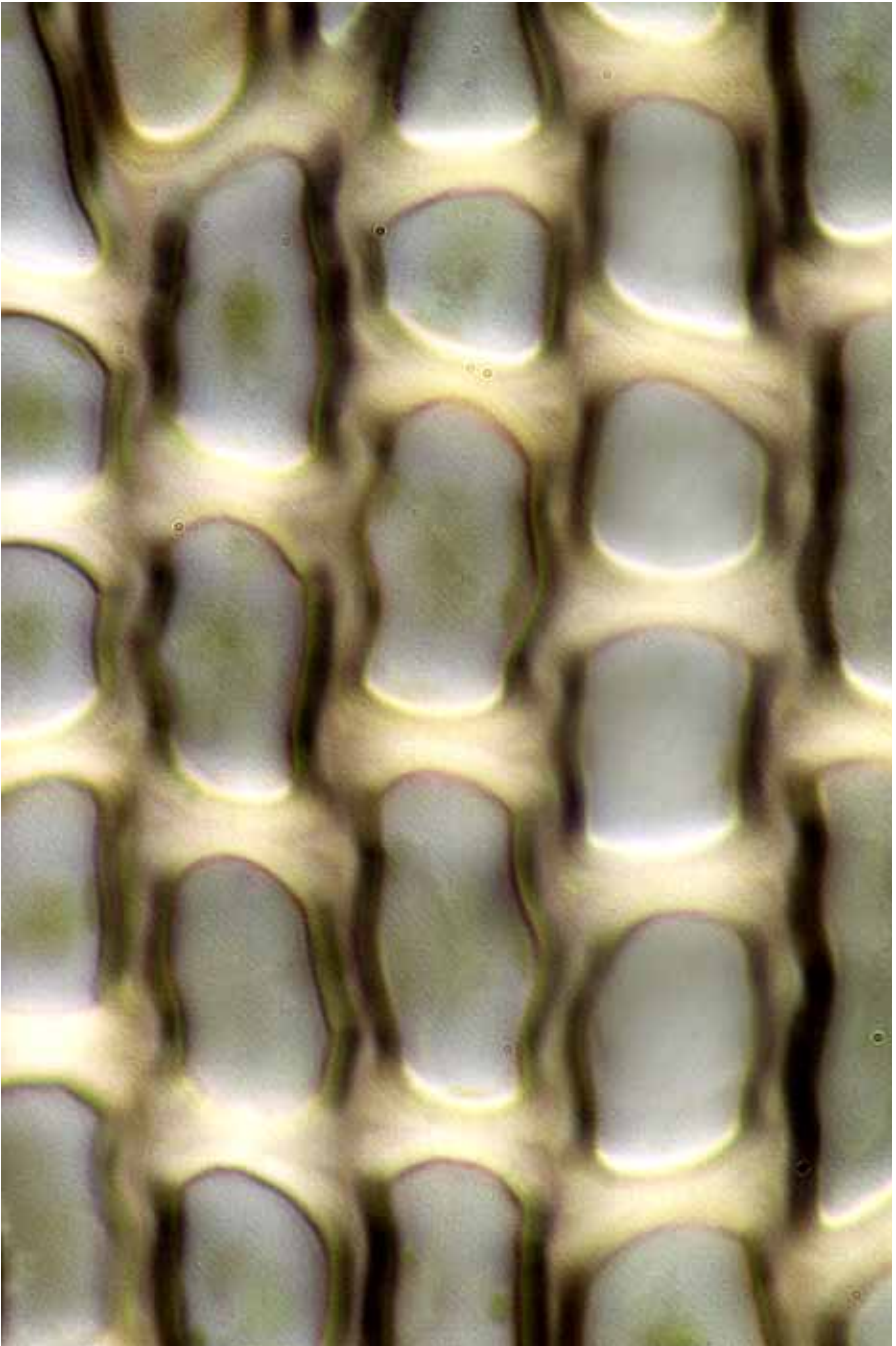
cells above midleaf, cells toward leaf base, and leaf basal angle
 10 μm, 10 μm, 10 μm

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Schistidium rivulare var. *rivulare* cells in lower leaf
10 μm

continued next page



Schistidium rivulare var. *rivulare* cells above midleaf
10 μ m

Schistidium rivulare var. **subflexifolium** (Müll.Hal.) Fife

form: loose mats of reddish brown, erect, sparsely branched stems, to about 50 mm tall, the lower leaves often eroded to costal remnants

habitat: dry rock in exposed subalpine and alpine sites

leaf: size: 2–3 × 0.8–1.1 mm

shape: oblong-ligulate, channelled

tip: acute, ± cucullate

base: not differentiated

costa: weak below, subpercurrent; adaxial cells long-rectangular

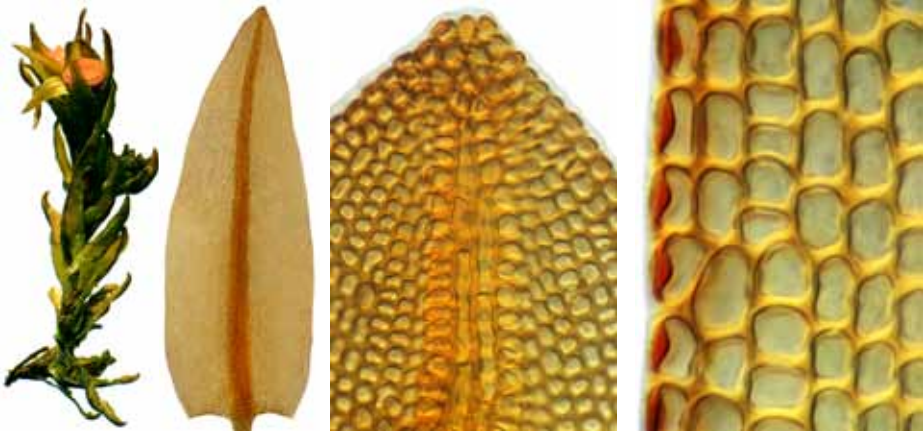
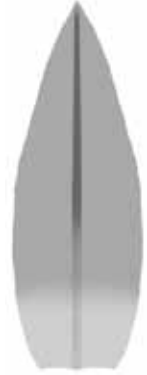
border: not differentiated

margin: entire, plane to weakly deflexed

cells: 6–12 μm, irregularly subquadrate, firm-walled, smooth

capsule: 1–2 mm, hemispherical to obovoid, reddish brown at maturity; seta short; peristome teeth perforate; calyptra cucullate

notes: considered to be a New Zealand endemic



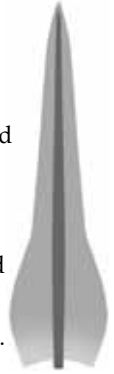
fertile shoot (dry), leaf outline, leaf apex, and margin midleaf

1 mm, 1 mm, 50 μm, 10 μm



costa above midleaf, margin near leaf base, and systylious capsule (dry)

50 μm, 10 μm, 1 mm

Ptychomitrium australe (Hampe) A.Jaeger**form:** cushions or turves of forked stems, to 7 mm tall, radiculose below**habitat:** rock or rarely rotting logs in open sites, to 1800 m**leaf:** size: 3.5–5 × 0.5–1.0 mm*shape:* ovate-lanceolate, concave, strongly crispate when dry*tip:* acute to rounded, ± cucullate*base:* basal cells rectangular to hexagonal, thin-walled; alar cells not differentiated*costa:* percurrent or failing below the apex*border:* not differentiated*margin:* entire, plane, bistratose above*cells:* upper cells 6 μm, oblate, firm-walled, smooth, bulging adaxially**capsule:** 1.5 mm, ± ovate, smooth, pale brown, red-mouthed, abruptly narrowed to the seta; seta 2.5–5 mm, straight; annulus present; operculum straight long-rostrate; calyptra mitriform or split, plicate, lobed; peristome teeth lanceolate, orange, smooth below, papillose, ± cleft or perforate; spores 12–16 μm in diam.

fertile shoot, capsules (dry) (2), leaf outline, leaf apex, and leaf base

1 mm, 0.5 mm (2), 0.25 mm, 50 μm, 50 μm



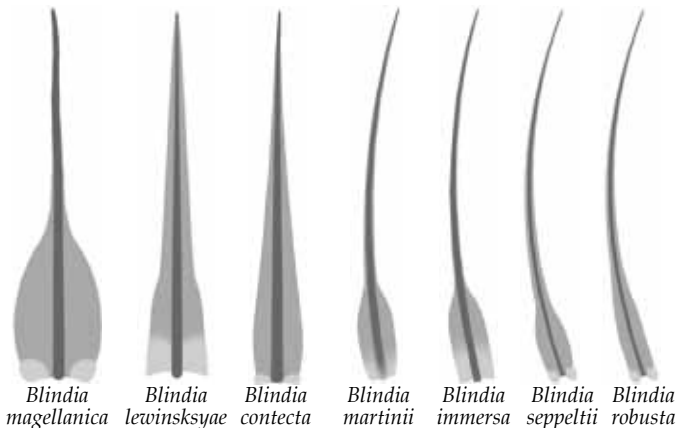
midleaf bistratose streaks, costa midleaf, and bistratose patches midleaf

50 μm, 10 μm, 10 μm

Key* to the New Zealand species of *Blindia* (7)

- 1 Capsule exserted2
 1: Capsule immersed5
- 2(1) Stems 10–30 mm long; seta arcuate when moist..... ● *Blindia magellanica*
 2: Stems 30–200 mm long; seta straight or flexuose when moist3
- 3(2:) Cells of the basal angles \pm inflated, forming a distinct and \pm decurrent group;
 subula 2–2.5 times the length of the base4
 3: Cells of the basal angles not inflated, not forming a distinct group; subula 3–5 times
 the length of the base..... ● *Blindia seppeltii*
- 4(3) Leaves 4–8 mm long, falcate-secund ● *Blindia robusta*
 4: Leaves 9–15 mm long, \pm straight..... ● *Blindia lewinskyae*
- 5(1:) Leaves strict; alar cells distinct ● *Blindia contecta*
 5: Leaves \pm falcate-secund; alar cells not or only weakly differentiated6
- 6(5:) Plants gymnostomous ● *Blindia immersa*
 6: Plants peristomate..... ● *Blindia martinii*

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*. RSNZ Bull. 5, 87, and Seppelt, RD (1994): *The Moss Flora of Macquarie Island*. Australian Antarctic Division, Kingston, 254.



Blindia contecta (Hook.f. & Wilson) Müll.Hal.

form: stiff, sparsely branched stems to 35 mm long, golden above, dark below

habitat: subaquatic, on wet rock faces and near waterfalls

leaf: size: 5.0–6.0 × 0.7–0.9 mm

shape: subulate from a narrowly ovate base; lamina extending up both sides of the subula to ± half the leaf length; weakly secund, little changed when dry

tip: obtuse or rounded

base: weakly clasping, ± auriculate; alar cells pigmented, thin-walled, often left behind on the stem when the leaves are pulled off

costa: strong; cells on both ad- and abaxial surfaces quadrate to short-rectangular

border: not differentiated

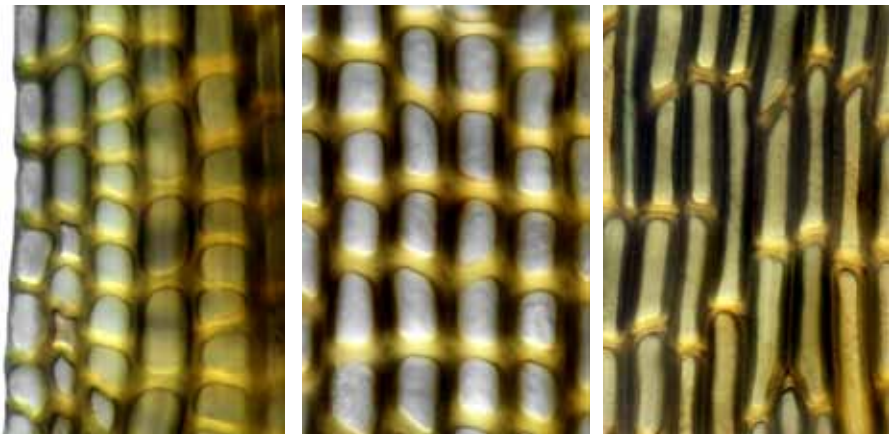
margin: entire, plane

cells: 12–20 × 6 μm above, to 60 μm long below, short-rectangular to rectangular, thick-walled, smooth

capsule: 1.0 × 0.9 mm, erect, obovate to hemispherical, immersed; seta 1–2 mm; operculum conic, long-beaked



fertile shoots (dry), leaf outline, apex, and subapex with ± quadrate superficial costa cells
 1 mm, 1 mm, 1 mm, 10 μm, 10 μm



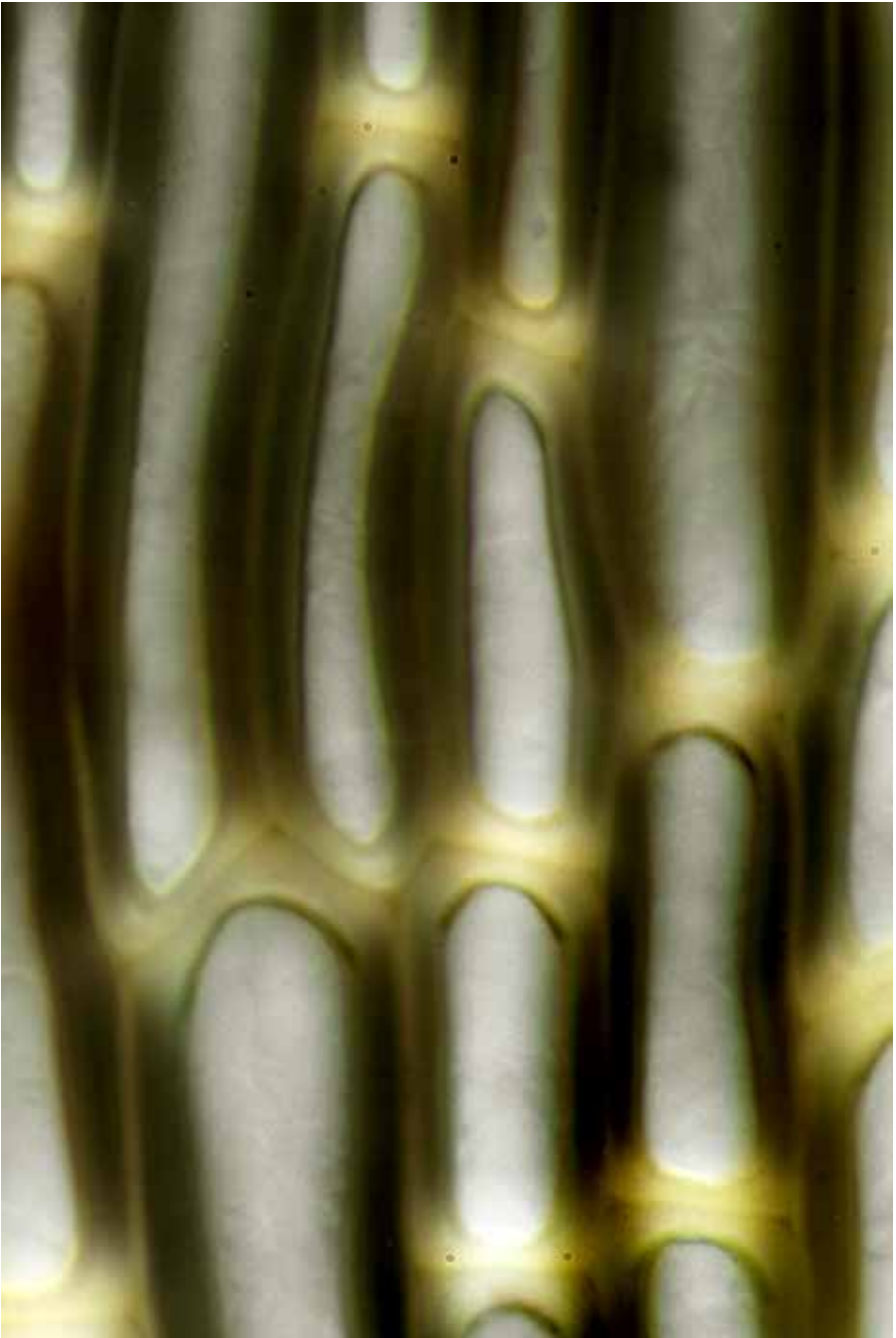
margin below midleaf, lamina cells, and cells near leaf base
 10 μm, 10 μm, 10 μm

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Blindia contecta lamina margin and short-rectangular cells on costa surface
10 μm

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Blindia contecta elongate lamina cells near leaf base
10 μm

Blindia immersa E.B.Bartram & Dixon

form: tufted, branched, yellow-brown to blackish green, flexuose, soft, to 180 mm
habitat: rock submerged or occasionally inundated, waterfalls, streams, to 700 m

leaf: size: 8–14 mm

shape: oblong-lanceolate, narrowed to a long, fine, ± flexuose subula

tip: bluntly acute, the terminal cells ± isodiametric

base: angle cells wider than the lamina cells but not forming a distinct alar group

costa: wide, ill-defined below, nearly filling the subula above

border: not differentiated

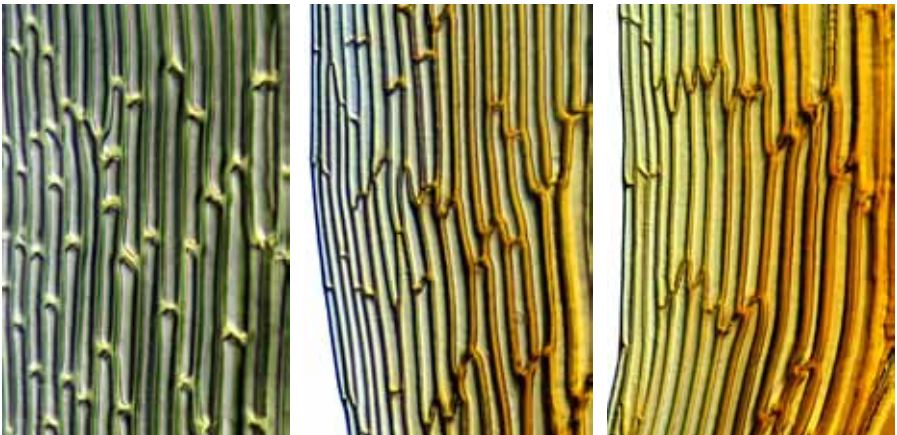
margin: entire, plane

cells: subula cells 45–90 × 6–10 μm, rectangular, thick-walled, smooth; sheath cells 120–160 × 10–20 μm, linear-rectangular, firm- to thick-walled, smooth

capsule: 0.8–1.0 mm, hemispherical-turbinate, cyathiform when empty, the mouth thickened, erect, immersed, brown; seta 1.5–2.0 mm, thick; columella persistent; peristome none or rudimentary; operculum long-rostrate; spores 24–36 μm in diam., green

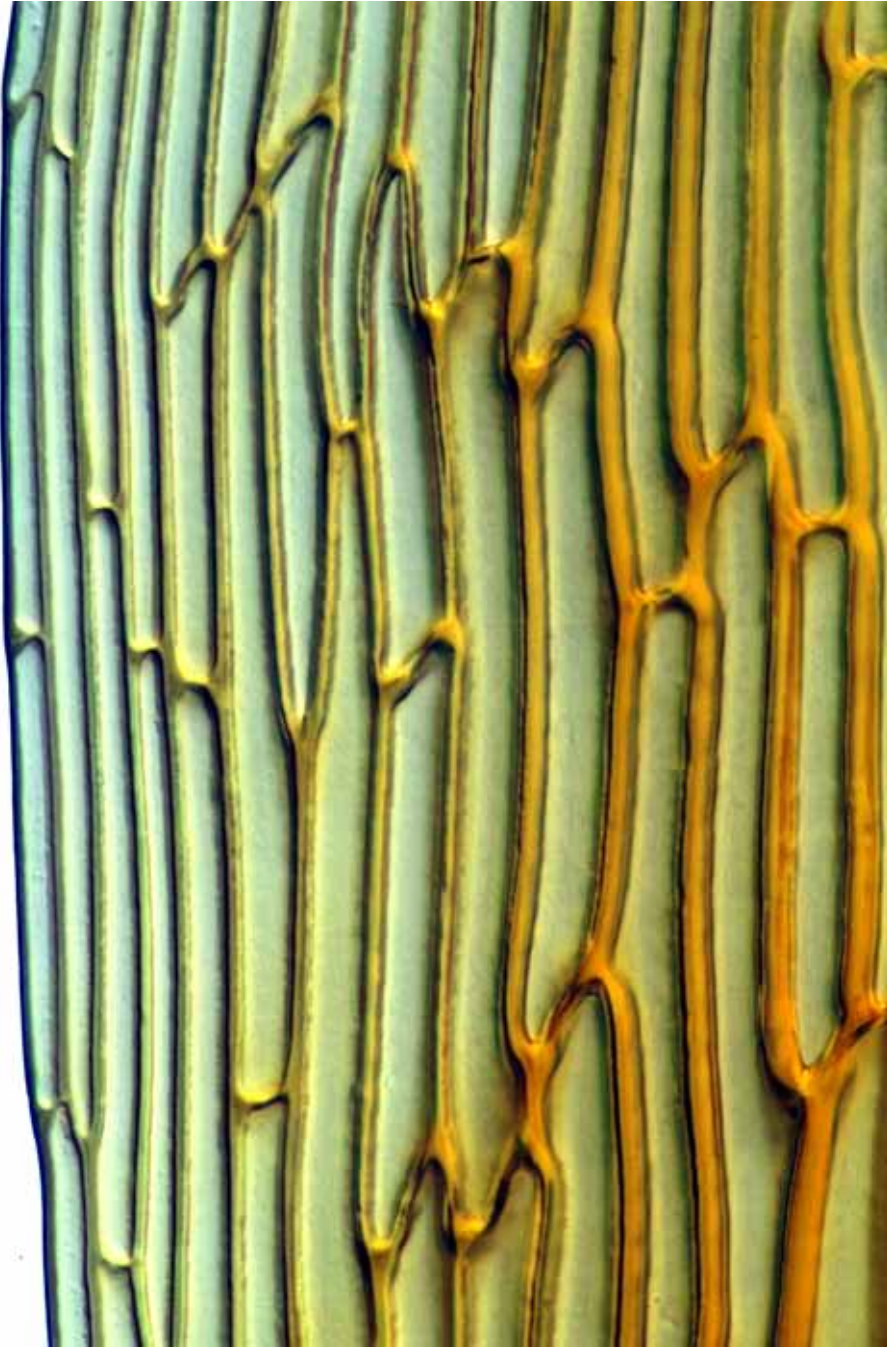


vegetative shoots (2), leaf outline, leaf apex, leaf subapex, and mid-sheath margin
 ■ 1 mm, ■ 1 mm, ■ 10 μm, ■ 10 μm, ■ 10 μm



upper sheath cells, mid-sheath margin, and just above sheath basal angle
 ■ 10 μm, ■ 10 μm, ■ 10 μm

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Blindia immersa margin of leaf sheath near base
10 μ m

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Blindia lewinskyae J.K.Bartlett & Vitt

form: tufted, glossy, flexuose, dark, sparsely branched stems, to 100 mm long
habitat: wet or submerged rock in shallow subalpine or alpine streams. to 900 m

leaf: size: 9–12 × 0.5–0.6 mm

shape: flexuose-filiform subula narrowing from an oblong-lanceolate base

tip: acute

base: not clasping or decurrent; alar cells 30–70 × 10–20 μm, thin-walled

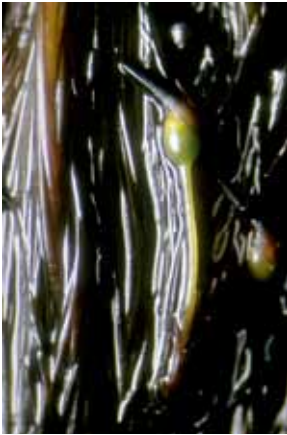
costa: filling the subula toward the tip

border: not differentiated

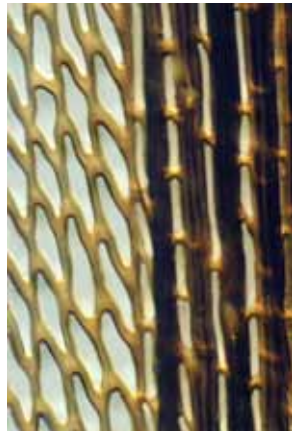
margin: entire, plane

cells: 60–100 × 3 μm (larger toward leaf base), linear to elongate, thin-walled, smooth

capsule: 0.6–0.9 × 0.7 mm, subglobose, straight, exserted, not stomatose; seta 4–7 mm, stout, not twisted; operculum long-rostrate; peristome reduced to only a few hyaline cells; spores 27–36 μm in diam., smooth, green



fertile habit (aquatic), capsule, leaf outlines (2), and leaf apex
 ■ 1 mm, ■ 0.5 mm, ■ 1 mm, ■ 10 μm



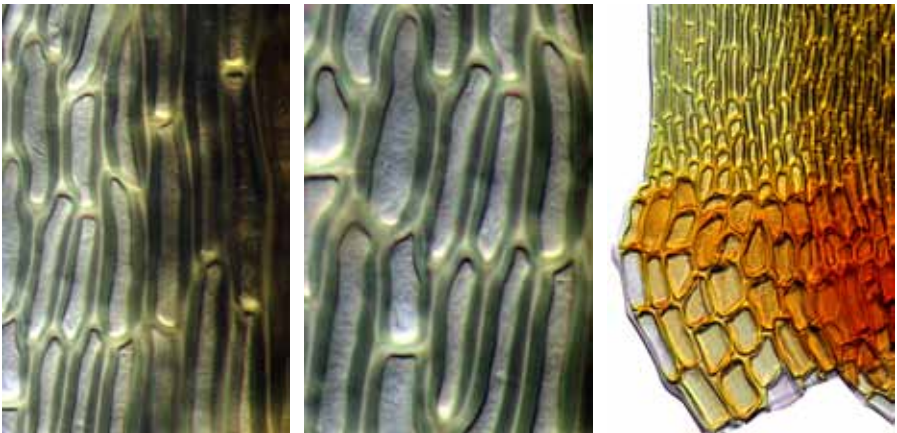
margin midleaf, costa midleaf, and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 10 μm

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Blindia magellanica Schimp.**form:** densely tufted, branched, golden brown, glossy stems, to 40 mm long**habitat:** wet or damp rock, rarely truly aquatic**leaf:** size: 2–5 mm*shape:* subulate from a lanceolate base, ± falcate-secund*tip:* bluntly acute at the tip of the subula*base:* alar cells conspicuous, large, firm-walled, coloured, ± in auricles*costa:* excurrent, nearly filling the subula above*border:* not differentiated*margin:* entire below, crenulate or denticulate near tip, plane*cells:* 20–60 × 3–4 μm, rhombic to linear, thick-walled, ± sinuose, smooth**capsule:** 0.7–0.9 × 0.7 mm, urceolate when dry, subglobose when wet, erect, thick-necked, turbinate when empty, exserted; seta 4–5 mm, flexuose when dry; calyptra cucullate; operculum long-beaked; peristome teeth 16, inserted below the rim, smooth, fragile, red; spores 18–24 μm in diam., smooth, green

vegetative shoots (dry) (2), leaf outline, leaf apex, and margin of upper shoulder

1 mm, 1 mm, 0.1 mm, 10 μm, 10 μm



juxtacostal cells midleaf, cells midshoulder, and leaf basal angle

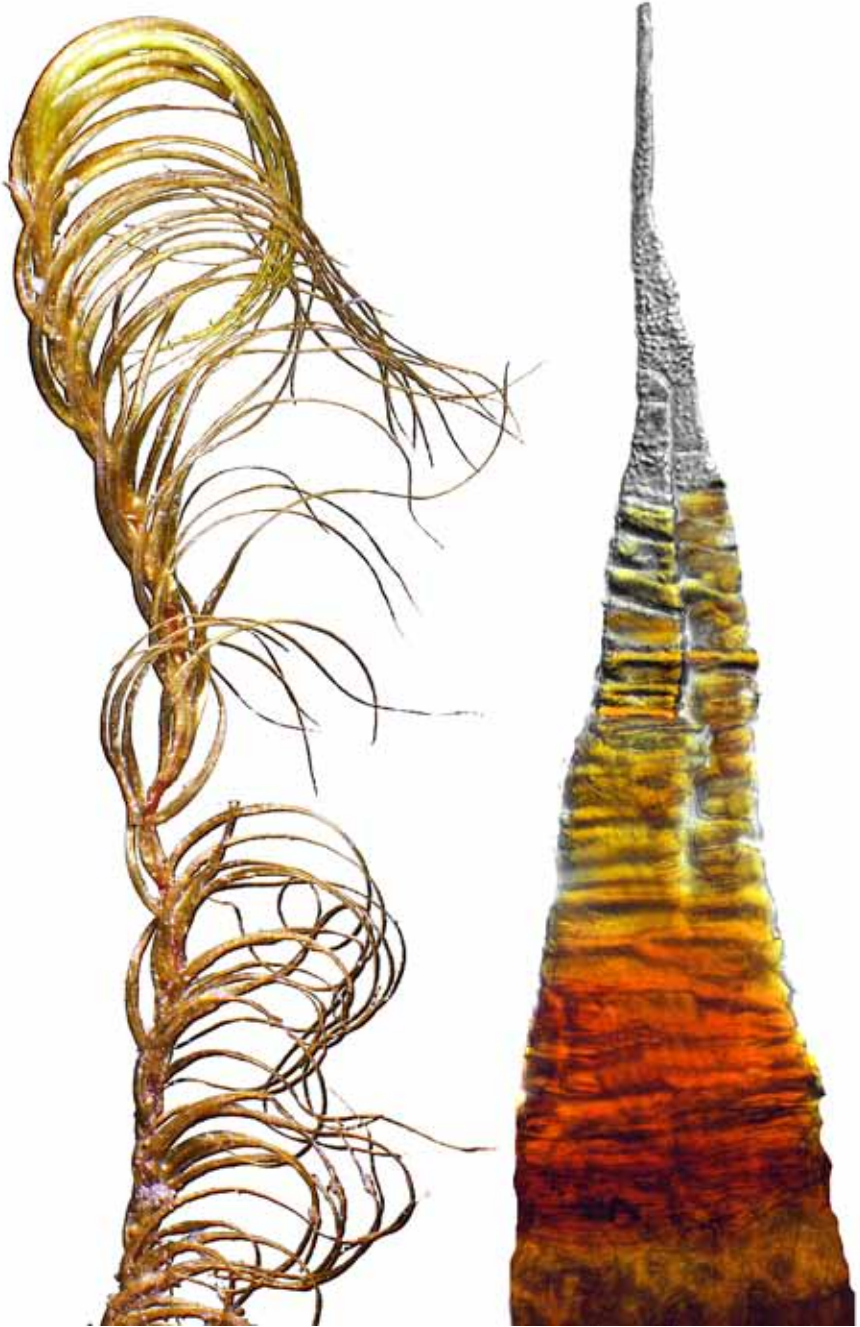
10 μm, 10 μm, 50 μm

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Blindia magellanica fertile habit
1 mm

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Blindia magellanica vegetative shoot (dry) and peristome tooth
1 mm, 10 μ m

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Blindia martinii Sainsbury

form: tufts of branched, wiry, flexuose stems, to 30 mm, the leaves crowded, falcate-secund, golden

habitat: rock near subalpine to alpine streams and seepages, not a true aquatic

leaf: size: 3.5–5 mm

shape: narrowly oblong base tapered to a long, filiform subula, falcate-secund

tip: bluntly acute

base: clasping, ± auriculate; basal cells variable, rectangular to subquadrate

costa: weak below, strong above, filling the subula

border: not differentiated

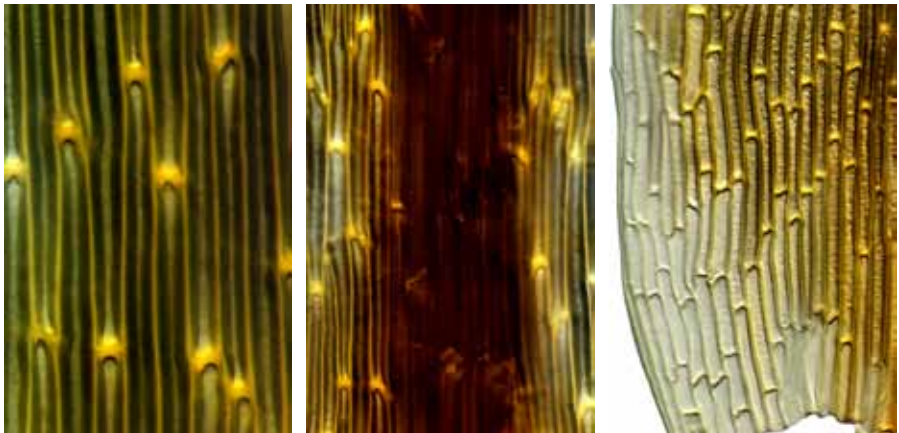
margin: entire, plane above, ± tubulose below

cells: upper cells $40\text{--}60 \times 3\text{--}5 \mu\text{m}$, long-rectangular, firm-walled, smooth; lower cells $35\text{--}70 \times 5\text{--}8 \mu\text{m}$, narrowly linear, thick-walled, smooth

capsule: 0.6–0.8 × 0.7 mm, hemispherical, erect, immersed, reddish brown, wide-mouthed when dry; seta to 0.7 mm; operculum conic; calyptra cucullate, naked; exostome red, the teeth lanceolate, smooth, trabeculate; spores 18–24 μm in diam.

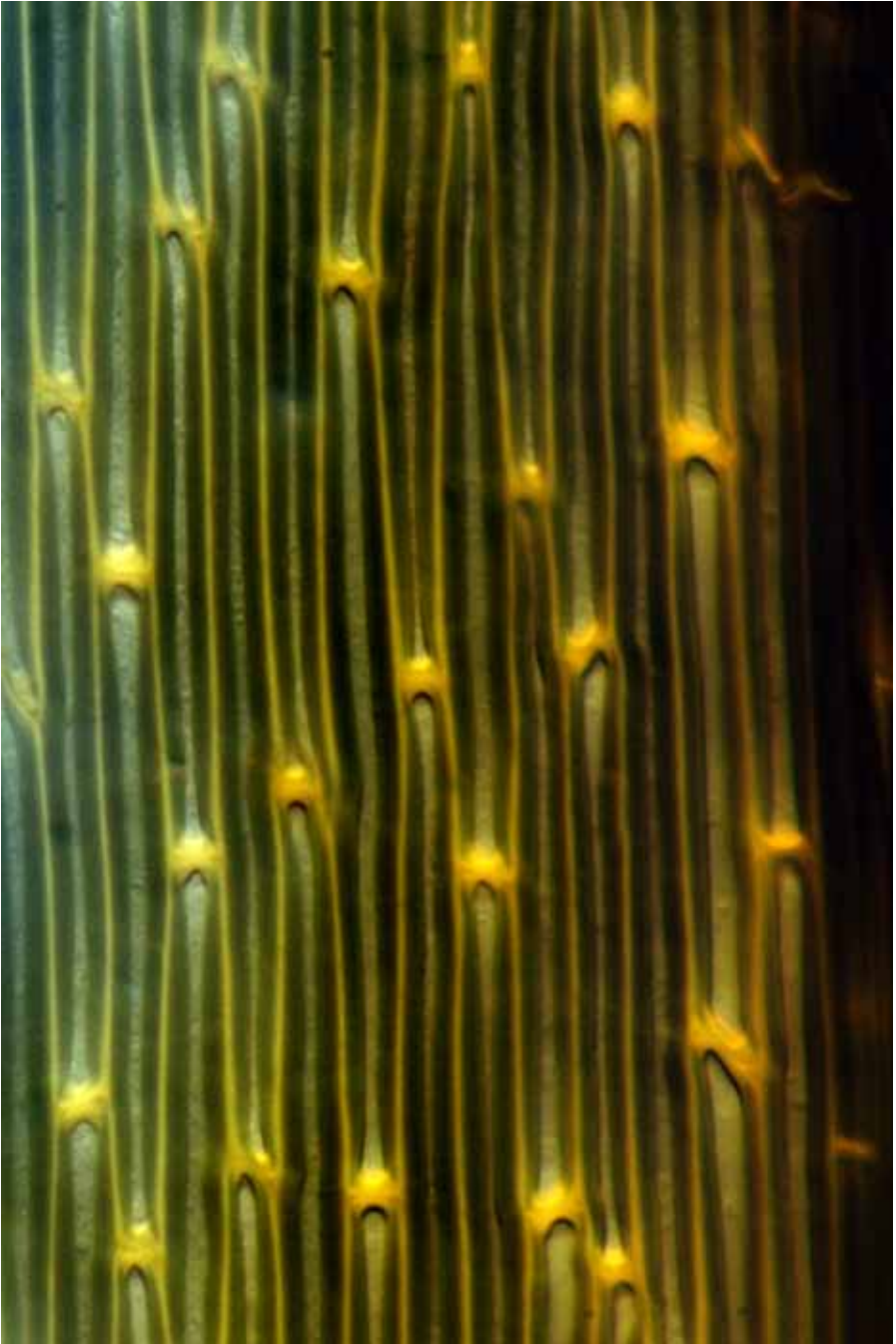


fertile shoots (dry), capsule, leaf outline, leaf apex, leaf subapex, and margin near base
 5 mm, 1 mm, 1 mm, 10 μm , 10 μm , 10 μm



leaf base juxtacostal cells, costa in lower leaf, and leaf basal angle
 10 μm , 50 μm , 10 μm

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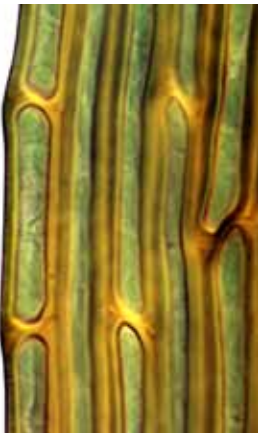


Blindia martinii juxtacostal cells in lower leaf
10 μ m

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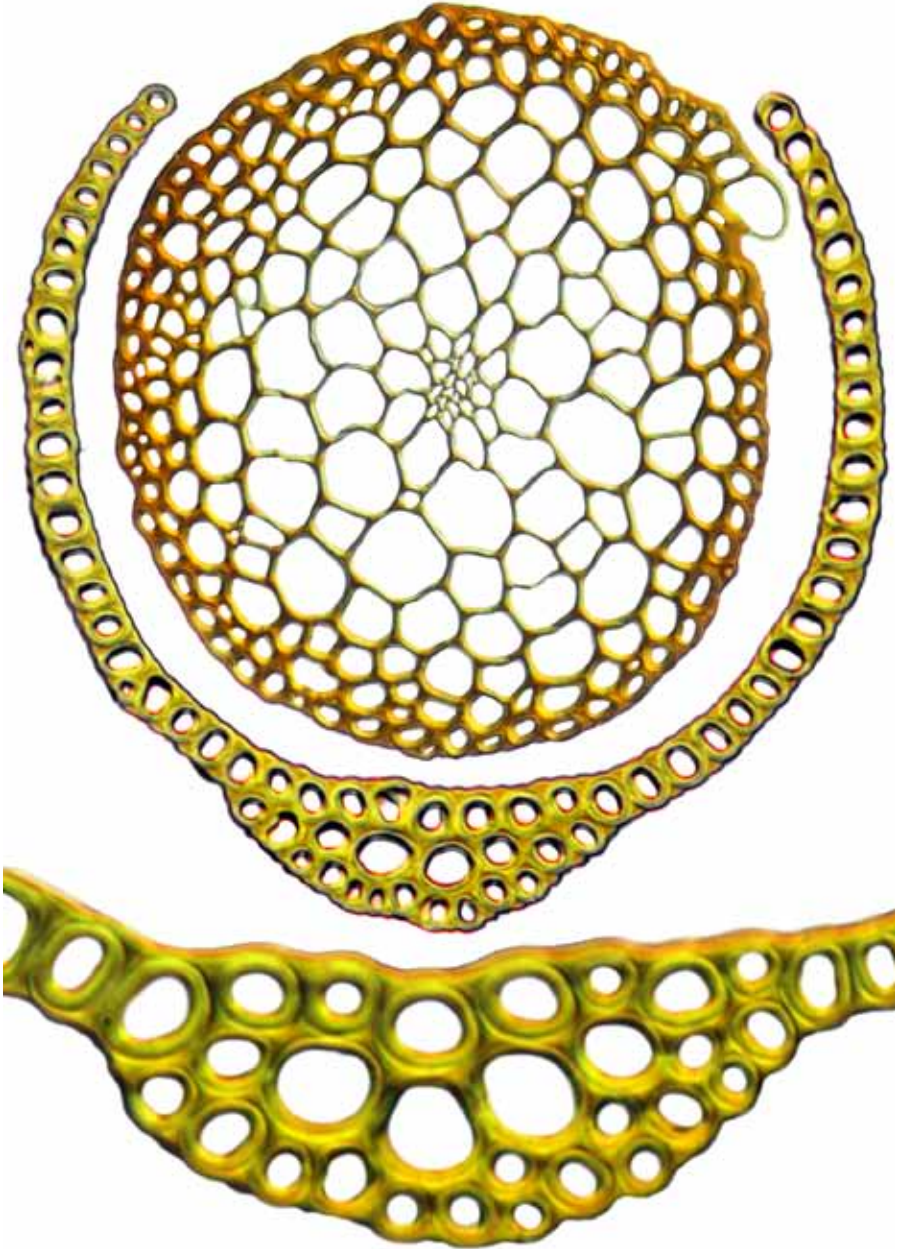
Blindia robusta Hampe**form:** tufted, glossy, flexuose, dark stems, sparsely branched, to 70 mm long**habitat:** wet rock in alpine seepages or margins of streams and pools, to 1900 m**leaf:** size: 4–10 × 0.3–0.8 mm*shape:* canaliculate-filiform subula narrowed from an oblong base, falcate-secund*tip:* narrowly acute*base:* clasping; alar cells subquadrate, brown, forming distinct auricles*costa:* filling the upper subula*border:* not differentiated*margin:* entire, plane above ± tubulose below*cells:* 36–60 × 3 μm, linear, incrassate, smooth**capsule:** 0.8–1 mm, ± urceolate, turbinate and systylious when empty, long-exserted; seta 8–16 mm, straight, orange; operculum long-rostrate; peristome teeth 16, red, lanceolate, split or perforate above; spores 27–45 μm in diam., smooth, green**note:** can form golden-brown, soggy mats in alpine pools

vegetative habit, leaf outline, leaf apex, leaf subapex, and systylious capsule
 1 mm, 1 mm, 10 μm (2), 0.5 mm



margin midleaf, cells midleaf, and alar region
 10 μm, 10 μm, 30 μm

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Blindia robusta stem, leaf, and costa cross-sections
■ 10 μm (top), ■ 10 μm (middle), ■ 10 μm (bottom)

Blindia seppeltii J.K.Bartlett & Vitt

form: mats or cushions of long (to 60 mm), glossy \pm branched stems, greenish (on land) or blackish (in water)

habitat: \pm aquatic, on moist or submerged rocks in or near seepages and lakes

leaf: size: 5–8 mm long, \pm erect, little altered when dry

shape: base decurrent and clasping, oblong-lanceolate, gradually narrowing to a narrow subula up to 4 times longer than the leaf base

tip: acute

base: alar cells weakly differentiated, $20\text{--}40 \times 10\text{--}18 \mu\text{m}$, thin-walled, hyaline, usually missing from leaves pulled off the stem

costa: to $100 \mu\text{m}$ wide at leaf base, filling the subula above

border: not differentiated

margin: entire, plane

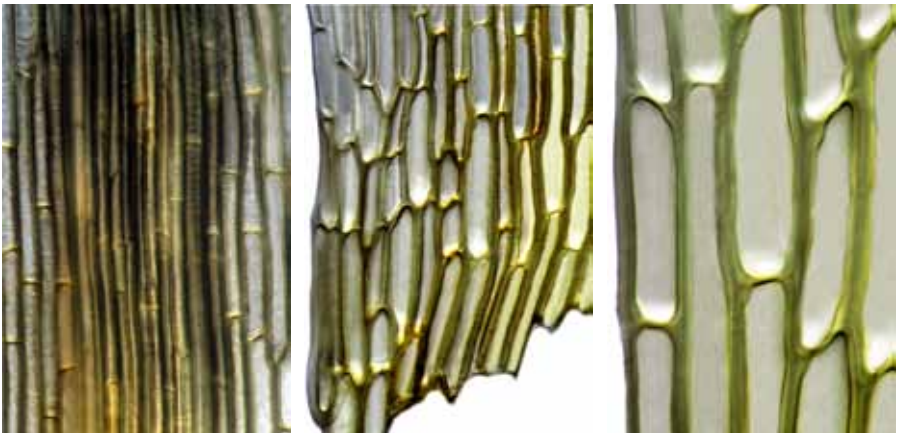
cells: $60\text{--}120 \times 4 \mu\text{m}$, linear, straight, thick-walled, smooth

capsule: $1 \times 0.8\text{--}1 \text{ mm}$ long, exserted, turbinate, wide-mouthed, dark; seta 5–13 mm long; operculum obliquely beaked; spores $16\text{--}40 \mu\text{m}$ in diam.



vegetative shoots (2), leaf outline, leaf apex, leaf subapex, and margin below shoulder

1 mm, 0.5 mm, 1 mm, 5 μm , 5 μm , 10 μm



sheath cells, leaf basal angle, and margin just above basal angle

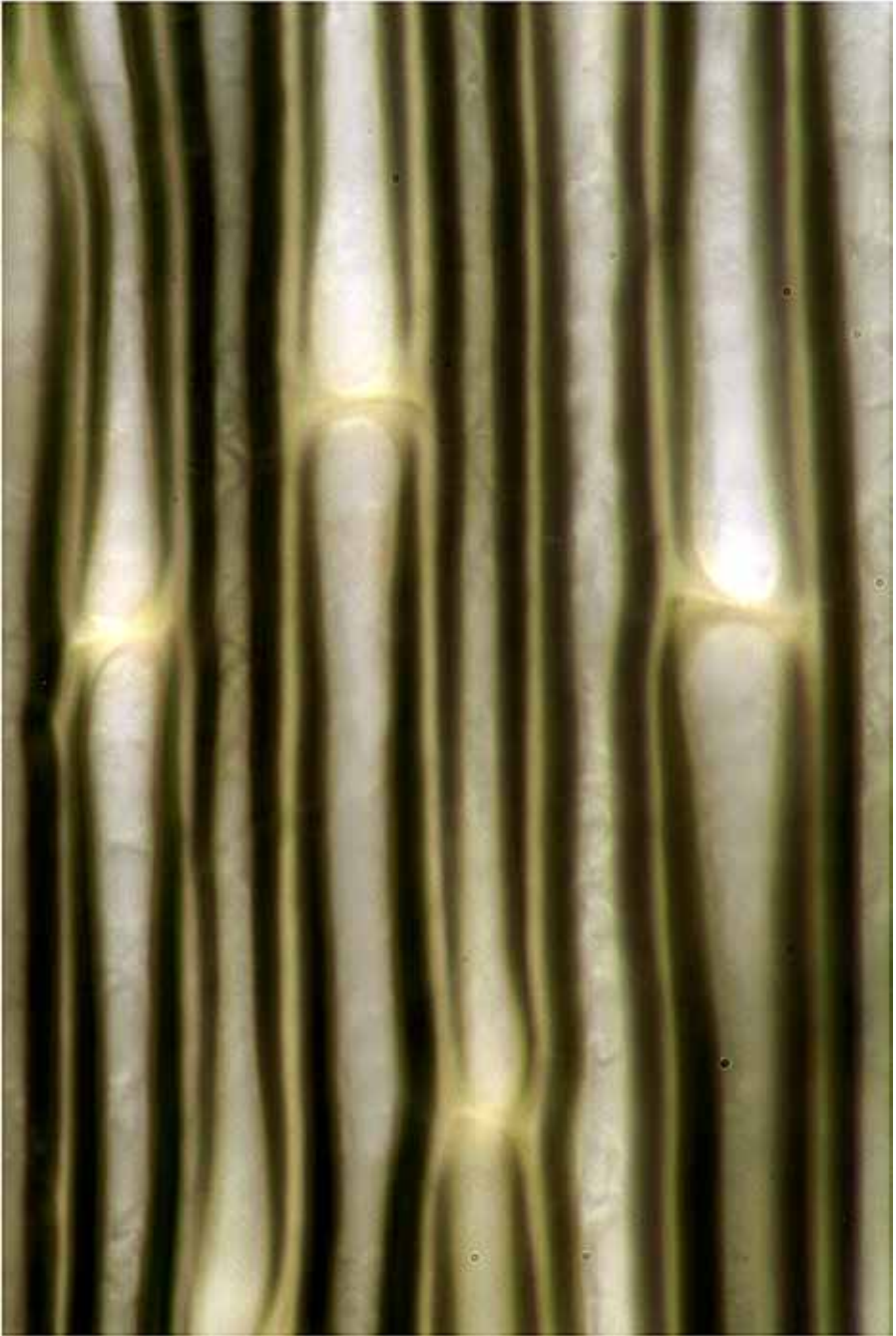
10 μm , 10 μm , 10 μm

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Blindia seppeltii vegetative shoots and leaf outline
1 mm, 1 mm, 1 mm

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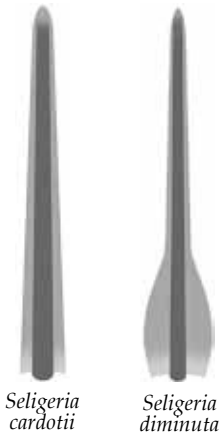


Blindia seppeltii lamina cells
10 μm

Key* to New Zealand species of Seligeria (2)

- 1 Leaves linear; median cells mostly longer than wide; lamina unistratose; seta erect, straight..... ● **Seligeria cardotii**
- 1: Leaves subulate from an ovate base; median cells mostly isodiametric; lamina partly bistratose; seta cygneous, flexuose..... ● **Seligeria diminuta**

*based on Vitt, DH; Bartlett, JA (1983): The genus *Seligeria* in New Zealand. *Bryologist* **86**, 107.



Seligeria cardotii R.Br.ter.

form: gregarious, pale, bluish green, glossy, sparingly branched stems, to 1.5 mm

habitat: wet, usually calcareous rock faces, lowland forest to alpine scrub, to 1500 m

leaf: size: 1.3–2.2 × 0.05–0.1 mm

shape: subulate from a widened base, ± flexuose

tip: acute

base: not sheathing; basal cells slightly longer than the blade cells

costa: ending at or just below the apex, filling the upper subula

border: not differentiated

margin: entire to ± crenulate, plane

cells: 10–25 × 4–8 μm, subquadrate to rectangular, thin-walled, smooth

capsule: 0.3–0.6 mm, exserted, ovate or turbinate, necked, wide-mouthed when empty; seta 1.5–0.8 mm, ± curved; peristome of 16 fragile, orange teeth; calyptra cucullate, naked, smooth; operculum obliquely rostrate; spores 10–15 μm in diam., green



vegetative shoot, leaf outline, leaf apex, and leaf subapex
 1 mm, 0.1 mm, 10 μm, 10 μm



margin, cells, and costa midleaf
 10 μm, 10 μm, 10 μm

continued next page

Seligeria diminuta (R.Br.bis) Dixon

form: loosely tufted, erect, matt, simple stems, dark olive-green, to 1 mm tall
habitat: sloping calcareous rock or the roof of rock crevices, to 2200 m

leaf: *size:* 1–2 mm

shape: ± abruptly subulate from a sheathing, ± ovate base

tip: bluntly acute

base: basal sheath cells ± rectangular, thin-walled

costa: filling most of the subula, ending at or below the apex

border: not differentiated

margin: entire, plane

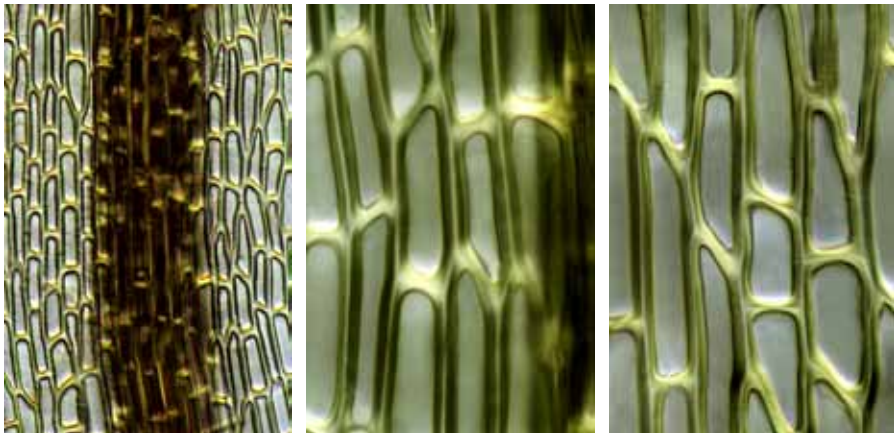
cells: subula cells 6–12 × 5–6 μm, rounded-quadrate, firm-walled, smooth; sheath cells irregularly rectangular to rhombic, 25 × 12 μm, firm-walled

capsule: 0.5–0.8 mm, oblong-ovate, inclined to pendent, long-exserted, brown; seta 2.5–3.2 mm, cygneous or curved wet or dry; peristome single, of 16 reddish, fragile, rigid, lanceolate teeth; operculum obliquely rostrate; calyptra cucullate, naked, smooth, shorter than the capsule; spores 8–12 μm in diam.



fertile shoot with mature capsule, leaf outline, leaf apex, and margin mid-sheath

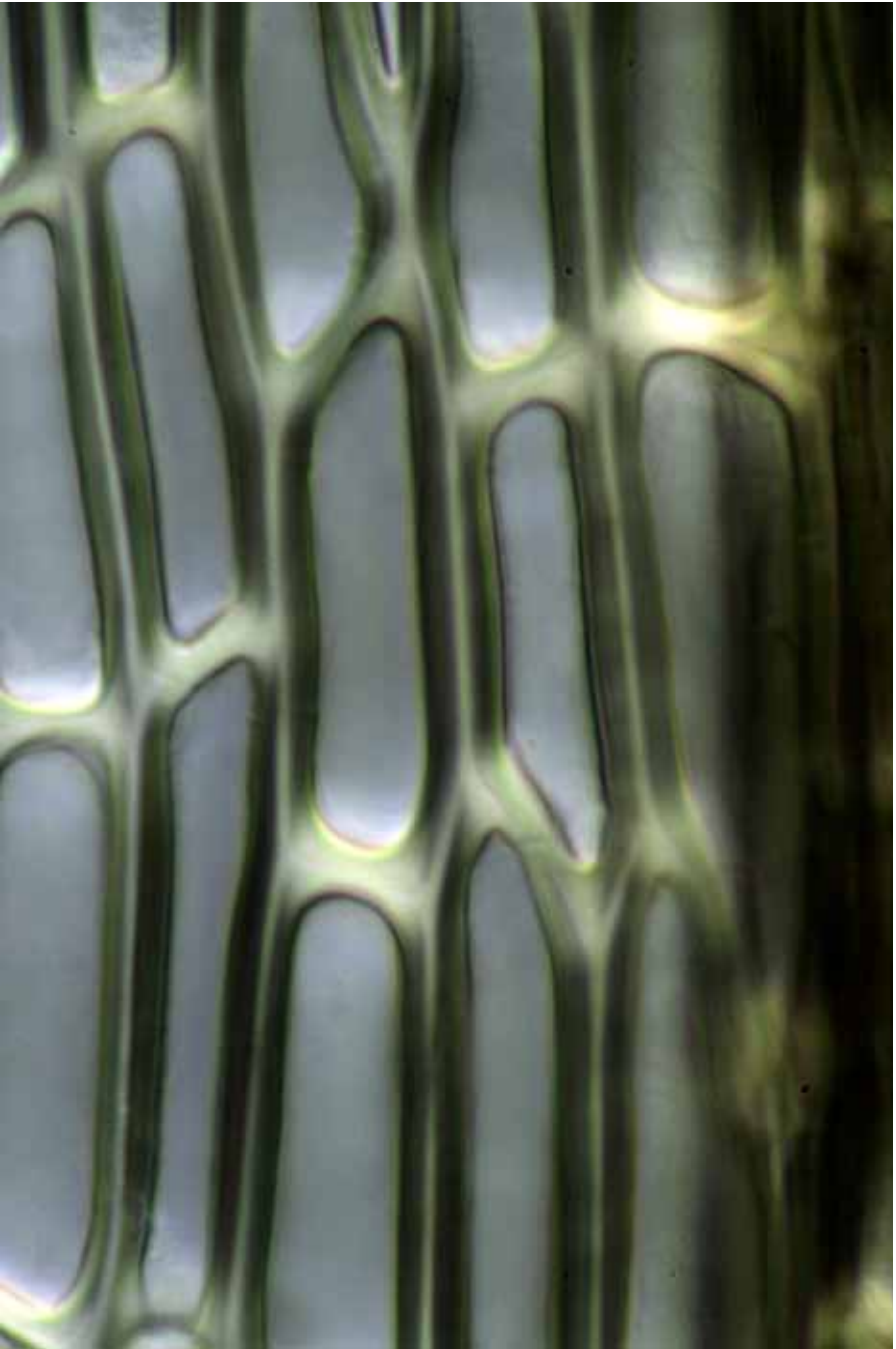
1 mm, 0.1 mm, 10 μm, 10 μm



costa mid-sheath, juxtacostal cells mid-sheath, and cells of mid-sheath

10 μm, 10 μm, 10 μm

continued next page



Seligeria diminuta juxtacostal cells midleaf
10 μm

Archidium elatum Dixon & Sainsbury

form: dense tufts of dull, highly branched, zigzag stems, to 18 mm tall; the leaf costa wide and stout; barren in New Zealand

habitat: pool edges and damp depressions in coastal volcanic rock

leaf: size: 1.0–1.5 × 0.2–0.3 mm

shape: triangular-lanceolate

tip: acuminate

base: basal angle cells quadrate to short-rectangular, 10–15 × 12 μm

costa: strong, to 1/3 the leaf base width, homogeneous xs, ± reaching the apex

border: not differentiated; quadrate basal cells extending up margin in 2–4 rows

margin: entire or faintly crenulate, narrowly recurved

cells: 25–40 × 9–12 μm, oblong-rectangular, firm-walled, smooth

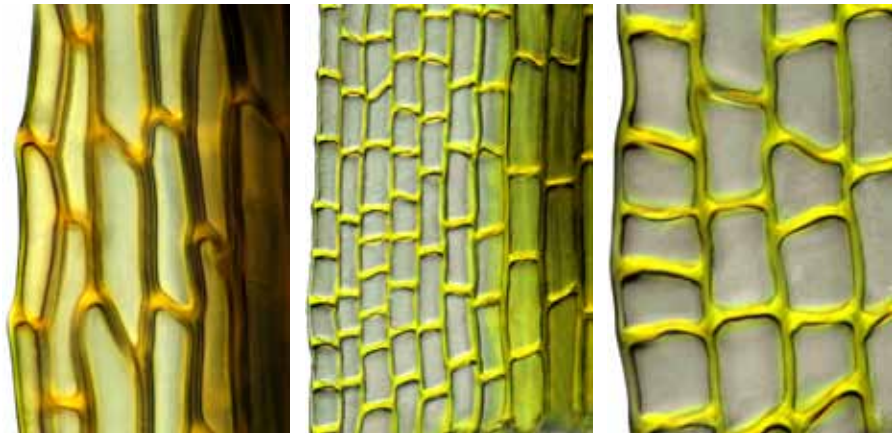
capsule: no capsules have been found in New Zealand

note: thought to be rare, but easily missed because of its small size



vegetative zig-zag shoots (dry) (3), leaf outline, leaf apex, and leaf subapex

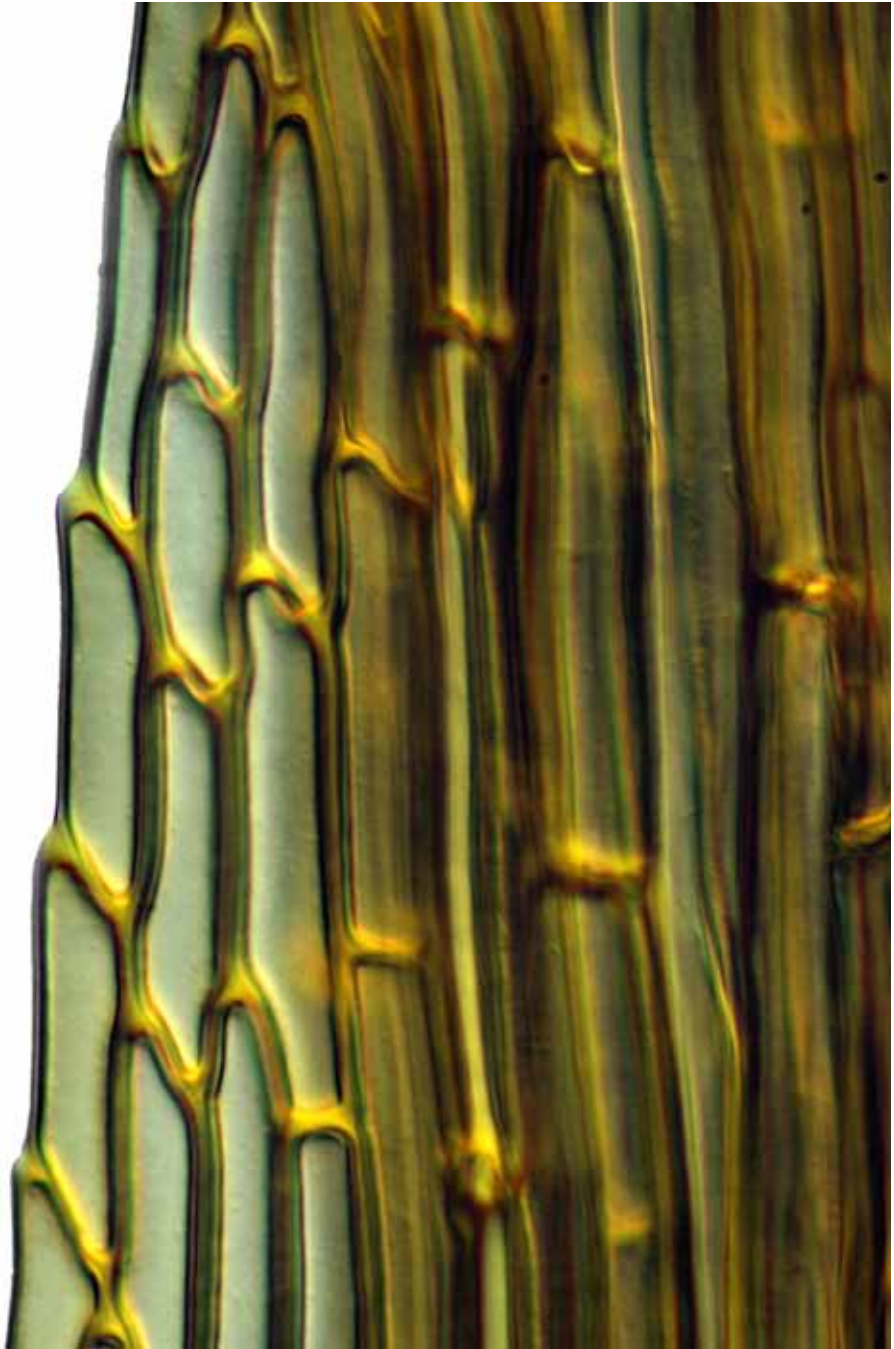
1 mm, 1 mm, 1 mm, 0.1 mm, 10 μm, 10 μm



margin midleaf, margin just above leaf basal angle, and margin detail near leaf base

10 μm, 10 μm, 10 μm

continued next page



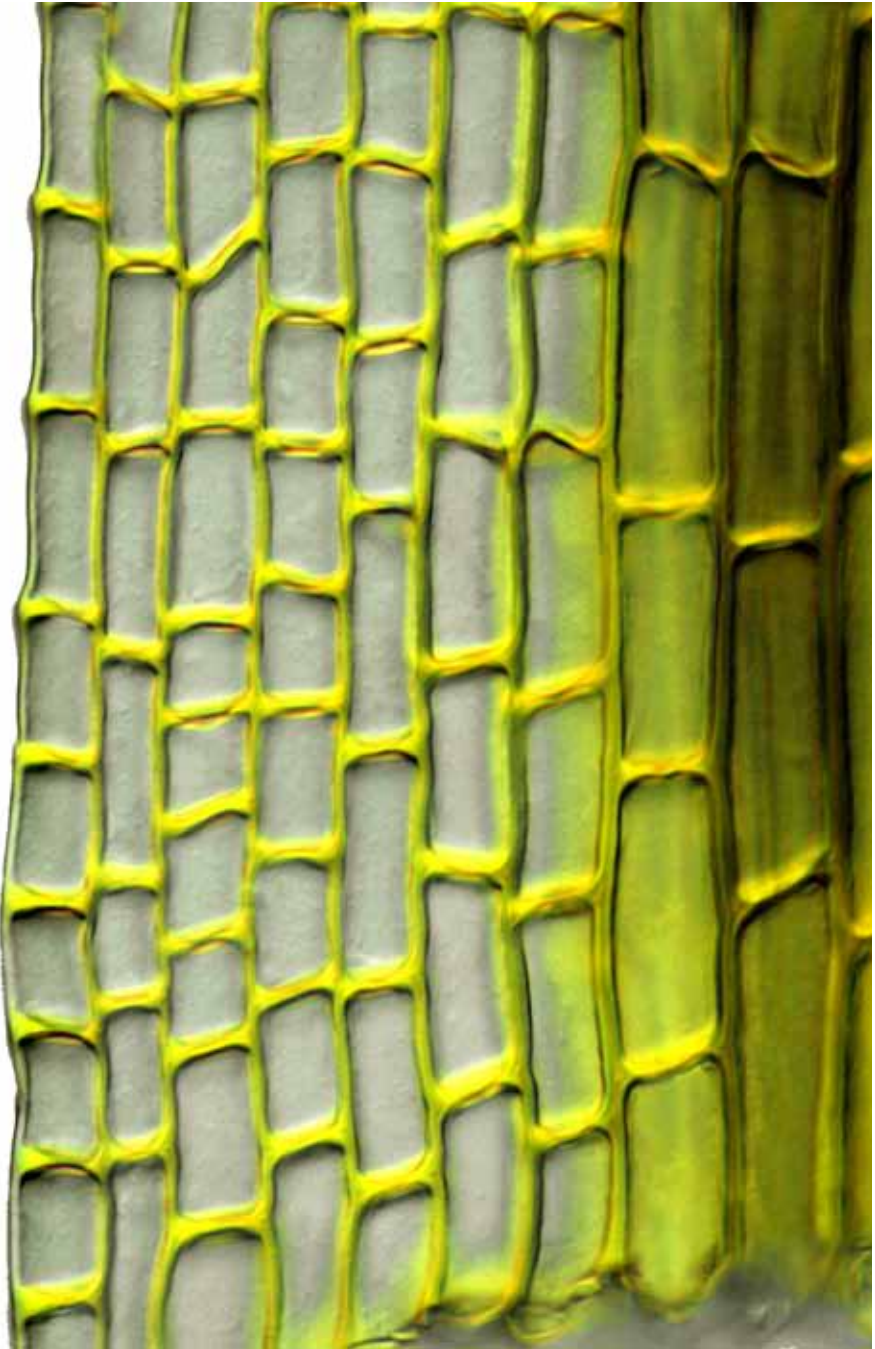
Archidium elatum margin above midleaf
10 μ m

continued next page



Archidium elatum margin midleaf
10 μ m

continued next page



Archidium elatum quadrate to short-rectangular basal angle cells.
10 μm

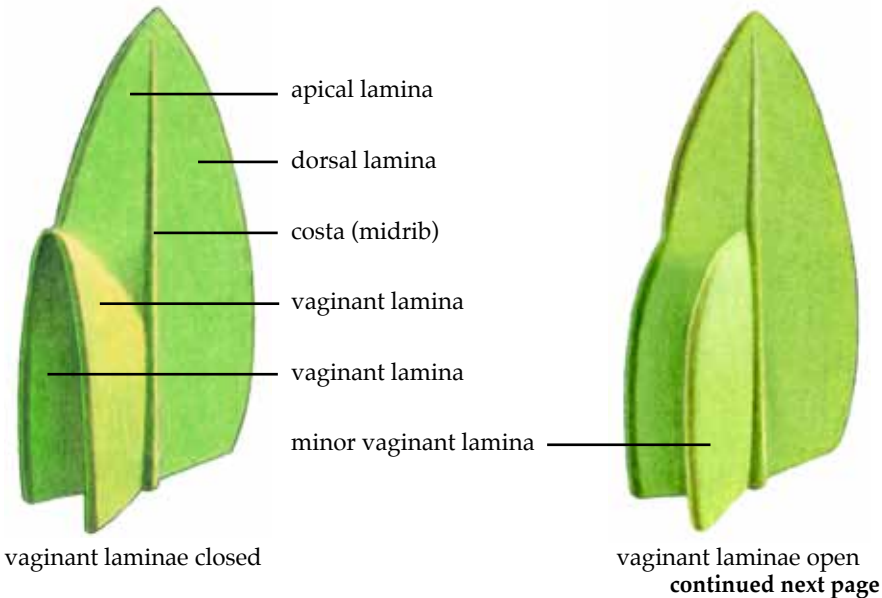
Fissidens

Every leaf of a *Fissidens* moss has a deep slot in its forward edge that can clasp the trailing edge of the leaf lying just above it on the stem (below), rather like a dovetailed joint in a finely crafted wooden cabinet. That's unique among all the world's mosses.



Because the *Fissidens* leaf is so distinctive, botanists have named its parts. The two sides of the slotted forward edge are called **vaginant laminae** (*vagina* in Latin means “sheath”, *lamina* means “blade”, and *laminae* is the plural of *lamina*). The slot is always located at the base of the leaf's forward edge (below), and the unslotted remainder of that same half of the leaf is called the **apical** (or **ventral**) **lamina**. The trailing edge of the leaf never has a slot in it, and is called the **dorsal lamina**.

If the two vaginant laminae are fused together along only the leaf's costa (midrib), they're said to be *open* (below, right). In that case, one of the two vaginant laminae merges seamlessly at its tip into the apical lamina, whereas the other at its tip is left dangling, and is re-named the *minor vaginant lamina*. If on the other hand the two vaginant laminae are fused together along their tops right out to the leaf's forward edge (below, left), they're said to be *closed*. The leaves of most *Fissidens* mosses have vaginant laminae that are somewhere in between the extremes of fully open or fully closed, hence are said to be *partially* open or closed.



Key* to the New Zealand species and infraspecies of Fissidens (34)

* based on Beever, J; Malcolm, B; Malcolm, N (2002): *The Moss Genus Fissidens in New Zealand, an Illustrated Key*. Micro-Optics Press, Nelson. For a key that's more detailed and makes more use of capsule traits, see Beever, J (2014): Fissidentaceae. *Flora of New Zealand – Mosses*. Fascicle 8, Manaaki Whenua Press, Lincoln.

- 1 Base of dorsal lamina strongly undulate (sometimes other laminae are undulate as well)..... ● **Fissidens taxifolius**
 1: Base of dorsal lamina plane or nearly so..... 2
- 2(1): Leaves 5–9 mm long..... ● **Fissidens berteroi**
 2: Leaves shorter than about 4 mm..... 3
- 3(2): Axillary hyaline nodules present (*see* glossary under *axillary*.); known in New Zealand from Kermadec Islands only..... ● **Fissidens crispulus** var. **robinsonii**
 3: Axillary hyaline nodules not present..... 4
- 4(3): Dorsal lamina border fused to costa near leaf base.. ● **Fissidens perangustus**
 4: Dorsal lamina border not fused to costa near leaf base..... 5
- 5(4): Protonema persistent..... ● **Fissidens exilis**
 5: Protonema not persistent..... 6
- 6(5): Peristome *sainsburia*-type (*see* glossary under *sainsburia*-type peristome.....)..... ● **Fissidens taylorii** var. **sainsburyanus**
 6: Peristome not *sainsburia*-type, or capsules not present..... 7
- 7(6): Leaves ecostate..... 8
 7: Leaves costate..... 9
- 8(7) Plants 5–8 mm tall; leaf margins entire, the marginal cells long and narrow, forming a distinct border..... ● **Fissidens dealbatus**
 8: Plants to only 3 mm tall; leaf margins toothed above, with no border..... ● **Fissidens hylogenes**
- 9(7): All laminae bordered with elongate or thick-walled cells for most or all of their length..... 10
 9: No laminae or only some laminae bordered with elongate or thick-walled cells..... 18
- 10(9) Leaves overlapping at mid-stem..... 11
 10: Leaves not overlapping at mid-stem..... 15
- 11(10) Plants aquatic or frequently submerged..... 12
 11: Plants not aquatic..... 13
- 12(11) Laminae bordered with elongate cells; lamina cells flat; laminae more than one cell layer thick in patches or near the costa... ● **Fissidens rigidulus** var. **rigidulus**
 12: Laminae bordered with isodiametric, thick-walled cells; lamina cells bulging; laminae one cell layer thick throughout..... ● **Fissidens adianthoides**
- 13(11:.) Vaginant laminae open, with intramarginal borders..... ● **Fissidens megalotis** subsp. **megalotis**
 13: Vaginant laminae partially or fully closed, with no intramarginal borders..... 14
- 14(13:) Plant on soil; leaves distorted when dry; laminae only one cell layer thick throughout; leaf border cells elongate; lamina cells flat..... ● **Fissidens curvatus** var. **curvatus**
 14: Plant on rock; leaves little changed when dry; laminae more than one cell layer thick in patches or near the costa; leaf border cells isodiametric and thick-walled; lamina cells bulging..... ● **Fissidens dubius**

continued next page

- 15(10:) Plants aquatic; leaf pairs mostly more than about 15... ● **Fissidens dietrichiae**
 15: Plants usually not aquatic; leaf pairs mostly fewer than about 15 16
- 16(15:) Leaf length-to-width ratio about 2:1 ● **Fissidens bryoides**
 16: Leaf length-to-width ratio more than 4:1 17
- 17(16:) Plants 2–6 mm tall, the leaves in 4–10 pairs; dorsal lamina failing above the leaf insertion, tapered to its base; lamina cells pellucid, flat, thin-walled
 ● **Fissidens anisophyllus**
 17: Plants 3–15 mm tall, the leaves in 4–30(–45) pairs; dorsal lamina reaching the leaf insertion and sometimes shortly decurrent; lamina cells obscure, bulging, firm-walled ● **Fissidens leptocladus**
- 18(9:) No laminae bordered with elongate cells 19
 18: At least one lamina bordered with elongate cells 28
- 19(18) Vaginant laminae open 20
 19: Vaginant laminae partially or fully closed 21
- 20(19) Fronds 10–60 mm tall; leaves > 2 mm long, in 10–25 pairs
 ● **Fissidens asplenioides**
 20: Fronds 1–3 mm tall; leaves < 1.5 mm long, in 3–6(–14) pairs
 ● **Fissidens tenellus** var. **australiensis**
- 21(19:) Cells of dorsal and apical laminae multipapillose 22
 21: Cells of dorsal and apical laminae smooth 23
- 22(21) Leaves linear (length-to-width ratio > 5:1), 0.1–0.2 mm wide, the apices narrowly acute and often asymmetric ● **Fissidens linearis** var. **angustifolius**
 22: Leaves oblong-lanceolate (length-to-width ratio < 5:1), 0.2–0.3 mm wide, the apices acute and symmetric ● **Fissidens linearis** var. **linearis**
- 23(21:) Plants aquatic 24
 23: Plants not aquatic 25
- 24(23) Costa distinct, white to yellow, often reddening with age; vaginant laminae unistratose ● **Fissidens strictus**
 24: Costa indistinct, partly overlain with shortly rectangular, thin-walled cells; vaginant laminae pluristratose ● **Fissidens rigidulus** var. **pseudistrictus**
- 25(23:) Plants usually on bark or exposed roots ● **Fissidens hyophilus**
 25: Plants usually on soil or rock 26
- 26(25:) Leaves pale to dark grey-green, glossy, little altered when dry, in 5–10(–17) pairs; leaf margins ± entire ● **Fissidens pallidus**
 26: Leaves medium to yellow-green, not glossy, the tips rolled when dry, in 12–30(–40) pairs; leaf margins crenulate from bulging cells 27
- 27(26:) Plants usually on rock; dorsal lamina often failing above the leaf insertion..
 ● **Fissidens oblongifolius**
 27: Plants usually on soil; dorsal lamina usually reaching the leaf insertion
 ● **Fissidens capitatus**
- 28(18:) Border of vaginant laminae intramarginal 29
 28: Border of vaginant laminae marginal 30
- 29(28) Plants aquatic, 5–15 mm tall, with 10–45 pairs of leaves that overlap at mid-stem; lamina cells flat ● **Fissidens integerrimus**
 29: Plants only rarely aquatic, 1–6 mm tall, with fewer than 15 pairs of leaves that do not overlap at mid-stem; lamina cells bulging
 ● **Fissidens tenellus** var. **tenellus**

continued next page

- 30(28:) Plants on rock, aquatic or frequently submerged; laminae more than one cell layer thick in patches near the costa..... ● **Fissidens waiensis**
 30: Plants on soil, not aquatic; laminae unistratose throughout 31
- 31(30:) Vaginant laminae open; lamina cells bulging ● **Fissidens blechnoides**
 31: Vaginant laminae partially or fully closed; lamina cells flat..... 32
- 32(31:) Leaves distorted when dry; dorsal lamina border rudimentary or lacking ...
 ● **Fissidens curvatus** var. **inclinabilis**
 32: Leaves little changed when dry; dorsal lamina border lacking 33
- 33(32:) Sterile shoots with leaves in 15–25 pairs ● **Fissidens taylorii** var. **epiphytus**
 33: Sterile shoots with leaves in 8–12(–17) pairs 34
- 34(33:) Peristome *sainsburia*-type (see glossary under *sainsburia*-type peristome).....
 ● **Fissidens taylorii** var. **sainsburyanus**
 34: Peristome not *sainsburia*-type ● **Fissidens taylorii** var. **taylorii**



Fissidens rigidulus var. *rigidulus* cross-sections of leaves (detail of costa on right) (partially schematic and computer-assembled). The costa (midrib) is about midway in both sections, with the dorsal lamina facing downwards and the vaginant laminae facing upwards.

50 μm (left),

50 μm (right)

continued next page

Fissidens adianthoides Hedw.

form: densely gregarious, yellow- to dark green, ± branched, to 90 mm long

habitat: aquatic, floating or on submerged rock or soil in depressions and lakes to 1600 m

leaf: size: 2.0–3.5 × 0.5–1.2 mm, in 10–50 pairs on the stem

shape: oblong-lanceolate, asymmetric

tip: acute

vaginant laminae: up to 0.7 of the leaf length, partially closed

base: not differentiated

costa: failing 2–4 cells below the apex

margin: with several rows of thicker-walled cells forming a pale band, irregularly and coarsely serrulate near the apex, plane

cells: 12–20 μm, rounded-isodiametric, firm-walled, bulging, smooth

capsule: 1.0–1.6 mm, asymmetric, erect to horizontal, brown; seta 15–20 mm, orange-brown, sinuose; calyptra smooth, cucullate; operculum curved-rostrate



vegetative shoot (dry) (2), leaf outline, and leaf apex

1 mm, 1 mm, 1 mm, 10 μm



margin midleaf, costa midleaf, and junction of apical and vaginant laminae

10 μm, 10 μm, 50 μm

continued next page

Fissidens anisophyllus Dixon

form: loosely gregarious, seldom-branched stems, with leaves in 4–10 pairs, not overlapping in mid-stem, 2–6 mm long

habitat: soil of lowland roadside banks, to 200 m

leaf: size: 0.8–1.4 × 0.2–0.3 mm

shape: oblong-lanceolate, crisped when dry, plane when moist

tip: acute

vaginant laminae: up to 0.7 of the leaf length, half-open to closed

base: dorsal lamina tapered, failing above the leaf insertion

costa: percurrent or failing a few cells below the apex

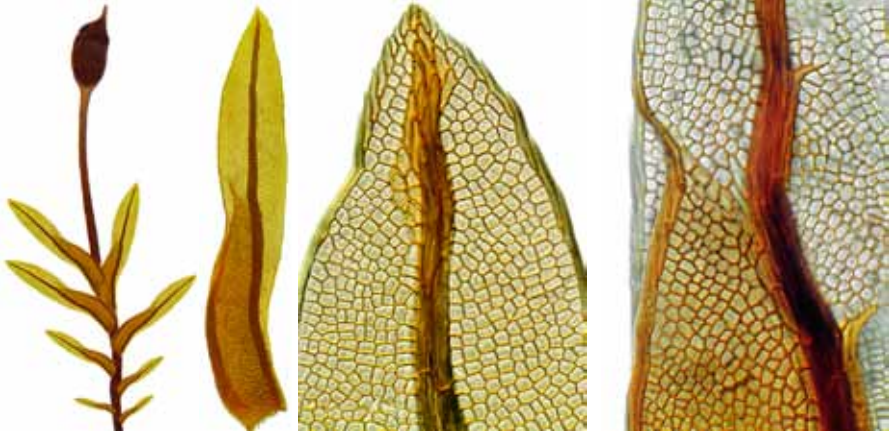
border: 1–2 rows of prosenchymatous cells, often absent on lower dorsal lamina

margin: entire below, serrulate near the apex, plane

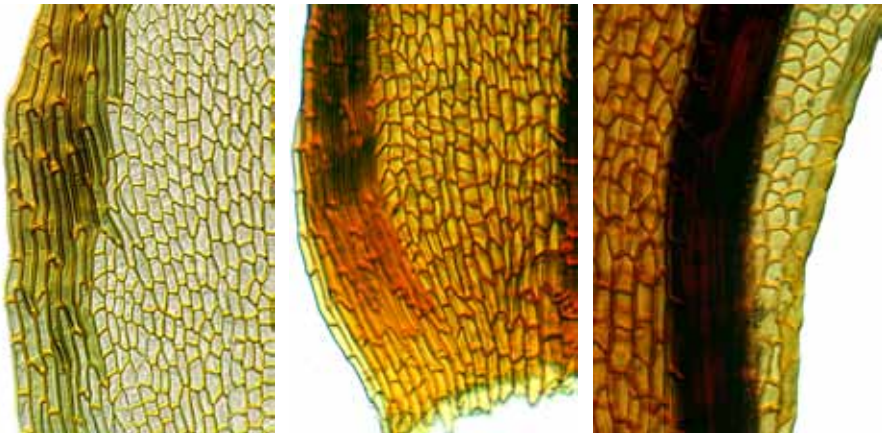
cells: 5–12 μm , quadrate to hexagonal, firm-walled, smooth

capsule: 0.3–0.5 mm, symmetric, erect, exserted, brown; seta 1.5–2.0 mm; operculum long-beaked; spores 10–14 μm in diam.

capsule: known from only a few collections in central Wairarapa



fertile shoot (moist), leaf outline, leaf apex, and junction of apical and vaginant laminae
 1 mm, 0.1 mm, 50 μm , 50 μm



margin of vaginant lamina, base of vaginant lamina, and base of dorsal lamina
 50 μm , 50 μm , 50 μm

continued next page

Fissidens asplenioides Hedw.

form: gregarious, rarely branched, rhizoidal below; up to 20 mm long when growing on soil, up to 60 mm long growing in water

habitat: soil or rock in forest, scrub, pasture, and lawns, from dry to very wet

leaf: size: 2.0–4.0 × 0.3–0.7 mm, in 10–25 pairs

shape: oblong-lingulate, ± curved, unistratose

tip: obtuse

vaginant laminae: up to 0.7 of the leaf length, ± open, the minor lamina rounded

base: dorsal lamina tapered, usually failing above the insertion

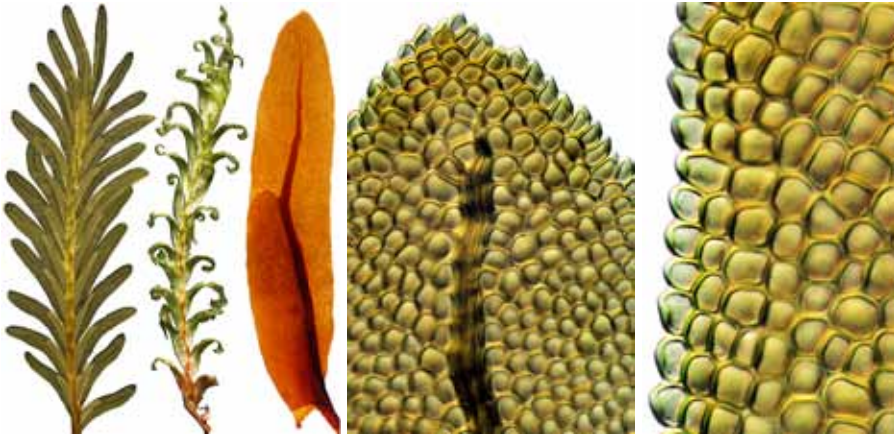
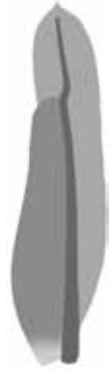
costa: failing 4–8 cells below the apex

border: not differentiated

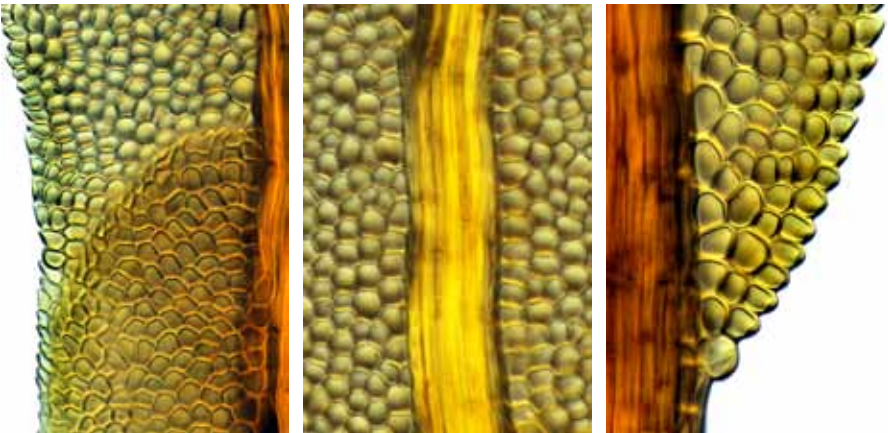
margin: serrulate throughout, plane

cells: 7–11 μm, rounded-hexagonal, firm-walled, bulging, smooth

capsule: 0.8–1.5 mm, ovoid, inclined, symmetric, exserted; seta 3–5 mm, stout, arcuate; operculum obliquely rostrate; peristome single, dicranoid; spores 14–19 μm in diam.



vegetative frond (moist and dry), leaf outline, leaf apex, and apical lamina margin
 ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 10 μm, ■ 10 μm



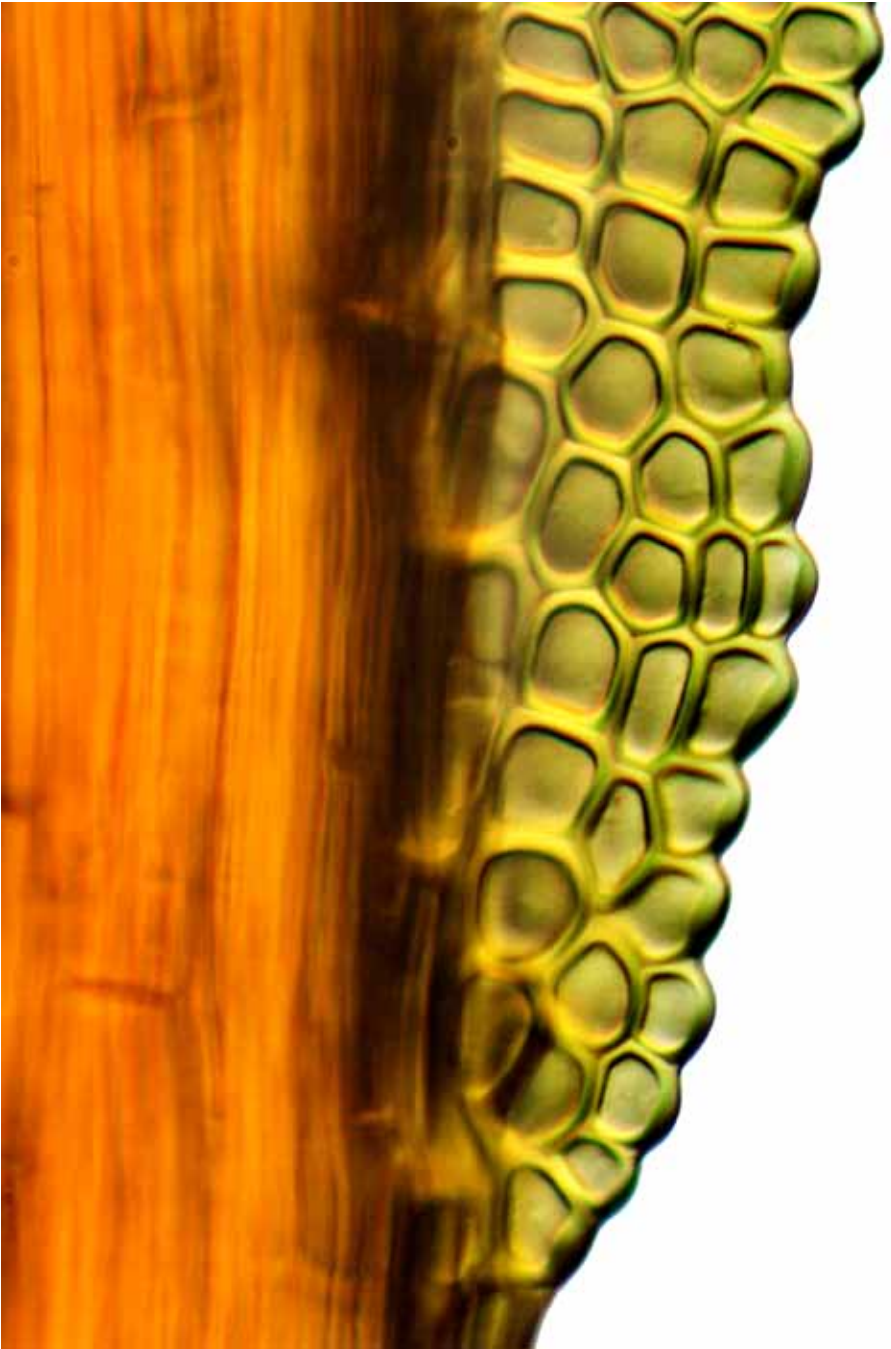
junction of apical and vaginant laminae, costa midleaf, and base of dorsal lamina
 ■ 50 μm, ■ 10 μm, ■ 10 μm

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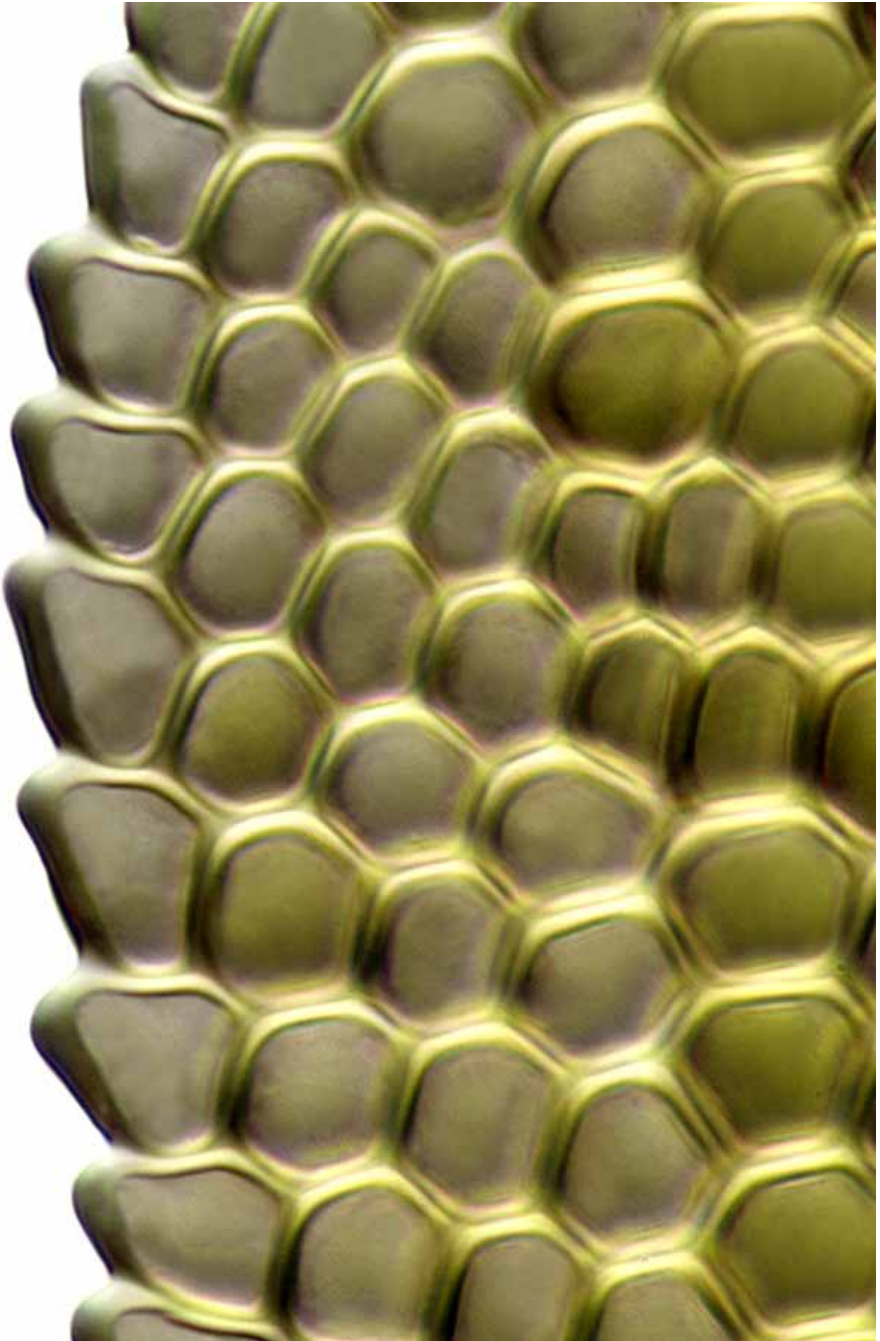
Fissidens asplenioides habit
1 mm

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Fissidens asplenioides base of dorsal lamina
10 μ m

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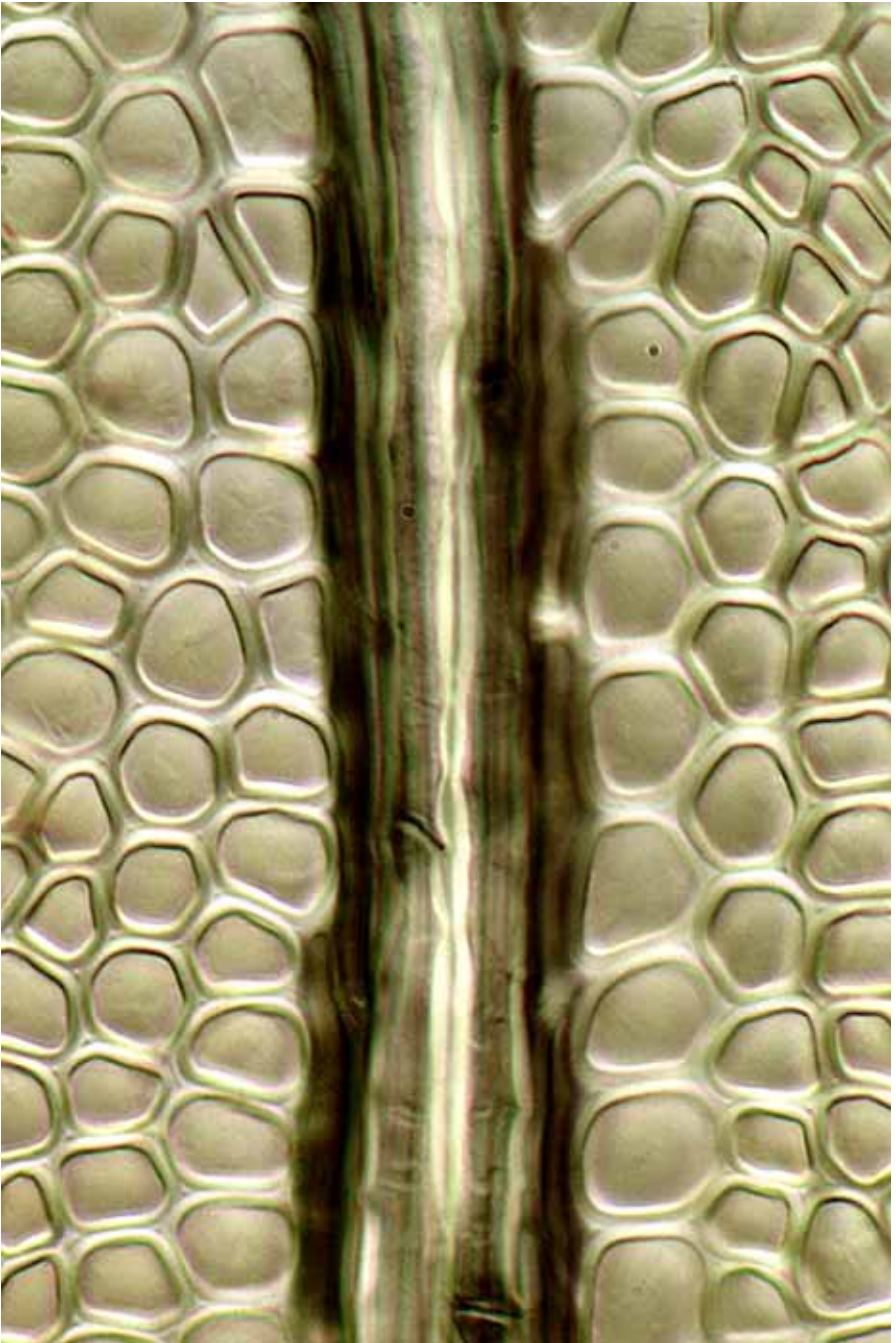
Fissidens asplenioides apical lamina margin
10 μm

continued next page



Fissidens asplenioides leaf apex showing costa terminus
10 μm

continued next page



Fissidens asplenioides costa midleaf
10 μm

continued next page

Fissidens berteroi (Mont.) Müll.Hall.

form: tufted or matted; branched; leaf-pairs distant on frond axis, green to yellow, up to 100 mm long

habitat: on wood, rock, or concrete submerged in fast-flowing lowland streams

leaf: size: 5.0–9.0 × 0.5–0.9 mm

shape: linear-lanceolate, unistratose

tip: acuminate

vaginant laminae: 0.4–0.5 the leaf length, almost closed

base: the dorsal lamina fails above the leaf insertion

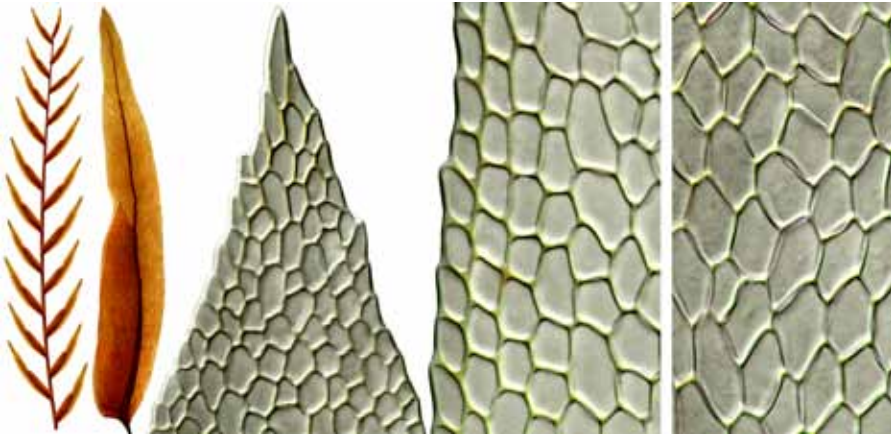
costa: failing 15–40 cells below the apex

border: not differentiated

margin: entire except for occasional serrations (especially near the apex), plane

cells: 12–20 μm, quadrate to irregularly hexagonal, thin-walled, smooth

capsule: 0.8–1.0 mm, ovoid, erect to horizontal, exserted, brown; seta 0.8–1.5 mm, stout, fleshy; operculum short-beaked; calyptra cucullate; spores 16–25 μm in diam.



vegetative frond, leaf outline, leaf apex, and margin and cells of apical (ventral) lamina
 ■ 5 mm, ■ 1 mm, ■ 10 μm, ■ 10 μm, ■ 10 μm



junction of apical and vaginant laminae, costa upper leaf, vaginant lamina basal angle
 ■ 10 μm, ■ 10 μm, ■ 50 μm

continued next page



Fissidens berteroi frond (moist) and leaf whole-mount
1 mm, 1 mm

continued next page

Fissidens blechnoides J.E.Beever

form: scattered to gregarious, rarely branched, yellow- to dark green stems up to 16 mm long; leaves in 6–15(–23) pairs, ± overlapping in mid-stem

habitat: soil on sloping banks in shaded forest and lawns, to 600 m

leaf: size: 1.0–1.6 × 0.3–0.4 mm

shape: oblong-lanceolate, unistratose, ± curved, little altered when dry

tip: acute to broadly acute, sometimes mucronate

vaginant laminae: up to 0.7 of the leaf length, open

base: dorsal lamina decurrent down the stem

costa: percurrent

border: differentiated on only the vaginant laminae

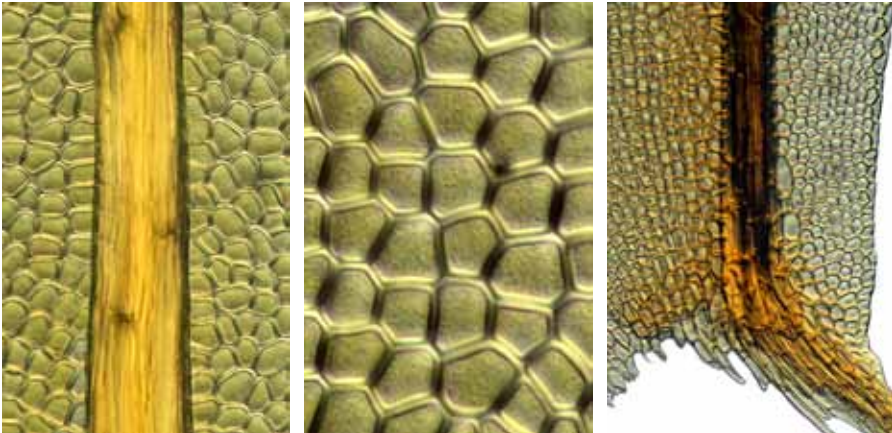
margin: entire on the vaginant laminae, minutely serrulate elsewhere, plane

cells: 5–11 μm, quadrate to hexagonal, firm-walled, bulging, smooth

capsule: 0.6–1.0 mm, ovoid, erect to inclined, exserted; seta 2–3 mm, wiry; operculum obliquely rostrate; peristome single, dicranoid; spores 14–21 μm in diam.

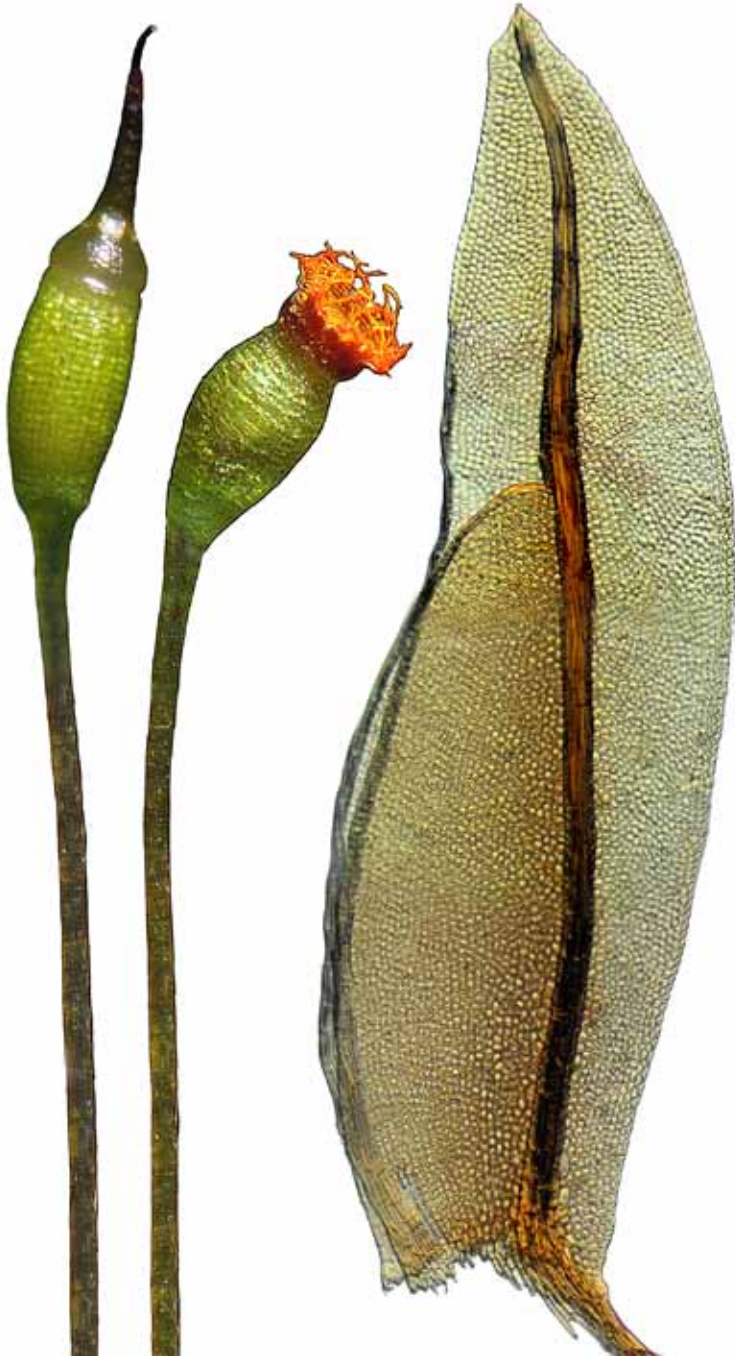


vegetative shoot (moist/dry), leaf outline, leaf apex, and apex of minor vaginant lamina
 1 mm, 1 mm, 0.1 mm, 50 μm, 50 μm



costa midleaf, cells midleaf, and decurrent base of dorsal lamina
 50 μm, 10 μm, 50 μm

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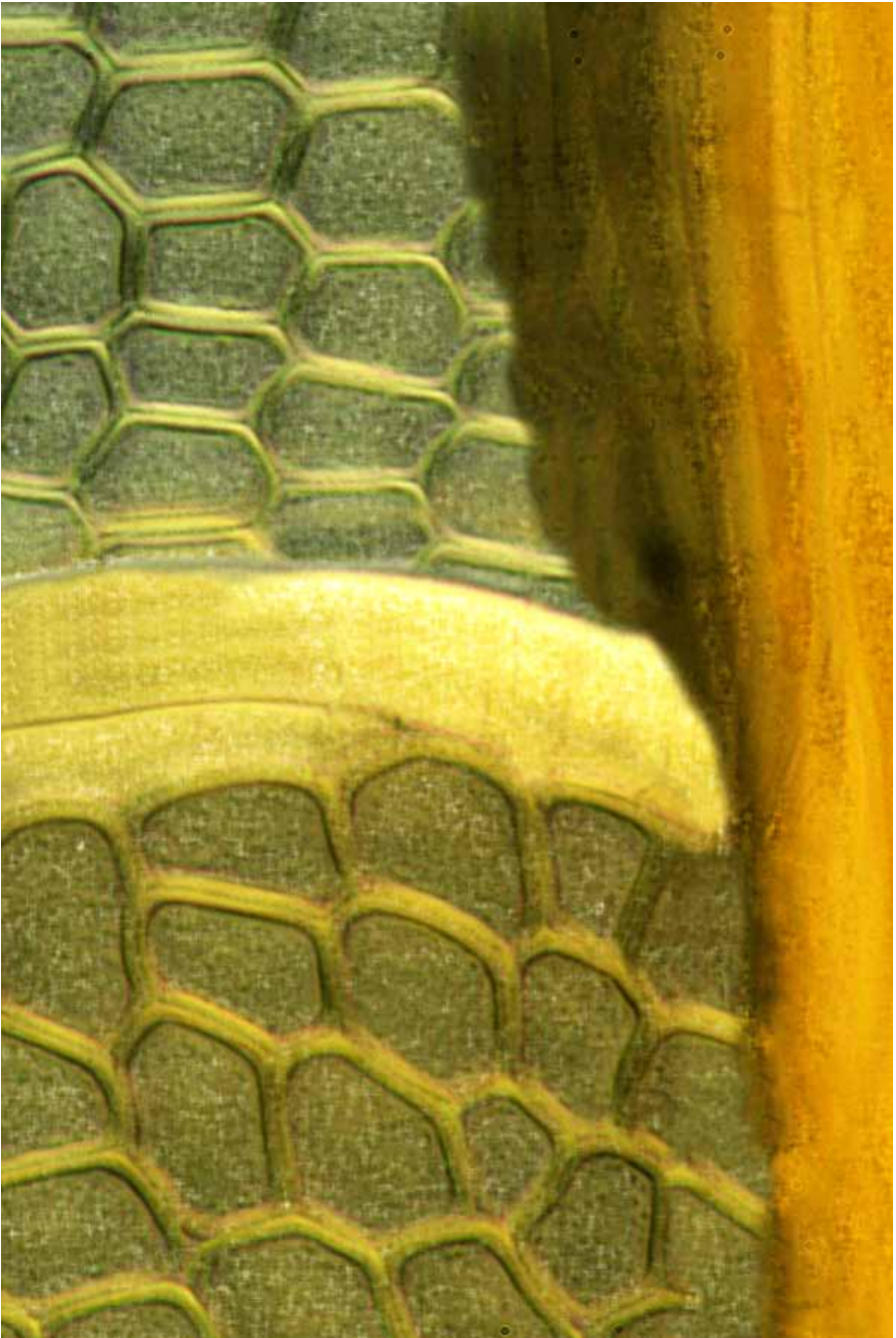
Fissidens blechnoides immature and mature capsules and leaf whole-mount
1 mm (2), 0.1 mm

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Fissidens blechnoides apex of vaginant lamina
50 μm

continued next page



Fissidens blechnoides apex of vaginant lamina (detail)
10 μ m

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Fissidens bryoides Hedw.

form: loosely gregarious, base-branched stems, 2–10 mm long; leaves in 3–20 pairs, not overlapping in mid-stem, green to yellow-green, radiculose
habitat: soil, in lawns, pastures, roadsides, and disturbed sites, to 600 m

leaf: size: 0.6–1.2 × 0.2–0.5 mm

shape: oblong-lanceolate, unistratose, crisped when dry

tip: broadly acute, apiculate

vaginant laminae: up to 0.7 of the leaf length, closed

base: dorsal lamina tapered, reaching the insertion or failing just above

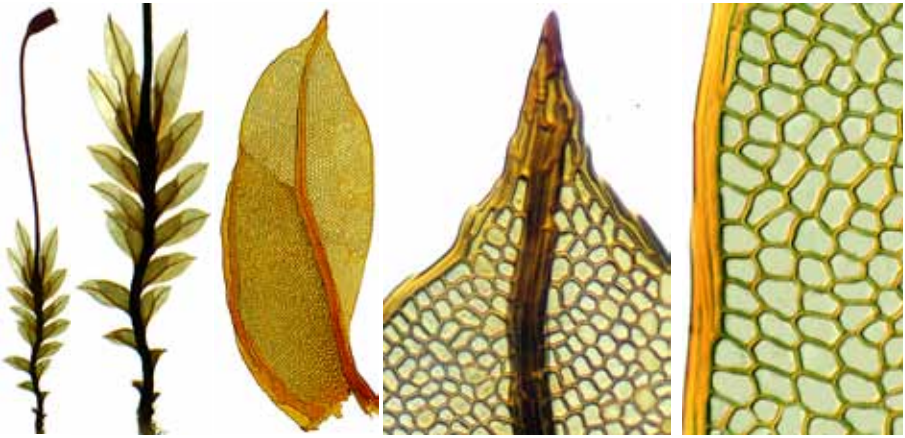
costa: percurrent to excurrent

border: pluristratose, 3–6 rows of narrow cells, ± fusing with costa at tip

margin: entire throughout, plane

cells: 5–12 μm, irregularly hexagonal, firm-walled, smooth, not bulging

capsule: 0.8–1.0 mm, asymmetric, inclined, long-exserted, brown; seta 5–13 mm, orange-brown, stiff; operculum apiculate; calyptra scabrous at the apex, cucullate; spores 15–18 μm in diam.



fertile shoot (moist) (2), leaf outline, leaf apex, and margin midleaf
 1 mm, 1 mm, 0.1 mm, 50 μm, 10 μm



junction of apical and vaginant laminae, costa upper leaf, and dorsal lamina base
 50 μm, 10 μm, 50 μm

continued next page



Fissidens bryoides dorsal lamina base (detail)
10 μm

continued next page

Fissidens capitatus Hook.f. & Wilson

form: densely gregarious, branched stems, leaves in 12–20(–30) pairs, over-

lapping in mid-stem, green to yellow-green, radiculose, 5–15 mm long

habitat: soil (rarely rock) in shaded lowland forest, upper North Island to 440 m

leaf: size: 2.0–3.0 × 0.3–0.4 mm

shape: linear-lanceolate, unistratose, the tips rolling up when dry

tip: acute to acuminate

vaginant laminae: up to 0.7 of the leaf length, half-open to closed

base: dorsal lamina reaching the leaf insertion

costa: failing below the apex

border: not differentiated

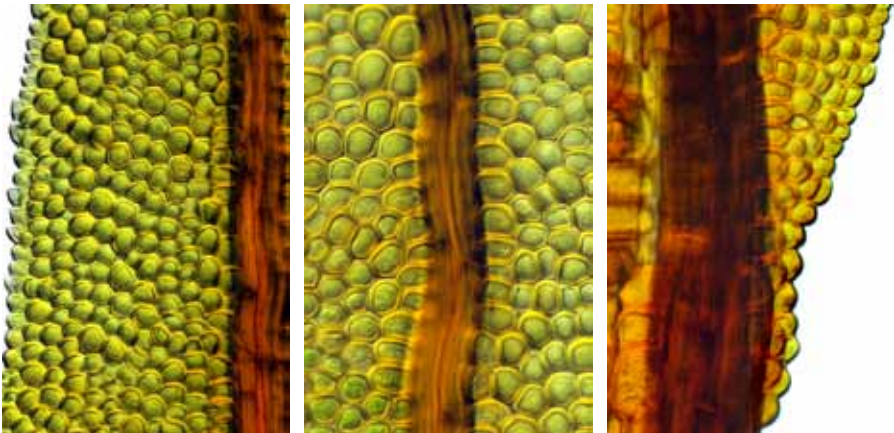
margin: serrulate-crenulate throughout, plane

cells: 7–12 μm , irregularly hexagonal, firm-walled, smooth, mammillose

capsule: 0.5–1.0 mm, asymmetric, horizontal, exserted, brown; seta 4–5 mm, tortuose when dry, light brown; calyptra smooth, mitrate; spores 9.0–13.5 μm in diam.

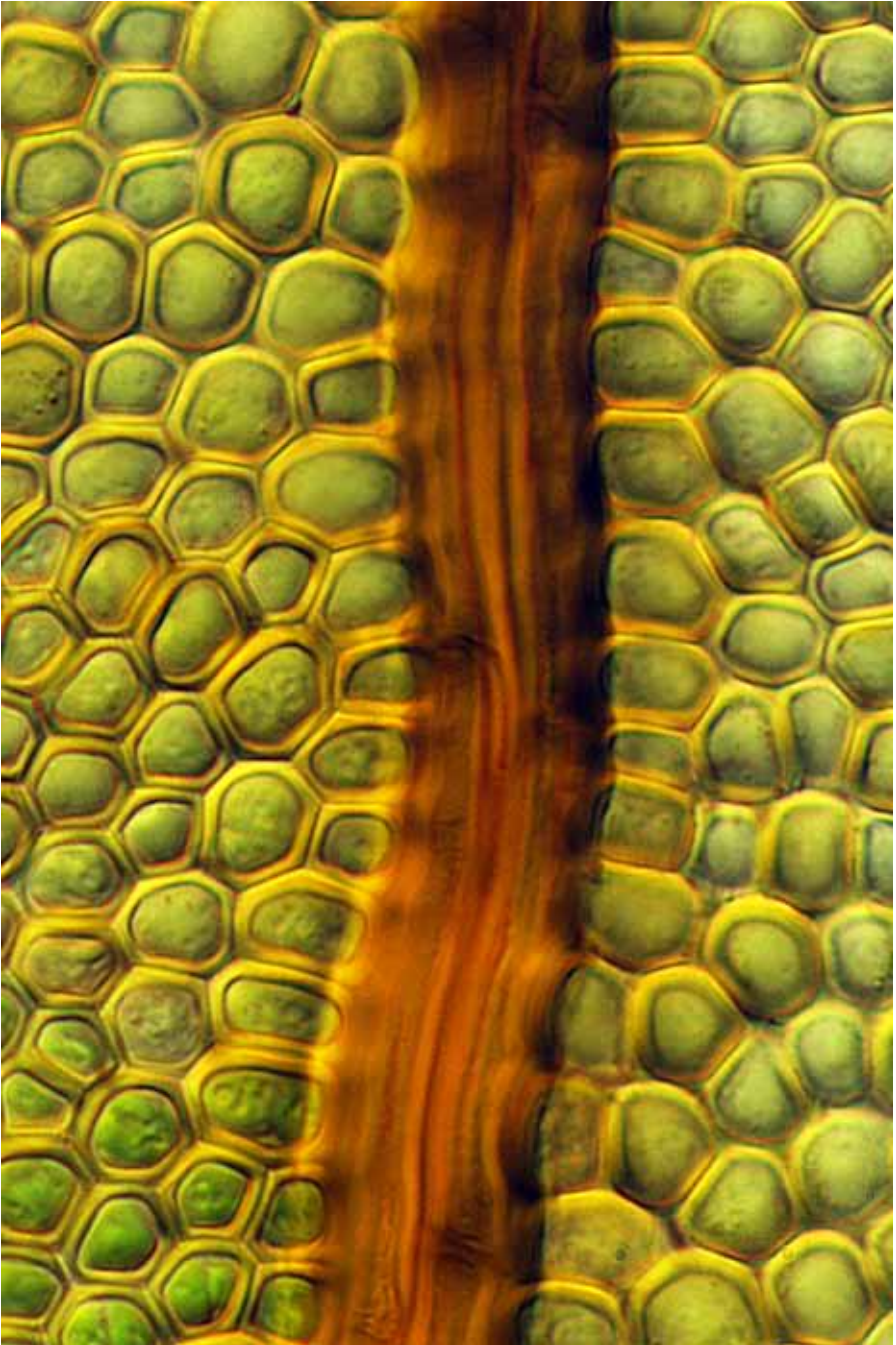


vegetative frond (dry), leaf outline, leaf apex, junction of apical and vaginant laminae
 1 mm, 1 mm, 10 μm , 10 μm



margin of upper leaf, costa in upper leaf, and base of dorsal lamina
 10 μm , 10 μm , 10 μm

continued next page



Fissidens capitatus costa upper leaf
10 μm

continued next page

Fissidens crispulus var. **robinsonii** (Broth.) Z.Iwats. & Z.-H.Li

form: densely tufted, erect branches from creeping stems

habitat: soil or rock, known from only Raoul Island

leaf: size: 1.4–1.8 × 0.18–0.24 mm, in 20–35 pairs per stem, overlapping from mid-stem upwards, the lower leaves much smaller than the upper leaves

shape: narrowly lanceolate, asymmetric

tip: acute

vaginant laminae: 0.5–0.7 of the leaf length, almost closed

base: dorsal lamina variable

costa: per- to excurrent

border: not differentiated

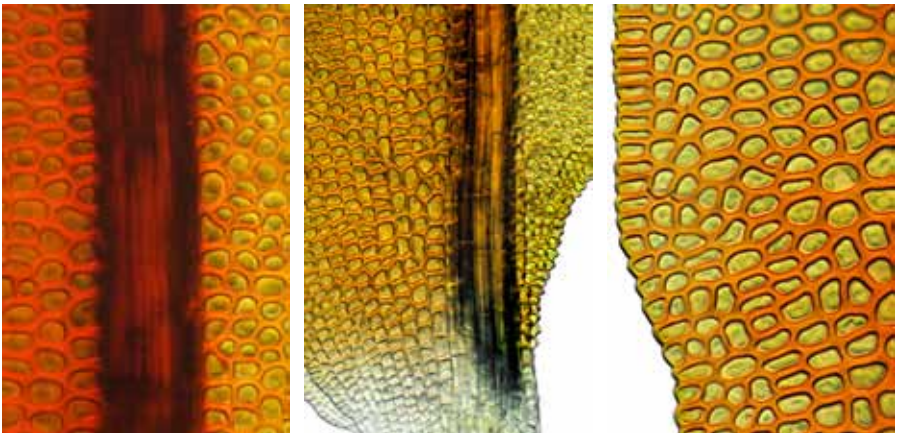
margin: finely serrulate, plane

cells: 6–8 μm, rounded-quadrate, thick-walled, mammillose, smooth

capsule: not seen in New Zealand collections; about 1 mm, urceolate, erect to inclined, exserted, brown; seta 3–4 mm; peristome dicranoid, red

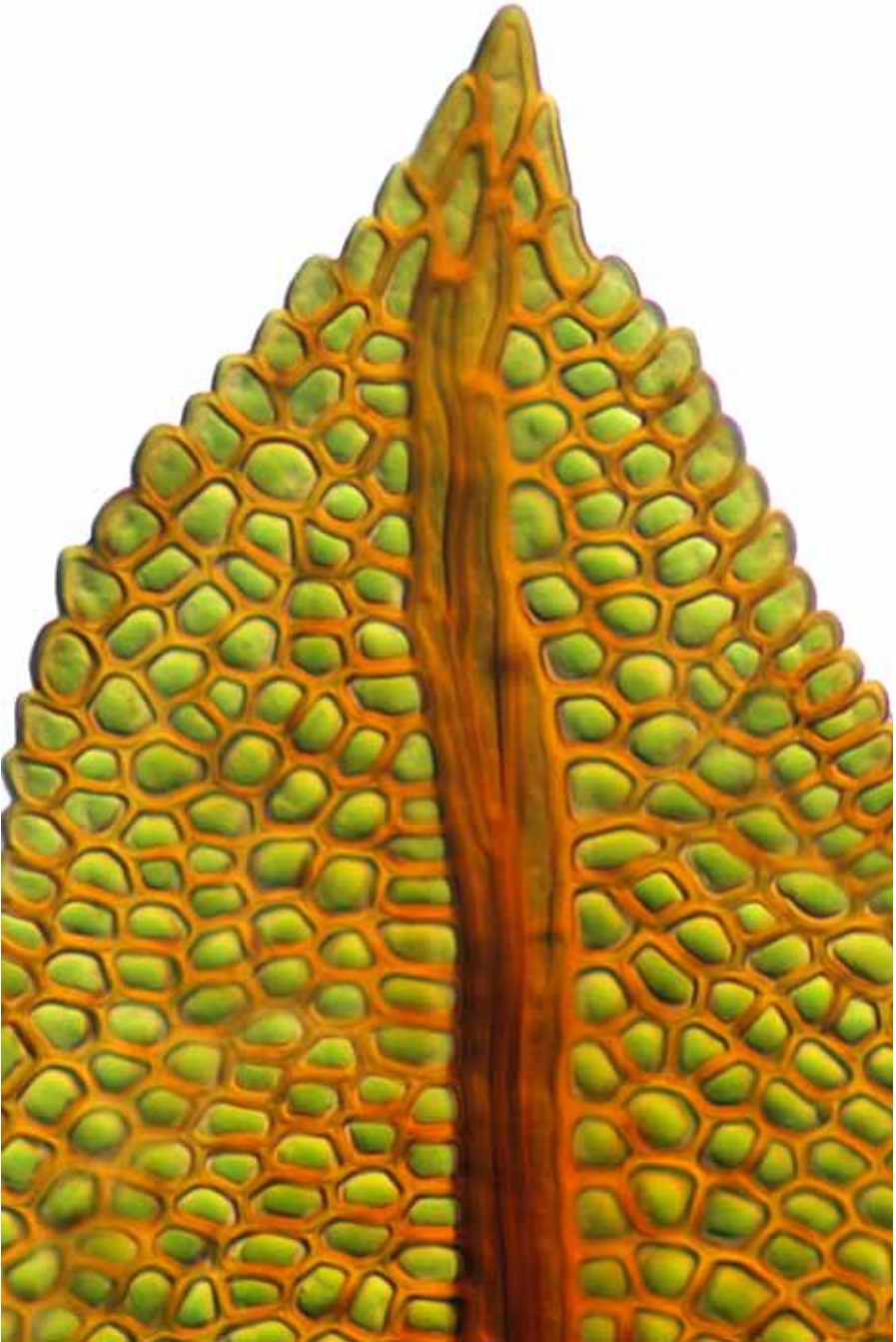


vegetative shoot (moist and dry), leaf outline, leaf apex, and apical/vaginant junction
 1 mm, 1 mm, 0.1 mm, 50 μm, 50 μm



costa near leaf base, leaf base, and vaginant lamina near base
 10 μm, 50 μm, 50 μm

continued next page



Fissidens crispulus var. *robinsonii* leaf tip
10 μ m

continued next page

Fissidens curvatus Hornsch. var. **curvatus**

form: gregarious, unbranched stems, with leaves in 3–8(–15) pairs, pale to dark green, radiculose below, 1.5–5(–8) mm tall

habitat: soil in indigenous and exotic forest, throughout, to 1000 m elevation

leaf: size: 0.5–1.0 × 0.1–0.25 mm

shape: oblong-lanceolate to linear-lanceolate, unistratose, crisped when dry

tip: acute to acuminate, usually cuspidate

vaginant laminae: up to 0.7 of the leaf length, closed, deeply indented

base: dorsal lamina reaching the leaf insertion or nearly

costa: subpercurrent to long-excurrent

border: pluristratose on all laminae, ± fusing with the costa at the leaf apex

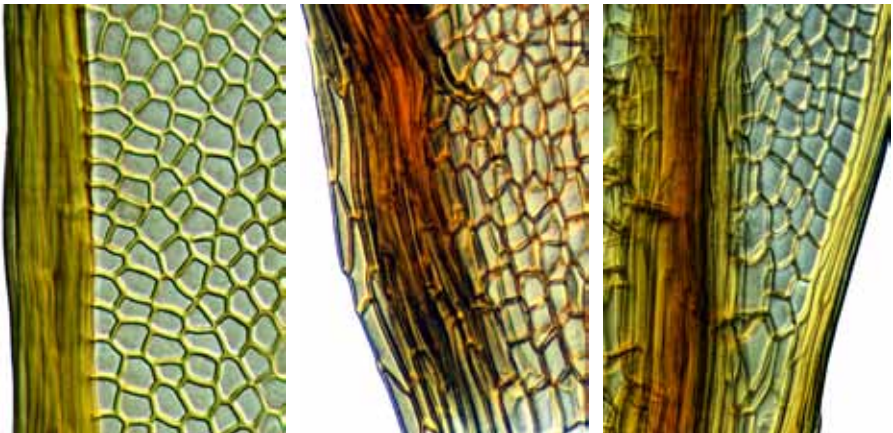
margin: entire, plane

cells: 6–14 μm, irregularly quadrate or hexagonal, firm-walled, smooth

capsule: 0.5–1.0 mm, erect to horizontal, symmetric to arcuate, exserted, brown; seta 2.5–12 mm, yellow to orange-brown; operculum beaked; calyptra smooth, cucullate; spores 12–21 μm in diam.



vegetative frond, leaf outline, leaf apex, and junction of apical and vaginant laminae
 0.5 mm, 0.1 mm, 50 μm, 50 μm



margin upper leaf, base of vaginant lamina, and near base of dorsal lamina
 10 μm, 10 μm, 10 μm

continued next page

Fissidens curvatus var. **inclinabilis** (Dixon) J.E.Beever

form: gregarious, unbranched stems, radiculose below, with leaves in 3–8(–15) pairs, not overlapping in mid-stem, pale to dark green, 1.5–5(–8) mm long

habitat: soil, from sea level to 200 m

leaf: size: 1.5–2.5 × 0.3–0.7 mm

shape: oblong- to linear-lanceolate, unistratose, crisped when dry

tip: acute to acuminate

vaginant laminae: up to 0.7 of the leaf, the minor lamina indented near its apex

base: dorsal lamina tapered, reaching the leaf insertion or failing just above

costa: subpercurrent to long-excurrent

border: 1–5 rows of elongate cells on the vaginant laminae, rarely other laminae

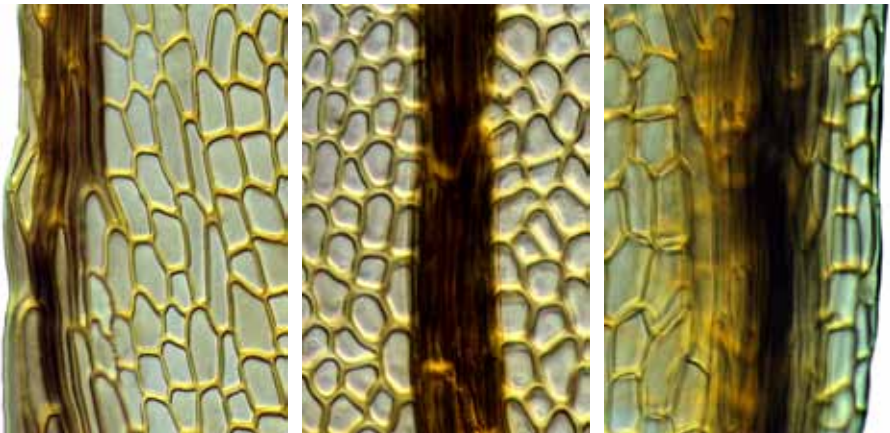
margin: entire, plane

cells: 7–12 μm , irregularly quadrate to hexagonal, thin-walled, smooth

capsule: 0.5–1.0 mm, asymmetric, arcuate, inclined to horizontal, exserted, brown; seta 4–15 mm, yellow to orange-brown; operculum beaked; calyptra smooth, cucullate; spores 12–21 μm in diam.



fronds (moist) (2), leaf outline, leaf apex, and junction of apical and vaginant laminae
 1 mm, 1 mm, 0.1 mm, 50 μm , 50 μm



vaginant lamina margin, costa upper leaf, and near base of dorsal lamina
 10 μm , 10 μm , 10 μm

continued next page



Fissidens curvatus var. *inclinabilis* vaginant lamina margin (detail)
10 μ m

continued next page

Fissidens dealbatus Hook.f. & Wilson

form: scattered to gregarious, erect, unbranched, delicate stems, radiculose below, leaves in 4–8 pairs, not overlapping in mid-stem, 5–8 mm tall

habitat: damp shaded mineral soil in forest along streambanks, to 800 m

leaf: size: 1.5–2.5 × 0.3–0.7 mm

shape: lanceolate, ± curved

tip: acute

vaginant laminae: up to 0.7 of the leaf, closed or nearly so

base: dorsal lamina reaching the leaf insertion, tapered below, decurrent

costa: not differentiated; the only other ecostate NZ *Fissidens* is *F. hylogenes*

border: pluristratose, 1–3 rows of elongate, thick-walled cells

margin: entire below, ± toothed near the apex, plane

cells: 40–80 × 20–40 μm, elongate-hexagonal, thin-walled, smooth

capsule: 0.6–1.0 mm, cylindric-ovoid, erect, exserted; seta 3–4 mm, fleshy; operculum rostrate; spores 12–17 μm in diam.



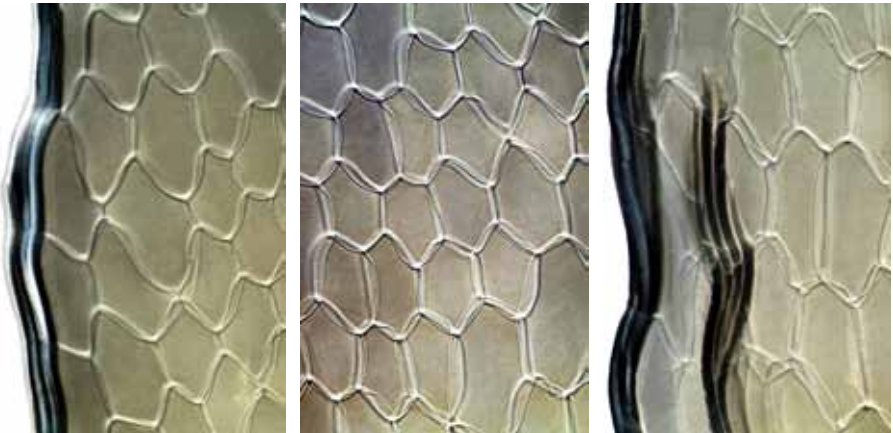
vegetative shoot, mature capsule, leaf outlines (2), and leaf apex

1 mm,

1 mm,

0.5 mm (2),

50 μm



margin midleaf, cells midleaf, and junction of apical and vaginant laminae

50 μm,

50 μm,

50 μm

continued next page



Fissidens dealbatus margin midleaf
50 μ m

continued next page



Fissidens dealbatus leaf apex

50 μ m

continued next page

Fissidens dietrichiae Müll.Hal.

form: densely gregarious, erect, sparingly branched stems, pale to dark green, leaves in 10–40(–50) pairs, not overlapping in mid-stem, to 35 mm tall

habitat: on soil and rock near springs and in ravines; from Raoul Island only

leaf: size: 1.6–2.1 × 0.7–0.8 mm

shape: oblong-ovate

tip: acute, occasionally mucronate

vaginant laminae: about half the leaf length, closed

base: basal juxtacostal dorsal lamina cells rectangular, to 38 μm long

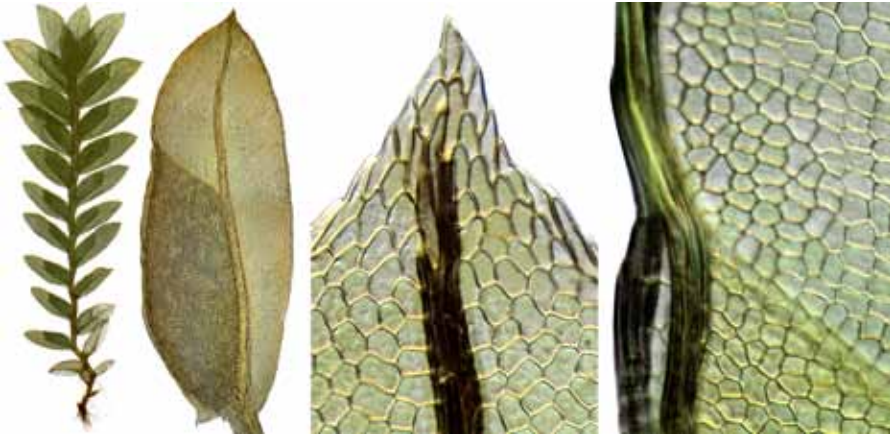
costa: prominent, reaching the apex or nearly, reddish brown

border: 1–3 rows of thin-walled linear cells 60 × 2 μm, to near the apex

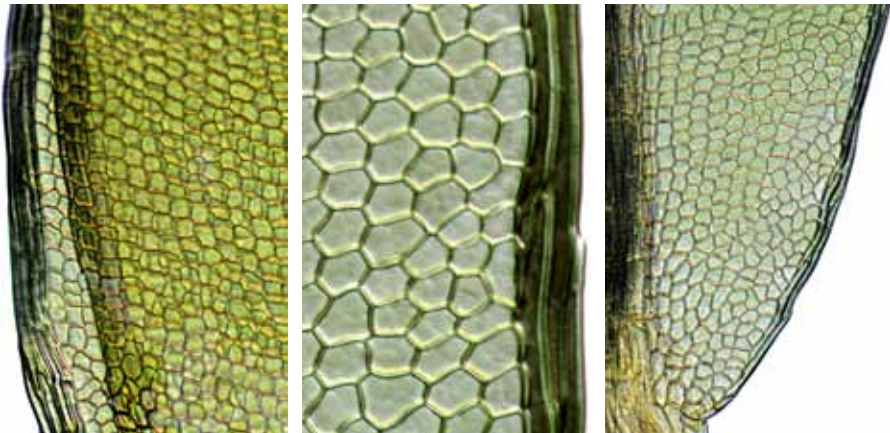
margin: mostly entire, weakly serrulate near the apex; plane

cells: 12–14 μm, larger near the costa, hexagonal, thin-walled, smooth

capsule: 0.8–1.4 mm, oblong, inclined, asymmetric, exserted, brown; seta 5–7 mm, light brown, matt; operculum acute-conic; exostome teeth dark red, to 300 μm, papillose; spores 18–25 μm in diam.



vegetative shoot (moist), leaf, leaf apex, and junction of apical and vaginant laminae
 1 mm, 0.1 mm, 10 μm, 10 μm



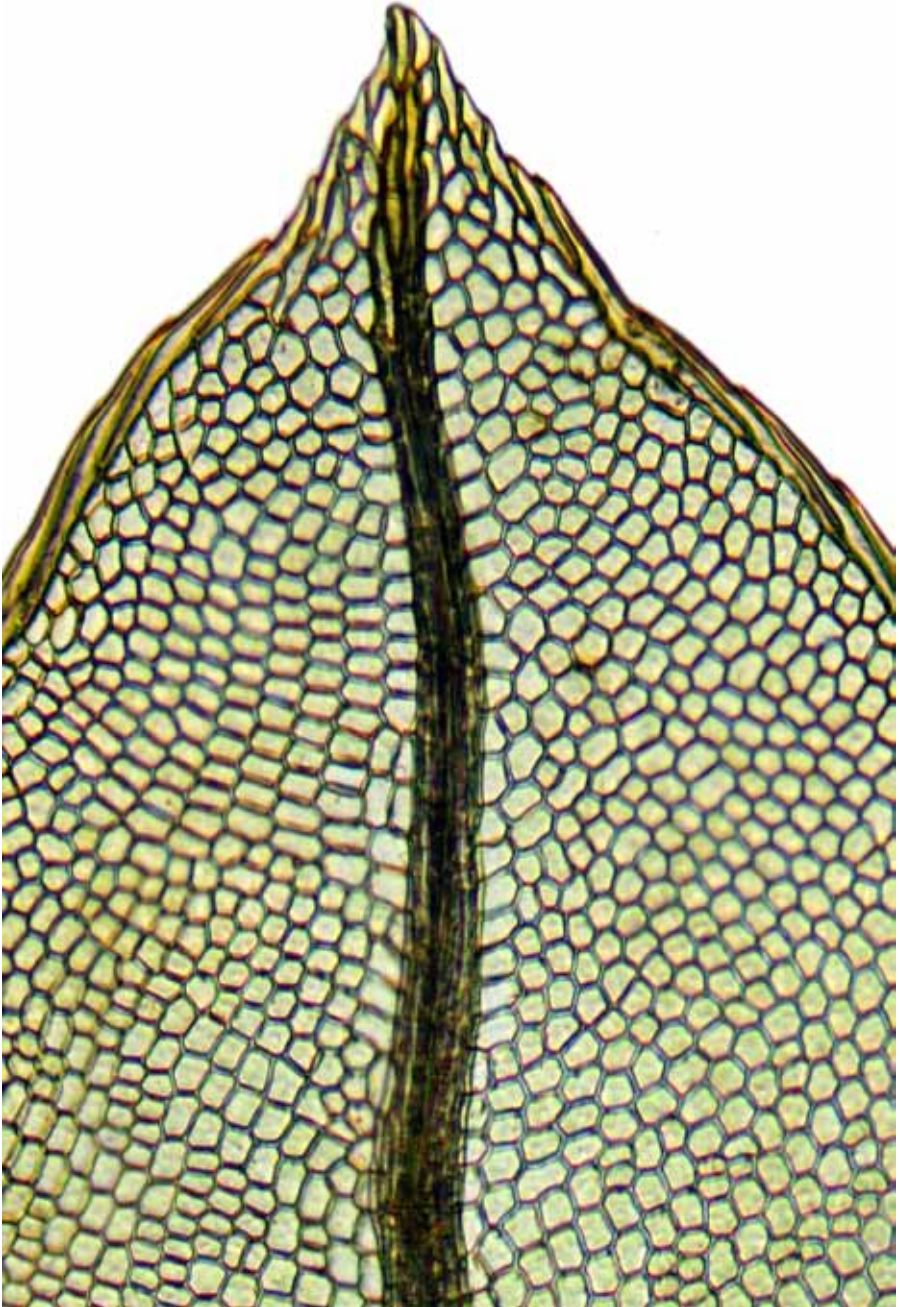
vaginant laminae borders, border of dorsal lamina, base of dorsal lamina
 50 μm, 10 μm, 50 μm

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Fissidens dietrichiae frond (dry on right)
1 mm

continued next page



Fissidens dietrichiae leaf apex
50 μm

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Fissidens dubius P.Beauv.

form: gregarious, branched stems, leaves in up to 35 pairs, overlapping in mid-stem, yellow-green, ± ragged and radiculose below, to 25 mm tall

habitat: on calcareous rock

leaf: size: 3.0–3.2 × 0.8–0.9 mm

shape: ovate-lanceolate, ± falcate, pluristratose in small irregular patches, little altered when dry

tip: acute

vaginant laminae: up to 0.7 of the leaf length, nearly closed

base: dorsal lamina reaching the leaf insertion, rounded, not decurrent

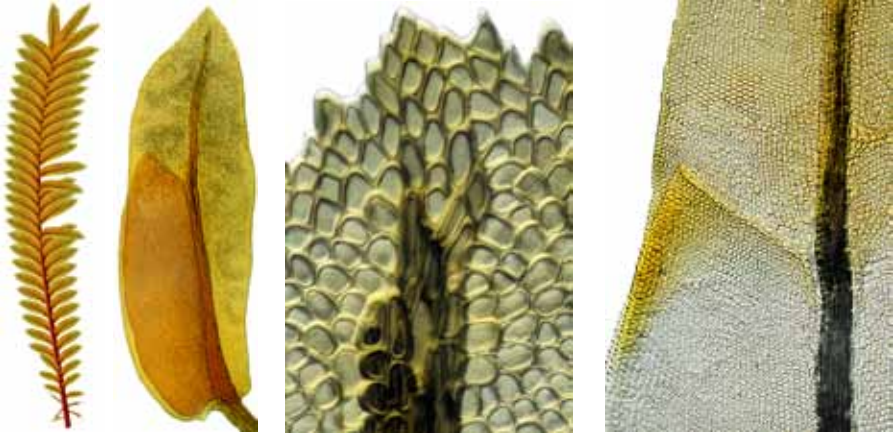
costa: failing 3–4 cells below the apex

margin: coarsely and irregularly serrate, plane, with several rows of thicker-walled cells forming a pale band

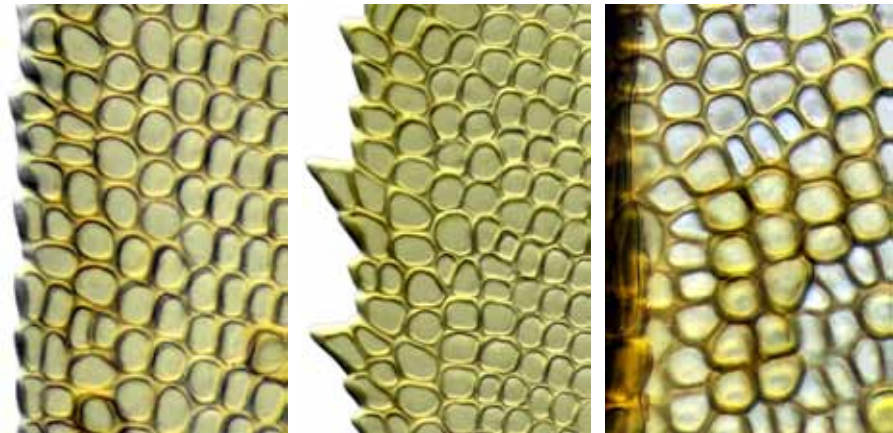
cells: 7–12 μm, quadrate to hexagonal, firm-walled, mammillose, smooth

capsule: capsules not seen in New Zealand

notes: probably introduced; known from only two Hawke's Bay collections

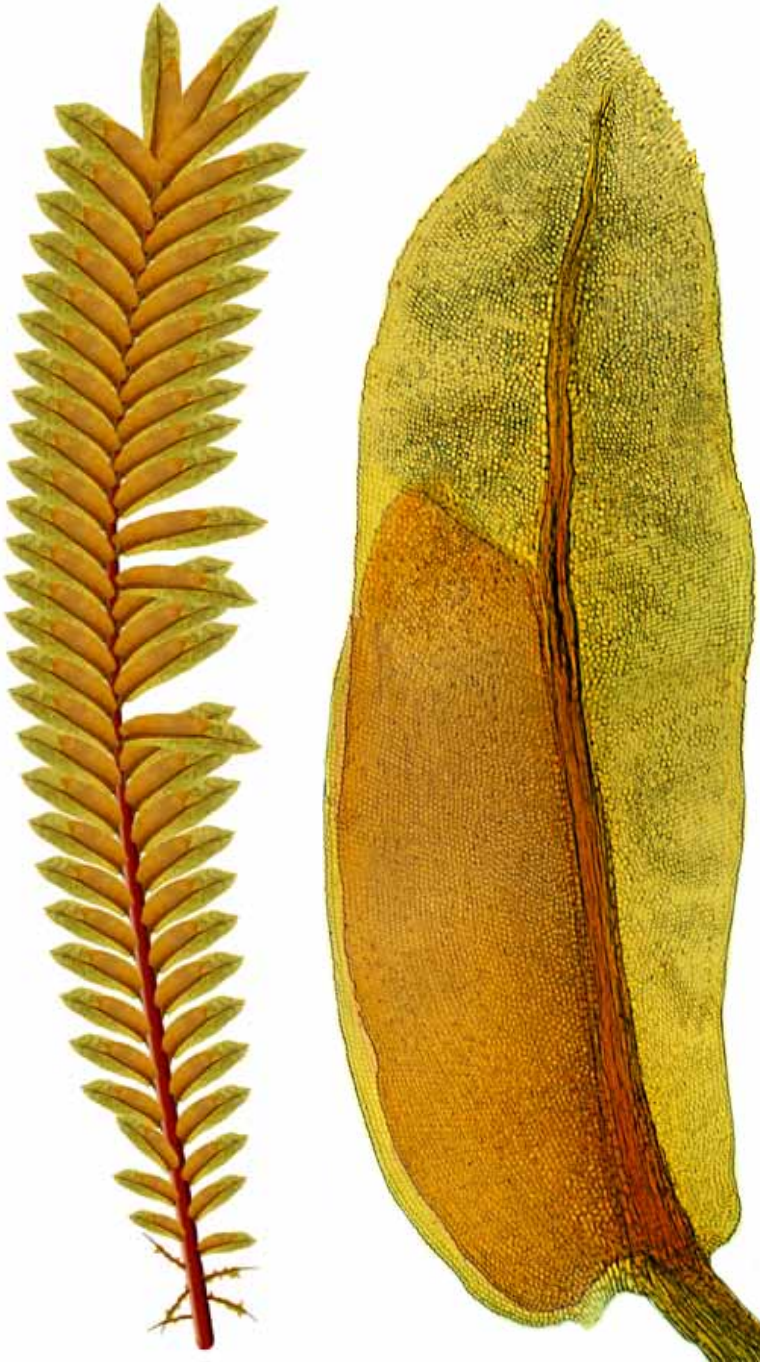


frond (moist), leaf outline, leaf apex, and junction of apical and vaginant laminae
 5 mm, 1 mm, 50 μm, 100 μm



margin upper leaf, margin near leaf base, and bistratose patch of lamina near costa
 10 μm, 10 μm, 10 μm

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Fissidens dubius vegetative frond (e- painting) and leaf whole-mount
1 mm, 0.1 mm

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Fissidens exilis Hedw.

form: scattered fertile shoots on protonema, 2–3 leaf-pairs, to 2 mm tall
habitat: soil in shaded, disturbed sites

leaf: size: 1.0–1.8 × 0.3–0.6 mm

shape: oblong-lanceolate, unistratose, little altered when dry

tip: acute

vaginant laminae: up to 0.7 of the leaf length, open

base: dorsal lamina tapered, failing above the leaf insertion

costa: percurrent

border: weak intramarginal border on the proximal vaginant laminae

margin: crenulate to serrulate; plane

cells: 9–16 μm, quadrate to hexagonal, firm-walled, slightly bulging, smooth

capsule: 0.5–0.8 mm, symmetric, erect, exserted, brown; seta 2–5 mm, yellow to light brown; operculum long-conic; calyptra smooth to slightly scabrous, mitrate; spores 9.0–13.5 μm in diam.

note: probably introduced

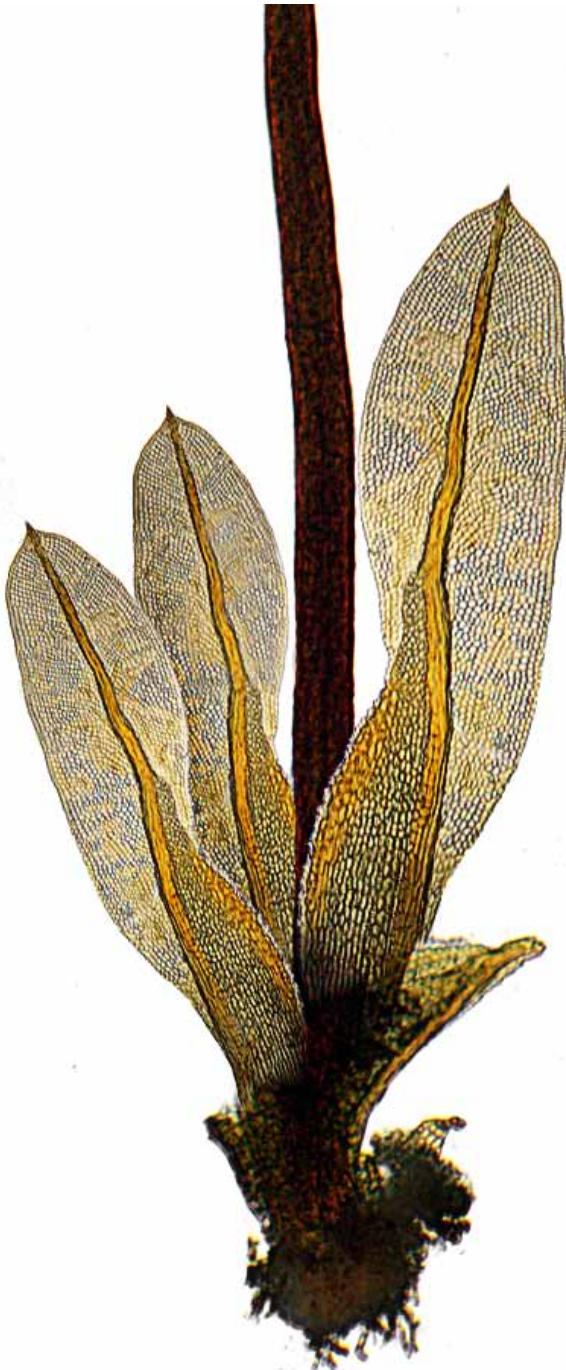


fertile shoot (moist), leaf outline, leaf apex, and junction of apical and vaginant laminae
 1 mm, 1 mm, 0.1 mm, 50 μm, 50 μm



margin upper leaf, margin of minor vaginant lamina, and near base of dorsal lamina
 10 μm, 10 μm, 10 μm

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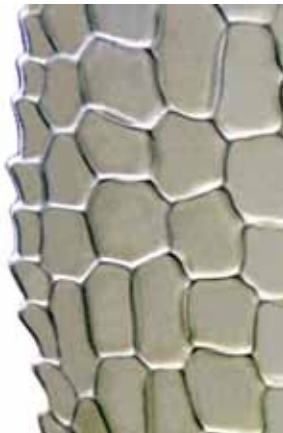
Fissidens exilis fertile bud-like shoot (partly diagrammatic)
— 0.1 mm

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Fissidens hylogenes Dixon**form:** small, scattered, unbranched stems with 3–8 pairs of leaves, to 3 mm tall**habitat:** on rotting tree-ferns or wood (rarely soil or rock) in shade, to 700 m**leaf:** size: 0.8–1.5 × 0.2–0.3 mm*shape:* oblong-spathulate, unistratose*tip:* broadly acute to obtuse*vaginant laminae:* up to 0.7 the leaf length, half open*base:* dorsal lamina decurrent down the stem*costa:* not differentiated*margin:* entire below, serrulate to serrate in the upper half, plane, with 1–2 rows of cells smaller than the other laminal cells*cells:* 20–50 × 15–25 μm, irregularly hexagonal, thin-walled, smooth**capsule:** 0.4–0.6 mm, ovoid, erect, exerted, brown; seta 1.5–2.0 mm, fleshy, colourless; operculum long-beaked; calyptra smooth, mitrate; spores 10–13 μm in diam.**note:** endemic

vegetative shoots (moist), bifurcate peristome teeth, leaf outline, and leaf apex

1 mm (2), 50 μm, 0.1 mm, 50 μm



margin upper leaf, cells in upper leaf, and junction of apical and vaginant laminae

50 μm, 50 μm, 50 μm

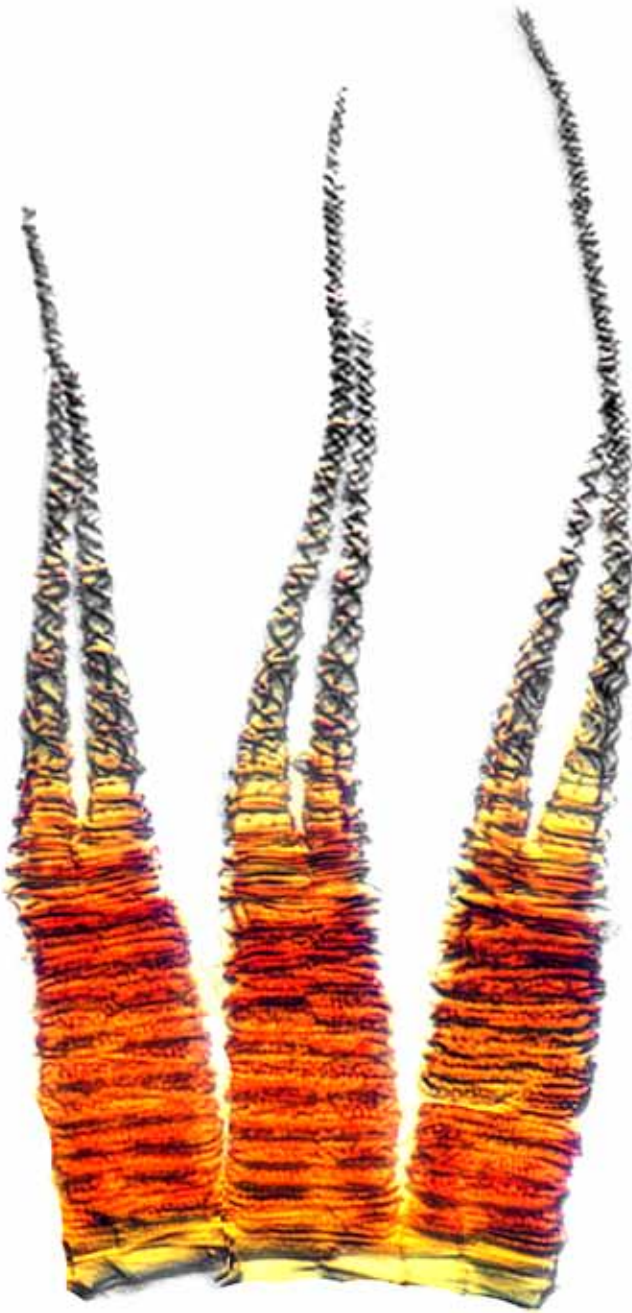
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Fissidens hylogenes fertile shoots (moist)

1 mm

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Fissidens hylogenes bifurcate peristome teeth
50 μm

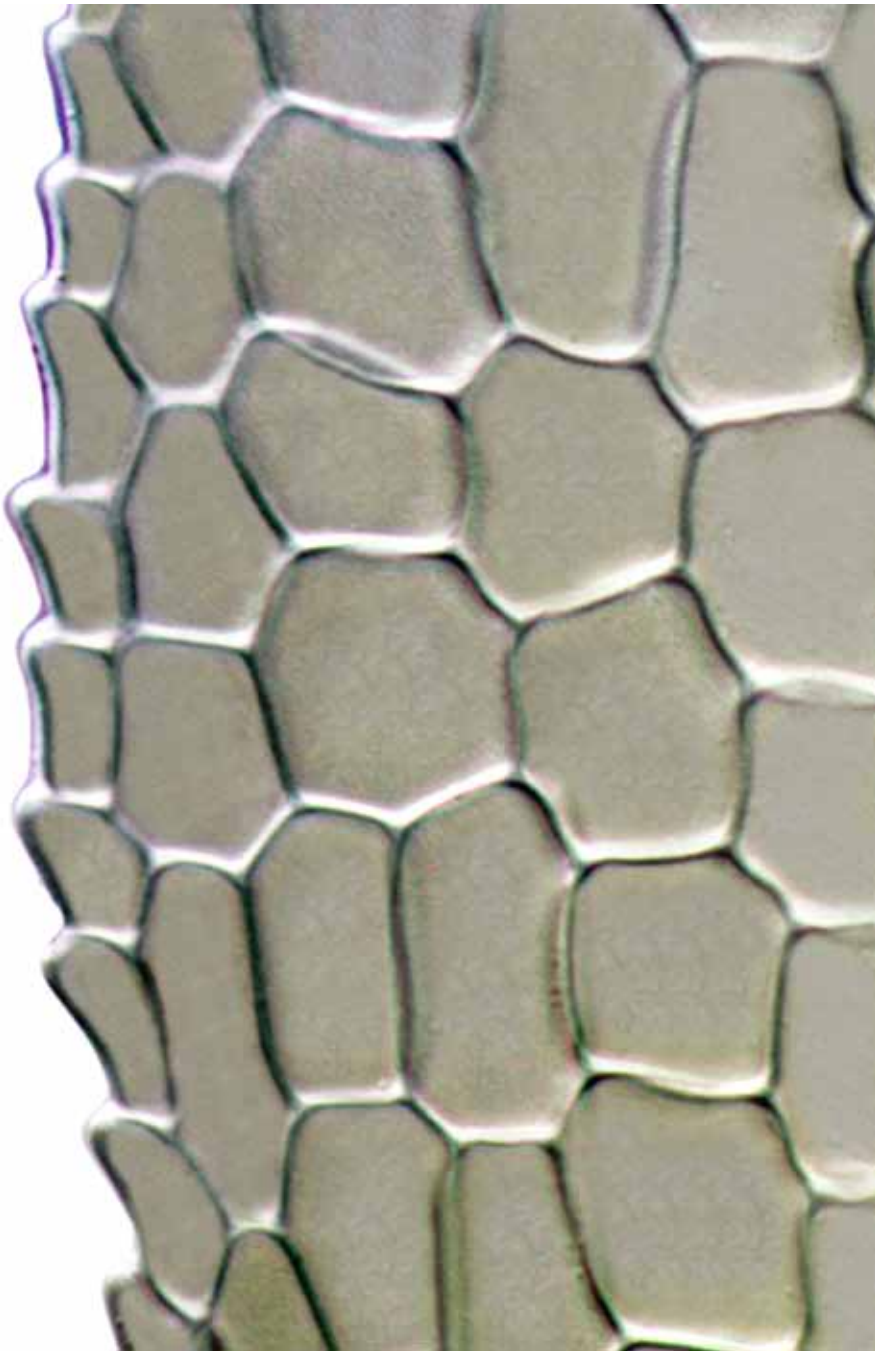
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Fissidens hylogenes leaf apex

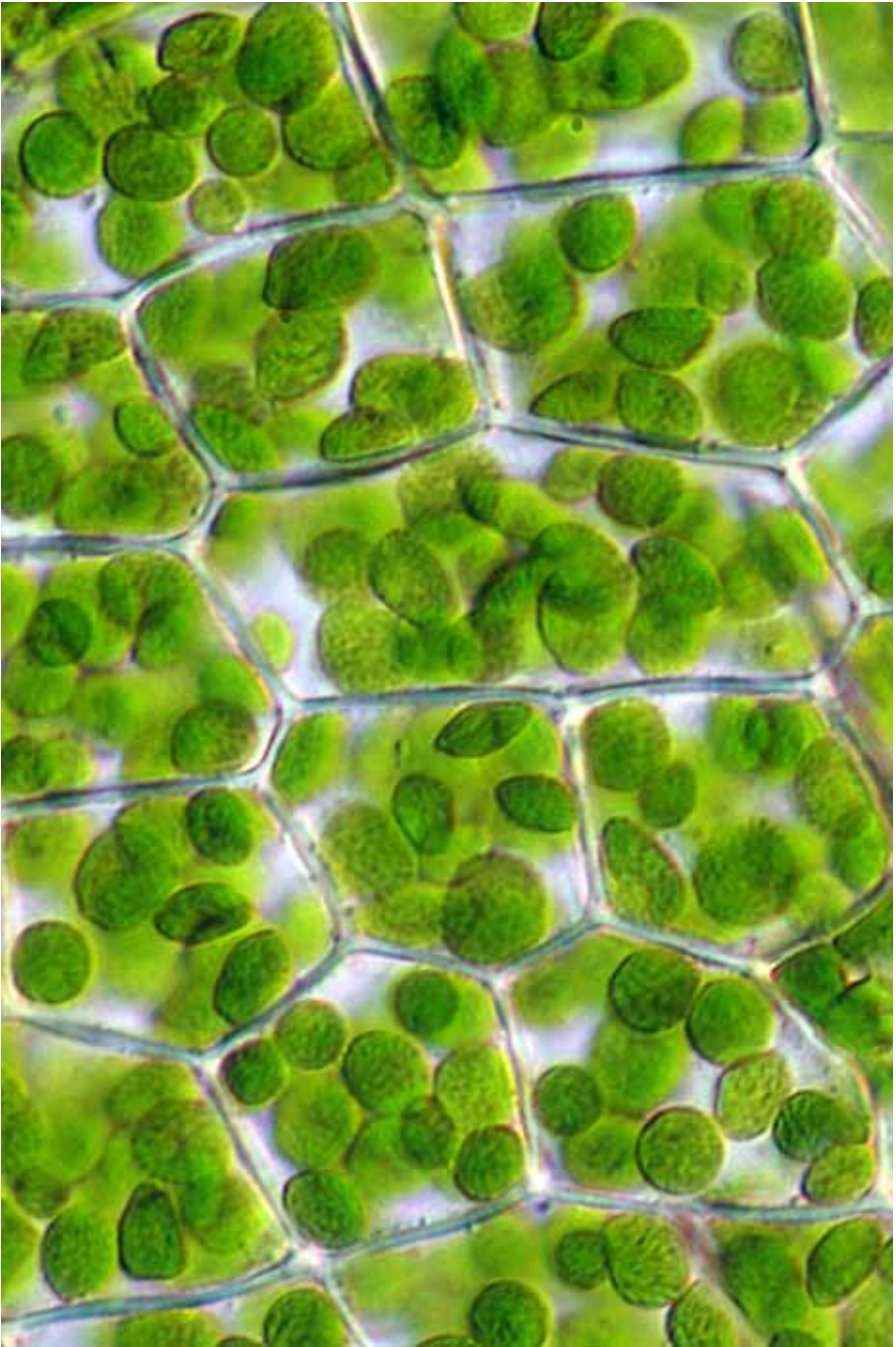
50 μ m

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Fissidens hylogenes margin upper leaf
10 μm

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Fissidens hylogenes leaf cells (moist)
10 μ m

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Fissidens hyophilus Mitt.

form: scattered to gregarious, branched stems, leaves in 10–16 pairs, overlapping in mid-stem, green to dark green, radiculose, 4–10 mm tall

habitat: smooth bark and exposed roots (rarely rock)

leaf: size: 1.5–2.5 × 0.3–0.4 mm

shape: lingulate, unistratose, the tips rolling upwards when dry

tip: obtuse to abruptly acute, often asymmetric

vaginant laminae: up to 0.5 of the leaf length, half-open to closed

base: dorsal lamina usually reaching the leaf insertion

costa: failing below the leaf apex

border: not differentiated

margin: serrulate-crenate throughout, plane

cells: 6–10 μm, irregularly hexagonal, firm-walled, mammillose, smooth

capsule: 0.5–0.8 mm, slightly asymmetric, inclined to erect, exerted, brown; seta 2.5–3.5 mm, strongly twisted when dry; calyptra smooth, mitrate; spores 10.0–13.5 μm in diam.



fronds (dry) (2), leaf outline, leaf apex, and junction of apical and vaginant laminae

1 mm,

1 mm,

0.1 mm,

50 μm,

50 μm



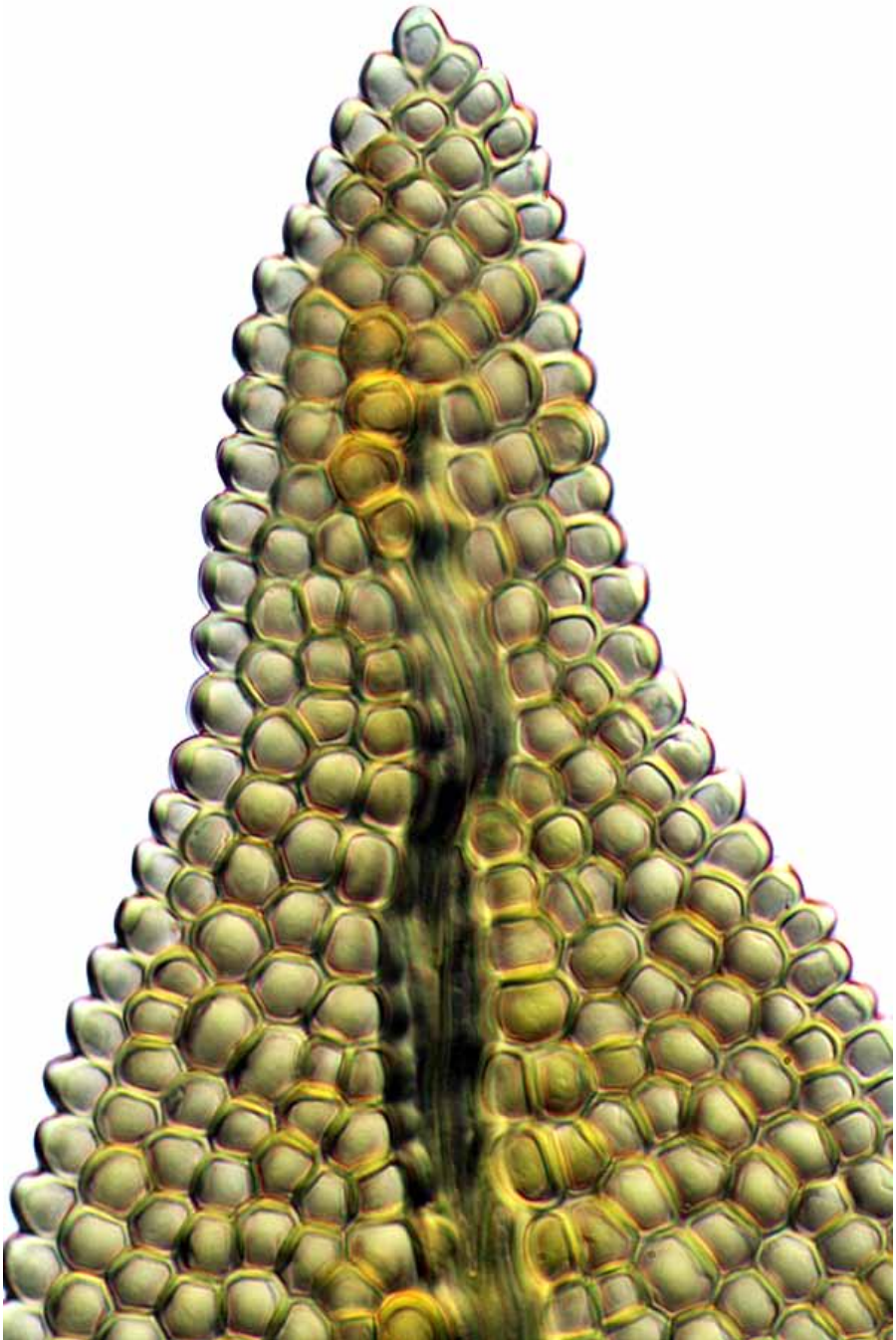
margin of vaginant lamina, costa in upper leaf, and leaf base

50 μm,

50 μm,

100 μm

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Fissidens hyophilus leaf apex showing costa terminus
10 μm

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Fissidens integerrimus Mitt.

form: gregarious or matted, branched stems, with leaves in 10–45 pairs, overlapping in the upper stem, 5–15 mm tall; branches easily detached

habitat: aquatic, on rock in streams and waterfalls, to 300 m elevation

leaf: size: 1.3–2.0 × 0.3–0.4 mm

shape: oblong-lanceolate, unistratose, little altered when dry

tip: acute to obtuse

vaginant laminae: up to 0.7 of the leaf length, half-open to closed

base: dorsal lamina tapering to the leaf insertion

costa: failing 2–5 cells below the apex

border: only 1–3 rows of intramarginal cells of the lower vaginant lamina

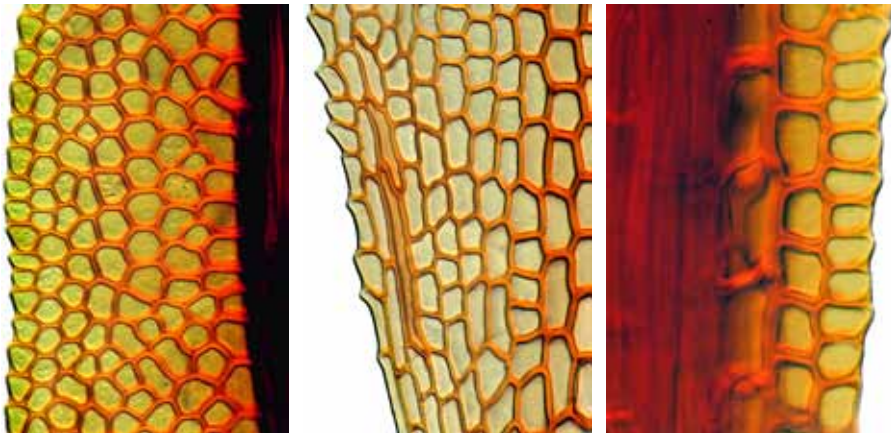
margin: serrulate throughout, plane

cells: 10–18 μm, quadrate to hexagonal, firm-walled, smooth

capsule: 0.4–0.6 mm, symmetric, inclined, exserted, brown; seta 2.5–3.5 mm, straw-coloured, stiff; operculum long-beaked; calyptra slightly scabrous at the apex, mitrate; spores 13–20 μm in diam.

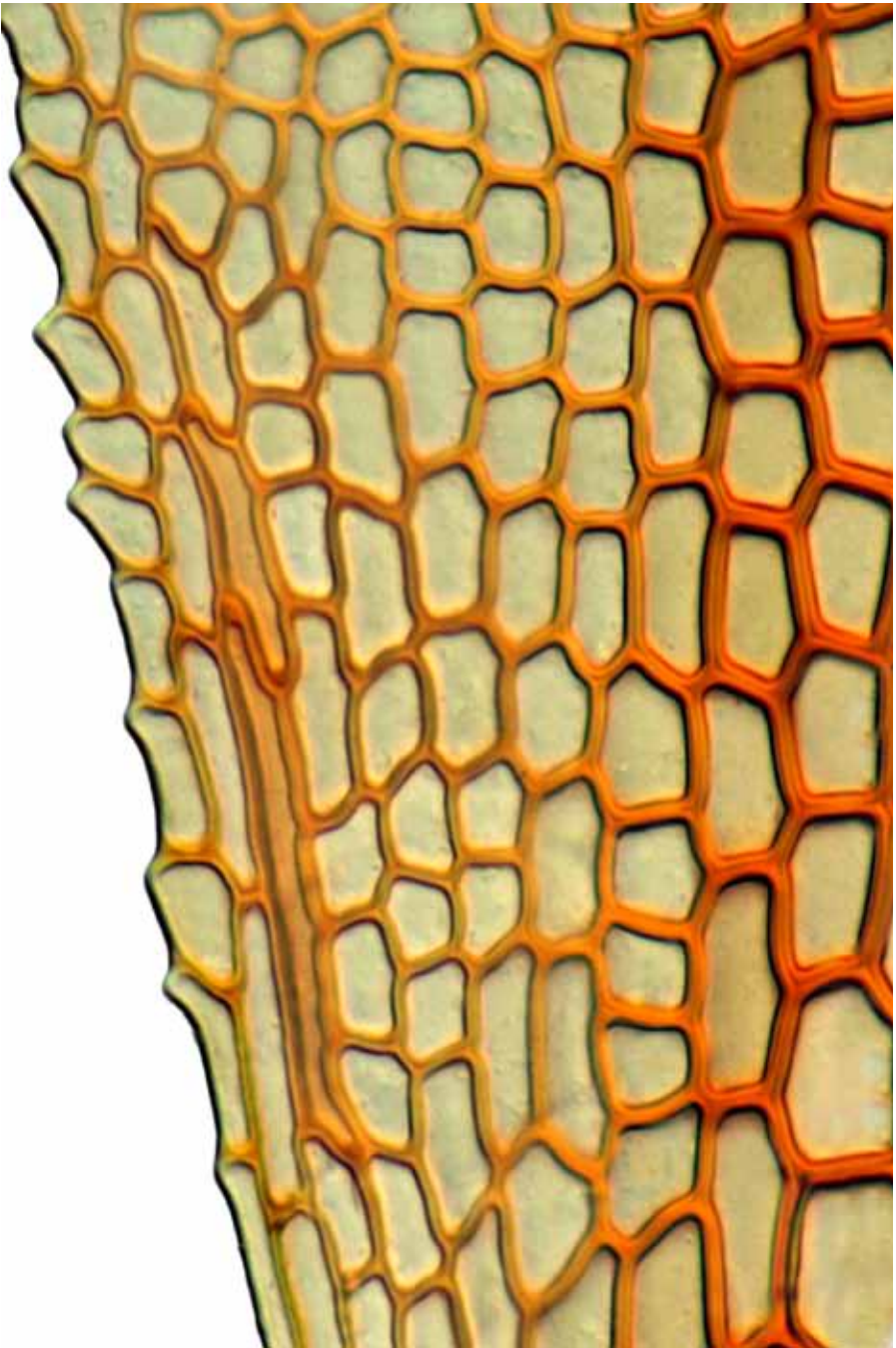


frond (moist), leaf outline, leaf apex, and junction of apical and vaginant laminae
 ■ 1 mm, ■ 0.1 mm, ■ 10 μm, ■ 50 μm



margin of upper leaf, vaginant intramarginal border, and near base of dorsal lamina
 ■ 10 μm, ■ 10 μm, ■ 10 μm

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Fissidens integerrimus intramarginal border of vaginant lamina
10 μ m

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Fissidens leptocladus Rodway

form: densely gregarious, sparsely branched, yellow- to dark green, radiculose below, variable, leaves in 4–30(–45) pairs, 3–15 mm tall

habitat: soil or rock in diverse vegetation types, from sea level to 1650 m

leaf: size: 1.0–1.6 × 0.2–0.4 mm

shape: linear-lanceolate to oblong-ovate, ± curved, unistratose

tip: acute

vaginant laminae: up to 0.7 of the leaf length, closed

base: dorsal lamina often reaching the leaf insertion

costa: failing within a few cells of the apex

border: one to several rows of thick-walled, elongate cells on all laminae

margin: entire, plane

cells: 6–9 × 5–8 μm, quadrate to hexagonal, firm-walled, smooth, ± bulging

capsule: 0.6–1.0 mm, ovoid, inclined, exserted, orange-brown; seta 3–4 mm; calyptra cucullate, smooth; operculum obliquely rostrate; spores 11–19 μm in diam.

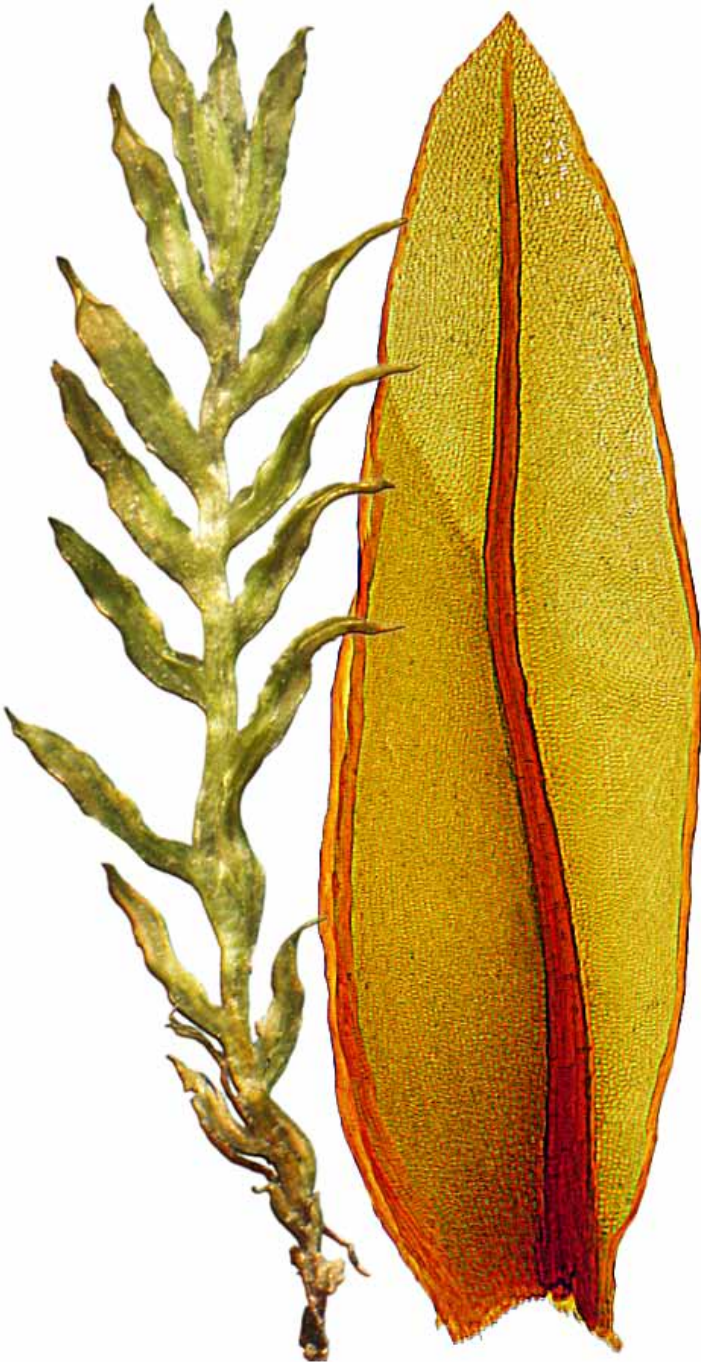


vegetative shoot (dry), mature capsule, peristome teeth (2), leaf outline, and leaf apex
 1 mm, 0.1 mm, 10 μm (2), 0.1 mm, 50 μm



vaginant lamina apex, margin midleaf, and costa midleaf
 50 μm, 50 μm, 50 μm

continued next page



Fissidens leptocladus frond (dry) and leaf whole-mount
0.5 mm, 50 μ m

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Fissidens linearis var. **angustifolius** (Dixon) I.G.Stone

form: densely gregarious, ± branched stems, leaves in 3–16 pairs, overlapping in mid-stem, dull green, radiculose below or where contacting soil, 1.5–5 mm tall

habitat: soil, especially eroding banks, in shaded indigenous forest, to 450 m

leaf: size: 0.8–1.4 × 0.1–0.2 mm

shape: linear, unistratose, the apices decurved when dry

tip: narrowly acute and often asymmetric

vaginant laminae: half or less of the leaf length, half-open

base: dorsal lamina tapered, reaching the leaf insertion or failing just above

costa: subpercurrent to percurrent

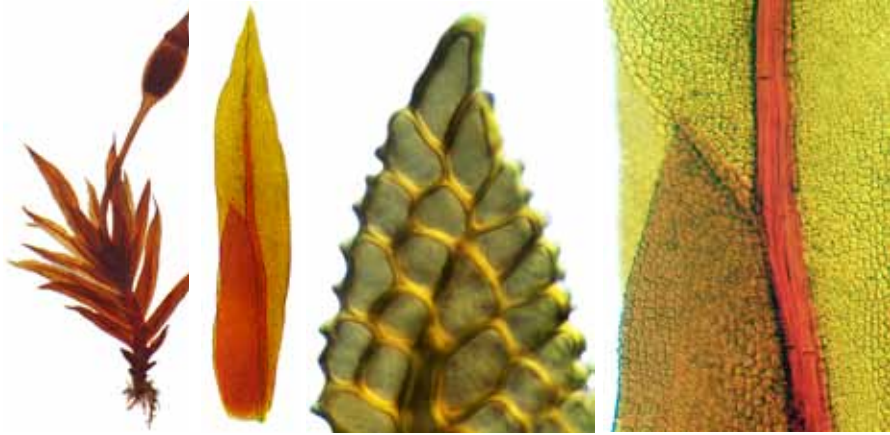
border: not differentiated

margin: crenulate and papillose, plane

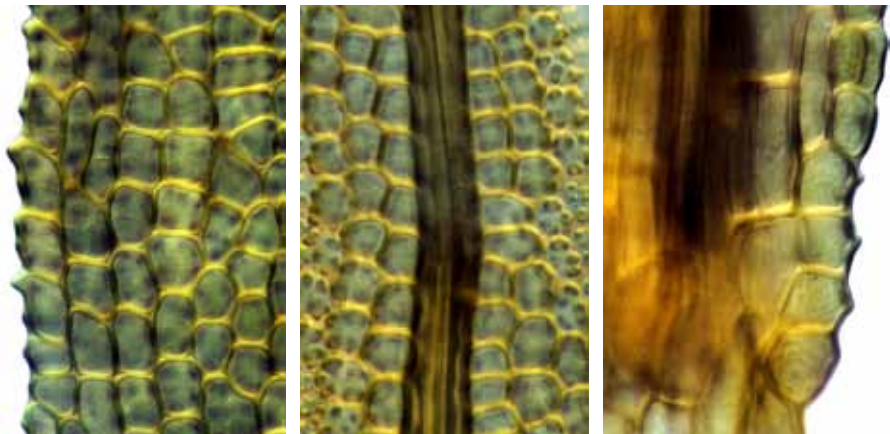
cells: 6–10 μm, quadrate to hexagonal, firm-walled, multipapillose

capsule: 0.5–0.7 mm, symmetric, erect, exserted, brown; seta 1.0–2.5 mm, yellow to light brown, stiff; operculum long-rostrate; spores 8–11 μm in diam.

note: endemic



fertile shoot (moist), leaf outline, leaf apex, and junction of apical and vaginant laminae
 1 mm, 0.1 mm, 10 μm, 100 μm



margin of vaginant lamina, costa in upper leaf, and base of dorsal lamina
 10 μm, 10 μm, 10 μm

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Fissidens linearis var. *angustifolius* leaf apex and costa terminus
10 μm

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Fissidens linearis Brid. var. **linearis**

form: densely gregarious, ± branched stems, leaves in 3–16 pairs, overlapping in mid-stem, dull green, radiculose below or with soil contact, 1.5–5 mm tall

habitat: soil or rock in shaded indigenous forest and coastal scrub, to 500 m

leaf: size: 0.8–1.4 × 0.2–0.3 mm

shape: oblong-lanceolate, unistratose, the apices decurved when dry

tip: acute

vaginant laminae: half or more of the leaf length, half-open

base: dorsal lamina tapered, reaching the leaf insertion or failing just above

costa: subpercurrent to percurrent

border: not differentiated

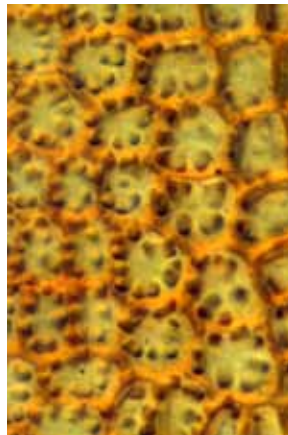
margin: crenulate and papillose, plane

cells: 6–10 μm, quadrate to hexagonal, firm-walled, multipapillose

capsule: 0.5–0.7 mm, symmetric, erect, exserted, brown; seta 1.0–2.5 mm, yellow to light brown, stiff; operculum long-rostrate; calyptra smooth to scabrous, cucullate; spores 8–18 μm in diam.



frond (moist), leaf outline, leaf apex, and junction of apical and vaginant laminae
 1 mm, 0.1 mm, 50 μm, 100 μm



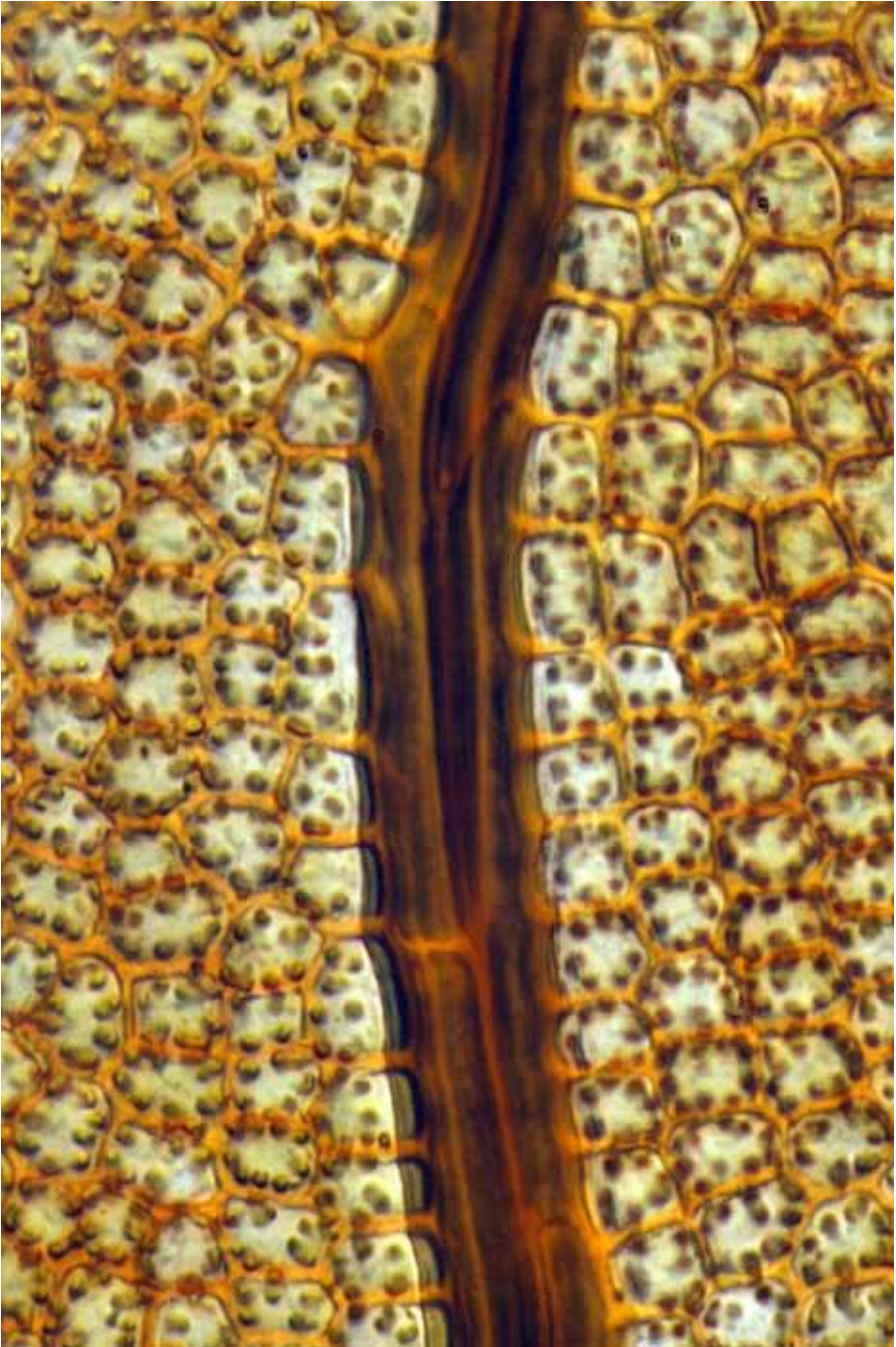
margin of upper leaf, lamina surface papillae, near base of dorsal lamina
 10 μm, 10 μm, 10 μm

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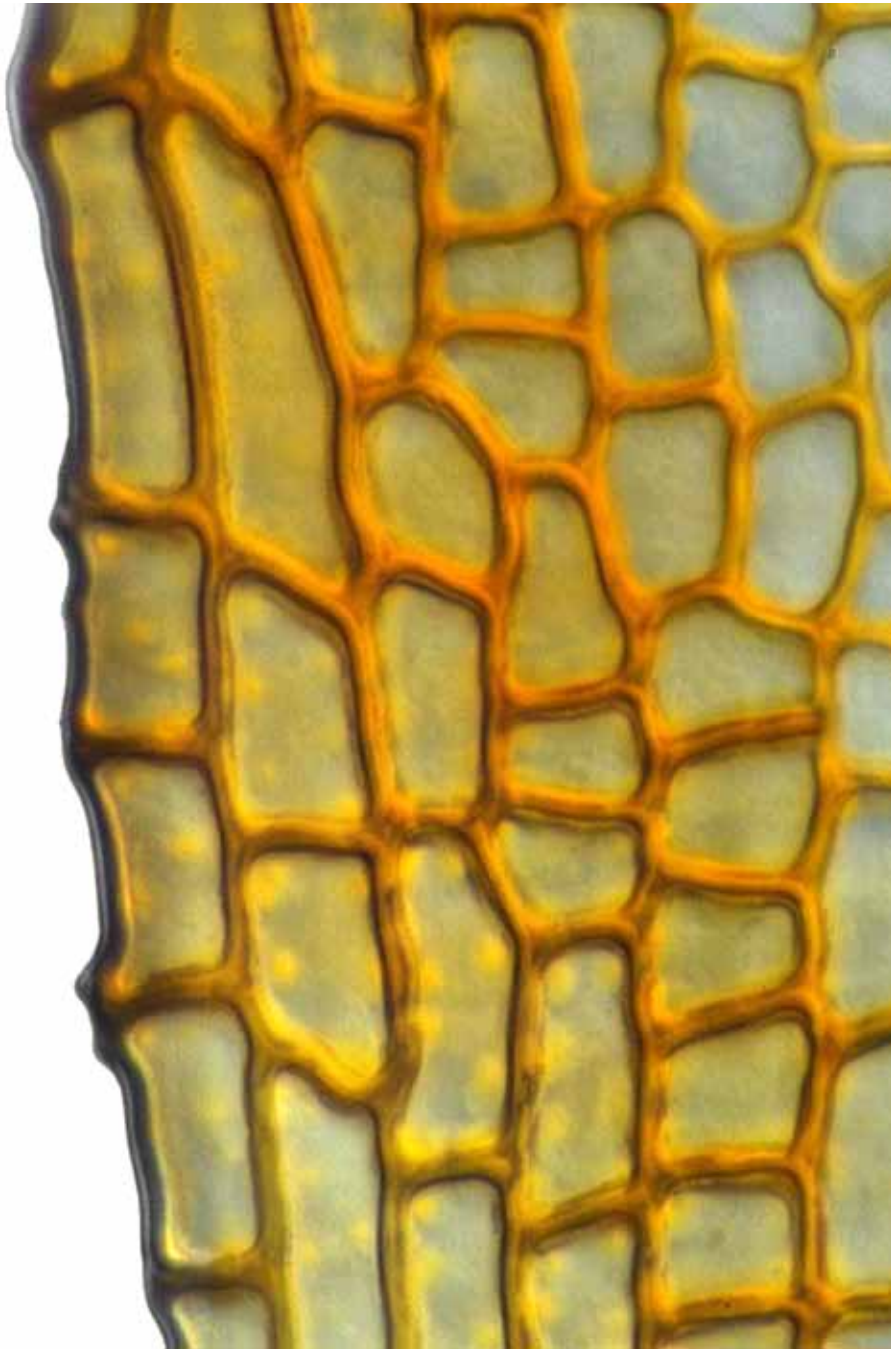
Fissidens linearis var. *linearis* frond (re-wetted dried specimen) and leaf whole-mount
0.5 mm, 0.1 mm

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Fissidens linearis var. *linearis* costa and papillae midleaf
10 μ m

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Fissidens linearis var. *linearis* minor vaginant lamina margin near leaf base
10 μ m

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Fissidens megalotis Müll.Hal. subsp. **megalotis**

form: densely gregarious, yellow- to brown-green, radiculose only at the base, sparsely branched, 6–15 leaf pairs, 4–6 mm tall

habitat: soil or rock in exposed sites, sea level to 600 m altitude, more common in the drier eastern halves of both major islands

leaf: size: 1.0–1.6 × 0.3–0.5 mm

shape: ovate-oblong, typically curled under toward the tip

tip: obtuse and apiculate

vaginant laminae: up to 0.8 of the leaf length, open and often gaping

base: not differentiated

costa: percurrent

border: most conspicuous on the vaginant laminae, intramarginal at base

margin: occasionally irregularly serrate at base of vaginant laminae, plane

cells: 5–8 μm, pentagonal to hexagonal, firm-walled, bulging, smooth to weakly uni- to pluripapillose

capsule: capsules not found in New Zealand



habit, vegetative shoot (moist), leaf outline, and leaf apex
 1 mm, 1 mm, 0.1 mm, 50 μm



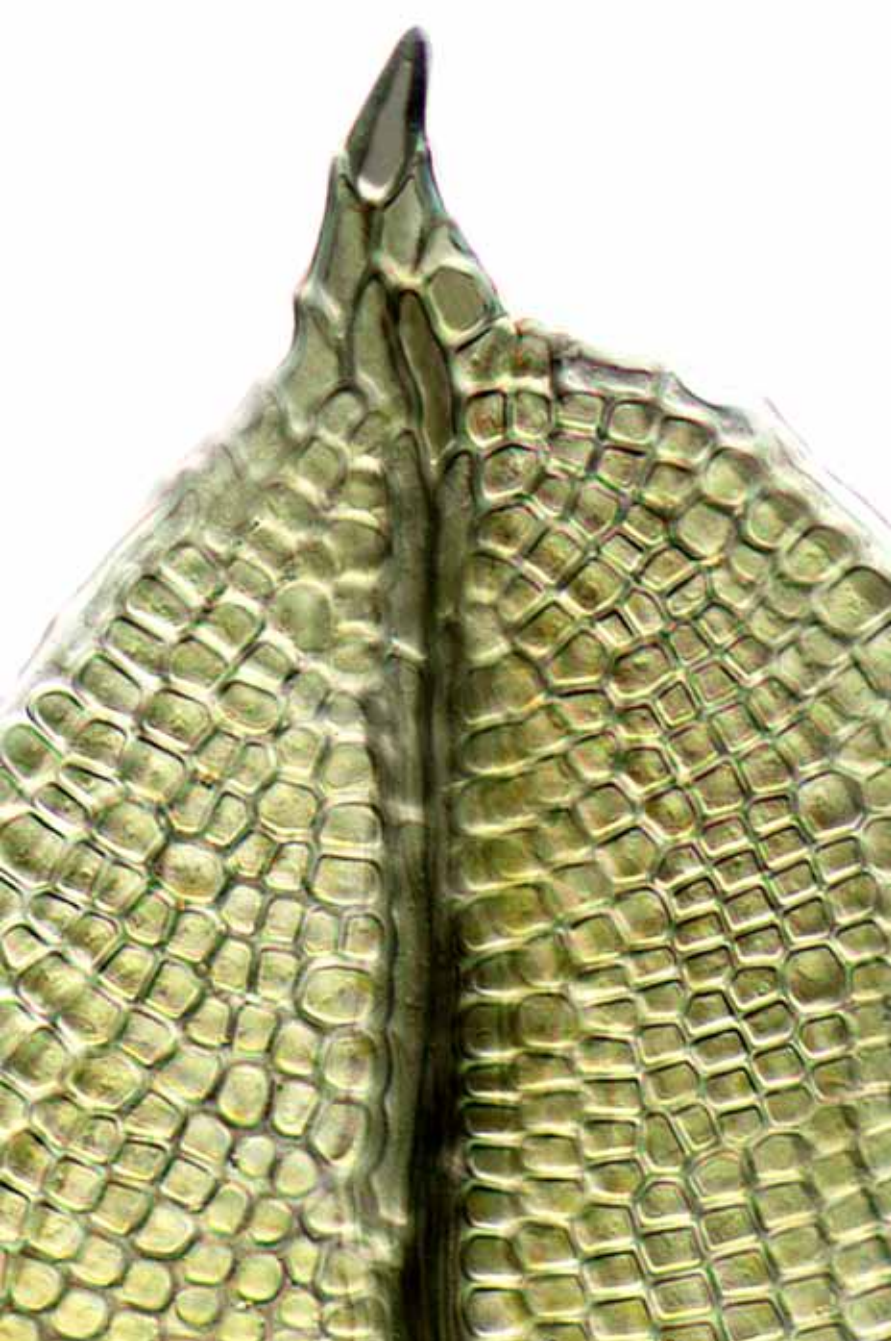
vaginant intramarginal border, costa midleaf, junction of apical and vaginant laminae
 50 μm, 50 μm, 50 μm

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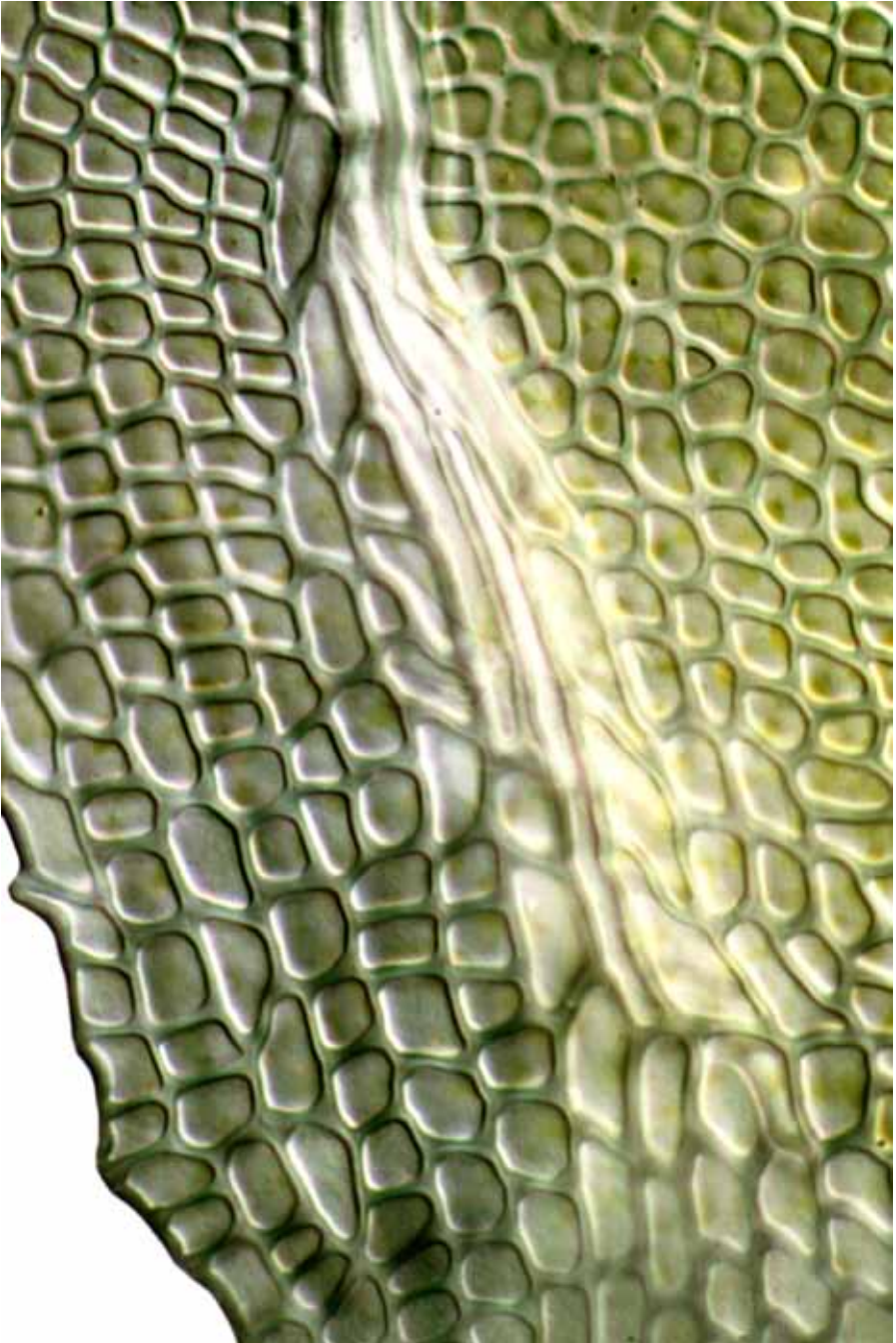
Fissidens megalotis subsp. *megalotis* habit
1 mm

continued next page



Fissidens megalotis subsp. *megalotis* leaf apex showing costa and apiculus
10 μ m

continued next page



Fissidens megalotis subsp. *megalotis* intramarginal border of the minor vaginant lamina
10 μ m

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Fissidens oblongifolius Hook.f. & Wilson

form: loosely gregarious, branched stems, with leaves in 15–30(–40) pairs, overlapping in mid-stem, dark below, radiculose at base only, 5–25 mm tall
habitat: usually on rock, on dripping rock faces or in lava crevices, e.g. on the bare lava fields of Rangitoto Island, to 200 m elevation

leaf: size: 1.7–3.0 × 0.3–0.4 mm

shape: ligulate, unistratose, the tips loosely rolling up when dry

tip: broadly acute

vaginant laminae: up to 0.7 of the leaf length, half-open to closed

base: dorsal lamina failing above the leaf insertion

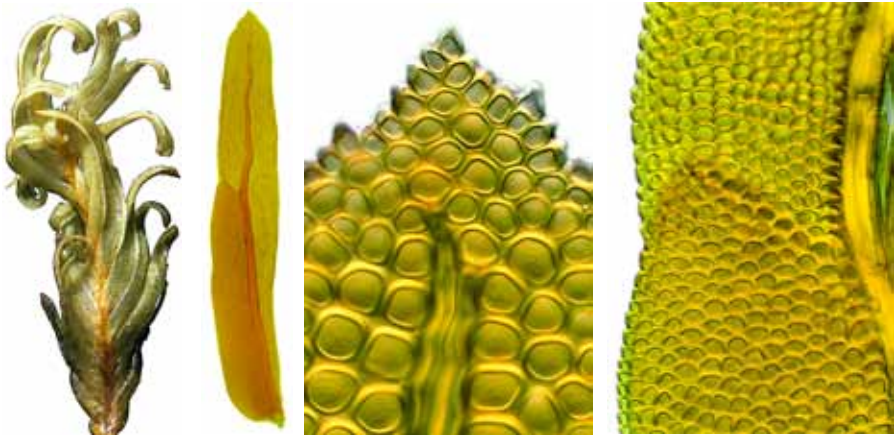
costa: failing below the leaf apex

border: not differentiated

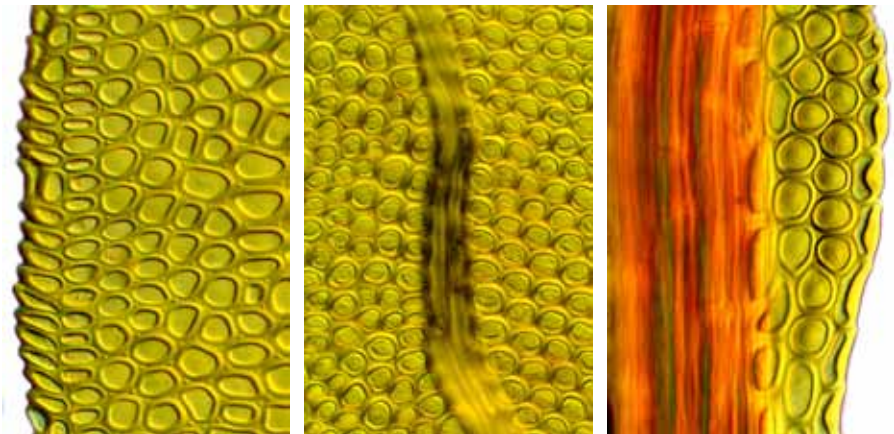
margin: serrulate-crenate throughout, plane

cells: 7–12 μm , irregularly hexagonal, firm-walled, smooth, mammillose

capsule: 0.5–1.0 mm, \pm asymmetric, inclined to horizontal, exserted, brown; seta 5–10 mm, tortuose when dry; calyptra and mature spores not seen in NZ



vegetative frond (dry), leaf, leaf apex, and junction of apical and vaginant laminae
 1 mm, 0.5 mm, 10 μm , 50 μm



margin of upper leaf, costa in upper leaf, near base of dorsal lamina
 10 μm , 50 μm , 10 μm

continued next page



Fissidens oblongifolius vegetative frond (dry), and leaf whole-mount
1 mm, 0.1 mm

continued next page

Fissidens pallidus Hook.f. & Wilson

form: tufted to densely gregarious, unbranched, with leaves in 5–10(–17) pairs, overlapping in mid-stem, 3–15(–35) mm tall

habitat: soil in shady forests, an early colonizer of disturbed sites, to 600 m

leaf: size: 2.5–3.5 × 0.3–0.7 mm

shape: linear-lanceolate, unistratose, little altered when dry

tip: acute to acuminate

vaginant laminae: up to 0.7 of the leaf length, half-open

base: dorsal lamina tapered, reaching the leaf insertion

costa: failing 3–6 cells below the apex

border: not differentiated

margin: entire to minutely serrulate, ± sinuose above, plane

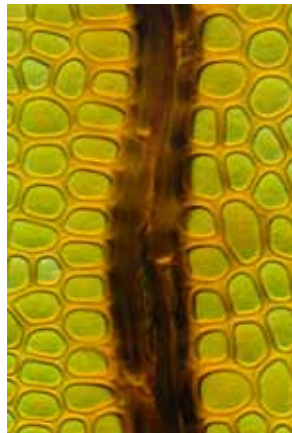
cells: 10–15 μm, irregularly rounded-hexagonal, firm-walled, smooth

capsule: 1.0–1.3 mm, ± urceolate, arcuate, horizontal; seta 3–8 mm, orange-brown, tortuose when dry; operculum long-beaked; calyptra smooth, mitrate; spores 9–12 μm in diam.



vegetative habit, shoot, leaf outline, and leaf apex

5 mm, 1 mm, 0.5 mm, 10 μm



margin of dorsal lamina, costa midleaf, and junction of apical and vaginant laminae

10 μm, 10 μm, 10 μm

continued next page



Fissidens pallidus vegetative shoot (detail) (UV microscope image)
50 μm

continued next page



Fissidens pallidus mature capsule
1 mm

continued next page

Fissidens perangustus Broth.

form: densely gregarious, unbranched stems, with leaves in 8–12 distant pairs, yellow-green, radiculose below, to 4 mm tall

habitat: on exposed, periodically inundated sandstone in indigenous forest

leaf: size: 0.6–0.8 × 0.2 mm

shape: lanceolate, unistratose, slightly falcate when moist, ± twisted when dry

tip: acute

vaginant laminae: up to 0.7 the leaf length, closed, the minor indented near apex

base: dorsal lamina tapered, its border adhering to the costa near the leaf base

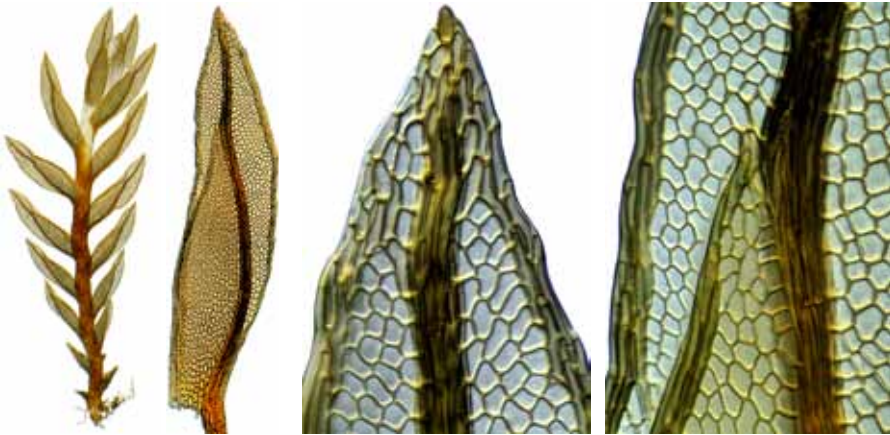
costa: subpercurrent, sometimes reddening with age

border: 2–4 rows of narrow, thick-walled cells on all laminae, to just below apex

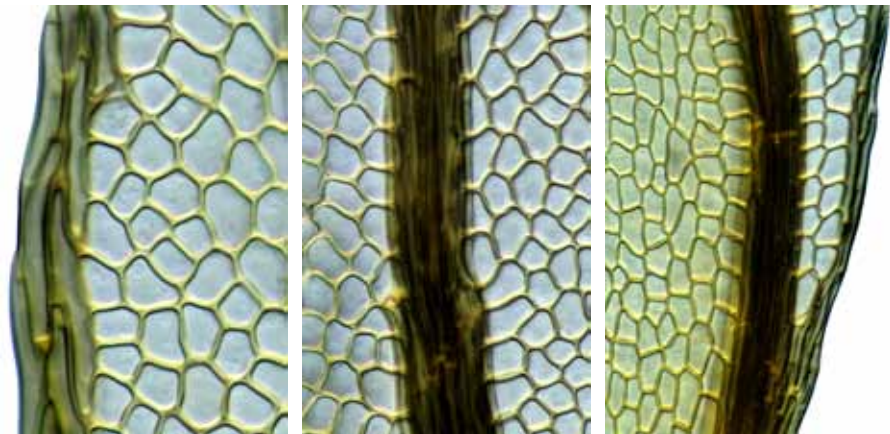
margin: entire, plane

cells: 7–14 μm, quadrate to irregularly hexagonal, thin-walled, smooth

capsule: 0.5–0.8 mm, ± asymmetric, erect to inclined, exserted; seta 2–3 mm, straw-coloured to orange-brown, stiff; operculum rostellate from a conic base; spores 19–25 μm in diam.



shoot (moist), leaf outline, leaf apex, and junction of apical and vaginant laminae
 1 mm, 0.1 mm, 50 μm, 50 μm



margin of upper leaf, costa in upper leaf, and base of dorsal lamina
 10 μm, 10 μm, 10 μm

continued next page



Fissidens perangustus base of dorsal lamina
10 μ m

continued next page

Fissidens rigidulus var. **pseudostrictus** J.E.Beever in Beever & Stone

form: densely gregarious, ± branched stems, with leaves in 10–50 pairs, slightly overlapping above, dark green to black, eroded and debris-covered below

habitat: rock in fast-flowing streams in indigenous forest, to 250 m elevation

leaf: size: 1.5–3.0 × 0.3–0.8 mm

shape: broadly lanceolate, variably uni- to pluristratose, little altered when dry
tip: acute

vaginant laminae: up to 0.7 of the leaf length, two-thirds to fully closed

base: dorsal lamina reaching the leaf insertion or shortly decurrent onto stem

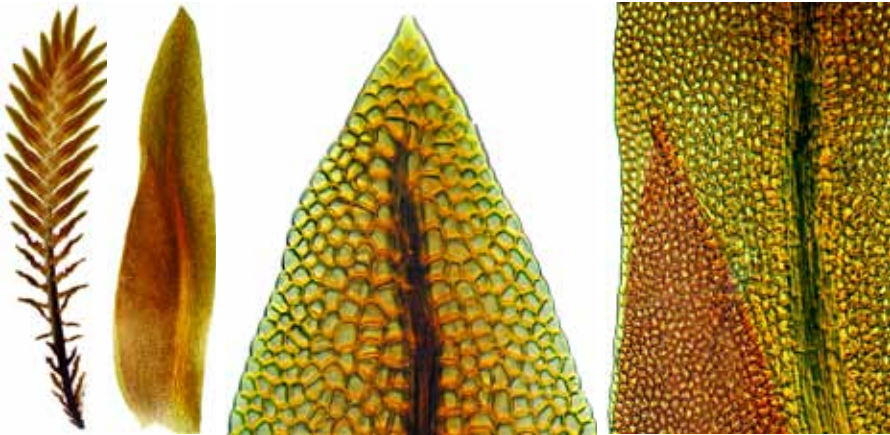
costa: subpercurrent

border: not differentiated

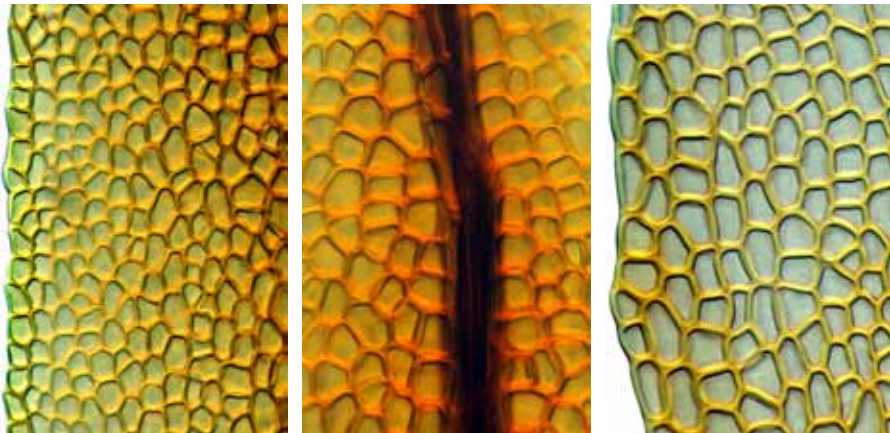
margin: entire to weakly crenulate, plane

cells: 7–17 μm, quadrate to irregularly hexagonal, firm-walled, smooth

capsule: capsules unknown



shoot (moist), leaf outline, leaf apex, and junction of apical and vaginant laminae
 5 mm, 0.5 mm, 50 μm, 100 μm



margin of upper leaf, costa in upper leaf, and margin of vaginant lamina
 50 μm, 10 μm, 10 μm

continued next page



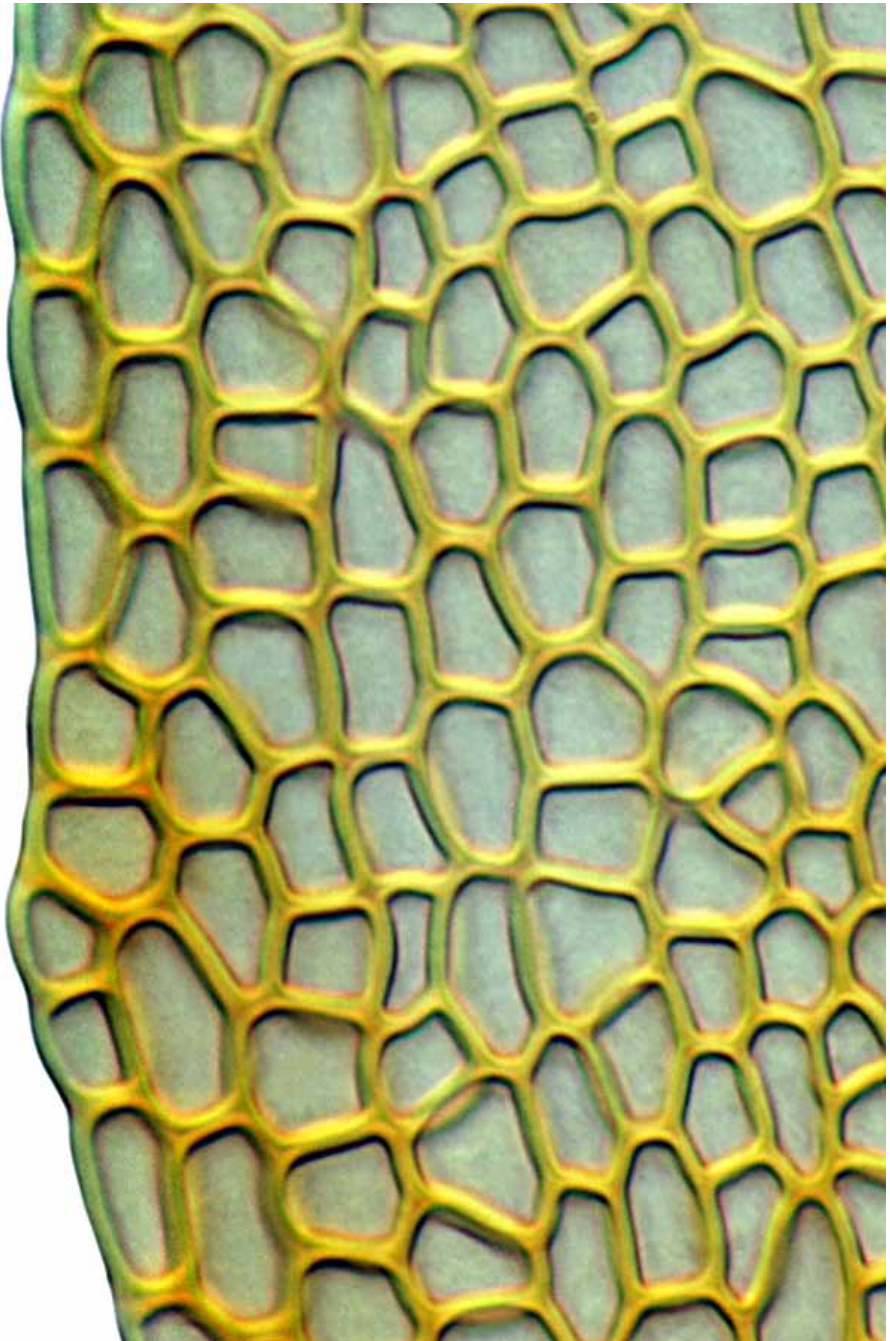
Fissidens rigidulus var. *pseudostrictus* frond and whole leaf
1 mm, 0.1 mm

continued next page



Fissidens rigidulus var. *pseudostrictus* leaf apex, showing costa terminus
10 μm

continued next page



Fissidens rigidulus var. *pseudostrictus* margin of vaginant lamina
10 μ m

continued next page

Fissidens rigidulus Hook.f. & Wilson in Wilson var. **rigidulus**

form: densely gregarious, sparingly branched, green to black, with 10–80 leaf pairs, \pm overlapping in mid-stem, 10–80(–120) mm long

habitat: aquatic, rock in seeps, waterfalls, or submerged in lakes or fast streams

leaf: size: 1.5–3 \times 0.3–0.8 mm

shape: lanceolate to oblong-lanceolate, bi- to pluristratose near the costa

tip: acute

vaginant laminae: to 0.7 the leaf length, two-thirds to fully closed

base: dorsal lamina reaching the leaf insertion

costa: failing below the apex

border: usually several rows of thick-walled, prosenchymatous cells, occasionally rudimentary

margin: entire, plane

cells: 7.5–10.5 μ m, quadrate to \pm hexagonal, thick-walled, smooth

capsule: 0.8–1.0 mm, ovate-oblong, inclined, \pm asymmetric; seta 4–7 mm, orange-brown, wiry; peristome teeth bright red



vegetative habit (moist) (2), shoot (moist), and leaf outline

5 mm,

5 mm,

1 mm,

1 mm



leaf apex, junction of apical and vaginant laminae, and border of vaginant lamina base

50 μ m,

50 μ m,

10 μ m

continued next page



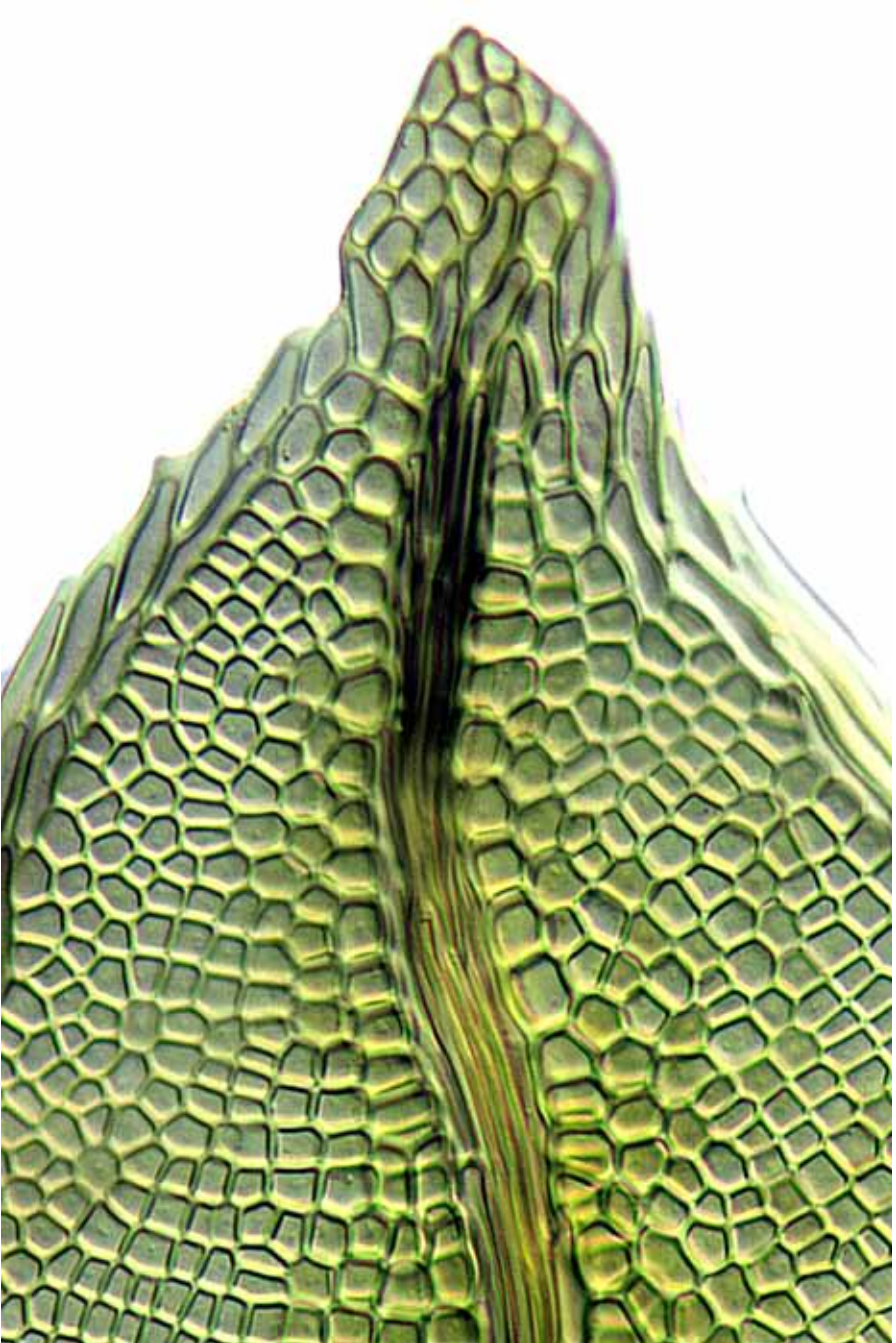
Fissidens rigidulus var. *rigidulus* capsules
0.5 mm

continued next page



Fissidens rigidulus var. *rigidulus* habit
1 mm

continued next page



Fissidens rigidulus var. *rigidulus* leaf apex showing costa terminus
10 μm

continued next page

Fissidens strictus Hook.f. & Wilson

form: tufted or matted, ± branched stems, leaves in 15–40 pairs, overlapping in mid-stem, the lowest leaves eroded and encrusted with epiphytes and detritus, 6–15 mm tall

habitat: rock, submerged or near to fast-flowing streams in indigenous forest, sea level to 320 m elevation

leaf: size: 1.5–2.0 × 0.2–0.3 mm

shape: linear; all laminae unistratose at the margin, bi- to pluristratose near costa

tip: acute to obtuse, occasionally asymmetric

vaginant laminae: half the leaf length, half-open

base: dorsal lamina reaching the leaf insertion and decurrent down the stem

costa: failing 5–10 cells below the apex

border: not differentiated

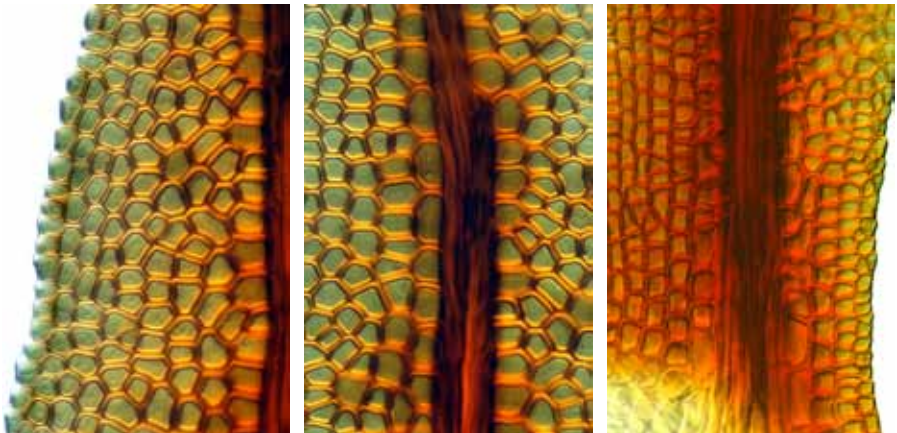
margin: crenulate, plane

cells: 9–14 μm, quadrate to irregularly hexagonal, firm-walled, smooth

capsule: mature capsules not seen in New Zealand



vegetative frond (2), leaf outline, leaf apex, and junction of apical and vaginant laminae
 1 mm, 1 mm, 0.1 mm, 10 μm, 50 μm



margin midleaf, costa in upper leaf, and near base of dorsal lamina
 10 μm, 10 μm, 50 μm

continued next page



Fissidens strictus margin of upper leaf
10 μm

continued next page

Fissidens taxifolius Hedw.

form: tufted to densely gregarious, yellow-green, branched at the base,
10–15 leaf pairs, overlapping in mid-stem, 5–10 mm tall

habitat: soil in moderate shade, mostly urban parks and gardens, to 400 m

leaf: size: 1.4–2.4 × 0.4–0.8 mm, in 10–15 pairs on the stem

shape: oblong-lanceolate; bistratose patches distally

tip: acute to broadly acute, mucronate to cuspidate on some leaves

vaginant laminae: 0.5–0.7 of the leaf length, almost closed

base: dorsal lamina reaching the leaf insertion, often undulate there

costa: percurrent to excurrent in a mucro or cusp

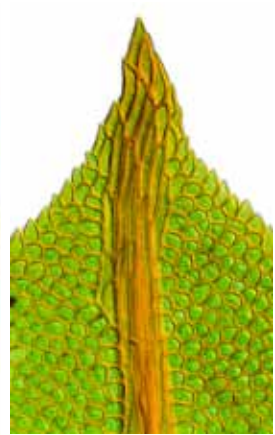
border: not differentiated

margin: serrulate, plane

cells: 8–10 μm, quadrate to hexagonal, firm-walled, bulging, smooth

capsule: capsules not found in New Zealand

notes: adventive and invasive, nearly cosmopolitan but not recorded yet from Australia



habit, vegetative shoot (dry), leaf outline, and leaf apex

■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 50 μm



junction of apical and vaginant laminae, costa in midleaf, and undulate leaf base

■ 50 μm, ■ 50 μm, ■ 50 μm

continued next page



Fissidens taxifolius vegetative habit
1 mm

continued next page



Fissidens taxifolius leaf whole-mount
— 0.1 mm

Fissidens taylorii var. **epiphytus** (Allison) I.G.Stone & J.E.Beever

form: scattered, ± branched stems, with leaves in 15–25 pairs, yellow-green to green, radiculose below, 2–10 mm tall

habitat: soil, sea level to 300 m elevation

leaf: size: 0.5–1.0 × 0.2–0.3 mm

shape: oblong to lanceolate, unistratose, little altered when dry

tip: acute to obtuse

vaginant laminae: to 0.8 of the leaf length, half to nearly fully closed

base: dorsal lamina narrow, failing above the leaf insertion

costa: percurrent to excurrent

border: 2–5 rows of narrow, thick-walled cells on only the vaginant laminae

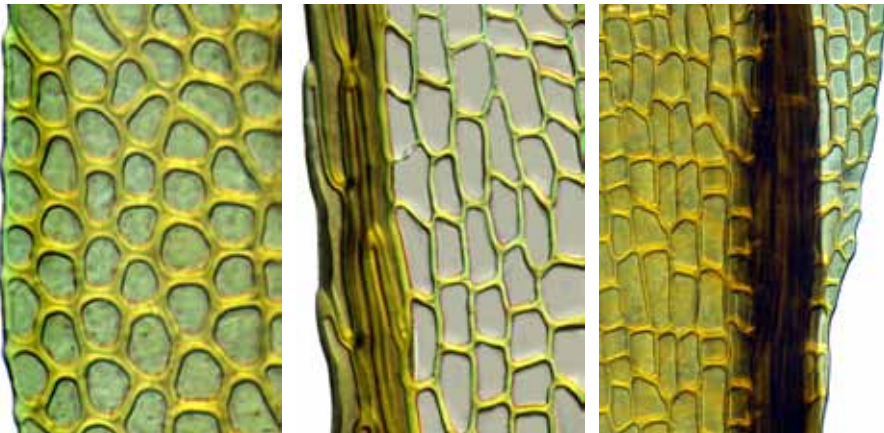
margin: entire to minutely serrulate, plane

cells: 8–16 μm, quadrate to irregularly hexagonal, firm-walled, smooth

capsule: 0.5–0.8 mm, symmetric to arcuate, erect to inclined, exserted, brown; seta 2–6 mm; operculum short-beaked; spores 25–36 μm in diam.

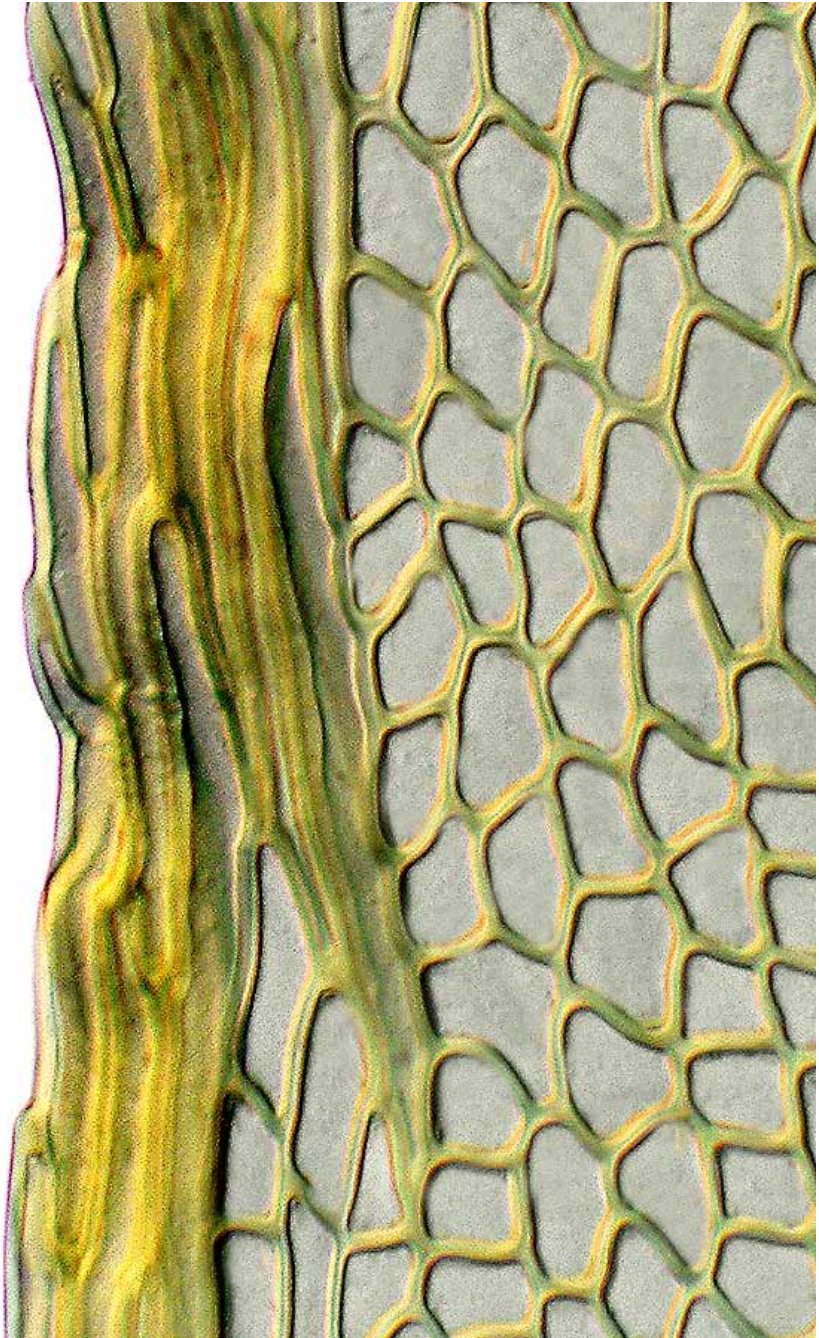


vegetative shoot (moist), leaf, leaf apex, and junction of apical and vaginant laminae
 1 mm, 0.5 mm, 0.1 mm, 50 μm, 10 μm



margin of upper leaf, border of vaginant lamina, and base of dorsal lamina
 10 μm, 10 μm, 10 μm

continued next page



Fissidens taylorii var. *epiphytus* spurred border of vaginant lamina
10 μ m

continued next page



Fissidens taylorii var. *epiphytus* leaf apex, showing costa terminus
10 μ m

continued next page

Fissidens taylorii var. **sainsburyanus** Allison

form: scattered, ± branched stems, with leaves in 8–12 pairs, yellow-green to green, radiculose at base of both main and branch shoots, 2–10 mm tall

habitat: soil, in lawns and other modified sites, mostly dry-eastern, to 250 m

leaf: size: 0.4–0.7 × 0.2 mm

shape: oblong to lanceolate, unistratose, little altered when dry

tip: obtuse to acute

vaginant laminae: up to 0.8 of the leaf length, half-open to almost closed

base: dorsal lamina narrow, failing above the leaf insertion

costa: subpercurrent to percurrent

border: vaginant laminae ± bordered

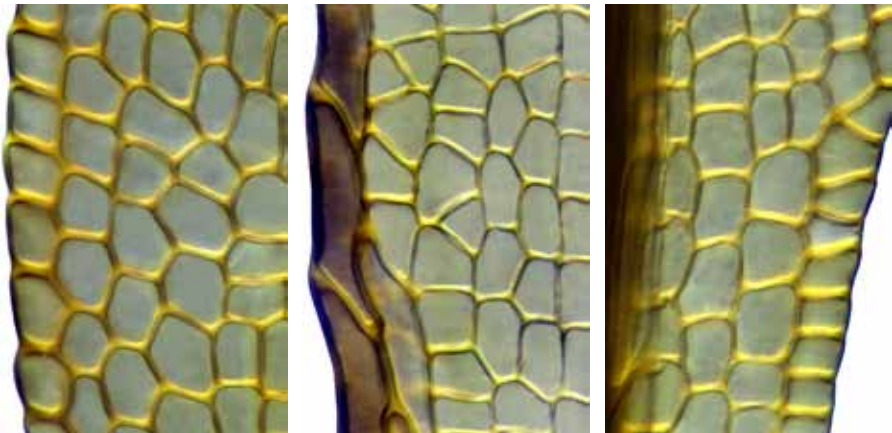
margin: entire to minutely serrulate, plane

cells: 7–14 μm, quadrate to irregularly hexagonal, firm-walled, smooth

capsule: 0.5–0.8 mm, erect to inclined, exserted, brown; seta 2–6 mm; operculum beaked; calyptra smooth, cucullate; peristome teeth erect, not split (= *sainsburia*-type peristome), spores 15–25 μm in diam.

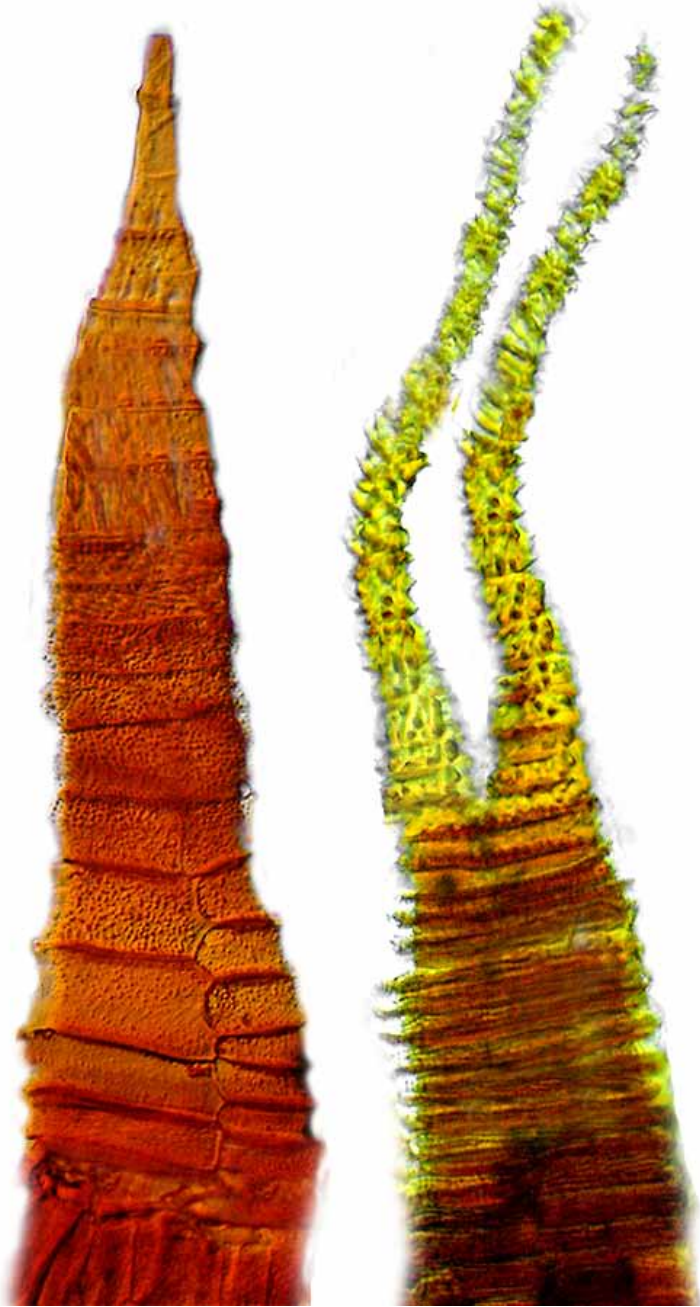


vegetative shoot (moist), leaf, leaf apex, and junction of apical and vaginant laminae
 1 mm, 0.1 mm, 10 μm, 10 μm



margin of upper leaf, margin of minor vaginant lamina, and margin of dorsal lamina
 10 μm, 10 μm, 10 μm

continued next page



Left — an undivided peristome tooth (exostome) of *Fissidens taylorii* var. *sainsburyanus*.
Right — a deeply divided tooth of *Fissidens leptocladus*, a peristome type that's found in most *Fissidens* species.

50 μ m

continued next page

Fissidens taylorii Müll.Hal. var. **taylorii**

form: scattered, ± branched stems, with leaves in 8–12 pairs, overlapping in only the upper stem, yellow-green to green, radiculose below, 2–10 mm tall
habitat: soil, mostly dry sites east of the ranges, to 250 m elevation

leaf: size: 0.3–0.9 × 0.1–0.2 mm

shape: oblong to lanceolate, unistratose, little altered when dry

tip: obtuse to acute

vaginant laminae: up to 0.8 of the leaf length, half to nearly closed

base: dorsal lamina narrow, usually failing above the leaf insertion

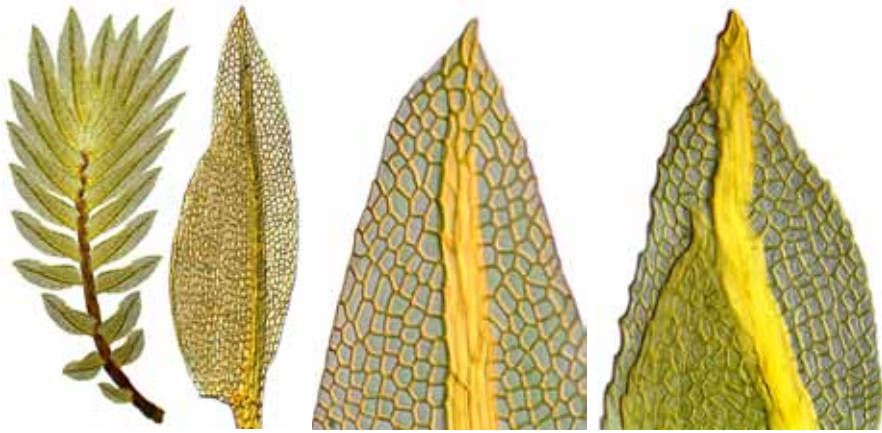
costa: subpercurrent to percurrent

border: on vaginant laminae only, sometimes 1–3 rows of elongate cells

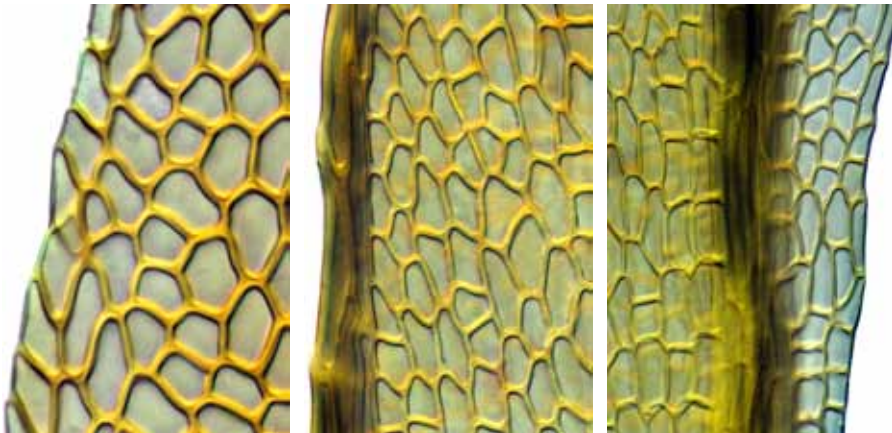
margin: entire to minutely serrulate, plane

cells: 7–20 μm, quadrate to irregularly hexagonal, firm-walled, smooth

capsule: 0.5–0.8 mm, symmetric, erect to inclined, exserted, brown; seta 2–6 mm; operculum beaked; calyptra smooth, cucullate; spores 15–35 μm in diam.

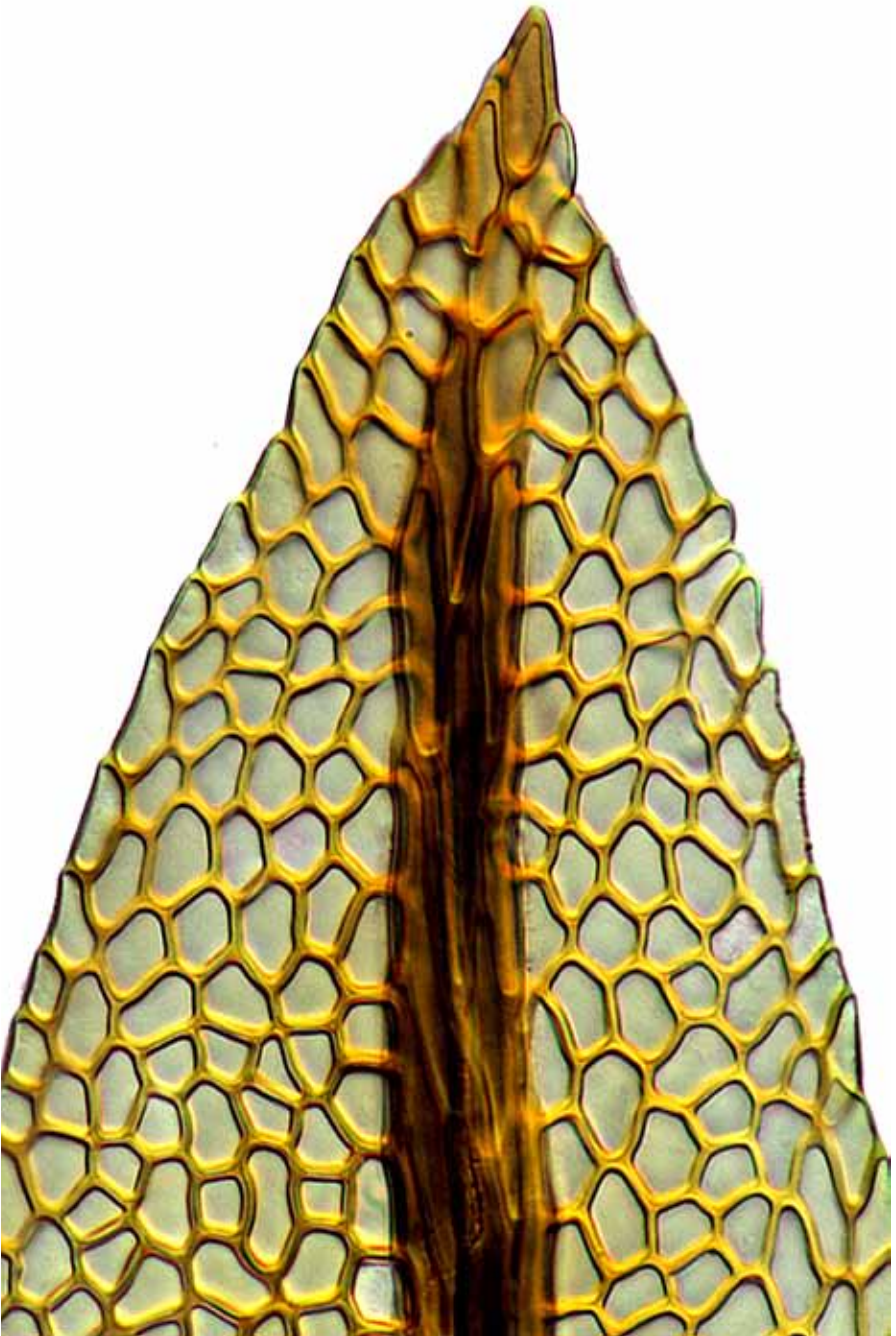


vegetative shoot (moist), leaf, leaf apex, and junction of apical and vaginant laminae
 0.5 mm, 0.1 mm, 10 μm, 10 μm



margin of upper leaf, margin of vaginant lamina, and near base of dorsal lamina
 10 μm, 10 μm, 10 μm

continued next page



Fissidens taylorii var. *taylorii* leaf apex showing end of costa
10 μ m

continued next page

Fissidens tenellus var. **australiensis** (A.Jaeger) J.E.Beever & I.G.Stone

form: gregarious, ± branched stems, with leaves in 3–6(–14) pairs, overlapping in mid-stem, yellow- to dark green, radiculose below, 1–3 mm long

habitat: bark, rotting wood or bone, *Astelia* bases, rarely soil or rock, to 440 m

leaf: size: 0.8–1.3 × 0.1–0.2 mm

shape: lanceolate, ± falcate, unistratose, little altered when dry

tip: acute

vaginant laminae: about half the leaf length, ± open

base: dorsal lamina tapered, reaching the leaf insertion or failing just above

costa: failing 3–4 cells below the apex

border: not differentiated

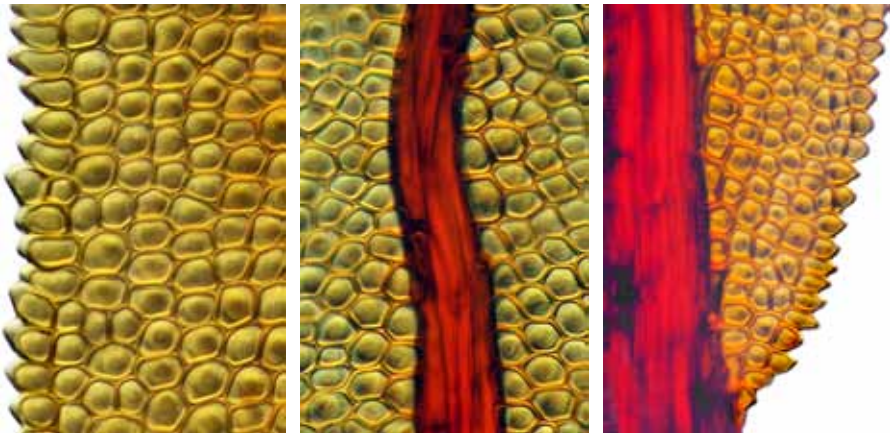
margin: denticulate throughout, plane

cells: 6–11 μm, quadrate to irregularly hexagonal, firm-walled, ± unipapillose

capsule: 0.5–0.8 mm, symmetric, erect, exserted, brown; seta 1.8–3.0 mm, light brown; operculum beaked; calyptra smooth to slightly scabrous, cucullate; spores 10–14 μm in diam.

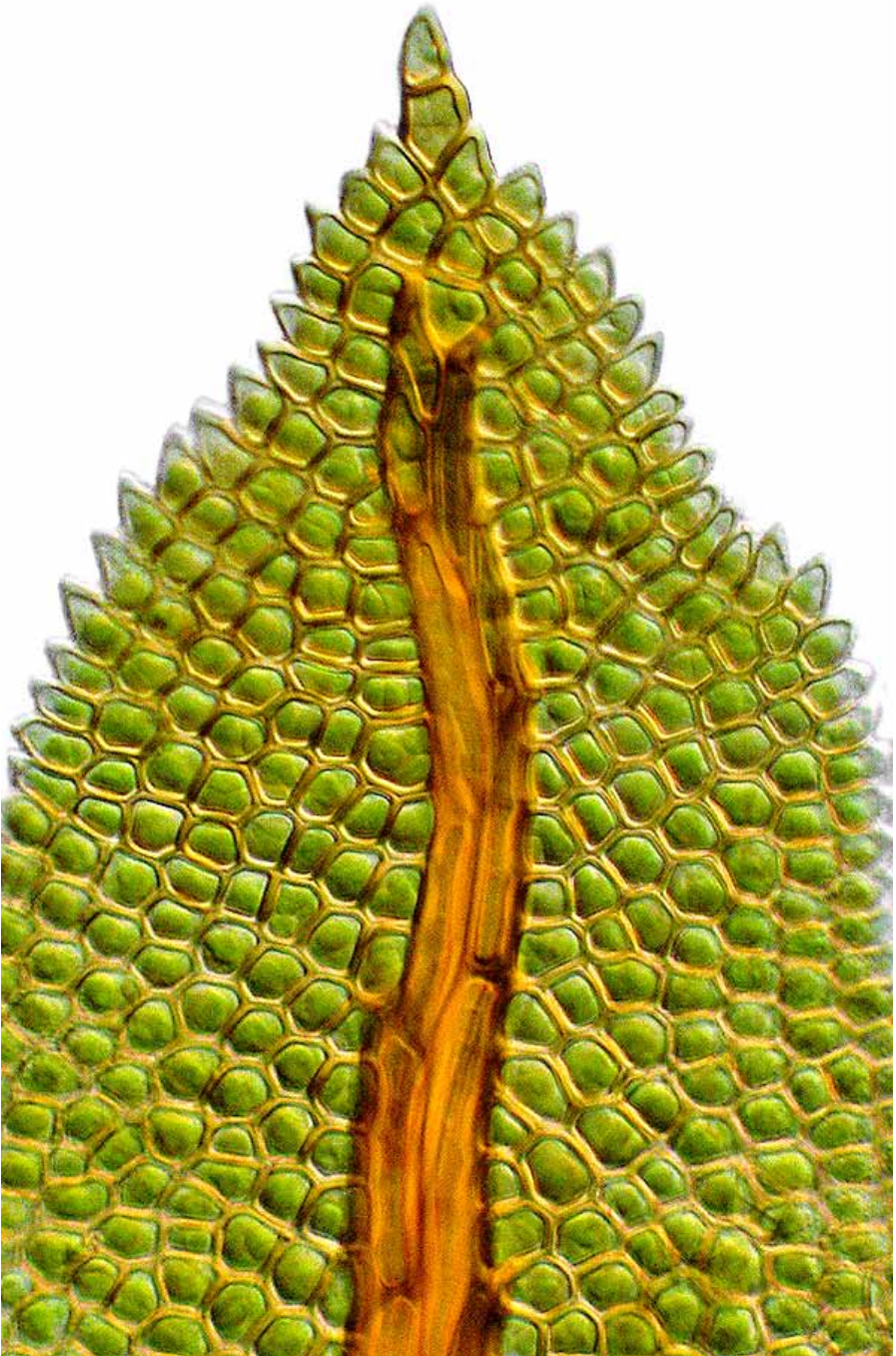


shoot (moist), leaf outline, leaf apex, and junction of apical and vaginant laminae
 1 mm, 0.1 mm, 50 μm, 50 μm



margin of upper leaf, costa in upper leaf, and base of dorsal lamina
 10 μm, 10 μm, 50 μm

continued next page



Fissidens tenellus var. *australiensis* leaf apex and costa terminus
10 μm

continued next page

Fissidens tenellus Hook.f. & Wilson var. **tenellus**

form: gregarious, ± branched stems, with leaves in 3–6(–14) pairs, overlapping in mid-stem, yellow- to dark green, radiculose below, 1–3 mm tall

habitat: soil or rarely rock, often on eroding banks in indigenous forest, to 950 m

leaf: size: 0.8–1.3 × 0.1–0.2 mm

shape: linear-lanceolate, ± falcate, unistratose, little altered when dry

tip: acute to acuminate

vaginant laminae: about half the leaf length, half to fully open

base: dorsal lamina tapered, reaching the leaf insertion or failing just above

costa: percurrent to shortly excurrent

border: ± intramarginal on the vaginant laminae

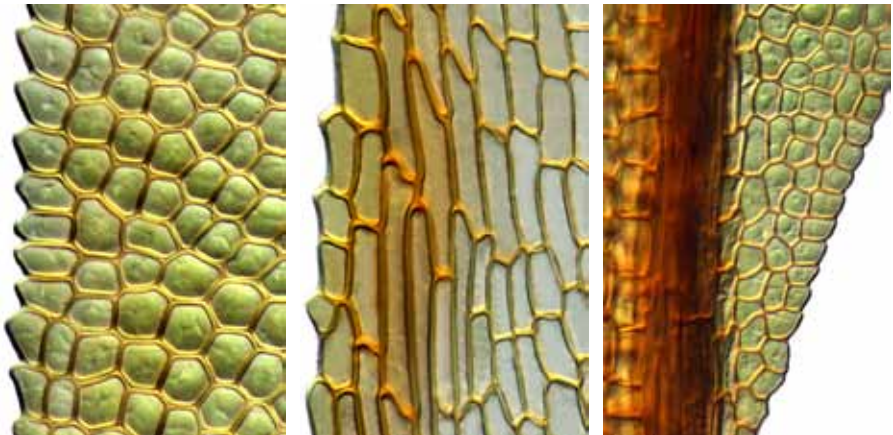
margin: crenulate to denticulate, plane

cells: 6–11 μm, quadrate to irregularly hexagonal, firm-walled, ± unipapillose

capsule: 0.4–0.7 mm, symmetric, erect, exserted, brown; seta 2–5(–10) mm, light brown; operculum beaked; calyptra scabrous, cucullate; spores 7.5–12 μm in diam.



fertile shoot (moist), leaf outline, leaf apex, and junction of apical and vaginant laminae
 0.5 mm, 0.1 mm, 50 μm, 50 μm



margin of upper leaf, margin of minor vaginant lamina, and base of dorsal lamina
 10 μm, 50 μm, 50 μm

continued next page



Fissidens tenellus var. *tenellus* leaf apex and failing costa
10 μ m

continued next page

Fissidens waiensis J.E.Beever

form: ± gregarious, branched stems, leaves in 10–25(–60) pairs, not overlapping in mid-stem, yellow- to dark green, rhizoids basal, axillary, 10–20(–50) mm tall
habitat: ± submerged rock (andesite, basalt, greywacke), in shade or exposed, indigenous or exotic forest, to 600 m elevation

leaf: size: 1.2–2.0 × 0.3–0.5 mm

shape: lanceolate, ± falcate, bistratose in patches and near costa, ± crisped dry

tip: acute

vaginant laminae: up to half the leaf length, closed or nearly so

base: dorsal lamina reaching to the leaf insertion

costa: failing 3–5 cells below the leaf apex

border: weak, a few rows of marginal cells in the vaginant laminae

margin: entire, plane

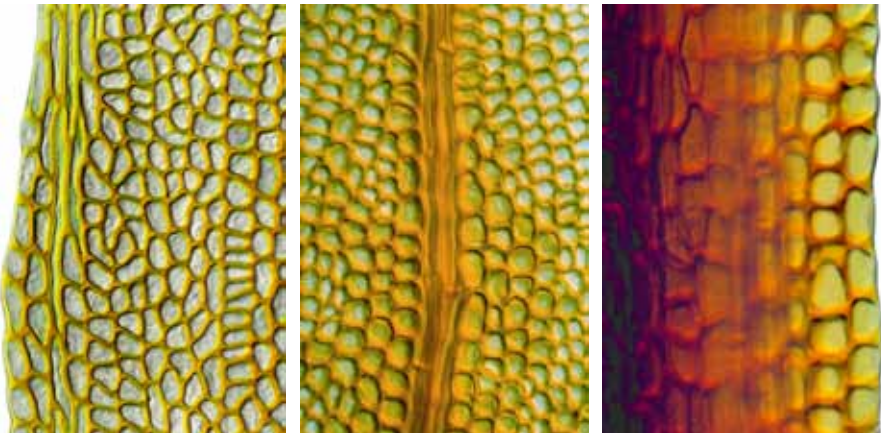
cells: 5–13 μm, quadrate to irregularly hexagonal, firm-walled, smooth

capsule: sporophytes not known

note: endemic



vegetative frond (moist), leaf, leaf apex, and junction of apical and vaginant laminae
 ■ 1 mm, ■ 0.1 mm, ■ 50 μm, ■ 50 μm



margin of vaginant lamina, costa in upper leaf, and near base of dorsal lamina
 ■ 50 μm, ■ 50 μm, ■ 10 μm

continued next page



Fissidens waiensis vegetative frond (re-wetted specimen), and leaf whole-mount
1 mm, 0.1 mm

Ceratodon purpureus subsp. **convolutus** (Reichardt) Burley**form:** dense tufts, dull, the stems often forked**habitat:** soil, rock, or sometimes wood in dry, open, or disturbed sites**leaf:** *size:* 1–2 × 0.3–0.7 mm*shape:* ovate-lanceolate to oblong-lanceolate, keeled, contorted when dry*tip:* acute to ± awned, lamina-costa junction oblique*base:* undifferentiated; basal cells short-rectangular*costa:* percurrent to shortly excurrent, prominent, terminal cell ± oblique*border:* not differentiated*margin:* entire below, a few blunt teeth above; revolute to near the apex*cells:* 8.5–12 μm, quadrate, thick-walled, collenchymatous, smooth**capsule:** 1–2.5 mm, oblong, strumose at the base, 4–6-angled, sulcate, more

so when dry, annulus large and revolute; seta 10–30 mm, purplish red,

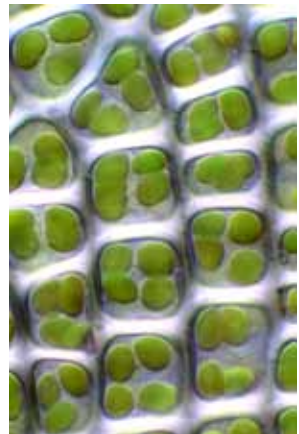
smooth; peristome single, of 16 teeth split nearly to the base, bordered

and papillose

note: a cosmopolitan “bryo-weed”, common in disturbed sites

habit (cutaway cushion), immature and mature capsules, leaf outline, and leaf apex

10 mm, 0.5 mm, 1 mm, 0.1 mm, 50 μm



leaf subapex, revolved leaf margins, and cells midleaf

50 μm, 50 μm, 10 μm



Ceratodon purpureus vegetative shoot (moist), and immature capsules
1 mm

continued next page



Ceratodon purpureus massed mature capsules, three with calyptrae
1 mm

continued next page



Ceratodon purpureus peristome teeth and annulus
50 μm

continued next page



Ceratodon purpureus cells midleaf
10 μm

Chrysoblastella chilensis (Mont.) Reim.

form: loose tufts, yellow to yellow-green, simple or branched, 10–20 mm tall
habitat: damp soil, often in sites disturbed naturally or by man

leaf: size: 2–3 × 0.5–0.8 mm

shape: oval-lanceolate to oblong-lanceolate; lamina bistratose throughout

tip: obtuse

base: basal cells oblong and smooth

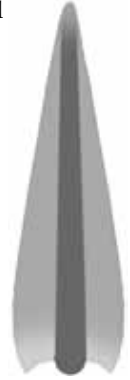
costa: percurrent, yellow, papillose at the back

border: absent

margin: entire, plane or partly recurved

cells: 10 × 7 μm, quadrate or short-rectangular, thick-walled, papillose

capsule: 2–3 mm, cylindric, slightly curved, pale brown; seta 10–20 mm, yellowish, ± flexuose when dry; annulus absent; calyptra cucullate; operculum rostrate to half the length of the capsule; peristome of 16 teeth, joined below into a cylinder, divided above into two filiform segments, papillose throughout; spores 15–18 μm in diam.



vegetative shoots (dry second from left), leaf outline, and leaf apex
 ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 10 μm



margin midleaf, leaf cell papillae, and recurved lower leaf margin
 ■ 10 μm, ■ 10 μm, ■ 10 μm

continued next page



Chrysoblastella chilensis habit
1 mm

continued next page



Chrysoblastella chilensis vegetative shoot (dry on right)

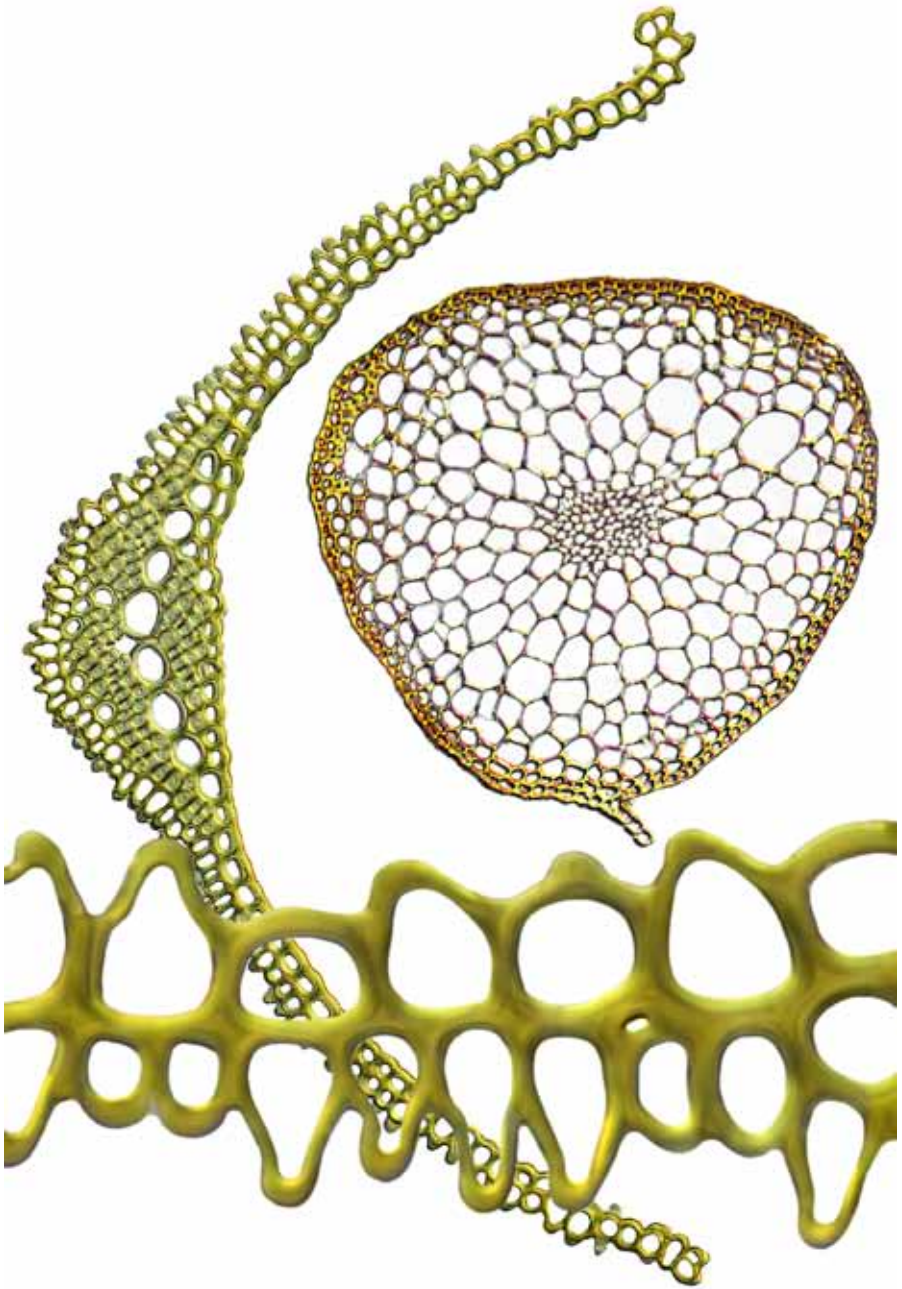
1 mm

continued next page



Chrysoblastella chilensis bistratose leaf, surface view
10 μm

continued next page



Chrysoblastella chilensis leaf (bistratose) and stem cross-sections

50 μm (left),

50 μm (right),

10 μm (below)

continued next page

Distichium capillaceum (Hedw.) Bruch & Schimp.

form: dense silky tufts, pale, simple or branched, slender, tomentose
habitat: exposed moist soil or calcareous rock

leaf: size: 2.5–4.5 × 0.4–0.7 mm

shape: distichous, subulate, flexuose, reflexed, narrowing from an oblong-oval sheathing base

tip: linear-acuminate

base: basal cells linear-oblong, 85–140 × 4–5 μm, firm-walled

costa: excurrent, filling the subula, papillose on the back

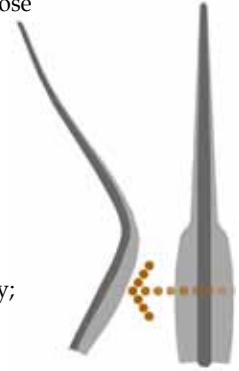
border: not differentiated

margin: entire, plane

cells: subula cells 15–20 μm, subquadrate, firm-walled, smooth

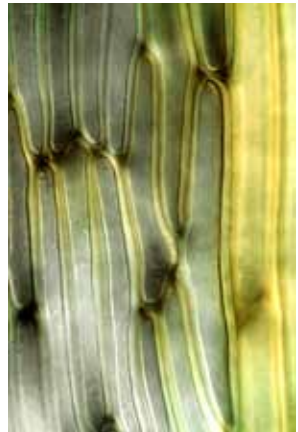
capsule: 1–2 mm, ovate-oblong to cylindric, ± erect, brown, glossy;
 seta 8–18 mm, slender, flexuose; peristome of 16 short reddish teeth inserted below the rim

note: cosmopolitan



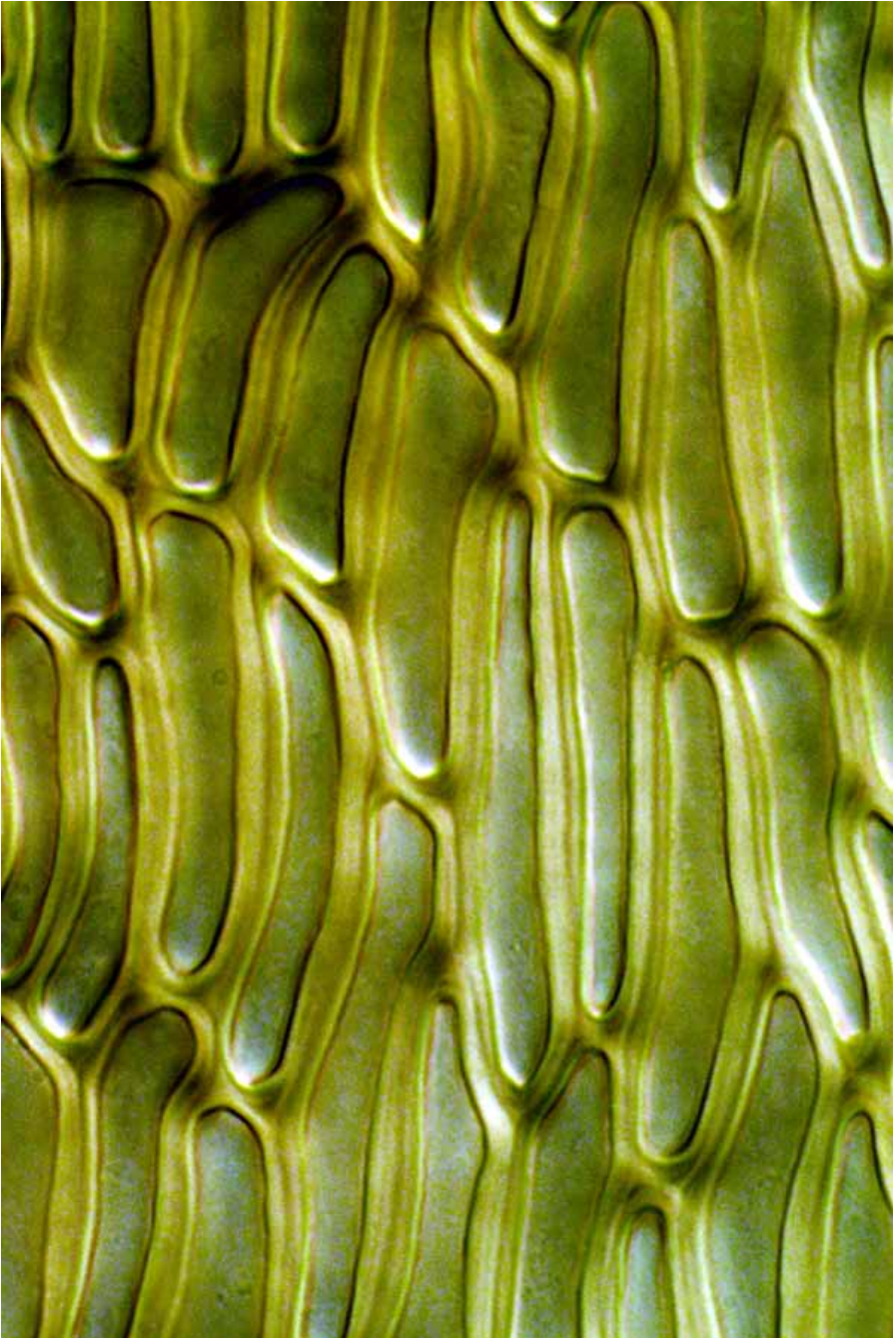
habit, vegetative shoot, leaf outline, and mature capsule

5 mm, 1 mm, 0.5 mm, 0.5 mm, 0.5 mm



margin mid-subula, lower leaf cells, and leaf base cells

10 μm, 10 μm, 10 μm

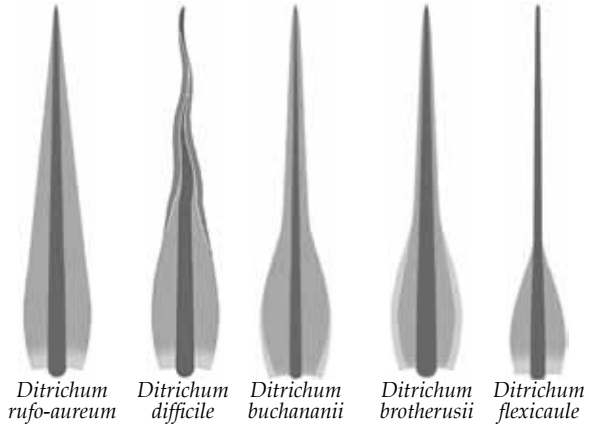
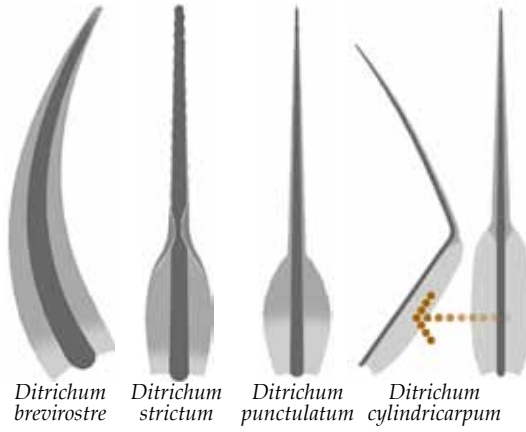


Distichium capillaceum cells lower leaf
10 μm

Key* to New Zealand species of *Ditrichum* (9)

- 1 Leaves with a hyaline margin at the base; peristome teeth entire or perforate..... 2
 1: Leaves without a hyaline margin at the base; peristome teeth divided to the base..... 3
- 2(1) Leaves contorted when dry, costa 100–150 μm wide near its base; spores 10–12 μm in diam..... ● ***Ditrichum buchananii***
 2: Leaves unaltered when dry; costa 150–200 μm wide near base; spores 65–70 μm long, (multicellular)..... ● ***Ditrichum brotherusii***
- 3(1): Leaves strongly falcate-secund..... ● ***Ditrichum brevirostre***
 3: Leaves not falcate-secund 4
- 4(3): Upper cells subquadrate or rounded and isodiametric..... 5
 4: Upper cells elongate, linear 8
- 5(4) Leaf base oblong, abruptly contracted to the subula 6
 5: Leaf base oval, gradually narrowed to the subula 7
- 6(5) Capsule brown, elliptic, tapered toward the mouth ● ***Ditrichum punctulatum***
 6: Capsule pale, long-cylindric, not tapered toward the mouth
 ● ***Ditrichum cylindricarpum***
- 7(5): Leaf apex wide-obtuse, denticulate, never hyaline-tipped .. ● ***Ditrichum strictum***
 7: Leaf apex narrow, entire, sometimes hyaline-tipped..... ● ***Ditrichum flexicaule***
- 8(4): Leaves 3–5 mm long, silky; plants lowland to montane; capsule ovate, flattened when dry ● ***Ditrichum difficile***
 8: Leaves 2.0–2.5 mm long, stiff; plants alpine; capsule cylindric, not flattened when dry
 ***Ditrichum rufo-aureum***

* based partly on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bulletin 5, 73, 81 plus Scott, GAM; Stone, IG; Rosser, C (1976): *The Mosses of Southern Australia*. Academic Press, London. 111.



Ditrichum brevirostre (R.Br.ter) Broth.

form: loosely tufted, erect, slender stems, simple or sparsely branched
habitat: soil or rock in exposed, disturbed sites

leaf: size: 1–2 mm

shape: long-subulate from an ovate-elliptic base, falcate-secund

tip: bluntly acute

base: sheathing

costa: 1/3 the width of the leaf base, filling most of the subula

border: not differentiated

margin: entire below, weakly denticulate near the apex, plane

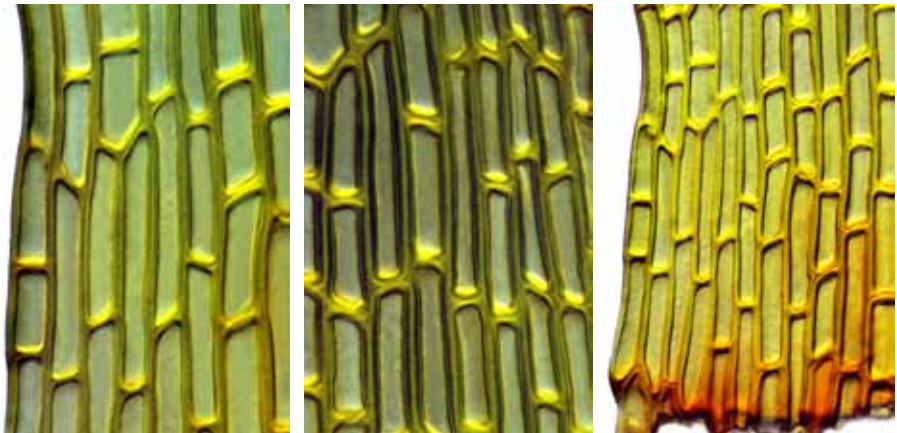
cells: subula cells 12–20 × 5–8 μm, rectangular, firm-walled, smooth

capsule: 1–1.5 mm, cylindrical, erect, exserted, reddish brown; seta 10–30 mm, ± flexuose, smooth; peristome single, the teeth filiform, papillose, split nearly to the base; operculum short-rostrate; calyptra cucullate, smooth, naked



vegetative shoots (dry), capsule (dry), leaf outline, leaf apex, and leaf subapex

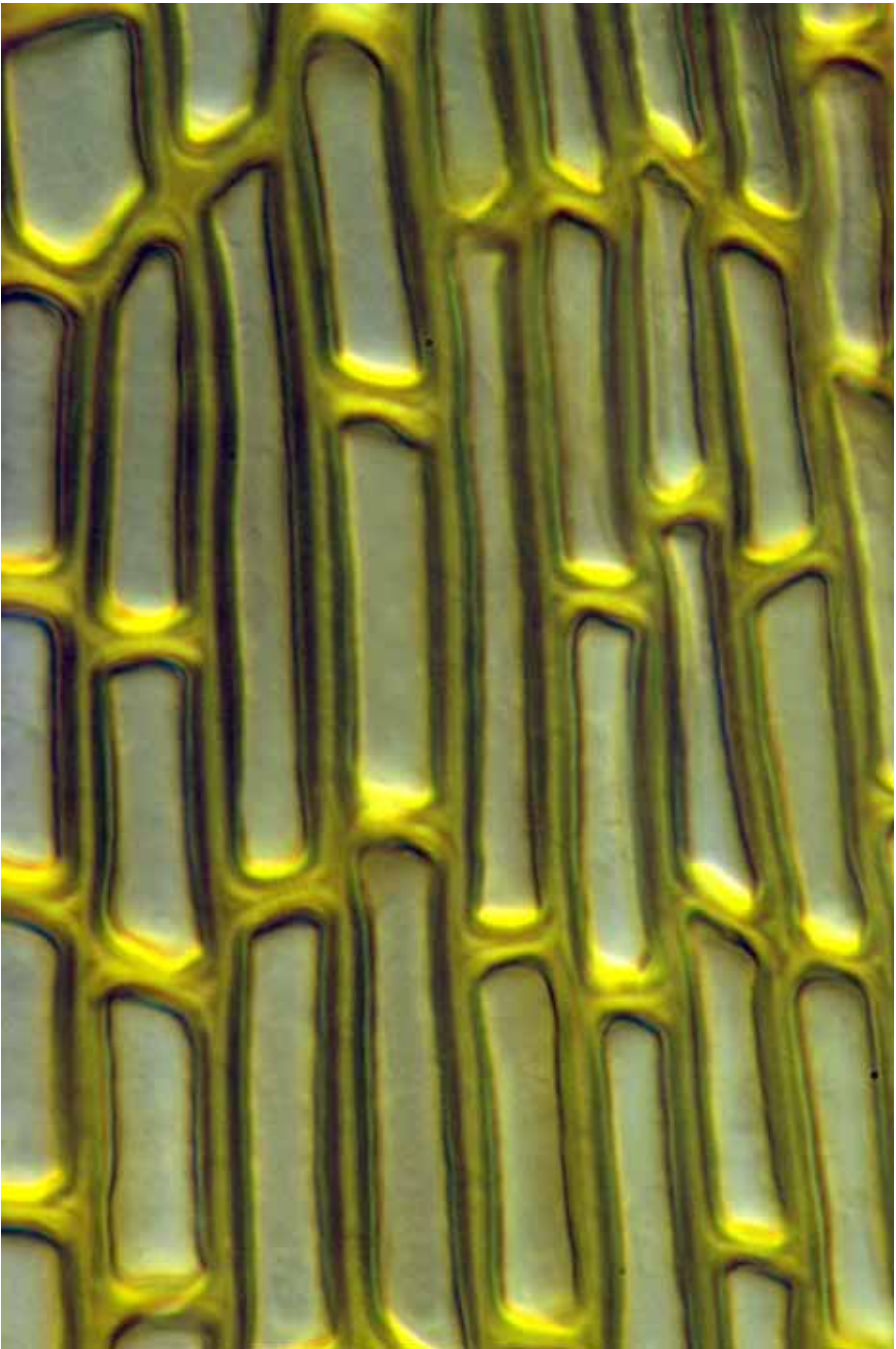
1 mm, 1 mm, 0.5 mm, 0.1 mm, 50 μm, 50 μm



margin lower leaf, cells near leaf base, and leaf basal angle

10 μm, 10 μm, 10 μm

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Ditrichum brevirostre cells near leaf base
10 μm

continued next page

Ditrichum brotherusii (R.Br.bis) Seppelt

form: densely tufted, branched, glossy, yellowish stems, dark below
habitat: soil

leaf: size: to 3 mm

shape: oval base contracting to a subula

tip: long-subulate

base: hyaline-bordered, basal cells short-rectangular, thin-walled

costa: 150–200 μm wide at its base

border: not differentiated

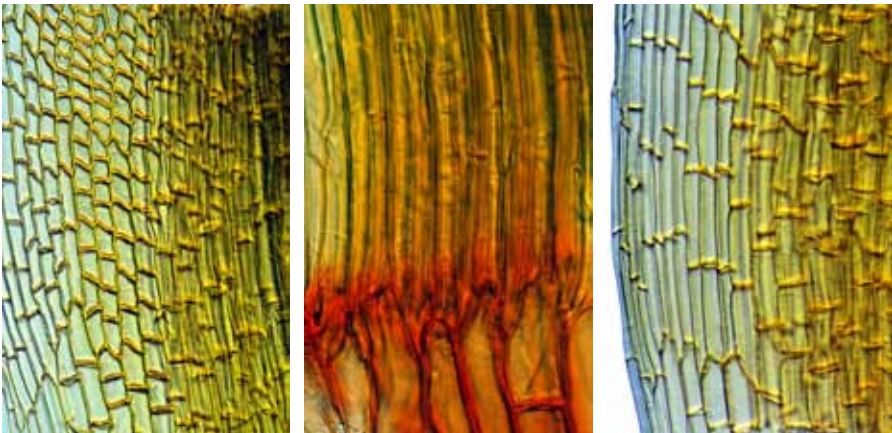
margin: entire below, denticulate at the apex, plane

cells: 10–20 \times 7–10 μm , oval, firm-walled, smooth

capsule: 1–1.5 mm, elliptic, inclined to horizontal, long-exserted, brown; seta 10–20 mm, slender, flexuose; operculum subulate; annulus present; peristome single, exostome teeth 16, short, orange, inserted below the rim; spores 65–70 μm in diam., multicellular



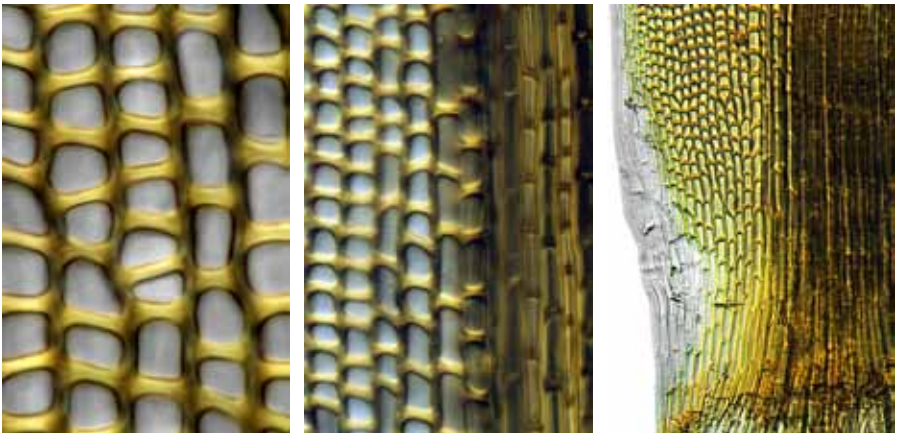
vegetative shoot (dry) (2), leaf outline, leaf apex, and margin midleaf
 1 mm, 1 mm, 0.5 mm, 10 μm , 10 μm



cells below shoulder, leaf insertion, and leaf basal angle
 50 μm , 10 μm , 50 μm

Ditrichum buchananii (R.Br.bis) Broth.**form:** densely tufted, erect, ± branched, yellowish stems, not glossy**habitat:** soil in exposed tussockland and river flats**leaf:** size: 2–3 mm*shape:* ovate or oblong base tapering gradually to an acute point*tip:* long-tapering, denticulate at the tip*base:* basal cells rectangular to linear*costa:* strong, 100–150 μm wide at the leaf base, percurrent*border:* several rows of narrow, thin-walled, hyaline cells at leaf base*margin:* entire below, denticulate near apex; broadly incurved*cells:* 7–10 μm, quadrate to oval, thick-walled, smooth**capsule:** 1–1.5 mm, oblong to ovate-oblong, ± erect, long-exserted, brown; seta to 10 mm, slender, flexuose; operculum short-beaked; peristome single, of 16 short, papillose teeth inserted below the rim, not split or perforate; spores 10–12 μm in diam.

fertile and vegetative shoots (dry), capsule (dry), leaf outline, leaf apex, margin midleaf
 1 mm, 1 mm, 0.5 mm, 0.5 mm, 10 μm, 50 μm



lamina cells midleaf, juxtacostal cells midleaf, and hyaline border at leaf base
 10 μm, 10 μm, 10 μm

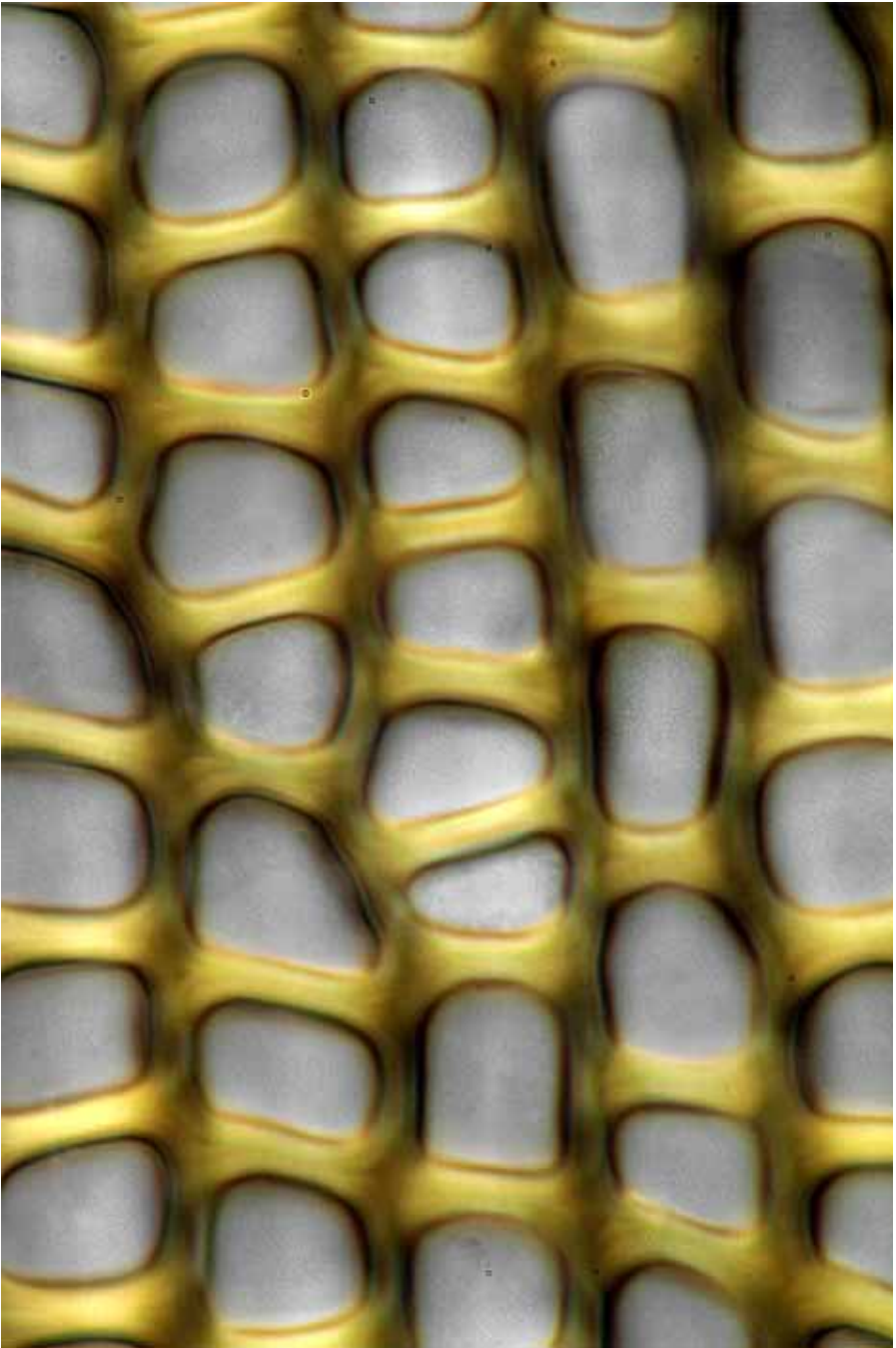
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Ditrichum buchananii vegetative shoots (dry)

1 mm

continued next page



Ditrichum buchananii cells midleaf
10 μm

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Ditrichum cylindricarpum (Müll.Hal.) Müll.Hal.

form: loosely tufted, simple or forked, dull yellow, brown, or green
habitat: soil and occasionally rock

leaf: size: 3–6 × 0.5–1.0 mm

shape: subulate, reflexed, ± flexuose, suddenly contracted from an oblong, concave base

tip: acute

base: basal cells elongate, thick-walled near the costa

costa: filling the upper subula, excurrent, denticulate at the apex

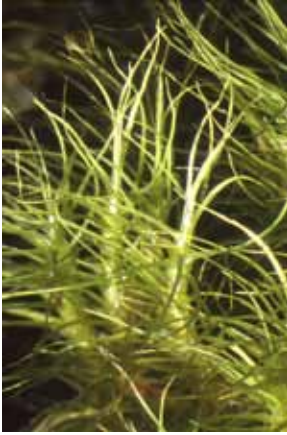
border: in the sheath, a few rows of narrow, thin-walled, hyaline cells

margin: entire, plane

cells: subula cells 15 × 5 μm, short-rectangular, incrassate, smooth

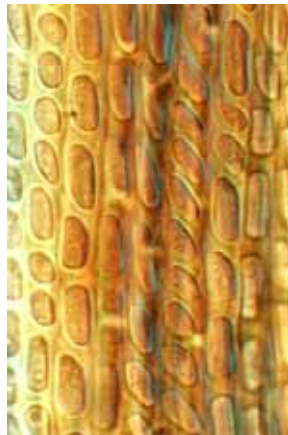
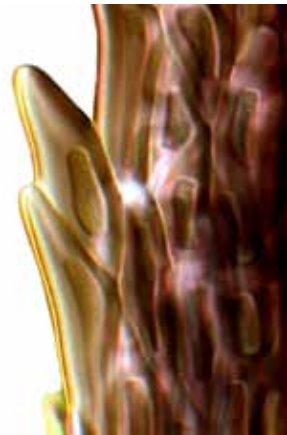
capsule: 2.5–4 mm, narrowly cylindrical, symmetrical, erect to inclined, pale brown; seta 10–30 mm, slender, reddish below

notes: differs from *Ditrichum punctulatum* in having a more narrowly cylindrical capsule with a dark mouth and neck



habit, mature capsules (dry) (2), leaf outlines (3), and leaf apex (2)

■ 1 mm, ■ 1 mm (2), ■ 0.5 mm (3), ■ 10 μm, ■ 10 μm



margin mid-subula, costa mid-subula, and basal costa and lamina cells

■ 10 μm, ■ 10 μm, ■ 10 μm

continued next page

Ditrichum difficile (Duby) M.Fleisch.

form: densely gregarious, sparingly branched, erect, silky, green to yellow-green
habitat: soil, especially track cuttings, lowland to montane

leaf: size: 3–5 mm

shape: oval or oblong base narrowed to a subula

tip: long, channelled, flexuose subula

base: alar cells not differentiated

costa: flattened, pale, excurrent, filling the upper subula

border: not differentiated

margin: entire below, ± denticulate at the extreme tip, plane

cells: 40–90 × 4–8 μm, rectangular above, linear below, firm-walled, smooth

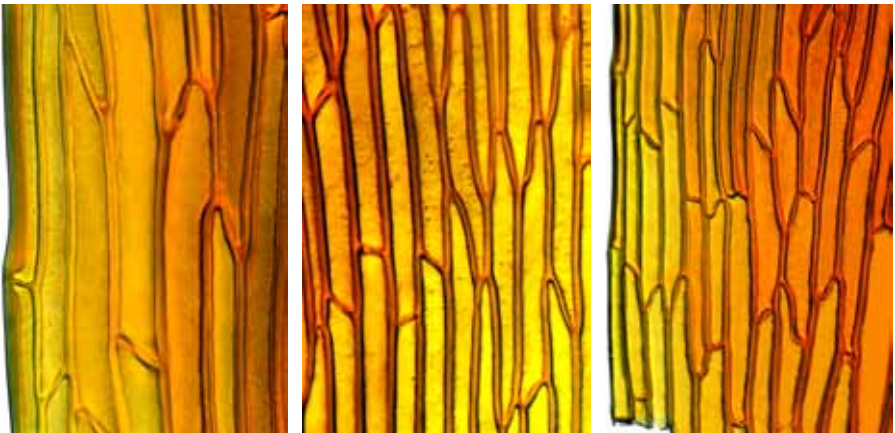
capsule: 2–3 mm, ovate-cylindric, inclined, long-exserted, flattened when dry, ± asymmetric, orange-brown; seta 20–30 mm, thin, flexuose, yellow or reddish; peristome teeth cleft to the base into two filiform, papillose segments; operculum beaked; calyptra cucullate, naked

note: common and widespread



vegetative shoot (dry), capsules (2), leaf outline, leaf apex, and midleaf margin

5 mm, 1 mm (2), 0.5 mm, 0.5 mm, 10 μm, 10 μm



margin near base, cells near leaf base, and leaf basal angle

10 μm, 10 μm, 10 μm

continued next page



Ditrichum difficile vegetative shoot (dry)

1 mm

continued next page

Ditrichum flexicaule (Schwägr.) Hampe

form: tufted, silky, yellowish, flexuose, fragile, branched stems, radiculose below, 10–50 mm tall

habitat: calcareous soil or rock

leaf: size: 3–3.5 mm

shape: lanceolate base narrowing to a subula

tip: bluntly acute to subobtuse on a long subula, sometimes hyaline-tipped

base: basal cells \pm rectangular, thin-walled

costa: wide, obscure, disappearing in the subula

border: 1–2 rows of narrow, hyaline cells in lower leaf

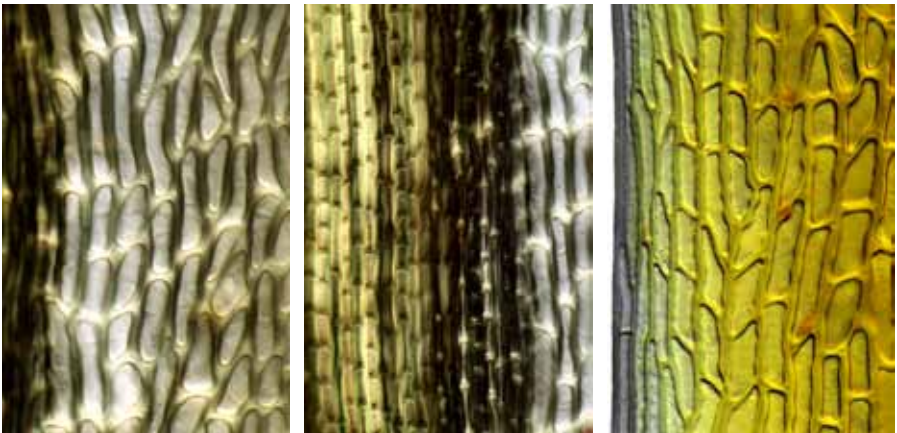
margin: entire, plane

cells: subula cells 8–10 μm , isodiametric to oval, sheath cells 20–60 \times 5–20 μm , linear to rhombic and irregular, \pm porose, firm- to thick-walled, smooth

capsule: capsules unknown



vegetative shoots (dry) (2), leaf outline, apex, subapex, and margin of upper shoulder
 5 mm, 5 mm, 1 mm, 10 μm , 10 μm , 10 μm



juxtacostal cells mid-sheath, costa cells mid-sheath, and margin near leaf base
 10 μm , 10 μm , 10 μm

continued next page

Ditrichum punctulatum Mitt.

form: tufts of erect, sparsely branched stems, dull, green to brown, the leaves glossy, spirally twisted along their length when dry, 10–30 mm tall

habitat: soil or rock

leaf: size: 3–4 mm

shape: from an oblong, concave base abruptly contracted to a narrow subula

tip: denticulate

base: basal leaves long-rectangular

costa: wide below, excurrent and filling the subula above

border: not differentiated

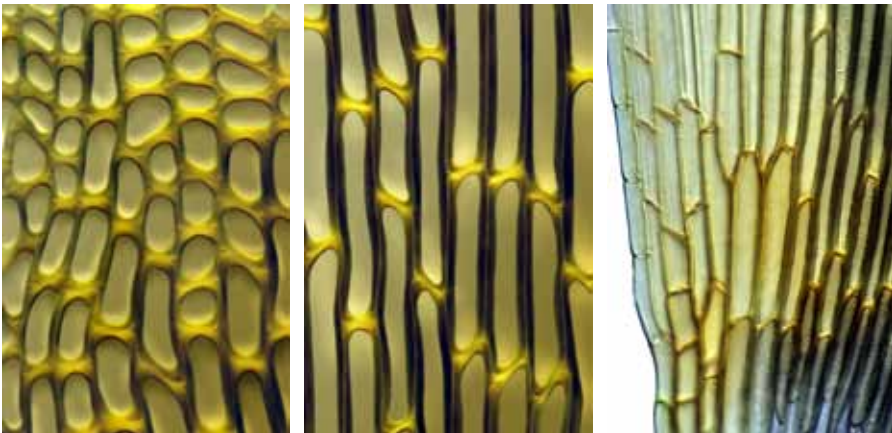
margin: entire below, denticulate toward the tip, plane

cells: 10–60 × 10 μm, rounded-quadrate at the shoulder and above, ± rectangular below, thick-walled, smooth

capsule: 1–2 mm, ellipsoid to oblong, symmetric, erect, exserted, brown; seta 10–13 mm, flexuose, reddish below, yellow above; operculum rostrate; peristome single, the teeth 16, deeply split into two densely papillose filaments

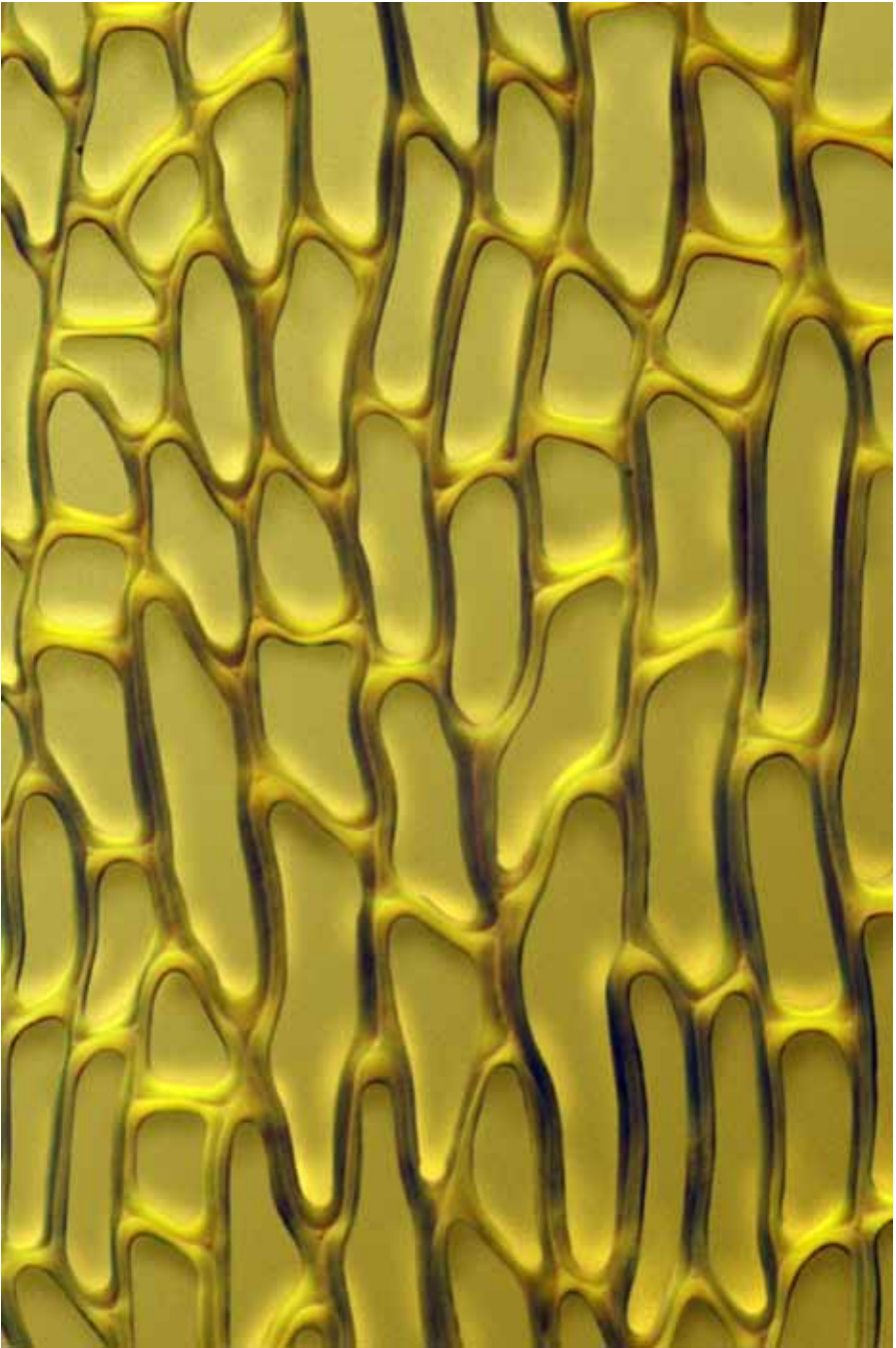


vegetative shoot (dry) (2), capsule (2), leaf outline, leaf apex, and margin of upper subula
 1 mm, 1 mm, 0.5 mm, 0.1 mm, 0.1 mm, 10 μm, 10 μm



leaf shoulder cells, cells near leaf base, and leaf basal angle
 10 μm, 10 μm, 10 μm

continued next page



Ditrichum punctulatum leaf shoulder cells
10 μm

continued next page

Ditrichum strictum (Hook.f. & Wilson) Hampe

form: tufted, sparsely branched, erect stems, dark below, 10–40 mm tall
habitat: soil

leaf: size: 5–8 mm

shape: oblong-lanceolate base abruptly tapering to a narrow rigid subula

tip: ± serrulate, blunt, sometimes subspathulate

base: basal cells ± linear, firm-walled, pigmented

costa: strong below, almost filling the subula, failing at the apex

border: weak and partial, 1–4 rows of narrow, hyaline cells near the base

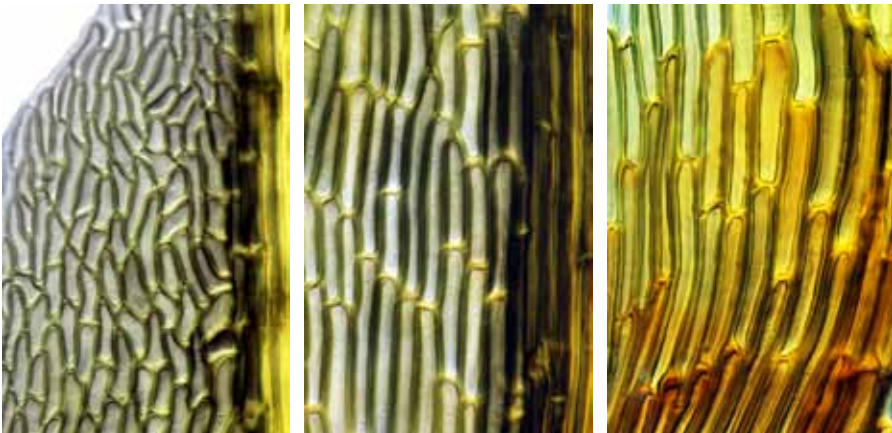
margin: entire below, ± denticulate near the apex, plane

cells: subula cells rounded-isodiametric, 8–10 μm, thick-walled, smooth; sheath cells 80–100 × 8–10 μm, rectangular to linear, firm-walled, smooth

capsule: 1.3–1.8 mm, ovate-oblong, erect, long-exserted, glossy, dark brown; seta 10–15 mm, orange, flexuose; peristome single, 16 teeth inserted below the capsule rim, undivided, coarsely papillose; operculum beak oblique, as long as the urn



fertile shoot, capsule, vegetative shoot (dry), leaf outline, leaf apex, and leaf subapex
 ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 10 μm, ■ 10 μm



irregular cells at shoulder, juxtacostal cells mid-sheath, and coloured cells near leaf base
 ■ 10 μm, ■ 10 μm, ■ 10 μm

continued next page



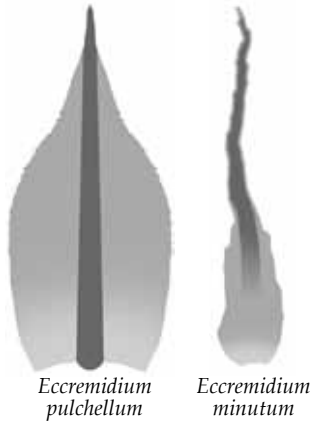
Ditrichum strictum juxtacostal cells mid-sheath
10 μm

continued next page

Key* to the New Zealand species of *Eccremidium* (2)

- 1 Leaves lanceolate, tapering to a subula; costa thin, occupying the larger part of the leaf in the upper half; seta straight, capsule erect..... ● ***Eccremidium minutum***
 1: Leaves broadly ovate, bluntly apiculate or rounded; costa strong above but absent below; seta arcuate, capsule pendent..... ● ***Eccremidium pulchellum***

* based partly on Catcheside, DG (1980): *Mosses of South Australia*. Government Printer, Adelaide. 95.



Eccremidium minutum (Mitt.) I.G.Stone & G.A.M.Scott

form: scattered or in turfs, erect, yellowish, radiculose below, to 2 mm tall
habitat: soil

leaf: size: 1.0–1.5 × 0.2–0.3 mm

shape: subulate, ± flexuose, tapering from an oblong base

tip: acute

base: lower leaf cells long-rectangular, 85–110 × 15–20 μm, thin-walled

costa: ± filling the upper half of the leaf

border: not differentiated

margin: entire below, serrulate above, plane

cells: 60–80 × 8–12 μm, long-rectangular, thin-walled, smooth

capsule: 0.3 mm in diam., spherical, emergent, pendent, cleistocarpous, reddish;
 seta 0.2 mm, curved at the apex; calyptra conic-mitrate, acuminate and darkened toward the apex; operculum and peristome absent



shoots (dry on far left), immature capsule, leaf outline, leaf apex, and leaf subapex
 1 mm, 1 mm, 0.1 mm, 0.1 mm, 10 μm, 10 μm



subula near its base, margin lower leaf, and leaf basal angle
 10 μm, 10 μm, 10 μm

continued next page

Eccremidium pulchellum (Hook.f. & Wilson) Müll.Hal.

form: gregarious, erect, ± branched stems, up to 5 mm tall

habitat: soil in exposed sites

leaf: size: 1.2–2.5 mm

shape: ± triangular to lanceolate and ovate

tip: bluntly apiculate to cuspidate or subulate

base: basal cells short-rectangular to subquadrate, thin-walled

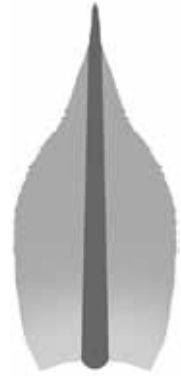
costa: excurrent, ± filling the cusp or subula

border: not differentiated

margin: entire to serrulate, adjacent cell ends projecting in pairs, plane

cells: 20–50 × 10–15 μm, irregularly rhombic, firm- to thick-walled, smooth

capsule: 0.3 mm, spherical, erect, emergent, brown, cleistocarpous, dehiscent at about mid-capsule; seta 0.2 mm; calyptra dark yellow, conic-mitrate, acuminate, blackish above, not flared below; spores 60–80 μm in diam.



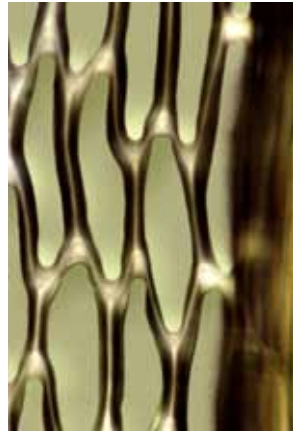
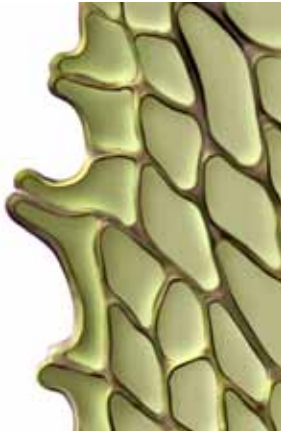
vegetative shoots (dry) (2), leaf outline, and leaf apex (2)

1 mm (2),

0.5 mm,

50 μm,

50 μm



margin upper leaf, justacostal cells midleaf, and leaf basal angle

10 μm,

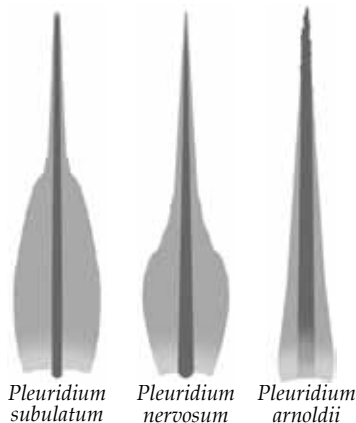
10 μm,

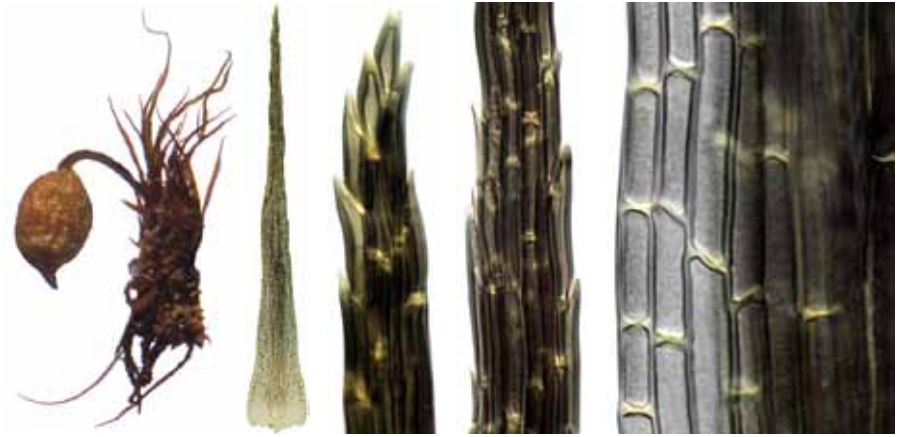
50 μm

Key* to the New Zealand species of *Pleuridium* (3)

- 1 Seta curved..... ● ***Pleuridium arnoldii***
 1: Seta straight or nearly so..... 2
- 2(1): Capsule long-beaked..... ● ***Pleuridium subulatum***
 2: Capsule short-pointed..... ● ***Pleuridium nervosum***

* based partly on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*. RSNZ Bull. 5, 69.



Pleuridium arnoldii (R.Br.bis) Paris**form:** tufted, minute, densely foliate, silky, branched stems, up to 2 mm tall**habitat:** exposed soil, especially disturbed sites in pastures or on cutbanks, from mid- to high-montane elevations**leaf:** size: to 2×0.3 mm*shape:* lanceolate-subulate from a concave base*tip:* long-acuminate, ending in a bluntly acute tip*base:* undifferentiated*costa:* percurrent to excurrent, almost filling the subula*border:* not differentiated*margin:* entire below, denticulate in the subula, plane*cells:* $20\text{--}50 \times 8\text{--}12$ μm , narrowly oblong, firm-walled, smooth**capsule:** 0.5 mm in diam., nearly globose, apiculate, erect, protruding from among the leaves, cleistocarpous, long-beaked seta strongly arched; calyptra cucullate; operculum absent; peristome absent; spores 30 μm in diam.

fertile shoot, leaf outline, leaf apex, leaf subapex, and margin midleaf

 0.5 mm, 0.1 mm, 10 μm , 10 μm , 10 μm


cells midleaf, costa midleaf, and margin near leaf base

 10 μm , 10 μm , 10 μm

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Pleuroidium nervosum (Hook.) Mitt.

form: loose to dense mats of small (3–5 mm tall), unbranched, comose stems
habitat: bare exposed soil

leaf: size: 0.5–3 × 0.3–0.7 mm

shape: ± subulate from an ovate or ovate-lanceolate base

tip: acute to long-acuminate

base: undifferentiated

costa: percurrent to excurrent

border: not differentiated

margin: entire below, crenate to denticulate above, plane

cells: 20–50 × 10–12 μm, rectangular to rhombic, firm-walled, smooth

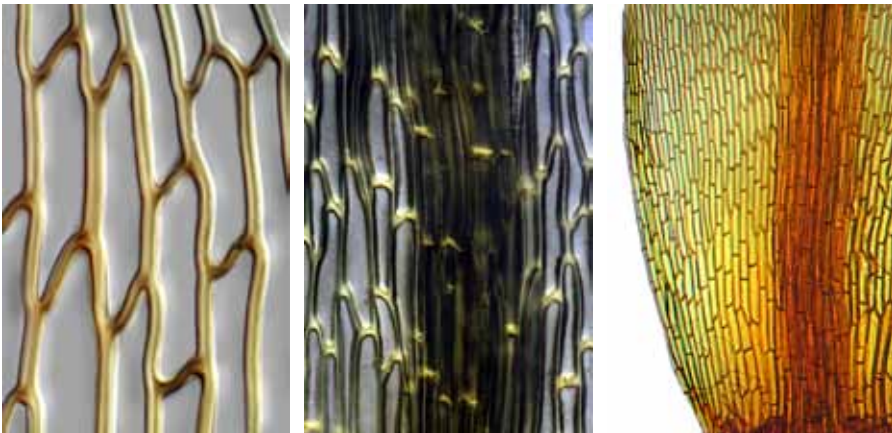
capsule: 1 mm in diam., ovoid to globose, erect, immersed, cleistocarpous, orange- to chestnut-coloured, apiculate; seta 1 mm long

notes: *Acaulon integrifolium* also has a reddish capsule, but differs in having wider leaves and leaf cells, and a capsule that's not apiculate



fertile shoots (2), capsule, leaf outline, leaf apex, and margin midleaf

1 mm, 1 mm, 0.5 mm, 0.5 mm, 30 μm, 10 μm



cells midleaf, costa midleaf, and leaf basal angle

10 μm, 50 μm, 50 μm

continued next page



Pleuridium nervosum costa midleaf
10 μm

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Pleuroidium subulatum (Hedw.) Rabenh.

form: gregarious to tufted, yellow-brown, erect, sparsely branched, to 3 mm tall
habitat: exposed soil in lawns, old fields, pastures, cemeteries, and roadsides

leaf: size: to 1.5–4 mm, ± homomallous

shape: long-setaceous from an oblong or ovate sheathing base

tip: subulate

base: cells of sheathing base short-rectangular, thin-walled

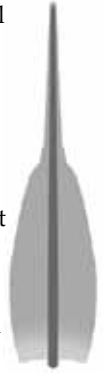
costa: stout, wide at the base, ± filling the subula

border: not differentiated

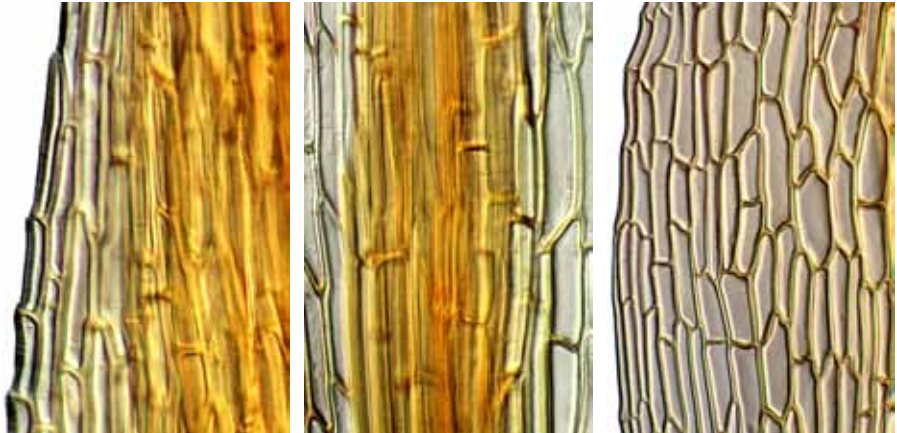
margin: serrulate above, the marginal wall thickened, tubulose above, sinuose at the shoulder, plane

cells: 20–70 × 5–8 μm, linear-flexuose, firm-walled, smooth

capsule: 0.6–0.8 mm, ovoid to subglobose, orange-brown, apiculate, cleistocarpous, stomatose throughout; seta 0.4–1 mm; calyptra cucullate; operculum absent; peristome absent; spores 24–41 μm in diam.

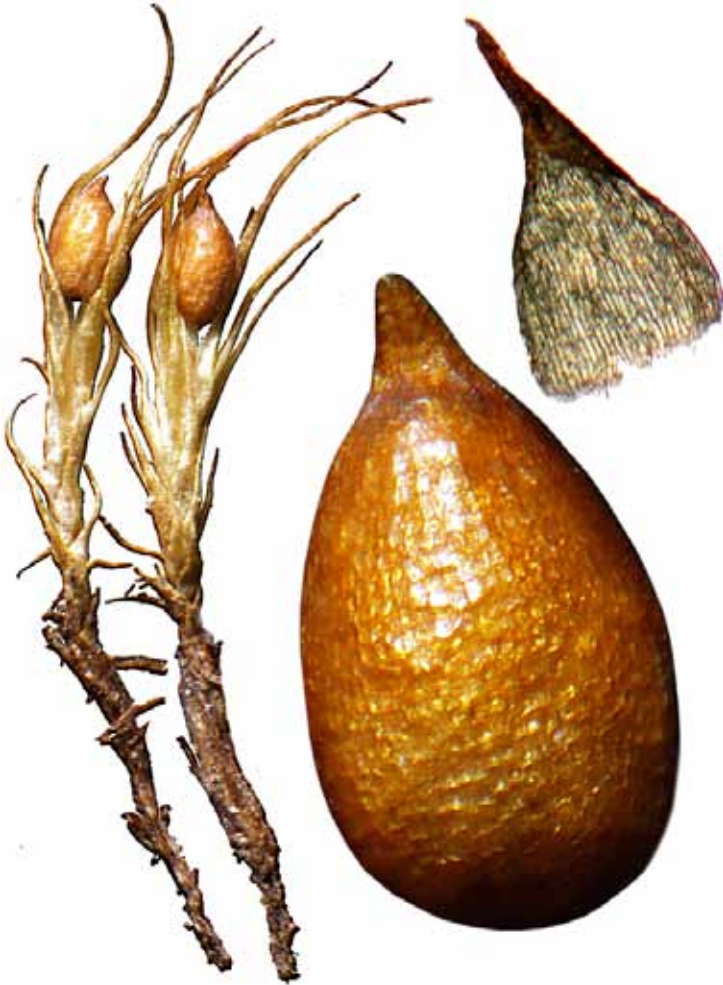


fertile shoots (dry) (4), leaf outline, subula, subapex, and thickened marginal cell walls
 1 mm (2), 1 mm (2), 0.1 mm, 0.1 mm, 50 μm, 10 μm



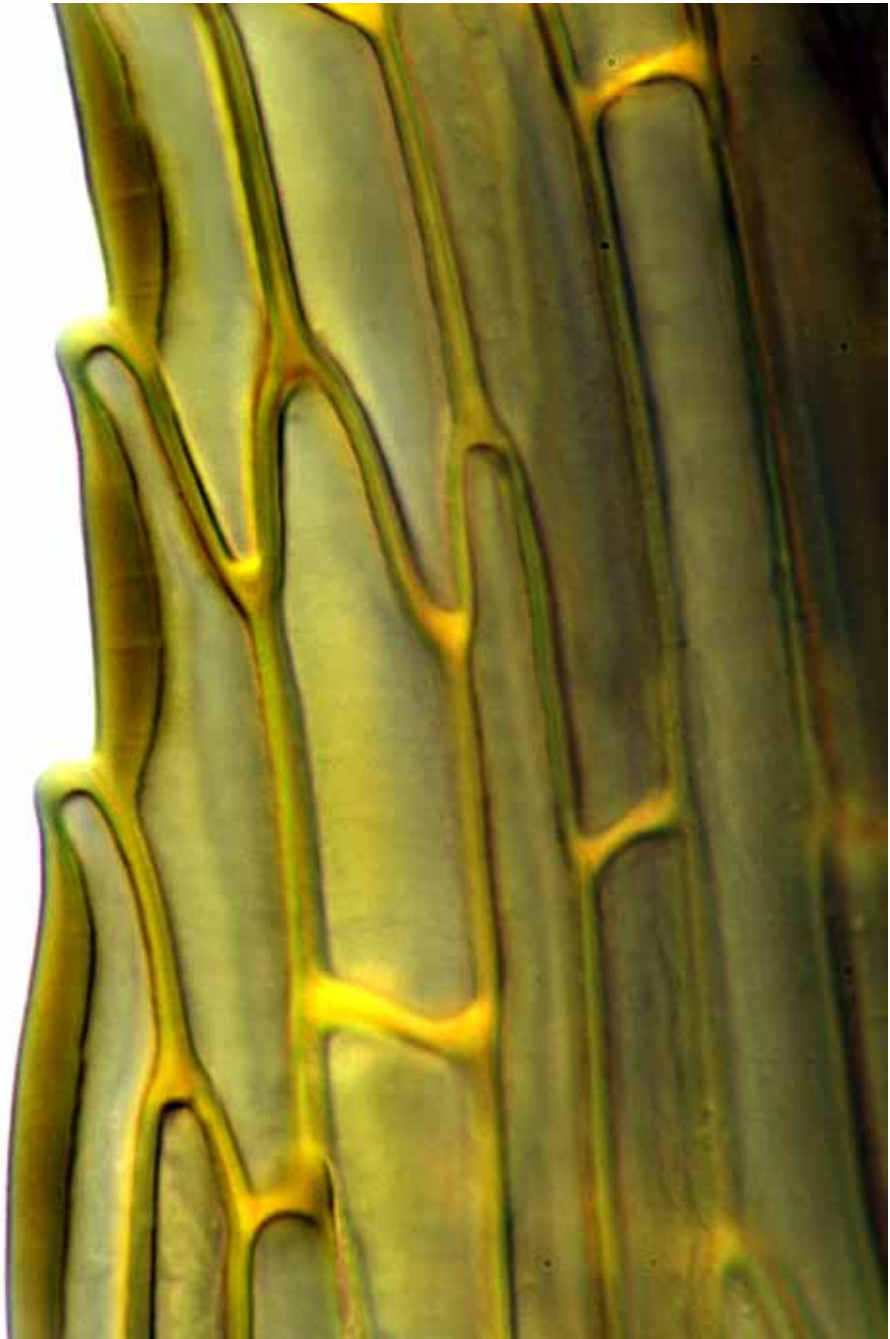
margin midleaf, costa midleaf, and margin near leaf base
 10 μm, 10 μm, 10 μm

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Pleuridium subulatum fertile shoots (dry), apiculate cleistocarpous capsule, and calyptra
1 mm, 0.1 mm (2)

continued next page



Pleuridium subulatum thickened marginal cell walls
10 μm

continued next page

Saelania glaucescens (Hedw.) Broth. ex Bom. & Broth.

form: tufted, soft, glaucous blue-green, glossy, erect, freely branched stems, with hyaline radicles in the leaf axils, up to 10 mm tall

habitat: rock crevices or rarely bark

leaf: size: 2–2.5 mm

shape: narrowly ovate-lanceolate or oblong-lanceolate

tip: acute to acuminate

base: basal cells shorter and wider than the other blade cells

costa: strong, terete, percurrent

border: not differentiated

margin: irregularly serrate above, recurved

cells: 80–150 × 12–15 μm, linear-rhombic, thin-walled, smooth

capsule: 0.6–1 mm, oval or oblong-oval, suberect to horizontal, contracted below the mouth when dry, brown; seta to 10 mm, slender, reddish, flexuose; operculum conic; peristome teeth purple, densely papillose, split into two filiform segments; spores 15–18 μm in diam.



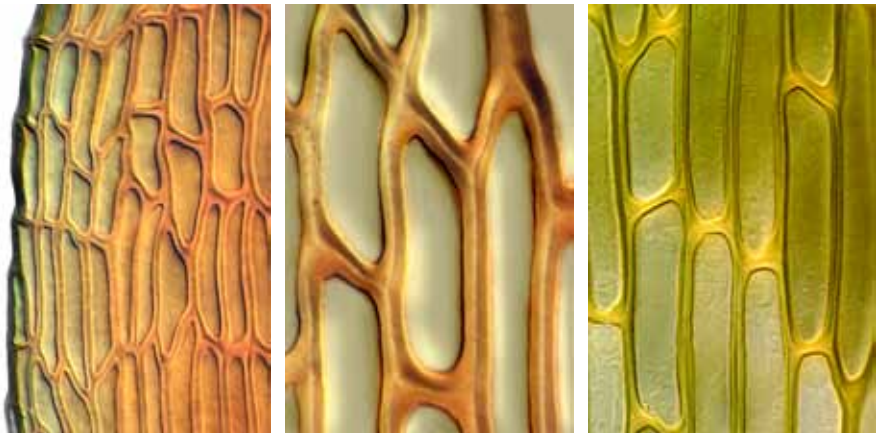
vegetative habit (dry) (2), leaf outline, and leaf apex
 1 mm, 0.5 mm, 0.5 mm, 10 μm



leaf subapex, margin midleaf, and leaf base cells
 50 μm, 10 μm, 10 μm

Trichodon cylindricus (Hedw.) Schimp.**form:** tufted, erect, slender, yellowish, unbranched stems, to 6 mm tall**habitat:** on exposed, bare, acidic soil in \pm disturbed sites such as roadsides**leaf:** size: 1–3 mm*shape:* subulate from a broad sheathing base*tip:* subulate, tubulose*base:* basal cells larger than other cells in the blade*costa:* percurrent to excurrent, filling the distal subula, prorulose abaxially above*border:* not differentiated*margin:* serrulate above, plane*cells:* 17–40 \times 3–5 μm , rectangular, firm-walled, prorulose distally**capsule:** 1.3–2 mm, narrowly cylindrical, exserted, suberect to inclined, \pm curved, smooth, pale brown; seta 5–25 mm, orange; operculum bluntly conic; peristome teeth 240–340 μm tall; spores 11–13 μm in diam.

vegetative shoot, capsule, leaf outline, leaf apices (2), and leaf shoulder margin
 0.5 mm, 0.5 mm, 0.5 mm, 5 μm , 5 μm , 5 μm

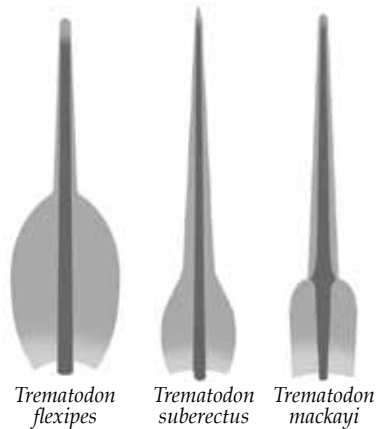


upper shoulder margin, upper shoulder cells, and leaf base cells
 5 μm , 5 μm , 5 μm

Key* to the New Zealand species of *Trematodon* (3)

- 1 Capsule gymnostomous; spores > 50 μm in diam. ● ***Trematodon mackayi***
 1: Capsule peristomate; spores < 40 μm in diam. 2
- 2(1:) Capsule 1.5–2 mm; seta strongly flexuose; peristome teeth 120–180 μm , reflexed when dry ● ***Trematodon flexipes***
 2: Capsule 3–6 mm; seta not flexuose; peristome teeth 300–500 μm , erect when dry ● ***Trematodon suberectus***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*. RSNZ Bull. 5, 94.



Trematodon flexipes Mitt.

form: gregarious, pale to yellowish, erect, unbranched stems, 2–5 mm tall

habitat: exposed soil, gravel, or peat along streams or tarn margins, or along tracks or in other disturbed sites, from lowland to mid-montane elevations

leaf: size: 1.5–2.5 × 0.5–0.6 mm

shape: elliptic to oval sheathing base abruptly narrowed to a long subula

tip: acute

base: basal cells 70–110 × 12–20 μm, rectangular, thin-walled

costa: ± filling the upper subula

border: not differentiated

margin: entire, plane

cells: subula cells 20–50 × 10–15 μm, ± oblong, firm-walled, smooth

capsule: 1.5–2 mm, ovoid, long-necked, ± strumose, erect; seta 2–5 mm, slender, flexuose, pale; operculum rostrate as long as the capsule; calyptra cucullate; peristome teeth vertically striate; spores 30–35 μm in diam.

note: differs from *Trematodon mackayi* in having a peristome



fertile shoots (cleared) (2), leaf outline, leaf apex, and leaf subapex
 ■ 1 mm (2), ■ 0.25 mm, ■ 50 μm, ■ 10 μm



shoulder margin, costa midleaf, and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 50 μm

continued next page

Trematodon mackayi (R.Br.bis) Broth.

form: densely gregarious, pale to yellowish, erect, rarely branched, 2–6 mm tall
habitat: exposed soil, often in disturbed sites, from lowland to mid-montane

leaf: size: 1.5–2(–8) × 0.3–0.4 mm, contorted when dry

shape: subulate, contracting from an oblong, concave, strongly sheathing base

tip: abruptly tapered to a long, narrow subula

base: basal cells 70–110 × 12–20 μm, rectangular, thin-walled. smooth

costa: filling most of the subula, sometimes slightly excurrent

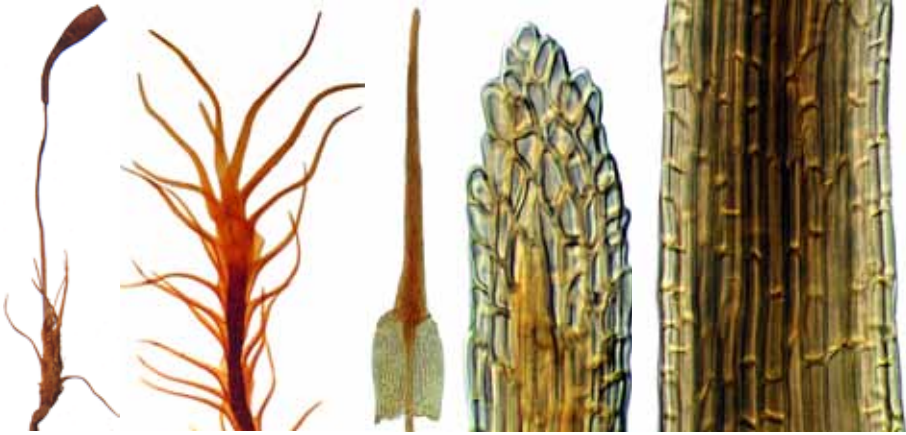
border: not differentiated

margin: entire below, denticulate above, plane

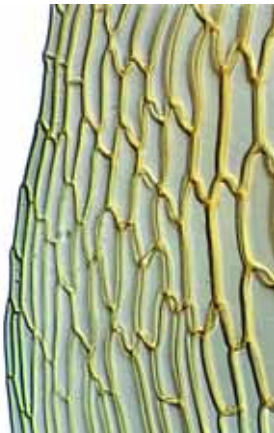
cells: subula cells 20–50 × 10–15 μm, ± oblong, firm-walled, smooth

capsule: 4–5 mm, clavate, suberect, ± curved, long-necked, gymnostomous (peristome reduced to a short hyaline membrane); seta 10–20 mm, slender, weakly flexuose, pale; calyptra 2–4-lobed at the base; operculum finely long-rostrate; spores uncommonly large, 50–70 μm in diam.

notes: differs from *Trematodon flexipes* and *T. suberectus* in lacking a peristome



fertile and vegetative shoots, leaf outline, leaf apex, and subula
 ■ 1 mm, ■ 1 mm, ■ 0.25 mm, ■ 10 μm, ■ 10 μm



margin mid-sheath (2), and margin near leaf base
 ■ 10 μm, ■ 10 μm, ■ 10 μm

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Trematodon suberectus Mitt.

form: densely gregarious, erect, radiculose, sparsely branched stems, 3–6 mm tall
habitat: exposed soil, sand, or gravel in disturbed sites, lowland to mid-montane

leaf: *size:* 2–2.5 mm, contorted when dry

shape: ovate-oblong, gradually narrowed to a flexuose subula

tip: acute

base: sheathing; basal cells $70\text{--}120 \times 12\text{--}20 \mu\text{m}$

costa: reaching the subula apex

border: not differentiated

margin: \pm denticulate toward the apex, entire below, plane

cells: upper cells $10\text{--}15 \mu\text{m}$, oblong to quadrate, thin-walled, smooth

capsule: 3–6 mm, cylindric, long-necked, erect or nearly so, variably curved to arcuate; seta 7–15(–30) mm, thin, pale yellow, \pm flexuose; annulus present; calyptra cucullate; operculum finely long-rostrate; peristome teeth 16, erect, joined at the base to form a low membrane, narrowly lanceolate, unequally split, joined at the tips, vertically striolate; spores $20\text{--}30 \mu\text{m}$ in diam.



vegetative habit (moist), immature capsules (2), peristome teeth, leaf outline, leaf apex
 1 mm, 0.5 mm (2), 50 μm , 0.25 mm, 50 μm



leaf base, costa in upper leaf, and costa near leaf base
 100 μm , 50 μm , 50 μm

Erpodium glaucum (Wilson) I.G.Stone

form: matted, creeping, irregularly branched stems, radiculose below, to 10 mm long, the leaves 4-ranked, dimorphic, weakly complanate, glaucous

habitat: bark of tree trunks and exposed roots, or rotting logs and rock

leaf: size: 0.4–0.7 × 0.5 mm; ventral leaves smaller

shape: dimorphic; dorsolateral leaves ovate; ventral leaves lanceolate

tip: dorsolateral leaves acute, ± apiculate; ventral leaves ± acuminate

base: a few basal cells longer than the other blade cells

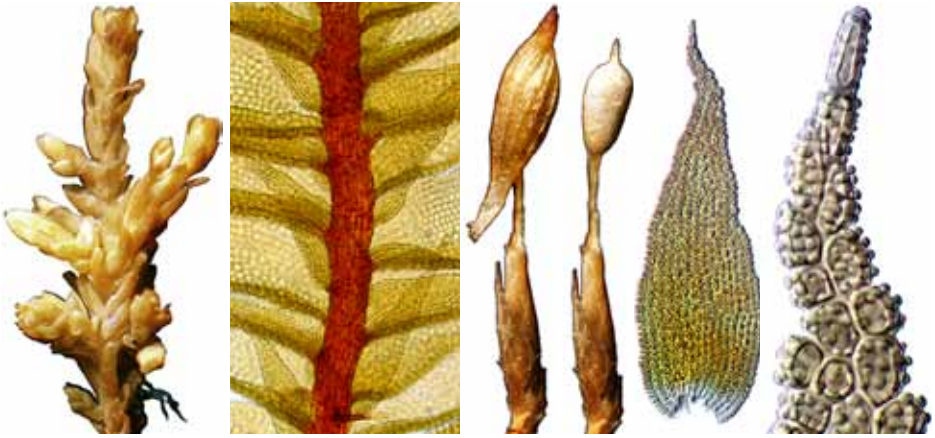
costa: none

border: not differentiated

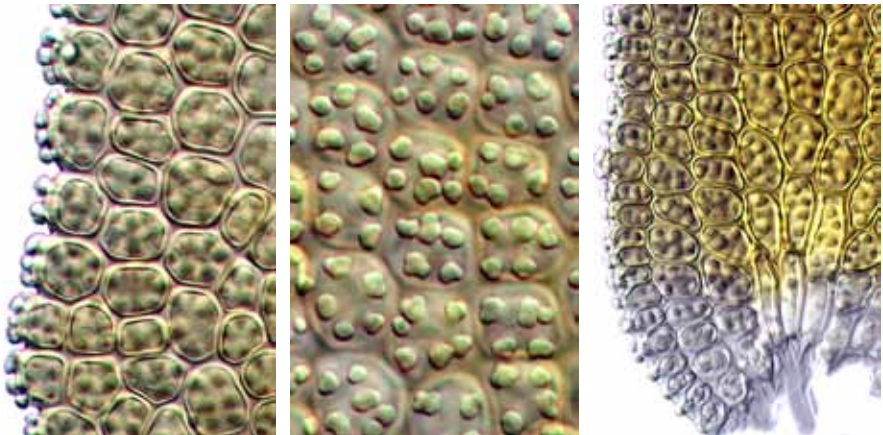
margin: crenulate-papillose, plane

cells: 20–30 μm, rounded-hexagonal, thin-walled, bulging, pluripapillose

capsule: 0.3 mm, ovoid, estomate, erect, emergent to exerted, annulus vestigial; seta 0.7–1 mm; calyptra cylindric, plicate, twisted, covering the entire capsule when immature, often clasping the seta below; operculum rostrate; peristome none; spores 32–36 μm in diam.



vegetative shoot (moist), dorsolateral leaves, calyptra, capsule, leaf outline, and leaf apex
 1 mm, 0.1 mm, 1 mm, 1 mm, 0.1 mm, 10 μm

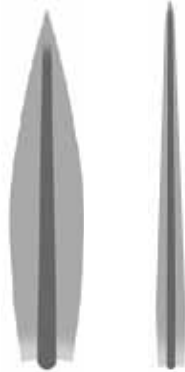


margin midleaf, lamina cell papillae, and leaf basal angle
 10 μm, 10 μm, 10 μm

Key to the New Zealand species of *Amphidium* (2)

- 1 Leaves oblong-lanceolate, 1.2–2.0 mm long ● ***Amphidium lapponicum***
 1: Leaves linear-lanceolate to ligulate, 2.0–3.8 mm long ... ● ***Amphidium cyathicarpum***

* based partly on Beaver, J; Allison, KW; Child, J (1992): *The Mosses of New Zealand*. University of Otago Press, Dunedin.



*Amphidium
lapponicum*

*Amphidium
cyathicarpum*

Amphidium cyathicarpum (Mont.) Broth.**form:** densely tufted, soft, dull, yellowish, simple or branched, 10–30 mm tall**habitat:** damp, shaded, usually acidic rock walls near streams at high altitude**leaf:** size: 2.5–4.0 × 0.2 mm**shape:** linear-lanceolate to ligulate, carinate, crisped when dry**tip:** acute**base:** basal cells oblong, firm-walled, and hyaline; alar cells not differentiated**costa:** subpercurrent or disappearing in the apex, yellow**border:** not differentiated**margin:** irregularly denticulate above, plane or narrowly revolute below**cells:** 9–12 μm, subquadrate, incrassate, multi low-papillose**capsule:** 1–1.5 mm, oval to pyriform, emergent, deeply 8-grooved and wide-mouthed when empty; seta 1.0–2.0 mm, straight or flexuose; peristome none; spores 11–15 μm in diam.**note:** differs from species of *Anoetangium* and *Zygodon* in having deuters (guide cells) in the centre of its costa cross-section

fertile shoots (dry) (3), capsule (dry), leaf outline, and leaf apex

1 mm, 1 mm, 1 mm, 1 mm, 0.25 mm, 5 μm



margin midleaf, and lamina surface papillae (2)

10 μm, 10 μm, 10 μm

Amphidium lapponicum (Hedw.) Schimp.

form: densely tufted, erect, dark green or brown stems, the leaves curled and contorted when dry, to 15 mm

habitat: damp acidic rock, in crevices or below overhangs, to 1500 m

leaf: size: 2–3 mm

shape: narrowly oblong-lanceolate; crispate when dry

tip: acute

base: basal cells somewhat enlarged, firm-walled, hyaline or pale yellow

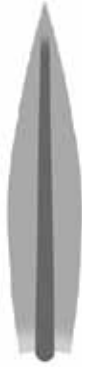
costa: subpercurrent

border: not differentiated

margin: entire, plane

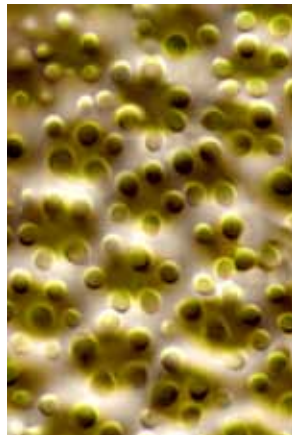
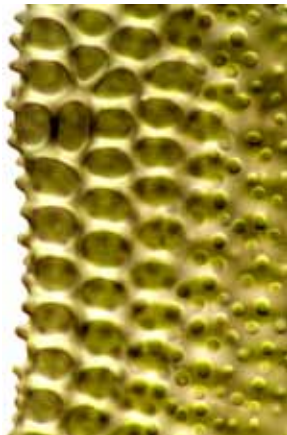
cells: 9–12 μm , isodiametric, thick-walled, densely warty-papillose

capsule: 0.8–1.3 mm, oblong to pyriform, half-emergent, erect, 8-ribbed at maturity, the mouth flared when dry and empty; seta 1–1.5 mm; calyptra cucullate; operculum obliquely short-rostrate; peristome none; spores 12–15 μm in diam.



vegetative and fertile shoots (3), leaf outline, and leaf apex

1 mm, 0.5 mm, 0.5 mm, 0.5 mm, 10 μm



margin midleaf, lamina papillae (detail), and leaf base

10 μm , 10 μm , 50 μm

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Amphidium lapponicum fertile shoot and immature capsule with calyptra

1 mm (left),

0.5 mm (right)

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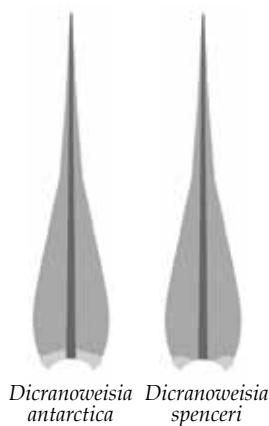
Amphidium lapponicum leaf apex showing papillae
10 μ m

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Key* to the New Zealand species of *Dicranoweisia* (2)

- 1 Alar cells conspicuous; capsule exannulate and astomatose; peristome teeth entire and coarsely papillose ● ***Dicranoweisia antarctica***
 1: Alar cells only weakly developed; capsule annulate and stomatose; peristome teeth deeply bifid and finely papillose above, striolate below ● ***Dicranoweisia spenceri***

* based partly on Scott, GAM; Stone, IG; Rosser, C (1976): *The Mosses of Southern Australia*. Academic Press, London. 158.



Dicranoweisia antarctica (C.M.) Paris

form: dense cushions of simple or branched stems, not tomentose, yellowish above, brown below, 15–40 mm tall

habitat: on acidic rock or soil over rock, in exposed sites, to 2600 m

leaf: size: 2–4 × 0.4–1.0 mm

shape: flexuose subula from an ovate-lanceolate base, concave to tubulose

tip: acute, strongly crisped and corkscrewed when dry

base: alar cells numerous, coloured, inflated, weakly auriculate

costa: shortly excurrent in the subula

border: not differentiated

margin: entire, plane

cells: 4–6 μm, ± quadrate, incrassate, smooth

capsule: 1.0–1.8 mm, oval to elliptic, erect, symmetric; seta 5–22 mm, slender, yellow; calyptra cucullate; operculum long-rostrate; peristome dicranoid, the teeth lanceolate, orange, inserted below rim; spores 15–24 μm in diam., green

note: widely distributed in high latitudes of both hemispheres



habit (dry), shoot (dry), capsule, leaf outline, leaf apex, and lower leaf margin
 ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 0.5 mm, ■ 10 μm, ■ 10 μm



costa midleaf, leaf basal angle, and alar region detail
 ■ 50 μm, ■ 100 μm, ■ 50 μm

Dicranoweisia spenceri Dixon & Sainsbury

form: densely tufted, yellow-green, erect, seldom-branched stems, to 10 mm tall
habitat: bark and rotting wood in open montane *Nothofagus* forest

leaf: size: 2–5 mm

shape: ovate-lanceolate base gradually narrowing to a long flexuose subula

tip: acute

base: lower cells narrowly linear; alar cells rectangular, orange to red

costa: excurrent in the subula

border: not differentiated

margin: entire, plane

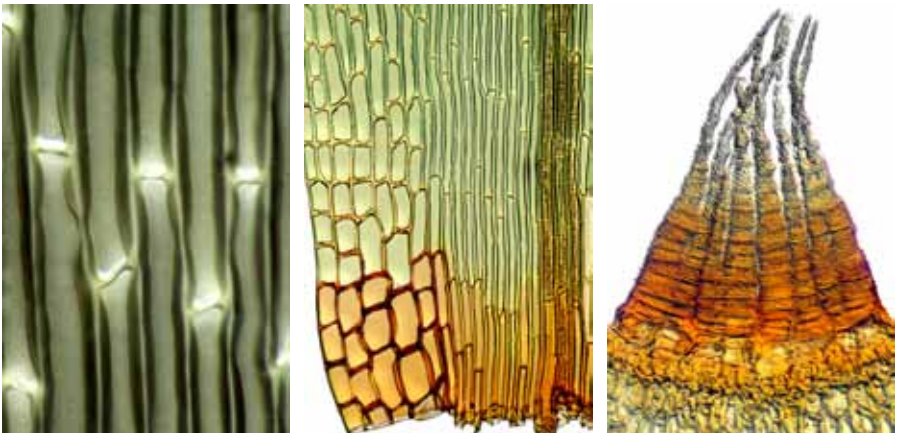
cells: 10–50 × 10 μm, oval to oblong, firm- to thick-walled, smooth

capsule: to 1.3 mm, oval to oblong, erect, exserted, light brown, red-rimmed;
 seta to 10 mm, slender, yellow; operculum long-beaked; calyptra cucullate;
 peristome teeth deeply bifid, striolate below

notes: known from only a few sites; collected recently from the Waihohonu Hut area of Tongariro National Park

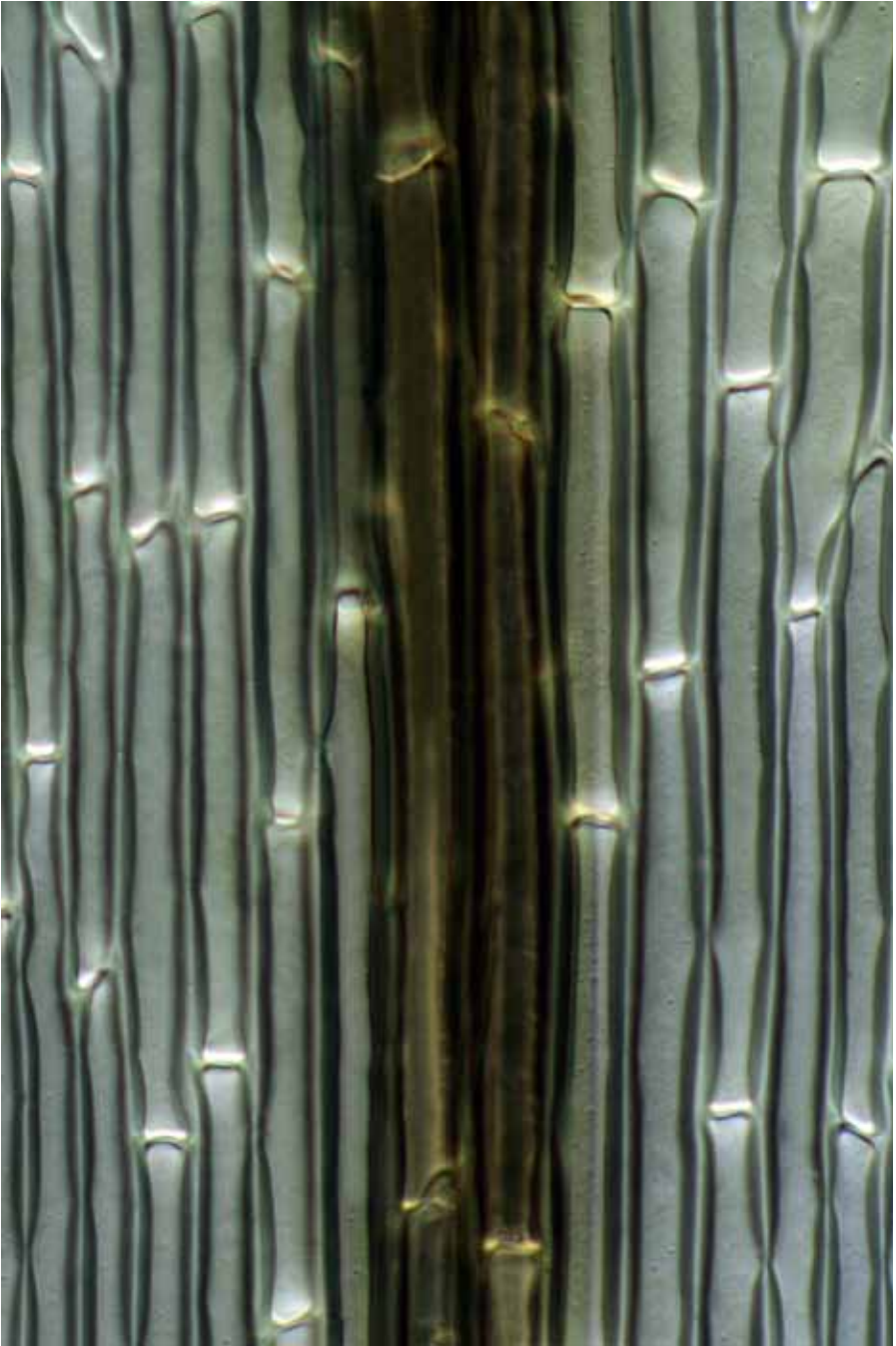


fertile shoot (dry), capsule, peristome, leaf outline, leaf apex, and margin midleaf
 1 mm, 1 mm, 0.5 mm, 0.1 mm, 10 μm, 10 μm



juxtacostal basal cells, leaf basal angle, and 4-tooth peristome fragment
 10 μm, 50 μm, 50 μm

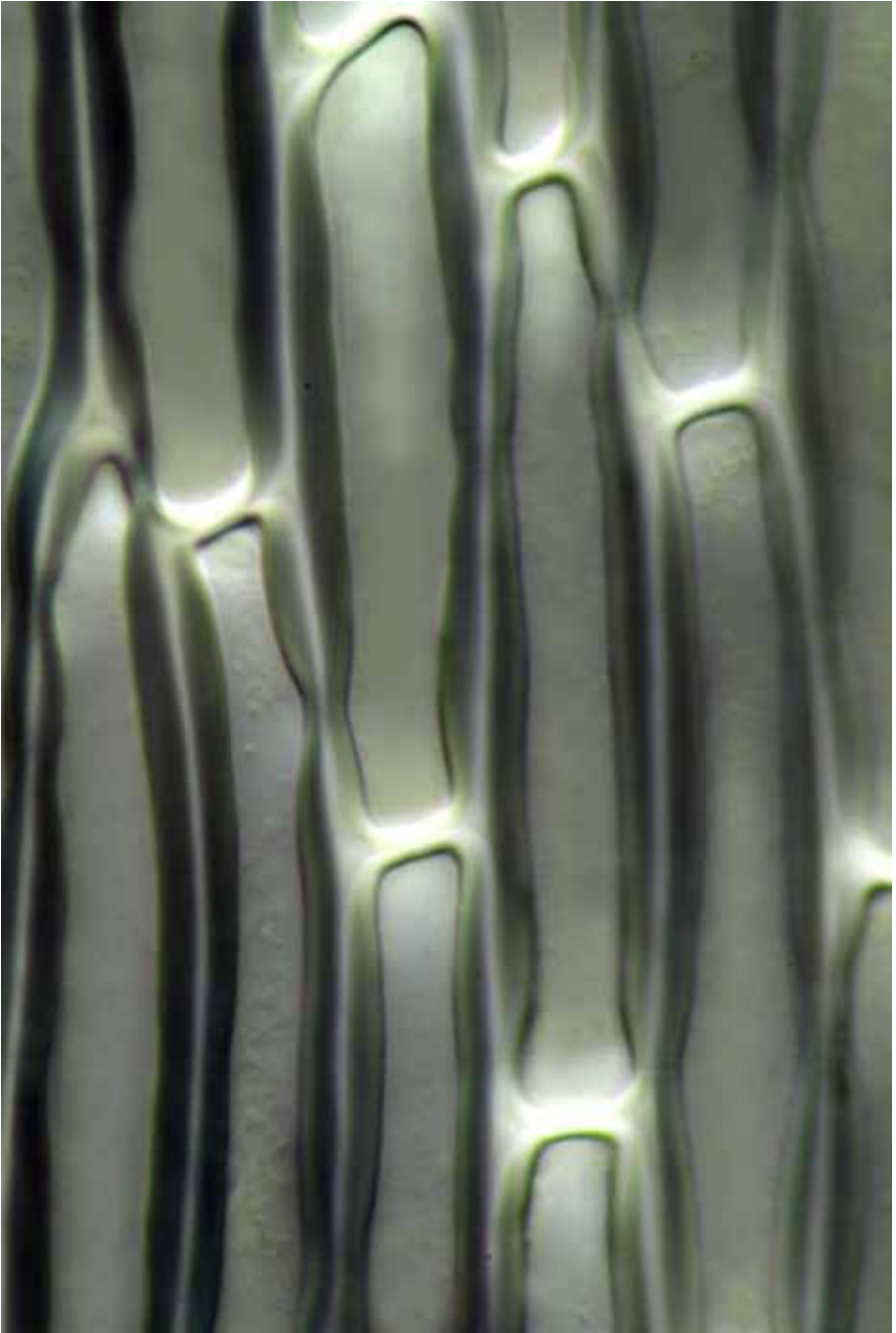
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Dicranoweisia spenceri costa lower leaf

10 μ m

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Dicranoweisia spenceri juxtacostal basal cells
10 μm

Holodontium strictum (Hook.f. & Wilson) Ochyra

form: loosely tufted, erect, dull, golden, \pm unbranched stems, 20–50 mm tall
habitat: wet soil or rock, sometimes submerged

leaf: size: 5–7 mm

shape: subulate from an ovate-lanceolate base, \pm falcate-secund

tip: gradually narrowed to an acute acumen

base: alar cells inflated, coloured, in distinct auricles

costa: excurrent and filling the width of the upper subula

border: not differentiated

margin: entire to slightly dentate near the apex, plane

cells: $50\text{--}90 \times 7\text{--}9 \mu\text{m}$, linear, thick-walled, smooth

capsule: 2–3 mm, narrowly oblong, oval, or subcylindric, erect, sparsely stomatose; seta to 25 mm, red, flexuose; calyptra cucullate, smooth, entire below; operculum long-rostrate; spores papillose



vegetative habit, leaf outline, leaf apex, and margin midleaf
 ■ 5 mm, ■ 0.1 mm, ■ 10 μm , ■ 10 μm



cells midleaf (2) and leaf basal angle
 ■ 10 μm , ■ 10 μm , ■ 10 μm

Kiaeria pumila (Mitt.) Ochyra

form: turves of slender, silky, dark yellow, glossy stems, simple or branched, not tomentose, 6–13 mm

habitat: acidic rock at high elevation, near late snow-melt beds, to 1900 m

leaf: size: 2.8–3.2 × 0.8–1.0 mm

shape: subulate-tubulose from a lanceolate base, falcate-secund

tip: subulate

base: alar cells rectangular to subquadrate, coloured

costa: poorly defined below, excurrent

border: not differentiated

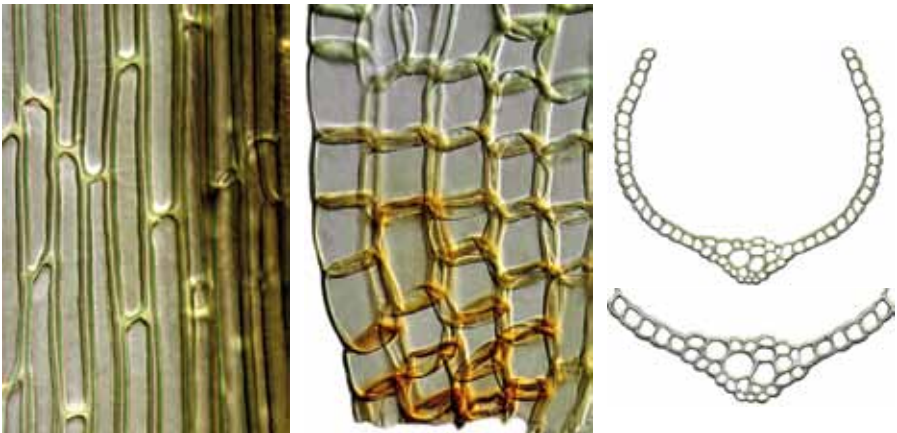
margin: entire, plane

cells: 25–60 × 4–7 μm, rectangular, firm-walled, smooth or mammillate

capsule: 1–1.5 mm, narrowly oblong-cylindric, erect, pale brown, red-mouthed, the neck tapered, annulus persistent; seta 6–11 mm, slender, yellow; operculum finely rostrate; peristome teeth red, vertically striate, split into two pale, papillose halves; spores 15–19 μm in diam.



fertile shoot and capsules (dry) (4), leaf outline, leaf apex (2), and margin midleaf
 ■ 1 mm (2), ■ 1 mm (2), ■ 0.5 mm, ■ 50 μm, ■ 10 μm, ■ 10 μm



linear basal juxtacostal cells, leaf basal angle, and leaf and costa cross-sections
 ■ 10 μm, ■ 10 μm, ■ 50 μm (upper), ■ 10 μm (lower)

Key* to the New Zealand species of *Campylopodium* (2)

- 1 Leaf abruptly narrowed from a wide base; margin entire above.....
 ● ***Campylopodium capillaceum***
- 1: Leaf gradually narrowed from a lanceolate base; margin denticulate above.....
 ● ***Campylopodium lineare***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*. RSNZ Bull. 5, 98.



Campylopodium capillaceum (Hook.f. & Wilson) Fife

form: dense tufts of silky, yellowish, ± branched stems, 5–40 mm, bright green

habitat: soil, often clay, ditches, road cuttings, lake or stream margins, to 1400 m

leaf: size: 3–6.5 × 0.5–0.9 mm, channelled below

shape: long flexuose subula abruptly narrowed from an obovate, ± sheathing base

tip: acuminate

base: cells of the sheath 40–50 × 5–6.5 μm, firm-walled

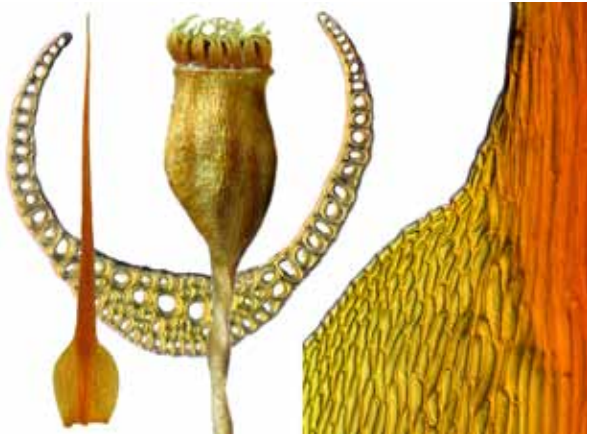
costa: narrowed at the leaf base, filling the subula above

border: not differentiated

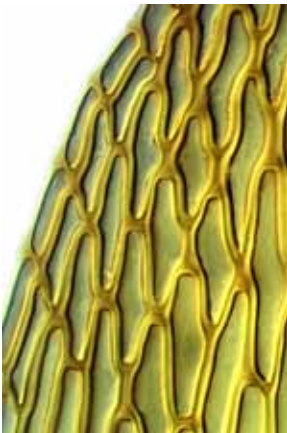
margin: entire or ± finely denticulate, plane

cells: upper cells 12–21 × 6 μm, rectangular to rhombic, firm-walled, smooth

capsule: 0.8–1.5 mm, oval or wide-fusiform, ± strumose, emergent, sulcate when dry; stomata superficial; seta 3–6 mm, cygneous when moist, flexuose when dry; calyptra cucullate; operculum long-rostrate; peristome dicranoid, the teeth 16 in a single row, deeply forked, papillose above and vertically pitted-striolate below; spores 22–30 μm in diam.

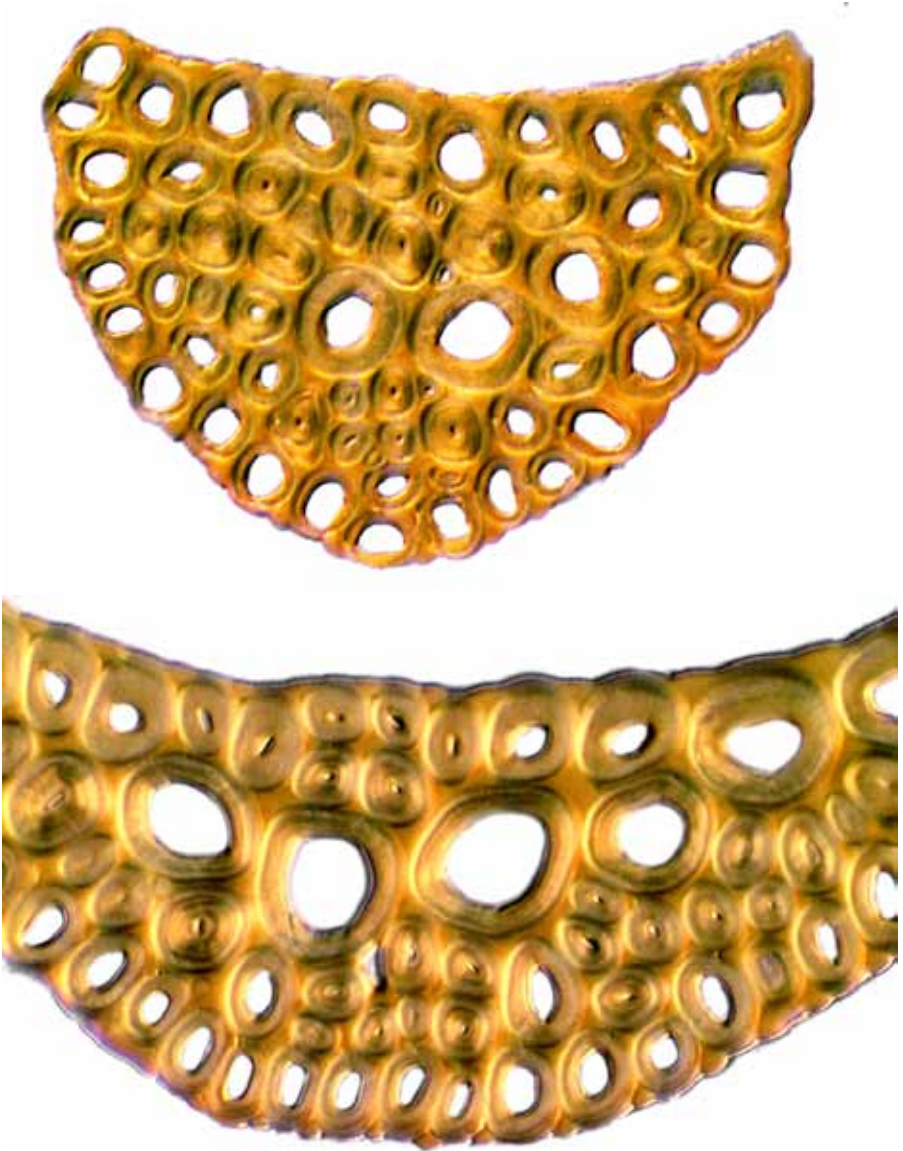


fertile habit, leaf cross-section, leaf outline, capsule, and shoulder / subula junction
 1 mm, 50 μm, 1 mm, 0.5 mm, 10 μm



shoulder margin, subula margin, and sheathing base cells
 10 μm, 10 μm, 10 μm

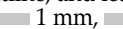
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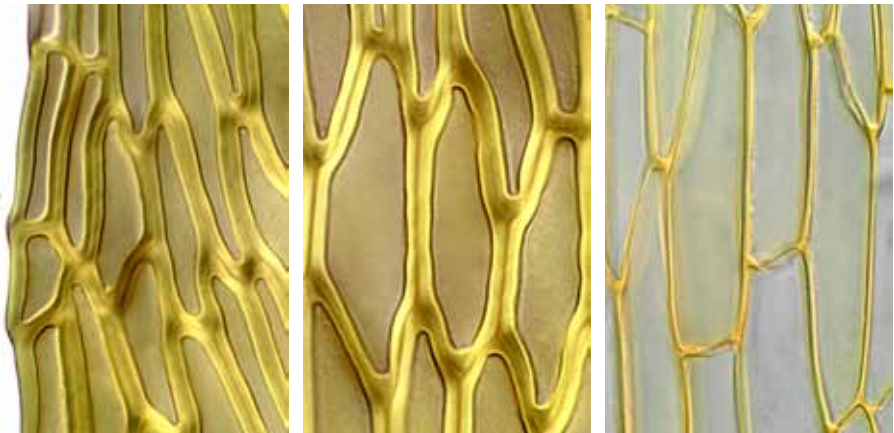


Campylopodium capillaceum cross-section through leaf subula (above) and sheath (below)
10 μm , 10 μm

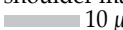
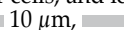
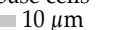
Campylopodium lineare (Mitt.) Dixon**form:** tufts of branched stems, radicle below, 2–5 mm tall**habitat:** soil on tracks, roadsides, railway banks, or over rock, to 1200 m**leaf:** size: 1.5–2.5 × 0.5–0.8 mm**shape:** subulate, gradually narrowed from an ovate-lanceolate, non-sheathing base**tip:** acute**base:** cells of the sheath 40–80 × 8–10 μm, thin-walled; no distinct alar region**costa:** percurrent to excurrent, nearly filling the subula, spinulose abaxially**border:** not differentiated**margin:** entire or crenulate below, serrulate toward the apex, plane**cells:** upper cells 20–30 × 6–8 μm, rhombic, firm-walled, smooth**capsule:** 0.8–1.0 mm, ovoid, narrowed below the mouth, furrowed and urceolate when dry; seta 3–5 mm, cygneous when moist, flexuose when dry; operculum rostrate; peristome teeth split, striate below, hyaline above; spores 21–24 μm**notes:** differs from *Dicranella* in its cygneous seta, and from *Campylopus* in its narrow costa and long subulate leaves

fertile shoot (dry), mature capsule, leaf outline, and leaf apex (2)

 1 mm,
  1 mm,
  1 mm,
  10 μm,
  10 μm



shoulder margin, shoulder cells, and leaf base cells

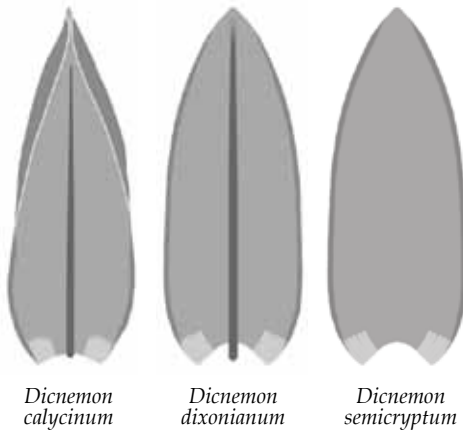
 10 μm,
  10 μm,
  10 μm

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Key* to the New Zealand species of *Dicnemon* (3)

- 1 Leaves ecostate, not rhizoidal at the base..... ● ***Dicnemon semicryptum***
 1: Leaves costate, often rhizoidal at the base 2
- 21(1:) Uppermost perichaetial bracts tapered, overtopping the capsule
 ● ***Dicnemon calycinum***
 2: Uppermost perichaetial bracts blunt, not overtopping the capsule
 ● ***Dicnemon dixonianum***

* based partly on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bulletin 5, 136.



Dicnemon calycinum (Hook.) Schwägr.

form: densely tufted, golden green, creeping, branched stems, to 40 mm
habitat: bark in montane *Nothofagus* forest

leaf: size: 2–2.5 × 0.5–0.6 mm

shape: oblong-lanceolate, concave below, with short rhizoid growths

tip: acute, cucullate at the apex; perichaetial leaf tips tapered

base: alar cells conspicuous, pigmented, subquadrate, incrassate

costa: failing below the apex

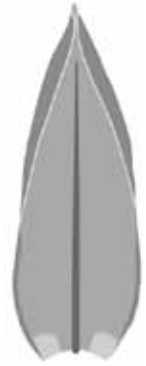
border: 1–3 rows of long, narrow, hyaline cells

margin: entire, plane below, incurved above

cells: 20–70 × 10–15 μm, irregular, incrassate, porose, smooth

capsule: 3 mm, calyptra side-split; subcylindric, curved, ± asymmetric, ± strumose, mouth oblique, immersed, erect to inclined; seta 4–5 mm; spores multicellular, to 250 μm long

notes: differs from *Dicnemon dixonianum* in having a cucullate calyptra, tapered perichaetial leaf tips, and ± immersed capsules



fertile habit, capsule, leaf outline with laminal rhizoids, and cucullate leaf apex
 1 mm, 0.5 mm, 0.5 mm, 50 μm



border lower leaf, cells midleaf, and leaf basal angle
 10 μm, 10 μm, 50 μm

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Dicnemon calycinum capsules with calyptrae
1 mm

continued next page

Dicnemon dixonianum B.Allen

form: densely tufted, golden green, creeping, branched stems, to 40 mm
habitat: bark in *Nothofagus* montane forest

leaf: *size:* 1.5–2 mm, short adventitious rhizoids near the base

shape: oblong to lanceolate

tip: acute, convolute; perichaetial leaf tips blunt

base: alar cells coloured, subquadrate, incrassate

costa: failing below the apex

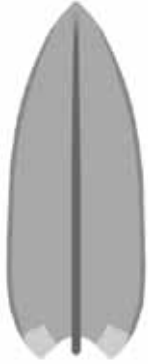
border: narrow, 1–2 rows of long hyaline cells

margin: entire, plane

cells: 30–40 × 10 μm, elongate, porose, smooth

capsule: 3 mm, subcylindric, curved, ± asymmetric, ± strumose, mouth oblique, emergent, erect to inclined; seta 4–5 mm; calyptra mitrate, scabrose

notes: differs from *Dicnemon calycina* in having a mitrate and scabrose calyptra, obtuse perichaetial leaf tips, and emergent capsules



fertile habit, capsules (2) and calyptra, perichaetial leaf apices, and leaf outline
 1 mm, 1 mm (2), 0.5 mm, 0.5 mm



margin midleaf, cells midleaf, and basal leaf cells
 10 μm, 10 μm, 10 μm

Dicnemon semicryptum C.Müll.

form: densely matted, creeping, tangled, branched stems, to 40 mm long
habitat: bark in *Nothofagus* montane forest

leaf: size: 2 mm

shape: oblong-lanceolate, concave below

tip: acute, ± convolute at the apex

base: alar cells conspicuous, pigmented, subquadrate, large, thin-walled

costa: none

border: 1–3 rows of long, narrow, hyaline cells

margin: entire, plane below, convolute above

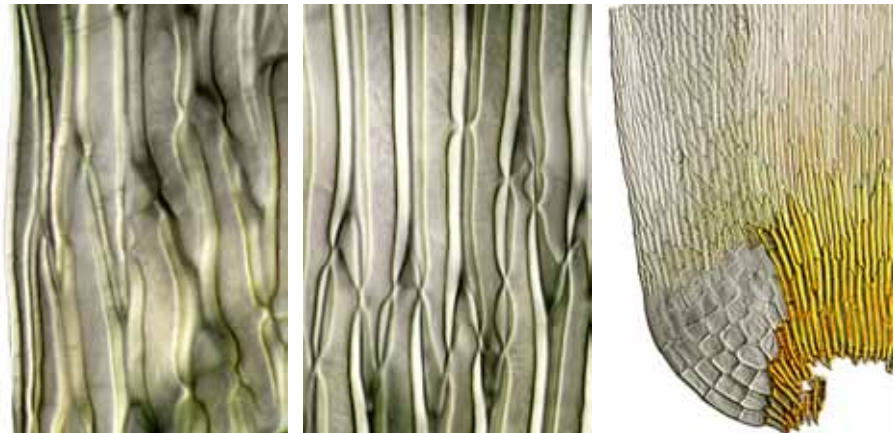
cells: 20–70 × 10–15 μm, irregular, incrassate, porose, smooth

capsule: to 3 mm; subcylindric, curved, ± asymmetric, not strumose, suberect; seta 4–5 mm; calyptra mitrate

note: differs from *Dicnemon calycinum* and *Dicnemon dixonianum* in lacking a costa and having rhizoidal growths on the leaf base



fertile shoot, capsule with calyptra, calyptra, leaf outline, and leaf apex
 ■ 1 mm, ■ 0.5 mm, ■ 1 mm, ■ 0.5 mm, ■ 50 μm



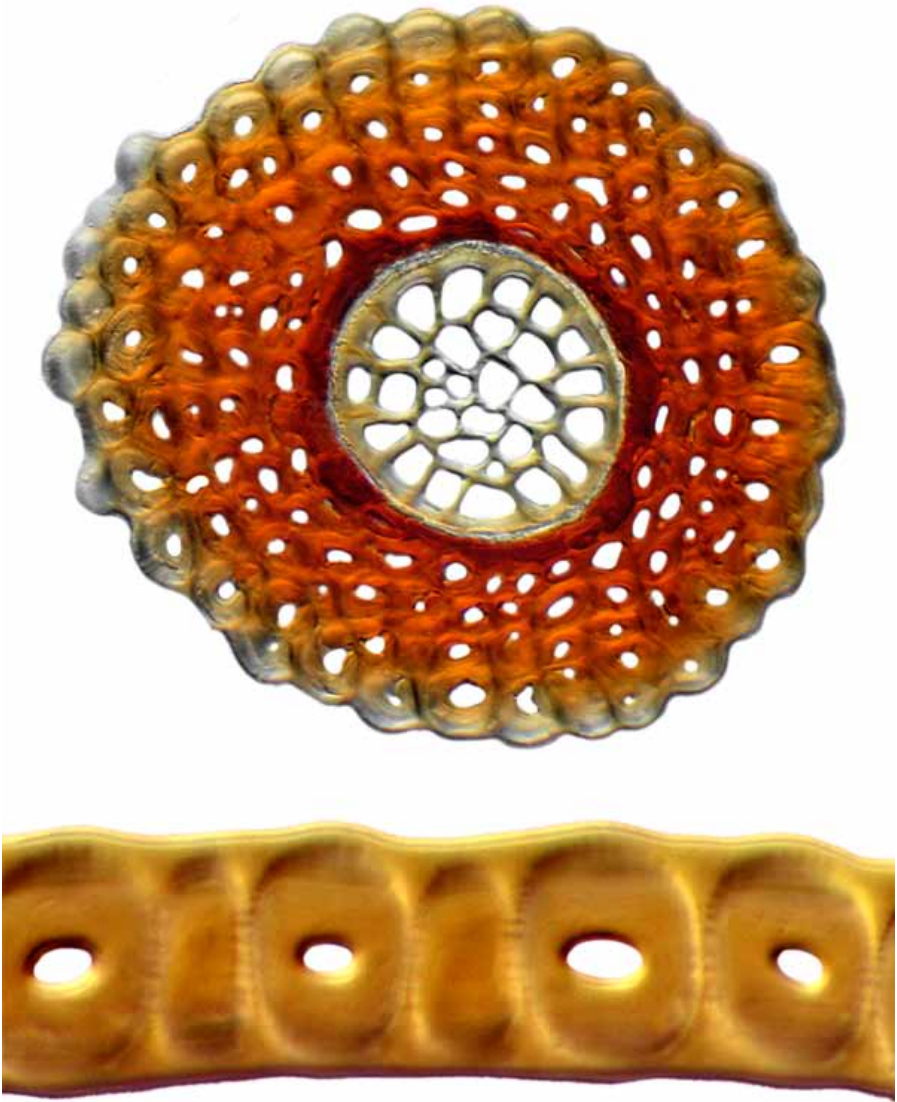
margin near leaf base, central cells just above leaf base, and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 50 μm

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Dicnemon semicryptum porose cells near lower leaf margin
10 μm

continued next page



Dicnemon semicryptum calyptra and seta (above) and leaf (below) cross-sections
10 μm (above), 10 μm (below)

Key* to the New Zealand species of *Dicranella* (6)

- 1 Base of upper leaves not sheathing 2
 1: Base of upper leaves distinctly sheathing 3
- 2(1) Capsule 0.6–0.9 mm long, erect, symmetric ● ***Dicranella gracillima***
 2: Capsule 1.5 mm, inclined to horizontal, asymmetric ● ***Dicranella heteromalla***
- 3(1:) Stems 5–10 mm tall ***Dicranella schreberiana***
 3: Stems 10–40 mm tall 4
- 4(3:) Leaves 1–2 mm long ● ***Dicranella cardotii***
 4: Leaves 3–4 mm long 5
- 5(4:) Plants on volcanically heated soil; peristome teeth smooth or slightly papillose above, vertically striolate below ● ***Dicranella dietrichiae***
 5: Plants not on volcanically heated soil; peristome teeth papillose throughout ● ***Dicranella vaginata***

* based partly on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bulletin 5, 136.



Dicranella gracillima



Dicranella cardotii



Dicranella schreberiana



Dicranella vaginata



Dicranella dietrichiae



Dicranella heteromalla

Dicranella cardotii (R.Br.bis) Dixon

form: dense curves of \pm unbranched, erect, tomentose stems, 10–70 mm
habitat: wet exposed soil along stream margins, to 1650 m

leaf: size: 1.1–3.5 \times 0.6–0.7 mm

shape: subulate from a wide-shouldered, strongly sheathing base

tip: acute to rounded

base: alar cells not differentiated

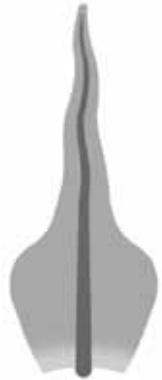
costa: failing just below the apex

border: not differentiated

margin: entire to crenulate, plane

cells: subula cells 8–20 \times 7–12 μm , quadrate to rectangular, firm-walled, smooth; sheath cells 40–80 \times 4–8 μm , linear, firm-walled, mammillose

capsule: 1–1.3 mm, cylindrical, erect, exserted, red-brown, wide-mouthed when dry; seta 5–20 mm, red, erect, flexuose; operculum long-rostrate; peristome dicranoid, the teeth deep red, perforate or split above; spores 21–36 μm in diam., green



habit, vegetative shoot (moist), capsule (dry), leaf outline, and leaf apex
 ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 0.1 mm, ■ 10 μm



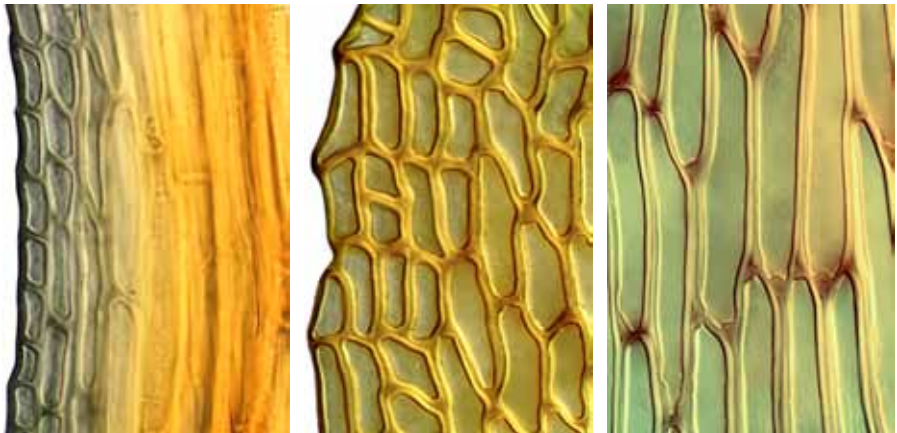
shoulder margin, sheath cells, and leaf basal angle
 ■ 10 μm , ■ 10 μm , ■ 10 μm

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Dicranella dietrichiae (Müll.Hal.) A.Jaeger**form:** curves of erect, unbranched, laxly foliate, yellow-brown stems, to 15 mm**habitat:** volcanically heated soil or open pasture**leaf:** size: 2.0–2.5 × 0.4–0.5 mm*shape:* oblong-ovovate base abruptly contracted to a narrow, flexuose subula*tip:* subulate*base:* sheathing; the sheath cells oblong-rectangular, 15–50 × 6–9 μm, smooth*costa:* weak below, failing below the apex*border:* not differentiated*margin:* crenulate above, entire below, plane above, reflexed at shoulders*cells:* subula cells 20 × 10 μm, short-rectangular, firm-walled, smooth**capsule:** 1.0–1.2 mm, ovate-cylindric, erect, symmetric, pale, sulcate when dry; seta 5–10 mm, slender, pale, flexuose; calyptra cucullate, smooth, naked, the base entire; operculum long-rostrate; peristome dicranoid, the teeth split to the middle, papillose above, vertically striolate below; spores 21–27 μm in diam.

shoot (dry), shoot (cleared), leaf outline, leaf apex, and lower subula margin

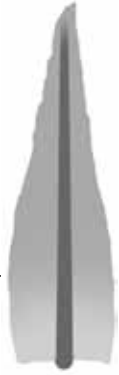
1 mm, 0.5 mm, 0.5 mm, 10 μm, 10 μm



upper subula margin, shoulder of sheathing base, and lower sheath cells

10 μm, 10 μm, 10 μm

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Dicranella gracillima (Beckett) Paris**form:** loose tufts of erect, mostly simple stems, 4–8 mm, the leaves secund**habitat:** clay, silt, or sand along exposed stream or ditch margins, to 800 m**leaf:** size: 1–1.5 mm*shape:* lanceolate to lanceolate-subulate, sometimes slightly curved*tip:* acute*base:* not sheathing; basal cells longer and wider than the other lamina cells*costa:* narrow, percurrent*border:* not differentiated*margin:* entire, plane*cells:* 45–75 × 6–9 μm, ± rectangular, firm-walled, smooth**capsule:** 0.5–1.0 mm, cylindric, erect, symmetric, long-exserted, brown, wide-mouthed when dry; seta 4–8 mm, brown; operculum beaked, shorter than the capsule; peristome single, teeth red, vertically striolate, partly cleft, the two segments papillose above and pale; spores 12–15 μm in diam.

vegetative shoots (dry) (4), leaf outline, and leaf apex (2)

1 mm (4), 0.1 mm, 50 μm, 50 μm



margin midleaf, costa upper leaf, and leaf basal angle

10 μm, 50 μm, 50 μm

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Dicranella heteromalla (Hedw.) Schimp.

form: tufts of ± forked stems, 4–7 mm, the leaves yellow to dark green, shiny, falcate-secund

habitat: soil of tracksides and roots of wind-felled trees in shady forest

leaf: size: 2–3 × 0.2 mm

shape: narrowly triangular, tapering to a slender subula ± filled with the costa

tip: bluntly acute

base: not sheathing, alar cells not differentiated

costa: filling a third of the leaf width at the base, excurrent, filling the subula

border: not differentiated

margin: entire below, faintly serrulate above, plane

cells: 15–40 × 6 μm, narrowly rectangular, firm-walled, smooth

capsule: 1–1.5 mm, curved, asymmetric, with a tapered neck, inclined to horizontal, exserted, reddish brown, furrowed and contracted below the mouth when dry; mouth distinctly oblique; seta 6 mm, yellowish; operculum beak long and curved; spores 14–18 μm in diam., minutely roughened



fertile shoot (dry and moist) (3), leaf outline, capsule with operculum, and leaf apex
 ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 0.5 mm, ■ 10 μm



margin midleaf, margin of shoulder, and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 10 μm

Dicranella vaginata (Hook.) Cardot

form: dense tufts of erect, simple or branched stems, to 150 mm; leaves distant
habitat: sand and rock (limestone, mudstone, or sandstone) along streambanks or in ditches, to 830 m

leaf: size: 1.0–3.5 × 0.5–0.7 mm

shape: subulate, narrowing from an oblong-obovate, pale, sheathing base

tip: obtuse, with several blunt irregular teeth

base: sheathing, shouldered, the sheath cells linear, 75–95 × 6–9 μm

costa: 70–100 μm wide, filling the subula, failing below the apex

border: not differentiated

margin: entire, plane

cells: 60–120 × 8–12 μm, linear, firm- to thick-walled, smooth

capsule: 1.3–1.8 mm, elliptic-ovate, erect, exserted, dark brown, glossy when dry; seta to 14 mm, reddish, slender, ± flexuose; operculum beak long and slanted; calyptra cucullate; peristome single, dicranoid, the teeth fused at the base, ± cracked, perforate, and papillose above; spores 21–30 μm in diam.



vegetative shoot (dry), leaf outline, leaf apex, leaf shoulder, and margin midleaf
 1 mm, 0.5 mm, 50 μm, 50 μm, 50 μm



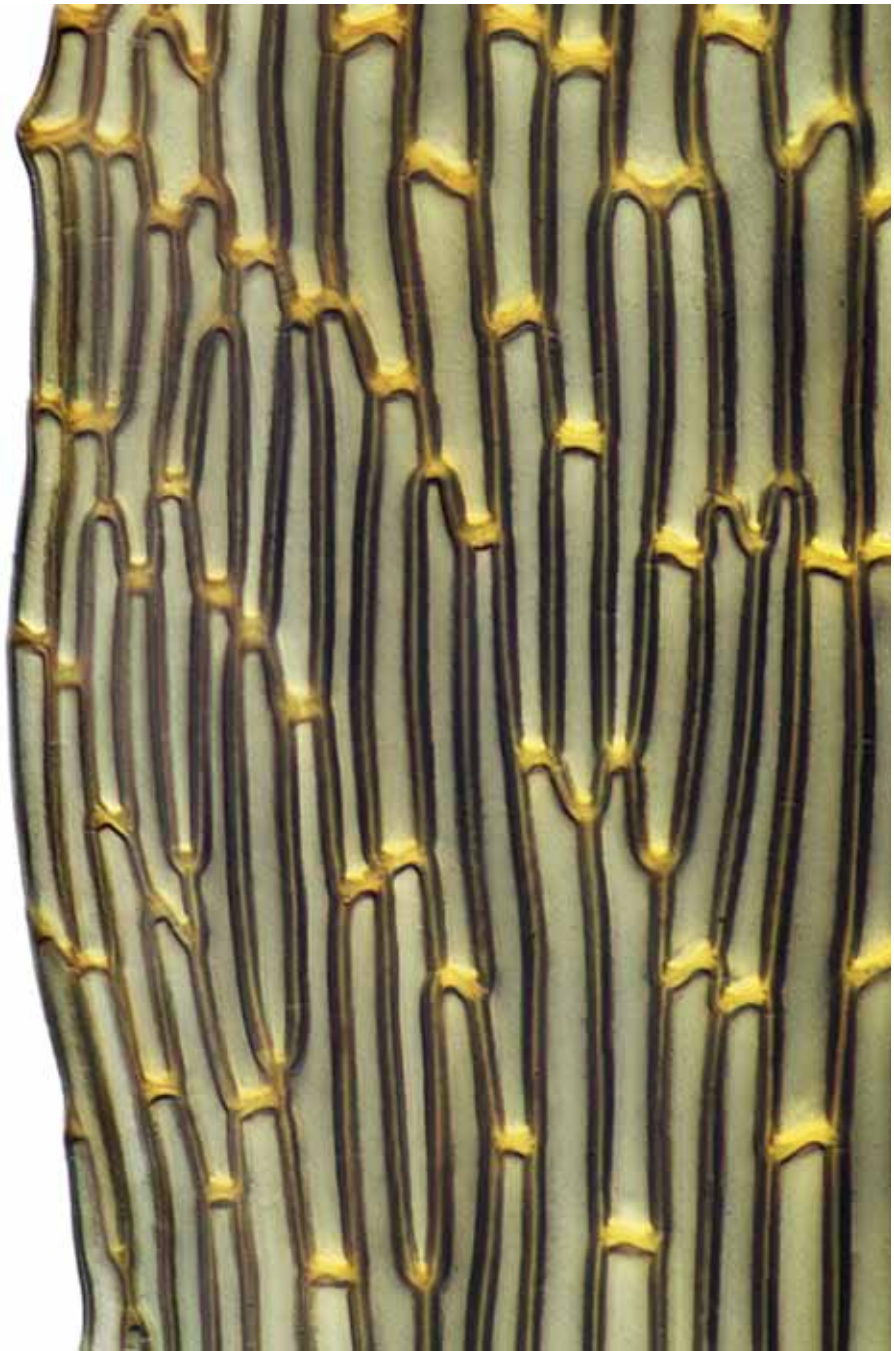
cells midleaf, juxtacostal cells midleaf, and margin near leaf base
 50 μm, 50 μm, 50 μm

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Dicranella vaginata leaf subula apex and subapex
10 μ m, 10 μ m

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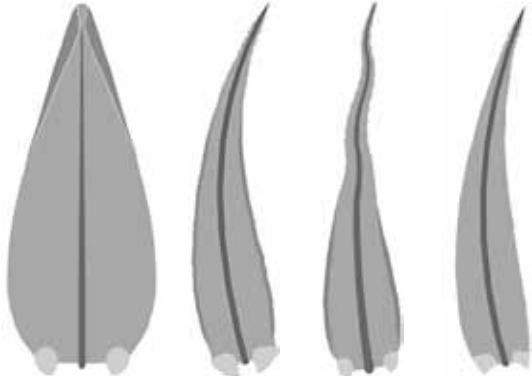


Dicranella vaginata margin midsheath
10 μm

Key* to the New Zealand species of Dicranoloma (8)

- 1 Leaf apex obtuse to rounded and \pm cucullate ● **Dicranoloma obesifolium**
 1: Leaf apex \pm subulate 2
- 2(1:) Subula cells isodiametric ● **Dicranoloma menziesii**
 2: Subula cells \pm elongate 3
- 3(2:) Juxtacostal cells of the subula markedly shorter than the marginal cells
 ● **Dicranoloma dicarpum**
 3: Juxtacostal cells of the subula not much shorter than the marginal cells 4
- 4(3:) Cells of subula 3×1 or shorter; costa undulate on the back when dry
 ● **Dicranoloma platycaulon**
 4: Cells of subula rarely shorter than 4×1 ; costa not undulate on the back when dry ... 5
- 5(4:) Costa in lamina broad, $> 60 \mu\text{m}$ (sometimes indistinct) ● **Dicranoloma plurisetum**
 5: Costa in lamina narrow, $< 50 \mu\text{m}$ and often much narrower 6
- 6(5:) Costa in lamina thick ● **Dicranoloma robustum**
 6: Costa in lamina faint, often indistinct below 7
- 7(6:) Leaf border distinct, hyaline; capsule immersed ● **Dicranoloma fasciatum**
 7: Leaf border narrow or indistinct; capsule exerted ● **Dicranoloma billardieri**

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bulletin 5, 126.

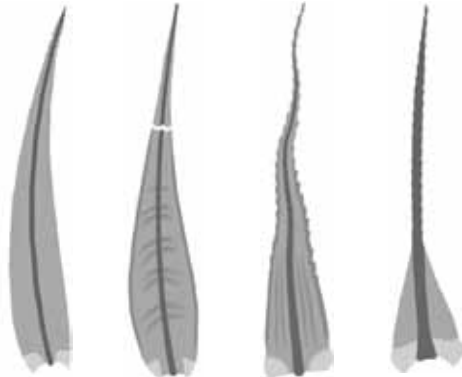


*Dicranoloma
obesifolium*

*Dicranoloma
plurisetum*

*Dicranoloma
robustum*

*Dicranoloma
billardieri*



*Dicranoloma
fasciatum*

*Dicranoloma
platycaulon*

*Dicranoloma
dicarpum*

*Dicranoloma
menziesii*

Dicranoloma billardieri (Brid.) Paris

form: cushions of erect, branched, glossy, yellowish to golden green stems, the leaves falcate and homomallous, radiculose in the axils, to 100 mm tall

habitat: soil, bark, tree trunks, or rock, in bogs, scrub, or beech forest, to 1250 m

leaf: size: 6–9 × 1.0–1.5 mm

shape: subulate, gradually tapering from an ovate-lanceolate base, falcate-second

tip: acuminate, often twisted

base: alar cells subquadrate, pigmented orange to brown, not inflated

costa: shortly excurrent, narrow and weak, 3–7 deuters in xs, dentate on the back

border: narrow and hyaline below

margin: entire below, ± serrate above, plane, ± channeled below

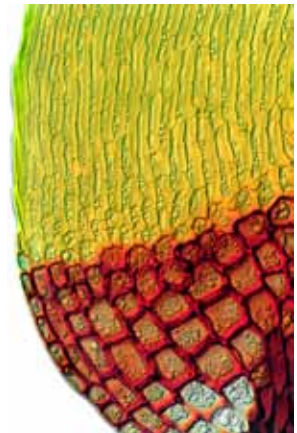
cells: mid lamina cells 40–75 × 4–6 μm, elongate, incrassate, porose, smooth

capsule: 2–3.5 mm, ± cylindrical, curved, horizontal, strumose below; seta 20–30 mm, straight or flexuose; operculum curved-rostrate; peristome dicranoid

notes: highly variable—the leaves can be curved to straight, and the margin entire to dentate



habit, leaf outline, leaf apex, capsule, and spears (calyptrae with persistent archegonia)
 ■ 10 mm, ■ 1 mm, ■ 10 μm, ■ 1 mm, ■ 1 mm (2), ■ 1 mm (2)



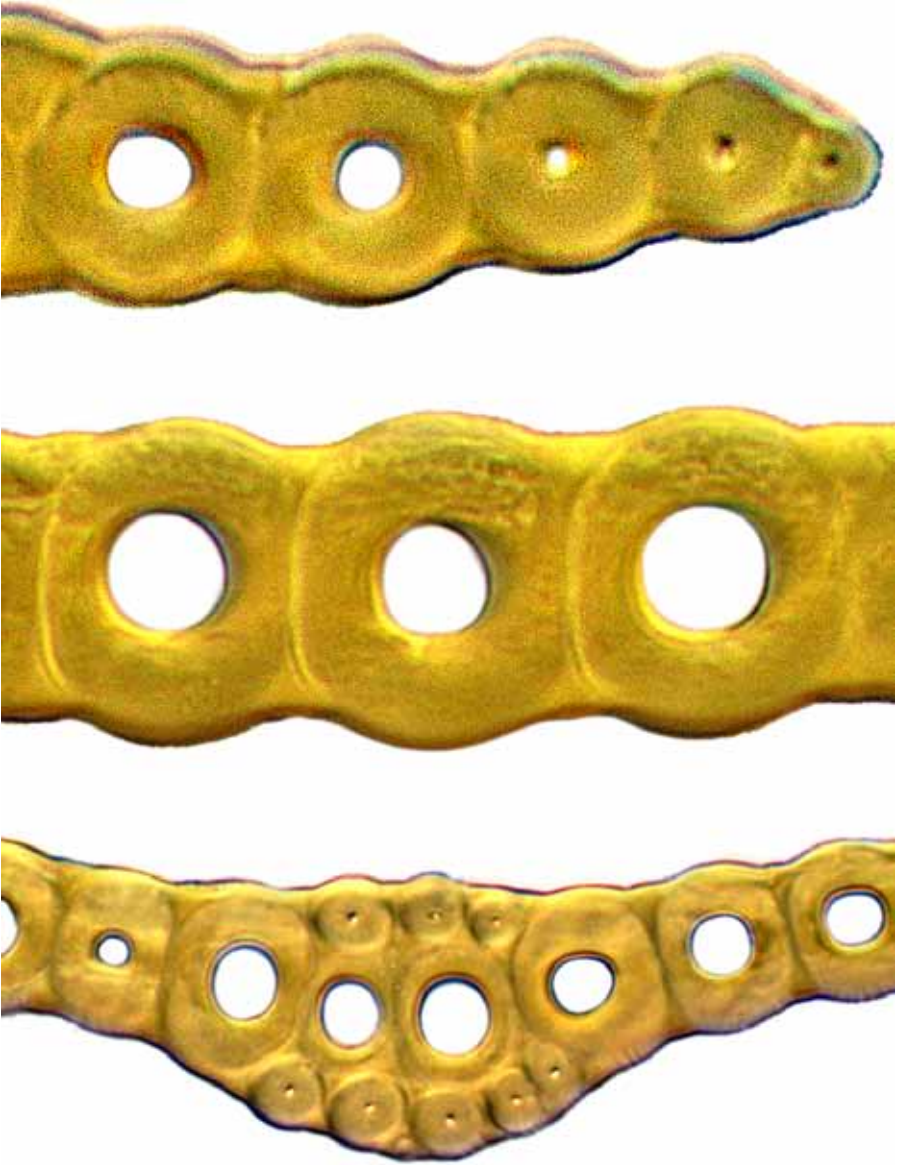
border lower leaf, cells midleaf, and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 50 μm



Dicranoloma billardieri habit

1 mm

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Dicranoloma billardieri leaf cross-sections: margin (top), lamina (middle), costa (bottom)
10 μ m, 10 μ m, 10 μ m

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Dicranoloma dicarpum (Nees) Par.

form: tufts or cushions of unbranched, flexuose stems, 35–90 mm tall, whitish tomentose below, leaves \pm falcate-secund

habitat: rotting logs or rarely tree trunks in dryish beech forest, to 1160 m

leaf: size: 6–10 \times 0.–1.0 mm

shape: oblong-lanceolate base gradually tapered above, keeled, \pm plicate, curved

tip: spinulose-dentate

base: alar cells pigmented, red in KOH, quadrate to short-rectangular, thin-walled

costa: narrow, spinulose on the back near the apex

border: 3–4 rows of linear, pale, thick-walled cells in lower leaf

margin: entire below, sharply spinose-serrate above, plane

cells: mid lamina cells 40–100 \times 6–10 μ m, 10–20 μ m near the costa, 40–100 μ m near the margin, smooth, \pm porose near the base

capsule: 2.5–3.5 mm, cylindric, erect to inclined, exserted, strumose, brown; seta 15–20 mm, up to 9 per perichaetium; peristome dicranoid; operculum long-beaked; calyptra cucullate, naked



vegetative shoot (dry) (2), leaf outline, leaf apex, and leaf subapex (abaxial surface)
 5 mm, 5 mm, 1 mm, 50 μ m, 50 μ m



upper margin, leaf base, and leaf basal angle
 50 μ m, 0.5 mm, 50 μ m

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Dicranoloma dicarpum vegetative shoot (dry)
1 mm

continued next page



Dicranoloma dicarpum strumose capsule (dry)
1 mm

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Dicranoloma fasciatum (Hedw.) Paris

form: cushions of branched, tomentose stems, 20–50 mm tall, the leaves pale green to yellowish, secund

habitat: bark, rotting logs, exposed roots, or rarely soil in cool to warm temperate rainforest, to 960 m

leaf: size: 4.0–6.5 × 0.8–1.0 mm

shape: ovate-lanceolate, secund, ± plicate

tip: gradually tapering to an acute, spinose tip

base: alar cells inflated, thin-walled, pigmented, to 75 × 40 μm

costa: ± percurrent, toothed in two rows abaxially above

border: 3–8 rows of linear, hyaline cells reaching the serrated portion

margin: spinose-serrate above, entire below, plane to ± tubulose

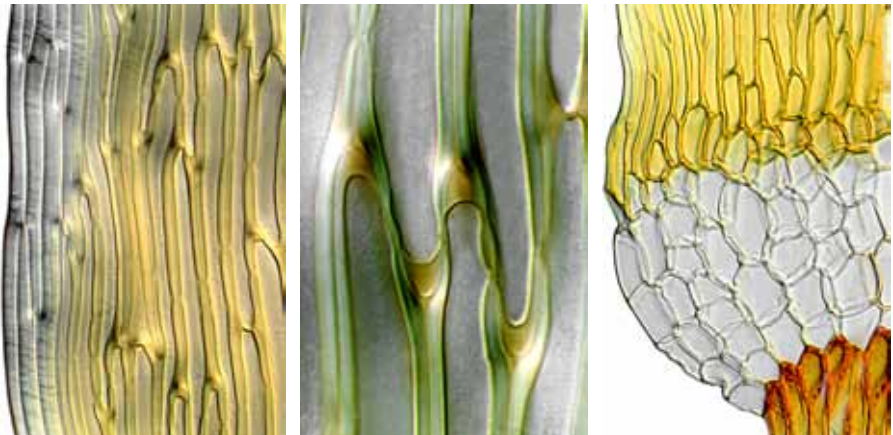
cells: 80–100 × 7–14 μm, elongate, thick-walled, porose, smooth

capsule: 1.8–3.0 mm, cylindric, curved, ± strumose, reached or overtopped by the sheathing perichaetial bracts; seta 8–10 mm, smooth; calyptra almost covering the capsule; operculum curved-rostrate; spores 15–18 μm in diam.



fertile shoots (dry) (2), leaf outline, leaf apex (2), and margin upper leaf

■ 5 mm, ■ 1 mm, ■ 0.5 mm, ■ 10 μm, ■ 10 μm, ■ 10 μm



margin midleaf, cells midleaf, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 50 μm

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Dicranoloma fasciatum spinose leaf tips
10 μm (left), 10 μm (right)

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Dicranoloma menziesii (Hook.f. & Wilson) Paris

form: cushions or turves of branched, \pm curved, radiculose stems, 10–50 mm, the leaves yellow- to dark green, \pm secund

habitat: bark of exposed roots and trunks, rotting logs and stumps, rarely rock in montane beech forest, to 1200 m

leaf: size: 9–14 \times 0.7–1.2 mm

shape: linear-lanceolate base tapering to a setaceous apex

tip: long-subulate

base: basal cells porose; alar cells numerous, sharply delimited, hyaline to yellow

costa: wide and strong below, filling the setaceous apex above

border: 1–3 rows of narrow, elongate cells

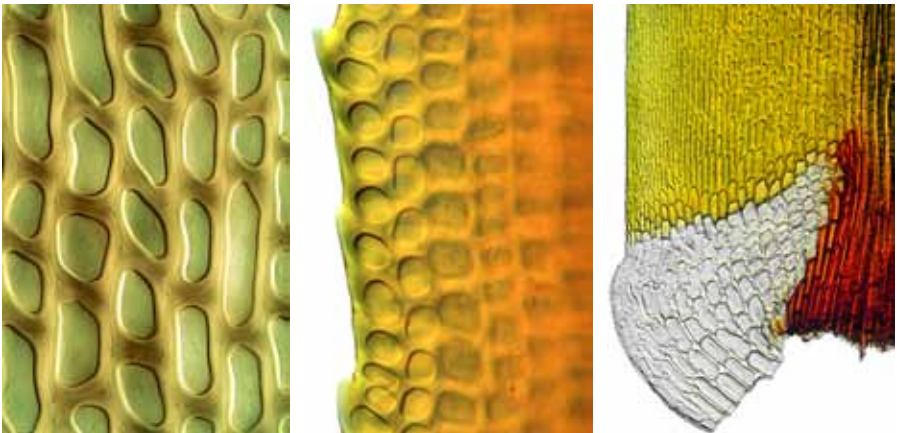
margin: entire below, weakly serrate above, plane

cells: cells 8–12 \times 6–8 μm , \pm isodiametric, incassate, smooth, not porose

capsule: 2.0–2.5 mm, cylindric, curved, \pm erect, exserted, strumose, striate; seta to 10 mm; operculum long-beaked; peristome teeth 16, red, vertically striolate on the outer face, split to halfway down, pale above; spores 15–18 μm in diam.

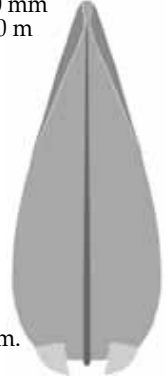


fertile shoot (dry), immature capsules (2), leaf outline, leaf apex, and margin lower leaf
 5 mm, 1 mm (2), 1 mm, 50 μm , 10 μm



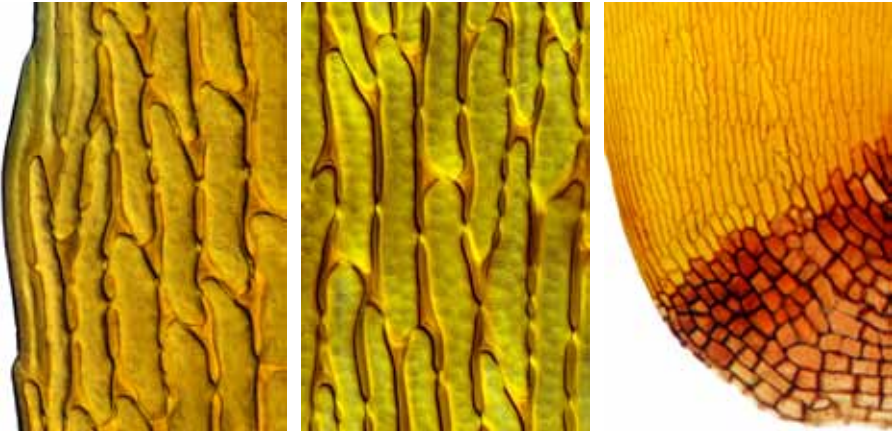
cells midleaf, subula margin, and leaf basal angle
 10 μm , 10 μm , 50 μm

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Dicranoloma obesifolium (R.Br.ter.) Broth.**form:** cushions of branched, erect stems, golden above, dark below, 30–120 mm**habitat:** soil or rock, in margins of bogs or tarns, or in beech forests, to 1650 m**leaf:** size: 4–8 × 1.5–3 mm*shape:* ovate, tubulose*tip:* rounded or obtuse, ± cucullate at the tip*base:* alar cells numerous, red-brown, quadrate, not inflated, auriculate*costa:* thin, narrow below, percurrent or failing at the apex*border:* weakly differentiated, 1–2 rows of elongate cells*margin:* entire, plane*cells:* 60–120 × 12–15 μm, irregularly rhombic to hexagonal with rounded ends, firm-walled, smooth, strongly porose throughout**capsule:** 3.0–3.5 mm, arcuate, strumose, cylindric, arcuate, strumose, exerted, brown; seta to 30 mm, red, flexuose; peristome teeth 16, red below, vertically striolate, cleft to about halfway; spores 18–21 μm in diam.**note:** endemic; our only species of *Dicranoloma* with an obtuse leaf apex

vegetative shoots (dry) (2), leaf outline, and leaf apex

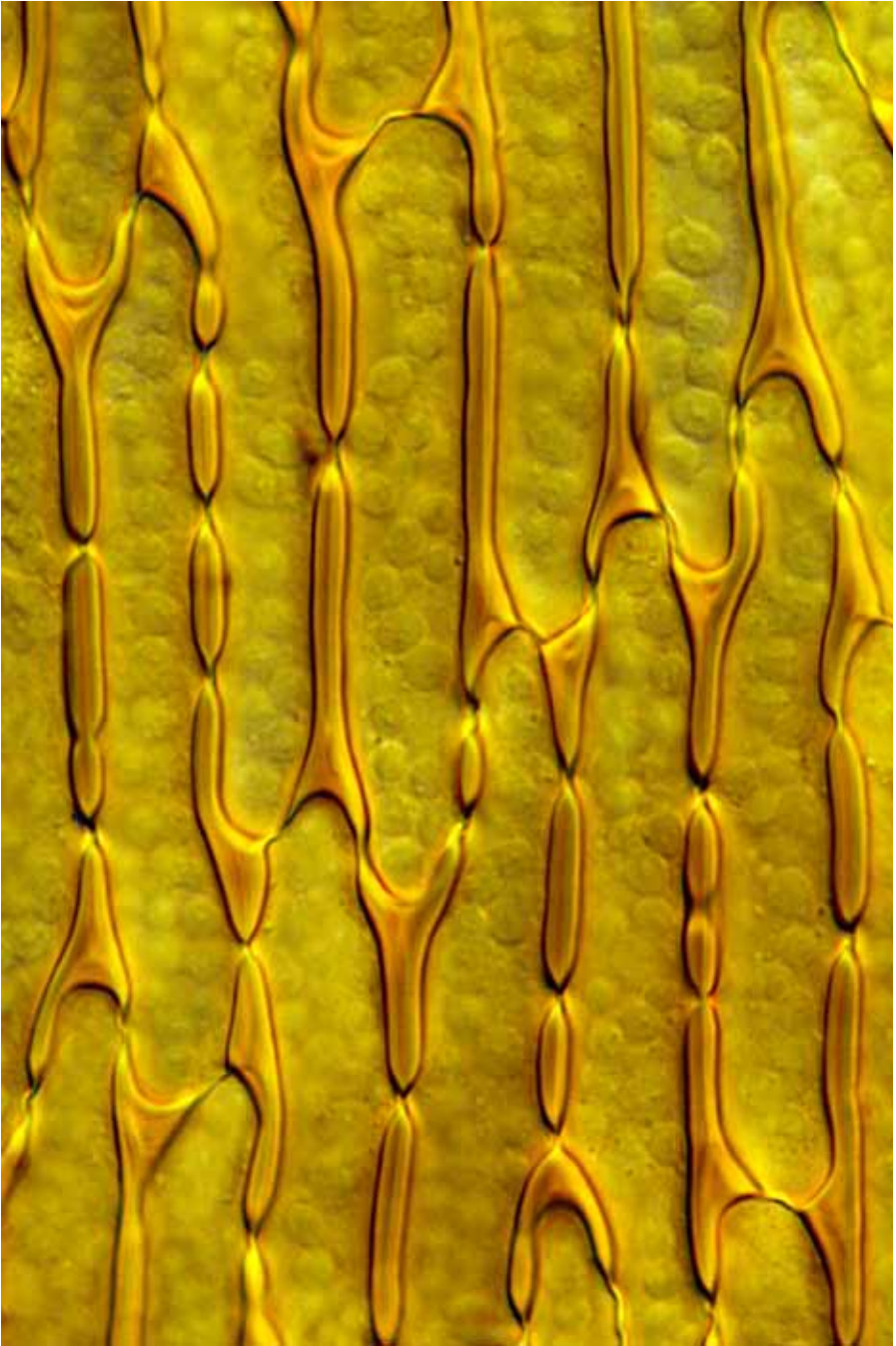
■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 10 μm



margin midleaf, cells midleaf, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 50 μm

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Dicranoloma obesifolium cells midleaf
10 μm

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Dicranoloma platycaulon Dixon

form: cushions of robust, tufted, tomentose, subflorally branched, glossy stems, 35–75 mm, the leaves \pm golden

habitat: duff, soil, rock, and bark, to 1350 m

leaf: size: 8–11 \times 1.4–1.5 mm

shape: ovate-lanceolate, undulate below, \pm tubulose, falcate-secund

tip: gradually long-acuminate with a blunt, toothed, fragile tip

base: lower cells porose, incrassate; alar cells \pm quadrate, inflated, thin-walled

costa: excurrent, with two rows of teeth abaxially above

border: 6–16 rows of elongate, hyaline cells reaching to the serrate portion

margin: entire below, serrate in about the upper half, plane

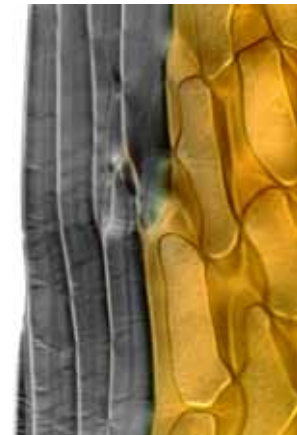
cells: upper cells 10–65 \times 6–15 μ m, irregular, variably thickened, smooth

capsule: 3–4 \times 0.7–0.8 mm, cylindric, \pm curved, \pm strumose, sulcate dry, erect to inclined; seta 11–14 mm, to 3 per perichaetium; spores 18–22 μ m in diam.

notes: differs from other species of Australasian *Dicranoloma* in having larger and paler leaves that are undulate along the costa when dry



fertile habit, leaf outline, leaf apex, and margin upper leaf
 ───────── 10 mm, ───────── 1 mm, ───────── 10 μ m, ───────── 10 μ m



cells midleaf, margin lower leaf, and leaf basal angle
 ───────── 10 μ m, ───────── 10 μ m, ───────── 50 μ m

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Dicranoloma plurisetum Dixon

form: cushions of ± branched stems, 30–100 mm, the leaves falcate-second, plicate, golden to pale yellow-green

habitat: soil or the bark of exposed roots in montane beech forest, to 1300 m

leaf: size: 7–9 mm

shape: ovate-lanceolate base tapering to the apex, keeled

tip: acuminate

base: clasping; basal cells incrassate and porose; alar cells in large inflated auricles

costa: narrow (about 60 μm), spinose in two rows on the back above, excurrent

border: up to 8 rows of elongate, incrassate, hyaline cells

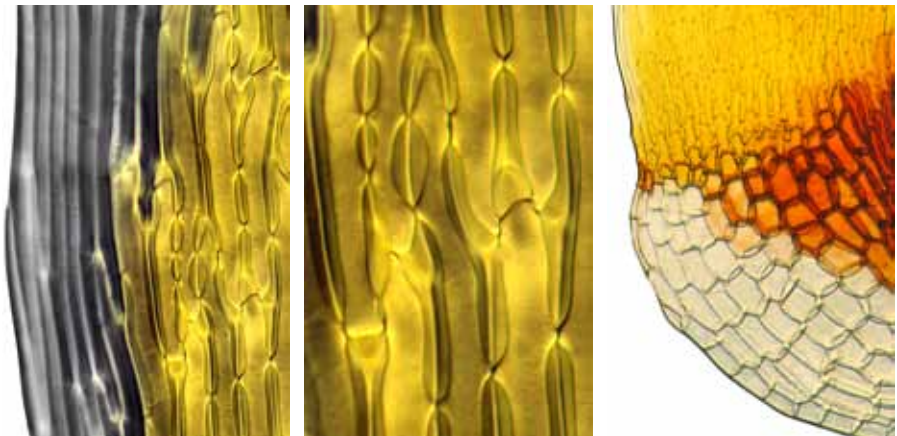
margin: entire below, sharply spinose-serrate above, plane

cells: 50–120 × 8–15 μm, elongate to irregular, incrassate, porose, smooth

capsule: 2–3 mm, cylindric, inclined, curved, exserted, reddish brown; seta 8–15 mm, up to 9 per perichaetium; operculum long-rostrate; peristome dicranoid; spores 16–19 μm in diam.



fertile shoot (dry), capsule, leaf outline, leaf apex, spinose costa, and subula margin
 ■ 5 mm, ■ 1 mm, ■ 1 mm, ■ 10 μm, ■ 10 μm, ■ 10 μm



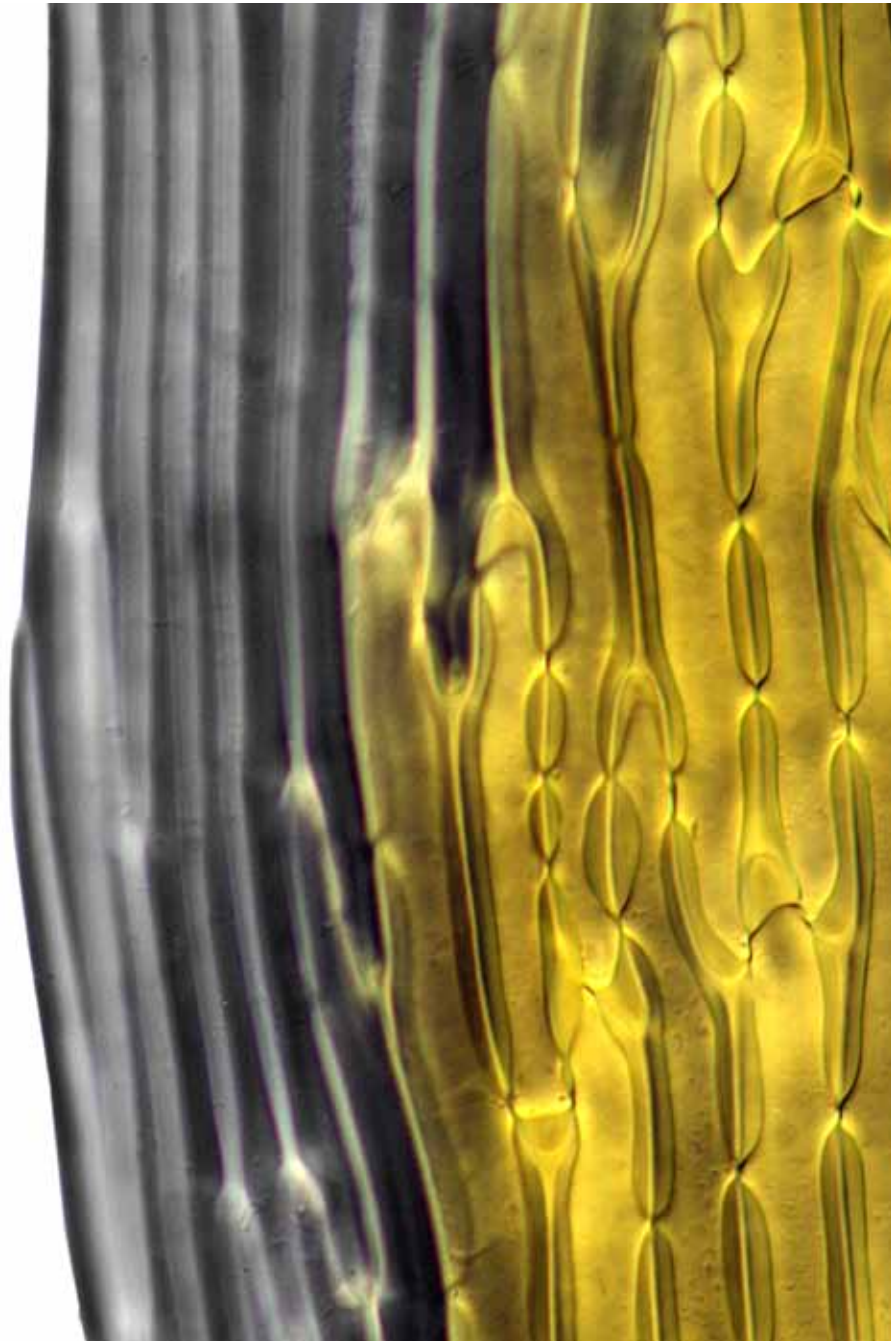
margin lower leaf, cells midleaf, and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 50 μm

continued next page



Dicranoloma plurisetum multiple sporophytes
1 mm, 1 mm

continued next page



Dicranoloma plurisetum leaf border, porose lamina cells
10 μ m

continued next page

Dicranoloma robustum (Hook.f. & Wilson) Paris

form: cushions of \pm branched stems, 20–120 mm tall, the leaves golden, glossy, falcate-secund

habitat: soil, rotting logs, and tree trunks in shady, subalpine beech forest

leaf: size: 10–22 \times 5 mm

shape: lanceolate base, long-tapered, \pm falcate and secund

tip: long, fine capillary subula

base: clasping, auriculate; alar cells numerous, coloured

costa: strong, variably denticulate at the back, excurrent

border: 2–4 rows of elongate, incrassate cells in lower leaf

margin: entire below, weakly toothed above, plane

cells: 45–120 \times 9–12 μm , linear, incrassate, porose, smooth

capsule: 2.3–3.5 mm, ovoid-cylindric, \pm erect, exserted, \pm curved, \pm strumose; seta 10–30 mm, reddish, flexuose; operculum curved-rostrate; peristome dicranoid, teeth 16, red, vertically striolate below, split halfway down; spores 16–21 μm in diam.

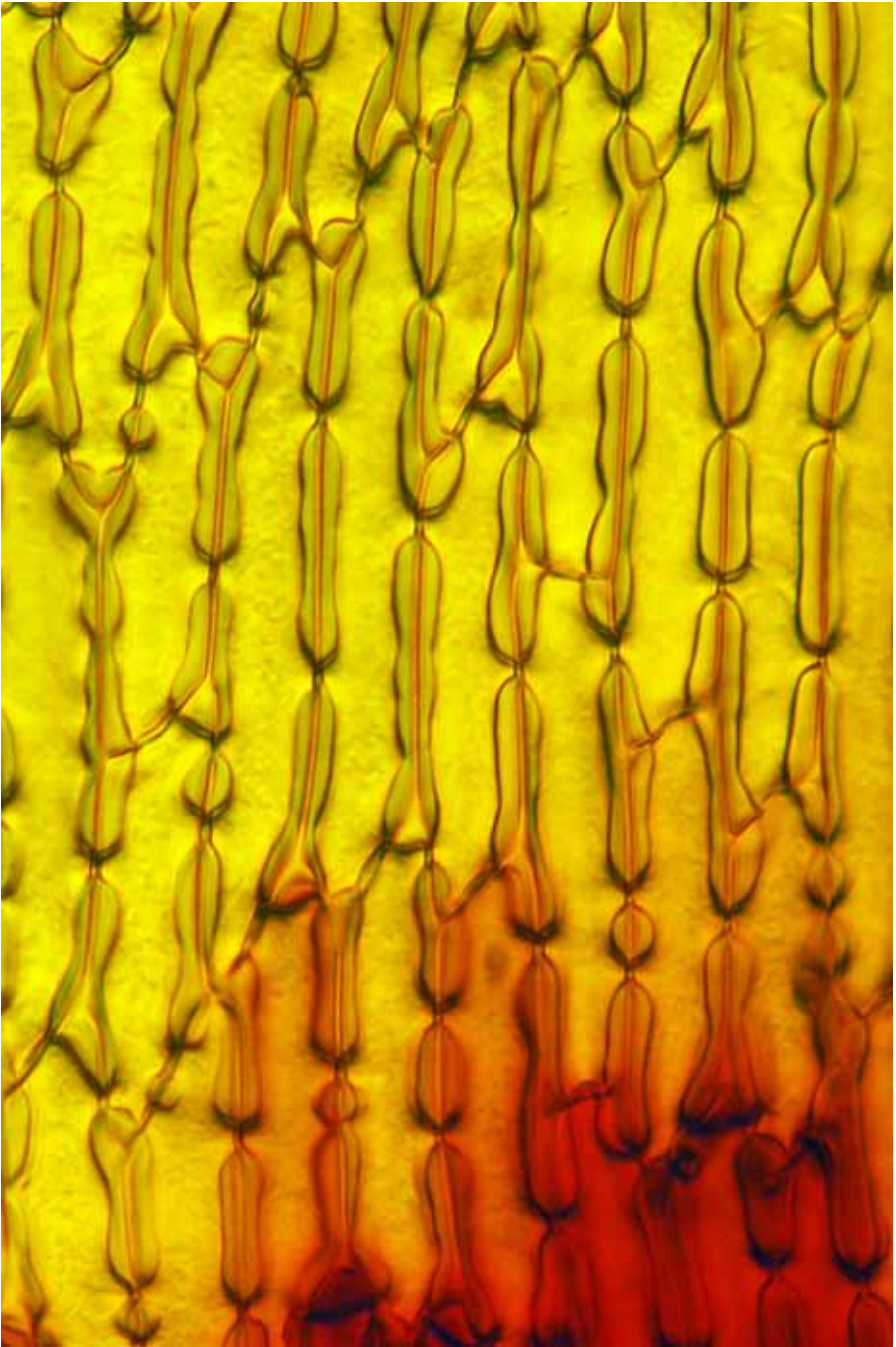


vegetative shoot (dry), mature capsule, leaf outline, leaf apex, and margin midleaf
 10 mm, 1 mm, 1 mm, 10 μm , 10 μm



margin lower leaf, porose cells of lower leaf, and leaf basal angle
 10 μm , 10 μm , 50 μm

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Dicranoloma robustum porose cells near leaf base
10 μm

continued next page

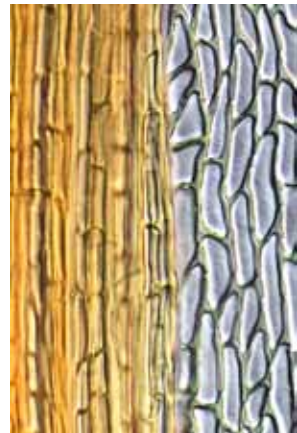
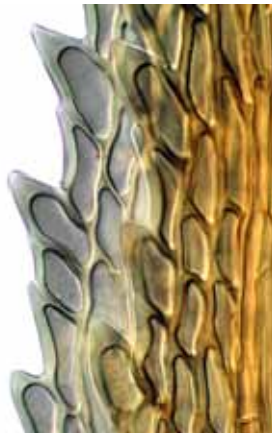


Dicranoloma robustum leaf and costa cross-sections
10 μm (above), 10 μm (below)

Dicranum leioneuron Kindb.**form:** cushions of erect, tomentose, branched stems, to 80 mm, leaves yellow-green**habitat:** acidic or leached soil, logs, bark, rock, mostly dunes and marshes, to 1700 m**leaf:** *size:* 2.6–3.5 × 1.1–3.3 mm*shape:* ovate-lanceolate, tubulose above, secund, arcuate, little changed when dry*tip:* bluntly acute, densely toothed*base:* alar cells ± bistratose, orange*costa:* narrow, percurrent, toothed above*border:* not differentiated*margin:* entire below, strongly dentate in the upper half, incurved below*cells:* midleaf 50–80 × 7–12 μm, rectangular-vermiculate, thick-walled, ± porose**capsule:** not found in New Zealand; 3–4 mm (excluding operculum), cylindric, curved, exserted, suberect, exannulate; seta 18–35 mm, red with age; calyptra cucullate, smooth, entire; operculum long-rostrate; peristome dicranoid, teeth split into 2(–3), vertically striolate; spores 16–24 μm in diam., finely papillose

habit (dry), shoot whole-mount, leaf outline, and leaf apex

1 mm, 1 mm, 10 μm, 10 μm



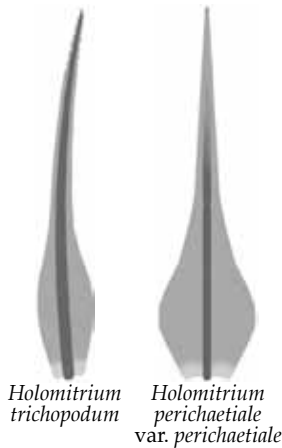
dentate subula (2) and costa midleaf

100 μm, 50 μm, 50 μm

Key* to the New Zealand species of *Holomitrium* (2)

- 1 Leaves falcate-secund, little changed when dry; peristome teeth split right to the base ● ***Holomitrium trichopodum***
 1: Leaves ± straight, strongly crisped when dry; peristome teeth irregularly split or with only median perforations ● ***Holomitrium perichaetiale* var. *perichaetiale***

* based on Klazenga, N (2006): *Holomitrium trichopodum* (Bryophyta, Dicranaceae), a *Holomitrium* with split peristome teeth from Australia and New Zealand. *Journal of the Hattori Botanical Laboratory* **100**, 293–303.



Holomitrium perichaetiale (Hook.) Brid. var. **perichaetiale**

form: cushions of branched, tomentose stems, 10–35 mm, microphyllous shoots in leaf axils

habitat: bark or rotting logs, rarely rock, to 1300 m

leaf: size: 3.0–4.5 × 0.8–1.0 mm, glossy when dry

shape: channeled, subulate, narrowing from an obovate-elliptic base

tip: acuminate

base: weakly sheathing; alar cells enlarged, pigmented, extending up margin

costa: strong but narrow, percurrent, sometimes hyaline-tipped

border: not differentiated

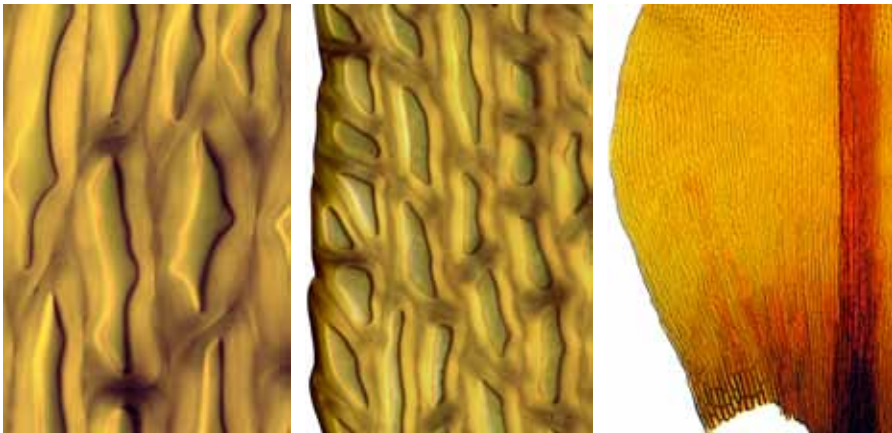
margin: entire, plane, bistratose in upper leaf

cells: mid lamina cells 5–12 × 0.5–0.8 μm, isodiametric, incrassate, smooth; sheath cells elongate, incrassate, ± porose

capsule: 2–2.6 mm, oblong-cylindric, ± curved, erect; seta 15–40 mm, flexuose, yellow; calyptra 5 mm, clasping at base; operculum long-rostrate; peristome dicranoid, teeth 16, ± divided into two papillose filaments; spores 14–21 μm



vegetative shoots (moist, dry), leaf outline, leaf apex, and upper sheath margin
 5 mm (2), 0.5 mm, 10 μm, 10 μm



cells mid-sheath, margin mid-sheath, and leaf basal angle
 10 μm, 10 μm, 100 μm

continued next page



Holomitrium perichaetiale fertile shoots (dry) and mature capsule
1 mm (2), 1 mm

continued next page

Holomitrium trichopodum (Mitt.) Klazenga

form: cushions of sparsely branched tomentose stems, 10–50 mm, the leaves glossy, light green when fresh

habitat: bark of branches and trunks, rarely rock, in wet areas, to 1400 m

leaf: size: 3–10 × 0.4–0.7 mm

shape: ovate-lanceolate base tapering to a long, flexuose subula, ± falcate

tip: tapered to subulate, tubulose acumen

base: weakly sheathing; alar cells inflated, coloured, forming a conspicuous group

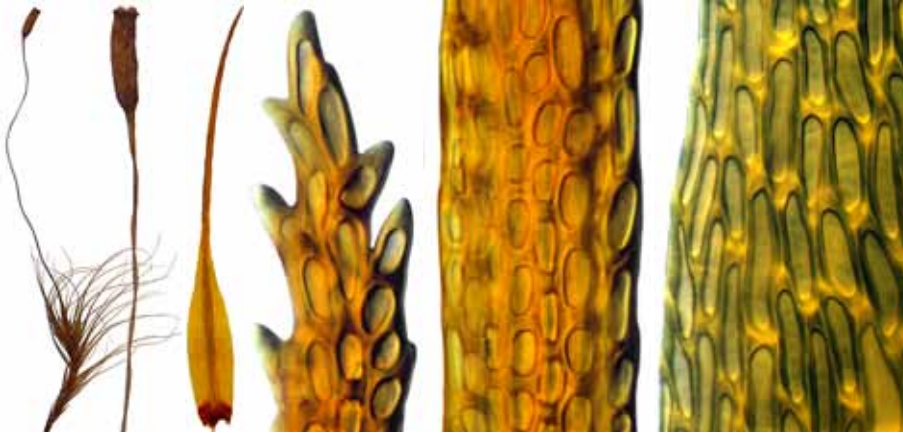
costa: excurrent into the subula, in xs with guide cells and two stereid bands

border: 1–4 rows of narrow, hyaline cells

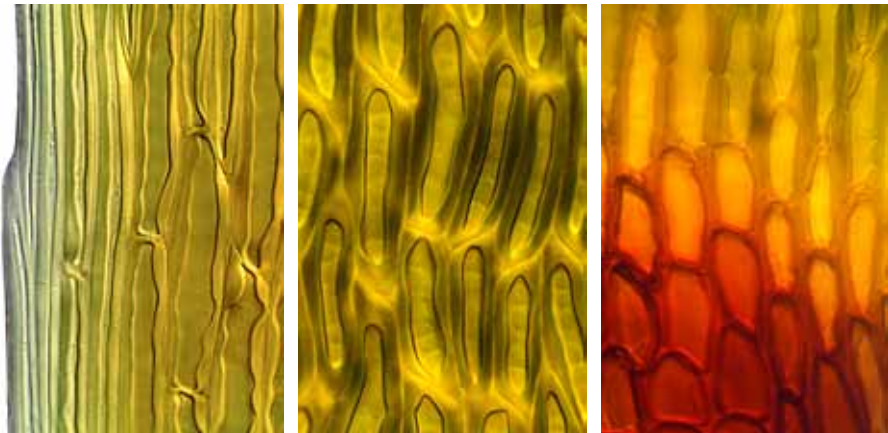
margin: entire to denticulate below, ± spinose-toothed near the apex, plane

cells: mid lamina cells 8–15 × 4–6 μm, rounded-oblong, incrassate, porose, smooth; basal cells 20–80 × 10–20 μm, linear, incrassate, porose, smooth

capsule: 2–3 mm, ± cylindrical; symmetric; seta 17–50 mm, yellow, slender, flexuose; operculum long-rostrate; peristome dicranoid, the teeth long, papillose, and split to their bases; spores 18 μm in diam., smooth



fertile shoot (dry), capsule, leaf outline, leaf apex, subula, and margin of upper sheath
 ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 10 μm, ■ 10 μm, ■ 10 μm



margin lower sheath, sheath cells, and pigmented cells near leaf base
 ■ 10 μm, ■ 10 μm, ■ 10 μm

continued next page



Holomitrium trichopodum sheath cells
10 μ m

Mesotus celatus Mitt.

form: patchy, creeping, erect, tomentose, brownish, \pm branched stems, in top view resembling pinwheels when moist, 30–100 mm

habitat: bark or rarely rock in damp lowland to montane forest, to 1200 m

leaf: size: stem: 1.7–2.8 \times 0.9 to 1.2 mm; branch: 4.0–6.5 \times 1.0–1.3 mm

shape: stem leaves with ovate base; branch leaves with oblong base, \pm sigmoid tip; acuminate

base: sheathing; alar cells numerous, oblong, pigmented, extending up margin

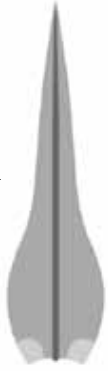
costa: failing below the apex or shortly excurrent

border: 2–3 rows of narrowly linear, hyaline, incrassate cells

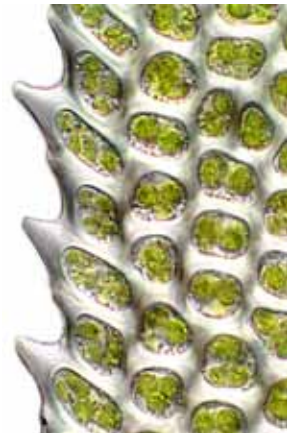
margin: undulate, spinulose-serrulate above, plane

cells: 9–11 μ m in diam., subquadrate, incrassate, papillose

capsule: 2 mm, seta very short; oval, erect, completely immersed; calyptra mitriform, lobed, covering only the operculum; operculum short-rostrate; peristome teeth inserted below the capsule rim, the teeth lanceolate, blunt, split and perforate; spores multicellular, dimorphic, 75–135 μ m long

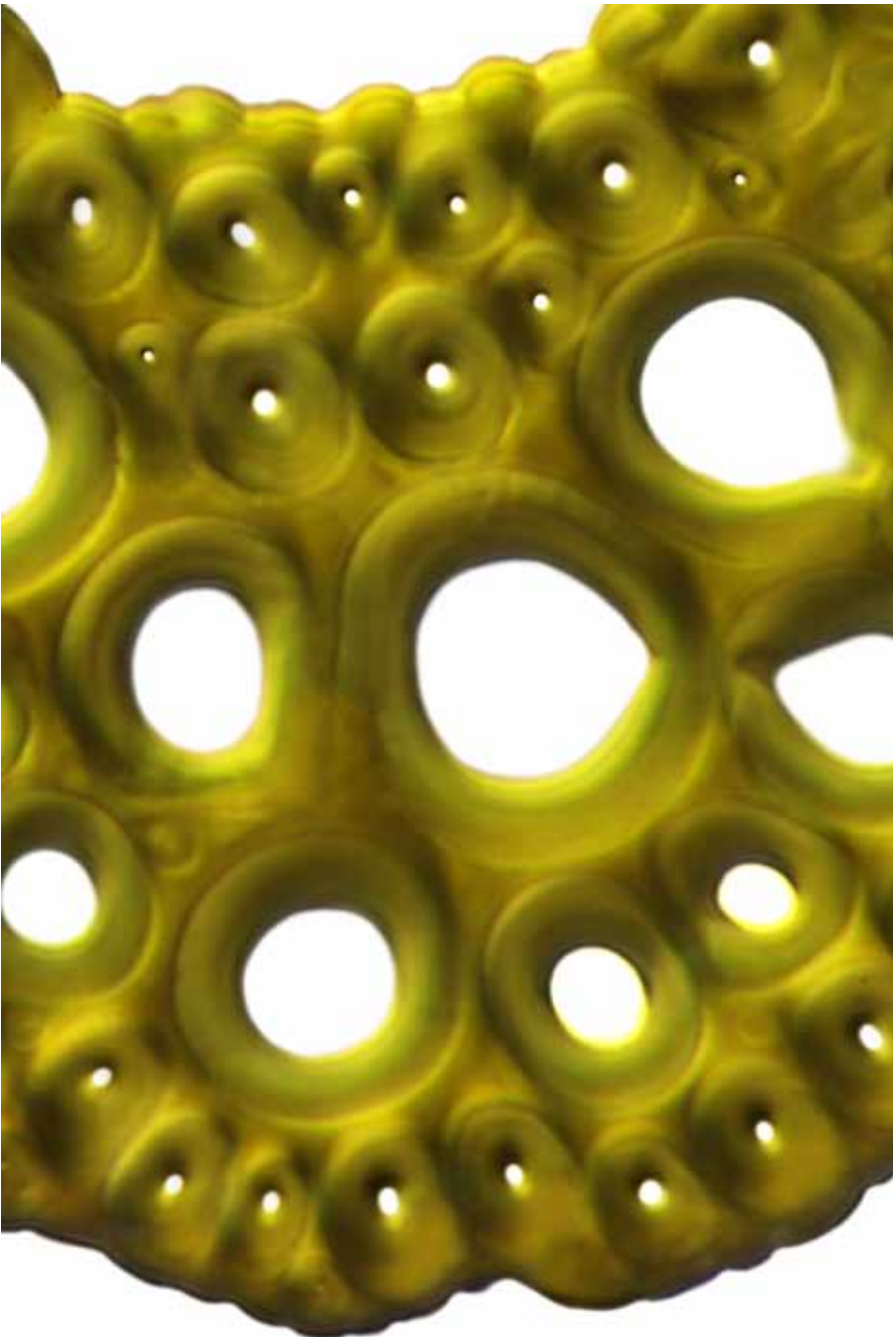


habit (top view, moist), fertile shoot (dry), capsule and calyptra, leaf outline, leaf apex
 5 mm, 5 mm, 0.5 mm, 0.5 mm, 10 μ m



margin midleaf, margin lower leaf, and leaf basal angle
 10 μ m, 10 μ m, 50 μ m

continued next page



Mesotus celatus costa cross-section
10 μ m

continued next page



Mesotus celatus leaf cross-section, margin detail
10 μm

Pseudephemerum nitidum (Hedw.) Reimers

form: loosely tufted, slender, pale, simple or branched stems, to 5 mm tall
habitat: soil, in open ground among rushes in swampy sites

leaf: size: 2×0.7 mm

shape: narrowly triangular to lanceolate

tip: acuminate

base: basal cells wider and more rectangular than the blade cells

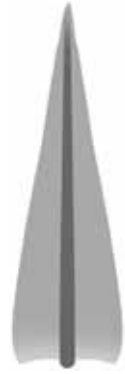
costa: weak, thin, failing below the apex

border: not differentiated

margin: \pm denticulate at the apex, plane

cells: $50\text{--}70 \times 8\text{--}15 \mu\text{m}$, rhombic, thin-walled, unipapillose at the lower end

capsule: 0.7–0.9 mm, cylindric, immersed, short-apiculate, cleistocarpous;
 seta 0.5 mm, often more than one per stem; calyptra cucullate; spores $30\text{--}45 \mu\text{m}$ in diam., globose, papillose



habit, leaf outline, leaf apex (2), and margin midleaf

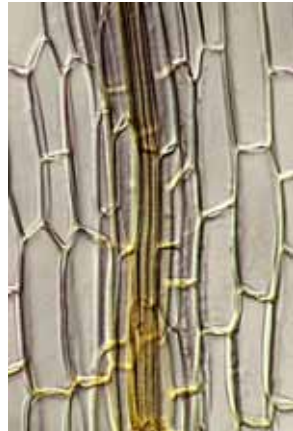
5 mm,

0.5 mm,

50 μm ,

10 μm ,

10 μm



cells midleaf, costa midleaf, and leaf base

10 μm ,

10 μm ,

50 μm

Sclerodontium pallidum (Hook.) Schwaegr.

form: mats of creeping, branched, wiry, radiculose stems, dull olive-green, to 25 mm, the branches in fascicles, erect

habitat: rock (mostly non-calcareous) or soil, to 600 m

leaf: size: 2.3–2.8 × 0.5–0.7 mm

shape: ovate-lanceolate, concave below, tubulose above

tip: acuminate, ± falcate, sometimes with a smooth, hyaline hair-point

base: alar cells numerous, quadrate, reddish brown, in triangular groups

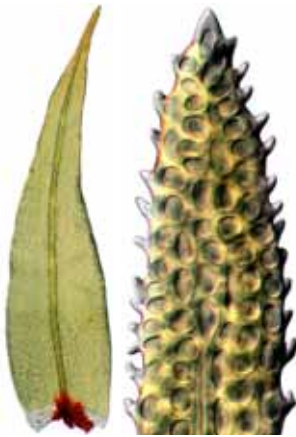
costa: thin, failing below the apex

border: 2–4 rows of elongate cells extending almost to the apex

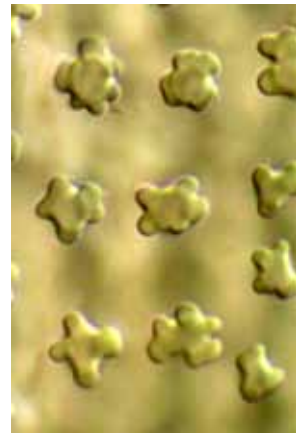
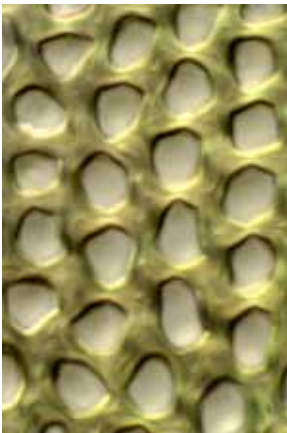
margin: entire below, weakly toothed at apex, plane

cells: 8–15 × 7–8 μm, isodiametric, irregular, incrassate, unipapillose (branched)

capsule: 1.0–1.8 mm, oblong-cylindric, ± inclined, symmetric, curved when dry; seta 7–14 mm, slender, red; operculum long-rostrate; peristome split to about the middle; spores 25–39 μm in diam., green



vegetative habit, leaf outline, leaf apex, and margin of lower leaf
 5 mm, 0.5 mm, 10 μm, 10 μm



cells midleaf, lamina cell papillae, and alar cells
 10 μm, 10 μm, 10 μm

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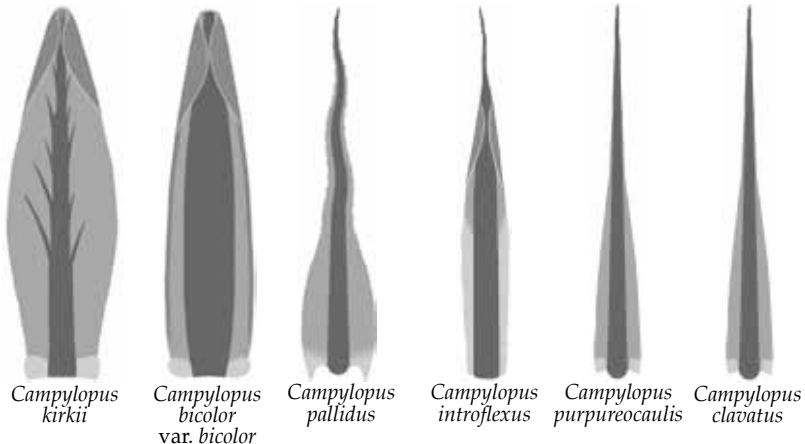
Sclerodontium pallidum habit (Rangitoto Island)

10 mm

Key* to the New Zealand species and varieties of *Campylopus* (6)

- 1 Shoot tips readily deciduous; upper lamina cells oval..... ● ***Campylopus clavatus***
 1: Shoot tips not deciduous; upper lamina cells rhombic, quadrate, or rectangular 2
- 2(1): Leaves ending in hyaline hair-points formed by the excurrent costa 3
 2: Leaves not ending in hyaline hair-points 4
- 3(2) Hair-points abruptly reflexed at a 90° angle when dry ● ***Campylopus introflexus***
 3: Hair-points not reflexed when dry ● ***Campylopus purpureocaulis***
- 4(2): Leaf tips cucullate..... 5
 4: Leaf tips not cucullate..... ● ***Campylopus pallidus***
- 5(4) Costa filling 2/3 of leaf width at the widest part, without side nerves (spurs)
 ● ***Campylopus bicolor* var. *bicolor***
 5: Costa filling only 1/3 of leaf width at the widest part, with side nerves (spurs).....
 ● ***Campylopus kirkii***

* based on Frahm, J-P; Malcolm, W (2005): *The Moss Family Dicranaceae in New Zealand, an Illustrated Key*. Micro-Optics Press, Nelson. 26.



Campylopus bicolor (Müll.Hal.) Wilson var. **bicolor**

form: dense tufts of erect, unbranched stems, to 50 mm tall, the leaves yellow-brown to dark green above, darker below, not glossy

habitat: wet peat, soil, or rock in acidic sites in montane forest, to 1230 m

leaf: size: 3.0–6.5 × 1.0 mm

shape: linear-lanceolate, ± tubulose, lamina unistratose, little altered when dry

tip: obtuse to rounded, abruptly cucullate, rarely with a hyaline hair-point

base: alar cells hyaline, thin-walled, not in groups

costa: wide throughout, filling half the width at the base, not spurred

border: weak, 1–3 rows of cells narrower than the other lamina cells

margin: entire below, ± denticulate at the tip, plane

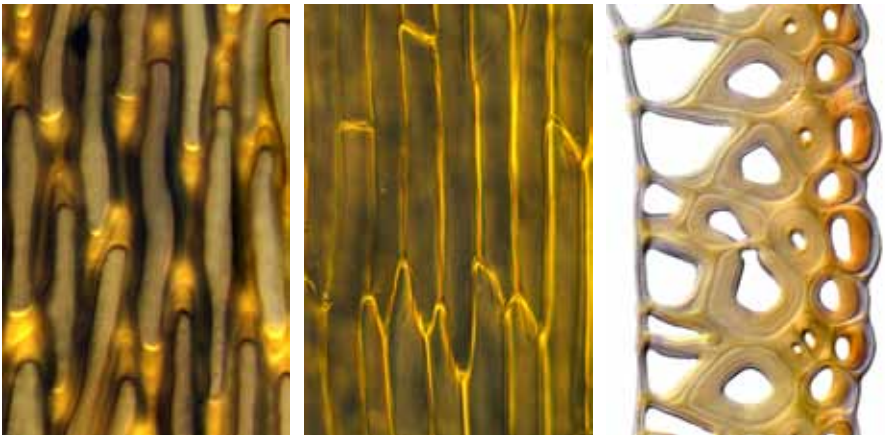
cells: 30–60 × 4–5 μm, linear-rhombic to vermicular, thick-walled, ± porose

capsule: 1–1.3 mm, oblong-ovoid, ± plicate when dry, erect, exserted, brown; seta to 8 mm, cygneous when moist, flexuose when dry; peristome dicranoid; spores 18–21 μm in diam.



vegetative shoots (dry), leaf outline, cucullate leaf apex, and margin midleaf

■ 1 mm, ■ 1 mm, ■ 10 μm, ■ 10 μm



lamina cells midleaf, adaxial costa cells midleaf, and costa cross-section

■ 10 μm, ■ 10 μm, ■ 10 μm

continued next page



Campylopus bicolor var. *bicolor* costa cross-sections — the leaf's large, thin-walled adaxial cells conserve water by spindling the leaf when they lose volume from desiccation and then collapse

10 μ m

continued next page

Campylopus clavatus (R.Br.) Hook.f. & Wilson

form: curves of tomentose, glossy, green-bronze stems, the tips readily deciduous

habitat: soil or rock, especially exposed road-cuttings, clay banks, and bare ground from sea level to the subalpine zone, to 1550 m

leaf: size: 4–6–6.0 × 0.6–0.7 mm

shape: lanceolate-subulate from an oblong base, ± tubular above

tip: toothed, bluntly acute, sometimes with a hyaline hair-point

base: alar cells rectangular, inflated, and pigmented, ± in auricles

costa: to half the leaf width below, excurrent in a ± denticulate subula, not spurred

border: weak, 1–3 rows of linear cells

margin: entire below, denticulate above, plane below, tubulose above

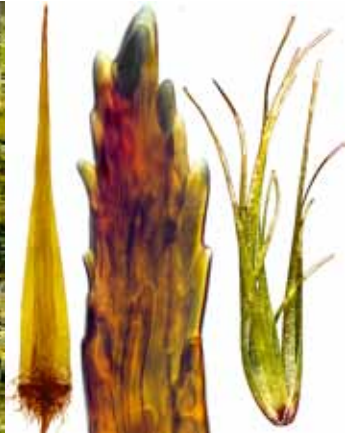
cells: 20–90 × 10–20 μm, obliquely rhombic, thick-walled, smooth, porose

capsule: 1.5–1.8 mm, elliptic to subcylindric, symmetric, erect, smooth, pale brown;

seta to 10 mm, cygneous when young; peristome teeth 16 but cleft to the base

into 32 filiform, densely papillose segments; spores 9–15 μm in diam.

note: highly variable, particularly the alar cells



habit, massed deciduous brood bodies, leaf outline, leaf apex, and brood body

10 cm, 5 mm, 0.5 mm, 10 μm, 0.5 mm



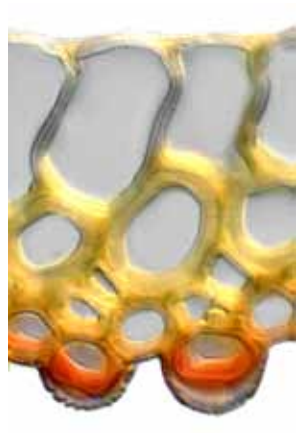
margin midleaf, leaf basal angle, peristome, and upper leaf cross-section

10 μm, 50 μm, 0.5 mm, 10 μm

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Campylopus introflexus (Hedw.) Brid.**form:** curves of simple or branched, erect, ± comose stems, 10–60 mm tall**habitat:** soil, sand, or peaty banks, less often on rotting or burnt wood, to 1530 m**leaf:** size: 3.5–5.0 × 0.5–0.8 mm*shape:* lanceolate-subulate from an oblong, concave base*tip:* acute to acuminate*base:* alar cells indistinct; basal cells rectangular, thin-walled, and hyaline*costa:* broad, excurrent in a hyaline point, ridged abaxially, reflexed 90° when dry*border:* weak, 1–2 rows of linear cells*margin:* ± denticulate, incurved, and tubular above, entire and plane below*cells:* upper cells 12–24 × 6–12 μm, rhombic, incrassate, and smooth, lower cells

40–55 × 8–10 μm, rectangular, thin-walled, smooth, and hyaline

capsule: 1.8 mm, narrowly oblong to elliptic, curved when dry, horizontal to nodding; seta up to 8 mm, cygneous when dry; calyptra fimbriate**note:** introduced into Britain about 1940, and now spreading rapidly throughout Europe, sometimes displacing the native *Campylopus pilifer*vegetative habit, dry shoot with hair-points reflexed 90°, leaf outline, and hair-point
margin midleaf, fringed calyptra, peristome, and abaxially ridged costa cross-section

continued next page

Campylopus kirkii Beckett

form: tufts of comose, ± unbranched stems, golden above, 20–50 mm

habitat: soil in bogs and other perpetually wet habitats, to 1030 m

leaf: size: 3.8–6.0 × 0.5–1.3 mm

shape: broadly lanceolate, concave, narrowed to the insertion

tip: obtuse, ± cucullate; no hair-point

base: basal cells thin-walled; alar cells inflated, pigmented or not, auriculate

costa: broad at the base, with side-nerves (spurs), percurrent

border: 1–2 rows of narrowed cells

margin: entire below, weakly toothed above, plane

cells: 40–75 × 6–9 μm, vermiform, incrassate, porose, smooth

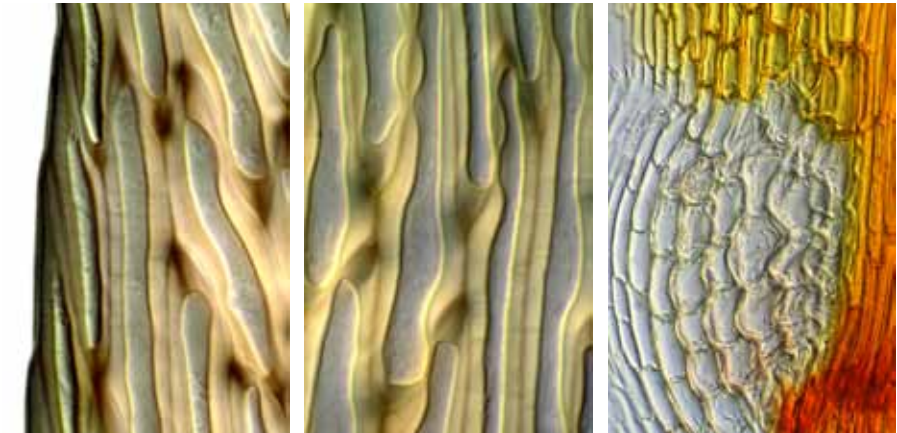
capsule: 2 mm, ovoid, furrowed; seta to 10 mm; calyptra cucullate, fringed at the base; operculum short-rostrate; peristome dicranoid; spores 15–18 μm in diam.

note: differs from var. *acuminatus* in having obtuse and cucullate rather than piliferous leaf tips, and a heavily spurred costa



vegetative shoot (dry), leaf outline, costa side-nerves, and leaf apex

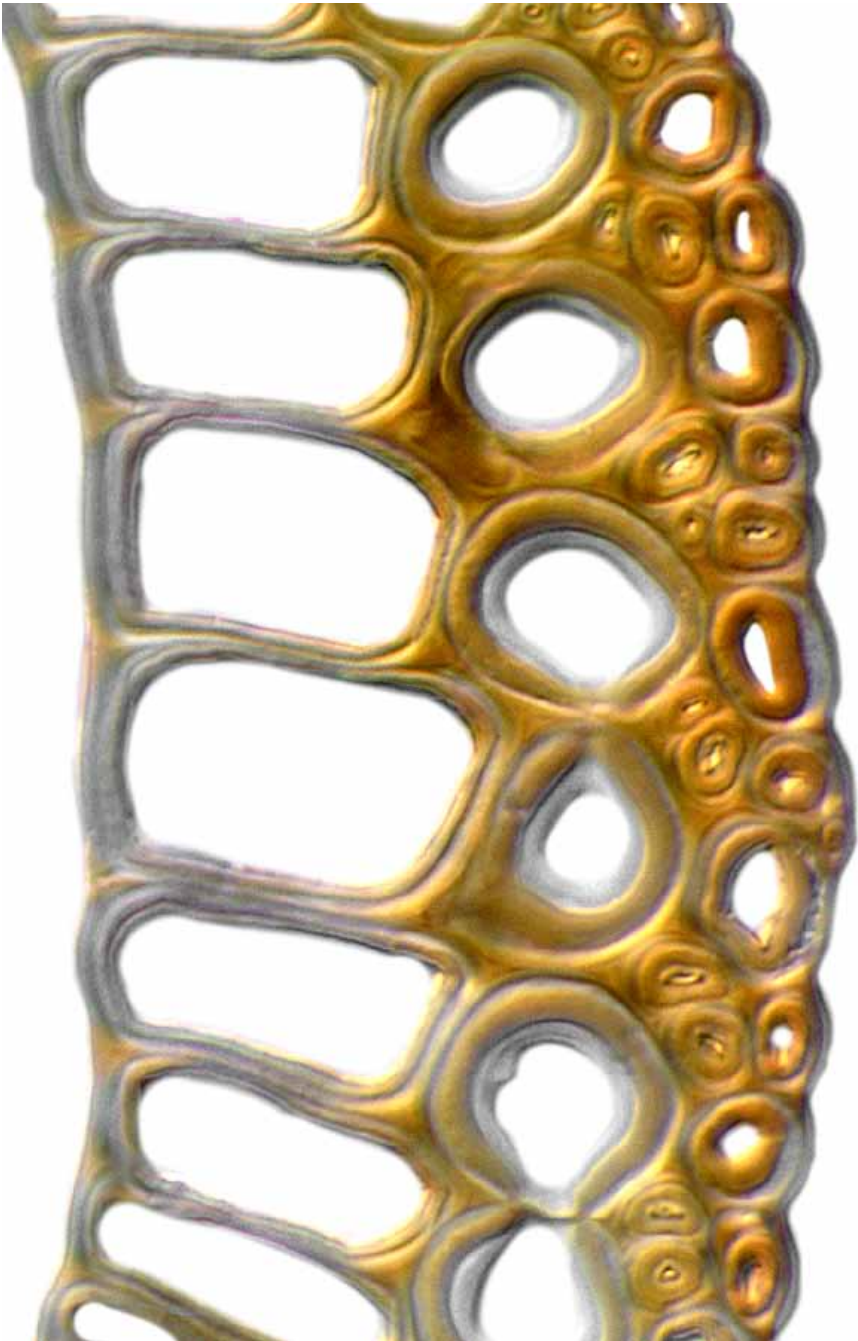
1 mm, 1 mm, 100 μm, 10 μm



margin midleaf, cells midleaf, and alar region

10 μm, 10 μm, 10 μm

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Campylopus kirkii leaf cross-section showing adaxial hyalocysts
10 μm

continued next page

Campylopus pallidus Hook.f. & Wilson

form: dense curves of red-tomentose stems, 5–50 mm, the leaves pale green, slender, silky, falcate

habitat: soil, logs, fumaroles, boggy or swampy ground or forests, to 1300 m

leaf: size: 3–7.5 × 0.5–0.7 mm

shape: lanceolate from an oblong, base, ± tubulose, tapering to a long subula

tip: slender, flexuose, sometimes hyaline subula

base: alar cells none or only weakly developed

costa: filling the upper subula, excurrent, not spurred

border: a few rows of narrow, hyaline cells in the lower leaf

margin: entire below, serrulate above, plane

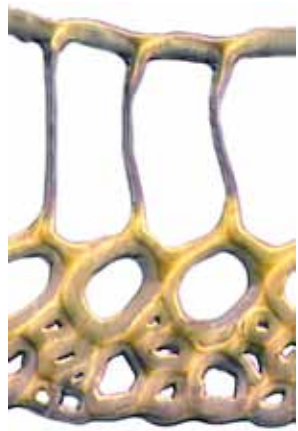
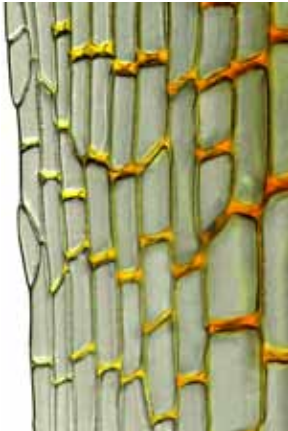
cells: 9–30 × 6–9 μm, quadrate to short-rectangular, firm-walled, smooth

capsule: 1.0–1.5 mm, ± cygneous; ovoid, erect, exserted, sulcate when dry, brown; seta 7–9 mm; calyptra fringed; operculum ± curved-rostrate, about half the length of the urn; operculum reddish, rostrate; peristome dicranoid, the teeth 16, cleft to the middle, vertical-striolate; spores 12–14 μm in diam.



vegetative shoot (dry), capsule, leaf outline, leaf apex (2), and mid-subula

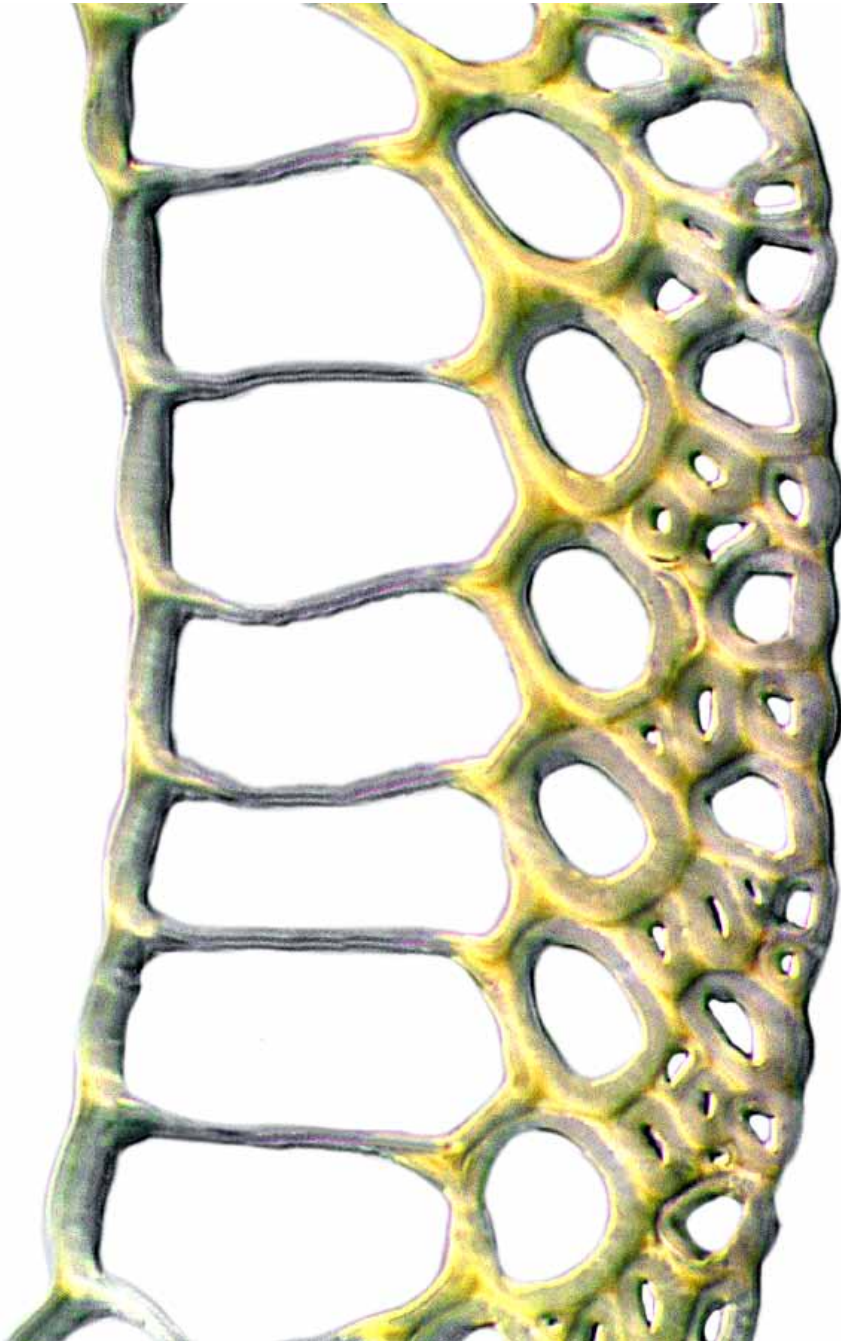
■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 50 μm, ■ 10 μm, ■ 50 μm



margin midleaf, margin near leaf base, and leaf cross-section

■ 10 μm, ■ 10 μm, ■ 10 μm

continued next page



Campylopus pallidus leaf cross-section showing adaxial hyalocysts
10 μ m

continued next page

Campylopus purpureocaulis Dusén

form: tufts of erect, branched stems, red-tomentose, to 50 mm, with brood bodies
habitat: rotting logs in forest clearings at high elevation, to 1300 m

leaf: size: to $2-6 \times 0.5-0.7$ mm

shape: lanceolate base narrowing to a long subula

tip: \pm serrate hair-point

base: alar cells inflated, pigmented, not in auricles

costa: excurrent in the hair-point, in section with dorsal and ventral stereid bands

border: weak, 1-5 rows of linear cells in lower leaf

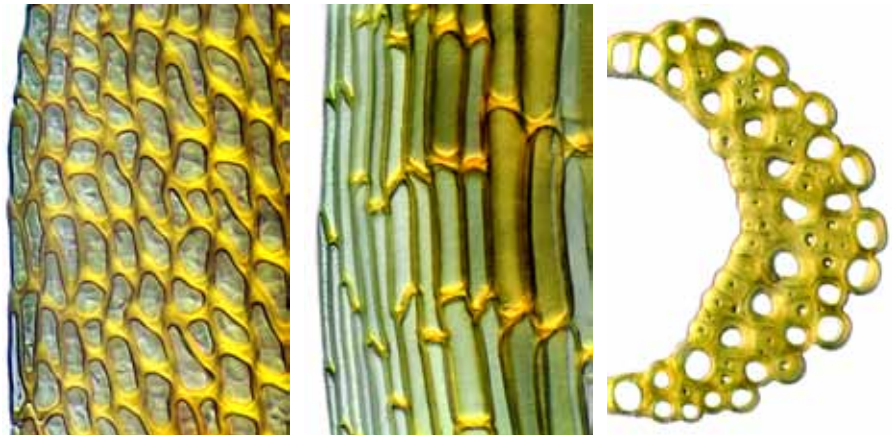
margin: entire, plane below, \pm tubular above

cells: upper lamina cells $6-21 \times 6-12 \mu\text{m}$, rhombic, thick-walled, smooth

capsule: 1.5 mm, ovoid, \pm strumose, symmetric, erect, smooth, pale brown; seta 8 mm, often aggregated; calyptra cucullate, fimbriate at the base; operculum rostrate, the beak erect and half the length of the urn; peristome dicranoid, the teeth 16, cleft to about the middle, lanceolate, reddish, hyaline and papillose above and vertically-striolate below

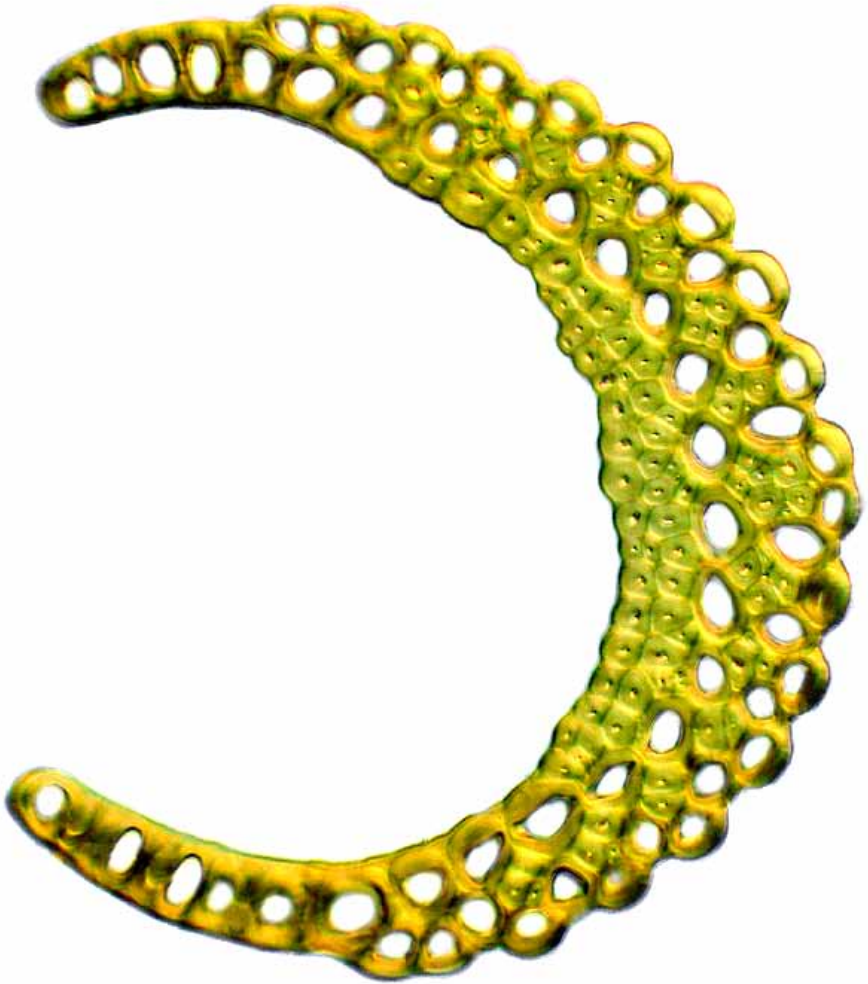


vegetative shoot (dry), leaf outline, mature capsule, leaf apices (2), and leaf subapex
 ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 10 μm (2), ■ 10 μm



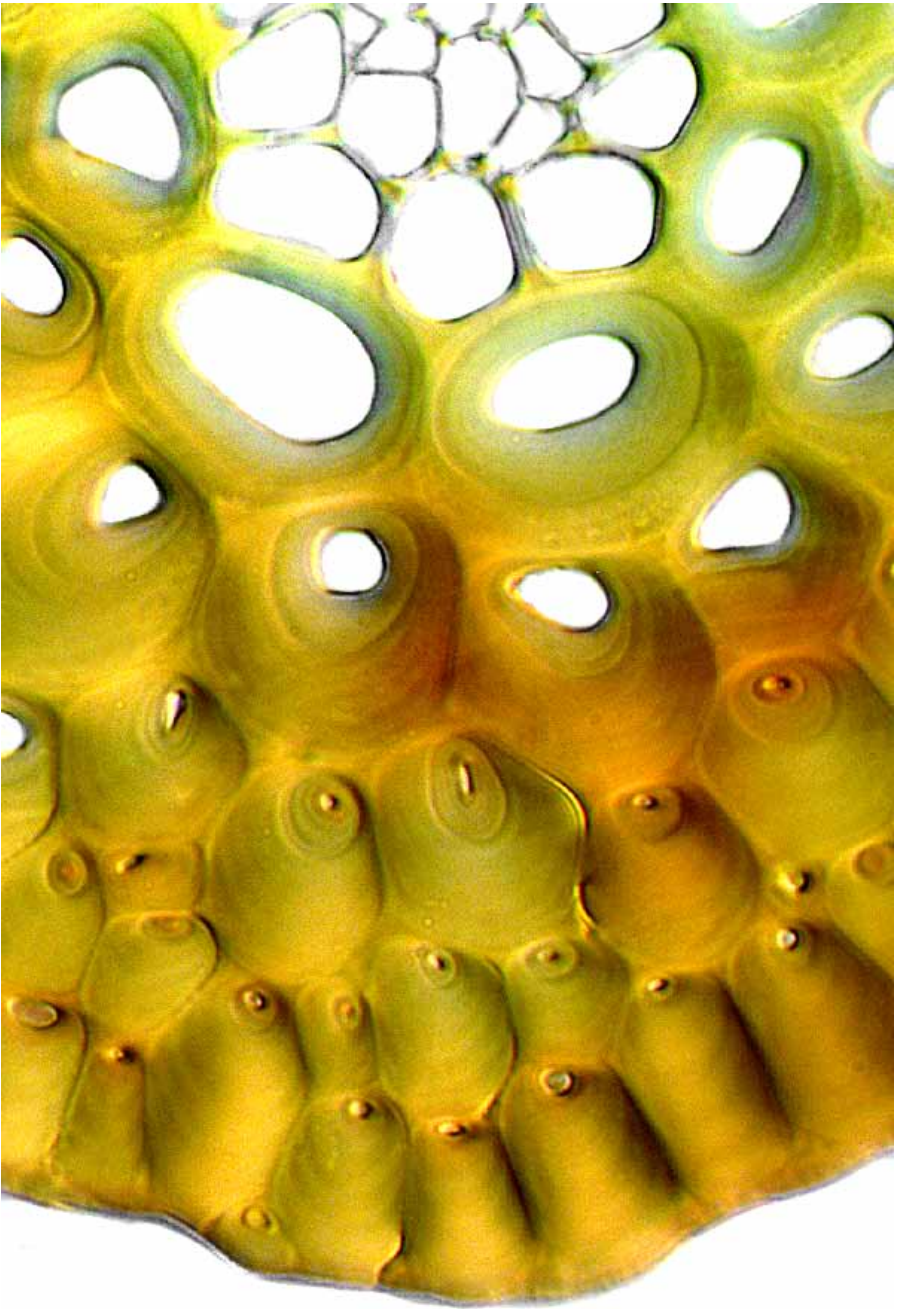
margin midleaf, margin lower leaf, and costa cross-section
 ■ 10 μm , ■ 10 μm , ■ 10 μm

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Campylopus purpureocaulis leaf cross-section
10 μm

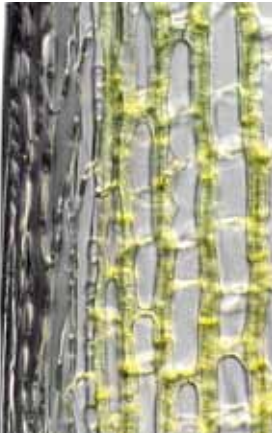
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Campylopus purpureocaulis stem cross-section
10 μm

Leucobryum javense (Brid.) Mitt.**form:** erect, forked, brittle, whitish stems in dense cushions, 10–80 mm tall**habitat:** soil, rotting logs, tree stumps, and exposed roots in forest**leaf:** size: 2–7 × 0.5–1.8 mm*shape:* lanceolate, falcate-secund, spindled into a conic tube*tip:* cucullate, denticulate subula narrowed from an oblong base*base:* undifferentiated*costa:* filling most of the leaf, which consists of a row of chlorocysts enclosed above and below by 2–6 layers of hyalocysts*border:* not differentiated*margin:* the true lamina, entire and plane, 4–6 rows of narrow, hyaline cells*cells:* hyalocysts 40 μm wide, rectangular, firm-walled, pored, smooth**capsule:** 1–1.5 mm, oblong, inclined, asymmetric, strumose, curved, 8-ribbed when dry; seta 13–20 mm, terminal or lateral, slender, red; calyptra cucullate; operculum long-rostrate; peristome dicranoid, the teeth 16, lanceolate, cleft to the middle, vertically pitted-striolate below

vegetative habit, fertile shoot, capsules (mature and immature), and leaf outline
 ■ 10 mm, ■ 1 mm, ■ 0.5 mm (4), ■ 1 mm



margin midleaf and leaf base (2)

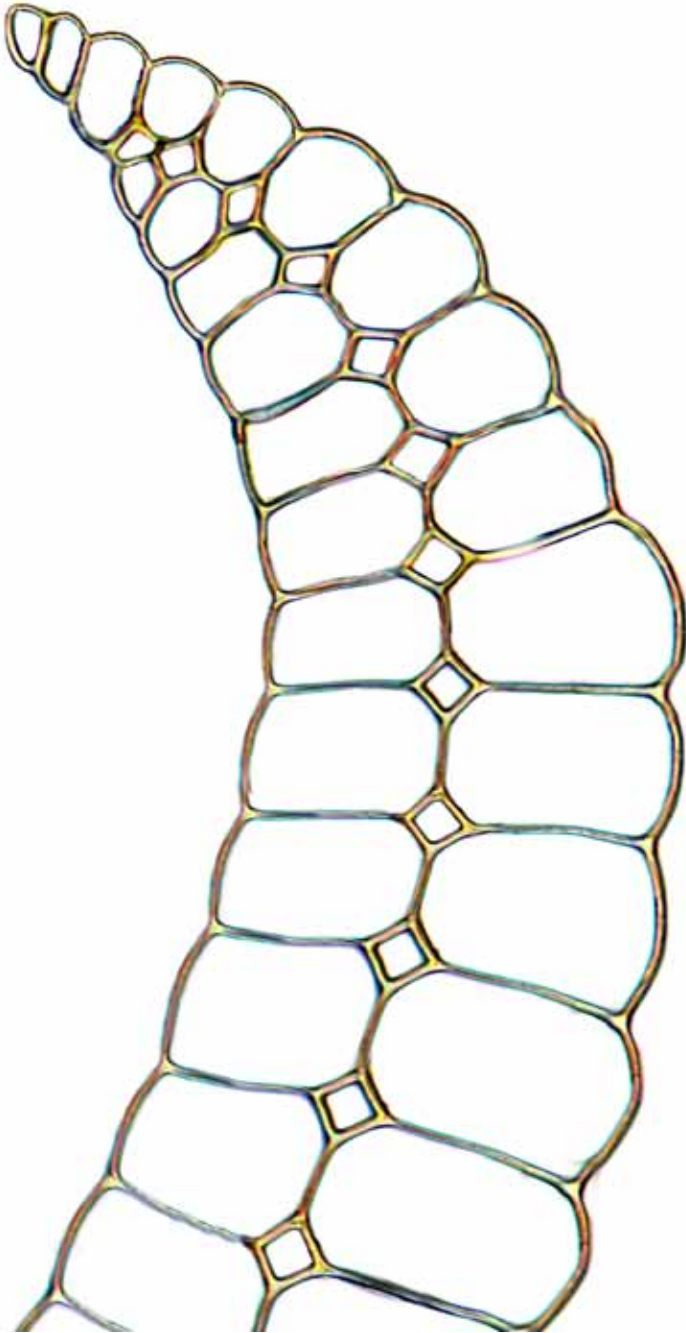
■ 50 μm, ■ 100 μm, ■ 50 μm

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Leucobryum javense immature capsules
0.5 mm

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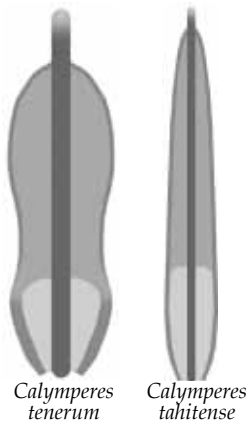


Leucobryum javense leaf cross-section
50 μm

Key* to the New Zealand species of Calymperes (2)

- 1 Leaves linear-lanceolate, 5–7 mm; costa percurrent, bearing gemmae in a cluster on only its adaxial surface; cells of the distal end of the cancellinae arranged in finger-like rows ● **Calymperes tahitense**
- 1: Leaves panduriform, 1.5–2 mm; costa excurrent, bearing gemmae in a sphere around its entire circumference; cells of the distal end of the cancellinae not arranged in finger-like rows ● **Calymperes tenerum**

* based partly on Reese, WD; Stone, IG (1995): The Calymperaceae of Australia. *Journal of the Hattori Botanical Laboratory* 78, 1–40.



Calymperes tahitense (Sull.) Mitt.

form: tufts or cushions of stems, often forked, dark green, 10–40 mm tall, rhizoidal below

habitat: bark and rock in humid and shaded lowland forest near streams

leaf: size: 5–7 × 1 mm

shape: linear-lanceolate, tubulose

tip: obtuse, tipped with a stout excurrent costa (proboscis)

base: sheathing, cancellinae on both sides, interfingered distally among lamina cells

costa: stout, excurrent, gemmiferous on its distal adaxial surface

border: strongly intramarginal below, nearly marginal above

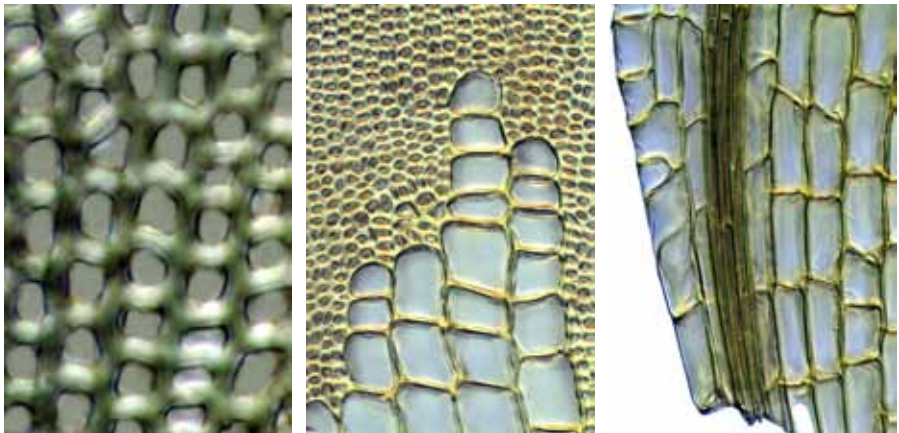
margin: minutely toothed below, coarsely toothed near apex, ± revolute

cells: lamina cells 3–5 μm , isodiametric, thick-walled, bulging on adaxial surface, smooth; cancellinae cells rectangular, thin-walled, smooth, 40–90 × 25 μm

capsule: not seen in New Zealand



vegetative shoots (dry), leaf outline, excurrent costa (naked), basal intramarginal border
 5 mm, 5 mm, 1 mm, 0.1 mm, 10 μm



cells midleaf, uppermost cancellinae cells, and leaf basal angle
 5 μm , 10 μm , 10 μm

continued next page

Calymperes tenerum Müll.Hal.

form: scattered tufts or cushions of erect, sparsely forked stems, up to 10 mm
habitat: bark, less often logs, rocks, or soil, in shady, damp forests

leaf: size: 1.5–2.7 × 0.6 mm

shape: panduriform from a sheathing cancellinate base, bistratose above

tip: excurrent costa bearing green propagules (gemmae)

base: sheathing, paired cancellinae of hyaline, thin-walled, ± rectangular cells

costa: stout, excurrent, bearing globose cluster of green, fusiform propagules (gemmae), 6–9-celled, 150–200 μm long

border: weak to absent, at most several rows of linear cells, not intramarginal

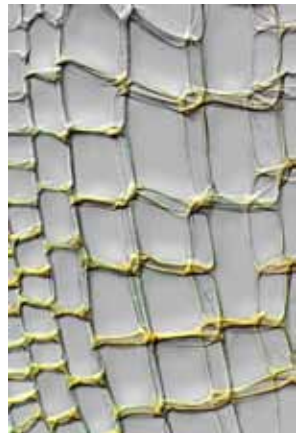
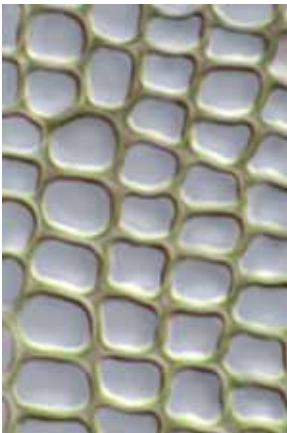
margin: ± entire, plane

cells: upper lamina cells 5–8 μm, isodiametric, firm-walled, smooth, strongly bulging adaxially in xs; cancellinae cells 60–75 × 30 μm, thin-walled, smooth

capsule: capsules not seen in NZ; 1.5–3 mm, cylindrical, emergent, erect; seta 1.5–2 mm, orange; calyptra persistent, covering the capsule; peristome none

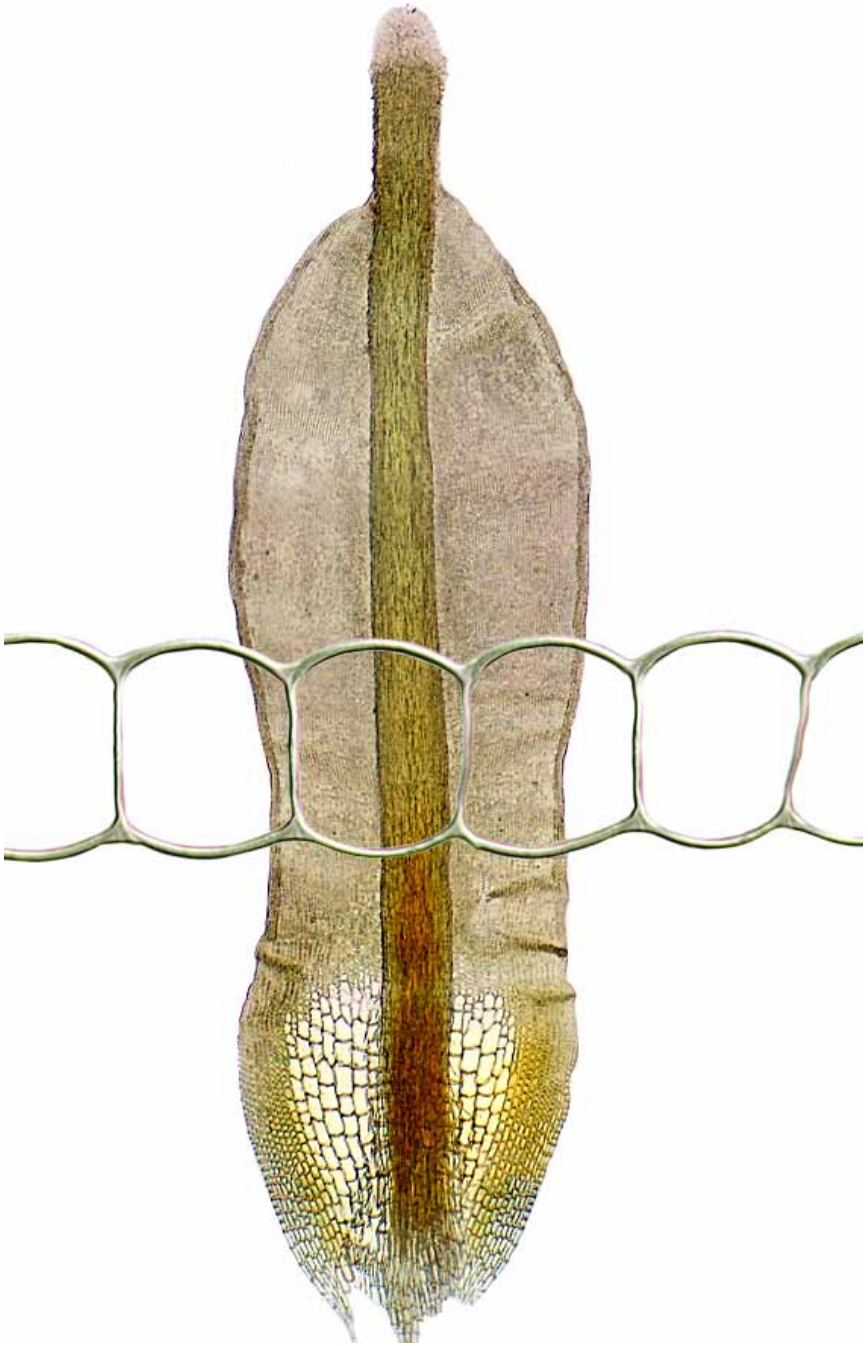


habit, vegetative shoot (dry), leaf outline, propagule, excurrent costa (naked)
 ■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm, ■ 100 μm



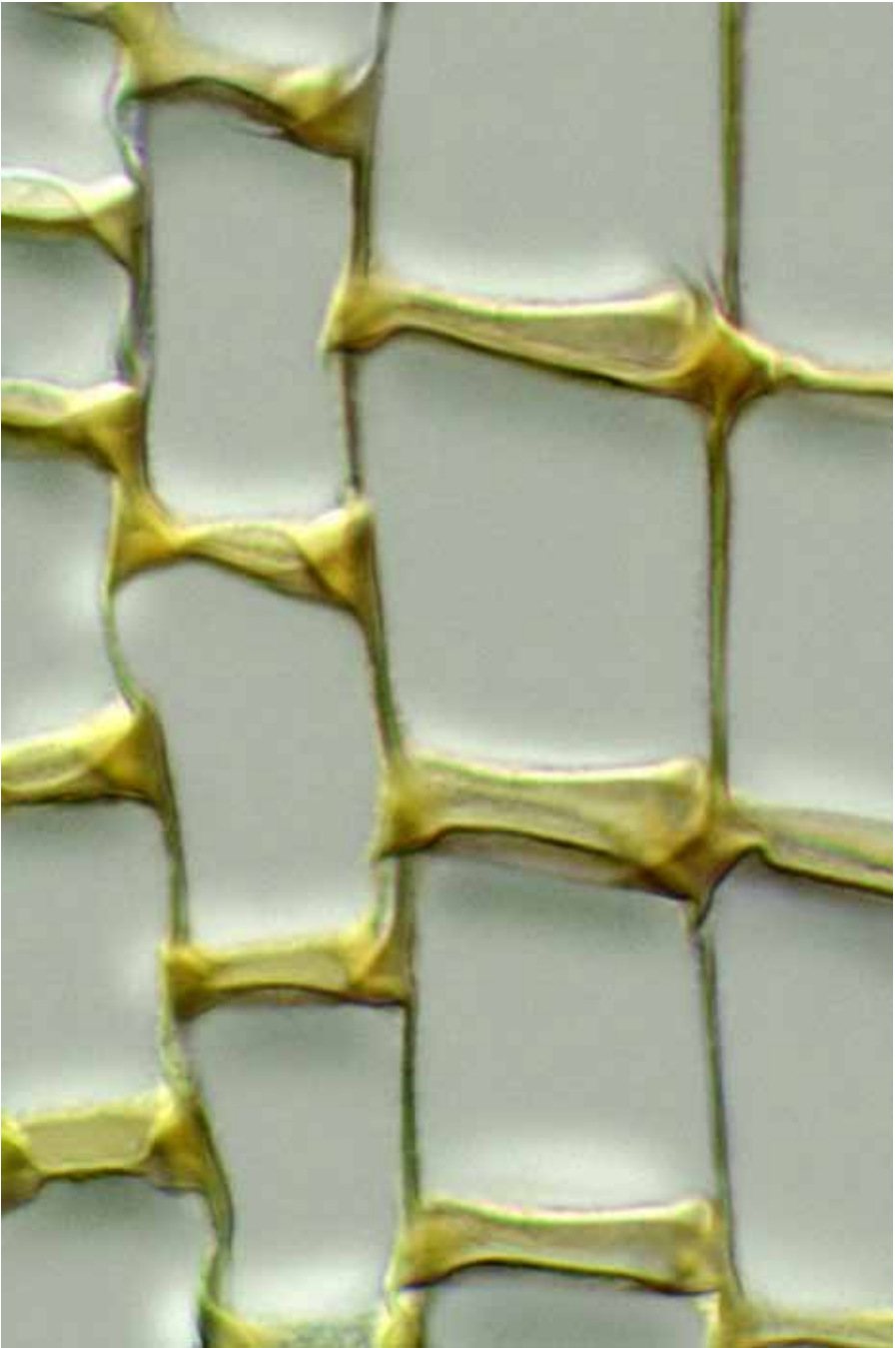
cells midleaf, costa and cancellinae at leaf base, and cancellinae
 ■ 10 μm, ■ 50 μm, ■ 10 μm

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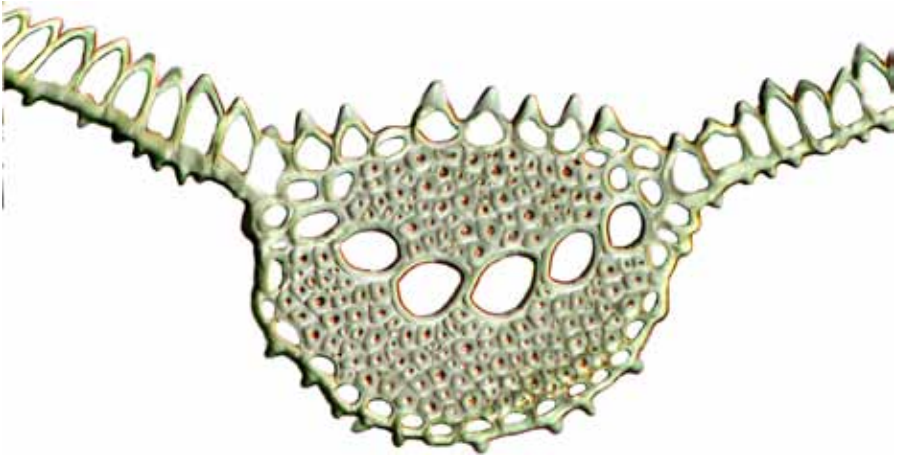
Calymperes tenerum leaf whole-mount and cross-section of cancellina cells
0.1 mm (leaf), 10 μ m (cancellina cells)

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Calymperes tenerum cancellina cells
10 μm

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Calymperes tenerum cross-section of costa (top), lamina at midleaf (middle), and margin (bottom), all showing leaf cells with adaxial bulge and papillae on underside
 ■ 10 μm (top), ■ 10 μm (middle), ■ 10 μm (bottom)

Syrhophodon armatus Mitt.

form: tufts or turves of erect, sparsely forked stems, with red papillose rhizoids, to 10 mm tall, the leaves often appearing glaucous

habitat: bark, soil, rotting logs, stumps, and rock, to 1800 m

leaf: size: 2.5–3.0 × 0.3–0.4 mm

shape: ligulate-linear from a slightly broader sheathing base

tip: mucronate; adaxial surface with a low dense pad of cylindric-clavate gemmae, 4–6-celled, 75 × 25 μm

base: cancellinae abruptly delimited about 1/3 up lamina

costa: subpercurrent, spinose-papillose abaxially

border: narrow, hyaline

margin: entire above, hyaline, toothed-ciliate below, the cilia ± retrorse, plane

cells: 10–15 μm, rounded-isodiametric, firm-walled, unipapillose on both surfaces

capsule: not known in New Zealand, 1–2.5 mm, cylindric, erect, exserted; seta 10–20 mm; calyptra cucullate, deciduous; operculum rostrate; peristome single, the teeth 16



vegetative shoot (moist on left) (2), leaf outline, and leaf apex

1 mm, 1 mm, 1 mm, 10 μm



armed costa, midleaf, lower margin showing cancellinae, and spinose lower margin

10 μm, 10 μm, 10 μm

***Acaulon integrifolium* C.Müll.**

form: gregarious, bulbiform, brownish, unbranched stems, 1–2 mm tall
habitat: bare exposed soil in semi-arid sites at low elevation

leaf: size: 0.5–1.0 × 0.3–0.5 mm

shape: ovate to obovate or elliptic

tip: shortly acute to acuminate

base: basal cells rectangular, hyaline, thin-walled

costa: excurrent in a mucro or arista

border: not differentiated

margin: entire or irregularly denticulate above, plane

cells: 20 × 10 μm, irregularly hexagonal, incrassate, smooth

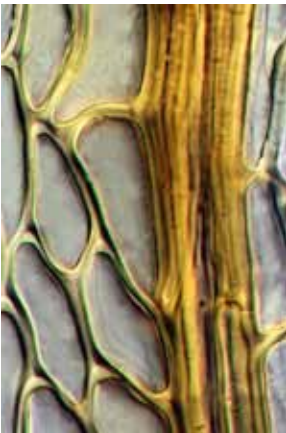
capsule: 0.7 mm in diam., globose, erect, immersed, cleistocarpous, orange to chestnut; seta 0.2 mm long; calyptra small; spores 36–38 μm in diam.

note: *Pleuridium nervosum* too has a reddish capsule, but differs in having narrower leaves and leaf cells



fertile habit, leaf outline, leaf apex, and margin midleaf

1 mm, 0.1 mm, 10 μm, 10 μm



costa midleaf, cells midleaf, and margin near leaf base

10 μm, 10 μm, 10 μm

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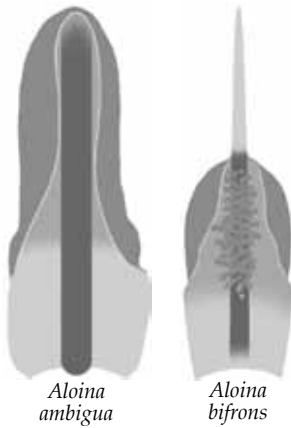


Acaulon integrifolium fertile habit
1 mm

Key* to the New Zealand species of *Aloina* (2)

- 1 Leaf apex muticous; costa percurrent to subpercurrent..... ● ***Aloina ambigua***
 1: Leaf apex piliferous; costa indistinct in upper leaf ● ***Aloina bifrons***

* based on Delgadillo M, C (2007): *Aloina*. *Flora of North America* 27, 615.



Aloina ambigua (Bruch & W.P.Schimper) Limpricht

form: rosettes of infolded leaves enclosing dense adaxial filaments

habitat: calcareous gravel and clayey soils

leaf: size: 1–3 × 0.3–0.7 mm

shape: lingulate from a slightly wider base

tip: obtuse (can be pointed when the leaf margins are spread), cucullate

base: basal cells rectangular with thick hourglass-shaped transverse walls

costa: ± reaching the apex; dense adaxial cushion of filaments 3–6 cells tall, the terminal cell apically thickened

border: not differentiated

margin: entire, deeply infolded

cells: 15–20 μm, quadrate to oblong, thick-walled, smooth

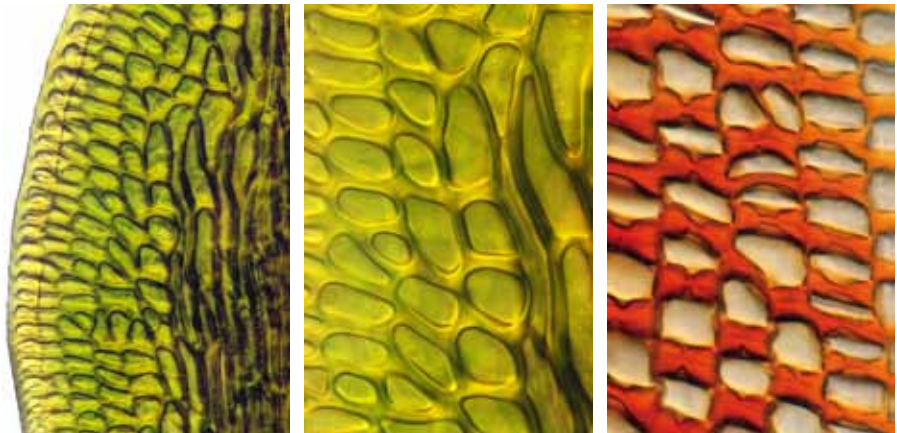
capsule: to 2.5 mm, narrowly cylindrical, straight, erect; seta 6–12 mm;

peristome teeth filiform, twisted

note: the rosette resembles an *Agave* plant in miniature



fertile shoot, capsule and peristome, rosette, leaf outline, leaf apex, and costal filaments
 ■ 1 mm, ■ 0.5 mm, ■ 0.5 mm, ■ 0.1 mm, ■ 10 μm, ■ 10 μm



margin midleaf, cells in upper leaf, and cells near leaf base
 ■ 10 μm, ■ 10 μm, ■ 10 μm

continued next page



Aloina ambigua filamentous peristome
0.1 mm

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Aloina bifrons (De Not.) Delgad.

form: gregarious to loosely tufted, erect, simple stems, 2–6 mm tall

habitat: limestone or calcareous soil in semi-arid sites to high elevations

leaf: *size:* to 2 mm including arista

shape: widely elliptic; KOH reaction red

tip: subacute, cucullate

base: sheath cells pellucid and their transverse walls strongly thickened

costa: broad, indistinct, excurrent in a cusp or a smooth, hyaline arista

border: not differentiated

margin: entire, strongly involute above

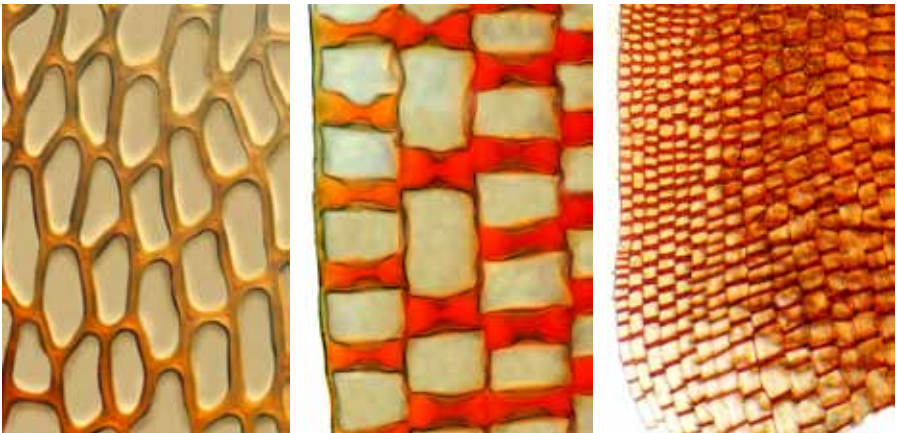
cells: 15 μm , \pm isodiametric, thick-walled, smooth

capsule: 3–3.5 mm, narrowly cylindrical, erect, brown; seta 10–40 mm, flexuose; peristome teeth 32, filamentous, arising from a low cylinder; operculum narrowly conic, about 1/3 the length of the capsule

note: on the adaxial costa and lamina is a dense mat of filamentous propagules



fertile shoot (dry), operculum, capsule, peristome, leaf outline, propagules, base of arista
 ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 0.1 mm, ■ 10 μm , ■ 10 μm



cells of sheathing leaf base, margin of lower leaf, and leaf basal angle
 ■ 10 μm , ■ 10 μm , ■ 50 μm

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Aloina bifrons margin near leaf base
10 μm

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Aloina bifrons margin of upper sheath
10 μm

Anoetangium aestivum (Hedw.) Mitt.

form: dull, matted tufts of sparsely branched, tomentose stems, 15–40 mm tall
habitat: damp rock, often calcareous, near water sources to high elevations

leaf: size: 1–1.5 × 0.2–0.3 mm

shape: linear-lanceolate, carinate, appressed and twisted when dry

tip: acuminate

base: cells at the base rectangular and smooth

costa: failing or shortly excurrent, papillose at the back

border: not differentiated

margin: entire, plane

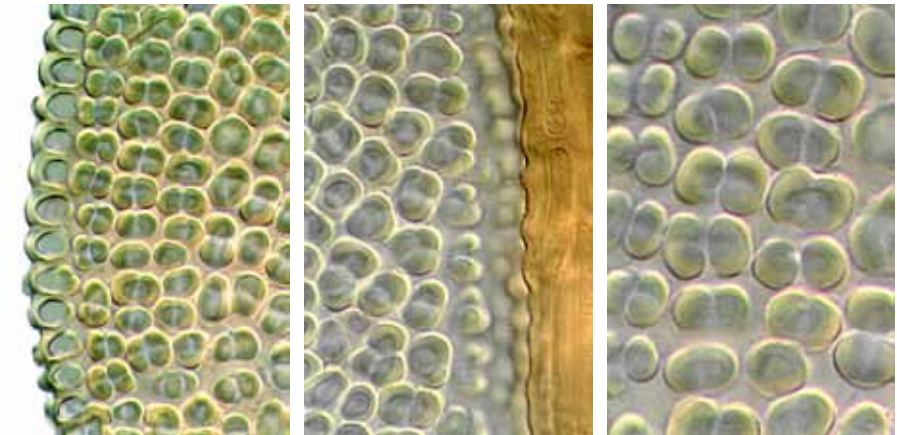
cells: 10 μm diam., subquadrate, thick-walled, papillose, rectangular below

capsule: 0.8–1.5 mm, oval to oblong with a tapered neck, erect, symmetrical; seta 10 mm, slender, lateral; operculum finely long-rostrate; peristome absent

note: *Amphidium cyathicarpum* differs in having a smooth costa and leaves that are crisped when dry



vegetative shoots (dry), leaf outline, leaf apex, and margin upper leaf
 1 mm, 0.5 mm, 10 μm, 10 μm



margin midleaf, cells near costa, and surface papillae
 10 μm, 10 μm, 10 μm

Ardeuma recurvirostrum (Hedw.) R.H.Zander & Hedd.
(formerly *Hymenostylium recurvirostrum*)

form: densely tufted, tomentose, erect, yellow-green stems, 5–40 mm tall

habitat: moist rock or soil over rock, especially limestone

leaf: size: 0.8–1.8 mm

shape: narrowly lanceolate

tip: acuminate

base: basal cells larger than the other blade cells, smooth, hyaline

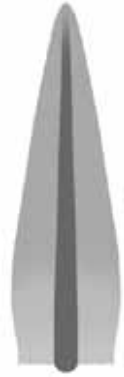
costa: ending below the apex

border: not differentiated

margin: entire, recurved on one or both sides below

cells: 6–13 μm , quadrate to rectangular, firm-walled, pluripapillose

capsule: 0.7–1.2 mm, operculum obliquely rostrate, often remaining attached to the columella after dehiscence, ovoid, erect, straight; seta 3–10 mm; calyptra cucullate, naked, smooth; peristome none; spores 14–20 μm , weakly papillose



shoots (2) (dry), leaf outlines (2), leaf apex, and leaf cross-section
 1 mm, 0.5 mm, 10 μm , 10 μm

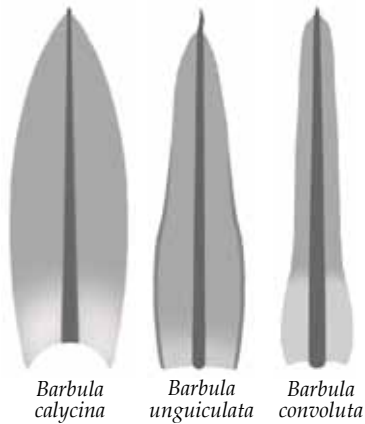


margin midleaf, costa midleaf, and margin near leaf base
 10 μm , 10 μm , 10 μm

Key* to the New Zealand species of *Barbula* (3)

- 1 Margin plane or only slightly recurved or revolute; leaves flaccid or undulate 2
 1: Margin strongly recurved; leaves stiff ● ***Barbula unguiculata***
- 2 Leaves broadly oblong-lanceolate; costa excurrent in a mucro ... ● ***Barbula calycina***
 2: Leaves oblong-ligulate from a broader base; costa ending at or just below the apex....
 ● ***Barbula convoluta***

* based partly on Catcheside, DG (1980): *Mosses of South Australia*. Government Printer, Adelaide. 177.



Barbula calycina Schwäger.

form: tufted, yellow-green, unbranched stems, tomentose, 5–30 mm tall
habitat: soil or rock in open dunes, forest, or scrub, to high elevations

leaf: size: 2–3 × 0.6–0.9 mm

shape: widely oblong-lanceolate, spirally contorted when dry

tip: acuminate with a mucro

base: basal cells rectangular, hyaline, smooth

costa: excurrent in a mucro

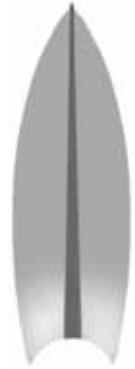
border: not differentiated

margin: entire, involute, variably undulate

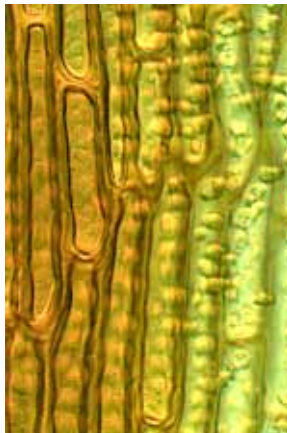
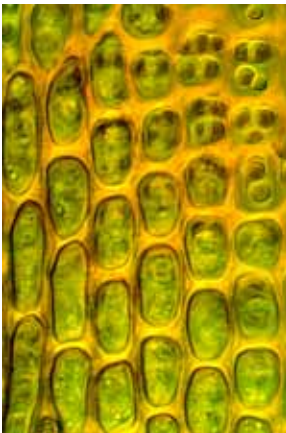
cells: 8–10 μm, isodiametric, thick-walled, densely papillose

capsule: 1.3–2 mm, elliptic or fusiform, slightly curved, erect or inclined;
 seta 10–35 mm, slender, often flexuose; operculum finely long-rostrate;
 peristome of 32 brown, papillose filaments; spores 8–10 μm in diam.

note: differs from *Tortella* in lacking a V-shaped base of hyaline cells



vegetative habit (moist), shoot (dry), leaf outline, and mucronate leaf apex
 5 mm, 5 mm, 1 mm, 50 μm



cells midleaf, juxtacostal cells in lower leaf, and costa cross-section
 10 μm, 10 μm, 10 μm

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Barbula calycina vegetative habit
1 mm

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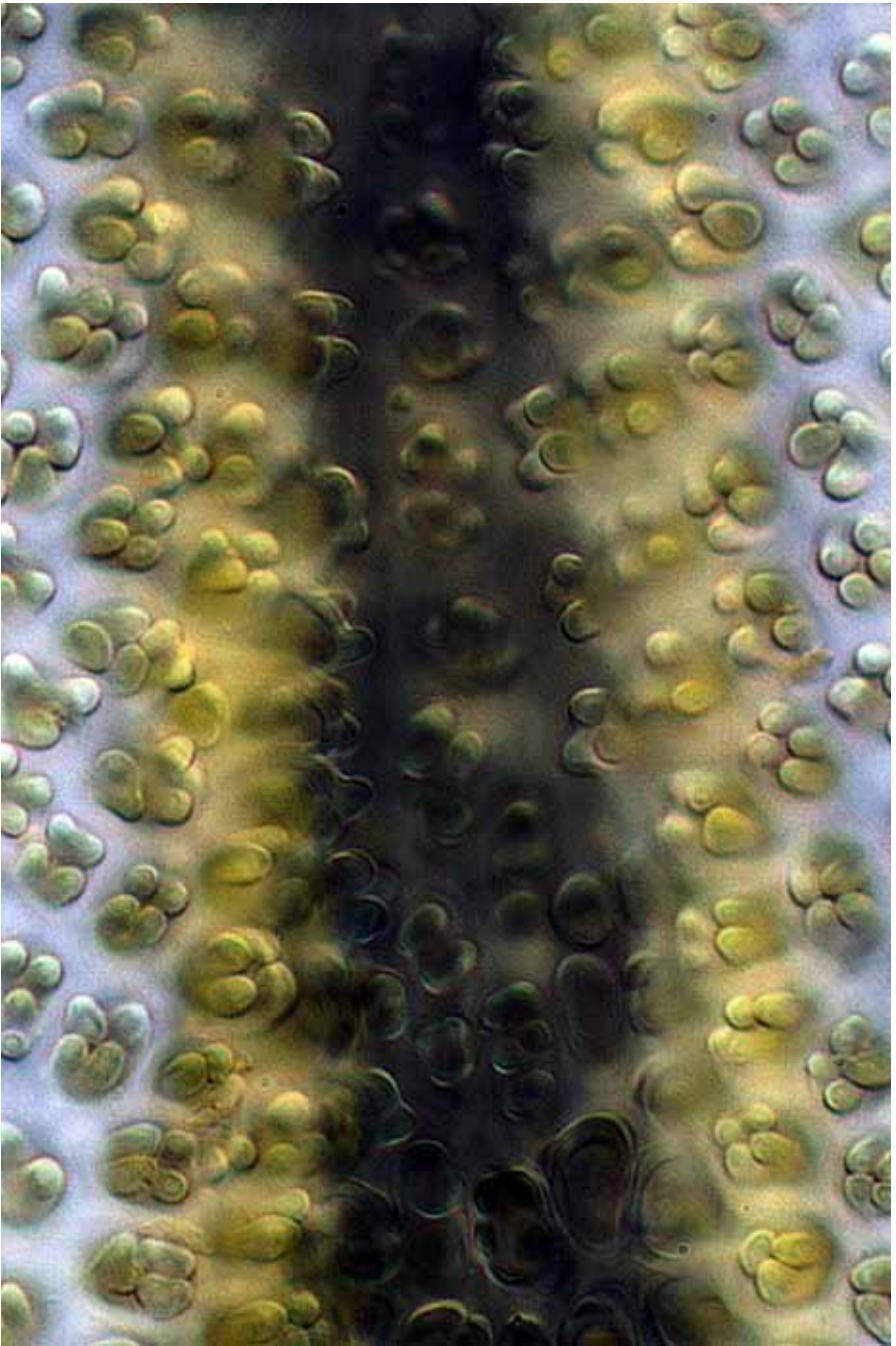
Barbula calycina vegetative habit
1 mm, 1 mm

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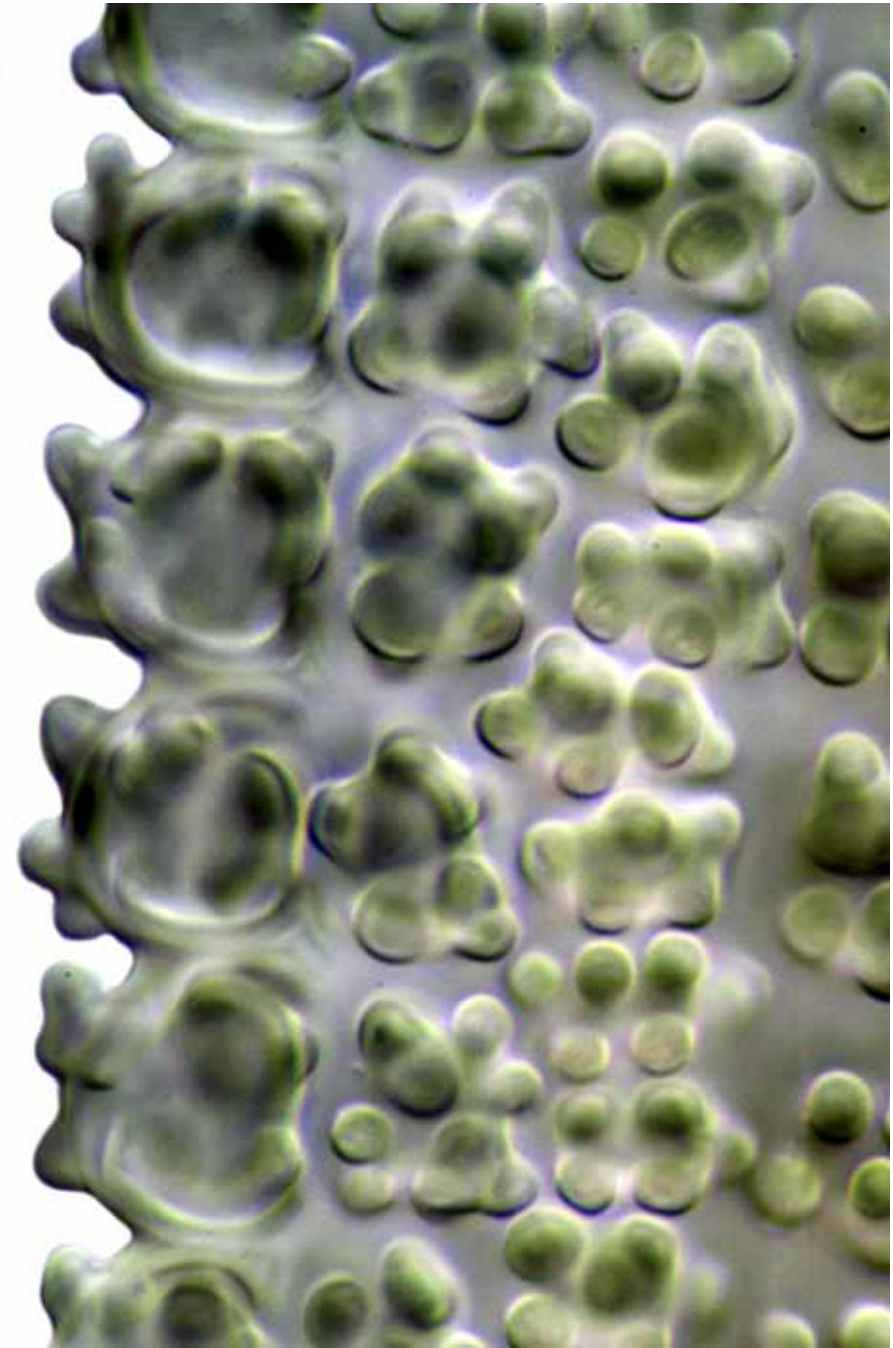
Barbula calycina fertile shoots, showing immature capsules and calyptrae
1 mm, 1 mm, 1 mm

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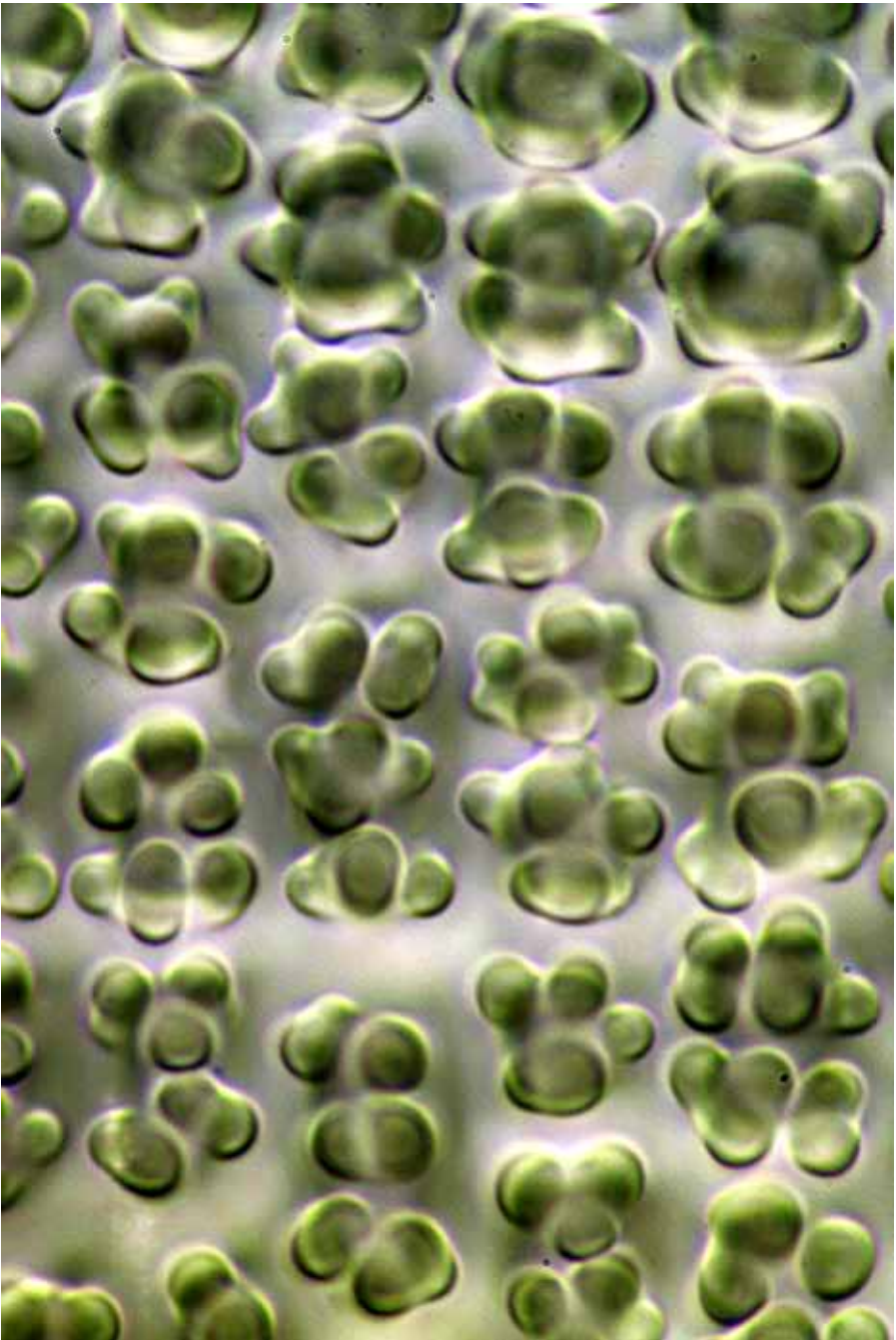
Barbula calycina leaf surface papillae above costa
10 μ m

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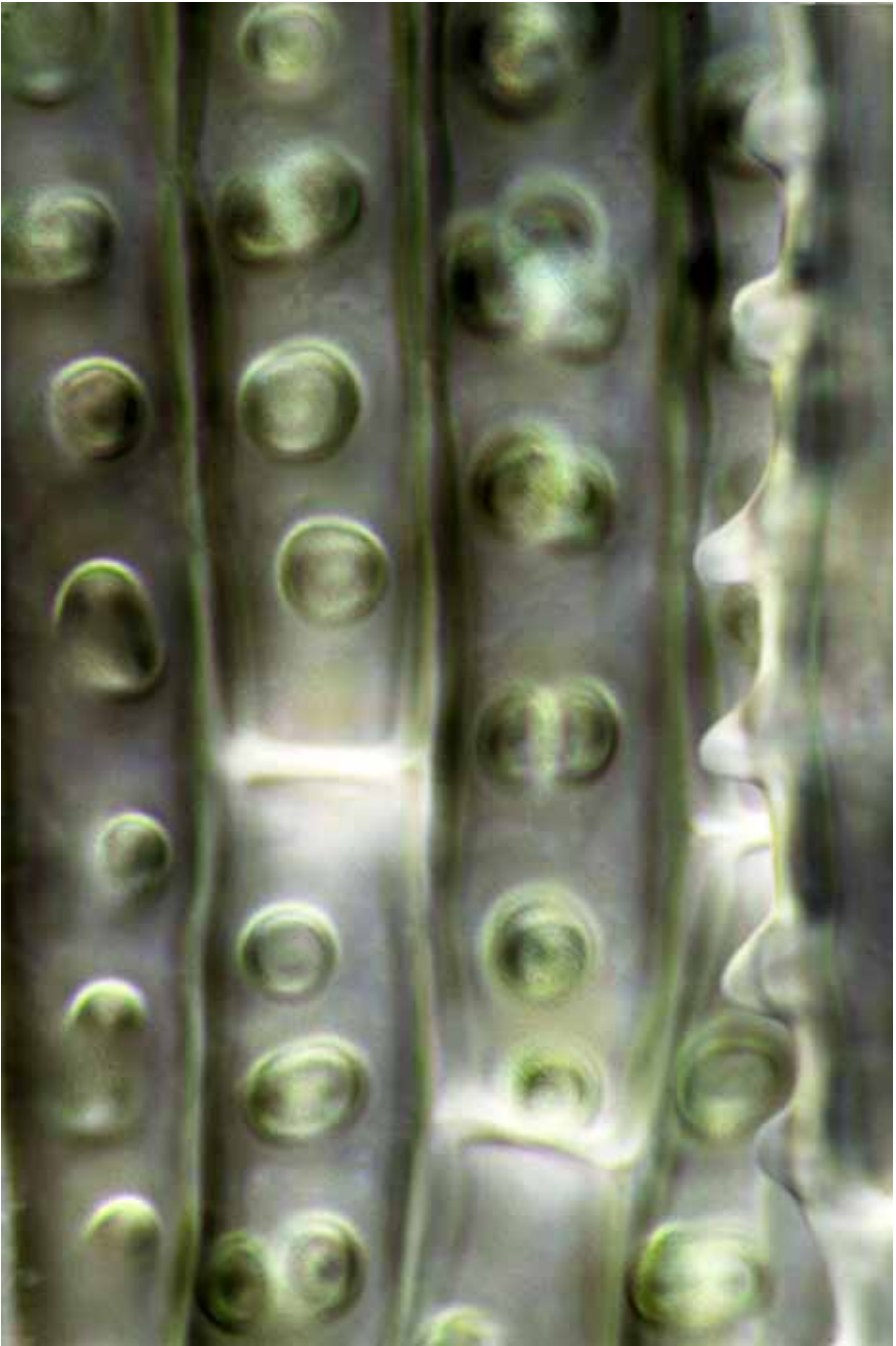
Barbula calycina margin midleaf showing surface papillae
10 μ m

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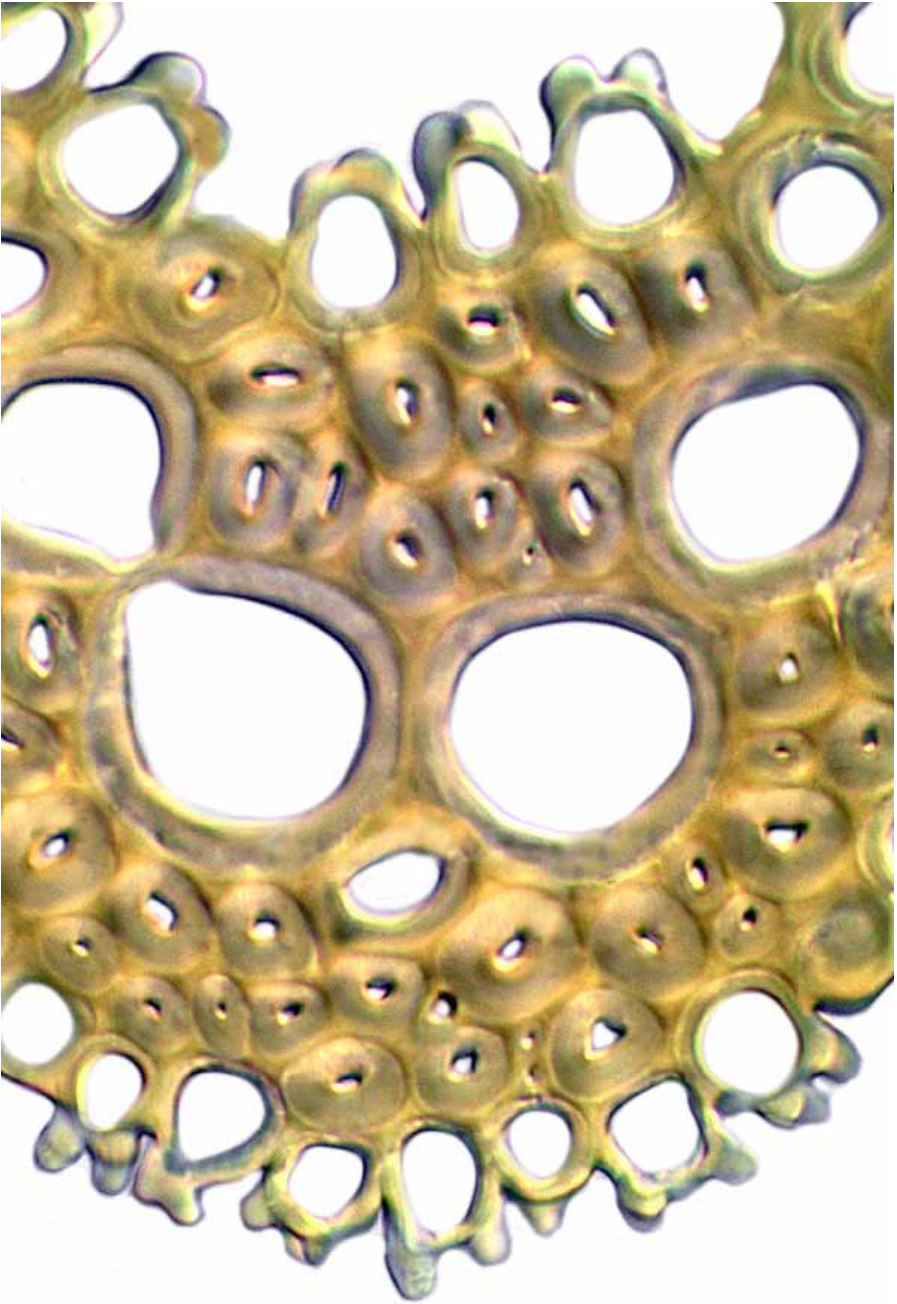
Barbula calycina surface papillae midleaf
10 μm

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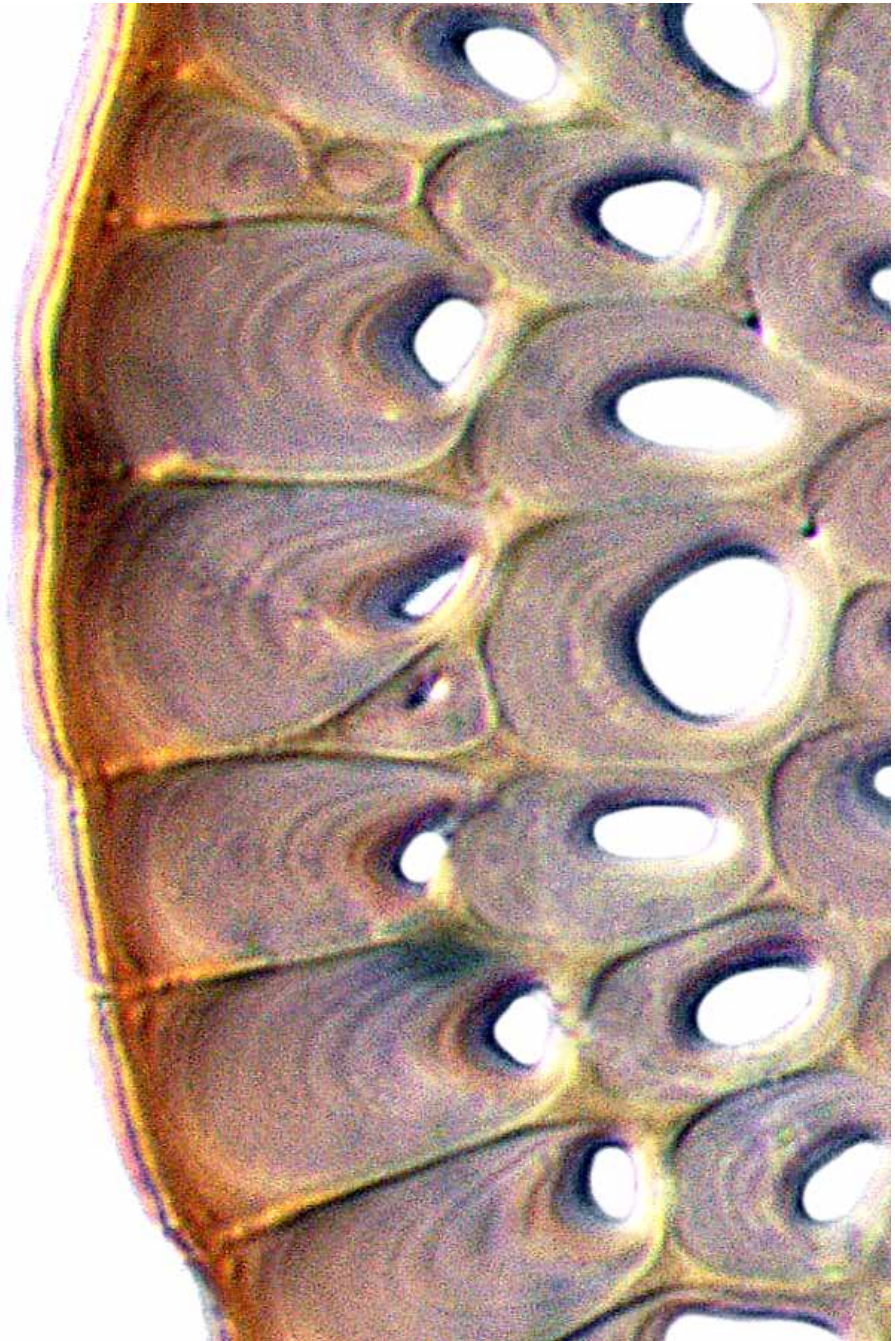
Barbula calycina juxtacostal cells in lower leaf, showing single rows of surface papillae
10 μm

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Barbula calycina costa cross-section
10 μ m

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Barbula calycina seta cross-section
10 μ m

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Barbula convoluta Hedw.**form:** densely tufted, green or yellowish stems, 5–15 mm tall**habitat:** calcareous soil or rock in open, disturbed sites such as roadsides**leaf:** size: 0.8–1.5 mm*shape:* oblong-lanceolate to oblong-ligulate*tip:* rounded-obtuse to broadly acute, usually minutely apiculate*base:* basal cells rectangular, firm-walled, pale, smooth*costa:* failing or excurrent in an apiculus*border:* not differentiated*margin:* crenulate-papillose, plane or revolute on one side toward the base*cells:* 6–9 μm , quadrate to hexagonal, thin-walled, densely papillose**capsule:** 1.2–1.8 mm, oblong-cylindric, erect to slightly inclined, light brown, short-necked, \pm furrowed when dry; seta 10–20 mm, slender, yellow or straw; annulus revolute; operculum a long narrow tilted cone; peristome teeth pink; spores 7–9 μm in diam.

vegetative shoots (the left two dry, the right one moist), leaf outline, and leaf apex
 1 mm (3), 0.25 mm, 10 μm



margin midleaf, costa midleaf, and costa cross-section
 10 μm , 10 μm , 10 μm

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Barbula unguiculata Hedw.

form: patchy to densely tufted, sparsely branched stems, 5–35 mm tall
habitat: calcareous soil and rock in the open, often in disturbed sites

leaf: size: 1–2.5 × 0.3–0.6 mm

shape: oblong-lanceolate from a widened base, contorted when dry

tip: blunt to broadly acute, abruptly apiculate

base: basal cells hyaline, rectangular, thin-walled, smooth

costa: shortly excurrent, papillose on the back

border: not differentiated

margin: entire to crenulate, revolute in the lower half or two-thirds

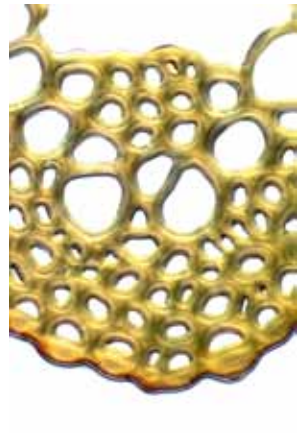
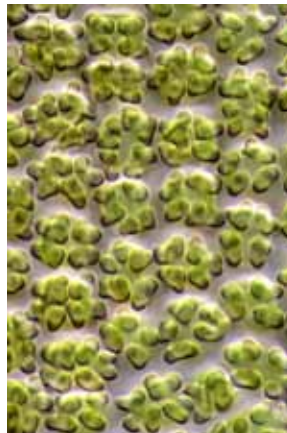
cells: 8–10 μm, rounded-hexagonal, firm-walled, pluripapillose

capsule: 1–2 mm, narrowly ellipsoid, straight, erect, stomatose at only the base; annulus absent; seta 5–13 mm, reddish; operculum a long, subulate cone; peristome orange or red; spores 9–13 μm in diam.

note: the stout, smooth apiculus of the leaf tip is a distinctive trait



vegetative habit, shoot (moist), leaf outline, and leaf apex
 1 mm, 1 mm, 0.1 mm, 50 μm



margin midleaf, surface papillae, and costa cross-section
 10 μm, 10 μm, 10 μm



Barbula unguiculata habit
1 mm

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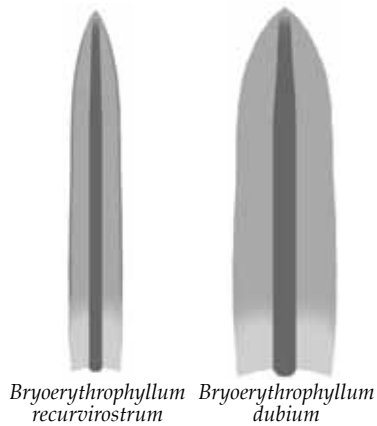


Barbula unguiculata leaf surface papillae
10 μ m

Key* to the New Zealand species of *Bryoerythrophyllum* (2)

- 1 Leaves linear; margin recurved to near the apex ● ***Bryoerythrophyllum recurvirostrum***
 1: Leaves widely oblong-lanceolate; margin slightly recurved only near the base..... ● ***Bryoerythrophyllum dubium***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bulletin 5, 159.



Bryoerythrophyllum dubium (Schwägr.) P.Sollman

form: tufted, erect, unbranched stems, bright rust-coloured, to 10 mm tall
habitat: soil or rock, often in disturbed sites, to high elevations

leaf: size: 1.5–2.5 mm

shape: oblong-lanceolate

tip: acute, with a ± hyaline apiculus

base: basal cells rectangular, hyaline, smooth

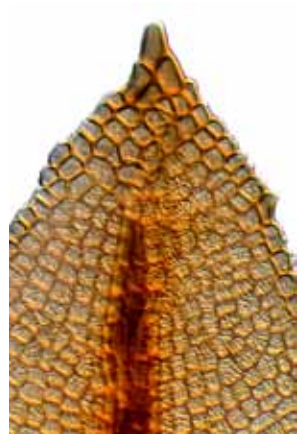
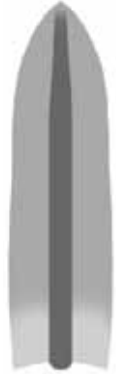
costa: failing below the apex

border: not differentiated

margin: faintly toothed toward the apex, plane or slightly recurved below

cells: 7–10 μm, subquadrate, firm-walled, multi-papillose

capsule: 2 mm, cylindric, ± curved, pale brown; annulus revoluble; seta 10 mm, flexuose; operculum obliquely short- to long-rostrate; peristome teeth 16, brown, short, divided from a short basal membrane into two papillose articulated filaments; spores 12 μm in diam.



vegetative habit, leaf outline, and leaf apex

1 mm, 0.5 mm, 100 μm



margin midleaf, costa midleaf, and leaf base cells

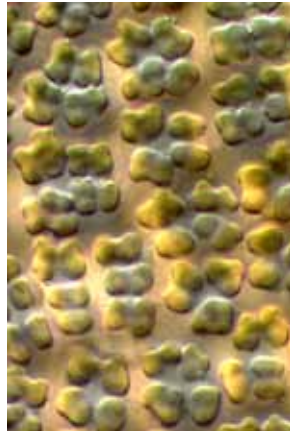
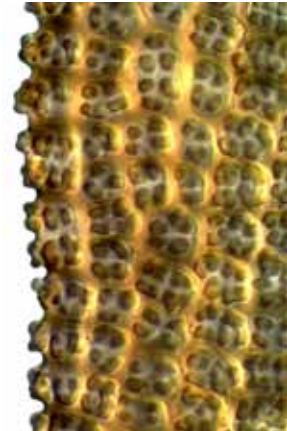
10 μm, 10 μm, 10 μm

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Bryoerythrophyllum recurvirostre (Hedw.) P.C.Chen**form:** loosely to densely tufted stems, brick-red above, 5–20(–30) mm tall**habitat:** moist soil, logs, or calcareous rock in shady or open, ± disturbed sites**leaf:** size: 2.0–2.8 × 0.3–0.5 mm, crisped or curled when dry**shape:** linear-lanceolate to ligulate from an oblong, erect base**tip:** bluntly acute, with a ± hyaline apiculus**base:** basal cells rectangular, hyaline to pale reddish brown, smooth**costa:** failing below the apex or shortly excurrent as a pellucid mucro**border:** not differentiated**margin:** faint toothing toward the apex, ± revolute throughout**cells:** 7–10 μm, subquadrate, firm-walled, multi-papillose (C-shaped)**capsule:** 1.3–2.5 mm, cylindrical, symmetric to slightly curved, reddish brown; annulus revolute; seta 6–16 mm, flexuose, red; peristome teeth tan to yellow, perforate or bifid, papillose**note:** *Bryoerythrophyllum recurvirostrum*'s most distinctive vegetative traits are its thin-walled basal cells and smooth irregular apical teeth

vegetative habit, leaf outline, leaf apex, and apical hyaline apiculus

1 mm, 0.5 mm, 10 μm, 10 μm



margin midleaf, papillose midleaf cells, and rectangular leaf base cells

10 μm, 10 μm, 10 μm

Calyptopogon mnioides (Schwägr.) Broth.

form: robust, tufted or matted, yellowish green stems, sparsely branched, rhizoidal below, 10–40 mm tall

habitat: scattered on bark of twigs in high-altitude forest

leaf: size: 3–4 × 0.9–1.2 mm

shape: oblong-lanceolate to elliptic, crisped when dry

tip: shortly acuminate

base: basal cells rectangular to linear, hyaline, thin-walled

costa: excurrent as a cusp; projecting abaxially

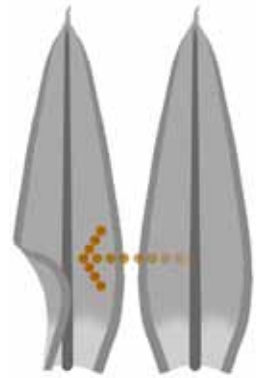
border: 2–3 intramarginal rows of long, thick-walled cells

margin: entire or minutely crenulate, undulate

cells: 10 μm, isodiametric, incrassate, papillose

capsule: 2–2.5 mm, erect, oblong-cylindric, erect, symmetrical, red-mouthed; seta 3–4 mm; calyptra mitriform, deeply lobed; peristome of 32 red filaments

note: brood bodies on the adaxial costa toward the leaf tip

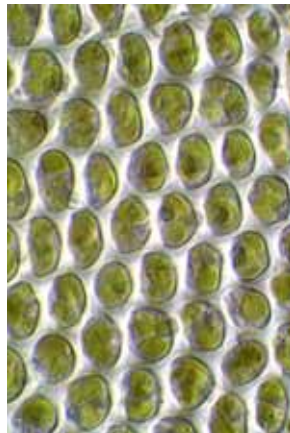


coverslipped



vegetative shoots (wet/dry), leaf outline, shoot (dry), and leaf apex with brood bodies

1 mm (2), 0.5 mm, 1 mm, 100 μm



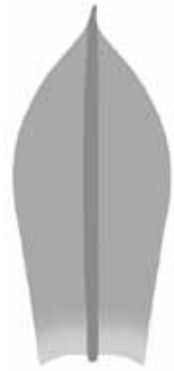
intramarginal leaf border, cells midleaf, and brood bodies

10 μm, 10 μm, 30 μm

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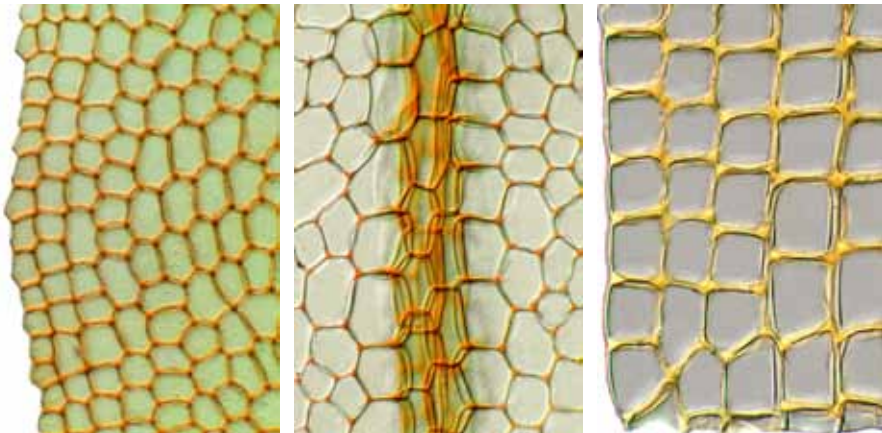


Calyptopogon mnioides costa and brood bodies cross-section
10 μm

Chenia leptophylla (Müll.Hal.) R.H.Zander**form:** solitary or clustered, erect, dark green stems, 3–8 mm tall**habitat:** moist soil, rock or rock walls, lowland to montane**leaf:** size: 1.4–2.0 × 0.4–0.6 mm*shape:* oblong to spatulate*tip:* acute, often apiculate*base:* basal cells 30–50 × 15–20 μm*costa:* percurrent to slightly excurrent*border:* not differentiated*margin:* irregular with projecting cells, plane*cells:* 17–30 × 15–20 μm, ± quadrate, irregularly thickened, ± smooth**capsule:** not seen in New Zealand; 0.5–0.7 mm, elliptic, erect, cleistocarpous, pale brown, with an oblique beak; seta 0.2 mm; annulus absent; calyptra cucullate to mitrate, smooth; operculum absent; spores 15–20 μm, smooth to papillose**note:** vegetative reproduction by rhizoidal tubers and deciduous leaves

vegetative habit (dry and moist), leaf outline, and leaf apex

1 mm, 1 mm, 0.1 mm, 10 μm



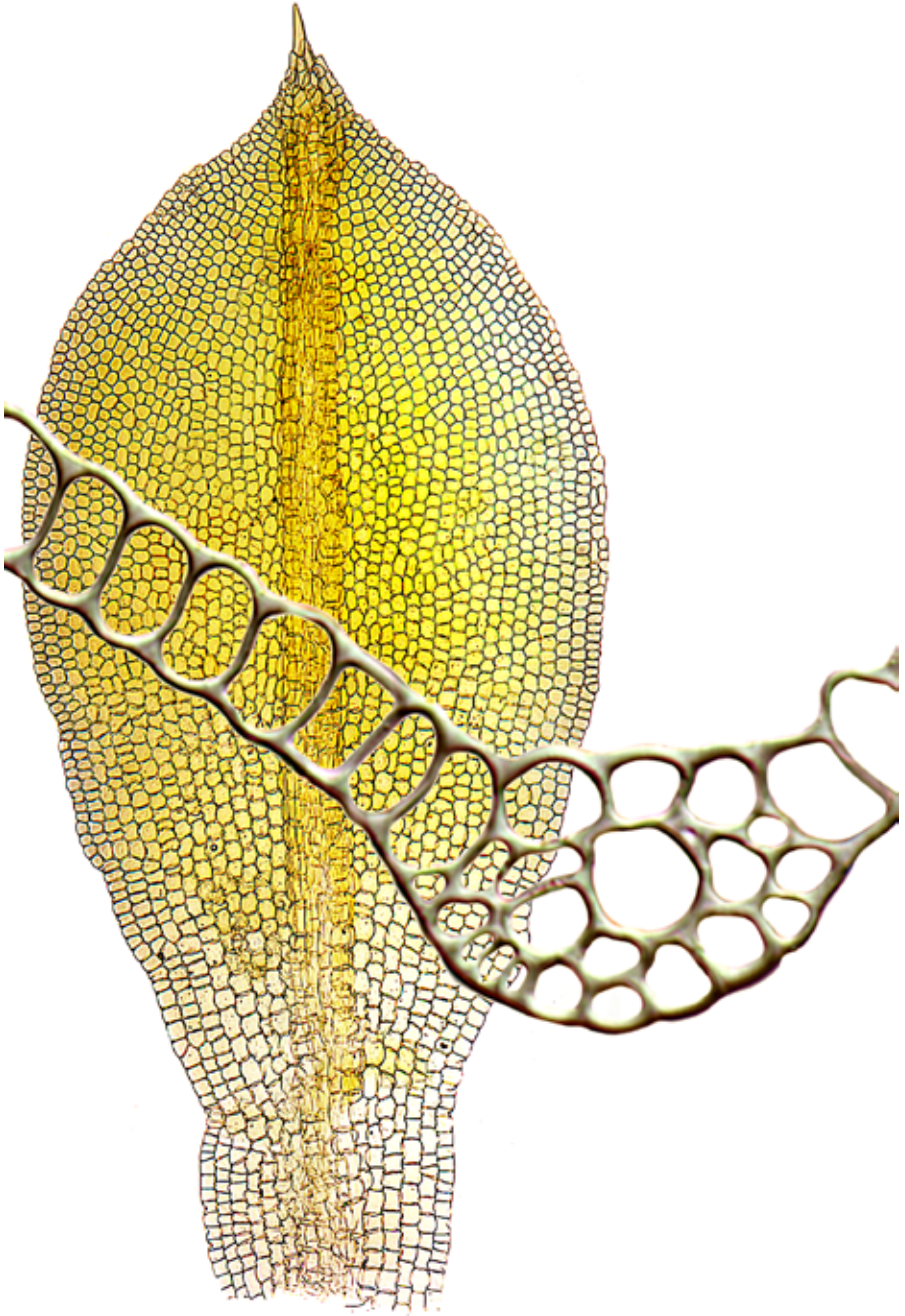
margin midleaf, costa midleaf, and leaf basal angle

10 μm, 10 μm, 10 μm



Chenia leptophylla habit
1 mm

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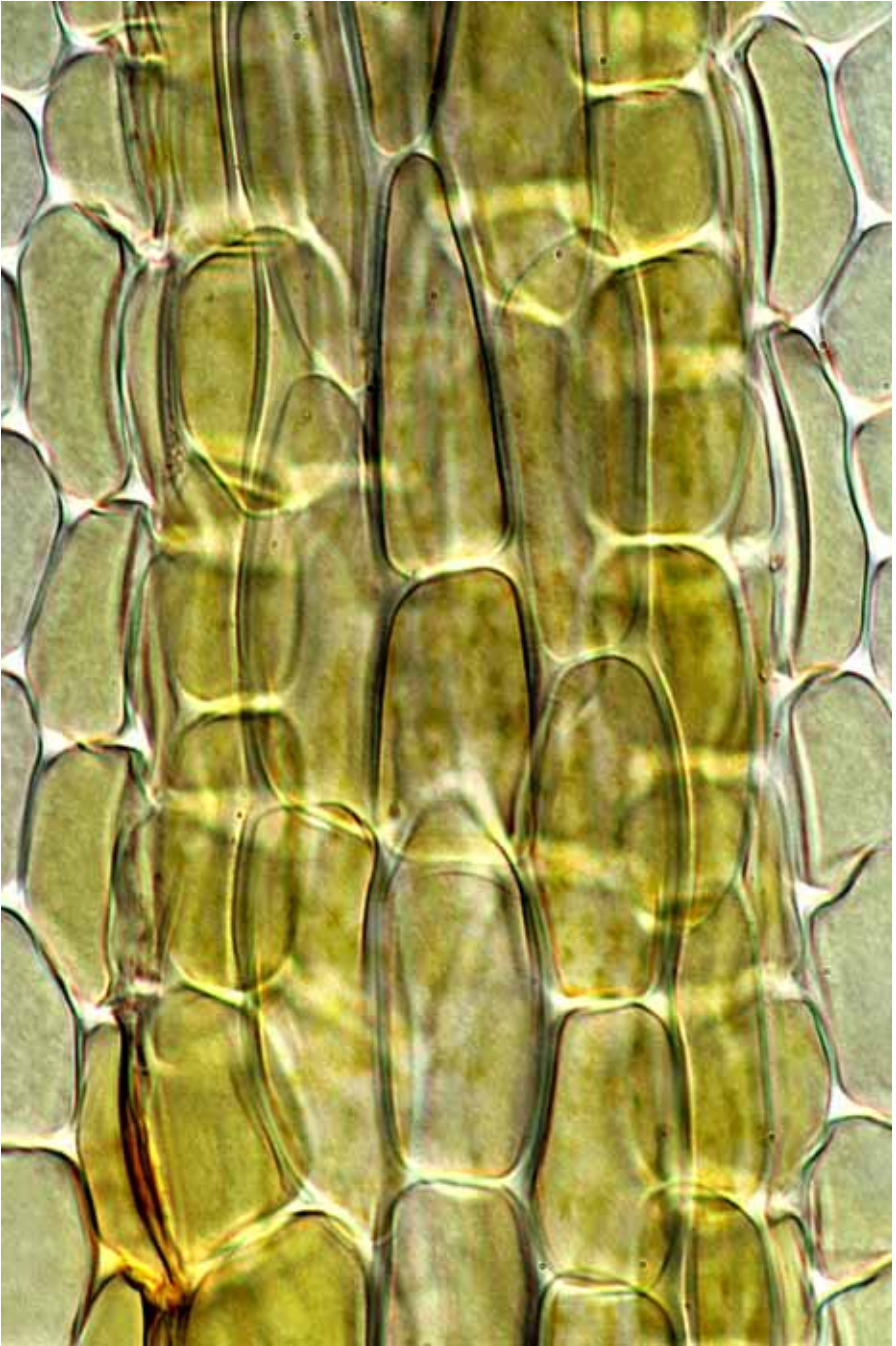
Chenia leptophylla leaf outline and costa cross-section
100 μm (outline), 10 μm (section)

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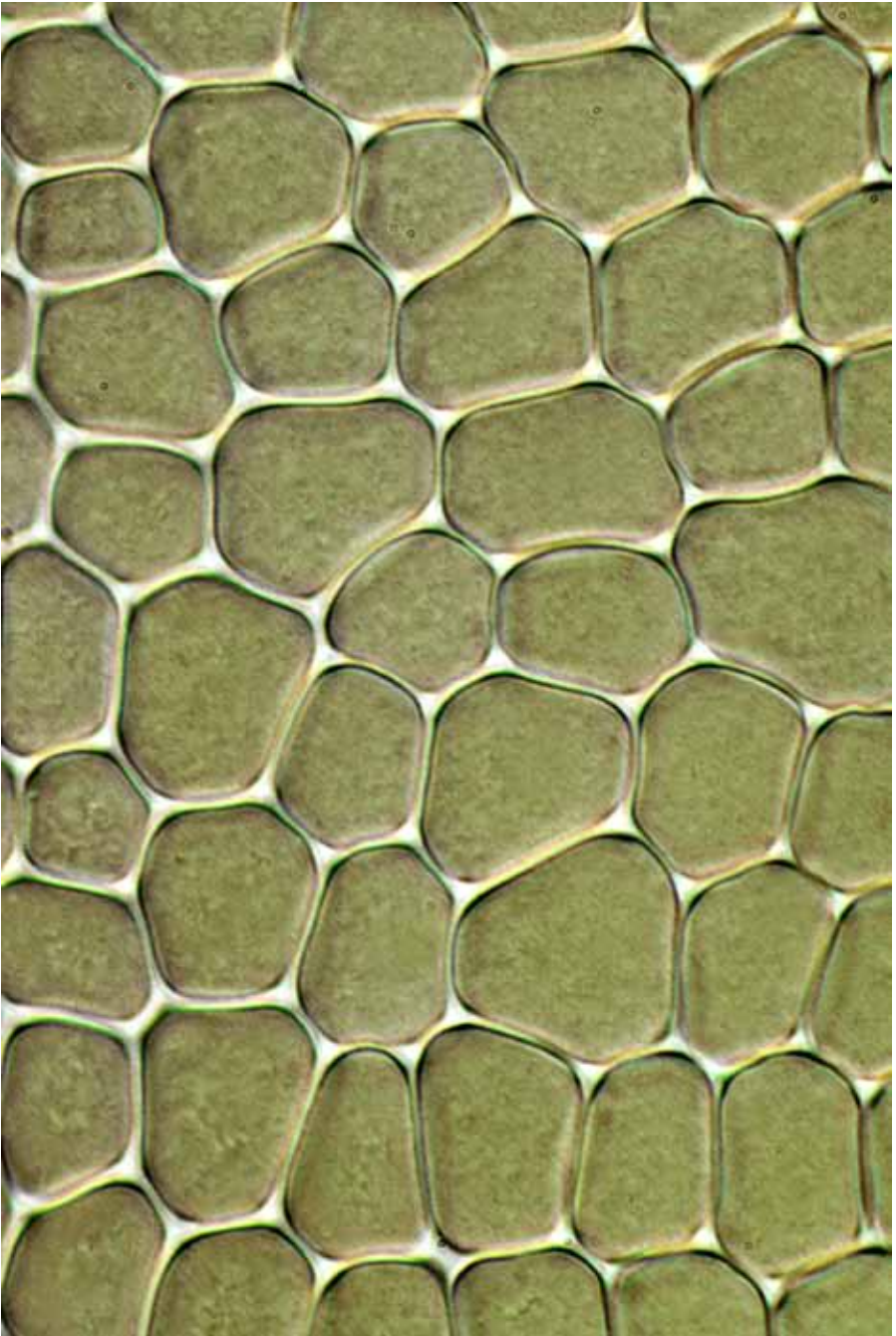
Chenia leptophylla leaf apex
10 μm

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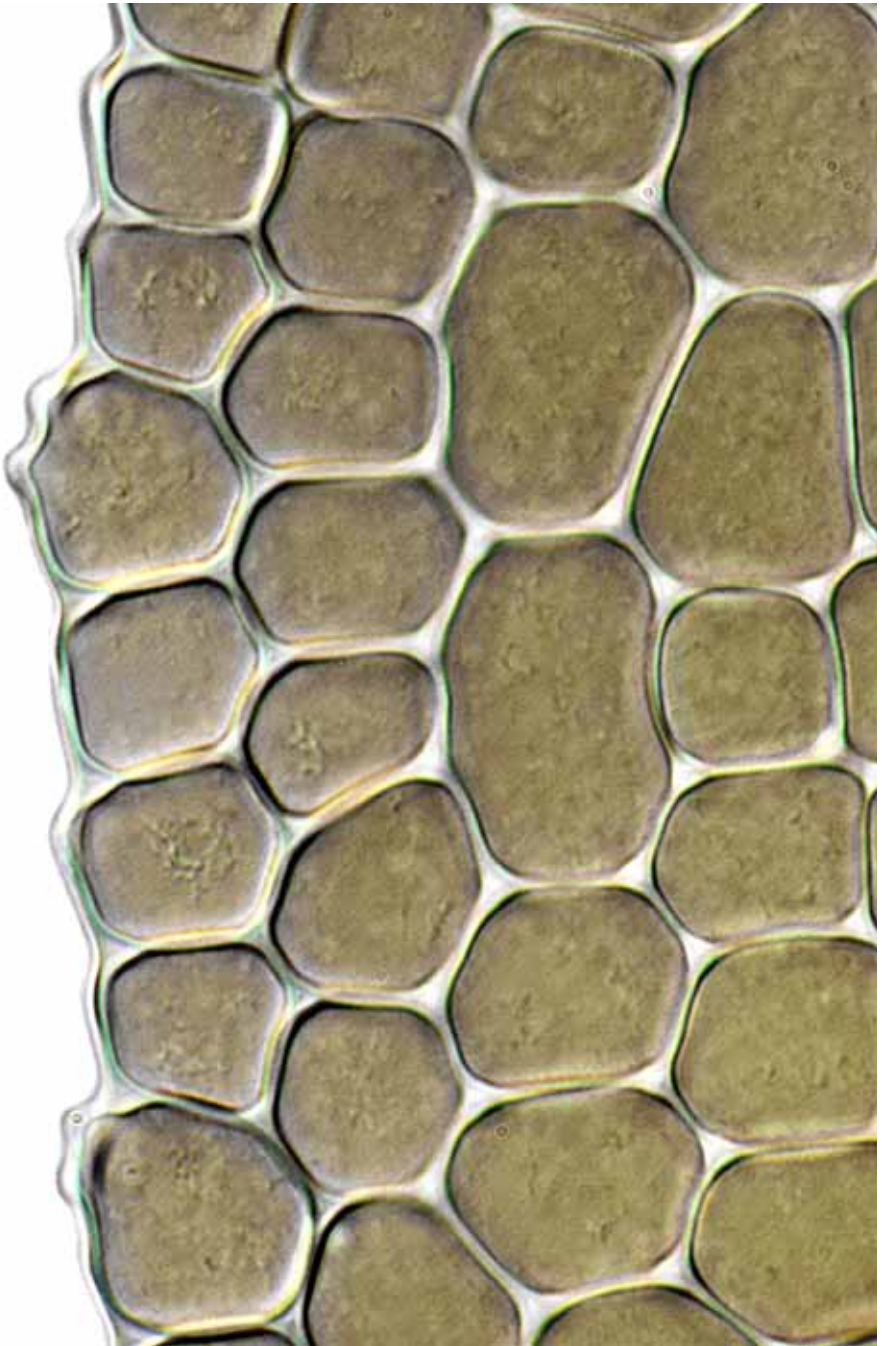
Chenia leptophylla costa midleaf
10 μm

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Chenia leptophylla cells midleaf
10 μ m

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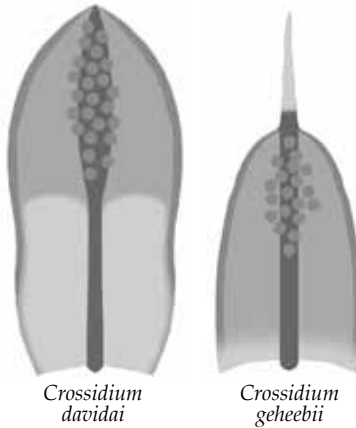


Chenia leptophylla margin midleaf
10 μ m

Key* to the New Zealand species of *Crossidium* (2)

- 1 Costa excurrent in a mucro; upper lamina cells papillose ● ***Crossidium davidai***
 1: Costa excurrent in a hair-point; upper lamina cells ± smooth ● ***Crossidium geheebii***

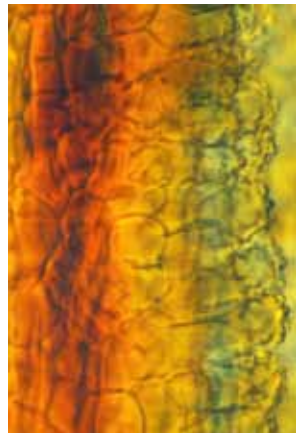
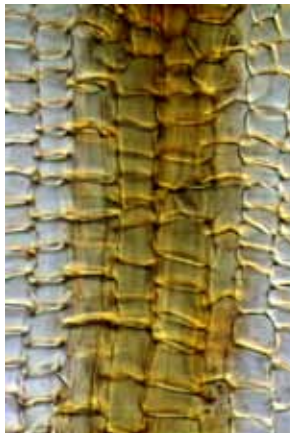
* based on Catcheside, DG (1980): *Mosses of South Australia*. Government Printer, Adelaide.



Crossidium davidai Catches.**form:** gregarious, erect stems, brown above**habitat:** soil in dry scrub**leaf:** size: 1.5–1.9 × 0.5–0.7 mm**shape:** linguulate-obovate; adaxial filaments 1–4 cells tall, the terminal cell ± globose, 20–25 μm in diam., with 4–6 mammillae**tip:** broadly acute to obtuse or rounded, subcucullate**base:** basal cells rectangular, 18–50 μm long**costa:** percurrent to excurrent in a short mucro, in cross-section with 6–8 rows of stereids**border:** not differentiated**margin:** entire, revolute to recurved to nearly the base**cells:** 12–16 μm, quadrate to rectangular, firm-walled, 1–4-papillose**capsule:** 2.0–2.3 mm, cylindric, erect, exserted, brown; seta 5–9 mm, pale brown; peristome of 32 pale papillose teeth; operculum conic

vegetative shoot (dry and moist), leaf outline, and leaf apex

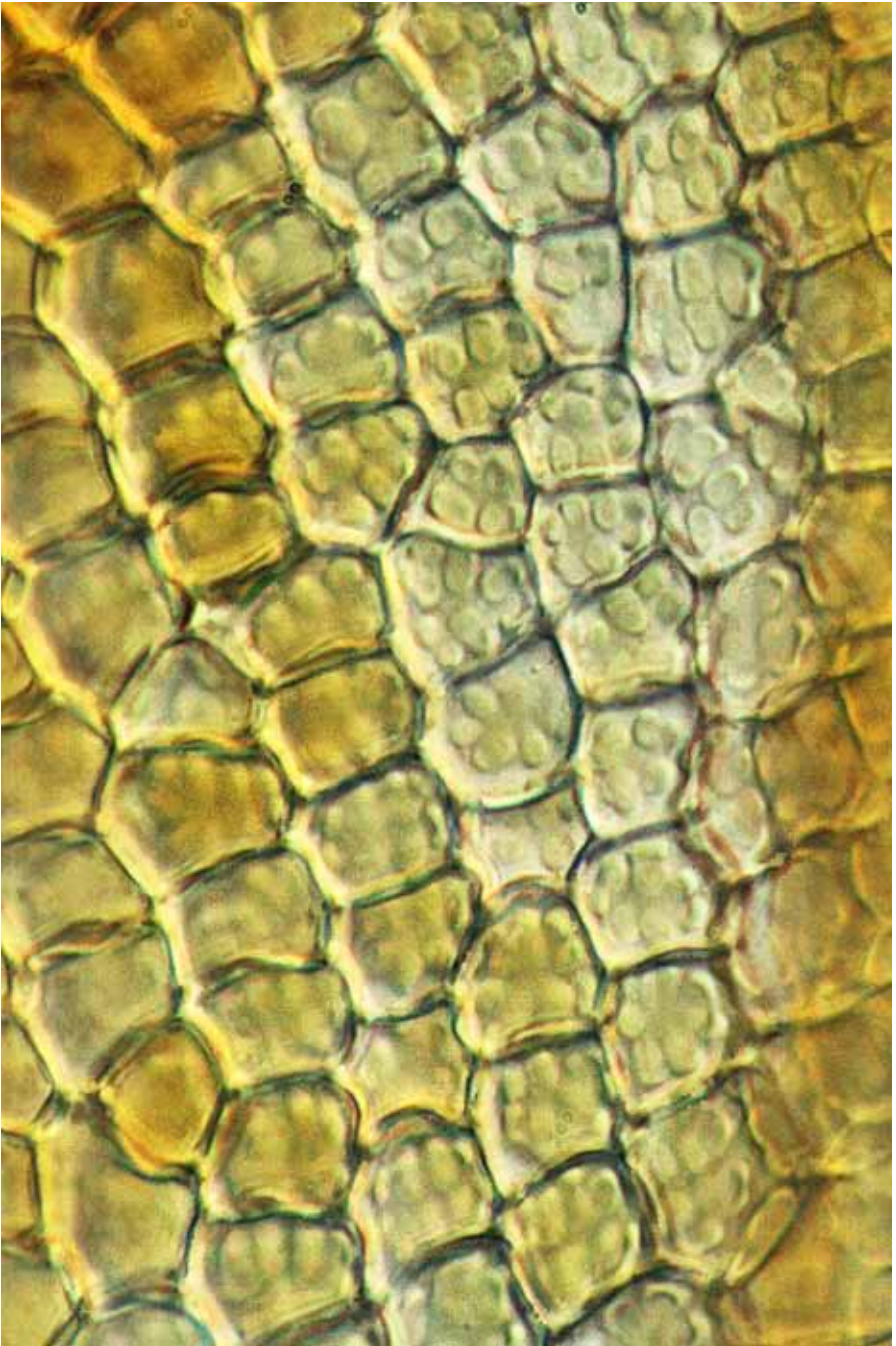
0.1 mm, 0.1 mm, 0.1 mm, 50 μm



revolute margin midleaf, costa below midleaf, and massed propagules

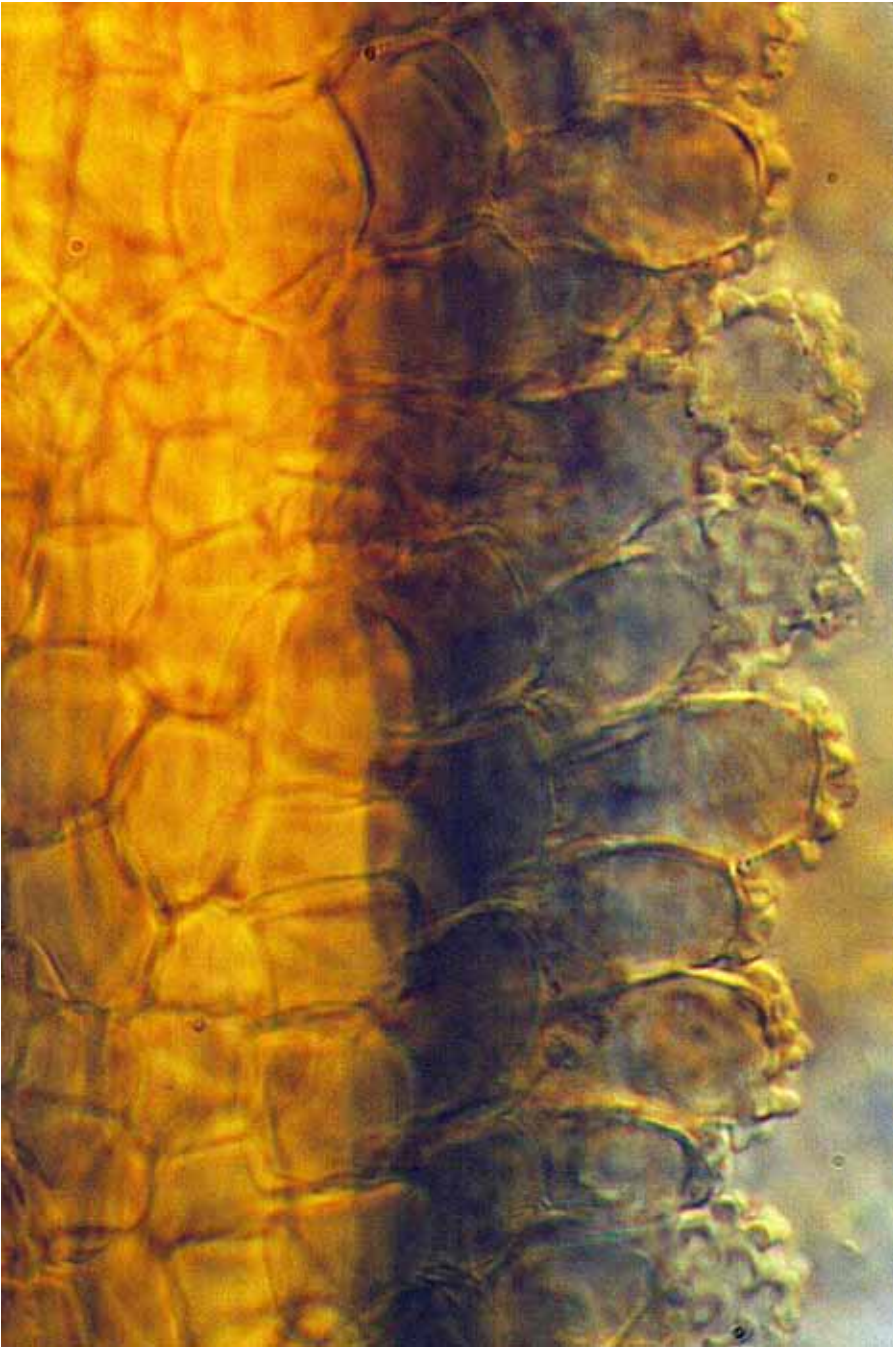
50 μm, 50 μm, 50 μm

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Crossidium davidai leaf surface papillae
10 μm

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Crossidium davidai propagules, showing globose, mammillose terminal cells
10 μm

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Crossidium geheebii (Broth.) Broth.

form: gregarious, erect, comose, light yellow-brown stems, 2–6 mm tall
habitat: limestone rock, lowland to upper montane elevations

leaf: size: 0.7–1.5 × 0.4–0.7 mm

shape: oblong to ovate, reacting yellow to orange in 2% KOH

tip: obtuse to rounded

base: basal cells rectangular to quadrate, 14–50 μm long

costa: excurrent in a mucro or hyaline hair-point

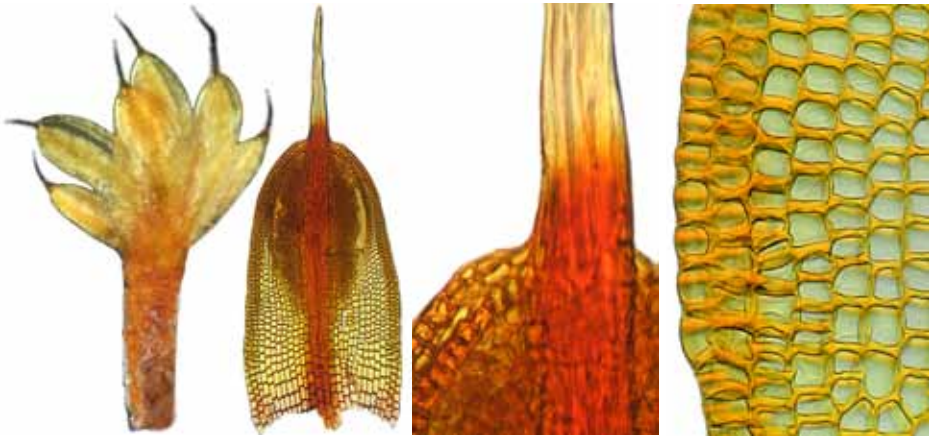
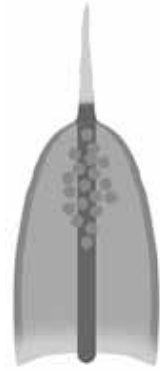
border: not differentiated

margin: entire, recurved below, incurved near the apex

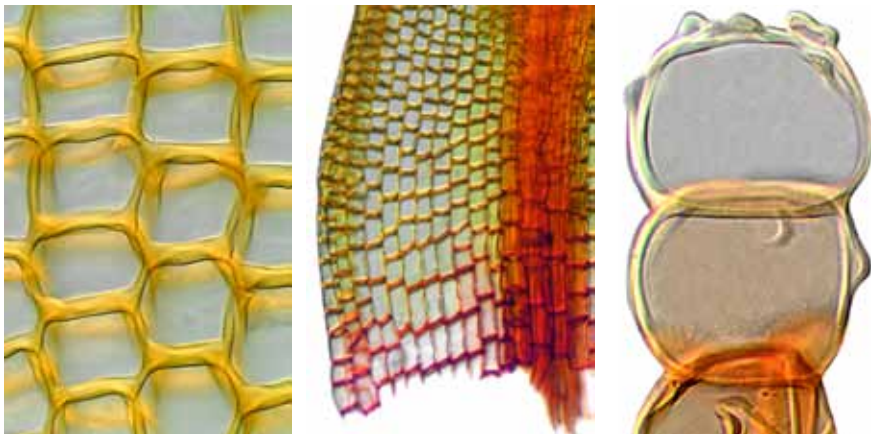
cells: 15 μm, subquadrate, firm-walled, smooth

capsule: 1.3–2.2 mm, cylindric to long-ovoid, erect; seta 10–40 mm, flexuose; operculum narrowly conic; calyptra cucullate, smooth; peristome teeth 32 from a low cylinder

note: asexual reproduction is by abundant branched filaments on the distal adaxial surface of the costa



vegetative shoot (cleared), leaf outline, hair-point base, and margin midleaf
 0.5 mm, 0.5 mm, 50 μm, 10 μm

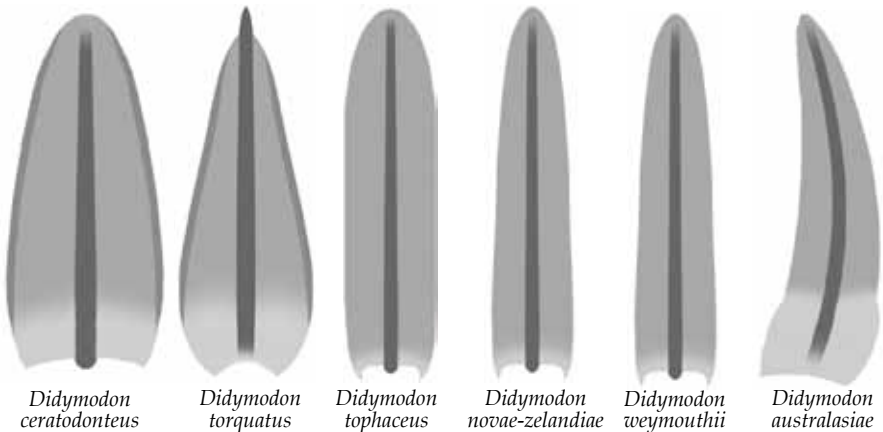


cells midleaf, leaf basal angle, and propagule apex
 10 μm, 50 μm, 10 μm

Key* to the New Zealand species of *Didymodon* (6)

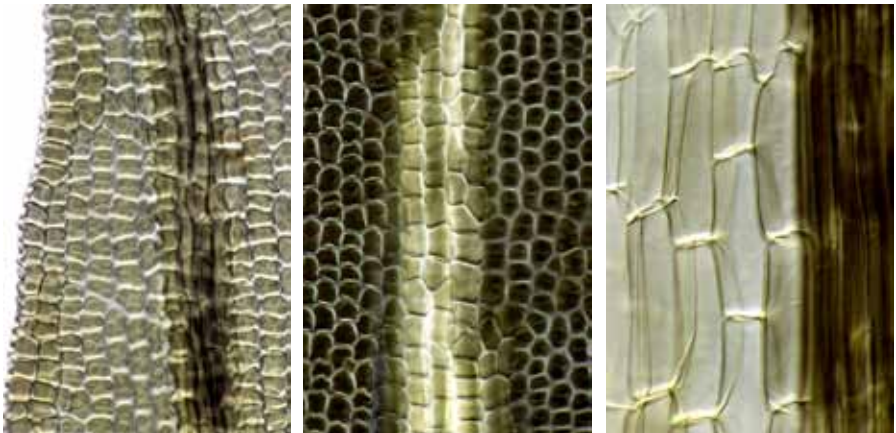
- 1 Costa excurrent as a stout point..... ● ***Didymodon torquatus***
 1: Costa not excurrent..... 2
- 2(1): Leaf bistratose at the margin; plant of dry habitats..... ● ***Didymodon australasiae***
 2: Leaf unistratose at the margin; plant of damp or wet habitats..... 3
- 3(2): Plants on calcareous rock or soil ● ***Didymodon tophaceus***
 3: Plants on acidic rock or soil 4
- 4(3): Leaf apex cucullate..... ● ***Didymodon novae-zelandiae***
 4: Leaf apex not cucullate..... 5
- 5(4): Leaves < 1 mm long; stems < 3 mm tall, bulbil-like, usually on soil
 ● ***Didymodon ceratodonteus***
 5: Leaves > 1.8–4 mm long; stems up to 30 mm tall, not bulbil-like, usually on rock.....
 ● ***Didymodon weymouthii***

* based on Catcheside, DG (1980): *Mosses of South Australia*. Government Printer, Adelaide, 172, plus Zander, RH (2007): *Didymodon*. *Flora of North America* 27, 299.



Didymodon australasiae (Hook. & Grev.) R.H.Zander**form:** erect, branched, dark stems in tufts or cushions, 10(–15) mm tall**habitat:** exposed gravelly soil or rock, dry to wet, to high elevations**leaf:** size: 1.0–2.5 × 0.4–1.0 mm*shape:* short-lanceolate*tip:* broadly to narrowly acute*base:* basal cells larger and thinner-walled than the blade cells*costa:* percurrent or failing a few cells below the apex*border:* not differentiated*margin:* entire, plane or recurved at midleaf*cells:* 7–12 μm, subquadrate, firm-walled, corners thickened, ± papillose**capsule:** 1–2 mm, oblong-ellipsoid, erect, straight, reddish when mature; seta 7–10 mm; calyptra cucullate, naked, smooth; operculum rostrate; peristome of 32 weakly twisted, linear teeth; spores 11–15 μm in diam., smooth to papillose

fertile shoot (dry), capsule, vegetative shoot (dry and wet), leaf outline, and leaf apex
 1 mm, 1 mm, 10 μm (2), 1 mm, 10 μm



margin midleaf, adaxial distal costa cells, and hyaline cells near leaf base
 50 μm, 50 μm, 10 μm

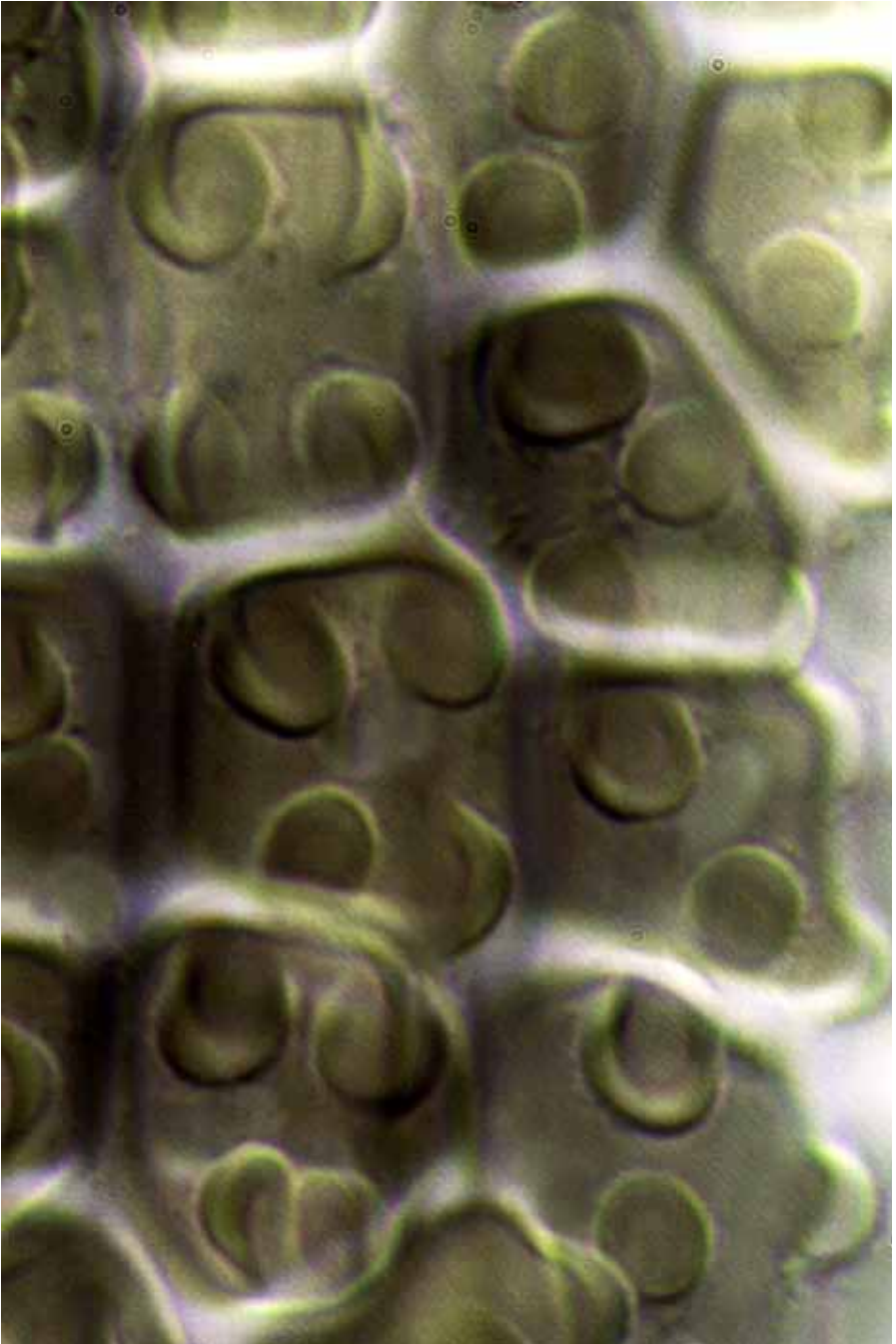
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Didymodon australasiae short cells of prominent abaxial costa.

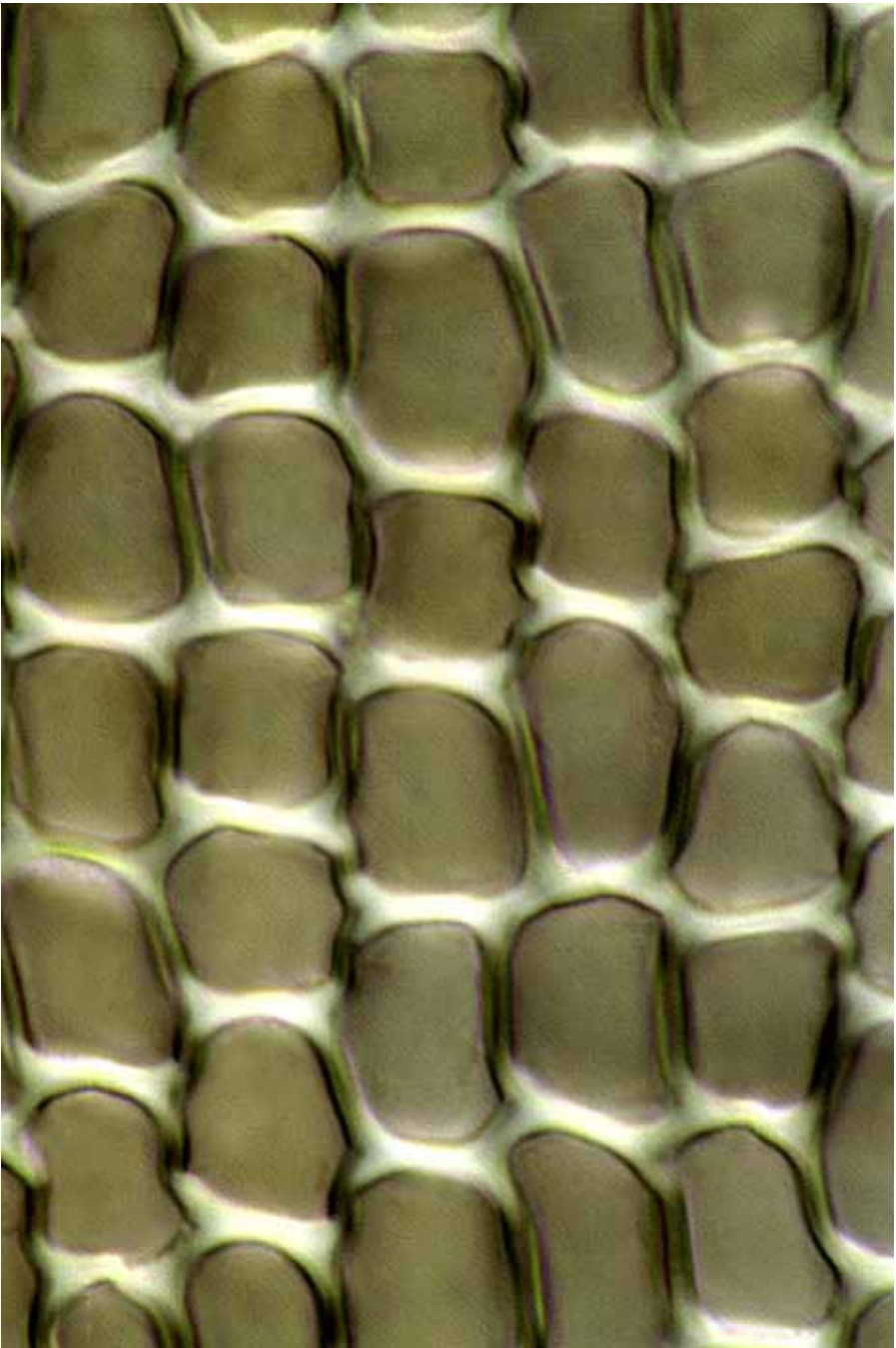
10 μ m

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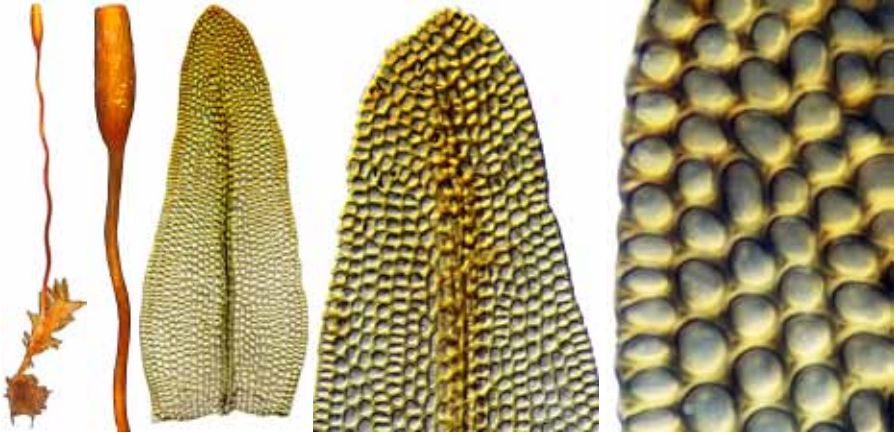
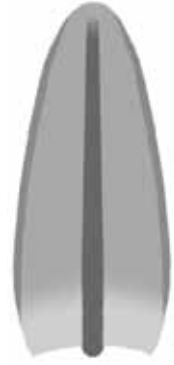
Didymodon australasiae papillose lamina cells
10 μ m

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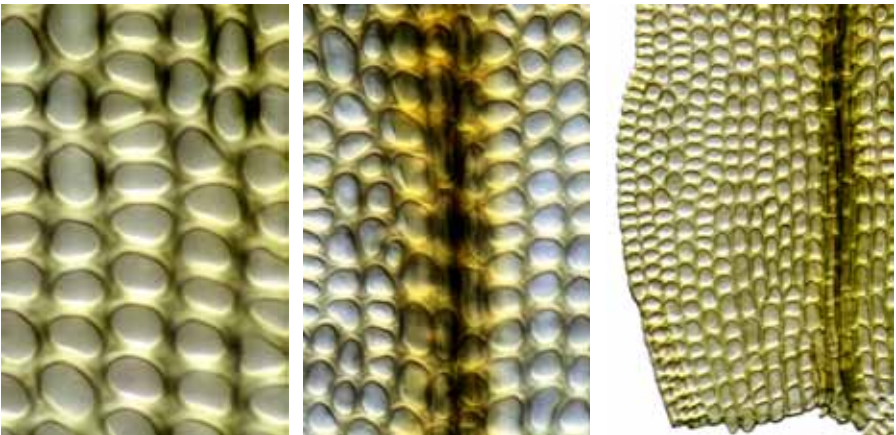


Didymodon australasiae cells about midleaf.
10 μm

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Didymodon ceratodonteus (Müll.Hal.) Dixon**form:** gregarious, tufted, minute, erect, brownish shoots**habitat:** damp clay or rock**leaf:** *size:* less than 1 mm long*shape:* widely oblong-lingulate*tip:* rounded*base:* basal cells slightly longer than the other lamina cells*costa:* failing below the apex, adaxial surface cells \pm quadrate distally*border:* not differentiated*margin:* entire to minutely crenate, plane to \pm revolute*cells:* 7–10 μm , \pm quadrate-rounded, firm-walled, smooth to \pm papillose**capsule:** 0.5–1.3 mm, oblong to elliptic, erect, long-exserted, brown;
seta 5–10 mm, red, wavy when dry; peristome teeth 16, brown,
papillose, divided nearly to the basal membrane

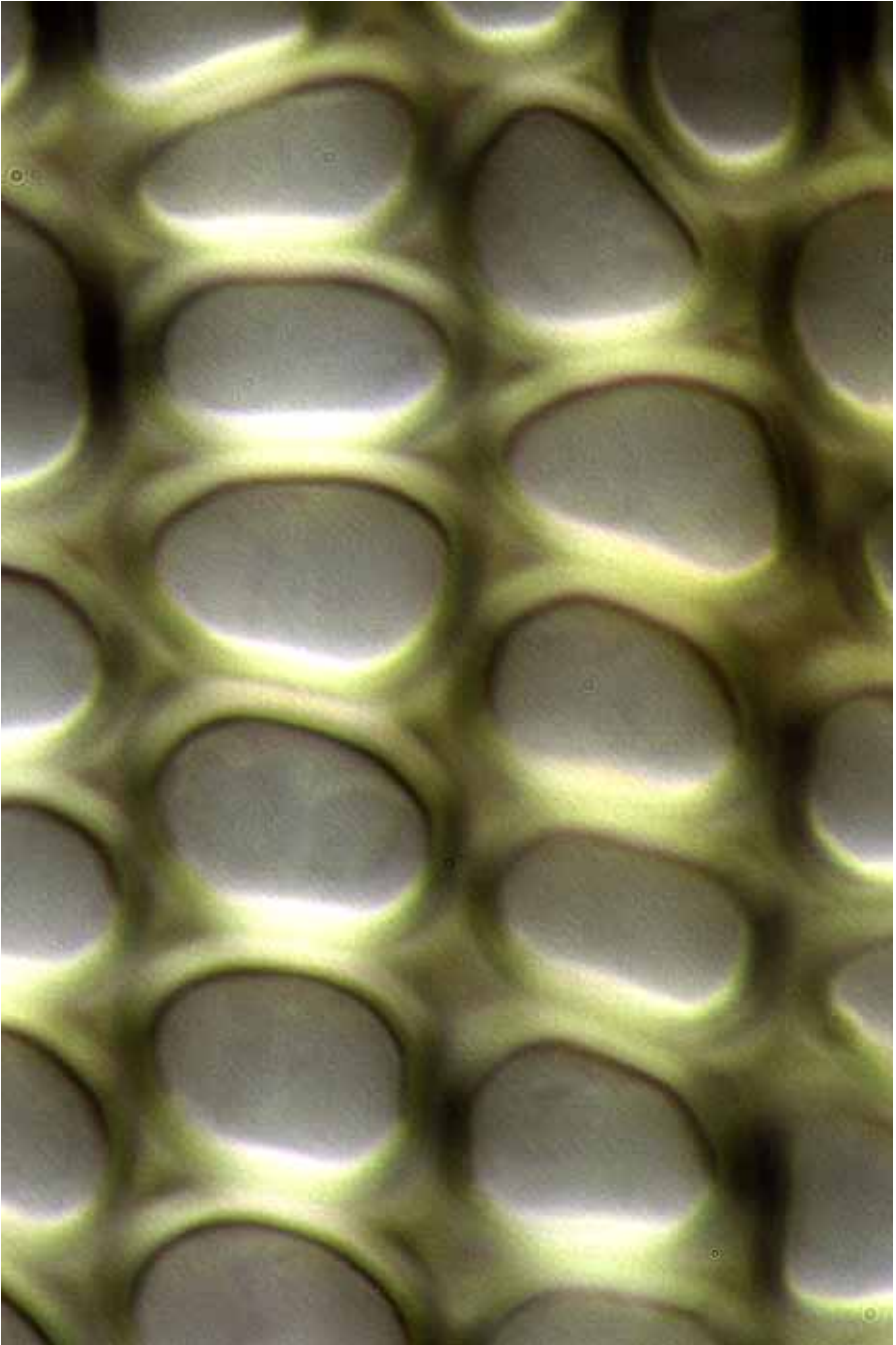
fertile shoot, capsule, leaf outline, leaf apex, and margin of upper leaf

 1 mm, 1 mm, 0.1 mm, 50 μm , 10 μm


lamina cells midleaf, superficial adaxial costa cells, and leaf basal angle

 10 μm , 50 μm , 50 μm

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Didymodon ceratodonteus lamina cells upper leaf
10 μm

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Didymodon novae-zelandiae J.E.Beever & Fife

form: gregarious, erect, sparsely branched stems, brownish green, to 30 mm
habitat: damp to wet calcareous mudstone

leaf: size: about 1.5×0.3 mm

shape: lingulate

tip: rounded, cucullate

base: basal cells slightly longer and thinner-walled than other lamina cells

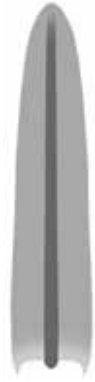
costa: failing below the apex; adaxial cells \pm quadrate in distal two-thirds

border: not differentiated

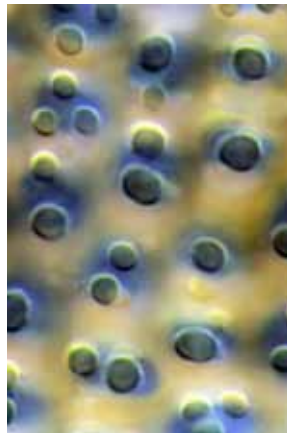
margin: entire, plane above, \pm recurved to reflexed below

cells: 8–12 μm , rounded-isodiametric, firm-walled, 2–4 low papillae per cell

capsule: 1.5 mm, oblong-elliptic, erect, long-exserted, brown; seta to 6 mm long; peristome teeth 16, \pm hyaline, narrowly lanceolate, papillose, \pm divided to about a third from the tip

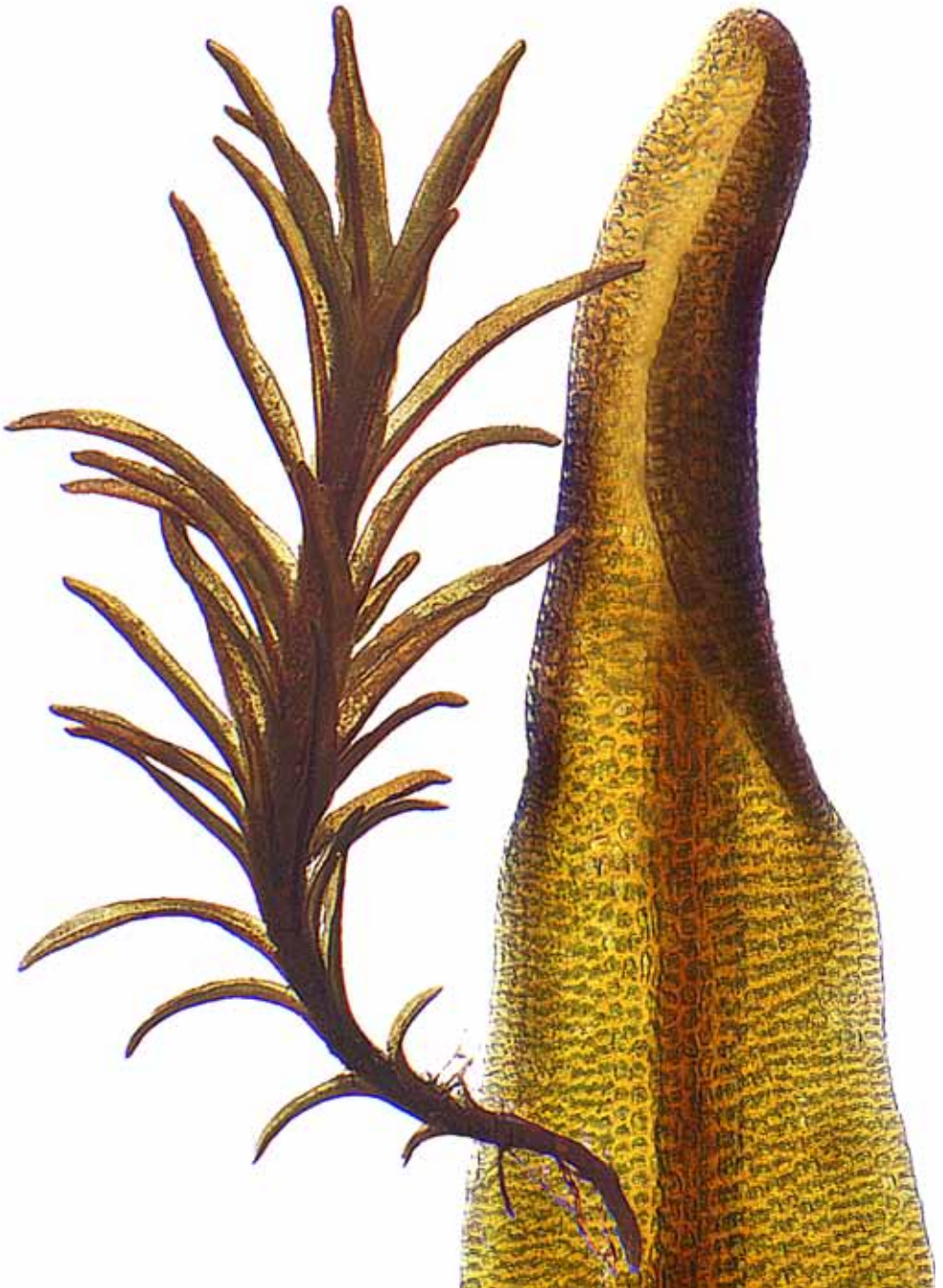


vegetative shoot (moist), leaf outline, cucullate leaf apex, and margin midleaf
 1 mm, 0.5 mm, 50 μm , 10 μm



peristome, papillae above midleaf, and leaf basal angle
 50 μm , 10 μm , 50 μm

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Didymodon novae-zelandiae vegetative shoot (moist) and cucullate leaf apex
1 mm, 100 μ m

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Didymodon novae-zelandiae adaxial superficial costal cells at about midleaf
10 μm

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Didymodon novae-zelandiae peristome, abaxial face (fragment)
10 μm

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Didymodon tophaceus (Bridel) Lisa

form: loosely to densely tufted, erect, branched, often lime-encrusted
habitat: rock or soil in calcareous springs, seeps, and streams

leaf: size: 1–2 × 0.5–1.0 mm

shape: lingulate

tip: rounded-obtuse

base: undifferentiated

costa: failing below the apex; superficial adaxial cells elongate

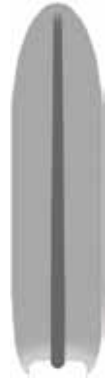
border: basal cells thin-walled, larger than other lamina cells

margin: entire, ± recurved below on both sides

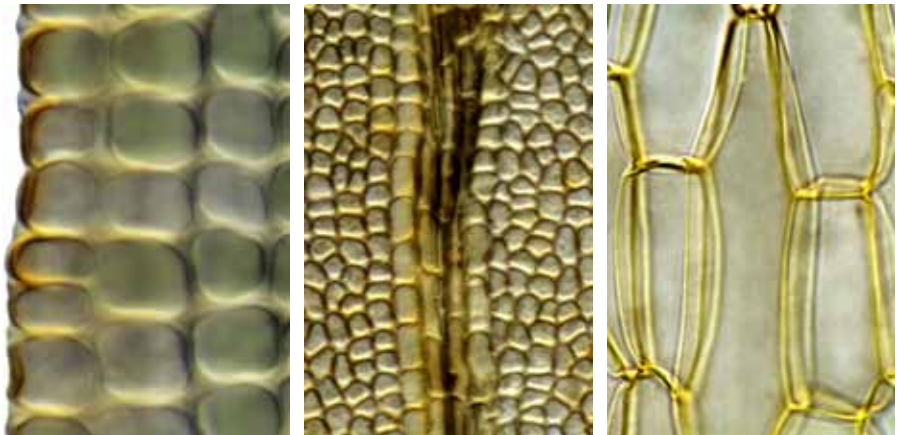
cells: 7–13 μm, irregularly subquadrate, firm-walled, mostly smooth

capsule: 1–1.5 mm, oblong-cylindric, red-brown; seta 10–12 mm, dark red-brown; peristome of long, pale filaments, ± twisted

note: *Didymodon ceratodonteus* differs in having ± quadrate superficial adaxial costal cells

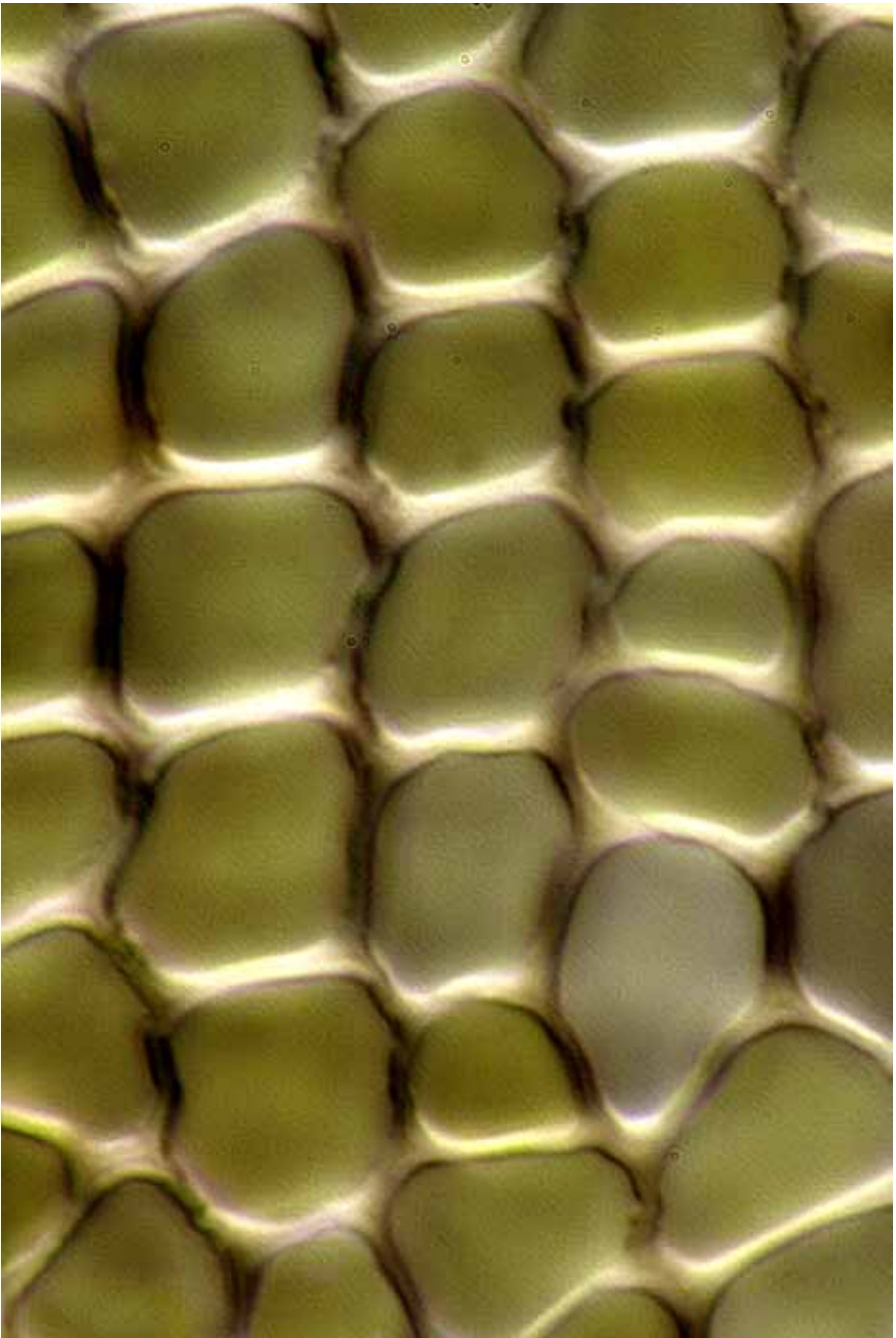


fertile shoot (dry), capsule and peristome, leaf outline, leaf apex, and failing costa
 1 mm, 1 mm, 0.1 mm, 100 μm, 50 μm



margin midleaf, elongate adaxial costa cells, and lamina cells near leaf base
 10 μm, 50 μm, 10 μm

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Didymodon tophaceus cells at about midleaf
10 μm

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Didymodon torquatus (Taylor) Catcheside

form: in cushions, erect, sparsely branched, olive-green, brownish below
habitat: soil, usually in exposed, semi-arid to arid sites

leaf: size: 1–2.5 mm

shape: broadly lanceolate, twisted around the stem when dry

tip: stout cusp

base: basal cells short-rectangular

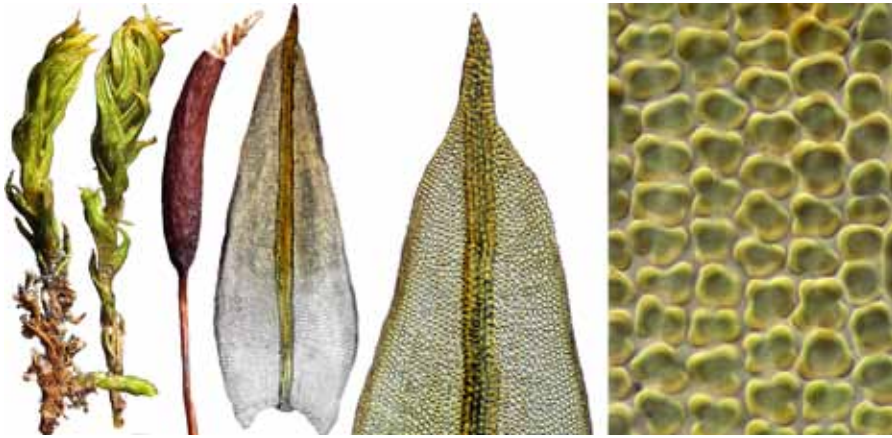
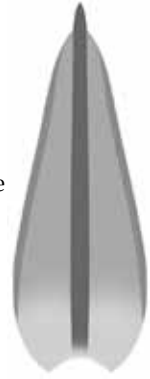
costa: yellow, percurrent to shortly excurrent; adaxial distal cells \pm quadrate

border: not differentiated

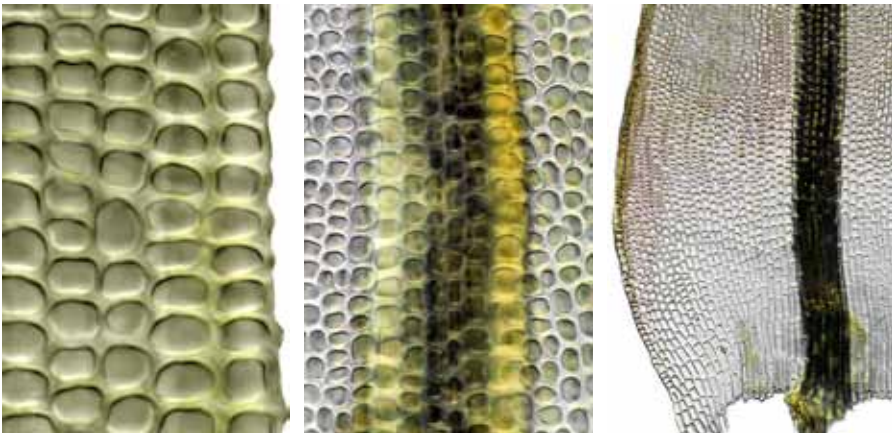
margin: entire, recurved on both sides

cells: 8–10 μm , \pm isodiametric, firm-walled, sparsely papillose

capsule: 1.8–2.5 mm, narrowly cylindrical to oval, \pm curved, erect, exserted, reddish brown; seta 10–18 mm, slender, reddish; operculum bluntly conically rostrate, half the urn length; peristome of 16 teeth on a low basal membrane and divided into twin papillose filaments



vegetative shoots (dry), capsule, leaf outline, leaf apex, and upper leaf papillae
 1 mm (2), 1 mm, 0.5 mm, 100 μm , 10 μm



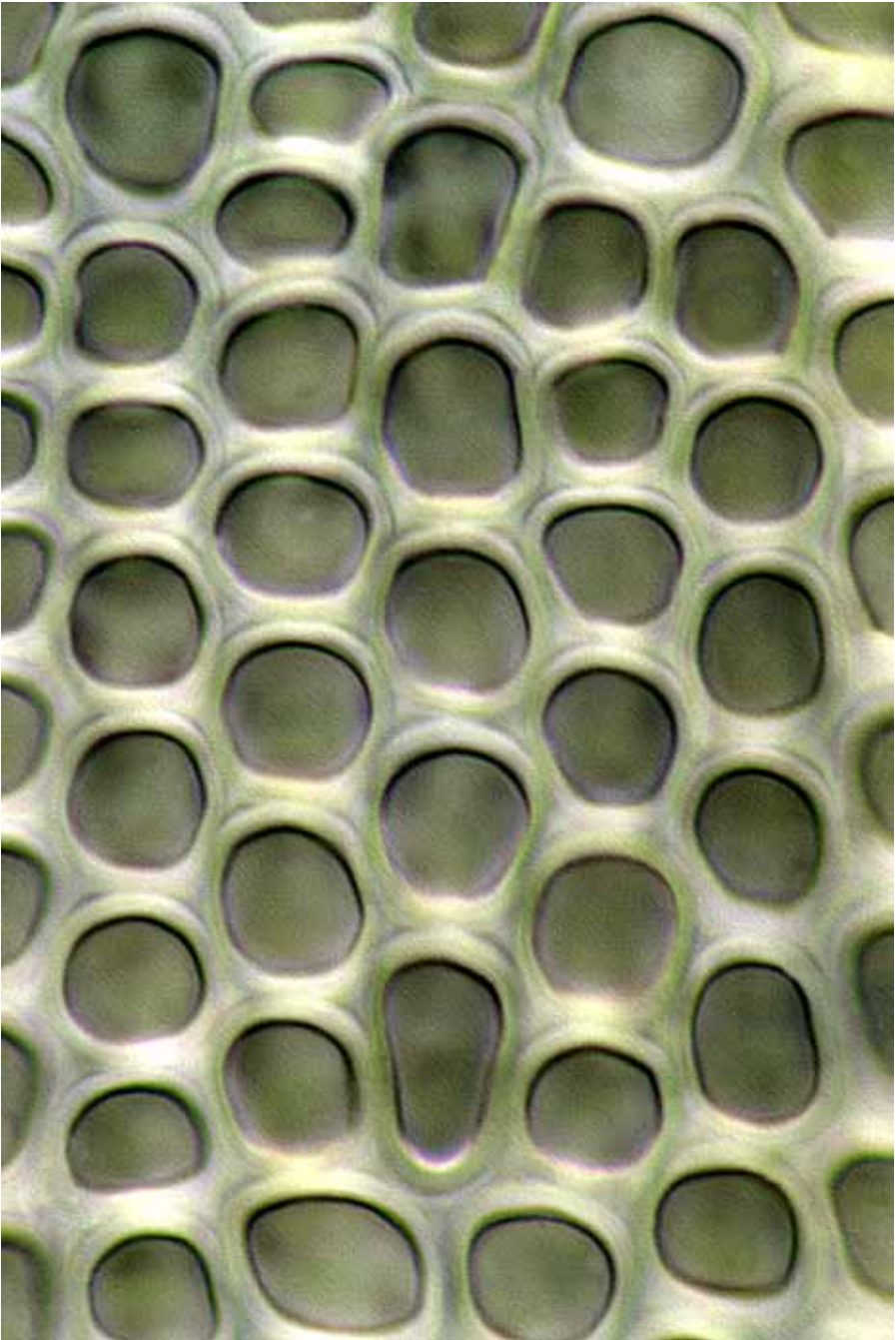
margin at about midleaf, adaxial distal costa cells, and leaf basal angle
 10 μm , 50 μm , 100 μm

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Didymodon torquatus mature capsule, peristome (whole-mount)
0.1 mm, 0.1 mm

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Didymodon torquatus laminal cells at about midleaf
10 μm

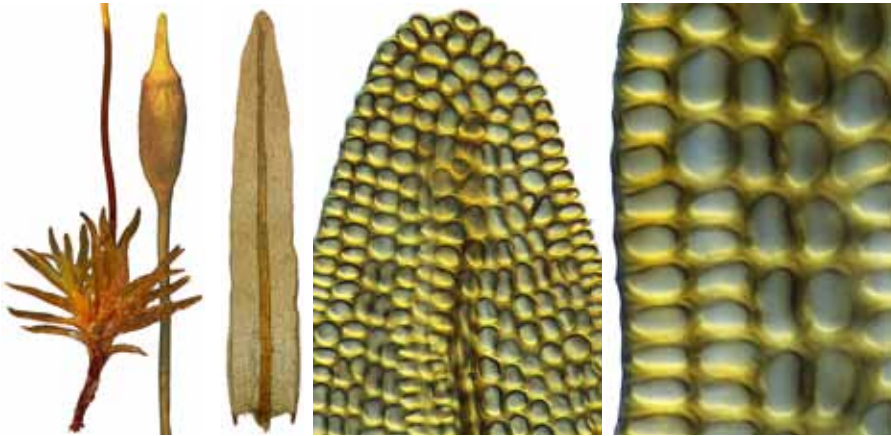
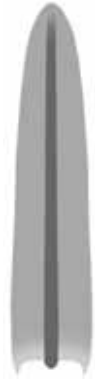
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Didymodon weymouthii (R.Br.bis) R.H.Zander**form:** densely tufted, erect, ± branched stems, yellowish, 3–30 mm tall**habitat:** damp to wet rock or less commonly soil**leaf:** size: 1.8–4 mm*shape:* lingulate to linear-lanceolate, concave to canaliculate*tip:* rounded or obtuse to subacute*base:* basal cells longer than other lamina cells, ± pigmented*costa:* percurrent to failing below the apex; distal adaxial cells ± elongate*border:* not differentiated*margin:* entire, plane above, recurved to reflexed below*cells:* 7–10 μm, rounded-isodiametric, firm-walled, smooth to ± papillose**capsule:** 0.8–2 mm, ovate to cylindric, erect, exserted, brown; seta 10–15 mm,

reddish; operculum rostrate, the beak from 1/3 to as long as the urn;

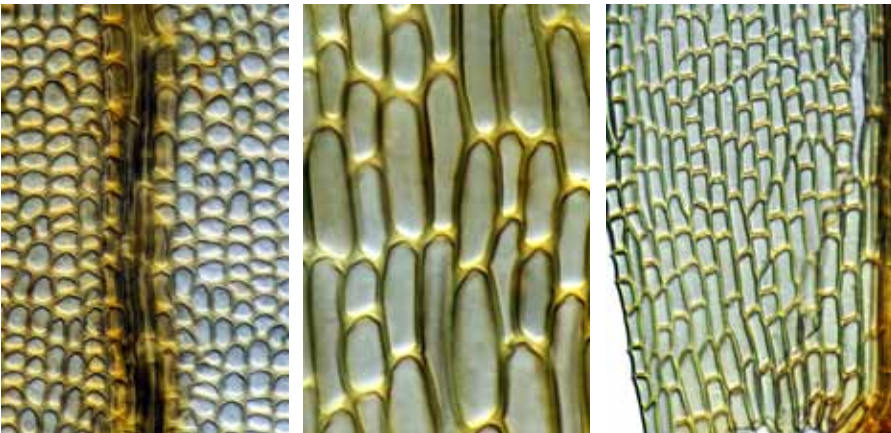
peristome variable, rudimentary to toothed, the teeth hyaline to yellow,

irregularly divided, smooth to finely papillose; spores 25–30 μm in diam.



fertile shoot, capsule, leaf outline, leaf apex, and margin midleaf

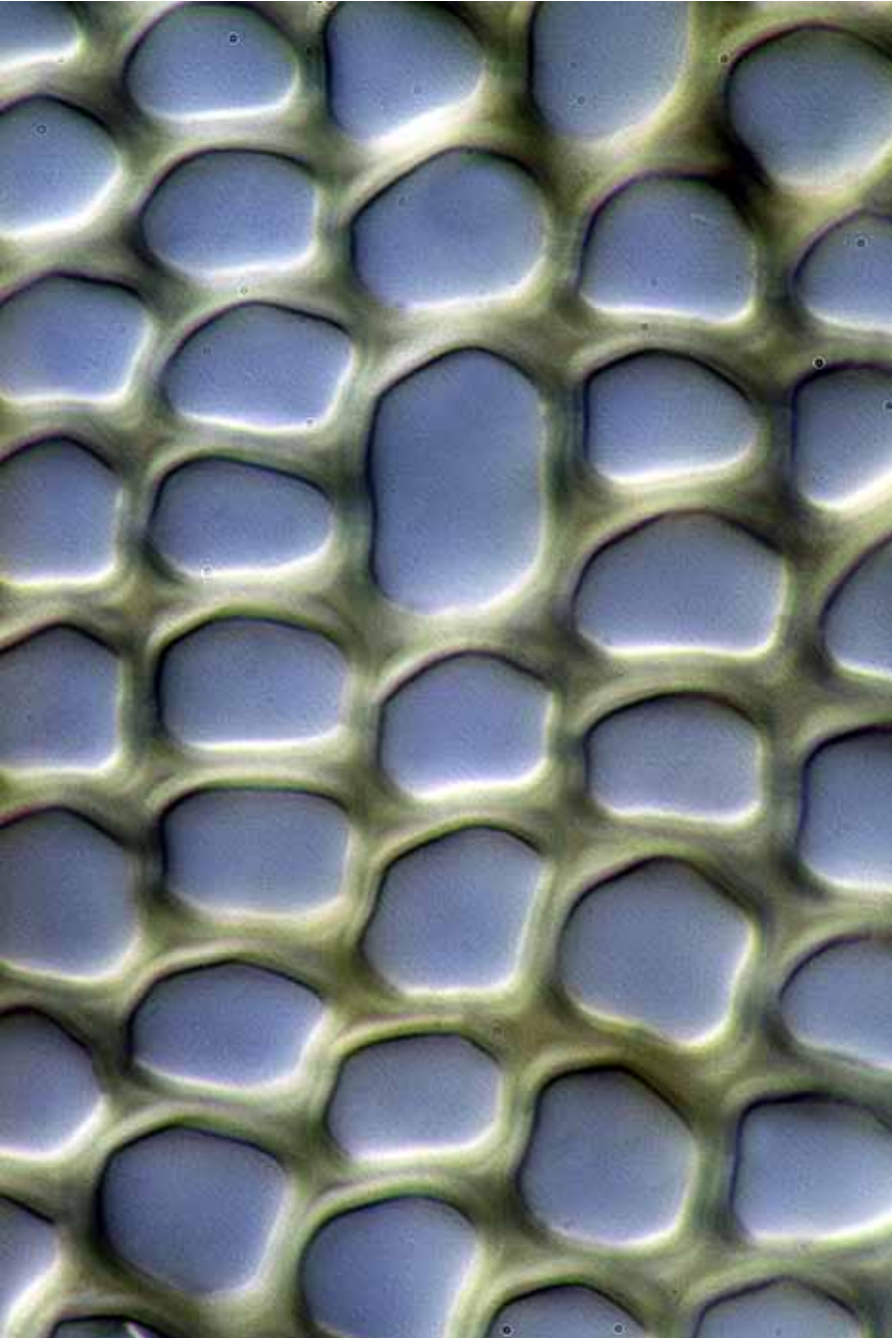
5 mm, 1 mm, 1 mm, 50 μm, 10 μm



adaxial distal costal cells, cells of lower leaf, and leaf basal angle

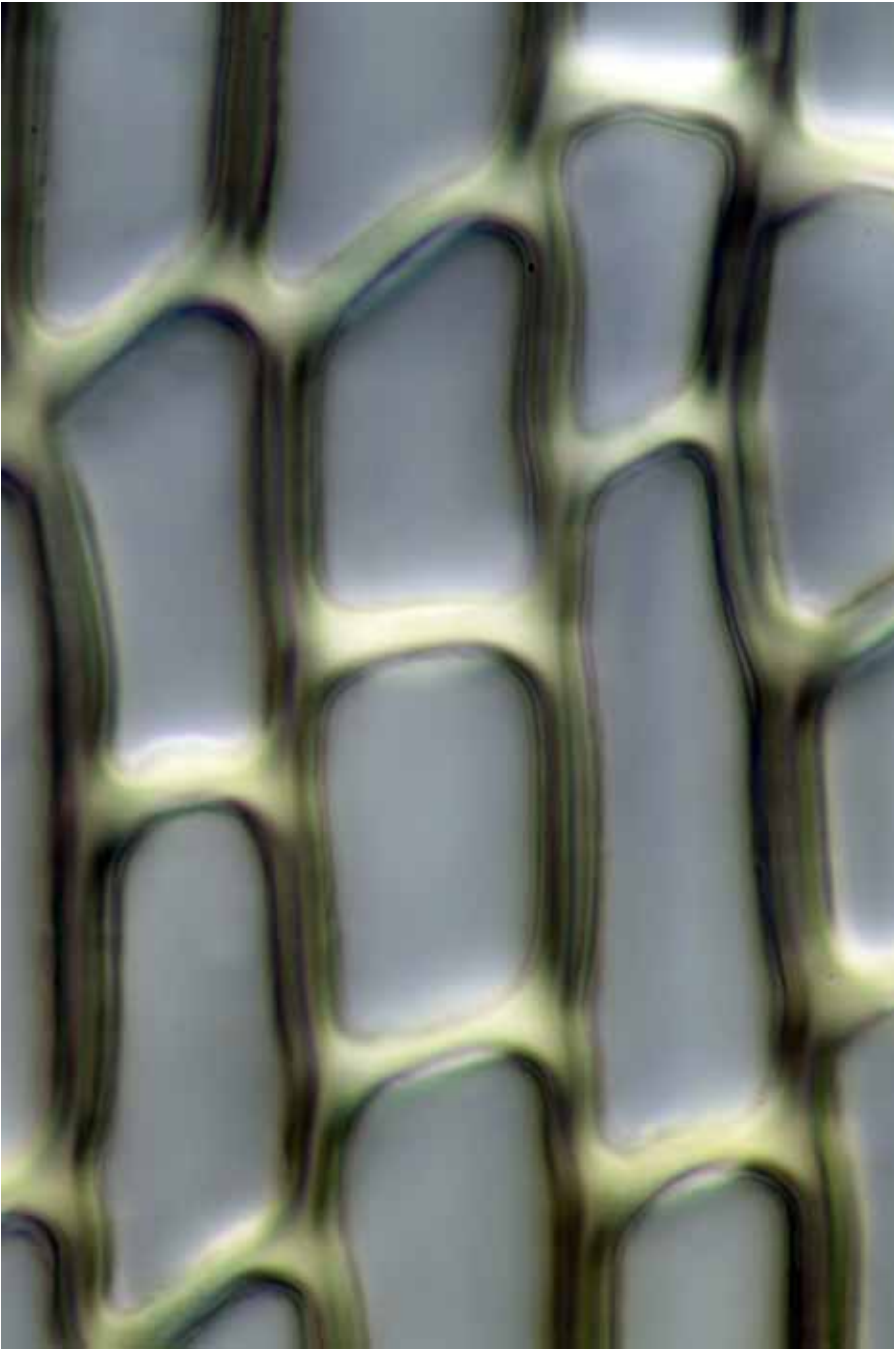
10 μm, 10 μm, 50 μm

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Didymodon weymouthii cells at midleaf
10 μ m

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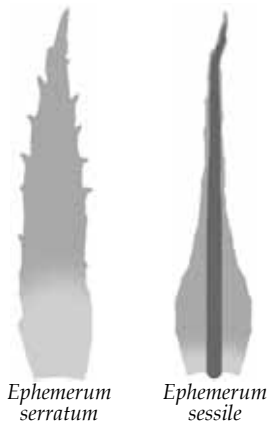


Didymodon weymouthii cells of lower leaf
10 μm

Key* to the New Zealand species of *Ephemerum* (2)

- 1 Leaves ecostate; margin spinose-toothed ● ***Ephemerum serratum***
 1: Leaves costate; margin \pm entire ● ***Ephemerum sessile***

* based on Smith, AJE; Smith, R (1978): *The Moss Flora of Britain and Ireland*. Cambridge University Press, Cambridge. 347.



Ephemerum serratum (Hedw.) Hampe**form:** rosettes of leafy stems in persistent mats of protonemata**habitat:** compacted, moist, exposed clayey soil, fields or alluvium, lowland**leaf:** size: 1.0–2.0 × 0.3 mm**shape:** narrowly lanceolate**tip:** acute or gradually acuminate, often ending in a single, sharp cell**base:** basal cells rectangular, hyaline**costa:** not differentiated or faint and restricted to the upper leaf**border:** not differentiated**margin:** irregularly spinose-dentate in the upper two-thirds, plane**cells:** 100–160 × 12–30 μm, irregularly rhombic, thin-walled, smooth**capsule:** 0.5 mm, ovoid to globose, conic-apiculate, immersed, indehiscent, stomatose at only the base; seta very short, the capsule appearing sessile; calyptra mitrate, naked, erose at the base; operculum absent; spores reniform, 50–90 μm long**note:** the protonema forms a dense green persistent mat

fertile habit, shoot (whole mount), leaf outline, and leaf apex



subapex, margin midleaf, and margin near leaf base

continued next page

Ephemerum sessile (Bruch) Müll.Hal.

form: gregarious, light green stems, on persistent protonema mats, to 1 mm tall
habitat: damp, compacted soil in open fields or tracks, low elevations

leaf: size: 1.5–2.0 × 0.2 mm

shape: narrowly lanceolate, narrowing to a costa-filled subula

tip: acuminate

base: basal cells larger and wider than other blade cells

costa: weak below, strong above, excurrent

border: not differentiated

margin: denticulate, plane

cells: 35–50 × 10–12 μm, ± rectangular, thin-walled, smooth

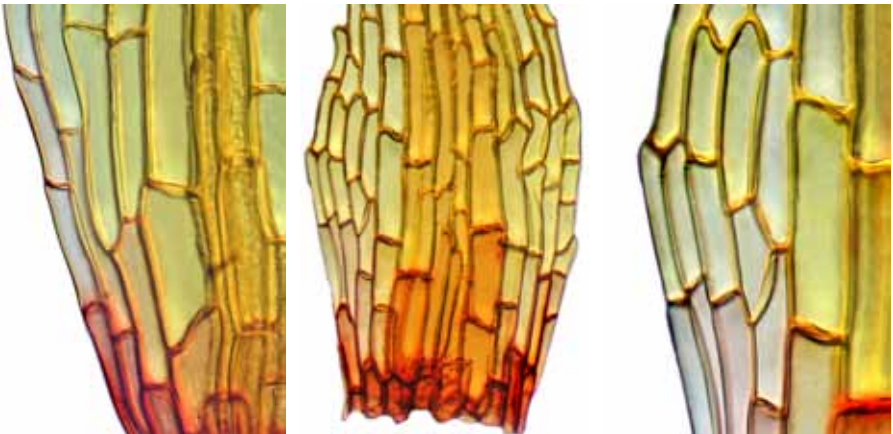
capsule: 0.5 mm, globose, short-apiculate, uniformly stomatose, cleistocarpous;
 seta very short; calyptra mitrate, erose at the base; spores reniform, brown,
 70–80 μm long, coarsely papillose

note: ephemeral



vegetative shoot, leaf outline, leaf apex, leaf subapex, and margin midleaf

■ 0.1 mm, ■ 0.1 mm, ■ 10 μm, ■ 10 μm, ■ 10 μm



margin near base, leaf base, and margin of lower leaf

■ 10 μm, ■ 10 μm, ■ 10 μm

Gymnostomum calcareum Nees & Hornsch.

form: tufted or matted, erect, slender, simple or branched stems, 3–20 mm tall
habitat: damp calcareous soil or rock in shaded sites at middle elevations

leaf: size: 0.7–1.0 × 0.2–0.3 mm

shape: narrowly lingulate, ligulate, or linear

tip: variably rounded, obtuse, acute, or apiculate

base: basal cells rectangular

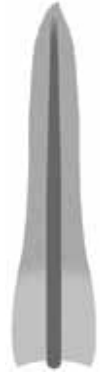
costa: failing just below the apex

border: not differentiated

margin: entire, plane

cells: 4–6 μm, quadrate, thick-walled, papillose

capsule: 0.6–1.0 mm, elliptic-oblong or cylindrical, erect, red-mouthed, gymnostomous; seta 5 mm, yellow; calyptra cucullate, naked, smooth; operculum obliquely rostrate; spores 9–11 μm in diam.



habit (moist), vegetative shoot (dry), capsule, leaf outline, and leaf apex

1 mm,

1 mm,

0.5 mm,

0.1 mm,

10 μm



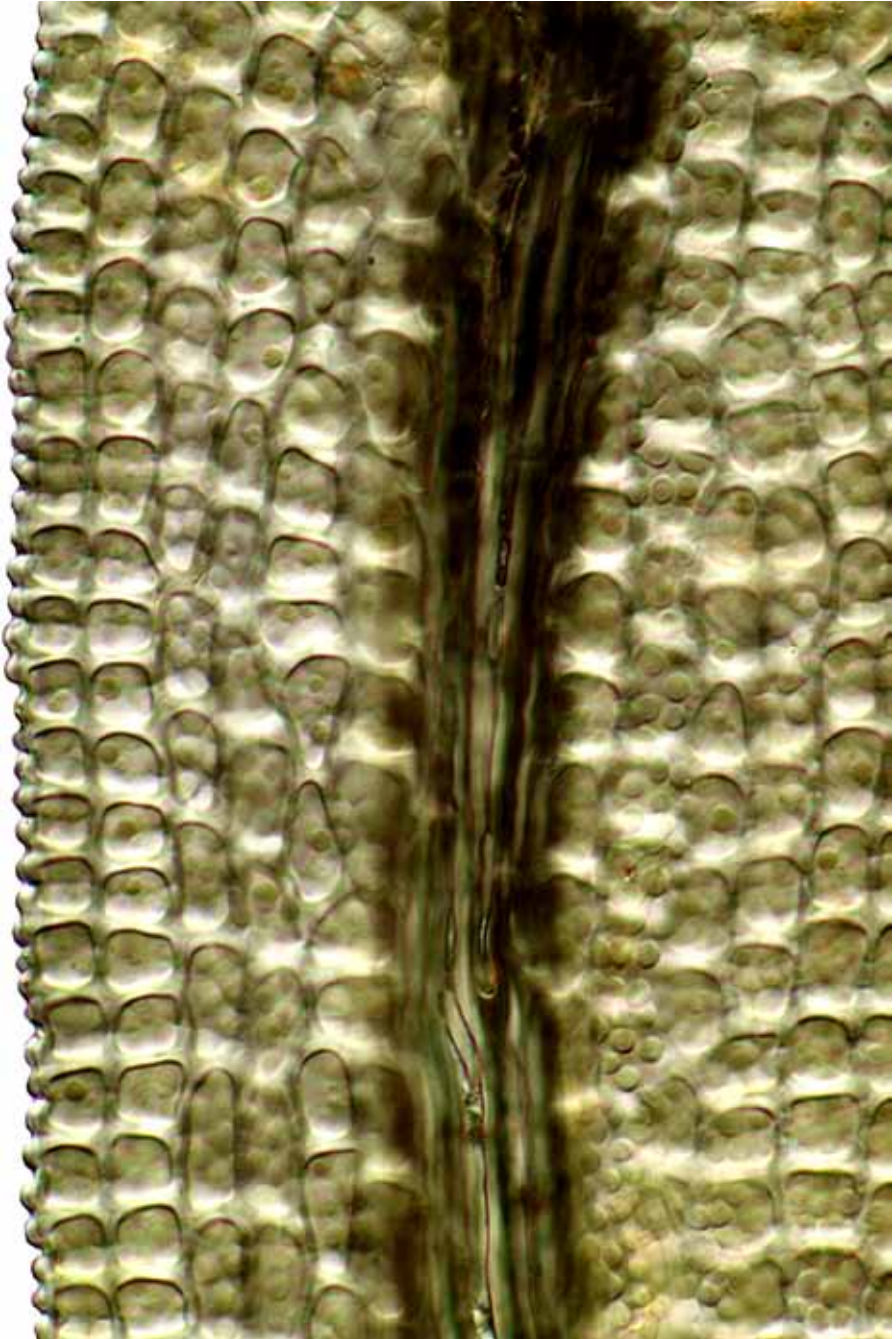
margin midleaf, costa midleaf, and midleaf cross-section

10 μm,

5 μm,

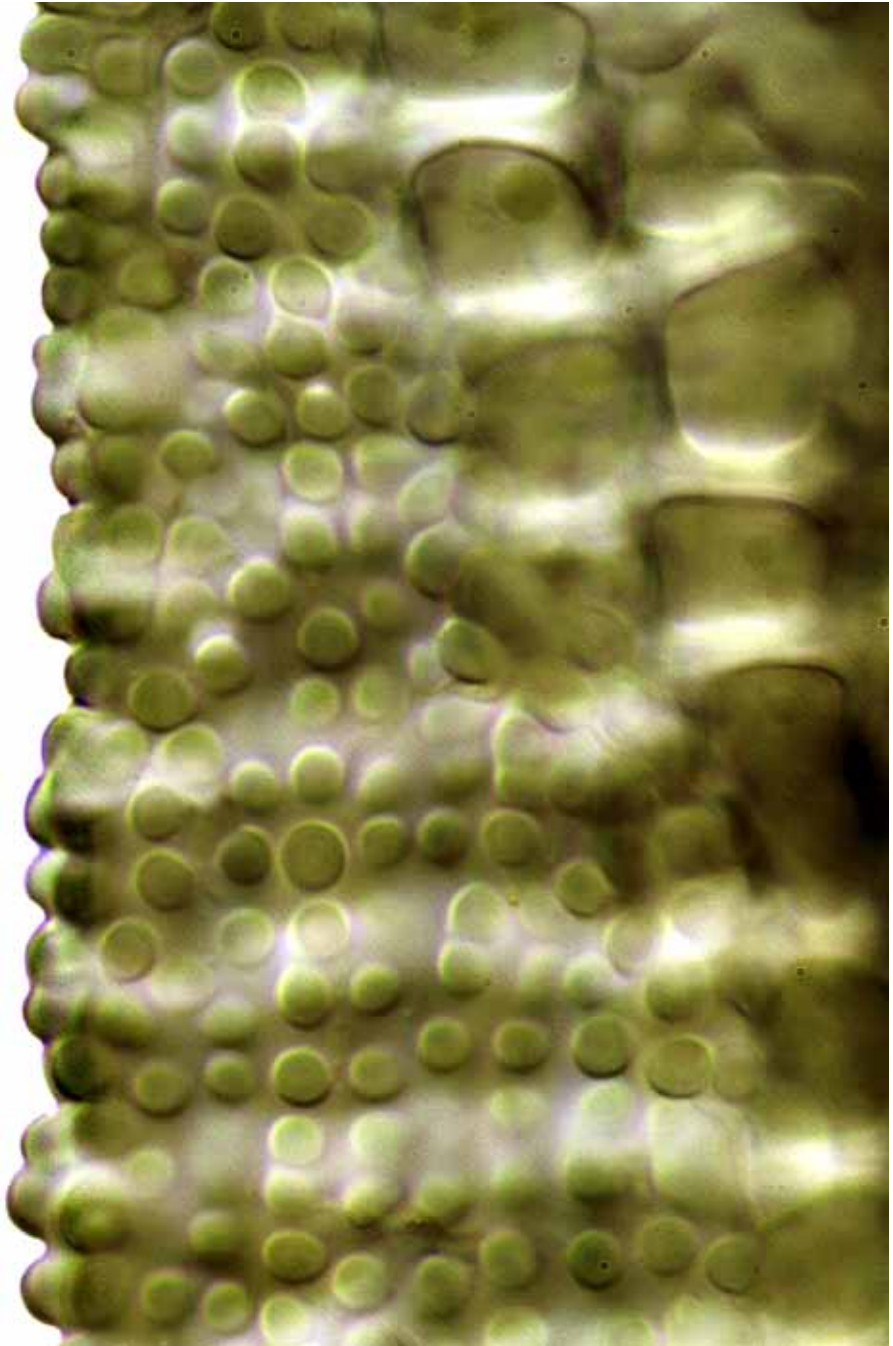
10 μm

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Gymnostomum calcareum margin, costa, and laminal papillae midleaf
10 μ m

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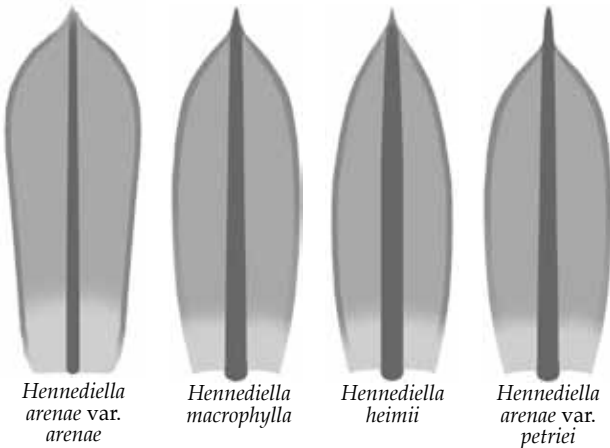


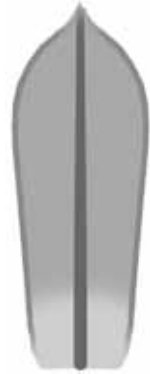
Gymnostomum calcareum margin and surface papillae
5 μ m

Key to the New Zealand species and varieties of *Hennediella* (4)

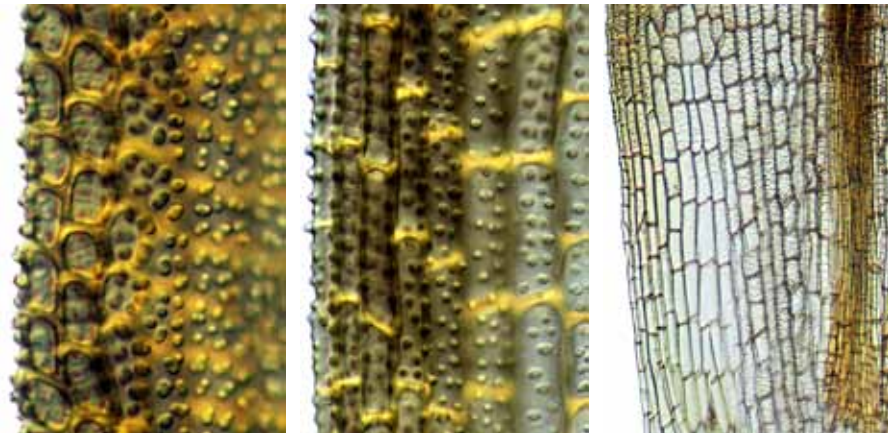
- 1 Peristome well-developed2
 1: Peristome none3
- 2(1) Border of 1–7(–10) cell rows; length/width ratio of mid-border cells at midleaf mostly less than 2..... ● *Hennediella arenae* var. *arenae*
 2: Border of 6–12 cell rows; length/width ratio of mid-border cells at midleaf mostly greater than 4..... ● *Hennediella arenae* var. *petriei*
- 3(1:) Leaf margin unistratose; seta 5–12 mm..... ● *Hennediella heimii*
 3: Leaf margin at least partly bistratose; seta 1.7–4 mm..... ● *Hennediella macrophylla*

* based partly on Cano, MJ (2008): Taxonomic revision of *Hennediella* Paris (Pottiaceae, Bryophyta). *Bryophytorum Bibliotheca* **64**, 1–142.



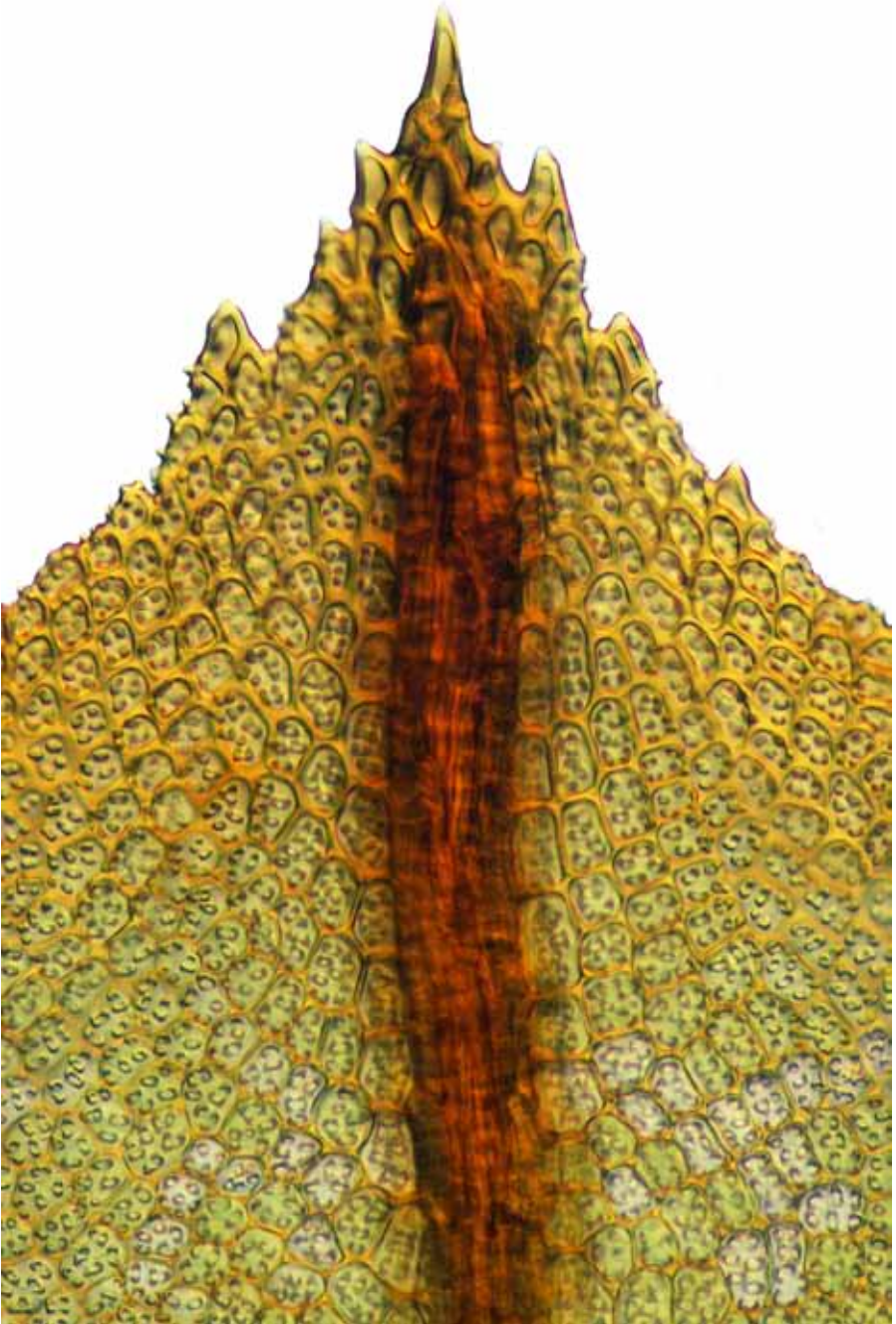
Hennediella arenae (Besch.) R.H.Zander var. **arenae****form:** tufted, erect, ± branched stems, light green above, 5–10 mm tall**habitat:** soil or soil over rock or in rock crevices**leaf:** size: 3–4 mm*shape:* ovate-lanceolate to spatulate*tip:* acute*base:* basal cells rectangular, pellucid, sparsely papillose to smooth*costa:* ending just below the apex*border:* 1–7(–10) rows, firm-walled, papillose; length/width ratio < 2*margin:* crenulate-papillate below, irregularly dentate near apex, plane*cells:* 17–20 μm, subquadrate to hexagonal, firm-walled, multipapillose**capsule:** 2.5 mm, cylindric, erect, ± curved, exserted, glossy, brown; seta 13–20 mm; operculum red, conic-subulate, to half the length of the capsule; calyptra cucullate, naked, smooth; peristome pale, to 1/3 the length of the capsule, basal tube long; spores 14–18 μm in diam.

vegetative shoot (dry), capsule, peristome, leaf outline, leaf apex, and margin upper leaf
 0.5 mm, 1 mm, 0.5 mm, 0.5 mm, 10 μm, 10 μm



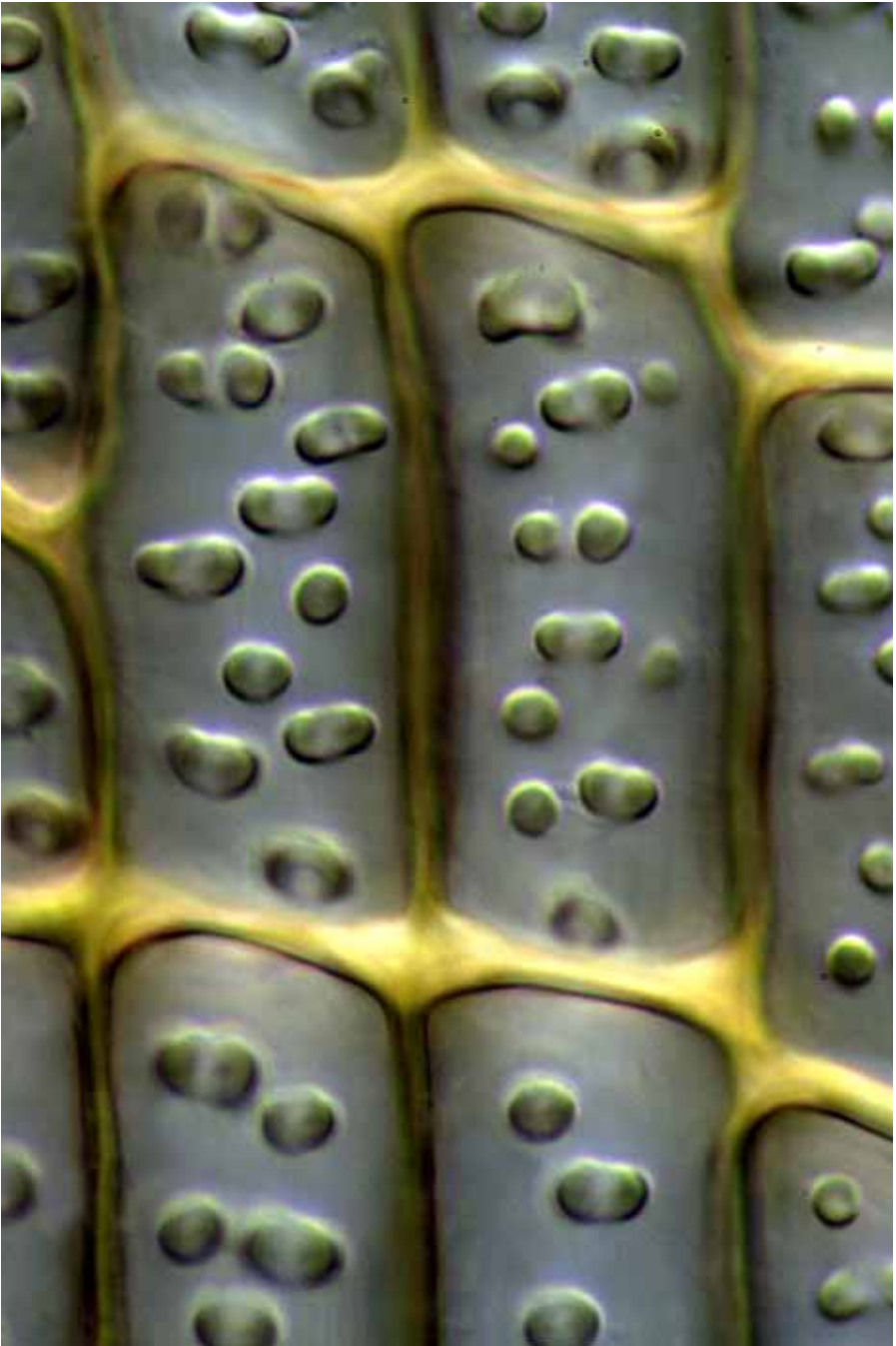
bordered margin midleaf, bordered margin of lower leaf, and leaf basal angle
 10 μm, 10 μm, 50 μm

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Henediella arenae var. *arenae* leaf apex
— 10 μ m

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Henniella arenae var. *arenae* cells of lower leaf
10 μ m

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Hennediella arenae var. **petriei** (Broth.) R.H.Zander

form: densely tufted, erect, ± branched stems, light green, 5–10 mm tall
habitat: exposed to shaded soil at subalpine to alpine elevations

leaf: size: 3–4 mm

shape: ovate- to oblong-lanceolate or subspathulate

tip: acute

base: basal cells rectangular, pellucid, sparsely papillose to smooth

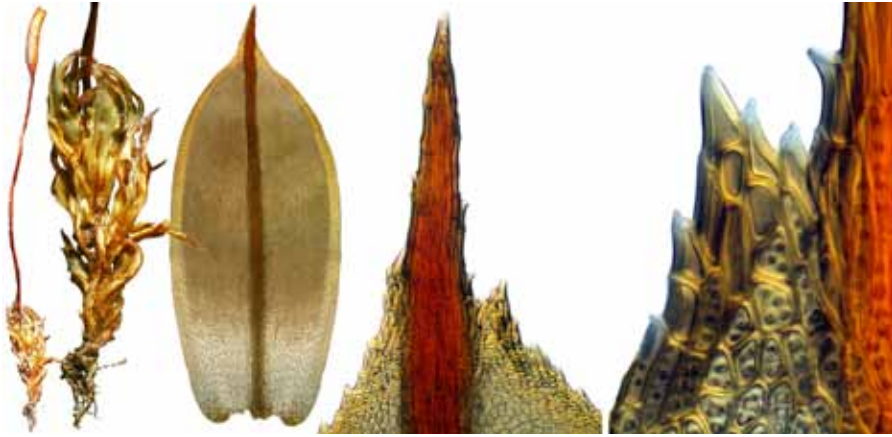
costa: strong, excurrent in a stout red point

border: 6–12 rows, firm-walled, ± papillose; length/width ratio mostly > 4

margin: entire below, ± toothed near apex, plane

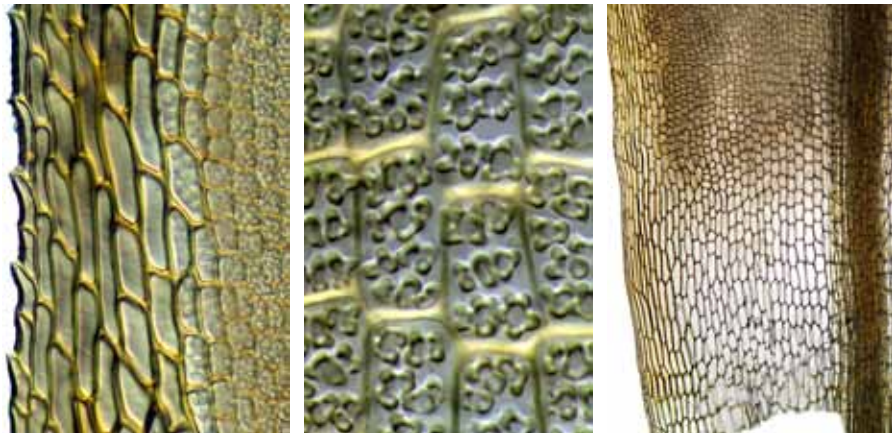
cells: 17–20 μm, subquadrate to hexagonal, firm-walled, multipapillose

capsule: 2.5–5 mm, cylindrical, ± curved, erect, exserted, glossy, brown; seta 13–20 mm, red; calyptra cucullate, smooth, naked; operculum conic-subulate, to half the capsule length; peristome pink, to 1/3 the length of the capsule; basal tube long; spores 14–18 μm in diam.



fertile shoot (dry), leaf outline, leaf apex, and margin at base of apical point

5 mm, 1 mm, 1 mm, 100 μm, 50 μm



bordered margin midleaf, cells below midleaf, and leaf basal angle

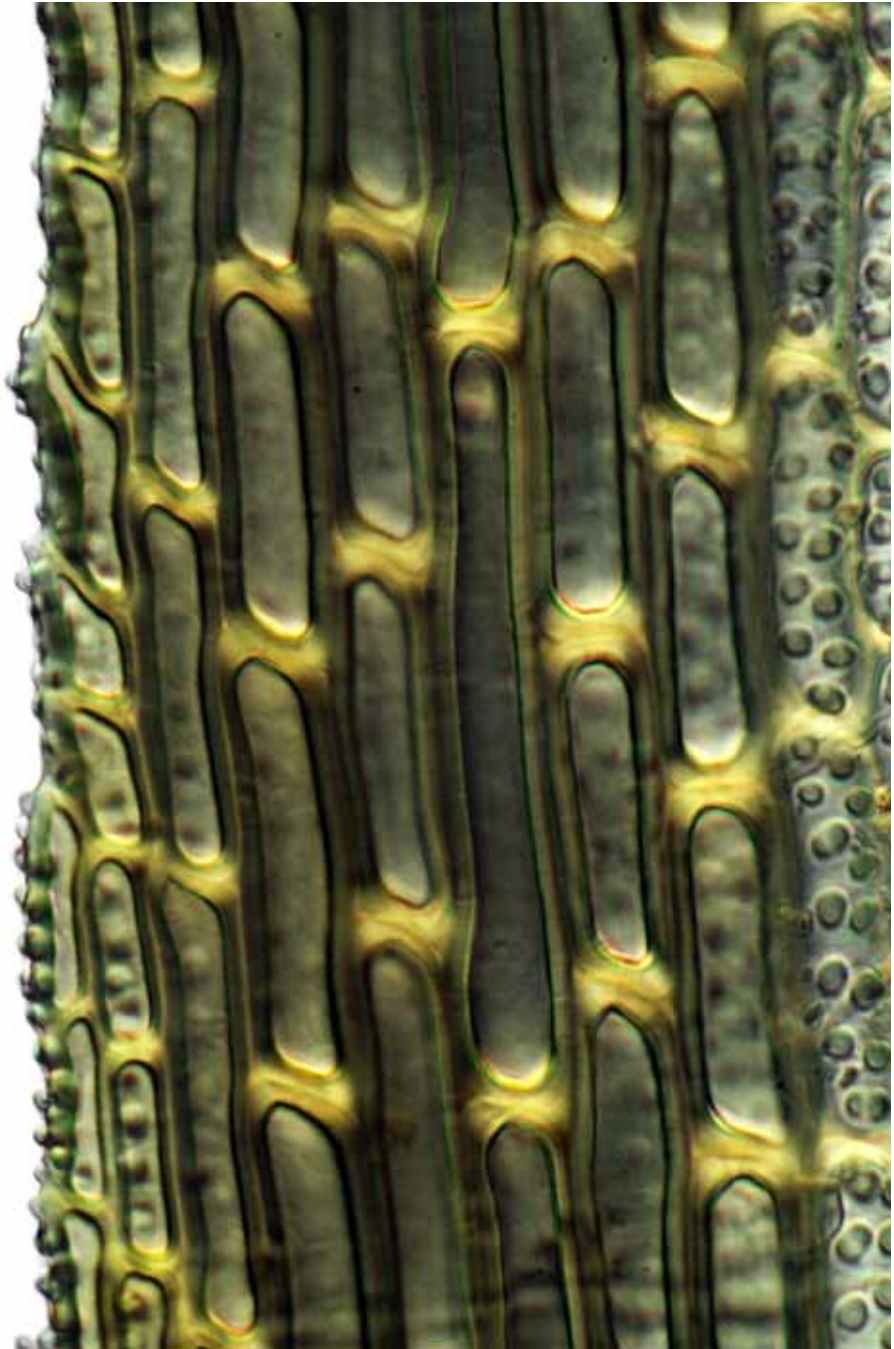
50 μm, 10 μm, 50 μm

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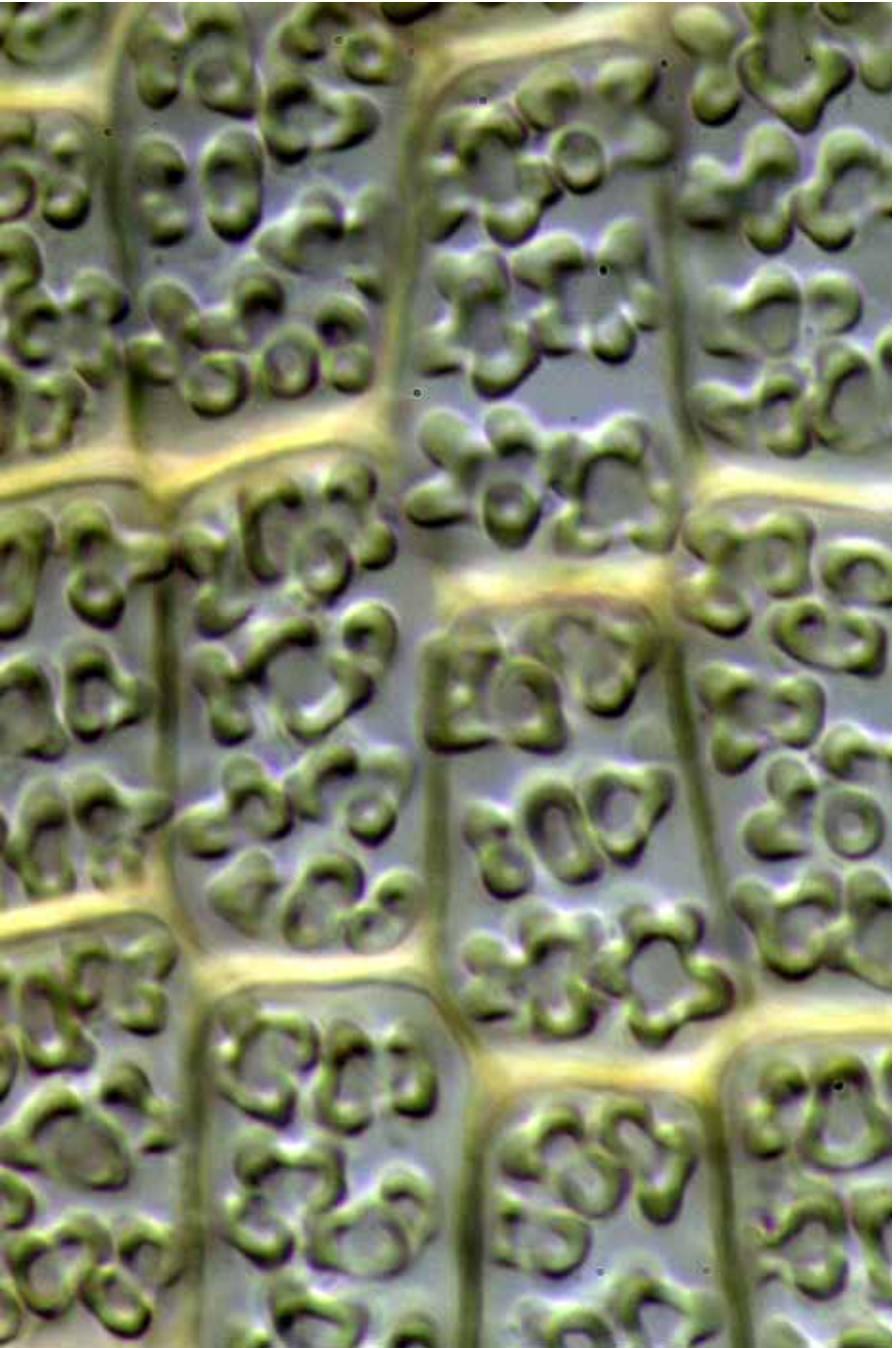
Henediella arenae var. *petriei* margin at base of apical point
— 10 μ m

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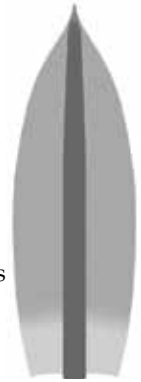
Hennediella arenae var. *petriei* bordered margin below midleaf
10 μ m

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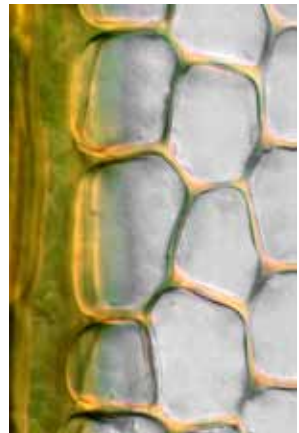
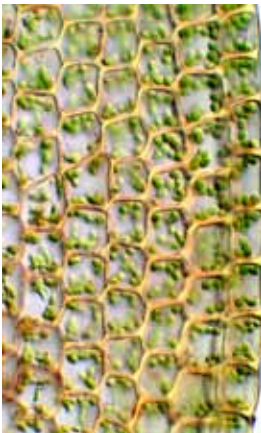
Hennediella arenae var. *petriei* cells just below midleaf
10 μ m

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Hennediella heimii (Hedw.) R.H.Zander**form:** densely tufted, erect, irregularly branched, reddish below**habitat:** soil or soil over rock; salt-tolerant**leaf:** size: 2.0–2.5 × 0.5–0.6 mm*shape:* narrowly oblong-lanceolate*tip:* acute, ± acuminate*base:* undifferentiated*costa:* excurrent in a cuspidate point*border:* not differentiated*margin:* entire to ± denticulate toward the apex, plane*cells:* 12–16 μm, subquadrate, firm-walled, papillose, the papillae ± bifid**capsule:** 1–2 mm, oblong, wide-mouthed, brown; seta 5–12 mm; lid persists attached to the columella

fertile habit, fertile shoots (2) and immature capsule, leaf outline, and leaf apex

5 mm,
 1 mm,
 1 mm,
 1 mm,
 10 μm



margin midleaf, costa midleaf, and cells midleaf

10 μm,
 10 μm,
 10 μm

continued next page

Hennediella macrophylla (R.Br.bis) Paris

form: gregarious or tufted stems, ± branched, light green, 3–6 mm tall
habitat: soil, rock, roots, or rotting logs in damp sites

leaf: size: 2–4 mm

shape: ovate- to oblong-spathulate, unistratose, flexuose when dry

tip: acute to acuminate, ending in an acute, dentate point

base: basal cells 60–120 × 20 μm, thin-walled, smooth

costa: excurrent in the dentate point

border: 2–4 rows of narrow, firm-walled, smooth cells

margin: denticulate above, minutely crenulate below, plane

cells: 15–20 μm, subquadrate or short-rectangular, thin-walled, C-papillose

capsule: 1.5–2.5 mm, oval to cylindric, erect, exserted, brown; seta 2–4 mm,

stout, reddish, twisted when dry; peristome none; operculum rostrate;

calyptra pale, large, campanulate, mitriform to nearly cucullate, with a

dark apex; spores 18–6 μm in diam., reddish brown

note: endemic

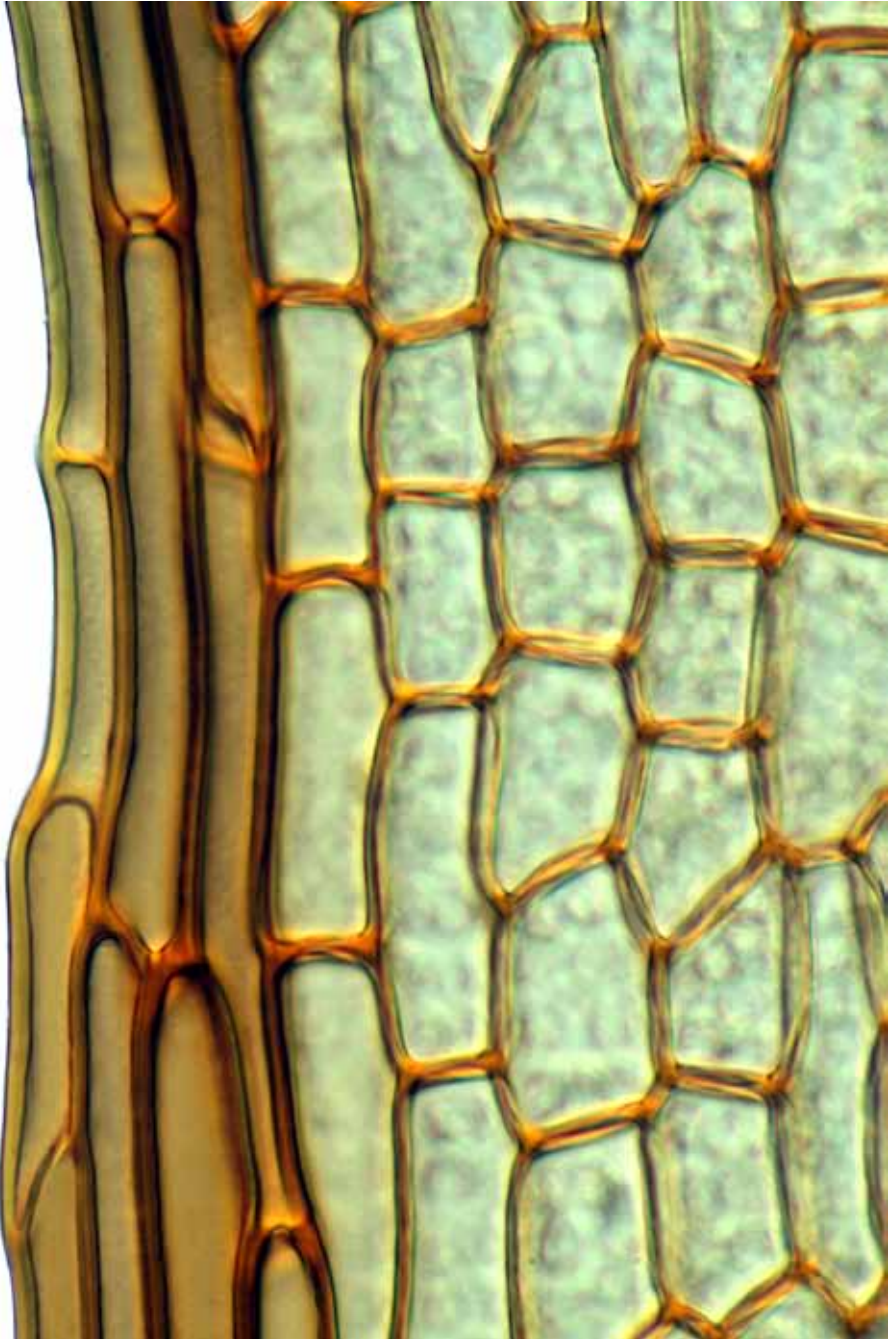


fertile shoot (moist), leaf outline, leaf apex, and margin upper leaf
 ■ 1 mm, ■ 1 mm, ■ 10 μm, ■ 10 μm



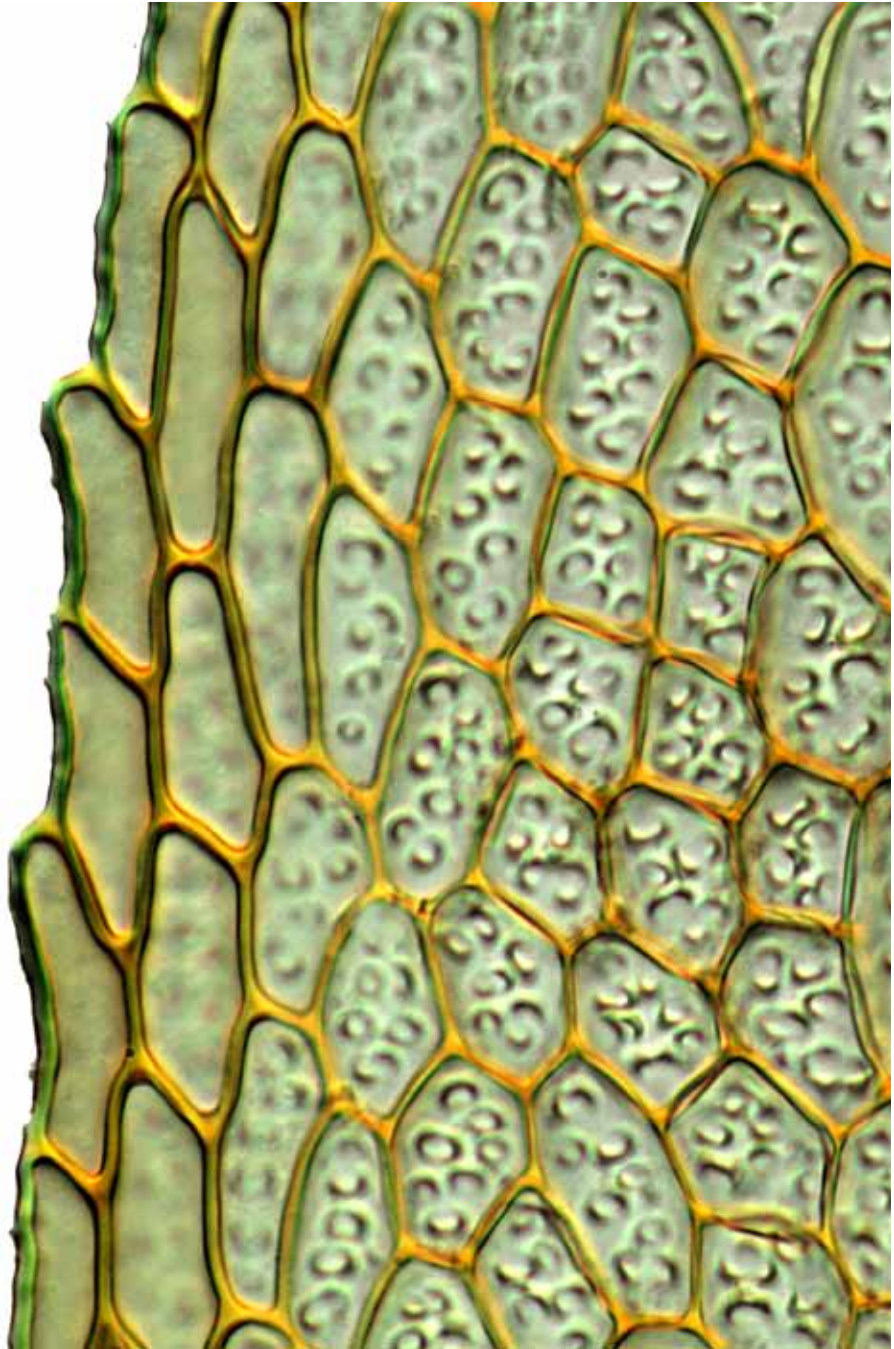
bordered margin midleaf, costa midleaf, and cells near leaf base
 ■ 10 μm, ■ 10 μm, ■ 10 μm

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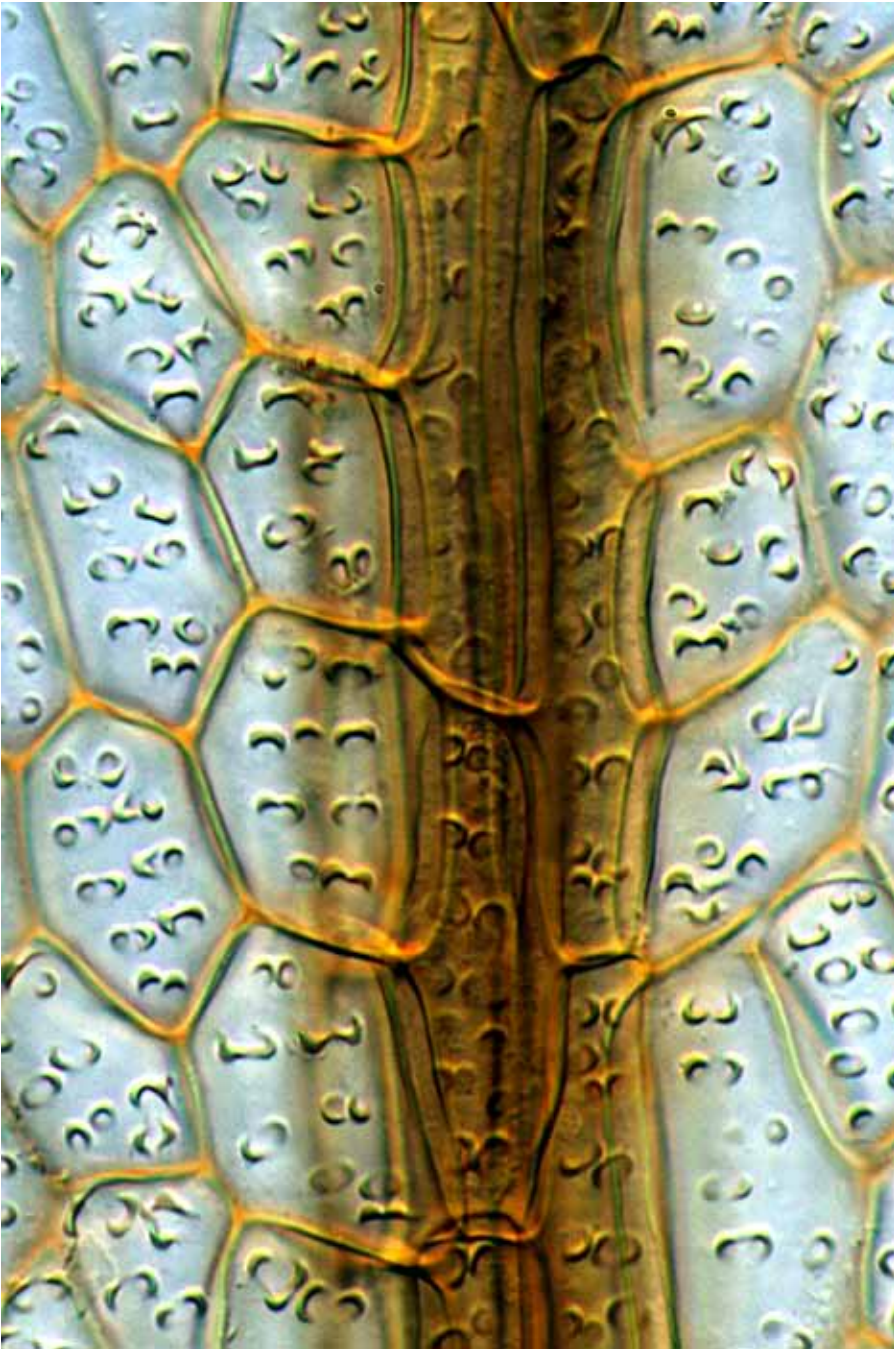
Henediella macrophylla margin midleaf
10 μm

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Henediella macrophylla weakly bordered margin upper leaf
10 μm

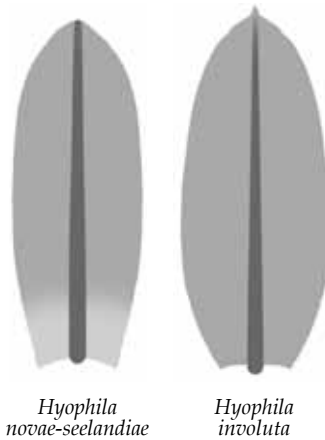
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Henediella macrophylla costa midleaf
10 μm

Key to the New Zealand species of *Hyophila* (2)

- 1 Peristome well-developed; leaf tip round ● ***Hyophila novae-seelandiae***
 1: Peristome none; leaf tip mucronate..... ● ***Hyophila involuta***



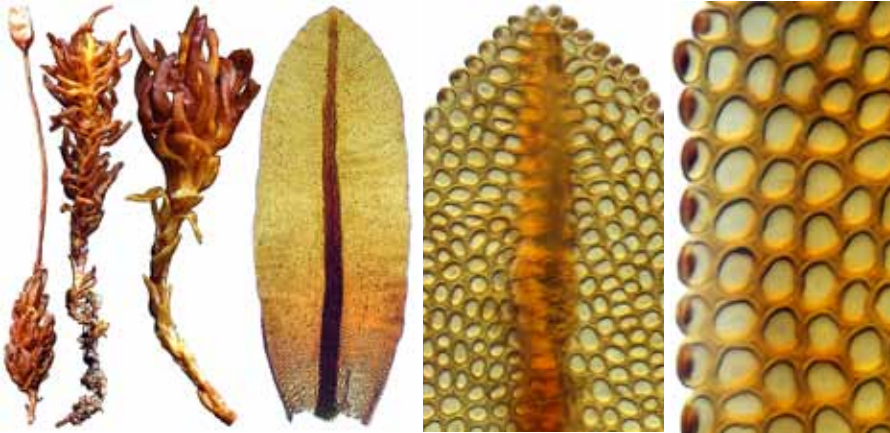
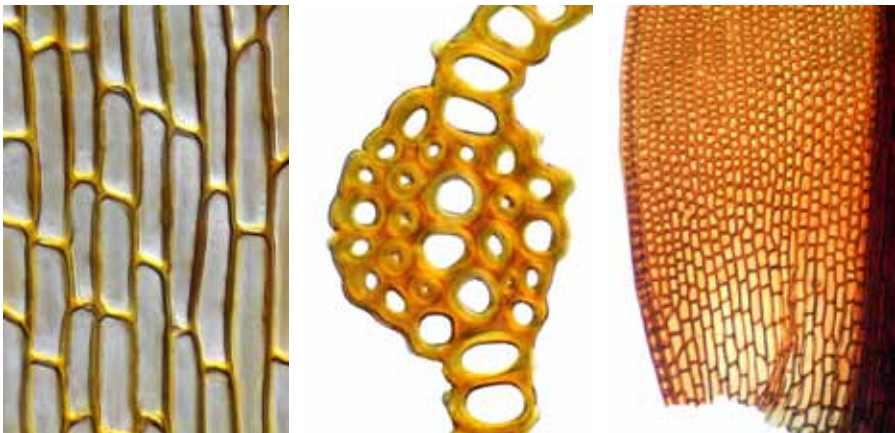
Hyophila involuta (Hook.) A. Jaeger**form:** tufts of erect unbranched stems**habitat:** wet concrete and calcareous rocks or soil-covered rocks**leaf:** *size:* 1.5–3 mm*shape:* oblong to oblong-spathulate*tip:* obtuse, mucronate*base:* cells rectangular near leaf insertion*costa:* vanishing in mucro*border:* not differentiated*margin:* irregularly serrulate above, plane when wet, inrolled when dry*cells:* 7–9 μm , subquadrate, firm-walled, bulging but not papillose**capsule:** 1.5–2.5 mm, narrowly cylindrical, erect; seta 6–17 mm

fertile shoot, leaf outline, and leaf apex (2)

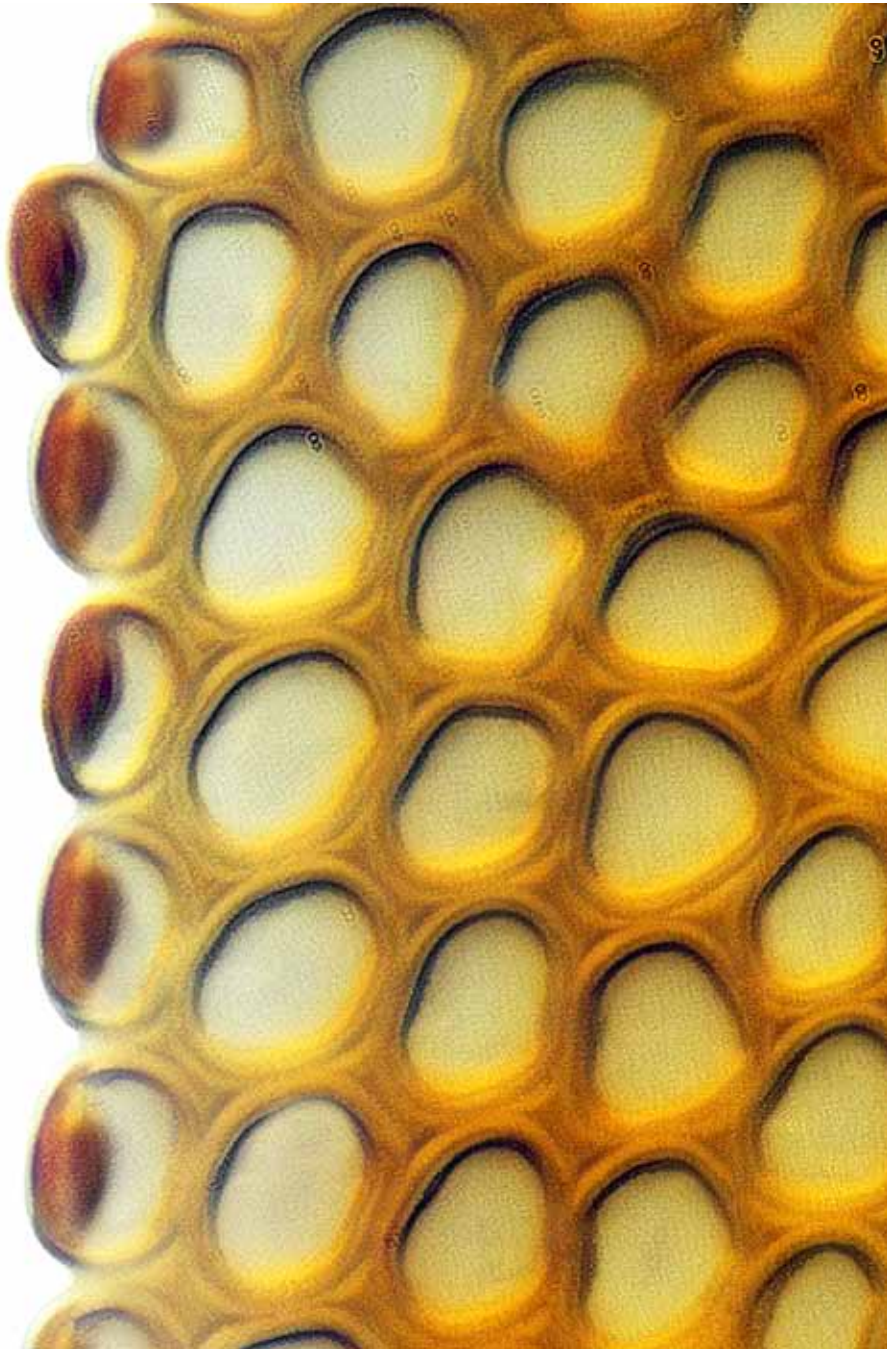
 1 mm, 0.5 mm, 10 μm (left), 10 μm (right)


margin midleaf, costa terminus, and propagule

 10 μm , 10 μm , 10 μm

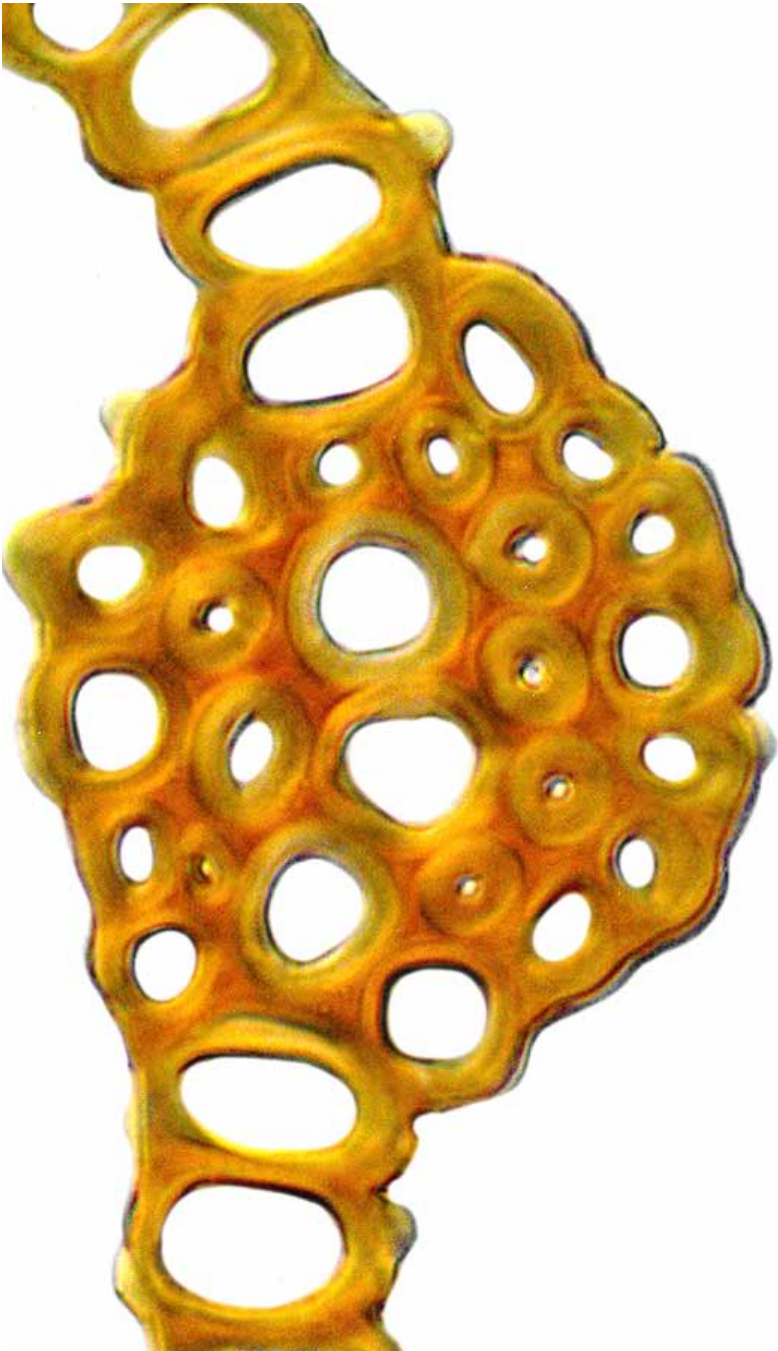
Hyophila novae-seelandiae Dixon & Sainsbury**form:** densely tufted, dull, erect, sparsely branched stems, 5–10 mm tall**habitat:** moist rock (limestone or sandstone) or soil, lowland to montane**leaf:** size: 2 mm*shape:* widely oblong, concave, carinate*tip:* obtuse, slightly recurved, rarely minutely apiculate*base:* basal cells rectangular, hyaline, thin-walled*costa:* strong, reddish, vanishing below the apex*border:* not differentiated*margin:* entire, plane*cells:* 7 μm , subrotund, incrassate, smooth**capsule:** 1 mm, narrowly elliptic or ovoid, gymnostomous; seta 5(–10) mm; operculum obliquely rostrate, the beak about as long as the urn; spores 14–15 μm in diam.**note:** endemicfertile and vegetative shoots (dry), leaf outline, leaf apex, and margin midleaf
 ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm , ■ 10 μm cells near leaf base, costa cross-section, and leaf basal angle
 ■ 10 μm , ■ 10 μm , ■ 50 μm

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Hyophila novae-seelandiae margin midleaf
10 μ m

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Hyophila novae-seelandiae costa cross-section
10 μm

Leptodontium interruptum (Mitt.) Broth.

form: loosely tufted, simple or branched stems with comal tufts, 20–50 mm tall
habitat: exposed soil or rock, to high elevations

leaf: size: 2–3 mm

shape: lanceolate from a wide ovate base

tip: acuminate

base: basal cells elongate to linear, mostly smooth

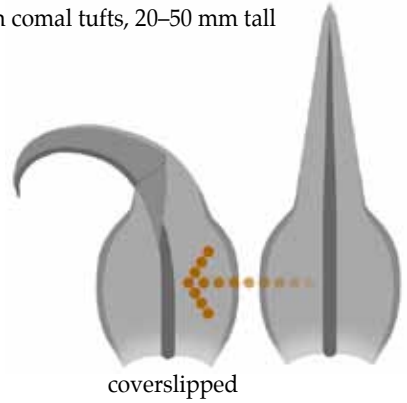
costa: failing below the apex

border: not differentiated

margin: erose or denticulate above, recurved below, sometimes undulate

cells: 7–9 μm , isodiametric, thick-walled, papillose

capsule: 1–1.5 mm, narrowly elliptic, erect, pale brown; seta 8–10 mm, yellow, flexuose, \pm paired; calyptra cucullate, naked, smooth; operculum subulate; peristome teeth 16, irregularly cleft



coverslipped



vegetative shoots (dry), leaf outline, and leaf apex
 1 mm, 0.5 mm, 10 μm



margin upper leaf, costa in lower leaf, costa cross-section
 10 μm , 10 μm , 10 μm

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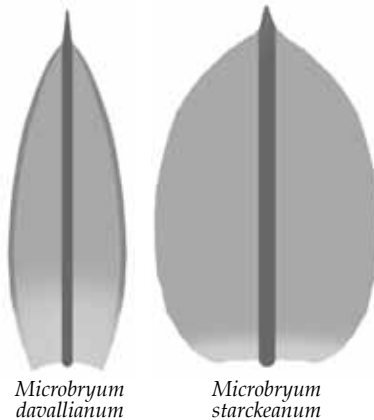
Leptodontium interruptum margin upper leaf
1 mm

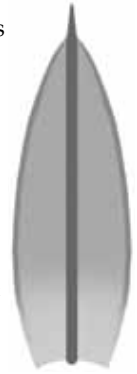
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Key* to the New Zealand species of *Microbryum* (2)

- 1 Peristome teeth absent or reduced to stumps; spores papillose or spiculose, opaque ● ***Microbryum davallianum***
 1: Peristome teeth to 120 μm tall; spores smooth or tuberculate, clear ● ***Microbryum starckeanum***

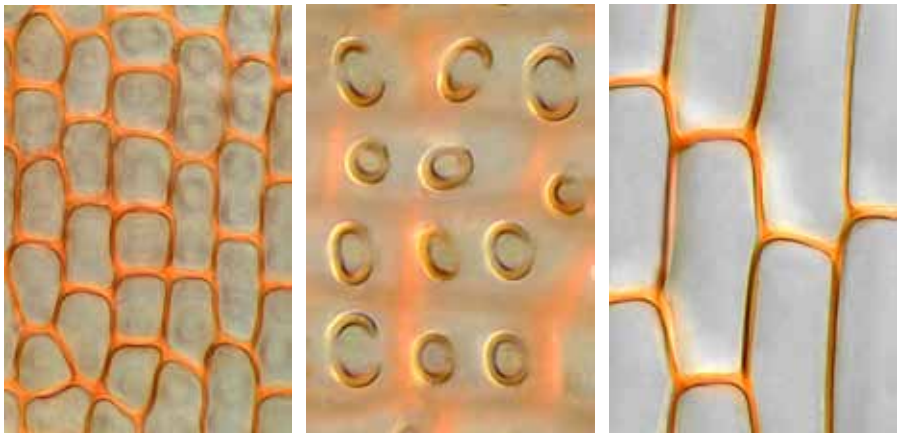
* based on Zander, RH (2007): *Microbryum*. *Flora of North America* 27, 628.



Microbryum davallianum (Sm.) R.H.Zander**form:** gregarious, erect, forked, red-brown stems, in turves, to 2 mm tall**habitat:** calcareous soil in old fields, pastures, lawns, or disturbed roadsides**leaf:** size: 1–1.6 × 0.3–0.5 mm*shape:* lanceolate to ovate-lanceolate*tip:* gradually acuminate, ending in a short red apiculus*base:* basal cells rectangular, hyaline, thin-walled, smooth*costa:* excurrent in an apiculus*border:* not differentiated*margin:* entire, revolute below*cells:* 12–15 μm, hexagonal, firm-walled, papillose, the papillae C-shaped**capsule:** 0.4–1 mm, short-oval to hemispheric, wide-mouthed when empty, brown; seta 1.5–3 mm; calyptra minutely papillose; operculum low-conic; peristome teeth none or reduced to stumps; spores 29–33 μm in diam., spinulose**note:** an ephemeral pioneer species on bare soil

vegetative shoot, leaf outline, leaf apex, and margin midleaf

1 mm, 0.1 mm, 10 μm, 10 μm



cells midleaf, leaf papillae, and leaf base cells

10 μm, 10 μm, 10 μm

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Microbryum starckeanum (Hedwig) Zander

form: gregarious, short, erect, unbranched stems, to 2 mm tall
habitat: moist, bare, compacted soil in fields or disturbed sites

leaf: size: 0.5–1.8 × 0.3–1.0 mm

shape: ovate to elliptic

tip: acute to obtuse

base: basal cells elongate, thin-walled, and smooth

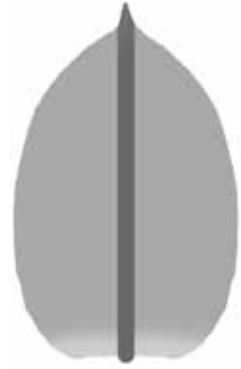
costa: reddish, excurrent in a short cusp or mucro, reddish

border: not differentiated

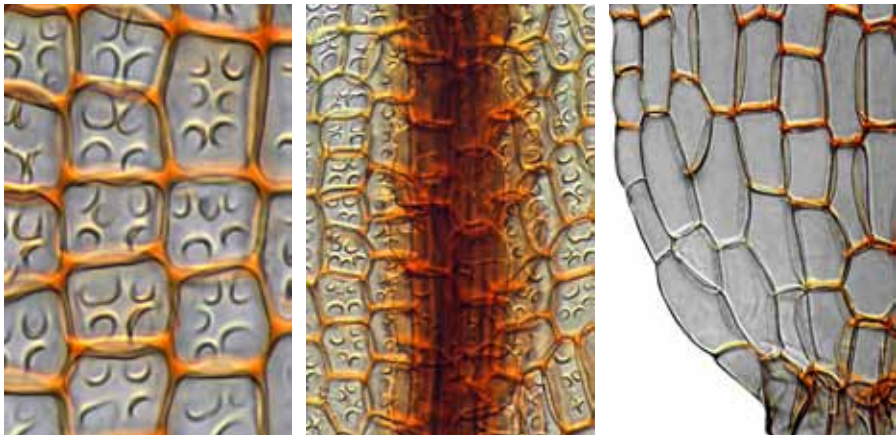
margin: entire, plane to ± revolute

cells: 10–15 μm, subquadrate, firm-walled, multipapillose

capsule: to 1 mm, oval, erect, dark brown, glossy, the mouth not wide when dry; seta to 4 mm; calyptra roughly papillose; operculum conic, obtuse or short-pointed; peristome teeth variable, flattened-linear, pale yellow; papillose; spores 25–30 μm, coarsely tuberculate



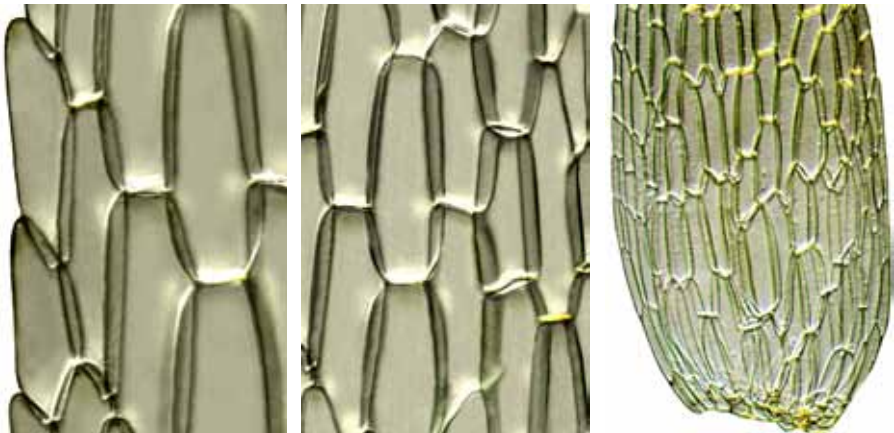
fertile shoot (dry), capsule (dry), leaf outline, leaf apex, and margin upper leaf
 — 1 mm, — 0.1 mm, — 0.1 mm, — 10 μm, — 10 μm



cells of upper leaf, costa in upper leaf, and leaf basal angle
 — 10 μm, — 10 μm, — 10 μm

Micromitrium tenerum (Bruch & Schimp.) Crosby**form:** scattered on thin protonema, minute, erect, unbranched**habitat:** exposed soil or sandy banks**leaf:** *size:* upper leaves $1.0\text{--}1.5 \times 0.2$ mm*shape:* linear-lanceolate*tip:* gradually attenuate, involute*base:* basal cells longer than the other blade cells but otherwise not differentiated*costa:* none*border:* not differentiated*margin:* serrulate or indistinctly crenate toward the apex, plane*cells:* $60\text{--}100 \times 16\text{--}20$ μm , rhombic-hexagonal, thin-walled, smooth**capsule:** 0.5–0.8 mm, globose, not apiculate, erect, emergent, cleistocarpous, usually dehiscent near the middle along a line of built-in weakness; seta very short

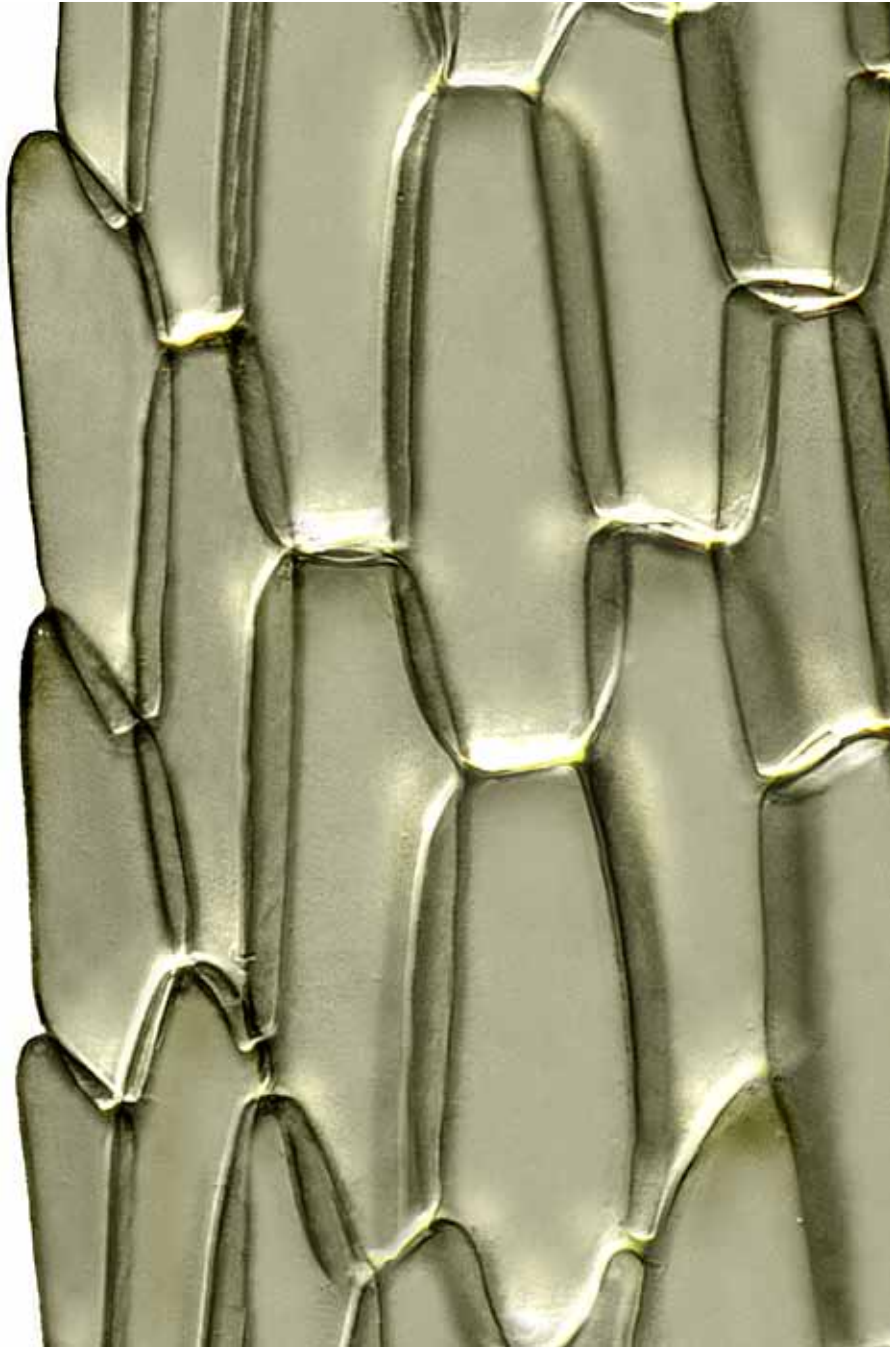
fertile shoot, immature capsule, leaf outline, and leaf apex

 1 mm, 0.1 mm, 0.5 mm, 10 μm


margin midleaf, cells in midleaf, and leaf base

 10 μm , 10 μm , 50 μm

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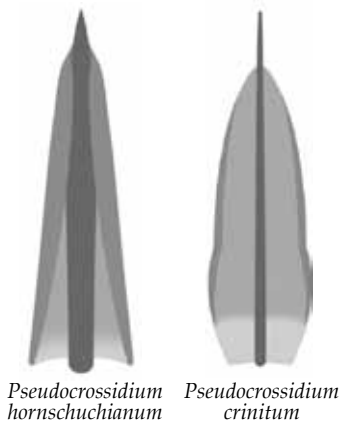


Micromitrium tenerum margin midleaf
10 μm

Key* to the New Zealand species and varieties of *Pseudocrossidium* (2)

- 1 Leaf apex narrowly acute at the base of the awn; costa convex adaxially, in cross-section with two guide cells ● ***Pseudocrossidium hornsouchianum***
 1: Leaf apex rounded-obtuse at the base of the awn; costa concave adaxially, in cross-section with four guide cells ● ***Pseudocrossidium crinitum***

* based partly on Zander, RH (2007): *Pseudocrossidium*. *Flora of North America* 27, 570.

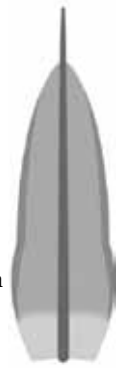


Pseudocrossidium crinitum (Schultz) R.H.Zander**form:** robust, yellowish, erect, comose, ± branched stems, 15–20 mm tall**habitat:** soil, usually sandy or gravelly in semi-arid sites**leaf:** size: 3–4.5 × 0.8–1.2 mm*shape:* linguulate-lanceolate, ± concave, twisted when dry*tip:* subacute, ending in a slender awn*base:* basal cells long-rectangular to linear, pellucid, smooth*costa:* excurrent in a yellowish, ± smooth arista, prominent abaxially*border:* absent*margin:* entire to minutely crenulate with projecting papillae, recurved*cells:* upper cells 9–12 μm, isodiametric, firm-walled, densely papillose**capsule:** 2.5–3 mm, narrowly cylindric, slightly curved, exserted, brown; seta

10–20 mm, pale or reddish; operculum long-beaked, up to 2 mm; calyptra

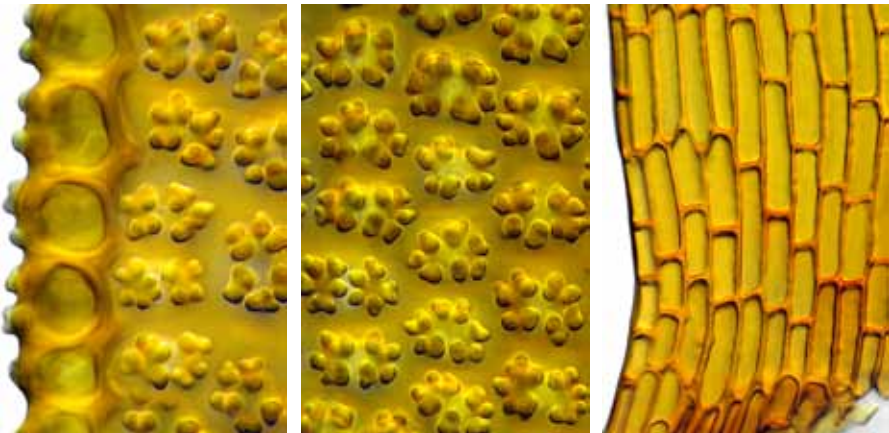
cucullate, smooth; peristome divided into 32 filaments on a low basal

membrane; spores 8–15 μm in diam., weakly papillose

note: common

vegetative shoot (dry), leaf outlines (2), and leaf apex (3)

5 mm, 1 mm (2), 50 μm, 10 μm, 10 μm



margin midleaf, leaf papillae, and leaf basal angle

10 μm, 10 μm, 10 μm

continued next page



Pseudocrossidium crinitum habit
1 mm

continued next page



Pseudocrossidium crinitum immature and mature capsules, calyptrae, and peristome

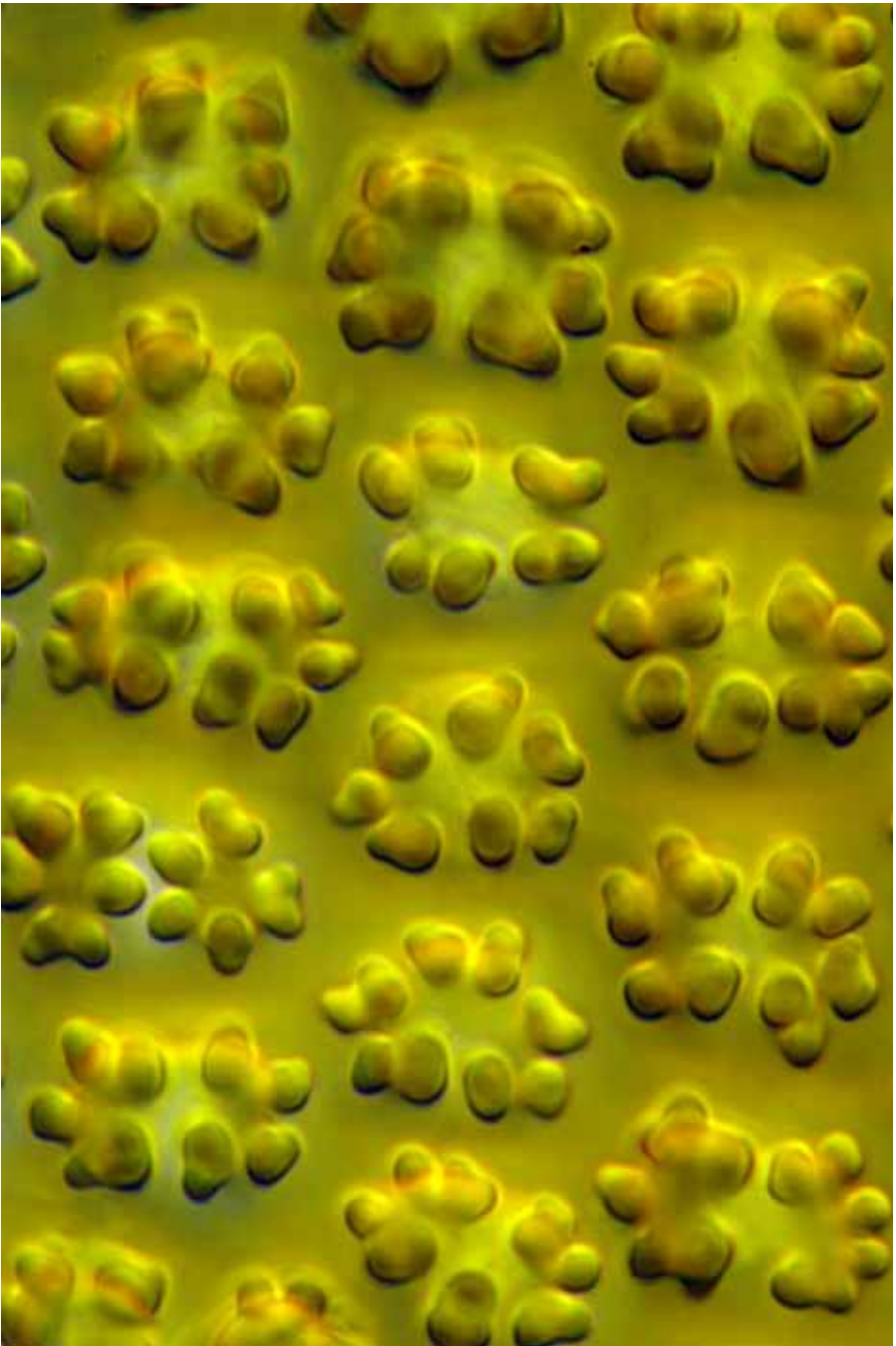
1 mm,

1 mm,

1 mm,

1 mm

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Pseudocrossidium crinitum leaf surface papillae
10 μ m

continued next page



Pseudocrossidium crinitum leaf and costa cross-sections
10 μm , 10 μm

continued next page

Pseudocrossidium hornschuchianum (Schultz) R.H.Zander

form: dark olive- to brownish green, erect, sparsely branched stems in dense, flat turves, weakly radiculose, 5–10 mm tall

habitat: bare soil in semi-arid areas, especially disturbed road verges

leaf: size: 1–1.5 × 0.3–0.5 mm

shape: narrowly triangular

tip: acuminate, ending in a stout awn

base: undifferentiated

costa: wider above, excurrent in the awn

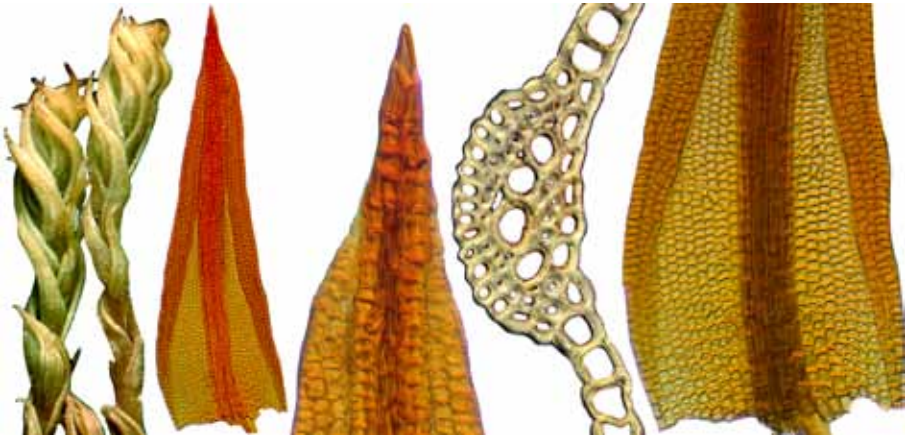
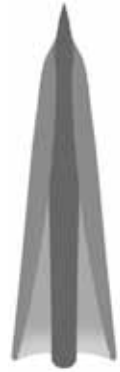
border: not differentiated

margin: entire, strongly revolute from the base to the apex

cells: 10–14 μm, rounded, rectangular near the costa, thick-walled, papillose

capsule: 0.8–1.5 mm, cylindric, straight, erect; calyptra narrowly conic; seta 6 mm, slender, reddish brown; operculum obliquely long-rostrate; the peristome divided into 32 spiculose filaments

note: possibly introduced



vegetative shoots (dry), leaf outline, leaf apex, costa cross-section, and leaf base

1 mm, 100 μm, 50 μm, 10 μm, 100 μm

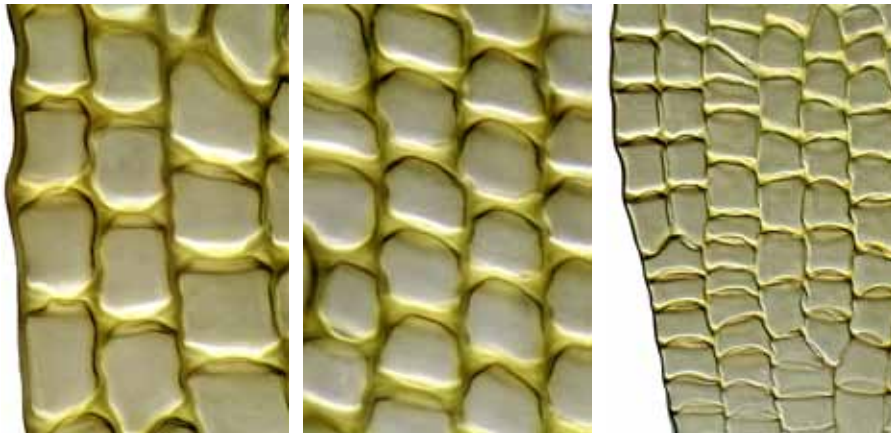


costa and revolute margin, cells in midleaf, and revolute margin

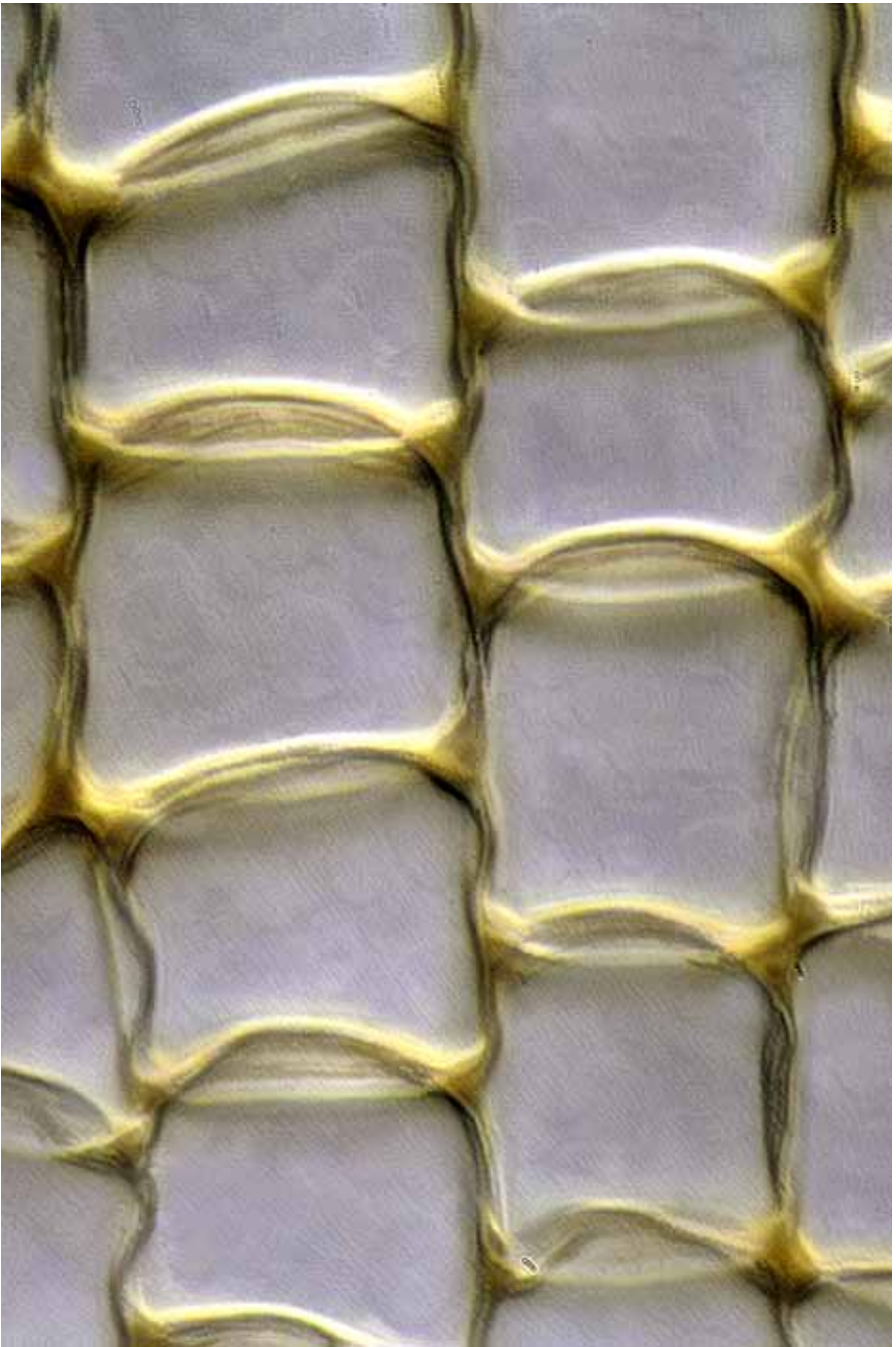
50 μm, 10 μm, 10 μm

Pterygoneurum ovatum (Hedw.) Dixon**form:** densely tufted, brownish, erect, unbranched stems, 3–5 mm tall**habitat:** exposed soil in disturbed sites like lawns, fields, and road verges**leaf:** size: 1.5–2 mm (including the awn)*shape:* oblong-ovate*tip:* obtuse to broadly acute, ending in a hyaline, ± serrulate awn*lamellae:* 2–4, each 5–7 cells tall, strongly crenate on the margin*base:* alar cells not differentiated*costa:* excurrent in a hyaline awn that can exceed the length of the lamina*border:* not differentiated*margin:* entire, plane to erect*cells:* 11–15 μm , rounded-quadrate, firm-walled, smooth**capsule:** 1–1.5 mm, long-cylindric, erect, symmetric, shortly exserted, dark brown, wrinkled-plicate when dry and empty; seta 1.5–3.5 mm, brown; operculum obliquely rostrate; calyptra cucullate; peristome none; spores 22–33 μm , papillose

fertile habit (dry), mature capsule (dry), leaf outline, leaf apex, and lamella (upended)



margin midleaf, cells in midleaf, and leaf basal angle

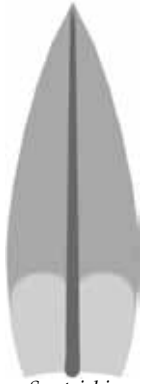


Pterygoneurum ovatum cells near leaf base
10 μm

Key* to the New Zealand species and varieties of *Syntrichia* (14)

- 1 Plants bearing propagula 2
 1: Plants not bearing propagula 5
- 2(1) Propagula in upper axils or clustered at the stem apex 3
 2: Propagula on tip or adaxial surface of the costa 4
- 3(2) Stems tipped with a rosette of tightly packed brood leaves .. ● *Syntrichia laevipila*
 3: Leaf-like propagules in upper leaf axils ● *Syntrichia pagorum*
- 4(2): Propagula on adaxial surface of costa ● *Syntrichia papillosa*
 4: Propagula at costa apex but soon shed, leaving a truncate tip *Syntrichia pygmaea*
- 5(1): Leaf bordered *Syntrichia rubella*
 5: Leaf not or only weakly bordered near the base 6
- 6(5): Costa typically failing *Syntrichia robusta*
 6: Costa typically excurrent 7
- 7(6): Margin entire or nearly so 8
 7: Margin toothed, at least near the apex 11
- 8(7) Plant on dry limestone; costa short-excurrent ● *Syntrichia phaea*
 8: Plant not on dry limestone; costa short- to long-excurrent 9
- 9(8): Leaf strongly narrowed in the middle *Syntrichia brevisetacea*
 9: Leaf not or only weakly narrowed in the middle 10
- 10(9): Costa red to the lamina apex ● *Syntrichia antarctica*
 10: Costa red only near the lamina base ● *Syntrichia ruralis*
- 11(7): Margin spinulose-dentate; costa red ● *Syntrichia serrata*
 11: Margin denticulate to dentate; costa orange or red only near the leaf base 12
- 12(11.): Stems < 30 mm tall; leaf < 4 mm long ● *Syntrichia anderssonii*
 12: Stems > 30 mm tall; leaf > 4 mm long 13
- 13(12): Cells densely papillose; plant on shaded alpine rock
 ● *Syntrichia rubra* var. *rubra*
 13: Cells sparsely papillose; plant on soil *Syntrichia rubra* var. *subantarctica*

* based partly on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 182.



*Syntrichia
robusta*



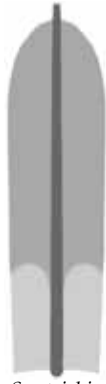
*Syntrichia
phaea*



*Syntrichia
rubra* var.
subantarctica



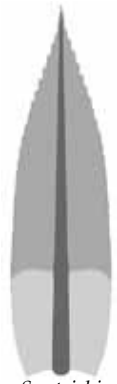
*Syntrichia
rubra* var.
rubra



*Syntrichia
pygmaea*



*Syntrichia
anderssonii*



*Syntrichia
serrata*



*Syntrichia
brevisetacea*



*Syntrichia
rubella*



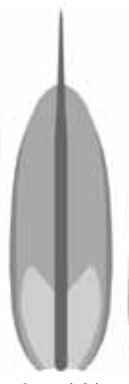
*Syntrichia
pagorum*



*Syntrichia
papillosa*



*Syntrichia
laevipila*



*Syntrichia
ruralis*



*Syntrichia
antarctica*

Syntrichia anderssonii (Ångstr.) R.H.Zander

form: loosely tufted, erect, \pm branched, foliate, hoary stems, to 30 mm tall
habitat: soil or rock in upland sites

leaf: size: 3–4 mm

shape: ovate- to oblong-lanceolate, twisted when dry

tip: acute

base: basal cells narrowly oblong to linear, 70–120 μm long, thin-walled

costa: excurrent in a narrow red or \pm hyaline point

border: weak, a single row of transversely elliptic cells

margin: entire below, \pm denticulate above, recurved in lower half

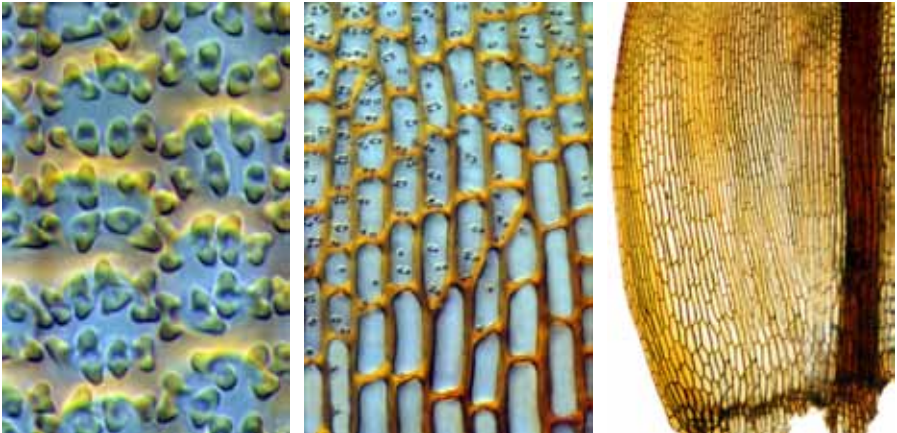
cells: 8–10 μm , irregularly hexagonal, firm-walled, pluri- to multipapillose

capsule: 2.5–5.5 mm, cylindric, erect, exserted, reddish brown; seta to 15 mm, reddish; operculum conic-subulate, to half the capsule length; calyptra cucullate; peristome tube pale below, teeth reddish, spirally twisted, papillose; spores 14–18 μm in diam., green, papillose



fertile shoot (2), peristome (dry), leaf outline, leaf apex, and margin midleaf

5 mm, 1 mm, 0.5 mm, 0.5 mm, 50 μm , 10 μm



cells midleaf, cells in lower leaf, and leaf basal angle

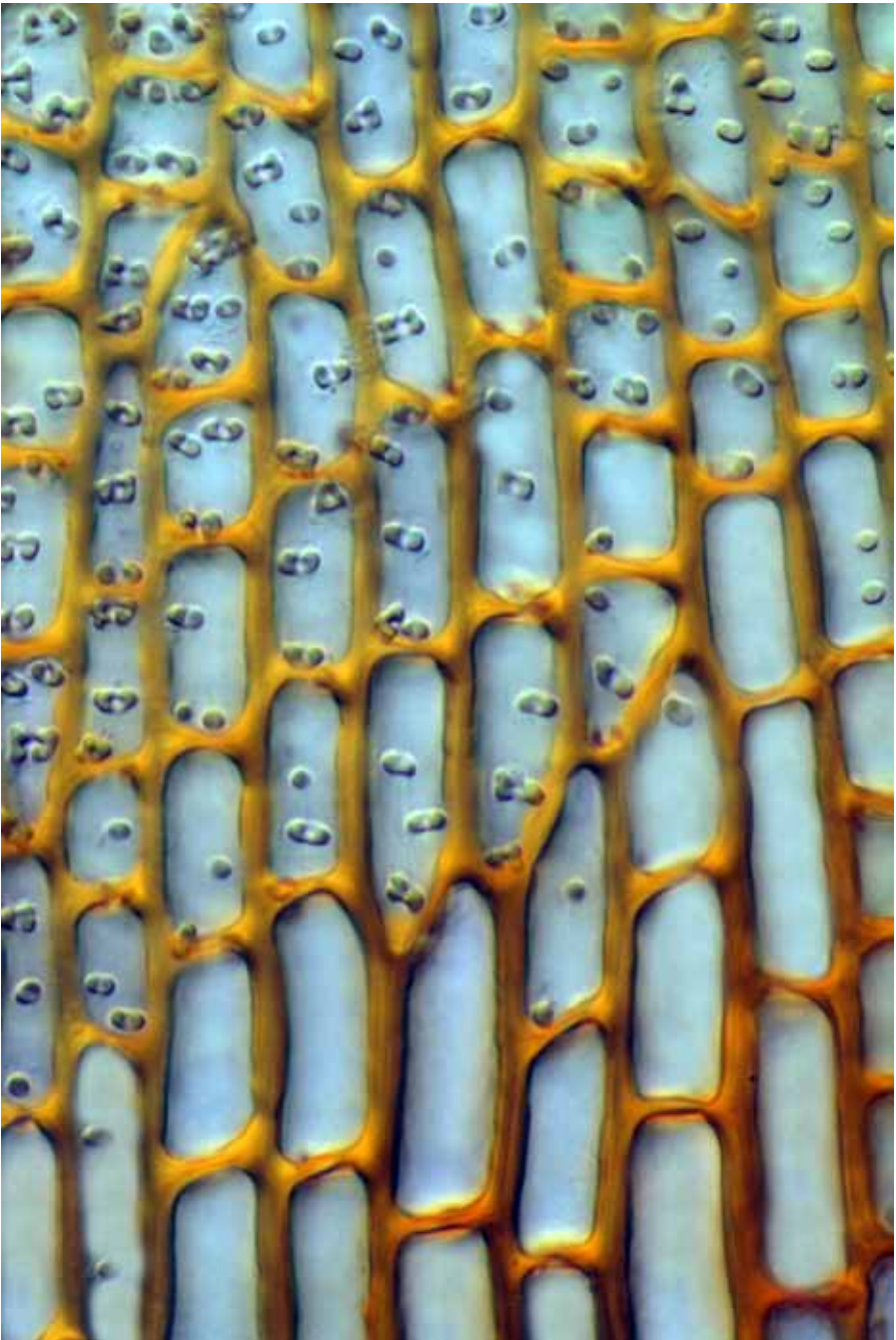
10 μm , 10 μm , 100 μm

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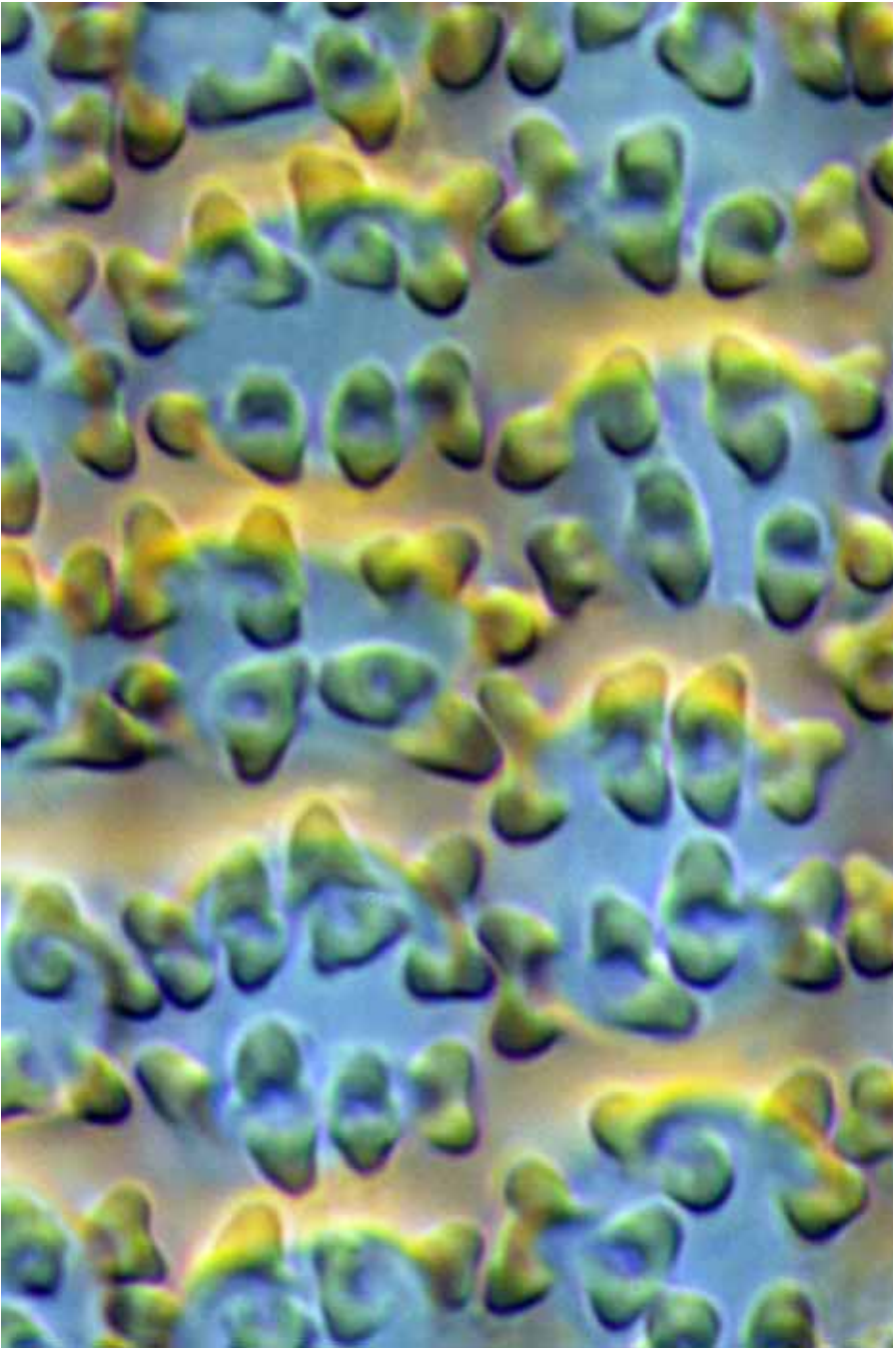
Syntrichia anderssonii fertile shoot, shoot apex, and peristome (dry)
 ■ 1 mm, ■ 1 mm, ■ 0.5 mm

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Syntrichia anderssonii lower leaf cells
10 μm

continued next page



Syntrichia anderssonii papillae midleaf
10 μm

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Syntrichia antarctica (Hampe) R.H.Zander

form: tufted, olive-green, erect, \pm unbranched stems, tomentose, to 20 mm tall
habitat: sandy soil, rotting logs, bark, or rock, lowland to high-montane

leaf: size: $4\text{--}5 \times 1.5$ mm

shape: elliptic to oblong-spathulate, \pm constricted below midleaf

tip: obtuse to emarginate, ending in a long, \pm reddish hair-point

base: basal cells hyaline, rectangular to linear, smooth

costa: excurrent in a denticulate, hyaline hair-point, reddish at the base

border: not differentiated

margin: entire, revolute to two-thirds up the leaf blade

cells: $12\text{--}20$ μm , hexagonal, firm-walled, papillose above, smooth below

capsule: 3.5–6 mm, cylindrical, erect, \pm curved, reddish brown; calyptra cucullate, operculum long-rostrate, curved; seta 10–30 mm, reddish, twisted; peristome teeth of 32 long, spiculate filaments, red-orange above, from a tall, pale to white tessellated cylinder, tightly twisted when dry, fragile



vegetative habit (moist), vegetative shoots (dry), leaf outline, capsules, and peristome
 ■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 0.5 mm (2), ■ 0.1 mm



revolute margin midleaf, hyaline basal cells, and costa cross-section
 ■ 10 μm , ■ 10 μm , ■ 10 μm

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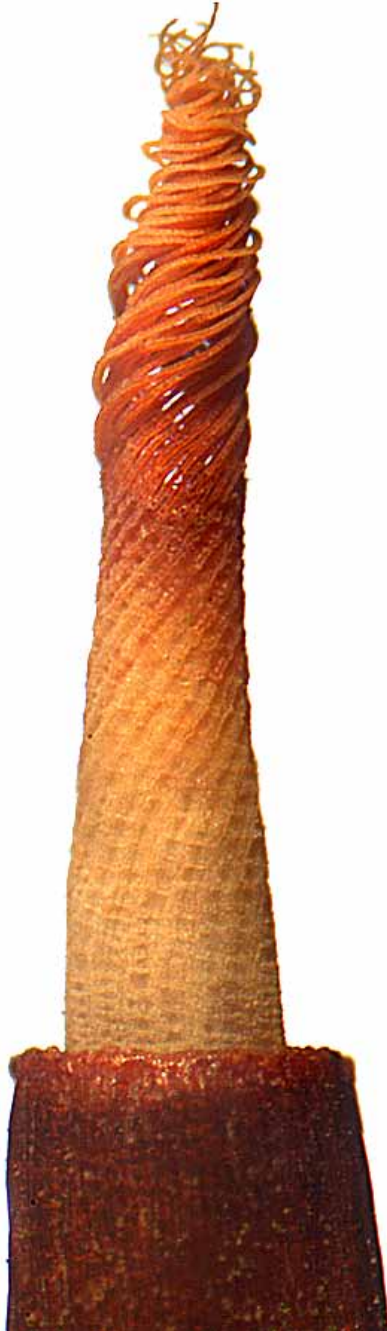
Syntrichia antarctica immature capsules and top view of vegetative shoots (moist)
1 mm

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Syntrichia antarctica vegetative shoots (dry)
1 mm

continued next page



Syntrichia antarctica peristome
100 μm

continued next page

Syntrichia laevipila Brid.

form: densely packed, erect, ± unbranched stems, the leaves comose, dark green, the hair-points hoary from a distance, 12–20 mm tall

habitat: bark or rock in dry, ± shaded, disturbed woodland and grassland

leaf: size: 1.8–2.5 × 0.7–0.8 mm

shape: spatulate to panduriform, ± constricted just below midleaf

tip: obtuse or emarginate

base: basal cells abruptly differentiated, rectangular, cross-walls ± thickened

costa: reddish, excurrent in a ± smooth yellowish or hyaline awn

border: weak, 0–4 rows of ± translucent, incrassate, and less papillose cells

margin: entire, plane to recurved in midleaf

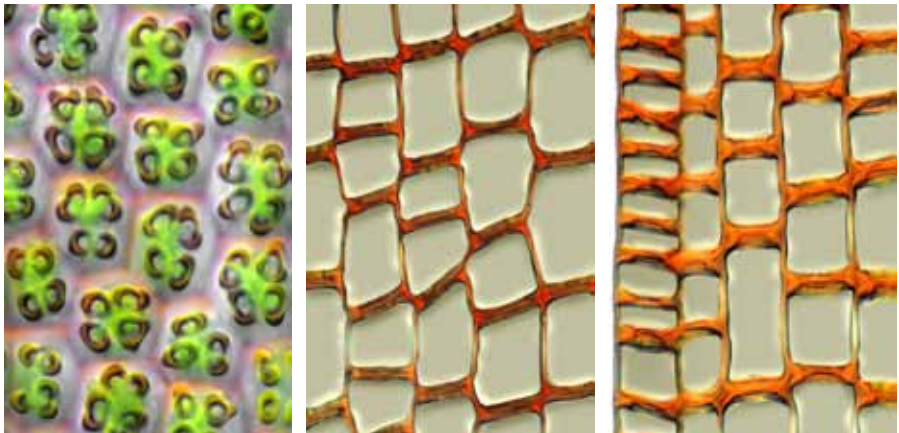
cells: 10–14 μm, quadrate-hexagonal, firm-walled, 3–6-papillose

capsule: 2.0–2.5 mm, cylindric, erect, exserted, brown, red-mouthed; seta 5–9 mm; calyptra narrowly conic, cucullate; peristome tubular and pale in lower half



fertile shoot (dry) (2), capsule, peristome, leaf outline, leaf apex, and margin midleaf

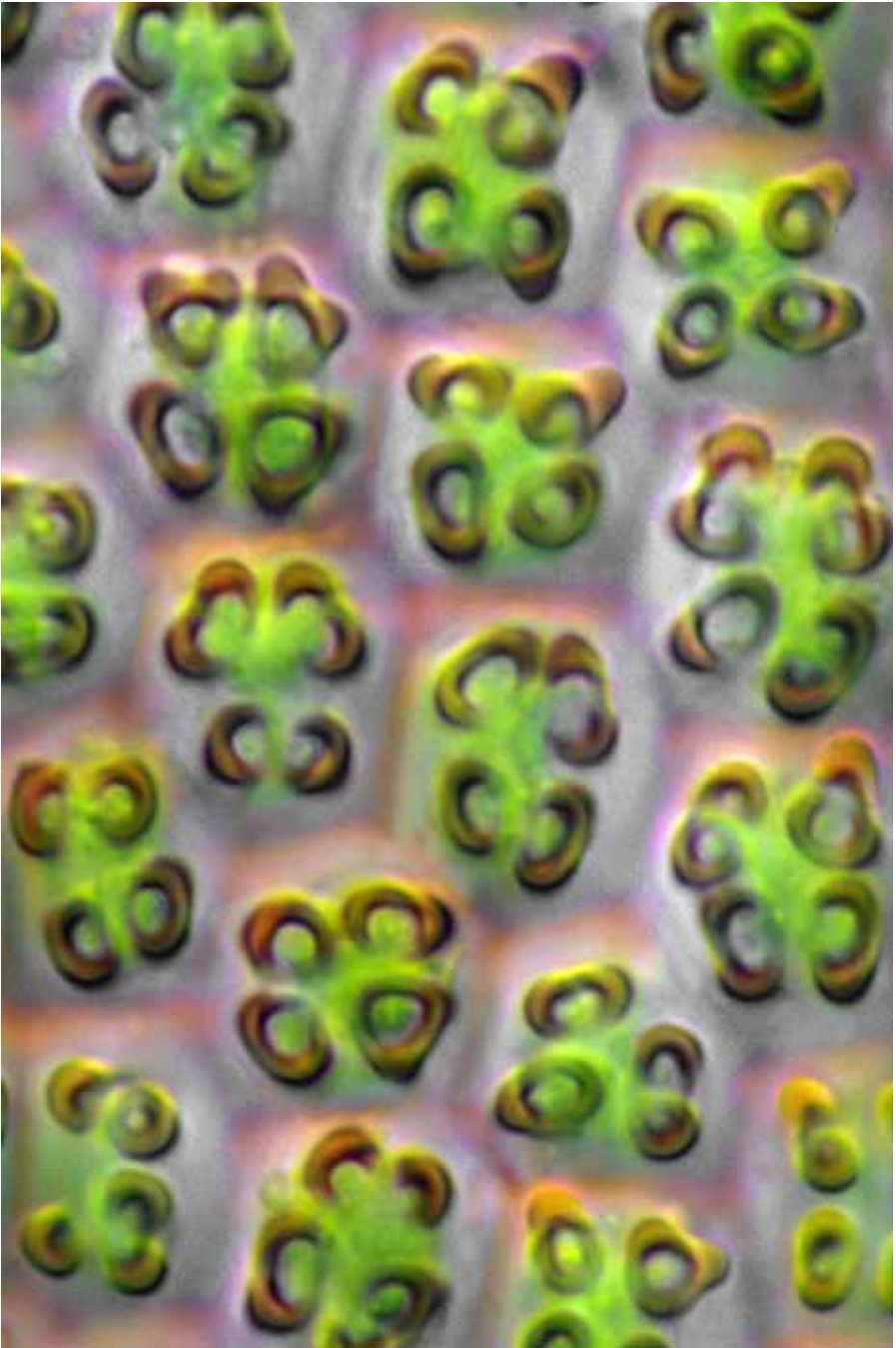
1 mm, 1 mm, 1 mm, 0.5 mm, 0.1 mm, 50 μm, 10 μm



surface papillae midleaf, lower leaf cells, and margin near leaf base

10 μm, 10 μm, 10 μm

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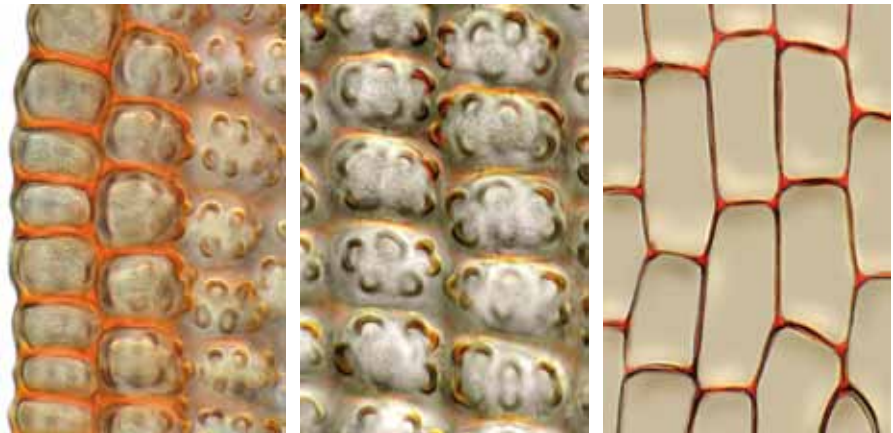


Syntrichia laevipila leaf surface papillae
10 μm

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Syntrichia pagorum (Milde) Amann**form:** loosely matted, erect, unbranched, radiculose stems, 5–10 mm tall**habitat:** bark of shrubs and trees, especially hardwoods, lowland**leaf:** size: 2.0–2.5 mm (not including the awn)*shape:* oblong, lingulate, or panduriform, concave above*tip:* rounded or rarely retuse*base:* basal cells rectangular, thin-walled, hyaline, smooth*costa:* excurrent in a smooth, hyaline awn*border:* not differentiated*margin:* entire, usually plane but rarely recurved below*cells:* 12 μm , subquadrate, firm-walled, several C-shaped papillae**capsule:** 2–2.5 mm, cylindrical, erect, brown; seta 5–9 mm; calyptra cucullate; operculum narrowly conic; peristome 32 filaments on a pale tessellated tube**note:** produces abundant leaf-like, ecostate, multicellular, densely papillose, axillary gemmae measuring 200–250 \times 80–100 μm 

vegetative shoot (dry), leaf outline, awn (3), and gemma

 0.5 mm, 0.1 mm, 50 μm , 50 μm , 10 μm , 20 μm


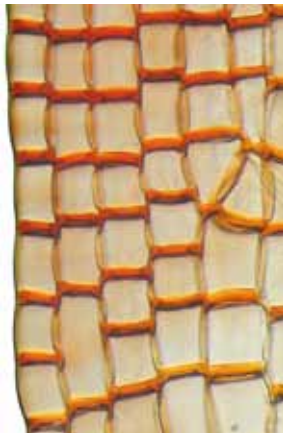
recurved margin midleaf, C-shaped leaf papillae, and basal leaf cells

 10 μm , 10 μm , 10 μm

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Sytrichia papillosa (Wilson *in* Spruce) Juratzka**form:** patchy or tufted, erect, unbranched stems, 2–10 mm tall**habitat:** bark of tree trunks, mostly hardwoods**leaf:** size: 1.5–3.0 (excluding the arista)**shape:** broadly obovate-spathulate, often constricted below the middle; nearly carinate when dry**tip:** rounded to acute**base:** basal cells rectangular, thin-walled, smooth**costa:** excurrent in a smooth, hyaline awn, gemmiferous adaxially**border:** not differentiated**margin:** entire, inflexed above**cells:** 16–24 μm , quadrate-hexagonal, thick-walled, papillose**capsule:** 2–2.5 mm, cylindric, straight, erect; seta 5 mm; calyptra cucullate; operculum narrowly conic; peristome of 32 spiculose, pale orange or pink filaments from a whitish tessellated tube; spores 8–10 μm , green-brown, \pm papillose

vegetative habit (moist), leaf outline, leaf apex, and margin midleaf



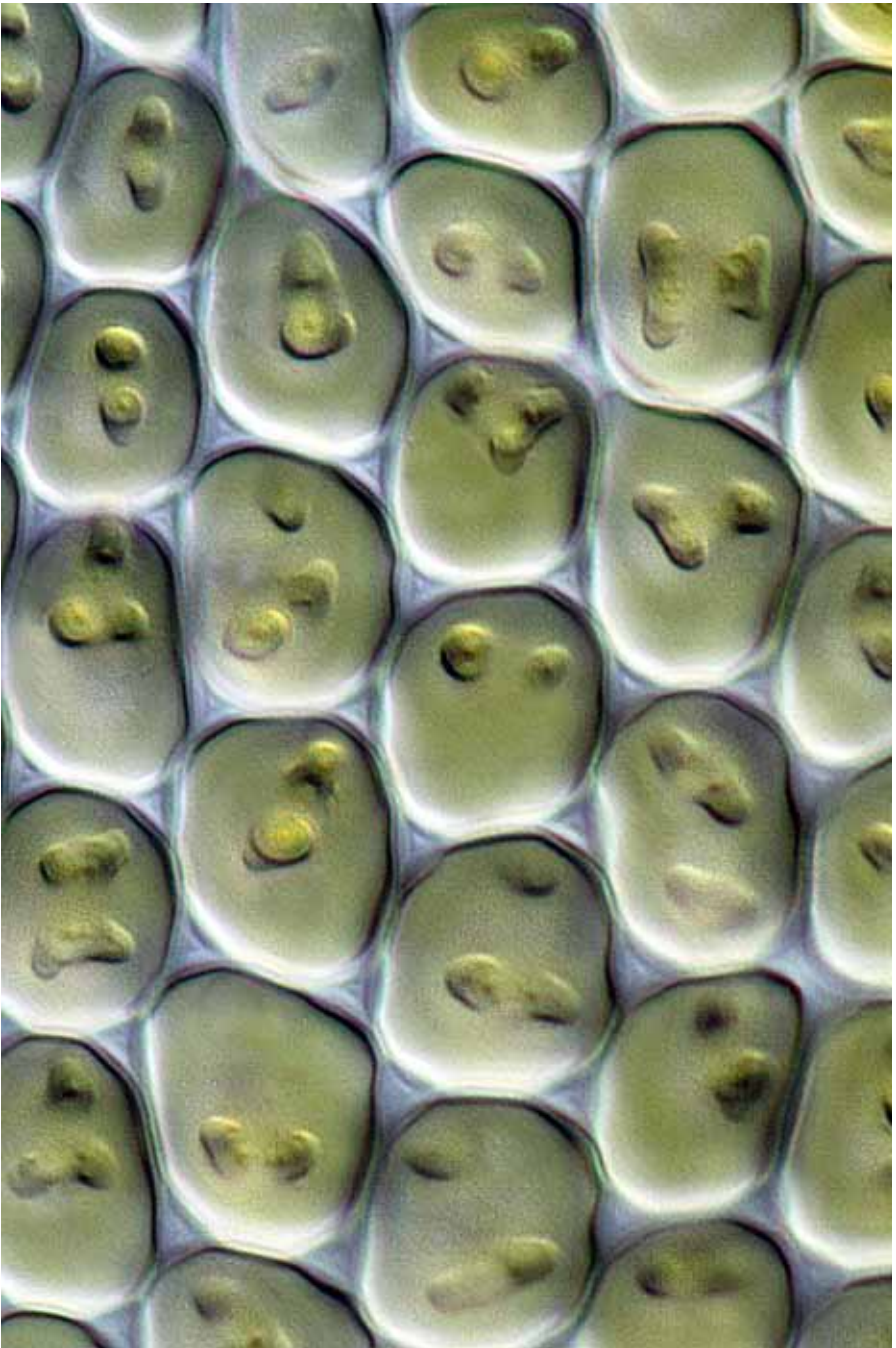
cells midleaf, margin near leaf base, and gemma whole-mount

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Syntrichia papillosa leaf subapex
10 μm

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Syntrichia papillosa cells midleaf, showing papillae
10 μ m

continued next page

Sytrichia phaea (Hook.f. & Wilson) R.H.Zander

form: densely tufted, branched, erect stems, dark brown above, 5–10 mm tall
habitat: calcareous rock in semi-arid sites

leaf: size: 2–2.3 mm

shape: variable, oblong- or lingulate-lanceolate to ± spatulate

tip: acute to obtuse, ± concave, marginal walls of apical cells silvery-hyaline

base: basal cells rectangular, pellucid, 1–2 rows along the margin shorter

costa: projecting abaxially, failing in the apex to excurrent

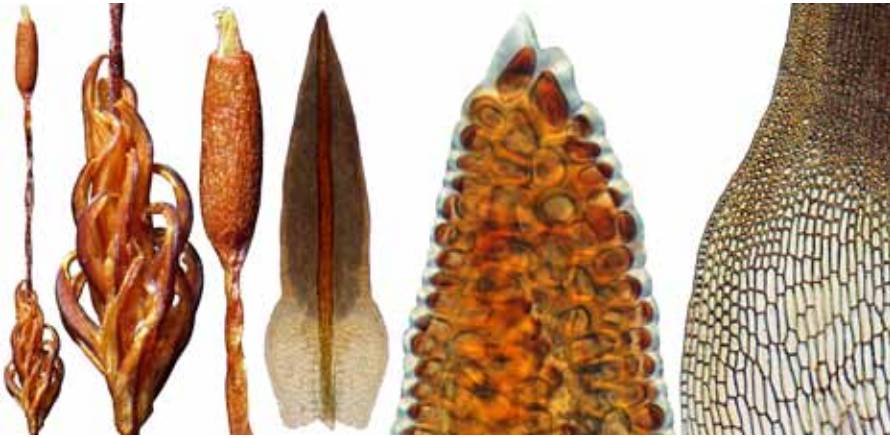
border: not differentiated

margin: entire, plane above, recurved or reflexed below

cells: 9–13 μm, subquadrate, firm-walled, densely papillose

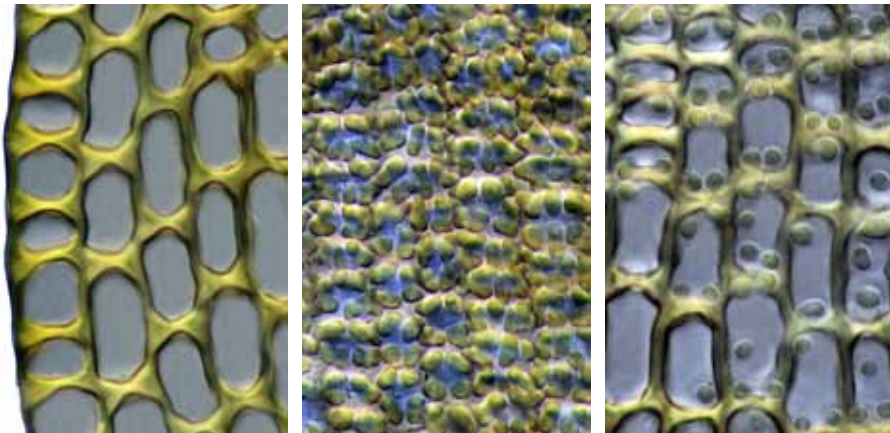
capsule: 1.5–2 mm, cylindrical, erect, exserted, brown; operculum conic-rostrate, as long as the urn; seta 5–8 mm, stout, reddish; peristome teeth dark red, filiform, twisted; basal tube about 1/5 the length of the teeth; spores 12 μm in diam.

note: endemic



fertile shoot (dry) (2), capsule (dry), leaf outline, leaf apex, and shoulder

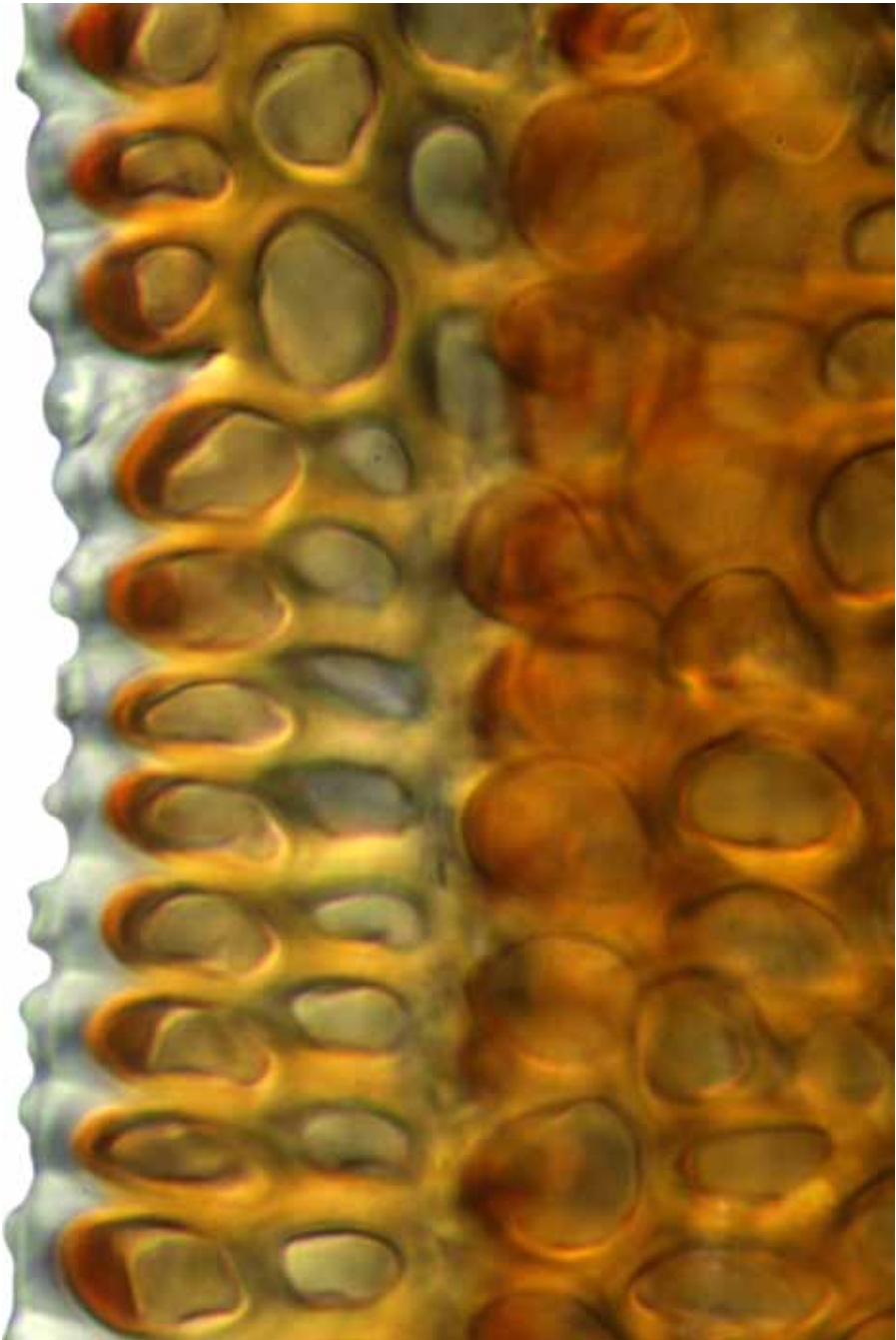
1 mm, 0.5 mm, 0.5 mm, 0.1 mm, 10 μm, 50 μm



margin below shoulder, cells midleaf, and cells just above shoulder

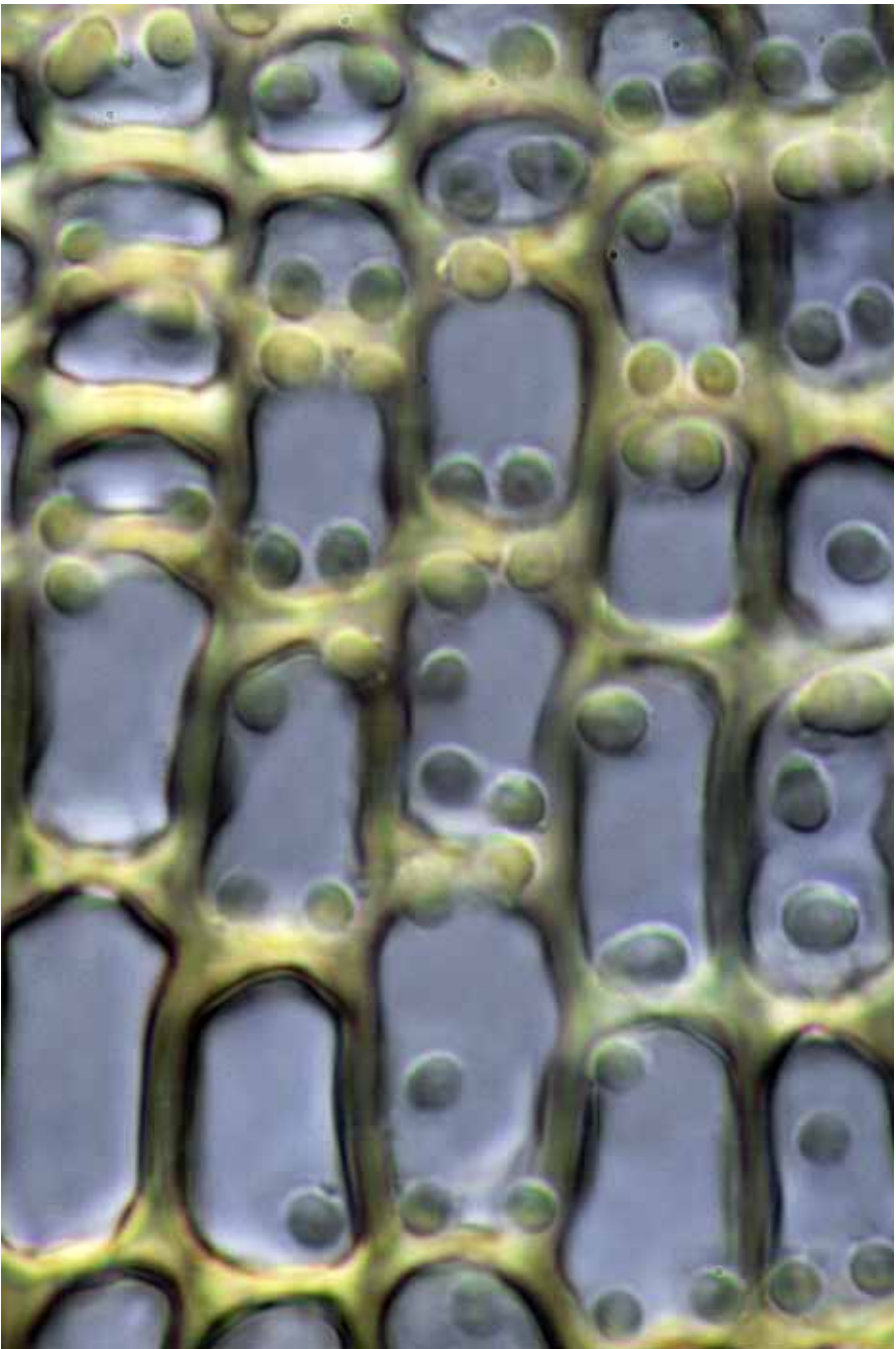
10 μm, 10 μm, 10 μm

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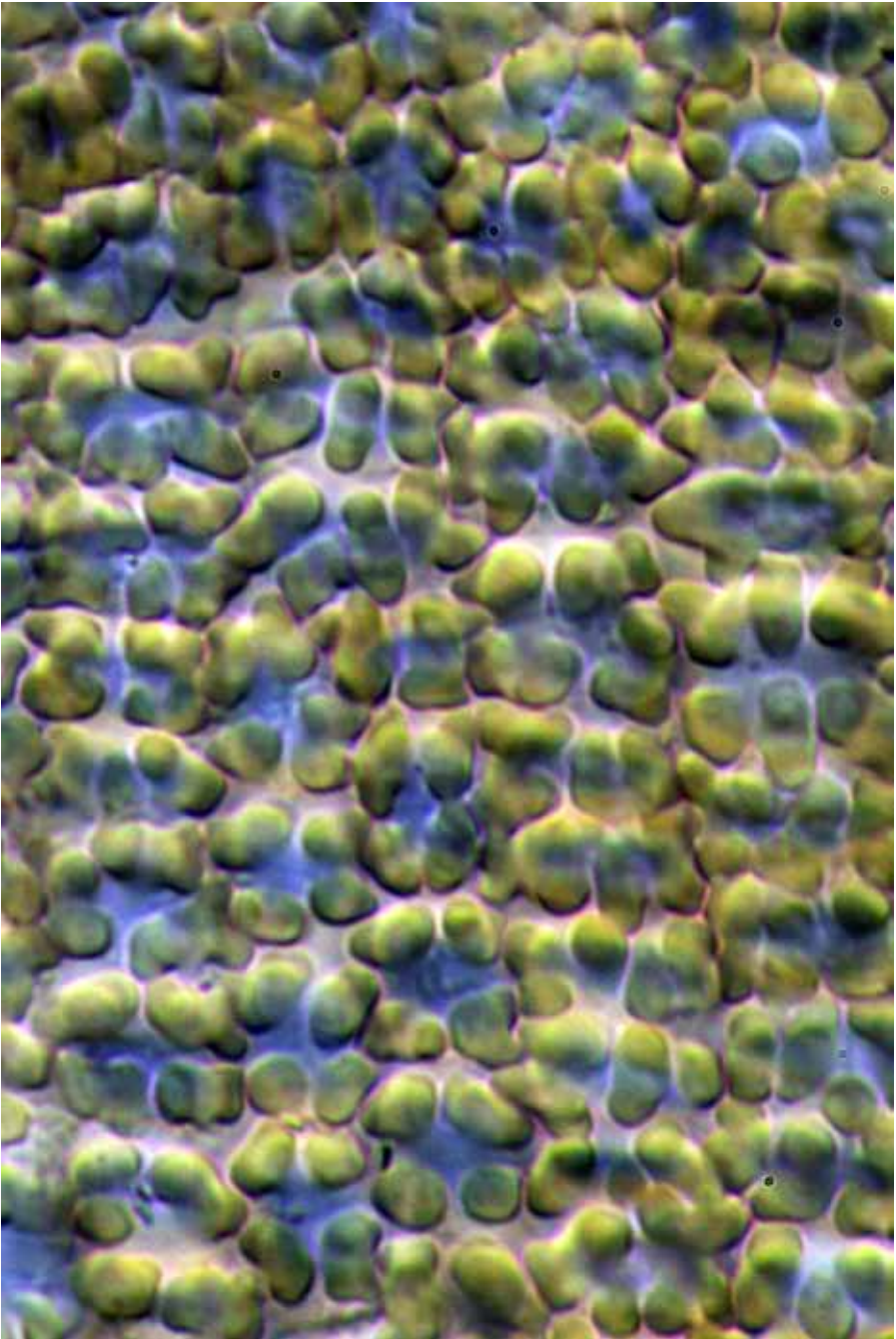
Syntrichia phaea margin near apex
10 μm

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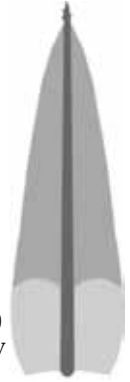
Syntrichia phaea cells of upper shoulder
10 μm

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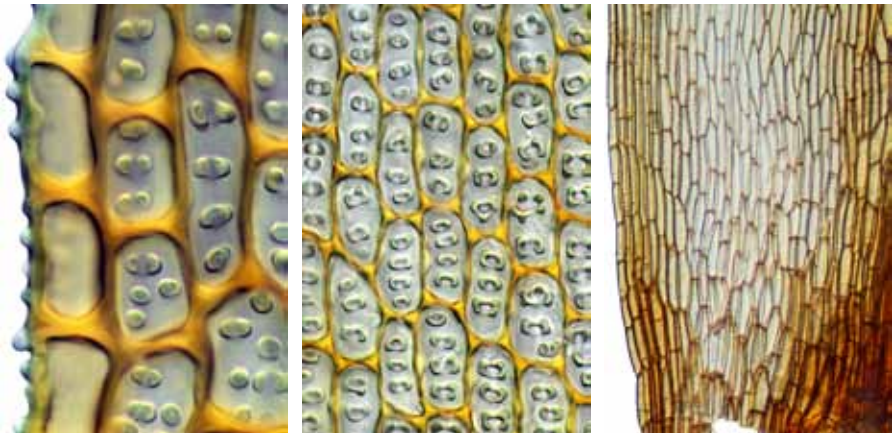


Syntrichia phaea leaf papillae
10 μm

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Syntrichia rubra (Mitt.) R.H.Zander var. **rubra****form:** erect, branched, reddish stems, in loose cushions, to 50 mm tall**habitat:** shaded alpine rock**leaf:** size: to 6 mm*shape:* oblong-lanceolate to broadly lingulate*tip:* acute*base:* suprabasal cells biseriately papillose; basal cells rectangular, thin-walled, smooth*costa:* reddish, prominent abaxially, excurrent in a stout, red, toothed point*border:* not differentiated*margin:* irregularly spinose-serrate close to the apex, plane*cells:* 12–20 μm , subquadrate to oblong-hexagonal, firm-walled, sparsely papillose**capsule:** 3–4 mm, cylindric, \pm curved, erect, exserted, light brown; seta 15–20 mm, glossy, red; peristome filaments \pm pinkish from a whitish tube, readily breaking off

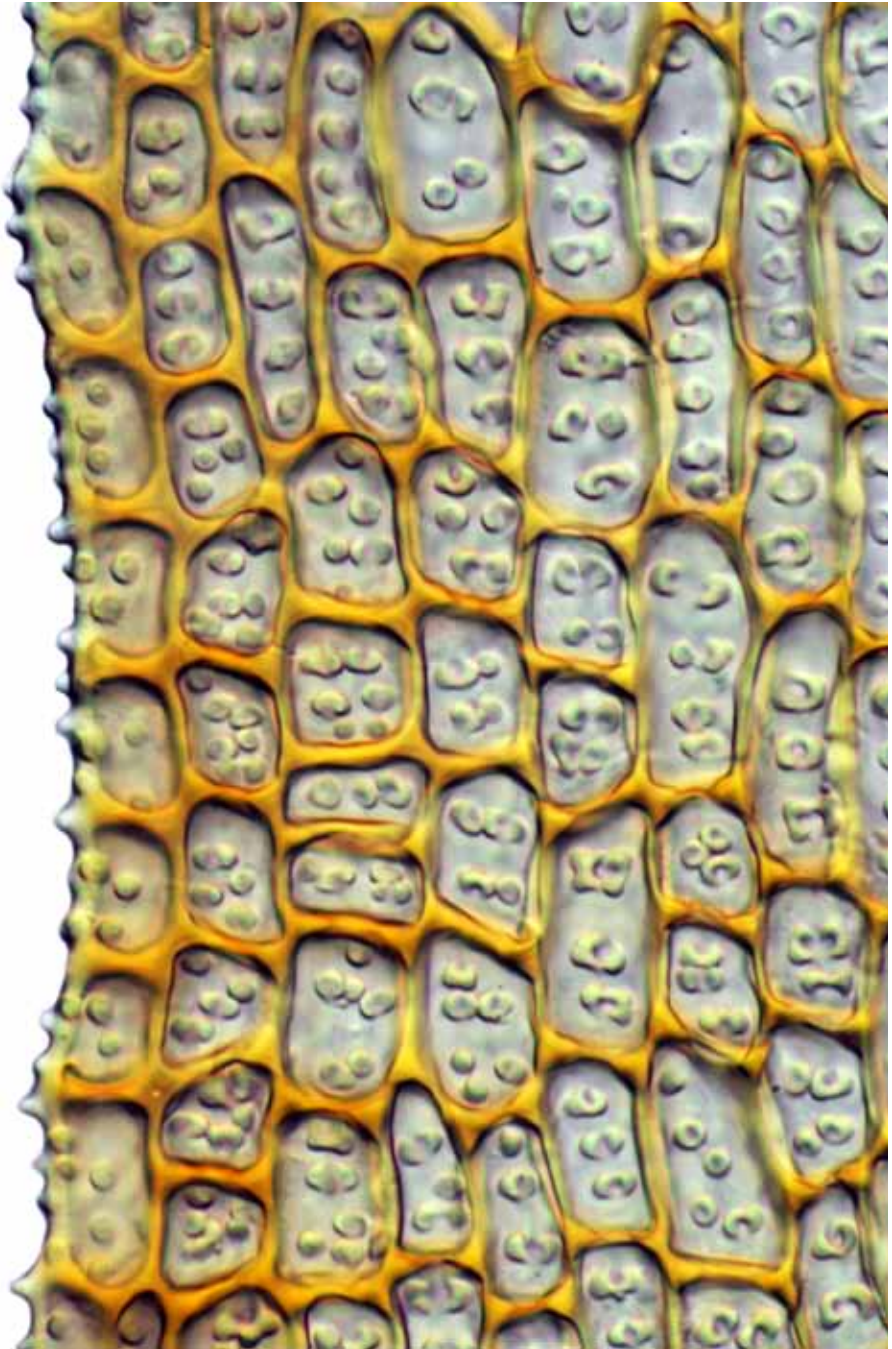
vegetative shoot (dry) (2), capsule (dry), leaf outline, and leaf apex (2)

 1 mm, 1 mm, 1 mm, 1 mm, 50 μm , 10 μm


margin below midleaf, cells below midleaf, and leaf basal angle

 10 μm , 10 μm , 50 μm

continued next page



Syntrichia rubra var. *rubra* margin below midleaf
10 μ m

continued next page

***Syntrichia rubra* var. *subantarctica* Sainsb.**

form: densely tufted, sparsely branched, erect stems, dull brown to greenish brown above, to 50 mm tall

habitat: soil

leaf: size: 1–6 mm

shape: ± lanceolate, patent when moist, contorted when dry

tip: acute

base: basal cells rectangular, pellucid, 1–3 rows along the margin narrower

costa: simple, excurrent in a stout point, papillose at the back

border: not differentiated

margin: irregularly spinose-serrate near apex, plane

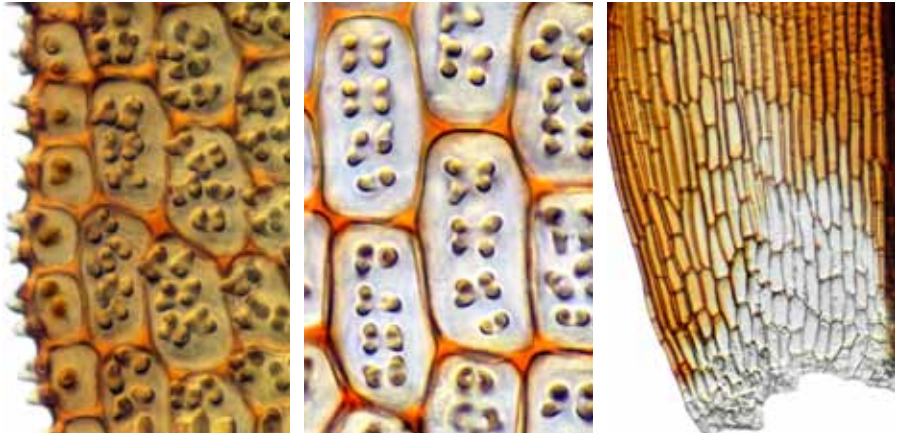
cells: 16–20 × 20–32 μm, subquadrate to oblong-hexagonal, thin-walled, biserially C-shaped papillose

capsule: not known

note: formerly *Tortula subantarctica*.

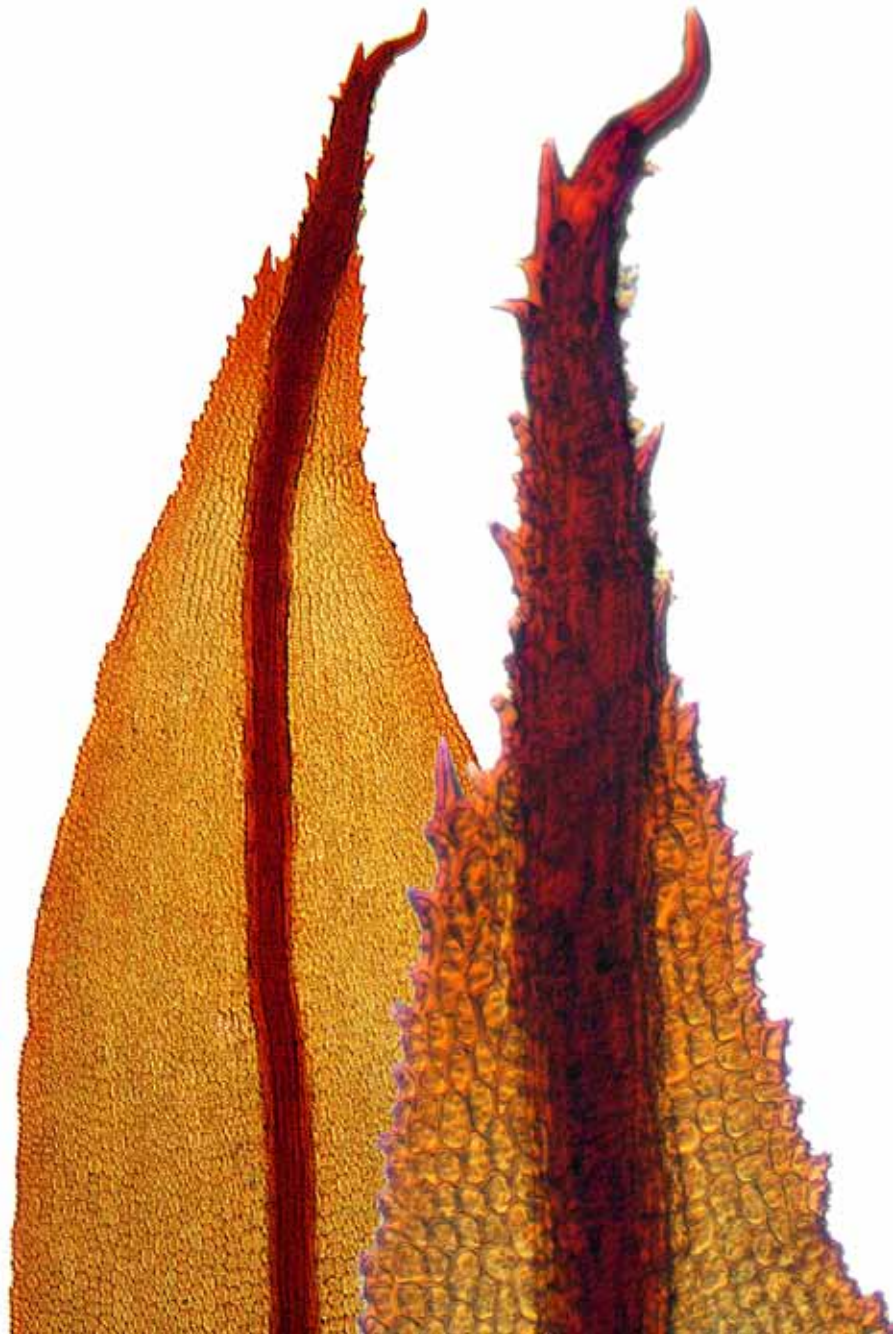


vegetative shoot (two on left dry, one on right moist), leaf outline, margin subapex
 1 mm, 1 mm, 1 mm, 1 mm, 50 μm



margin midleaf, cells in lower leaf, and leaf basal angle
 10 μm, 10 μm, 50 μm

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Syntrichia rubra var. *subantarctica* upper leaf, showing excurrent costa
0.1 mm, 0.1 mm

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Syntrichia rubra var. *subantarctica* cells in lower leaf, showing papillae
10 μ m

continued next page

Syntrichia ruralis (Hedw.) F.Weber & D.Mohr

form: tufted, hoary, dull, erect, sparsely branched stems, reddish above, radiculose to tomentose, 10–40(–70) mm tall

habitat: exposed soil or rock, usually calcareous, also sandy lakesides

leaf: size: 2–4 mm, not including the awn

shape: oblong, keeled

tip: obtuse, rounded, or emarginate, ending in a ± spinulose awn

base: basal cells ± rectangular, hyaline, thin-walled, smooth, abruptly forming a distinct V-shaped area

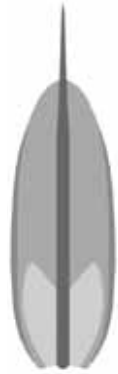
costa: excurrent in the awn

border: not differentiated

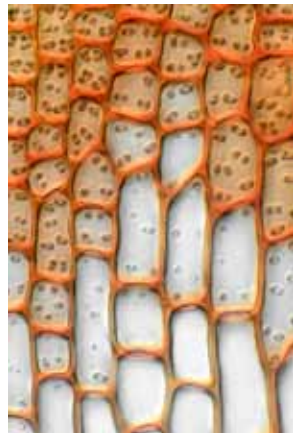
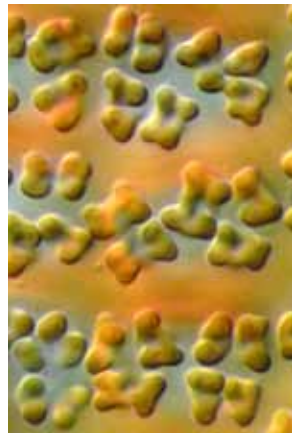
margin: entire, revolute in at least the lower two-thirds

cells: 9–15 μm, hexagonal, firm-walled, densely papillose (C-shaped)

capsule: 2.5–4 mm, cylindric, straight, erect, brown; seta 11–18 mm, red; operculum high-conic; peristome teeth 32, filamentous from a tall, pale, tessellated basal membrane; spores 7–13 μm in disam.



vegetative shoot (top view moist, side view dry), leaf outline, leaf apex, and subapex
 ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 10 μm, ■ 10 μm

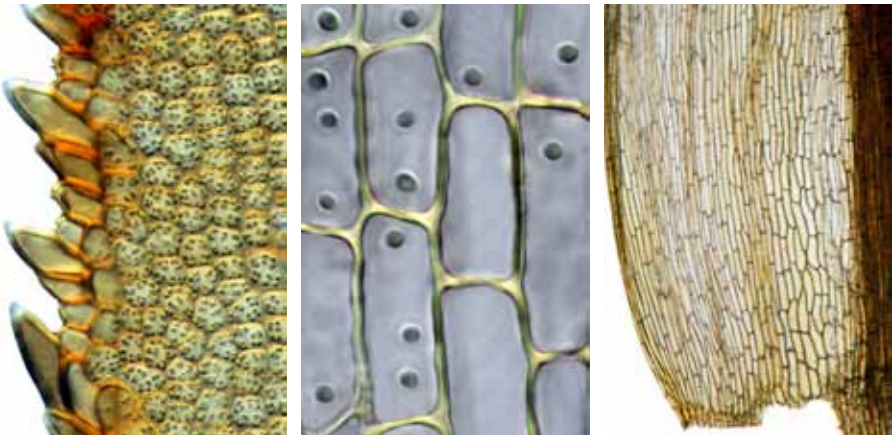


margin midleaf, leaf papillae, and leaf base cells
 ■ 50 μm, ■ 10 μm, ■ 10 μm

continued next page

Syntrichia serrata (Dixon) R.H.Zander**form:** tufted, erect, ± branched, green to reddish brown stems, 15–40 mm tall**habitat:** rock or silty soil, lowland to alpine**leaf:** size: 3.5–5 mm, twisted and apically curved when dry*shape:* lanceolate from an ovate base, concave above*tip:* acute to acuminate*base:* basal cells rectangular to linear, thin-walled, smooth*costa:* strong, red, excurrent in an acute point*border:* not differentiated*margin:* irregularly dentate in upper third, ± recurved in lower half*cells:* 6–10 μm , isodiametric to subquadrate, firm-walled, pluripapillose**capsule:** 2.5–3 mm, cylindrical, erect, exserted, brown; operculum conic-subulate, over half the length of the capsule; seta 10–15 mm, reddish; calyptra cucullate; peristome filaments spiculose, red, spirally twisted, the tube pale at its very base; spores 10–12 μm in diam.

vegetative shoot (dry) (2), capsule (dry), peristome, leaf outline, and leaf apex

 5 mm, 1 mm, 0.5 mm, 0.5 mm, 0.5 mm, 50 μm


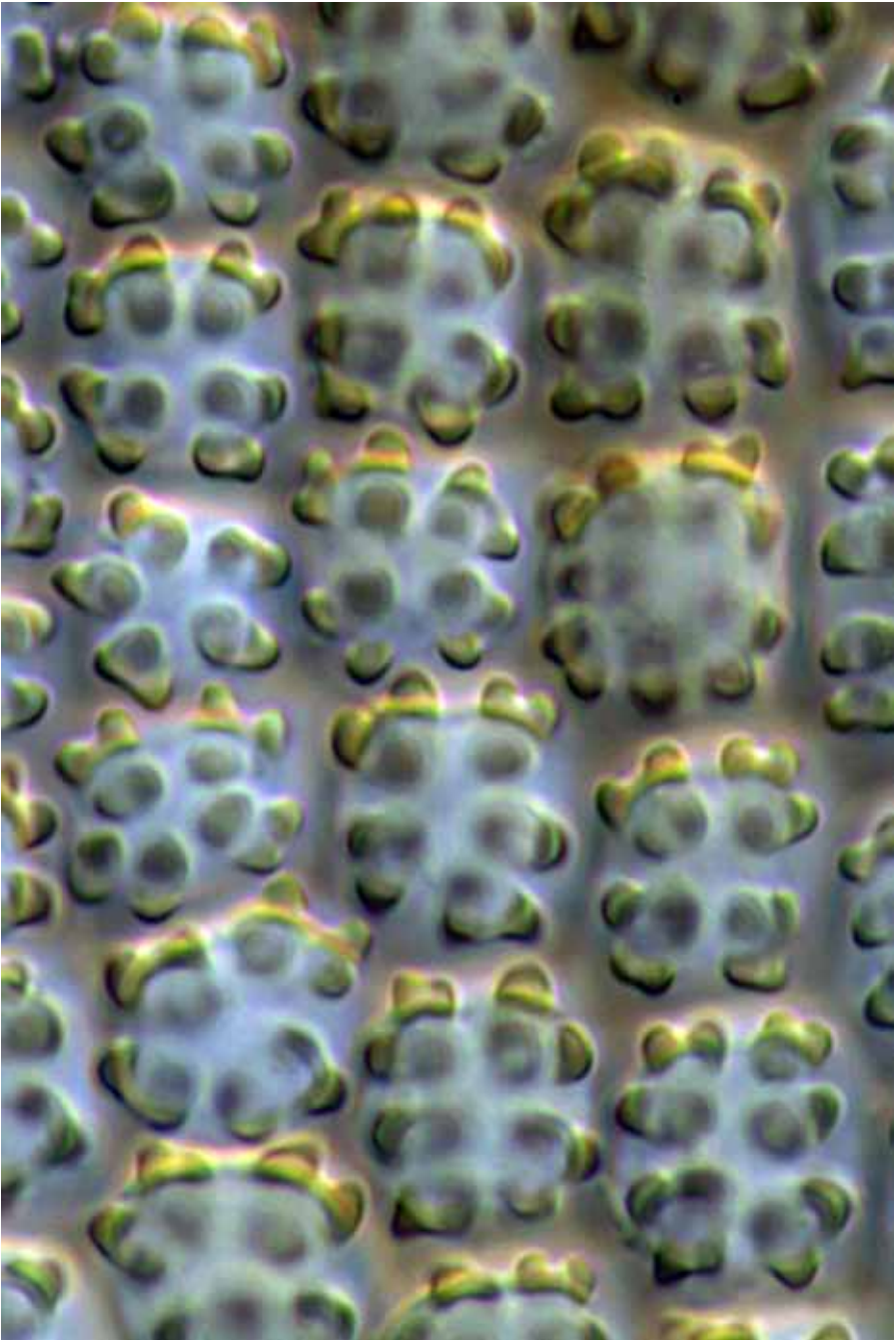
margin upper leaf, lower leaf cells, and leaf basal angle

 10 μm , 10 μm , 100 μm



Syntrichia serrata margin upper leaf
10 μm

continued next page



Syntrichia serrata papillae midleaf
10 μm

Tetrascocinodon irroratus (Mitt.) R.H.Zander

form: densely tufted, erect, sparsely branched stems, often lime-encrusted, 10–30 mm tall

habitat: dripping limestone rock faces, lowland

leaf: size: 2–2.5 mm

shape: lanceolate-subulate from a widened base

tip: rounded or obtuse

base: basal cells rectangular or hexagonal, thin-walled

costa: stout, orange, filling most of the subula, vanishing below the apex

border: not differentiated

margin: crenulate-papillose, plane

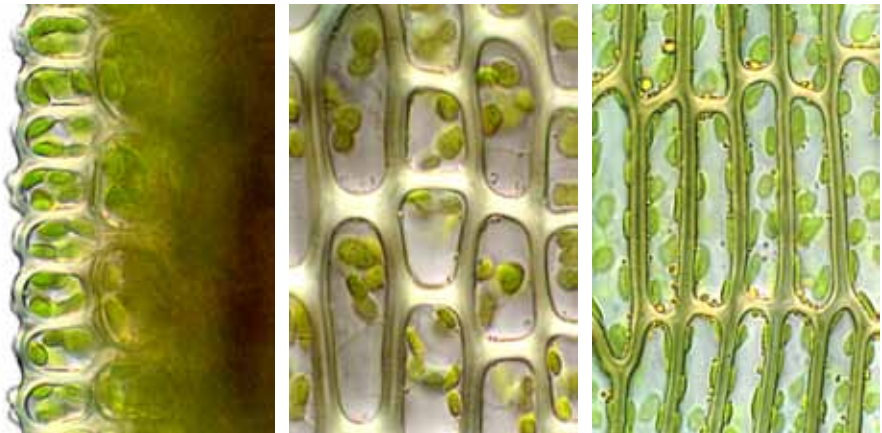
cells: 10 μm , subquadrate, incrasate, papillose

capsule: 1–1.4 mm, oblong, erect, glossy, reddish brown to near-black; seta 10–15 mm, stout, red; operculum obliquely long-rostrate, up to the length of the capsule; peristome teeth short, \pm yellow, irregularly perforate, split, and re-joined



vegetative shoots (dry) (2), capsule (young and mature), leaf outline and leaf apex

1 mm, 0.5 mm, 0.5 mm, 0.5 mm, 0.5 mm, 10 μm



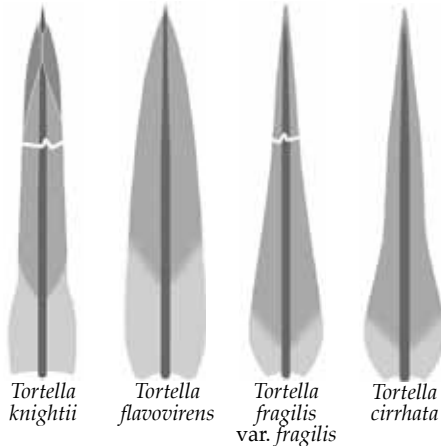
margin of subula, cells in subula, and cells below subula

10 μm , 10 μm , 10 μm

Key* to the New Zealand species and varieties of *Tortella* (4)

- 1 Peristome teeth spirally twisted.....2
 1: Peristome teeth straight or nearly so.....3
- 2(1) Leaves 4–5 mm long; operculum high-conic..... ● ***Tortella fragilis* var. *fragilis***
 2: Leaves 2.8–3.5 mm long; operculum long-beaked..... ● ***Tortella knightii***
- 3(1:) Costa percurrent or short-excurrent..... ● ***Tortella flavovirens***
 3: Costa excurrent in an acute rigid point..... ● ***Tortella cirrhata***

* based on Smith, AJE; Smith, R (1978): *The Moss Flora of Britain and Ireland*. Cambridge University Press, Cambridge, 291, plus Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 161.



***Tortella cirrhata* Broth.**

form: densely tufted, erect, sparsely branched stems, 5–10 mm tall, radiculose

below, leaves crowded, dull, yellowish green, curled and glossy when dry

habitat: soil or rock, especially sparsely vegetated costal sand dunes, but also on fences, derelict houses, and stone bridges

leaf: size: 2–2.5 mm

shape: lanceolate or lanceolate-subulate

tip: acute, concave below

base: basal cells thin-walled, hyaline, widely rectangular, extending obliquely slightly higher up the margin

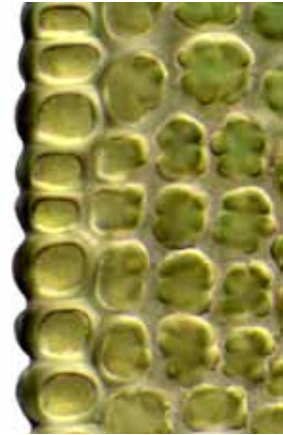
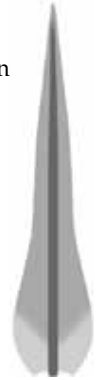
costa: weak below, stout above, excurrent in an acute, rigid point

border: not differentiated

margin: finely crenulate, incurved or convolute in the subula

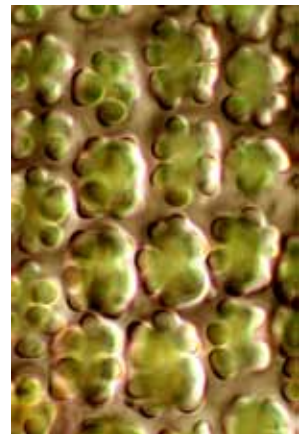
cells: 8–10 μm , rounded-subquadrate, incrassate, \pm papillose

capsule: 1.5–2 mm, narrowly cylindric, erect, exserted, pale brown, the mouth reddish; seta 15 mm, slender, reddish



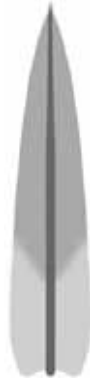
vegetative habit, capsules (4), leaf outline, and margin midleaf

■ 1 mm, ■ 0.5 mm (4), ■ 0.1 mm, ■ 10 μm

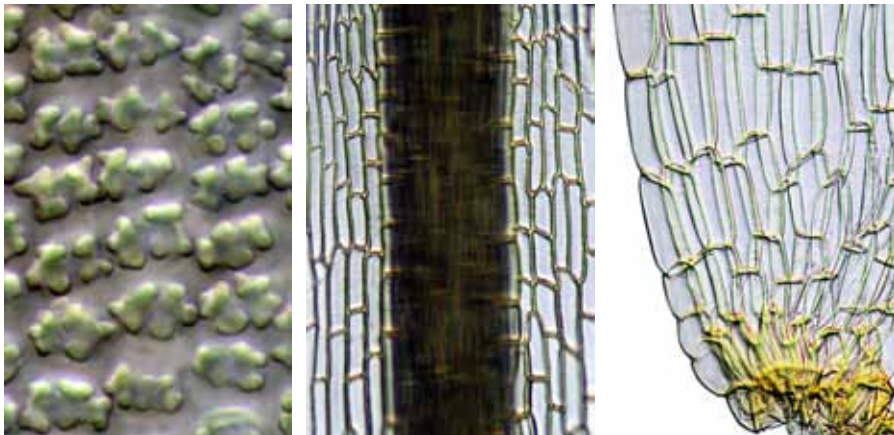


costa midleaf, leaf base cells, and leaf papillae

■ 10 μm , ■ 10 μm , ■ 10 μm

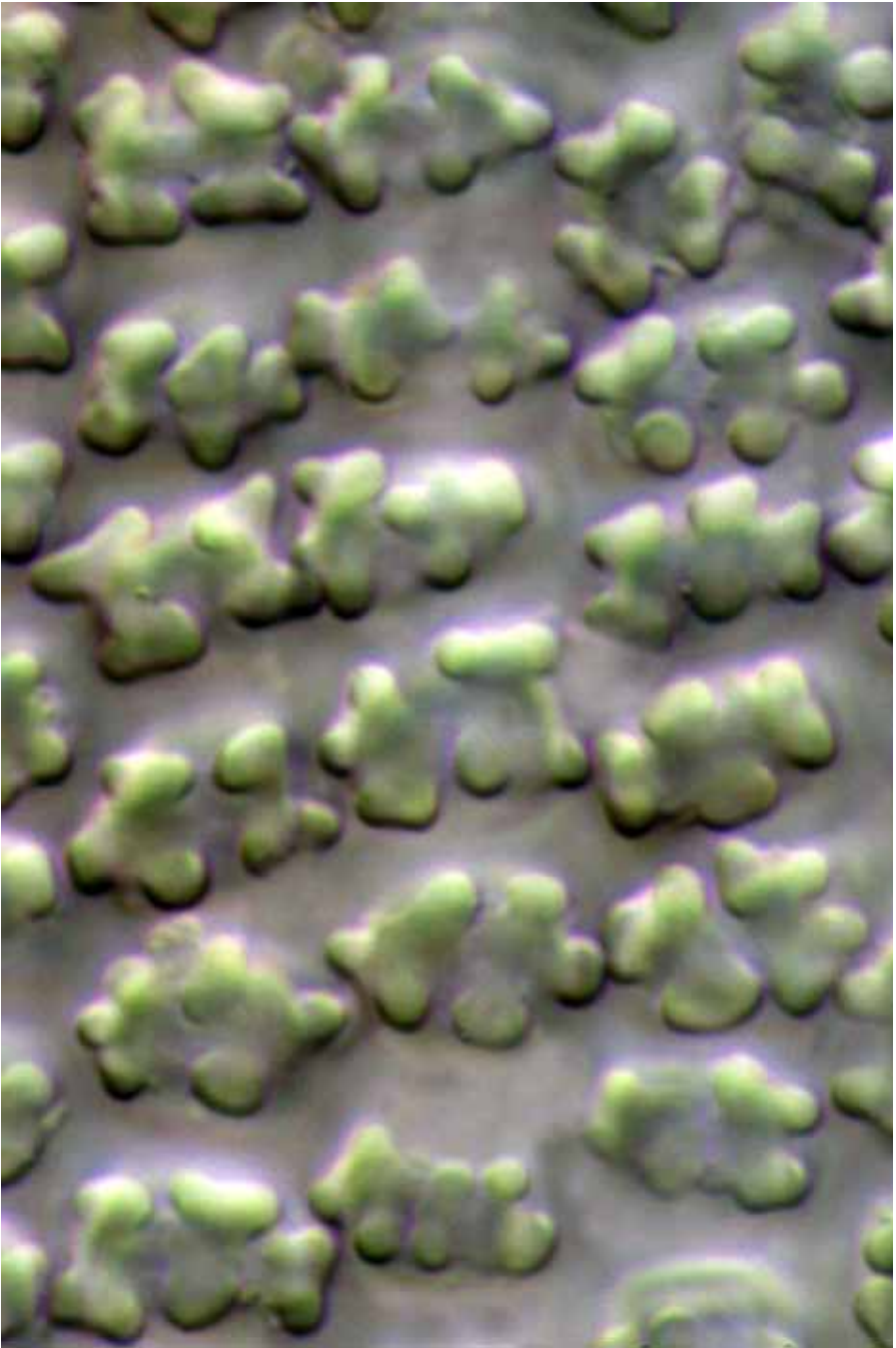
Tortella flavovirens (Bruch) Broth.**form:** tufted, erect, \pm comose stems, yellowish above, brown below, 3–10 mm tall**habitat:** sandy soil in exposed, \pm disturbed coastal sites, scrub, or lawns, and mortar or damp concrete, lowland**leaf:** size: 2–3.5 mm*shape:* oblong-ovate to ovate-lanceolate, strongly keeled above*tip:* acute to subobtusate, \pm cucullate*base:* basal cells long-rectangular; marginal cells \pm extending up the blade*costa:* percurrent to shortly excurrent*border:* not differentiated*margin:* entire, incurved to involute above*cells:* 9–12 μm , isodiametric, firm-walled, pluripapillose**capsule:** 1.8–2.2 mm, cylindric, erect, exserted, brown; seta 11–13 mm; annulus none; operculum subulate to long-conic; peristome teeth short, \pm twisted; spores 12–14 μm in diam.**note:** salt-tolerant

fertile shoot (dry), capsule with peristome, leaf outline, leaf apex, and margin midleaf
 ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 0.5 mm, ■ 50 μm , ■ 10 μm



leaf papillae, costa midleaf, and leaf basal angle
 ■ 10 μm , ■ 50 μm , ■ 10 μm

continued next page



Tortella flavovirens leaf papillae
10 μm

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Tortella fragilis (Hook.f. and Wilson) Limpr. var. ***fragilis***

form: densely tufted, rigid, erect stems, yellowish or brownish, to 45 mm tall
habitat: calcareous rock or soil, less often on rotting logs or peaty humus

leaf: size: 4–5 mm

shape: linear-lanceolate from a broader base

tip: subulate, fragile and often broken off

base: basal cells longer than the other lamina cells

costa: percurrent, filling the subula

border: marginal cells narrower and less papillose than the other lamina cells

margin: ± entire, plane

cells: upper cells 9–11 μm, rounded-quadrate, thick-walled, low-papillose

capsule: 1.8–3 mm, cylindric, erect, exserted, yellow to reddish brown; seta 15–20 mm; operculum high-conic; annulus none or weak; peristome teeth long, spirally twisted 1–3 times; spores 8–11 μm in diam.

note: recognized by its long fragile leaf tips, little contorted when dry



tuft split open, vegetative shoot (moist), leaf outline, and leaf apex (2)
 ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 50 μm, ■ 50 μm



margin in lower leaf (2), and costa near leaf base
 ■ 50 μm, ■ 10 μm, ■ 50 μm



Tortella fragilis var. *fragilis* habit (moist)

1 mm

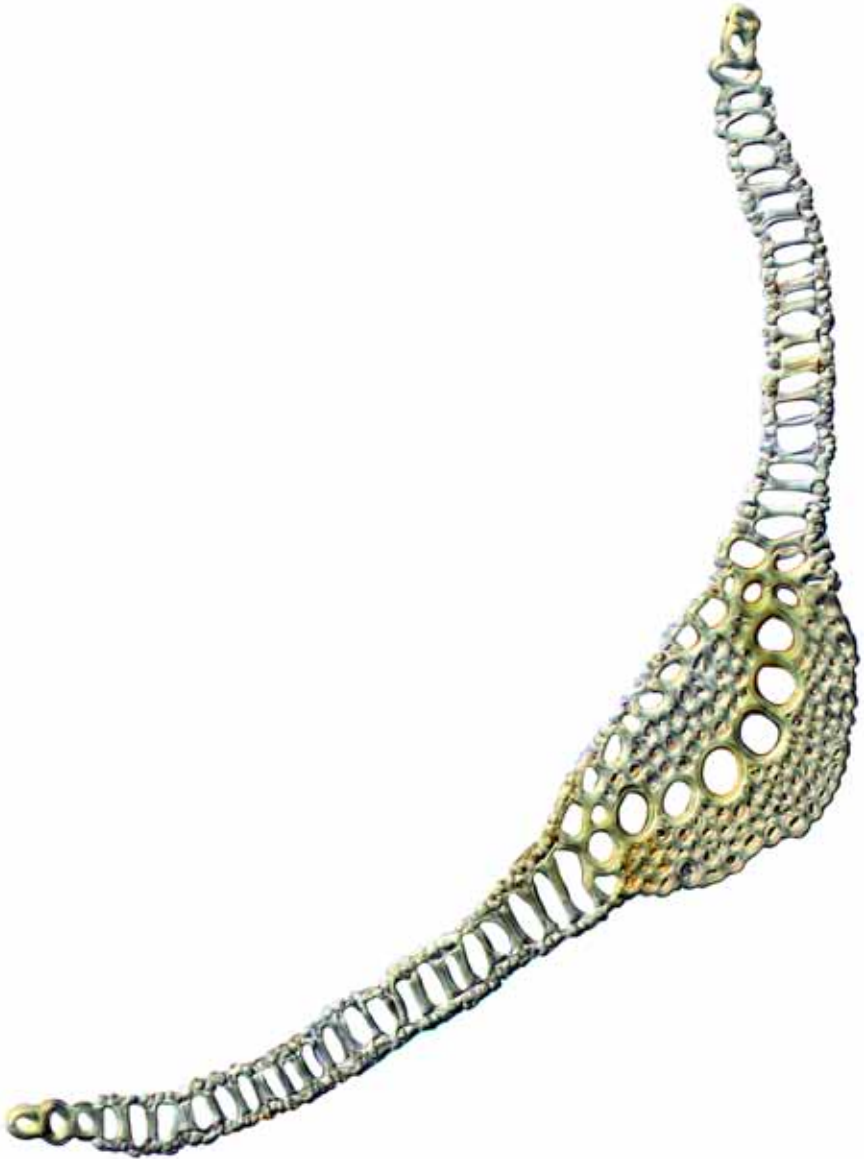
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Tortella fragilis var. *fragilis* vegetative shoot (moist)

1 mm

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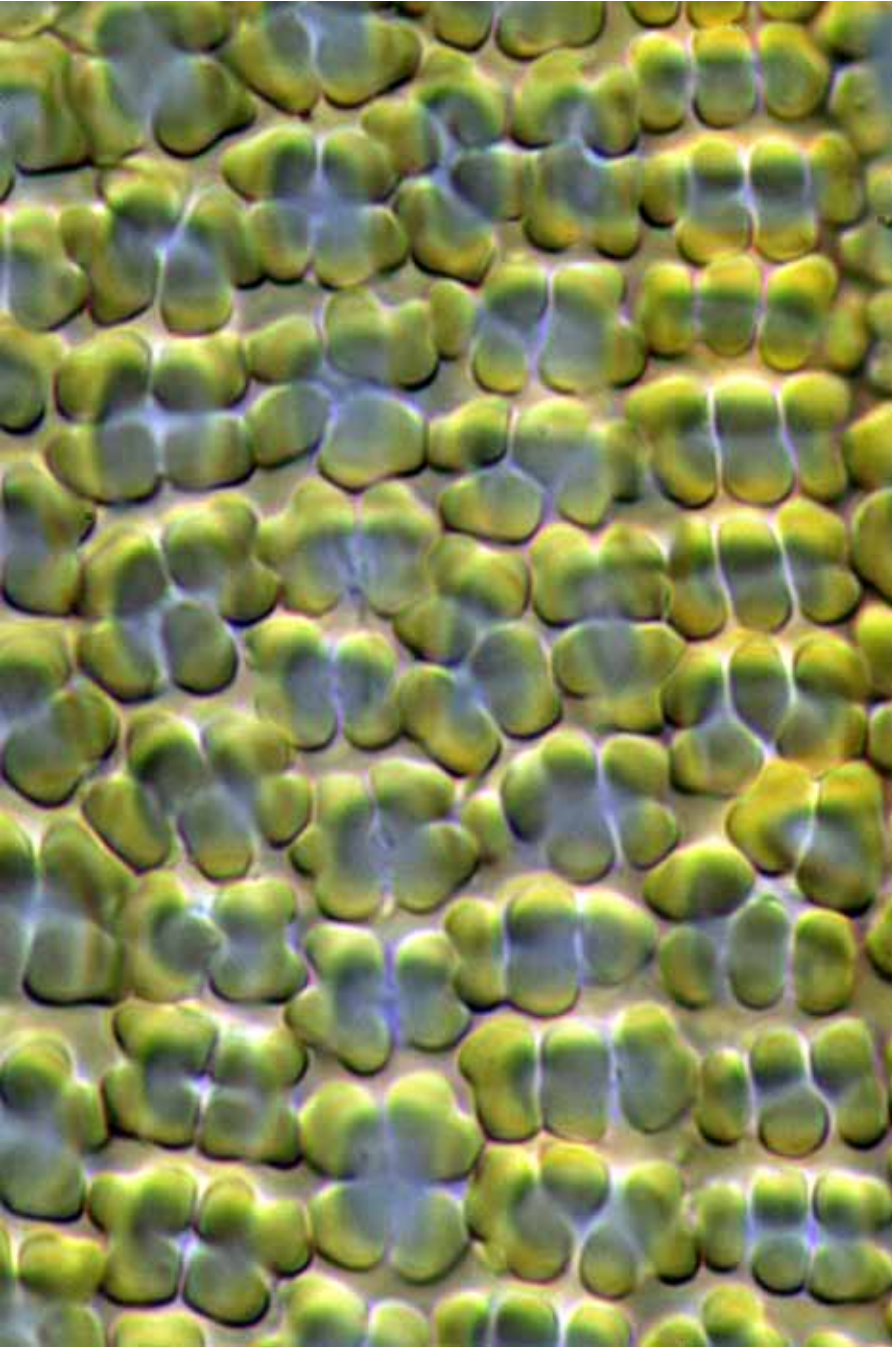
Tortella fragilis var. *fragilis* leaf cross-section showing glabrous margin
50 μ m

continued next page



Tortella fragilis var. *fragilis* glabrous leaf margin
10 μm

continued next page



Tortella fragilis var. *fragilis* leaf surface papillae
10 μ m

continued next page

Tortella knightii (Mitt.) Broth.

form: densely tufted, erect, pale, simple or branched stems, 8–20 mm tall
habitat: soil, the bark of rotting logs, or rock

leaf: size: 2.5–3.5 × 0.5–0.7 mm

shape: linear-lanceolate from an oblong transparent base, often fragile

tip: finely acuminate

base: basal cells rectangular, thin-walled, hyaline

costa: excurrent in a fine point

border: not differentiated

margin: irregularly denticulate above, narrowly revolute below, undulate

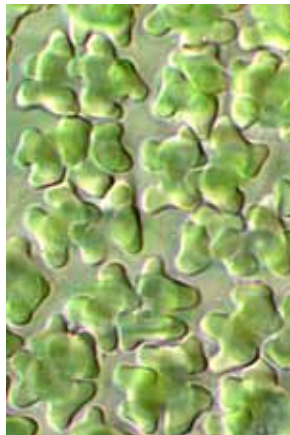
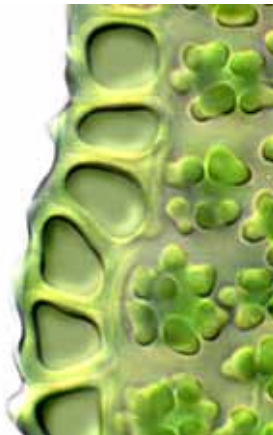
cells: 7–8 μm, ± isodiametric, thick-walled, densely stellate-papillose

capsule: 2–2.5 mm, narrowly cylindrical to elliptic, erect, ± curved, pale brown, red-mouthed; seta 10–18 mm, slender, ± flexuose, yellowish above; operculum straight, long-rostrate, the cells in spiral rows; calyptra cucullate; peristome teeth 16, reddish, on a low basal membrane, cleft into two reddish papillose filaments, spirally twisted twice; spores 8–10 μm in diam.



fertile shoot, peristome, leaf outline, and leaf apex and subapex

■ 1 mm, ■ 0.1 mm, ■ 0.5 mm, ■ 10 μm, ■ 10 μm



margin midleaf, leaf surface papillae, and leaf base cells

■ 10 μm, ■ 10 μm, ■ 10 μm

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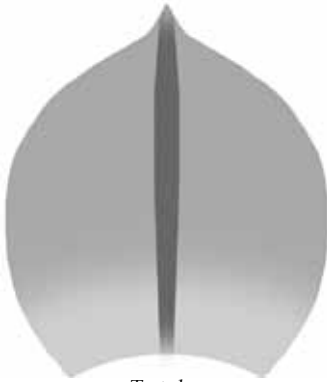


Tortella knightii habit
1 mm

Key* to the New Zealand species of *Tortula* (11)

- 1 Capsule cleistocarpous, splitting at about the middle ● ***Tortula splashnoides***
 1: Capsule stegocarpous..... 2
- 2(1): Peristome rudimentary or absent..... 3
 2: Peristome well-developed 6
- 3(2) Costa usually failing ● ***Tortula areolata***
 3: Costa usually at least shortly excurrent..... 4
- 4(3): Leaf \pm ovate ● ***Tortula acaulon***
 4: Leaf oblong to lanceolate 5
- 5(4): Plant coastal, on sandy soil \pm inundated at high tide ● ***Tortula maritima***
 5: Plant not coastal, on calcareous soil ● ***Tortula truncata***
- 6(2): Leaf constricted in the middle ● ***Tortula muralis***
 6: Leaf not constricted in the middle..... 7
- 7(6): Costa apex bearing gemma, or truncate from gemma loss ● ***Tortula abruptinervis***
 7: Costa apex not gemmiferous..... 8
- 8(7): Leaf ovate; costa ending in a red point ● ***Tortula atrovirens***
 8: Leaf narrower; costa not ending in a red point 9
- 9(8): Peristome teeth arising from a tall tessellated tube..... ● ***Tortula mucronifolia***
 9: Peristome teeth arising from a low membrane..... 10
- 10(9:) Plants on calcareous soil; borderless; margin recurved midleaf . ***Tortula viridipila***
 10: Plants on basic rock and walls; border of 2–4 rows of incrassate cells; margin plane .
 ● ***Tortula marginata***

* based partly on Scott, GAM; Stone, IG; Rosser, C (1976): *The Mosses of Southern Australia*. Academic Press, London. 186.



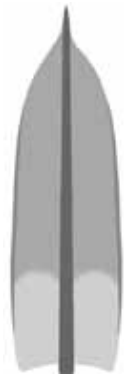
*Tortula
splachnoides*



*Tortula
maritima*



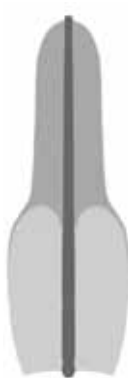
*Tortula
atrovirens*



*Tortula
acaulon*



*Tortula
truncata*



*Tortula
abruptinervis*



*Tortula
areolata*



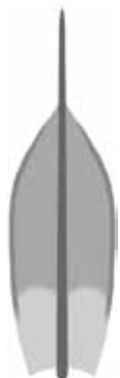
*Tortula
mucronifolia*



*Tortula
marginata*



*Tortula
muralis*



*Tortula
viridipila*

Tortula abruptinervis Dixon

form: densely matted, ± branched stems, dark green above, 2–7 mm tall
habitat: bark (mostly willow and ngiao) or more rarely rotting logs

leaf: size: to 1 mm

shape: lingulate from an oblong base, ending with a fusiform, multi-celled, hyaline-tipped gemma up to 300 μm long, soon deciduous

tip: rounded-obtuse

base: basal cells rectangular to linear, thin-walled, smooth

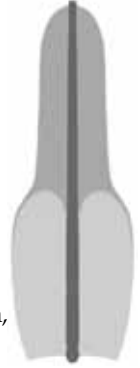
costa: excurrent, truncate-mucronate from the loss of the apical gemma

border: not differentiated

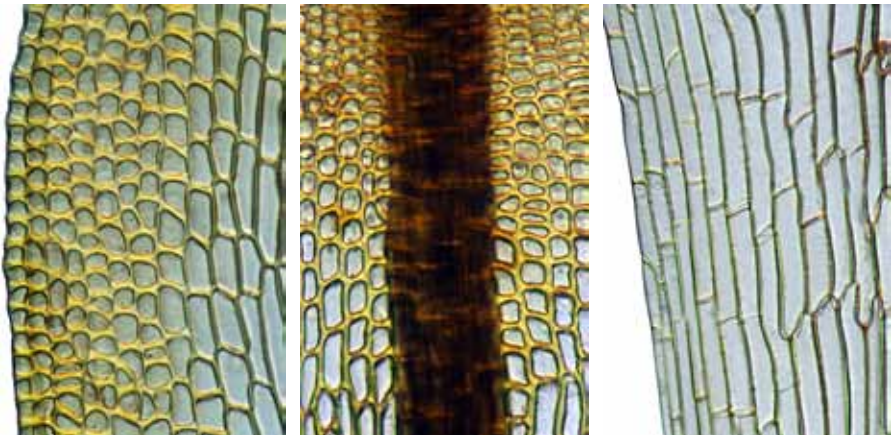
margin: entire, plane

cells: 9–14 μm, rounded-quadrate, firm-walled, pluripapillose

capsule: 1–1.3 mm, cylindrical to elliptic, erect, exserted, brown; seta 4–5 mm, reddish; annulus none; calyptra cucullate; operculum long-rostrate; peristome teeth ± conjoined, 300 μm tall, papillose, the basal tube low; spores 10–12 μm in diam.

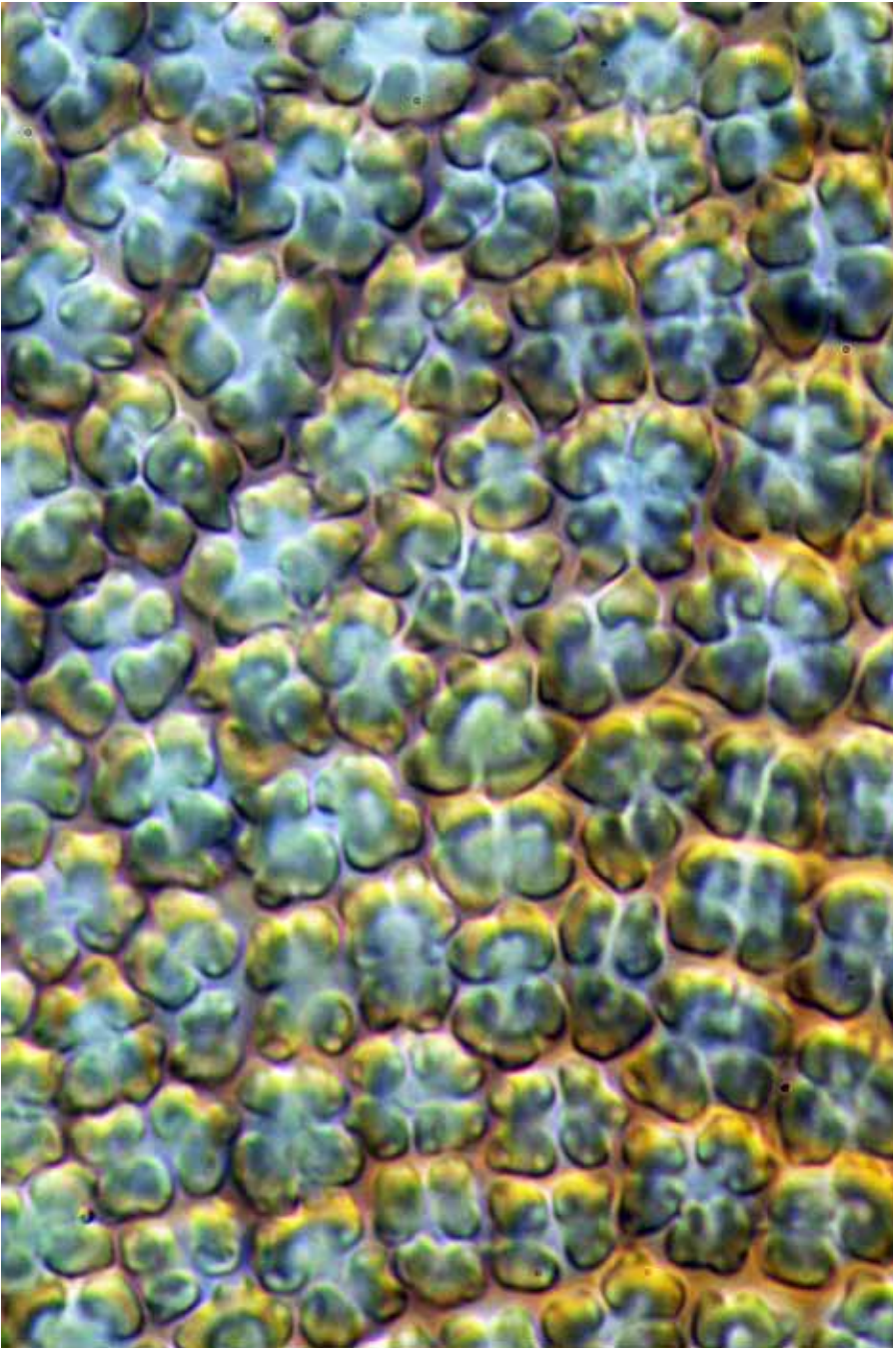


fertile shoots (dry, young), leaf outlines, gemma, and leaf apex after gemma abscission
 1 mm (2), 0.1 mm, 0.1 mm, 50 μm, 100 μm



margin midleaf, costa midleaf, and margin near leaf base
 10 μm, 10 μm, 50 μm

continued next page



Tortula abruptinervis leaf surface papillae
10 μm

continued next page

Tortula acaulon (With.) R.H.Zander

form: gregarious to crowded, erect shoots, papery and glossy when dry
habitat: soil in lawns, fields, and banks, low- to mid-elevations

leaf: size: 1.5–2 mm

shape: ovate to oblong-lanceolate

tip: acute to mucronate or short-awned

base: basal cells rectangular, thin-walled, smooth

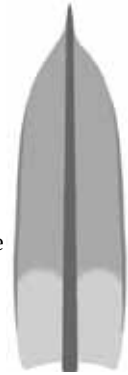
costa: excurrent, covered adaxially with 2–3 cells across the width

border: not differentiated

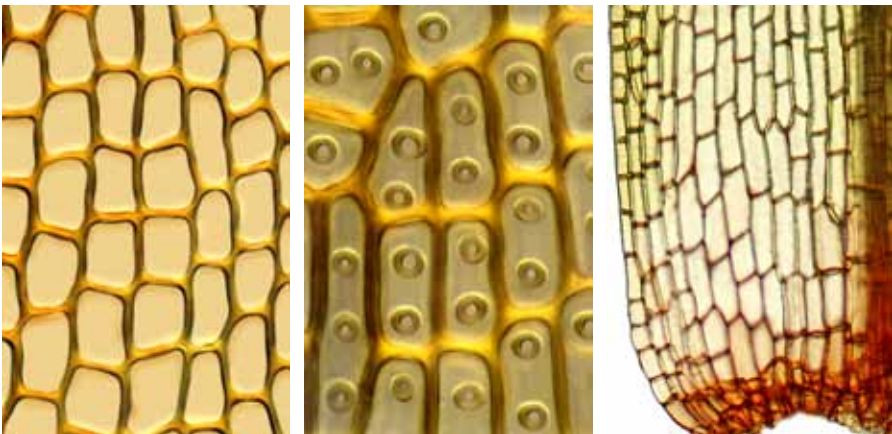
margin: entire, plane to recurved on both sides to near the apex

cells: 13–17 μm , quadrate-hexagonal above, increasing in length toward base of blade, firm-walled, from smooth to 1–2-papillose

capsule: 0.9–1.3 mm, short-ellipsoid, cleistocarpous, erect, immersed, purplish brown; seta very short; operculum and peristome absent; spores 33–40 μm in diam., globose, densely papillose

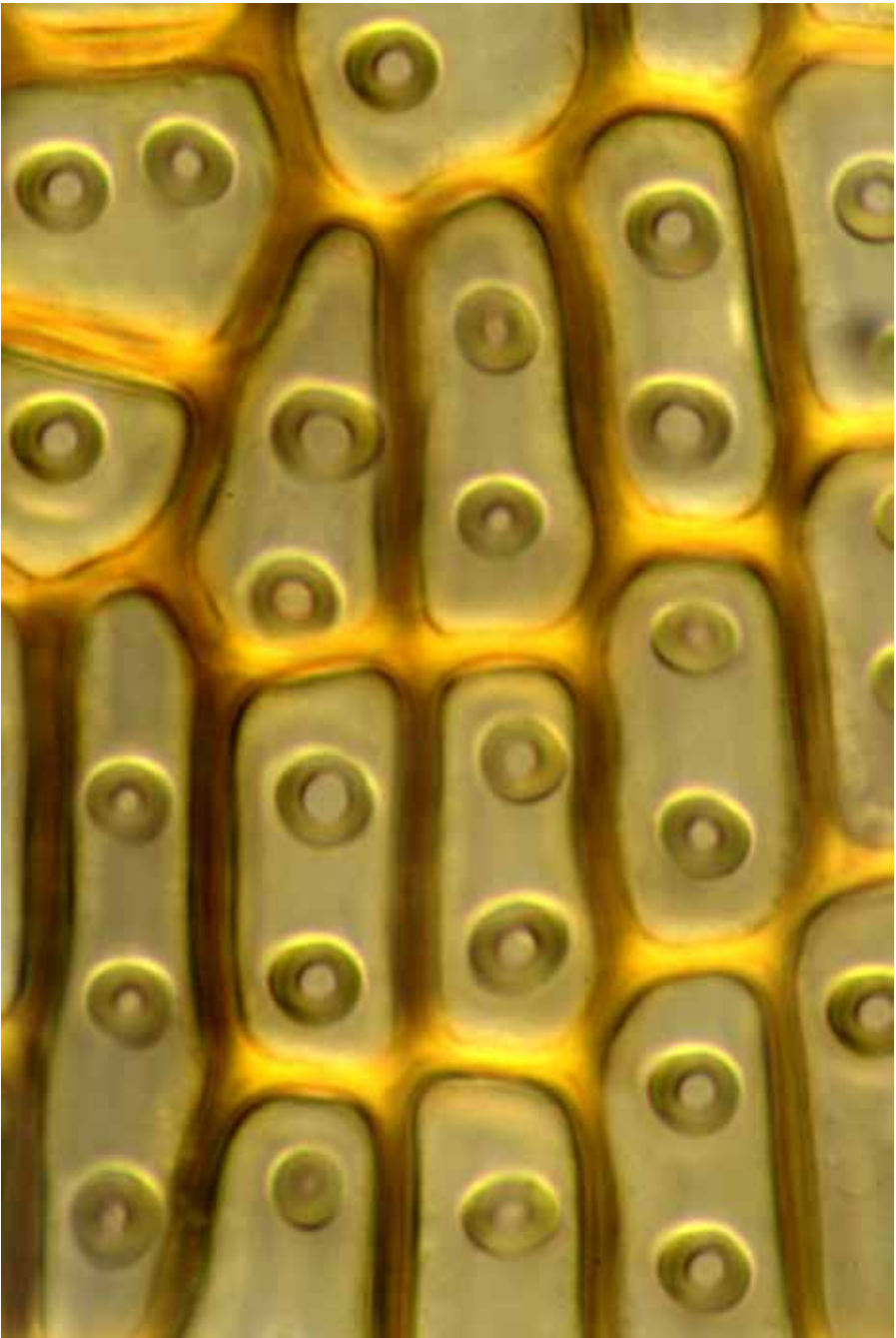


fertile habit (dry), leaf outline, leaf apex, and margin upper leaf
 ■ 1 mm, ■ 0.1 mm, ■ 50 μm , ■ 10 μm



cells upper leaf, papillae below midleaf, and leaf basal angle
 ■ 10 μm , ■ 10 μm , ■ 50 μm

continued next page



Tortula acaulon papillose cells below midleaf
10 μ m

continued next page

Tortula areolata (C.Knight) Fife

form: gregarious, erect, unbranched stems, leaves imbricate, to 1.5 mm tall
habitat: soil

leaf: size: 1–1.3 mm

shape: subspathulate to oblong, little altered when dry

tip: subacute, apiculate

base: basal cells enlarged, rectangular, hyaline, thin-walled

costa: subpercurrent, less often percurrent or slightly excurrent

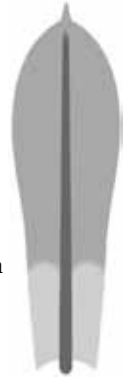
border: not differentiated

margin: entire, plane below, the apex slightly incurved

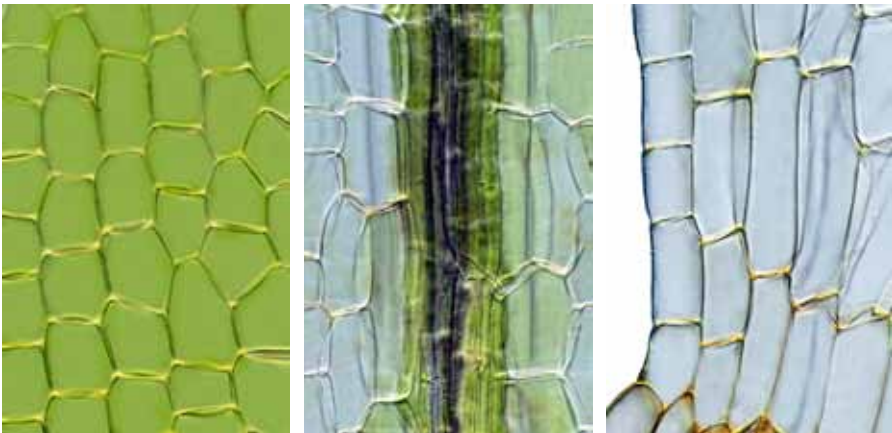
cells: 20 μm , isodiametric, subquadrate, or hexagonal, firm-walled, smooth

capsule: 1 mm, ovate, erect, exserted, brown, the mouth wide when dry; seta 2–3 mm; operculum conico-rostrate; peristome none; spores 18–24 μm in diam.

note: endemic



mature capsule, fertile shoot (moist) (2), leaf outline, leaf apex, and margin midleaf
 0.5 mm, 1 mm, 0.5 mm, 0.1 mm, 50 μm , 10 μm



cells midleaf, costa midleaf, and leaf basal angle
 10 μm , 10 μm , 10 μm

continued next page



Tortula areolata margin midleaf
10 μm

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Tortula atrovirens (Sm.) Lindb.

form: densely gregarious, erect, ± branched stems, yellow-green, 2 mm tall
habitat: soil or calcareous rock in exposed arid to semi-arid sites

leaf: size: 0.8–1.2 × 0.8 mm

shape: ovate to lingulate or subspathulate

tip: broadly acute to rounded, ending in a mucro

base: basal cells elongate, thin-walled

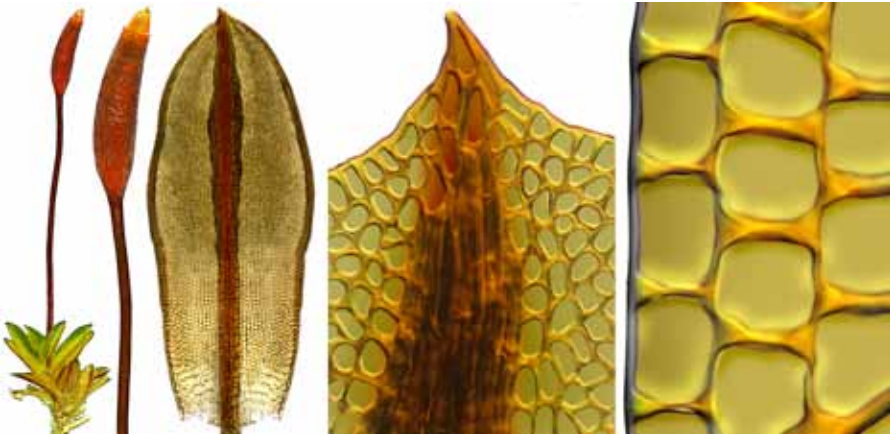
costa: strong, widened above, excurrent in the mucro

border: not differentiated

margin: entire, plane to revolute throughout

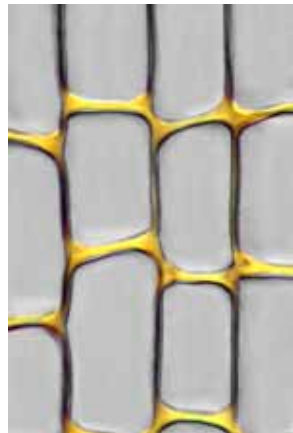
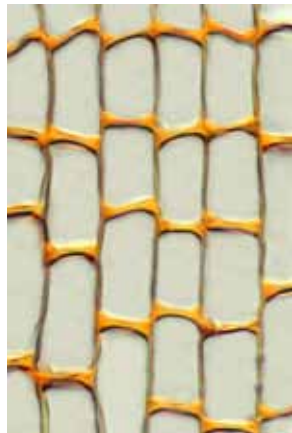
cells: 10–20 μm, rounded-quadrate, firm-walled, 4–6-C-papillose

capsule: 1–1.5 mm, narrowly oblong to elliptic, erect, exserted, red-brown, annulus none; seta 5–10 mm, reddish below, yellow above; operculum long-rostrate, to about half the length of the urn; peristome teeth to 400 μm long, inserted on a short basal membrane, papillose, oblique or twisted when moist



fertile shoot (dry), capsule, leaf outline, leaf apex, and margin midleaf

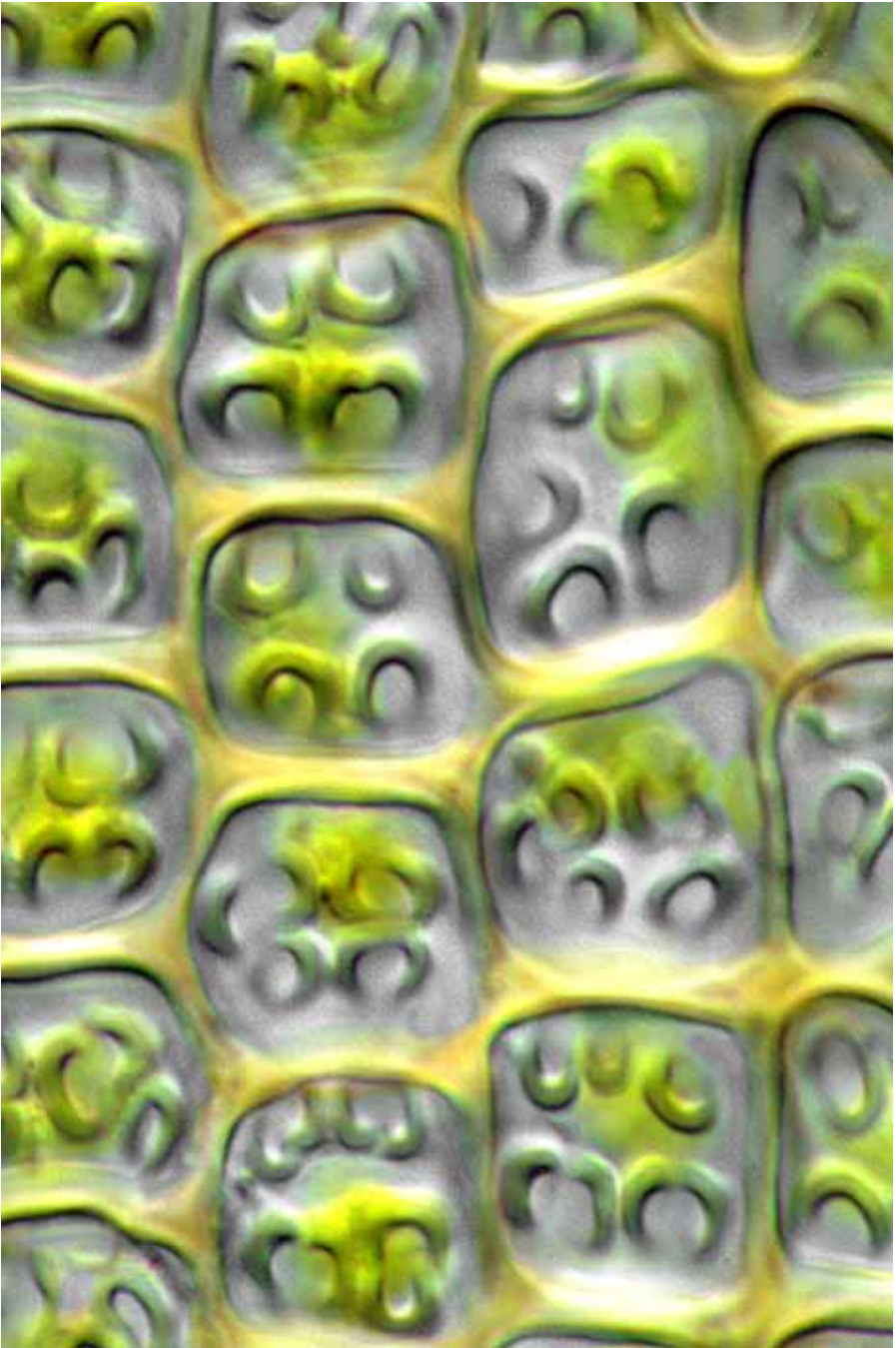
1 mm, 1 mm, 0.1 mm, 50 μm, 10 μm



papillose cells midleaf, and cells near leaf base (2)

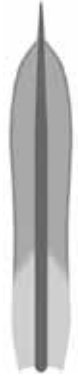
10 μm, 10 μm, 10 μm

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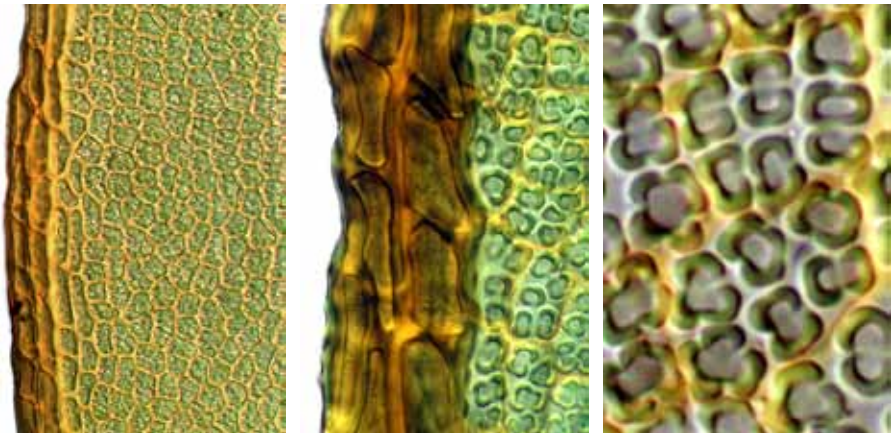


Tortula atrovirens papillose cells midleaf
10 μ m

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Tortula marginata (Bruch & Schimp.) Spruce**form:** patchy or loosely tufted stems, the leaves yellow-green, 2–3 mm tall**habitat:** damp basic rock and walls in shady sites**leaf:** size: to 2 mm*shape:* narrowly lanceolate or lingulate to narrowly lingulate-spathulate*tip:* obtuse to acute*base:* basal cells narrowly rectangular*costa:* excurrent in a yellow point up to a quarter the length of the blade*border:* 2–4 rows of incrassate cells from base to nearly the apex*margin:* sinuose with projecting cell walls, plane*cells:* 8–14 μm , irregularly quadrate-hexagonal, firm-walled, papillose**capsule:** 2.5 mm, short-cylindric, symmetrical, erect; seta 10 mm, orange-red; peristome teeth free down to their insertion; spores 8 μm in diam.**note:** New Zealand's only *Tortula* species with a distinct border

vegetative shoot, leaf outline, and leaf apex and subapex

 0.5 mm, 0.1 mm, 50 μm , 50 μm


border midleaf (2), and leaf papillae

 50 μm , 10 μm , 10 μm

continued next page

Tortula maritima (R.Br.bis) R.H.Zander

form: gregarious, erect, unbranched stems, 15–20 mm tall, the leaves yellow-green

habitat: damp sandy soil occasionally inundated at high tide

leaf: size: 1.2 mm

shape: widely oblong, deeply concave

tip: acute to subobtusate

base: basal cells rectangular, pellucid, thin-walled

costa: percurrent to excurrent

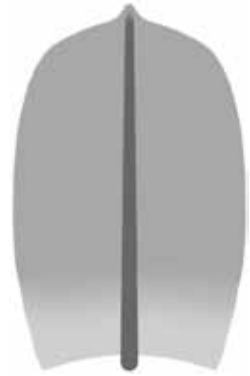
border: not differentiated

margin: entire, plane

cells: 18–28 μm , subquadrate, firm-walled, smooth

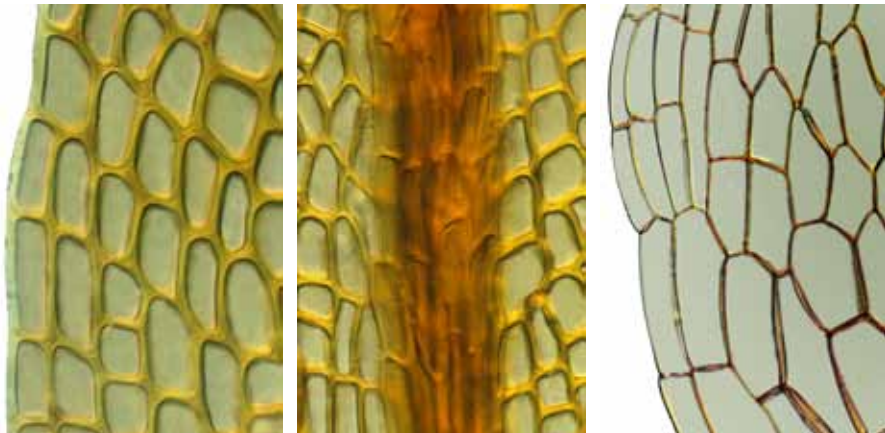
capsule: 1–1.5 mm, ovate, \pm beaked even though cleistocarpous, reddish brown, breaking in roughly the middle; seta 2–3 mm, orange, \pm flexuose when dry; spores 30–36 μm in diam.

note: a coastal endemic



fertile shoot, capsule (dry), leaf outline, and leaf apex

1 mm, 1 mm, 0.1 mm, 10 μm



margin midleaf, costa midleaf, and margin near base

10 μm , 10 μm , 10 μm

continued next page

Tortula mucronifolia Schwägr.

form: densely tufted, erect, branched stems, comal, 5–15 mm tall, the leaves dark green

habitat: calcareous soil on ledges or crevices of exposed cliffs or rock-piles

leaf: size: 2.0–3.5 mm

shape: oblong-lanceolate to spatulate, concave

tip: acute to acuminate

base: basal cells progressively longer toward the base, thin-walled

costa: tapering above, excurrent in a short to spinose mucro

border: not differentiated

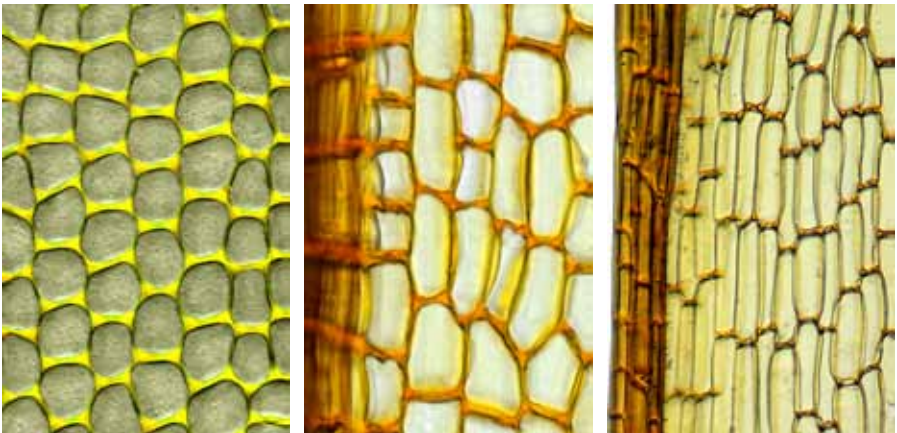
margin: entire, plane above, narrowly revolute on both sides below

cells: 16–28 μm , subquadrate to rounded-hexagonal, firm-walled, smooth

capsule: 2–2.5 mm, long-cylindric, erect, exerted, reddish brown; seta 1–2.5 mm; operculum conic-subulate; peristome filiform, pink to orange, strongly twisted, from a tall tessellated tube about half the height of the peristome; spores 11–15 μm , greenish

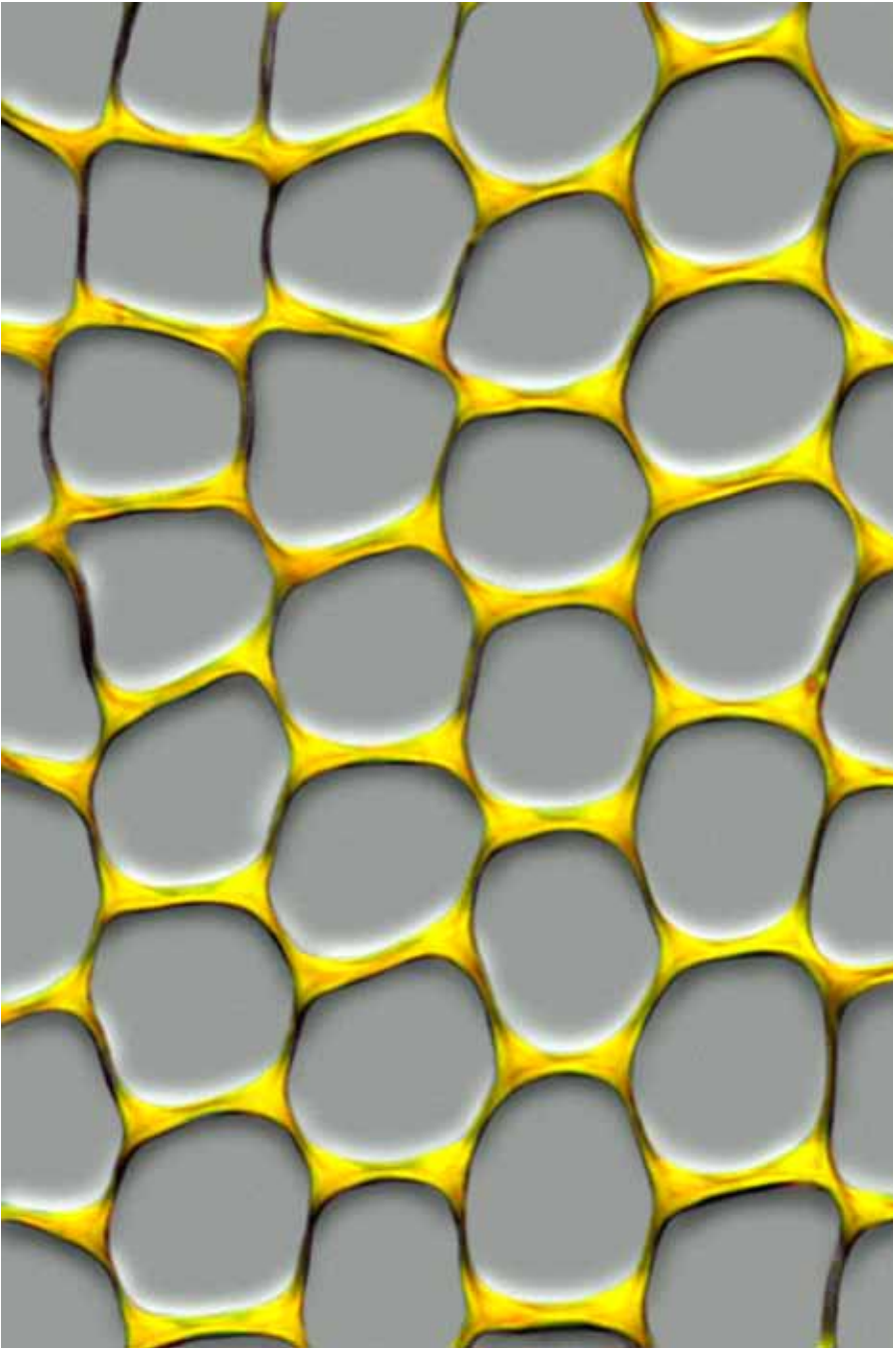


fertile shoots (dry) (2), capsule, leaf outline, leaf apex, and recurved margin midleaf
 1 mm, 1 mm, 1 mm, 0.1 mm, 50 μm , 10 μm



cells midleaf, costa just below midleaf, and margin near leaf base
 10 μm , 10 μm , 50 μm

continued next page



Tortula mucronifolia cells upper leaf
10 μm

continued next page

Tortula muralis Hedw.

form: tufted or patchy, erect, glaucous, radiculose, hoary stems, 5–15 mm tall
habitat: basic rock or mortar, concrete, and walls, an urban bryo-weed

leaf: size: 2–3.5 × 0.5–0.8 mm

shape: oblong-lanceolate

tip: acute to obtuse, with a long hyaline awn

base: basal cells rectangular, hyaline, smooth

costa: long-excurrent as a smooth, hyaline hair-point

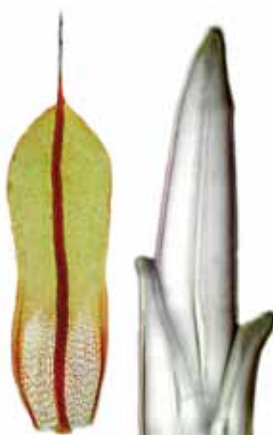
border: weak, 1–3 rows of incassate, smooth, yellow cells

margin: entire, revolute to nearly the apex

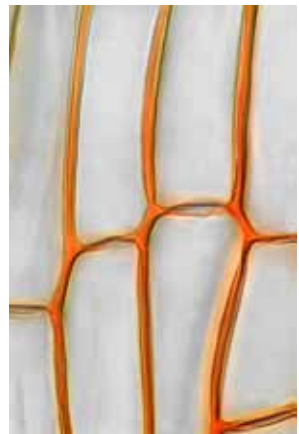
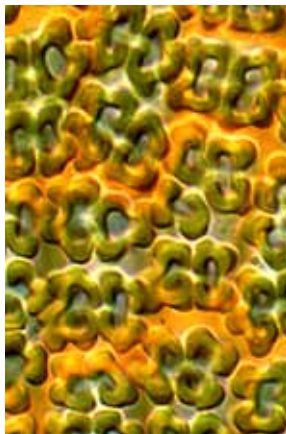
cells: 12–16 μm, rounded-hexagonal, incassate, densely C-papillose

capsule: 1–2.5 mm, cylindric, ± curved, erect, red-brown at maturity, stomatose at the base; seta 10–20 mm, flexuose, red with age; annulus revolute; operculum bluntly high-conic, the cells in spiral rows; peristome teeth pink, spirally twisted from a low basal tube; spores 10 μm in diam.

note: common in disturbed urban sites



fertile habit, leaf outline, leaf apex, and hair-point junction
 5 mm, 0.5 mm, 10 μm, 50 μm



revolute margin midleaf, lamina cell papillae, and leaf base cells
 10 μm, 10 μm, 10 μm

continued next page

Tortula splachnoides (Hornsch.) R.H.Zander

form: gregarious ± bulbiform stems, yellow-green, 4 mm
habitat: compacted soil in exposed coastal salt marsh

leaf: size: to 1 mm in length

shape: orbicular or nearly so, strongly concave

tip: apiculate to mucronate or cuspidate

base: basal cells larger and thinner-walled than the other lamina cells

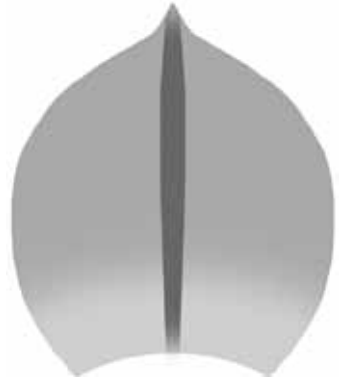
costa: percurrent to shortly excurrent

border: not differentiated

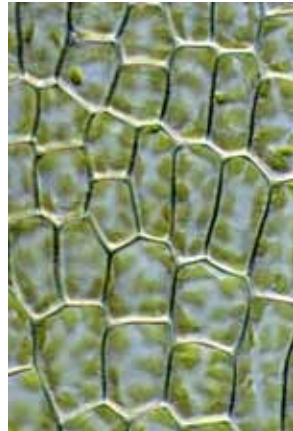
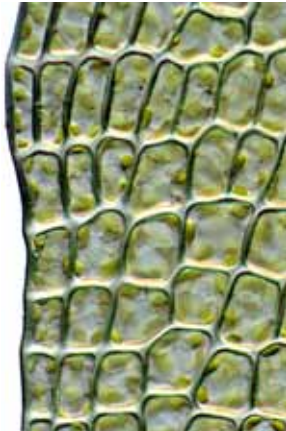
margin: entire

cells: 18–40 × 10–18 μm, quadrate to rectangular, firm-walled, 1–4-papillose (C-shaped)

capsule: 1 mm, ovoid, erect, exserted, glossy, red-brown when mature, cleistocarpous, splitting near the equator; seta 3–4 mm; calyptra cucullate



fertile shoots (dry), cleistocarpous capsule splitting, capsule remnant, and leaf outline
 ■ 1 mm (2), ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 50 μm



leaf tip, margin midleaf, and cells near leaf base
 ■ 10 μm, ■ 10 μm, ■ 10 μm



Tortula splachnoides fertile habit

1 mm

continued next page

Tortula truncata (Hedw.) Mitt.

form: scattered to gregarious, loosely tufted, erect stems, 3–5 mm tall
habitat: calcareous soil in fallow fields, pastures, and roadside verges

leaf: size: 1.5–3 × 0.5–1.0 mm

shape: oblong-lanceolate to obovate

tip: acuminate or acute, ending in a stout apiculus

base: undifferentiated

costa: excurrent in the apiculus

border: not differentiated

margin: entire, variably recurved in midleaf

cells: 15–22 μm, irregularly hexagonal to rhombic, firm-walled, smooth

capsule: 0.4–0.8 mm, obovoid or obconic, erect, glossy, dark brown, widening at the mouth when dry; seta 2–6 mm, orange to red, sometimes paired; calyptra cucullate, smooth; operculum obliquely long-rostrate; peristome absent or rudimentary; spores 22–32 μm in diam., globose, brown, finely papillose



habit, turbinated capsules, leaf outline, and leaf apex

1 mm, 0.25 mm, 20 μm, 10 μm



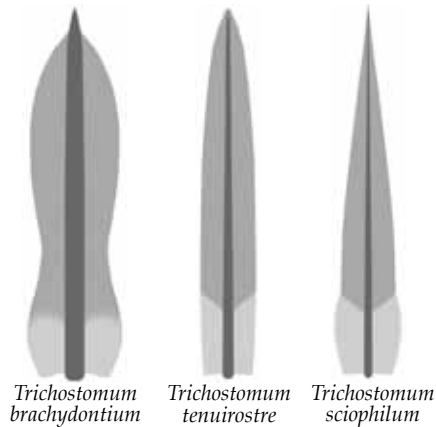
leaf subapex, costa edge midleaf, and margin midleaf

10 μm, 10 μm, 10 μm

Key* to the New Zealand species of *Trichostomum* (3)

- 1 Leaf margin crenulate; papillae of upper cells low and scattered ● ***Trichostomum tenuirostre***
 1: Leaf margin entire; papillae of upper cells large and crowded.....2
- 2(1:) Plants up to 25 mm tall; leaves crisped and incurved when dry, 2.0–2.5(–3.0) mm long; costa excurrent as a stout mucro..... ● ***Trichostomum brachydonium***
 2: Plants 2–3 mm tall; leaves recurved when dry, 1.5–2.0 mm long; costa percurrent to short-excurrent as a cusp ● ***Trichostomum sciophilum***

* based partly on Zander, RH (2007): *Trichostomum*. *Flora of North America* 27, 489.



Trichostomum brachydontium Bruch

form: densely tufted, simple, yellowish stems, dark with age, 10–40 mm tall
habitat: soil or soil in rock crevices, shaded to exposed sites

leaf: size: 2.5–3 × 0.5–0.7 mm, orange reaction to 2% KOH

shape: narrowly lingulate to ± spatulate, crisped and incurved when dry

tip: acute to obtuse or acuminate, not cucullate

base: basal cells more rectangular than the blade cells, 20–35 × 9–12 μm

costa: shortly excurrent in a mucro or cusp

border: not differentiated

margin: papillose-crenulate, plane to narrowly recurved

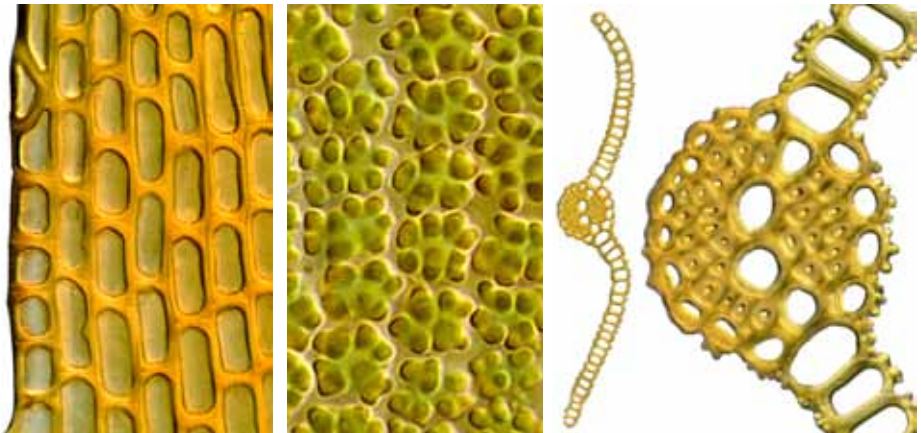
cells: 6–8 μm, subquadrate, firm-walled, papillose

capsule: 1.5–2 mm, ellipsoid, straight, erect; seta 6 mm, yellow; operculum obliquely rostrate; calyptra cucullate, naked, smooth; peristome teeth short, distally divided, fragile; spores 14–18 μm in diam., papillose

note: highly variable



vegetative shoot, leaf outline, leaf apex, and margin midleaf
 1 mm, 0.5 mm, 50 μm, 10 μm



margin near leaf base, leaf papillae, and costa and leaf cross-sections
 10 μm, 10 μm, 50 μm, 10 μm

continued next page

Trichostomum sciophilum Müll.Hal.

form: gregarious erect shoots, olive-green above and brown below, 3–5 mm tall
habitat: exposed soil, lowland

leaf: size: 1.5–2.0 mm

shape: narrowly lanceolate, short-sheathing

tip: long-acuminate

base: basal cells elongate, thin-walled; alar cells not differentiated

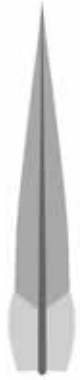
costa: percurrent to excurrent in a cusp

border: not differentiated

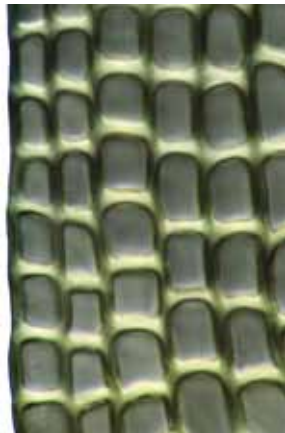
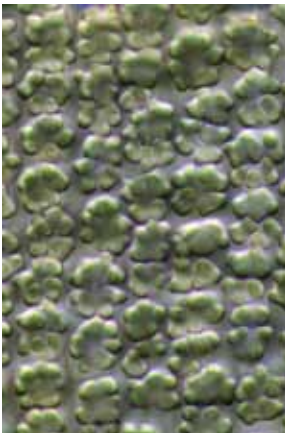
margin: entire, plane to recurved

cells: 10 μm , quadrate to short-rectangular, thick-walled, multipapillose

capsule: 1.5 mm, elliptic, erect, exserted, brown; seta 5–8 mm; calyptra cucullate, naked, smooth; operculum obliquely rostrate; peristome rudimentary



immature capsules, vegetative shoot (dry), leaf outline, leaf apex, and margin midleaf
 0.5 mm, 0.5 mm, 1 mm, 0.1 mm, 100 μm , 50 μm



leaf papillae, margin of lower leaf, and leaf basal angle
 10 μm , 10 μm , 50 μm

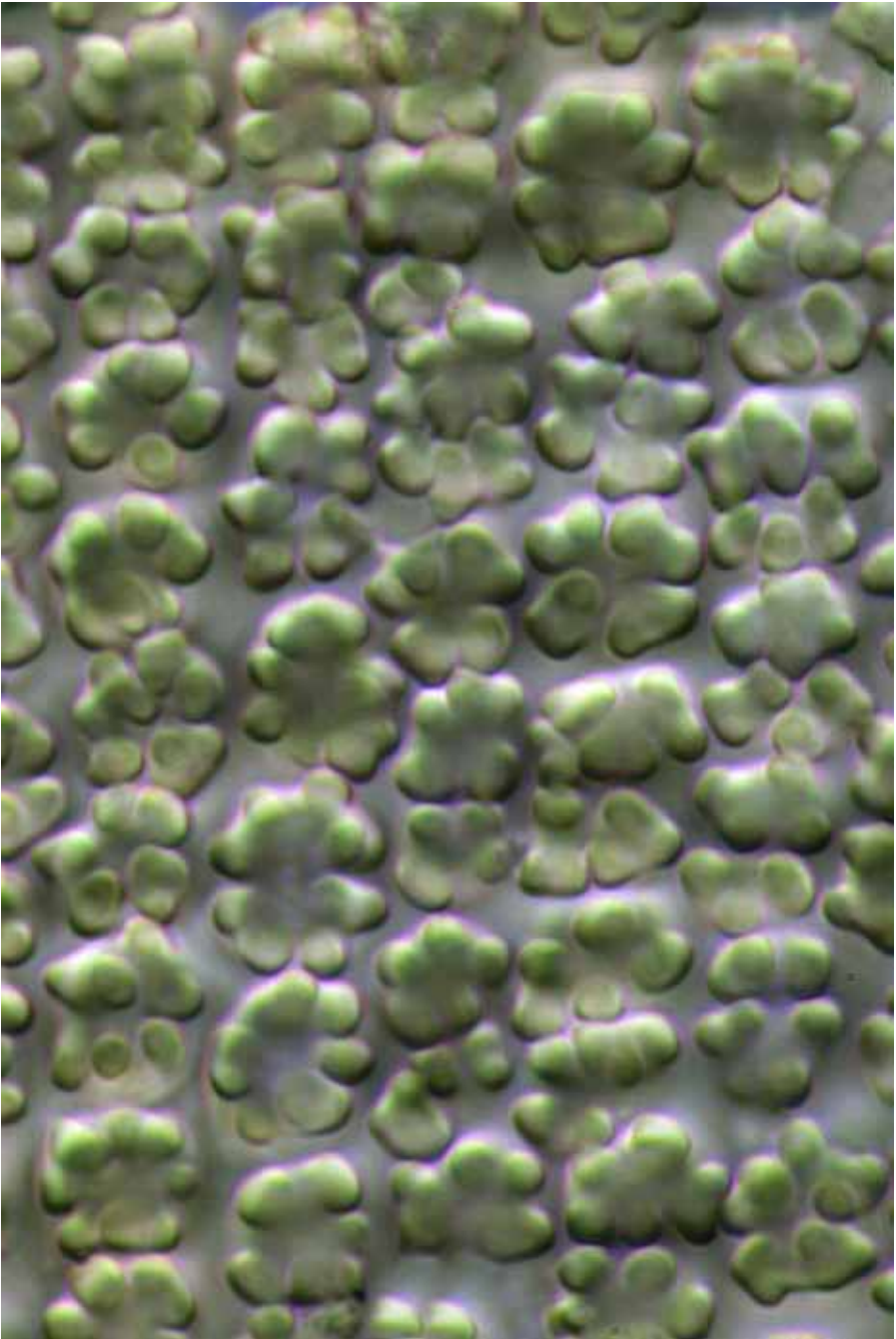
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Trichostomum sciophilum vegetative shoot (dry)

0.5 mm

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Trichostomum sciophilum leaf papillae
10 μ m

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Trichostomum tenuirostre (Hook. & Taylor) Lindb.

form: loosely tufted, erect stems, to 10 mm tall, the leaves yellow-green or brown
habitat: peat, bark of roots, soil, or soil over rock, from lowland to alpine

leaf: size: 2–7 mm

shape: linear-lanceolate to oblong-lanceolate, unistratose

tip: acute, ± apiculate, incurved and contorted when dry

base: basal cells 30–45 × 7–8 μm, ± inflated, hyaline, thin-walled, smooth

costa: glossy, prominent on the back, ending in the apex to ± excurrent

border: not or only obscurely differentiated

margin: entire to minutely serrulate-crenulate from papillae, ± undulate

cells: 6–9 μm, quadrate to irregular, firm-walled, pluri- to multipapillose

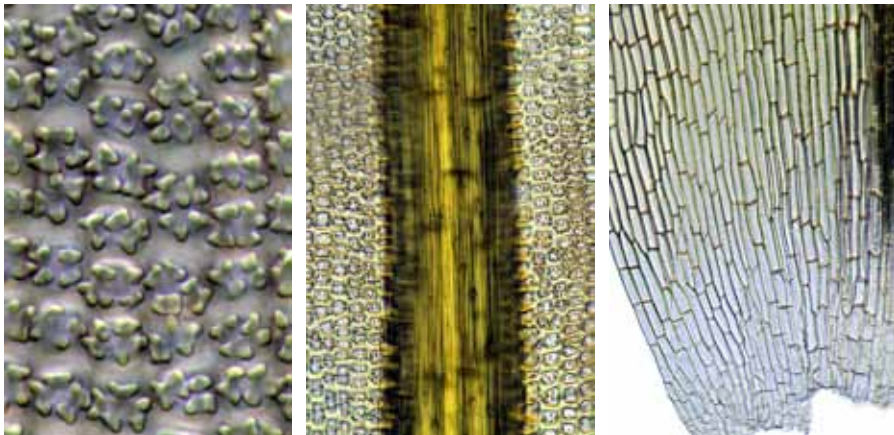
capsule: 1.2–1.8 mm, cylindric, erect, smooth to ± wrinkled when dry, exserted, brown; seta 7–10 mm; operculum long-conic to rostrate; peristome of 16 entire or irregularly divided, ± papillose teeth; spores 9–13 μm in diam.

note: capsules not seen in New Zealand



vegetative shoots (dry) (2), leaf outline, leaf apex, and margin midleaf

5 mm, 1 mm, 1 mm, 10 μm, 10 μm



leaf papillae, costa midleaf, and leaf basal angle

10 μm, 50 μm, 50 μm

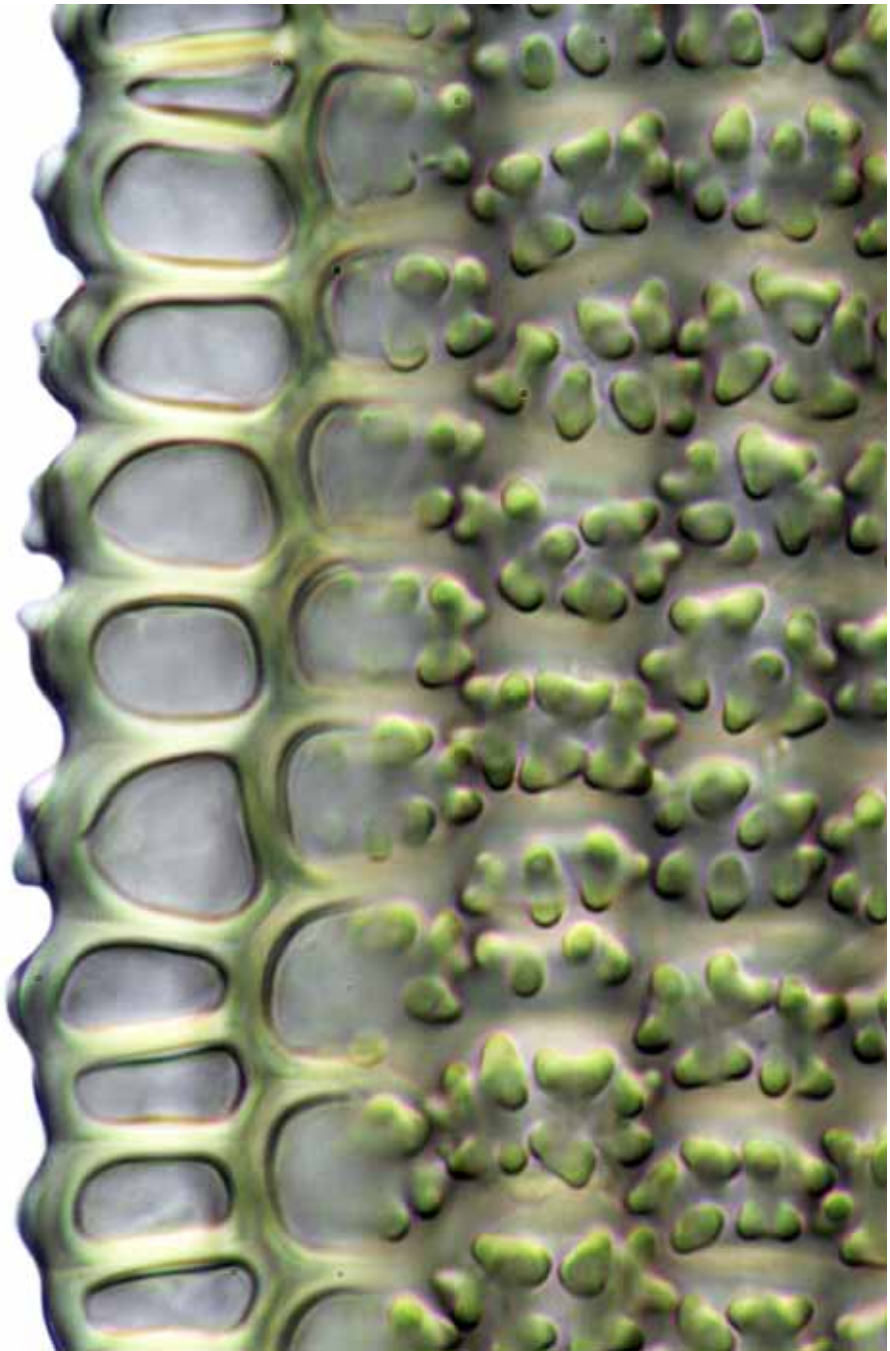
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Trichostomum tenuirostre vegetative shoot (dry)

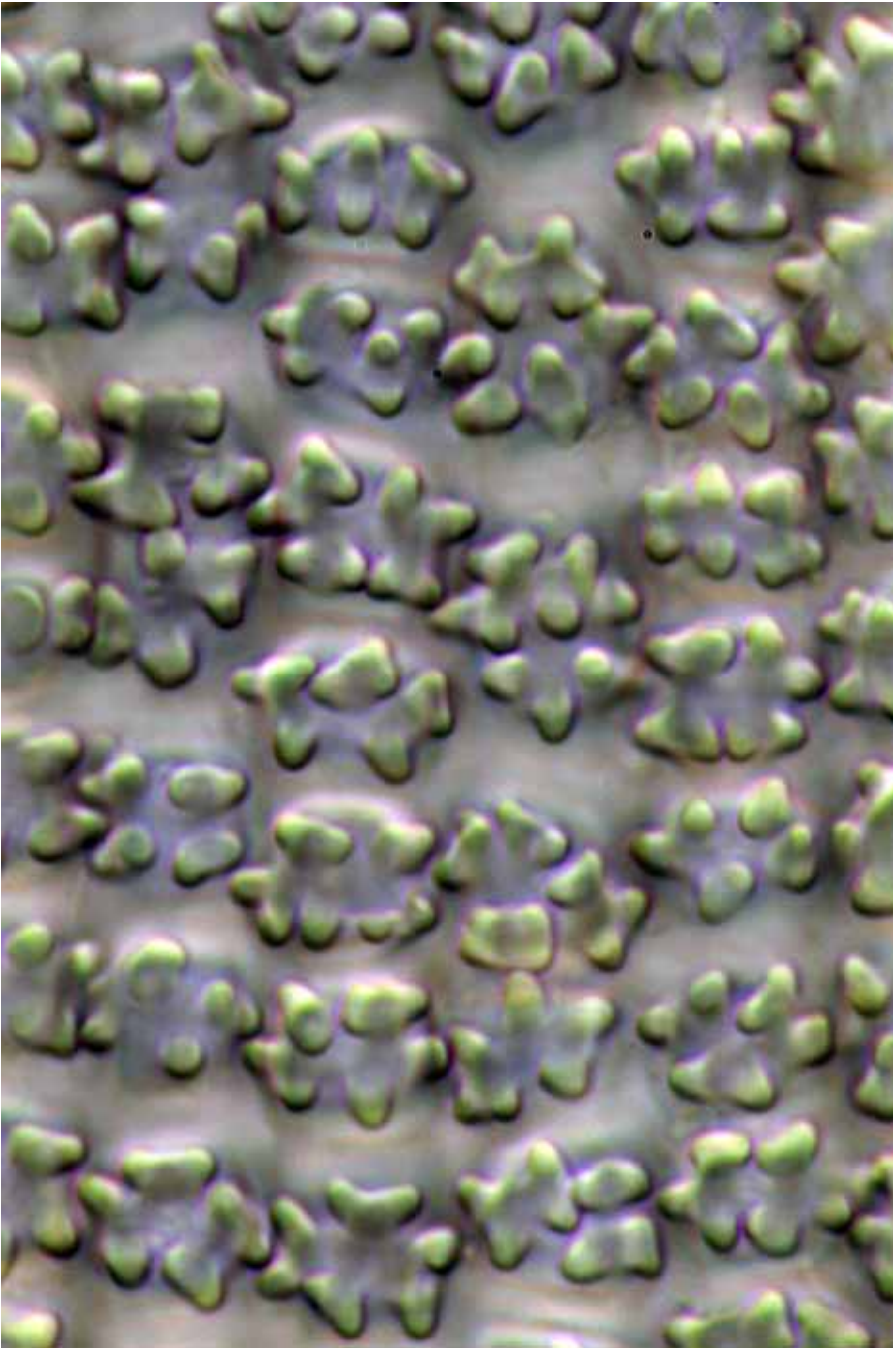
0.5 mm

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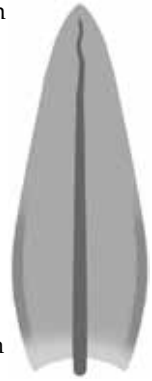
Trichostomum tenuirostre margin midleaf
10 μ m

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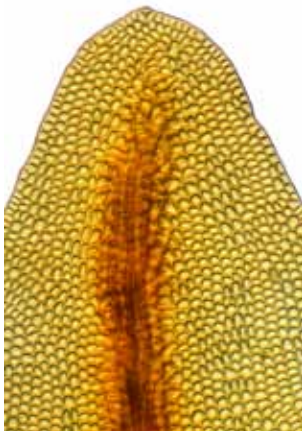


Trichostomum tenuirostre leaf papillae
10 μ m

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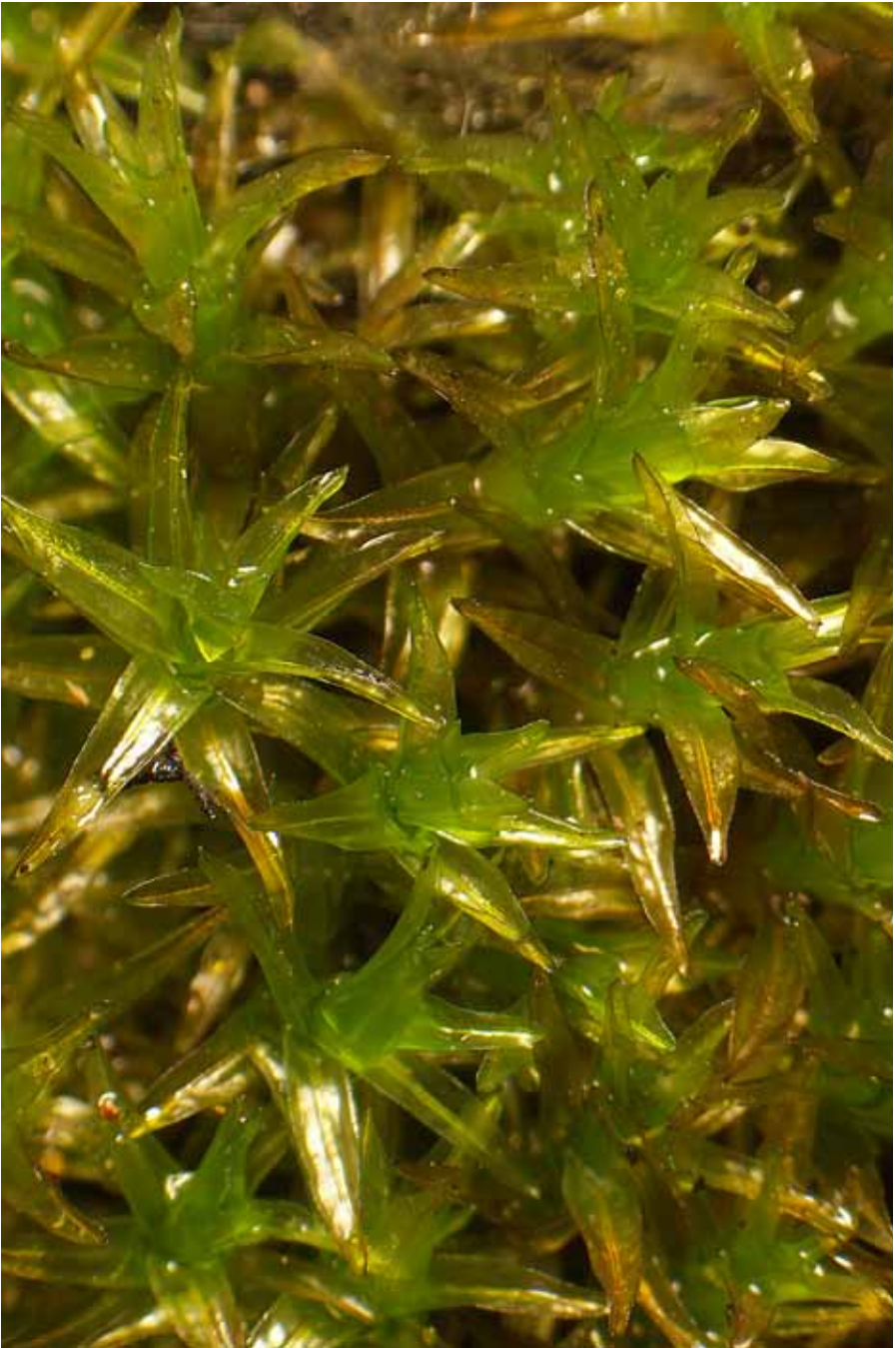
Tridontium tasmanicum Hook.f.**form:** robust, tufted, brownish, branched stems, denuded below, to 80 mm**habitat:** damp soil or rock, especially in stream beds**leaf:** size: 2–4.5 × 0.7–1.5 mm*shape:* oblong-lanceolate*tip:* obtuse to rounded, rarely acute*base:* undifferentiated*costa:* failing below the apex*border:* in the lower half, an intramarginal border of thick-walled cells*margin:* entire, inrolled above, plane or concave below*cells:* 8–10 μm, isodiametric, thick-walled, smooth**capsule:** 1.5–2 mm, turbinate, brown, pachydermatous, with a thickened mouth; seta 10–20 mm, erect, flexuose, red; calyptra cucullate; operculum long-rostrate; peristome teeth 16, short, yellowish, inserted under the rim, variably 2–3-split and perforated below; spores 16–20 μm

fertile shoot (wet), vegetative shoot (dry, wet), margin xs, capsule, tooth, and leaf outline
 5 mm, 1 mm, 1 mm, 10 μm, 1 mm, 100 μm, 1 mm



leaf apex and costa terminus, margin midleaf, and intramarginal border in lower leaf
 100 μm, 10 μm, 100 μm

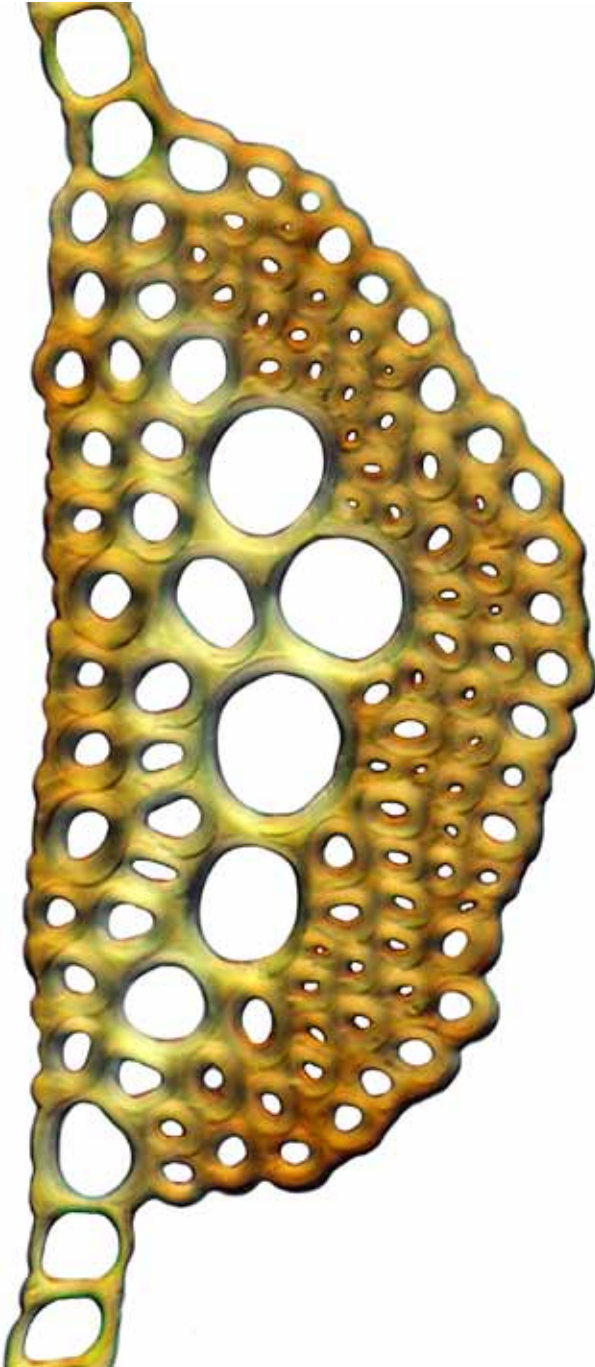
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Tridontium tasmanicum habit (moist)

1 mm

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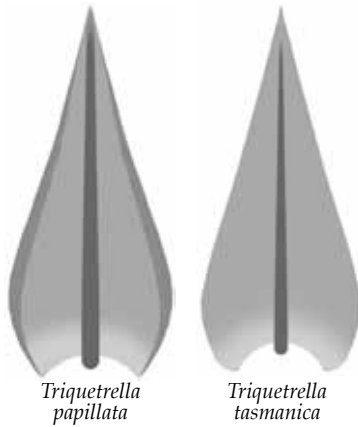
Tridontium tasmanicum costa cross-section
10 μm

continued next page

Key* to the New Zealand species of *Triquetrella* (2)

- 1 Papillae tall and mostly bifid; leaves unaltered when dry ● ***Triquetrella papillata***
 1: Papillae low and simple; leaves twisted around the stem when dry..... ● ***Triquetrella tasmanica***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bulletin 5, 154.



Triquetrella papillata (Hook.f. & Wilson) Broth.

form: tufted, filiform, radiculose stems, the leaves distinctly 3-ranked,
yellowish or brownish, 20–40 mm tall

habitat: exposed soil, sand, or rock, in pasture or near coasts

leaf: size: 1.5–2 × 0.5–0.7 mm

shape: triangular to ovate-triangular

tip: acute or acuminate

base: undifferentiated, decurrent

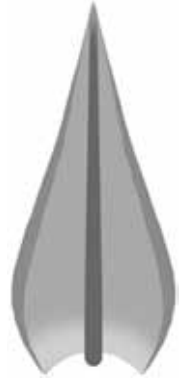
costa: percurrent or failing below the apex, papillose

border: not differentiated

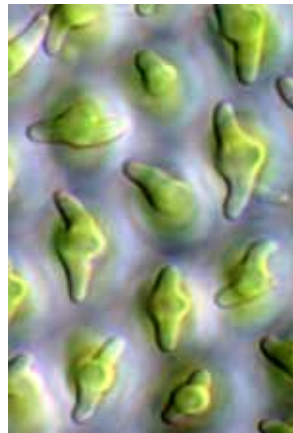
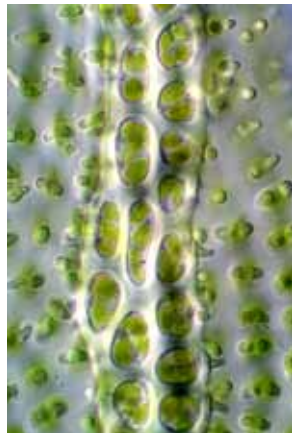
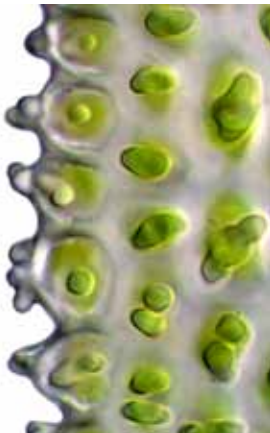
margin: entire, variably recurved midleaf

cells: 9–12 μm, rounded-hexagonal, thick-walled, papillose, the papillae mostly simple or bifid

capsule: 1.5 mm, narrowly cylindric, exserted, erect, straight; seta 15–23 mm, flexuose, yellow; operculum bluntly rostrate; peristome teeth 16, short, blunt, hyaline, obliquely striolate



vegetative habit (moist), immature capsule, leaf outline, leaf apex, and leaf cross-section
 5 mm, 1 mm, 0.1 mm, 10 μm, 10 μm

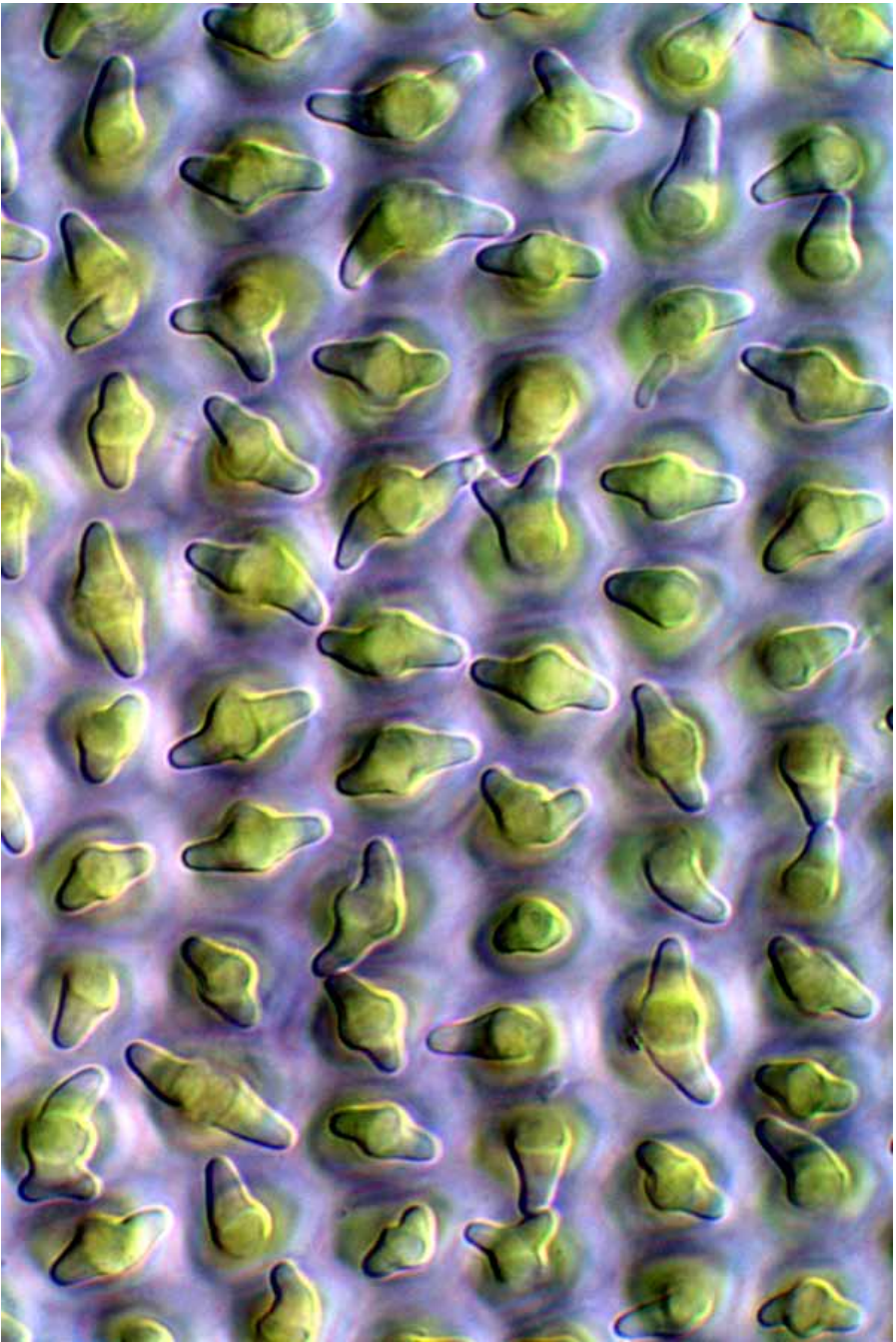


margin midleaf, costa and papillae midleaf, and leaf papillae detail
 10 μm, 10 μm, 10 μm



Triquetrella papillata vegetative habit (moist)
5 mm

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Triquetrella papillata leaf surface papillae
10 μm

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Triquetrella tasmanica (Broth.) Granzow-de la Cerda

form: tufted or matted, yellowish, branched stems, purple-radiculose;
leaves \pm 3-ranked, twisted around the stem when dry, 20–40 mm tall

habitat: soil or rock in sheltered sites

leaf: size: 1–1.5 \times 0.4–0.6 mm

shape: ovate-lanceolate or ovate-cordate

tip: acuminate or acute, \pm hyaline, often ending in a single long cell

base: not differentiated, decurrent

costa: failing below the apex

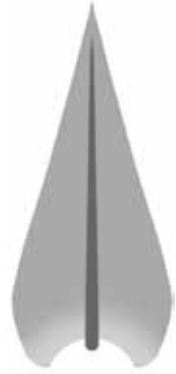
border: not differentiated

margin: entire, variably revolute below

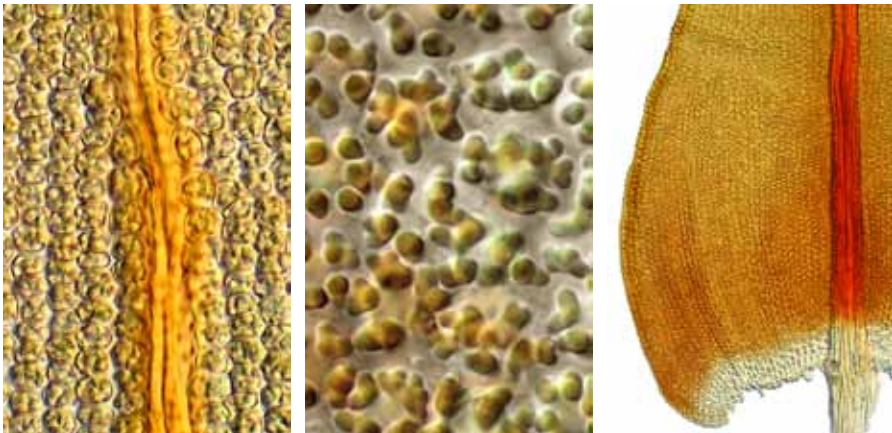
cells: 10–14 μ m, rounded, incrassate, papillose

capsule: unknown

note: rare, known from only a few widely scattered sites



vegetative shoot (dry on far left), leaf outline, upper third of leaf, and leaf apex
 1 mm, 1 mm, 0.1 mm, 100 μ m, 10 μ m

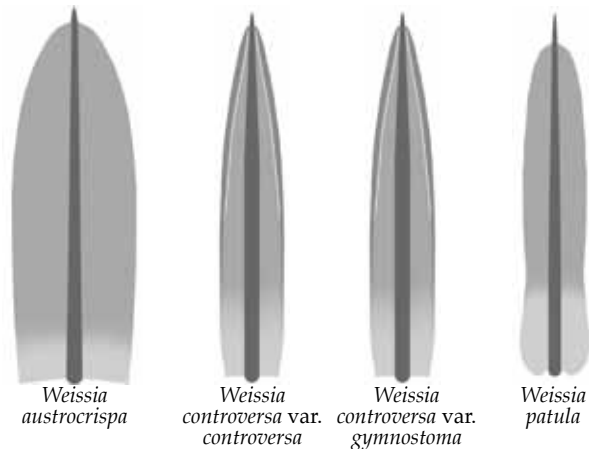


costa and papillae midleaf, papillae detail, and leaf basal angle
 10 μ m, 10 μ m, 100 μ m

Key* to the New Zealand species of *Weissia* (4)

- 1 Margin plane throughout..... ● ***Weissia austrocrispa***
 1: Margin involute above or reflexed below2
- 2(1:) Margin reflexed midleaf; costa failing below the apex..... ● ***Weissia patula***
 2: Margin strongly involute above; costa excurrent.....3
- 3(2:) Peristome teeth 16, red to hyaline..... ● ***Weissia controversa* var. *controversa***
 3: Peristome teeth none ● ***Weissia controversa* var. *gymnostoma***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bulletin 5, 146, and Catcheside, DG (1980): *Mosses of South Australia*. Government Printer, Adelaide. 193.



Weissia austrocrispa (Beckett) I.G.Stone

form: densely gregarious, erect, yellowish stems, 3–5 mm tall
habitat: exposed soil

leaf: size: 2–2.5 mm

shape: linear-lanceolate from an oval base

tip: mucronate

base: basal cells long-rectangular, thin-walled

costa: excurrent in a stout mucro

border: not differentiated

margin: entire, plane

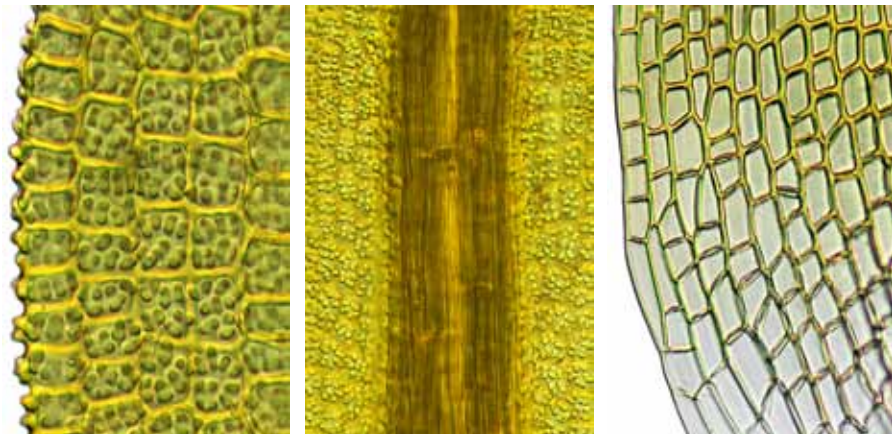
cells: 8–12 μm , quadrate, firm-walled, pluri- to multipapillose

capsule: 1 mm, oval, erect, immersed, brown; seta very short; operculum conic, short-rostrate; calyptra only half-formed, smooth, the base entire; peristome absent

note: differs from *Barbula unguiculata* in having immersed capsules



vegetative shoot (moist on far left), leaf outline, leaf apex, and mucro
 1 mm (2), 0.1 mm, 50 μm , 10 μm



margin midleaf, costa midleaf, and margin near leaf base
 10 μm , 10 μm , 10 μm

continued next page



Weissia austrocrispa vegetative shoot (dry)
1 mm

continued next page

Weissia controversa Hedw. var. **controversa**

form: loosely to densely tufted stems, 3–10 mm tall, the leaves pale green

habitat: moist soil or rock on banks, walls, roadsides, cliffs, and coastal dunes

leaf: size: 2–3 × 0.4–0.6 mm

shape: linear-lanceolate, concave below, strongly crispate when dry

tip: acute, ± abruptly pointed by the excurrent costa

base: basal cells rectangular, ± thick-walled

costa: shortly excurrent

border: not differentiated

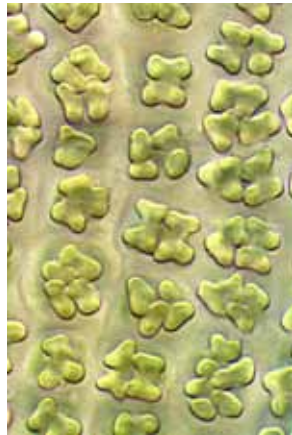
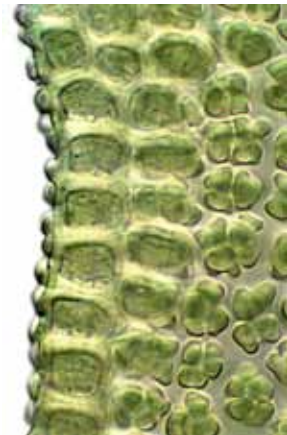
margin: entire, plane below, incurved or tightly involute above

cells: 6–8 μm, subquadrate, incrassate, densely papillose

capsule: 0.7–1.5 mm, ovoid, oblong, or cylindric, ± curved, erect, stomatose at the base; seta 4–13 mm, terminal, yellowish; calyptra cucullate, smooth, naked; mouth narrow, red, thickened; operculum obliquely rostrate; peristome variable or lacking, the teeth 16, red, short or rudimentary, entire or ± cleft and perforate, often filiform-divided to a low basal membrane



vegetative habit (dry), leaf outline and apex, leaf apex, and mature capsule
 1 mm, 0.5 mm, 10 μm, 10 μm, 0.5 mm



margin midleaf, leaf papillae, and leaf cross-section
 10 μm, 10 μm, 50 μm

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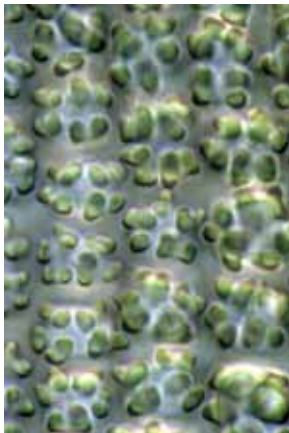
Weissia controversa var. *controversa* habit, immature capsules
1 mm, 1 mm

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Weissia controversa var. **gymnostoma** (Dixon) Sainsbury**form:** loosely to densely tufted, erect stems, 3–10 mm tall, pale green**habitat:** moist calcareous soil or rock**leaf:** size: 2–3 × 0.4–0.6 mm*shape:* linear-lanceolate, concave below, strongly crispate when dry*tip:* acute, ± abruptly pointed by the yellow excurrent costa*base:* basal cells rectangular, firm-walled*costa:* shortly excurrent*border:* not differentiated*margin:* entire, plane below; ± incurved above*cells:* 6–8 μm, subquadrate, incrassate, pluripapillose**capsule:** 0.7–1.5 mm, ovoid, oblong, or cylindric, erect, ± curved, stomatose at the base; seta 4–13 mm, yellowish; calyptra cucullate, smooth, naked; mouth red, narrow, thickened; operculum obliquely rostrate; peristome none; spores 16–20 μm in diam.

fertile shoot (dry) (2), capsule, leaf outline, leaf apex, and margin midleaf

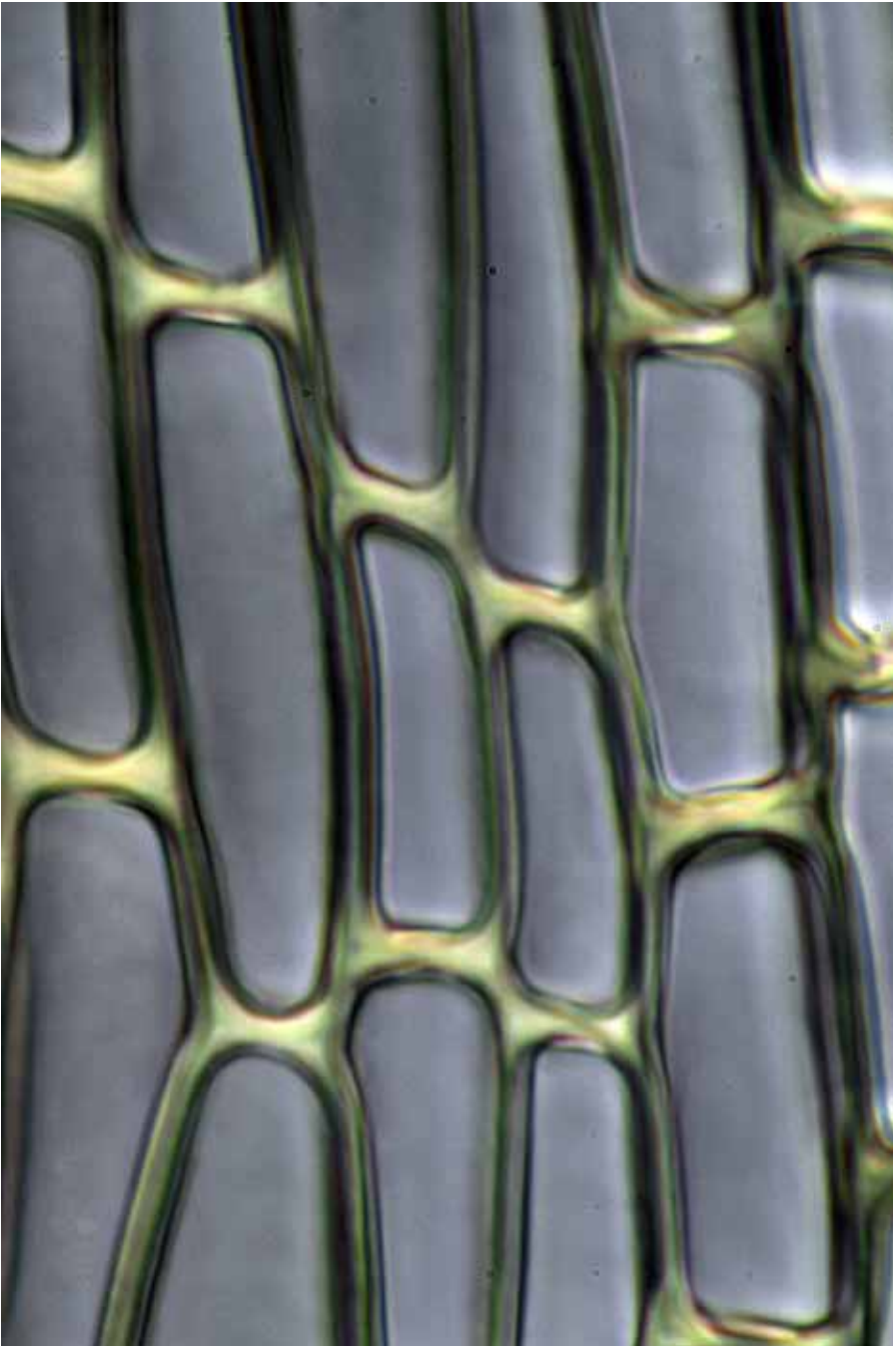
1 mm,
 1 mm,
 1 mm,
 0.5 mm,
 50 μm,
 10 μm



costa lower leaf, surface papillae midleaf, and leaf basal angle

10 μm,
 10 μm,
 50 μm

continued next page



Weissia controversa var. *gymnostoma* cells lower leaf
10 μ m

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Weissia patula (C.Knight) Fife

form: tufted, erect, sparsely branched stems, to 5 mm tall, yellow-green
habitat: disturbed soil

leaf: size: to 2.5 mm

shape: narrowly ligulate

tip: acute, ending in a stout arista

base: basal cells short-rectangular, firm-walled, hyaline, smooth

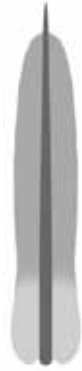
costa: excurrent as a stout arista

border: not differentiated

margin: erect, involute to strongly incurved

cells: 7–10 μm , subquadrate to hexagonal, firm-walled, pluripapillose

capsule: 1–1.5 mm, ovoid to cylindric, erect, exserted; seta 10–12 mm; peristome none, the mouth of the capsule closed by a membrane



vegetative shoot, leaf outline, and leaf apex

1 mm, 0.5 mm, 50 μm , 10 μm

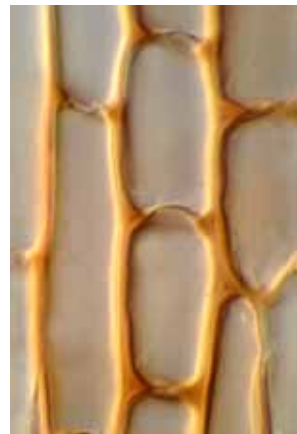


margin midleaf, costa in upper leaf, and costa cross-section

10 μm , 50 μm , 10 μm

Willia calobolax (C.Müll.) Lightowlers**form:** tufted erect, sparsely branched stems, 10–15 mm tall, in cushions**habitat:** bark or rock, often coastal**leaf:** size: to 2.5 mm*shape:* oblong, concave, reacting red in 2% KOH*tip:* widely acute or obtuse*base:* basal cells rectangular, thin-walled, smooth*costa:* stout, excurrent in a stout mucro or arista, red*border:* not differentiated*margin:* entire, plane*cells:* 10–15 μm , isodiametric, firm-walled, \pm papillose**capsule:** capsules not known

vegetative shoots (dry) (2), leaf outline, leaf apex, and costa cross-section

 1 mm (2), 0.1 mm, 50 μm , 10 μm


margin midleaf, leaf papillae, and basal leaf cells

 10 μm , 10 μm , 10 μm

Pleurophascum ovalifolium Fife & P.J.Dalton

form: gregarious; primary stems creeping; secondary stems erect, sparsely branched, julaceous, 20–40(–60) mm tall

habitat: soil in cushion bogs on pakihī soils, and in grasslands

leaf: size: 2–3 × 1.5–2 mm

shape: broadly elliptic, strongly concave

tip: rounded

base: alar cells shorter and wider than adjacent blade cells

costa: none

border: weak, oblong in a few rows

margin: entire, narrowly recurved below

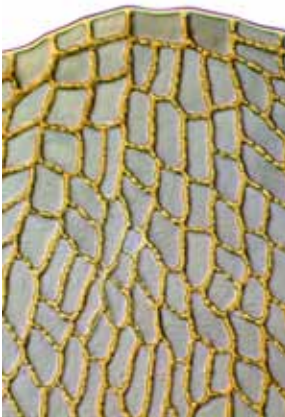
cells: 40–70 × 15–18 μm, oblong to hexagonal, firm-walled, strongly porose, smooth

capsule: 6–12 × 3 mm, globose and yellow when young, discoid and bright red at maturity, cleistocarpous; seta 10–35 mm, yellow; calyptra cucullate; spores 33–45 μm in diam.



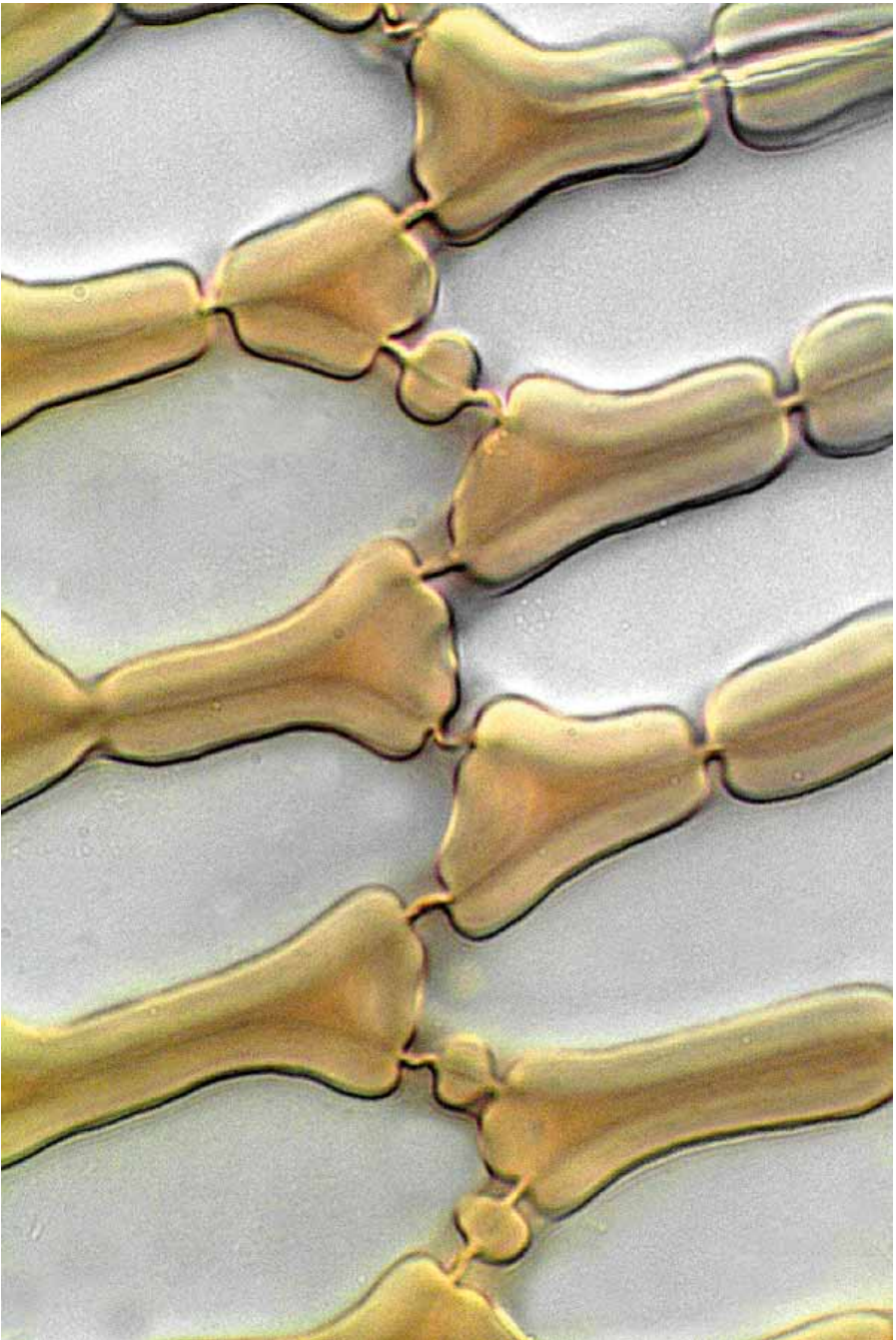
fertile habit, capsule, vegetative shoot, and leaf outline

■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 0.5 mm



leaf apex, margin midleaf, and cells midleaf

■ 10 μm, ■ 10 μm, ■ 5 μm



Pleurophascum ovalifolium porose leaf cells
10 μm

continued next page

Mittenia plumula (Mitt.) Lindb.

form: gregarious or in swards, slender, unbranched stems, to 20 mm
habitat: shaded soil, overhangs, and banks in beech forest, to 1200 m

leaf: size: 0.7–1.0 × 0.3–0.5 mm

shape: oblong-lingulate to oval, asymmetric, distichous

tip: obtuse, ± short-apiculate

base: basipetal margin decurrent; alar cells undifferentiated

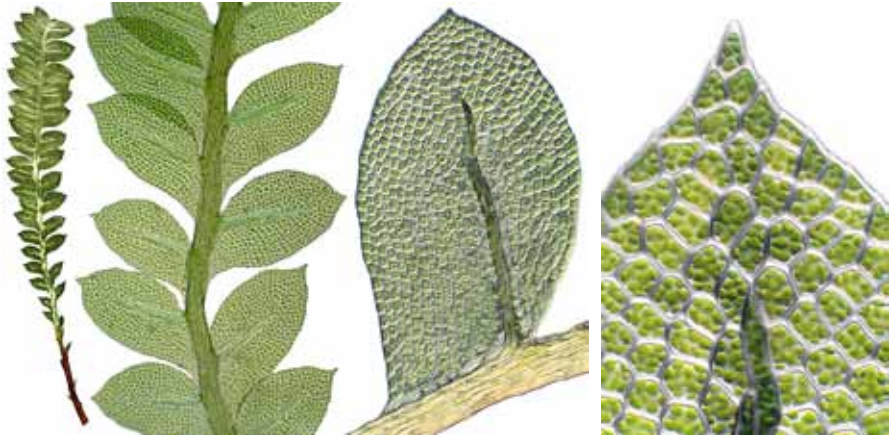
costa: pale, ending above midleaf, sometimes forked above

border: not differentiated

margin: entire, plane

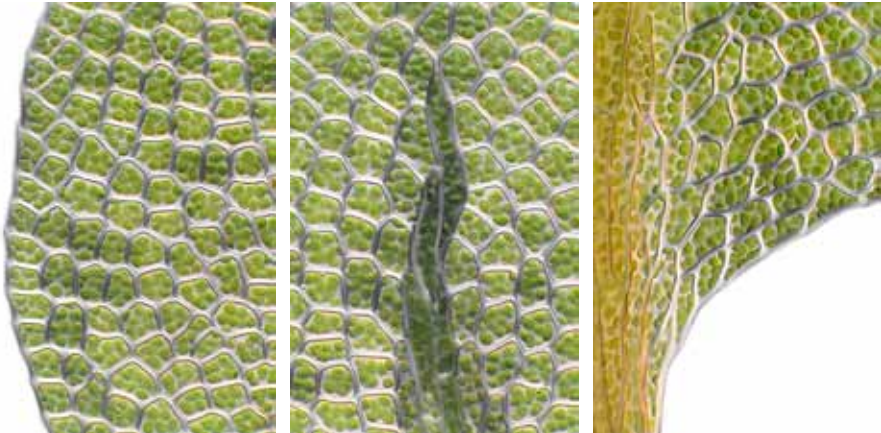
cells: 15–24 μm, ± isodiametric, firm-walled, smooth

capsule: 2 mm, narrowly oblong, erect to inclined, brown, not stomatose; seta 2–4 mm, geniculate at the base; annulus none; operculum obliquely long-rostrate; calyptra mitriform, smooth; peristome double; outer of 16 dark, long-filiform teeth, inner of 16 filiform nodulose processes; spores 9–12 μm in diam.



vegetative shoot, leaf outlines (2), and leaf apex

1 mm, 0.5 mm, 0.1 mm, 50 μm



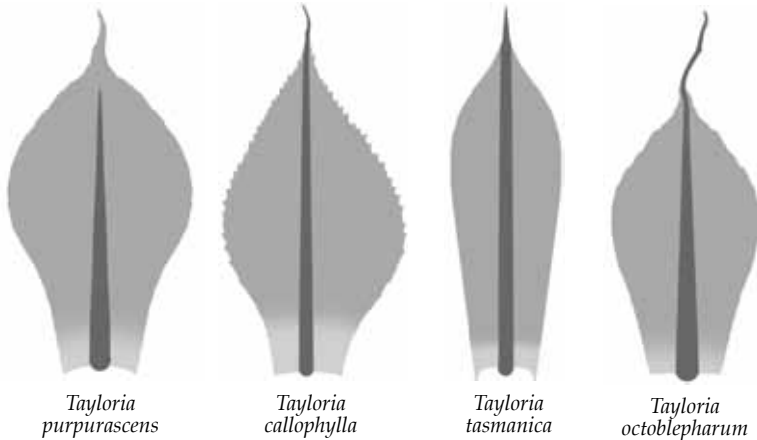
margin midleaf, costa terminus, and decurrent leaf base

50 μm, 50 μm, 50 μm

Key* to the New Zealand species of *Tayloria* (4)

- 1 Leaf margin sharply toothed or spinose above ● ***Tayloria callophylla***
 1: Leaf margin entire or weakly toothed above 2
- 2(1:) In upper leaves, the costa excurrent in a long, ± flexuose, pigmented arista
 ● ***Tayloria octoblepharum***
 2: In upper leaves, costa not excurrent into an arista (at most, cuspidate to acuminate) .. 3
- 3 Costa ending well below the leaf apex; capsule elliptic, purple or brown, peristome
 teeth erect or incurved when dry ● ***Tayloria purpurascens***
 3: Costa percurrent or shortly excurrent; capsule hypophysis inflated, grey; peristome
 teeth recurved when dry ● ***Tayloria tasmanica***

* based partly on Goffinet, B (2006): *Tayloria*. *Flora of Australia* 51, 174.



Tayloria callophylla (Müll.Hal.) Mitt.

form: tufts of erect, glossy, tomentose stems, to 40 mm tall, green to red
habitat: dung, bone, or moist, nutrient-rich soil, in montane scrub

leaf: *size:* 3–5 × 1.0–2.0 mm

shape: oblong-ovovate to elliptic from a narrow, weakly sheathing base

tip: long-acuminate, flexuose

base: basal cells longer than the blade cells; 1–2 rows of cells decurrent

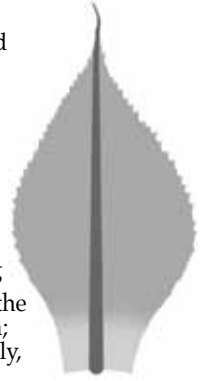
costa: ending below the apex or excurrent in the acumen

border: not differentiated

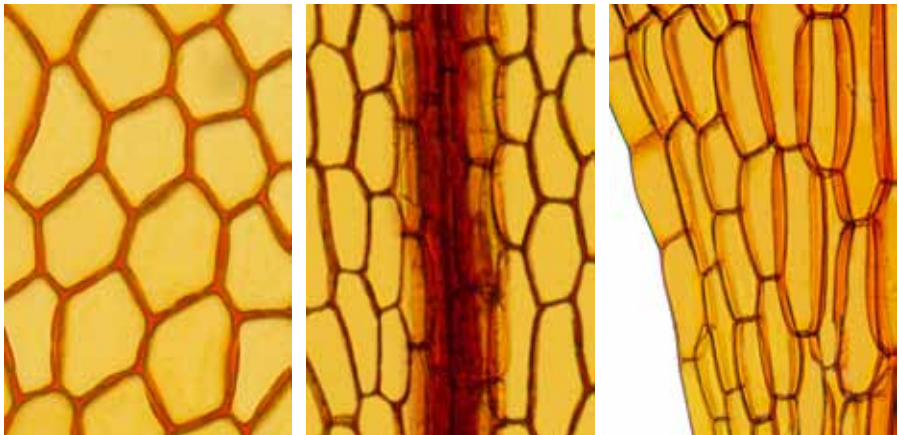
margin: strongly toothed to spinose, plane

cells: 50–120 × 20–60 μm, irregular to hexagonal, thin-walled, ± bulging

capsule: to 5 mm, ellipsoid, erect, long-necked, yellow to pale brown, the mouth narrow, upper neck stomatose; seta to 20 mm, yellow, smooth; calyptra mitrate, fimbriate; operculum conic; peristome exostome only, the teeth yellow, incurved when dry, completely closing the capsule mouth; spores 9–12 μm in diam., smooth



vegetative shoot (dry), leaf outline, leaf apex, and margin of upper leaf
 1 mm, 0.5 mm, 100 μm, 50 μm



cells of upper leaf, costa at midleaf, and margin near leaf base
 50 μm, 50 μm, 50 μm

continued next page

Tayloria octoblepharum (Hook.) Mitt.

form: densely tufted, erect, unbranched stems, 3–20 mm tall, matted with reddish or purple tomentum (smooth rhizoids)

habitat: dung, carcasses or bones, less often on bark, damp soil, or rock

leaf: size: 3.0–4.5 × 0.8–2.0 mm

shape: ovate-spathulate to elliptic; 1–2 rows of cells decurrent

tip: tapered to a long, slender, pigmented arista to 2 mm long

base: basal cells longer than the blade cells

costa: excurrent in the upper leaves in the flexuose awn

border: not differentiated

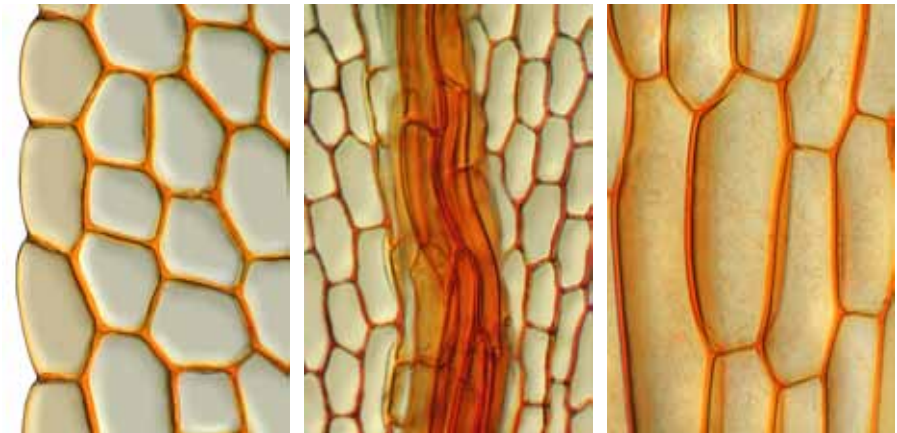
margin: entire to ± serrulate, recurved to revolute in midleaf

cells: 40–70 × 20–45 μm, oblong-hexagonal, thin-walled, smooth

capsule: 2–5 mm, fusiform, long-necked, yellowish, mouth narrow, purplish, the columella protruding from the urn at maturity; seta 3–15 mm, reddish; calyptra 4-lobed; peristome of 8 pairs of teeth reflexed against the mouth when dry; spores 12–15 μm in diam., smooth



fertile shoot (painting), capsules with and without a lid, leaf outline, and leaf apices (2)
 5 mm, 1 mm (2), 0.5 mm, 100 μm (2)



margin midleaf, costa at midleaf, and leaf base cells
 50 μm, 50 μm, 50 μm

Tayloria purpurascens (Hook.f. & Wilson) Broth.

form: densely tufted, tomentose (red-brown, smooth rhizoids), glossy, erect, sparsely branched, wine-coloured stems, 15–40 mm tall

habitat: damp soil, animal droppings, decaying stumps, and rock

leaf: size: 2.3–3.3 × 1.0–2.5 mm

shape: broadly obovate

tip: abruptly tapered to a reflexed apiculus or long piliform point

base: basal cells rectangular; alar cells little differentiated

costa: failing below the apiculus

border: not differentiated

margin: ± denticulate toward the apex, entire below, plane

cells: 60–115 × 25–30 μm, hexagonal-rhombic, thin-walled, smooth

capsule: 3.5–6 mm, fusiform, erect, exserted, dark reddish brown; seta 10–25 mm, orange to reddish purple; operculum bluntly conic; calyptra 4-lobed at the base; peristome 8 pairs of teeth, erect when dry, incurved when moist; spores 8–14 μm in diam.



vegetative shoot, mature capsules (dry) (2), leaf outline, and leaf apex
 ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 0.5 mm, ■ 1 mm



margin at midleaf, costa at midleaf, and young capsule and calyptra
 ■ 50 μm, ■ 50 μm, ■ 1 mm, ■ 0.1 mm

continued next page

Tayloria tasmanica (Hampe) Broth.

form: dense tufts of erect, sparsely branched, tomentose (dark red papillose thizoids) stems, female plants to 25 mm tall, males shorter

habitat: dung or wet soil in heathland, peatland, and alpine scrub, to 1200 m

leaf: size: 2.2–3.5 × 0.5–1.3 mm

shape: ovate-lanceolate

tip: tapering gradually to an acute or acuminate, ± reflexed tip

base: basal cells short- to long-rectangular

costa: percurrent or excurrent into a cusp or acumen, partially bistratose

border: not differentiated

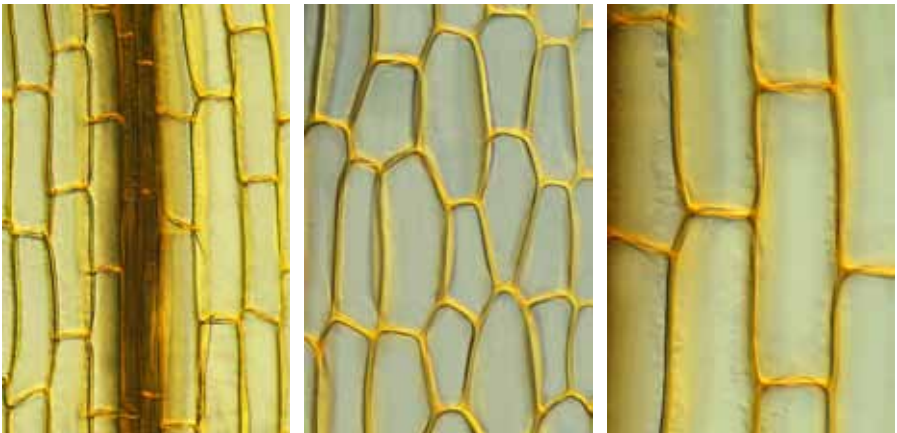
margin: entire, plane

cells: 30–80 × 15–45 μm, rectangular to ± hexagonal, thin-walled, smooth

capsule: to 1.2 mm, erect, exserted, with an inflated, ± globose, grey-white hypophysis; seta to 10 mm, rough below; peristome teeth 8, recurved when dry; spores 15–18 μm in diam., smooth



fertile shoot (dry), capsule (dry), leaf outline, leaf apex, club-hair, and margin midleaf
 1 mm, 1 mm, 0.5 mm, 50 μm, 10 μm, 50 μm



costa midleaf, cells at midleaf, and cells near leaf base
 50 μm, 50 μm, 50 μm

continued next page

Leptobryum pyriforme (Hedw.) Wilson

form: curves of slender, silky, pale, \pm unbranched, comose stems, radiculose below (reddish papillose rhizoids), pale green to yellowish, to 30 mm (sterile shoots)

habitat: damp soil or limestone, mostly in marshes, ditches, and glasshouses

leaf: size: 3.5–5.0 \times 0.8–1.0 mm

shape: subulate from a lanceolate base; perichaetial leaves much longer

tip: linear-setaceous subula, ending in an acute tip

base: alar region little differentiated

costa: wide, nearly filling the subula, percurrent

border: not differentiated

margin: entire or minutely denticulate above, plane

cells: 80–100 \times 8–10 μ m, linear, firm- to thin-walled, smooth

capsule: 1.5–2.5 mm, pyriform, inclined to pendent, wide-mouthed when empty, reddish brown and glossy when mature; seta 20–50 mm, slender, flexuose, reddish; operculum apiculate; peristome double; spores 10–13 μ m in diam.

note: \pm cosmopolitan, a NZ adventive, often invades flower-pots in glasshouses



vegetative shoot, capsule, operculum, calyptra, leaf outline, and leaf apex

■ 1 mm, ■ 0.1 mm, ■ 0.1 mm, ■ 0.1 mm, ■ 1 mm, ■ 10 μ m



upper leaf, margin in upper leaf, and margin in lower leaf

■ 10 μ m, ■ 10 μ m, ■ 10 μ m

Meesia uliginosa Hedw.

form: dense tufts of erect, \pm unbranched stems, tomentose, 20–50 mm

habitat: wet limey soil, peaty humus, or rarely rotting logs, to 1500 m

leaf: size: 1.0–3.2 \times 0.6 mm; hairs with pigmented bases abundant in axils

shape: lanceolate to oblong-lingulate, keeled above, not 3-ranked

tip: obtuse to broadly rounded

base: not decurrent; basal cells long-rectangular; alar cells not differentiated

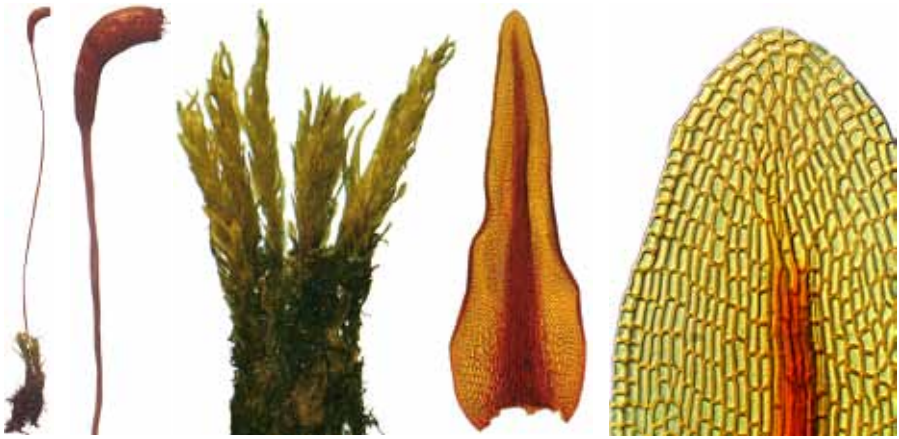
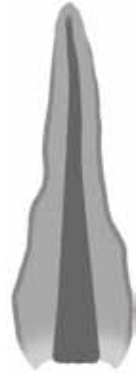
costa: subpercurrent, wide at base (half the leaf width), prominent abaxially

border: not differentiated

margin: entire to serrulate above, plane to recurved in midleaf

cells: 20–40 \times 9–13 μ m, oblong to rectangular, firm-walled, smooth

capsule: 1.5–4 mm, erect, clavate-pyriform, curved, long-necked, the neck wrinkled when dry; seta 15–40 mm; operculum bluntly conic; calyptra cucullate, smooth, naked; peristome double, the exostome teeth 16, reduced, the endostome segments 2–4 times longer, keeled, perforate, smooth; spores 45–55 μ m in diam., papillose



fertile shoot (dry), capsule, vegetative shoots (moist), leaf outline, and leaf apex

5 mm, 1 mm, 1 mm, 0.5 mm, 50 μ m



margin at midleaf, costa terminus, and leaf basal angle

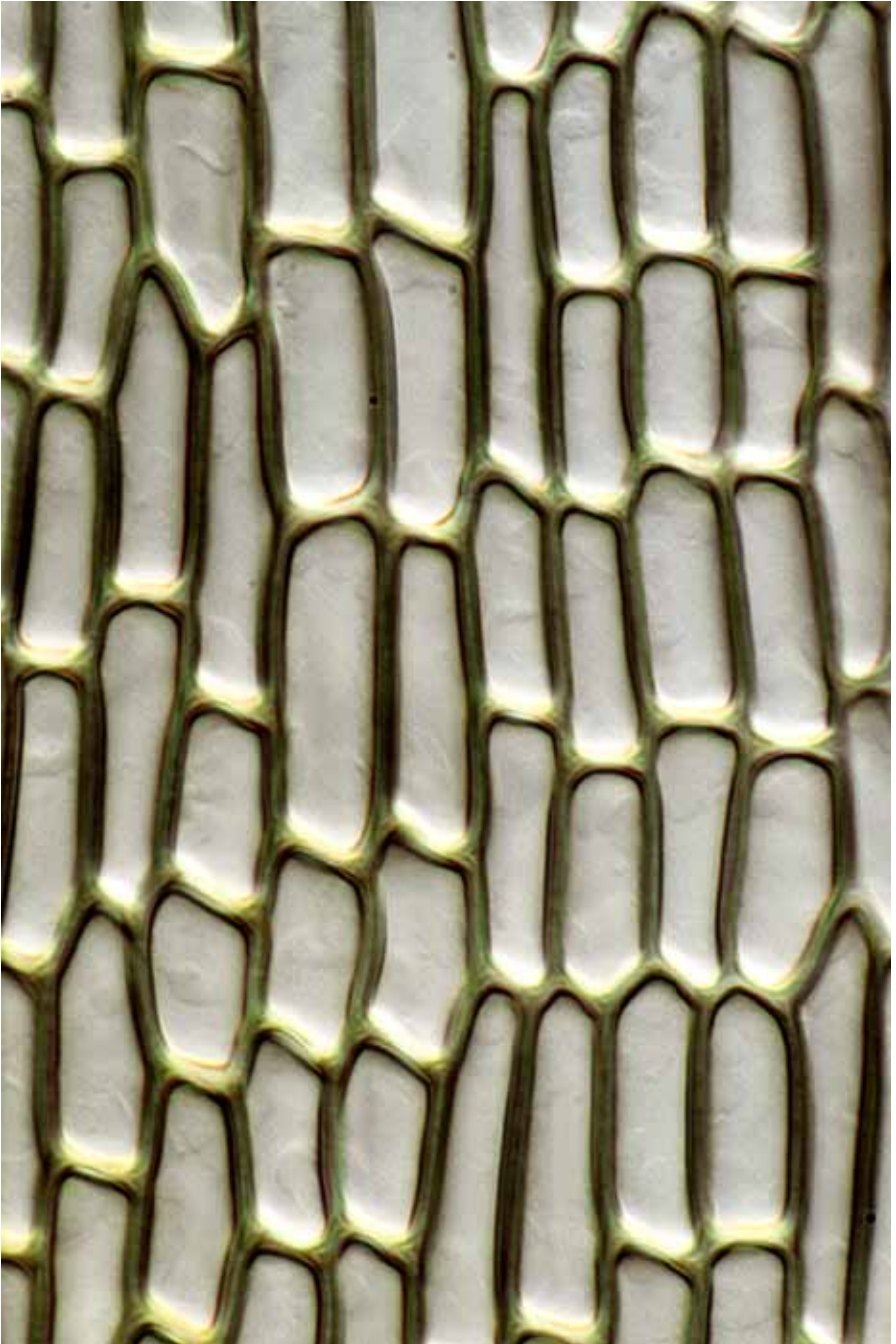
10 μ m, 50 μ m, 50 μ m

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Meesia uliginosa axillary hairs showing 2-3 pigmented basal cells
10 μm

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Meesia uliginosa lamina cells midleaf
10 μm

Pulchrinodus inflatus (Hook.f. & Wilson) B.H.Allen

form: loosely matted, ± erect, sparsely branched stems, not tomentose, 10–50(–300) mm, with foliose-ciliate pseudoparaphyllia, the leaves papery, glossy, golden, and translucent

habitat: exposed damp soil, on volcanic rocks or in scrub in geothermal areas, to 1000 m

leaf: size: 5–8 × 2–3 mm, rugose-wrinkled wet or dry

shape: elliptic to narrowly ovate, concave, undulate, markedly papery

tip: acute with hyaline hair-point

base: alar regions hyaline, base pigmented at the insertion; axillary filaments 6–8 cells long, the basal cells pigmented; pseudoparaphyllia foliose-ciliate

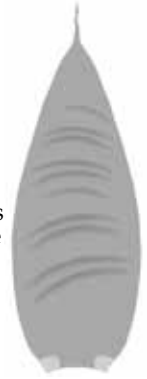
costa: none or short and double

border: not differentiated

margin: entire to denticulate, convolute above, incurved below

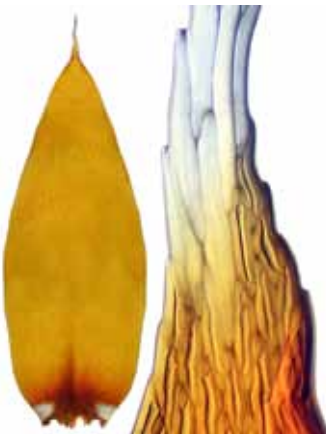
cells: 60–120 × 7–9 μm, rhombic-linear, incrassate, strongly porose, smooth

capsule: unknown



habit (dew-wetted) and fully hydrated shoots (2)

50 mm, 10 mm, 10 mm



leaf outline, base of hair-point, porose cells at midleaf, and alar region

1 mm, 10 μm, 10 μm, 10 μm

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Pulchrinodus inflatus vegetative habit (moist) (Rangitoto Island)
5 mm

Key* to the New Zealand genera of Bryaceae (5)

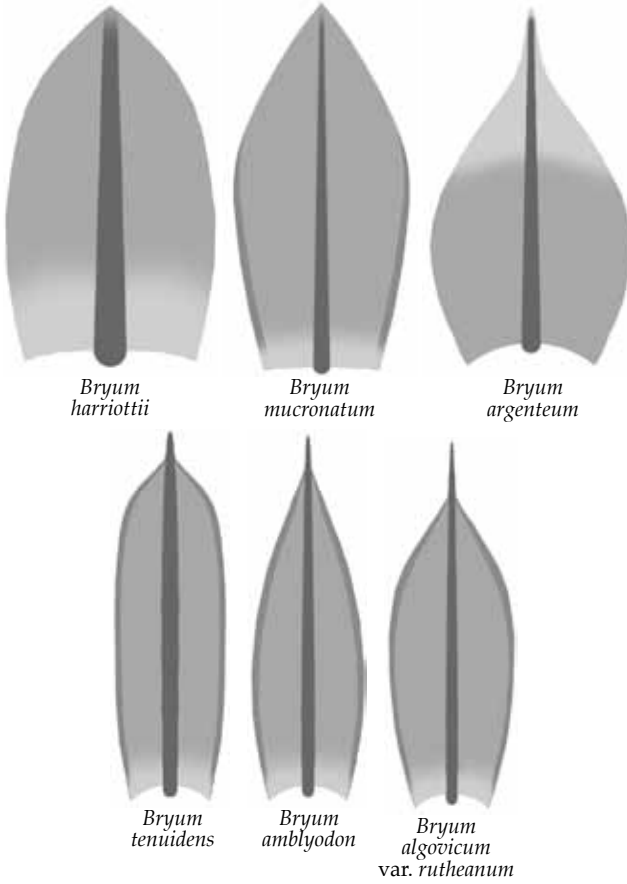
- 1 Main stems or innovations julaceous.....2
 1: Main stems or innovations not julaceous3
- 2(1) Costa failing well below the leaf apex; apex rounded **Plagiobryum**
 2: Costa usually excurrent, but at least subpercurrent; leaf apex mostly acute **Bryum**
- 3(1:) Plants rosulate; most leaves wider above midleaf..... **Rosulabryum**
 3: Plants not rosulate; most leaves wider below midleaf4
- 4(3:) Propagula in leaf axils or underground **Gemmabryum**
 4: Propagula usually absent.....**Ptychostomum**

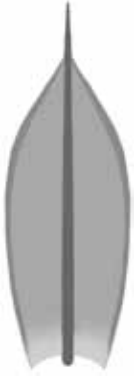
* based partly on Spence, JR (2011): Bryaceae. Bryophyte Flora of North America, (provisional publication), BFNA web-site.

Key* to the New Zealand species and infraspecies of *Bryum* (6)

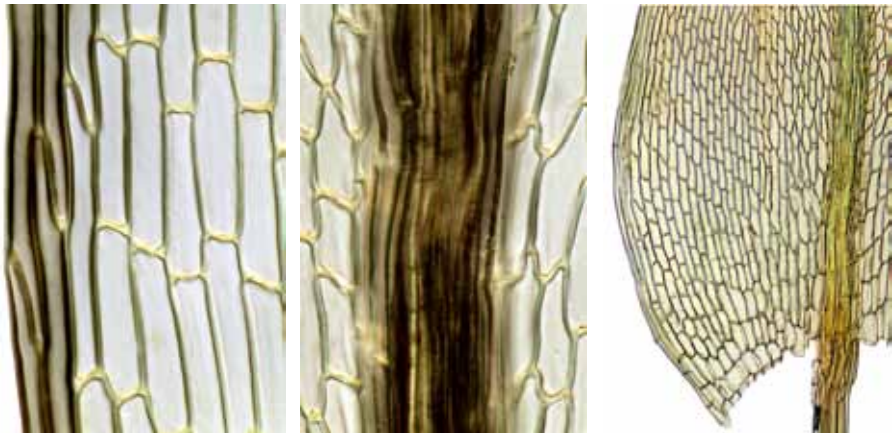
- 1 Plants silvery from hyaline leaf tips ● ***Bryum argenteum***
 1: Plants not silvery 2
- 2(1:) Leaf distinctly bordered 3
 2: Leaf not or only faintly bordered ● ***Bryum harriottii***
- 3(2) Costa failing below the apex to percurrent ● ***Bryum mucronatum***
 3: Costa excurrent 4
- 4(3:) Vertical and oblique joins clearly visible between adjacent transverse articulations
 of the exostome teeth ● ***Bryum algovicum* var. *rutheanum***
 4: Joins between adjacent transverse articulations of the exostome teeth either absent or
 obscure 5
- 5(4:) Leaves ovate-lanceolate to lanceolate; margin recurved ● ***Bryum amblyodon***
 5: Leaves oblong; margin plane ***Bryum tenuidens***

* based partly on Smith, AJE; Smith, R (1978): *The Moss Flora of Britain and Ireland*.
 Cambridge University Press, Cambridge, 384.



Bryum algovicum var. **rutheanum** (Warnst.) Crundw.**form:** tufts of erect, ± green, comose stems to 15 mm, often radiculose below**habitat:** sandy and basic soils or rock walls and crevices in dry, exposed sites**leaf:** size: 0.8–2.0 × 0.3–0.7 mm**shape:** ovate to lanceolate, slightly concave, not decurrent**tip:** acuminate**base:** basal cells rectangular, longer than other lamina cells**costa:** excurrent in a long narrow cusp**border:** 2–4 rows of linear, dark, thicker-walled cells**margin:** entire to ± denticulate above, recurved**cells:** 40–60 × 20 μm, hexagonal to rectangular, thin-walled, smooth**capsule:** 2–3 mm, pyriform, pendent, symmetric, red-mouthed; seta 10–30 mm; operculum apiculate; exostome strongly attached to endostome and thus appearing chambered; endostome processes ovately perforate; spores 22–35 μm in diam., strongly papillose, light brown**notes:** no tubers, gemmae, or other specialized asexual structures

vegetative shoots (dry), mature capsule, peristome tooth, leaf outline, and leaf apex (2)
 1 mm, 1 mm, 1 mm, 50 μm, 0.1 mm, 50 μm, 50 μm



margin below midleaf, costa midleaf, and leaf basal angle
 50 μm, 50 μm, 50 μm

continued next page



Bryum algovicum var. *rutheanum* mature capsule and "chambered" exostome tooth
1 mm, 10 μ m

Bryum amblyodon Müll.Hal.

form: erect, strongly branching, turf-forming stems, 15–23 mm tall, comose, green to yellowish above, reddish below with papillose rhizoids

habitat: on thin soil over calcareous rock or in boulder fields up to 1470 m

leaf: size: 2–4 × 0.8–1

shape: oblong-lanceolate, erect when moist, twisted around stem when dry

tip: abruptly acuminate, with a narrow, often red-pigmented awn

base: basal cells ± red-pigmented, base weakly decurrent on both sides

costa: strong, merging with borders at apex, excurrent and filling the awn

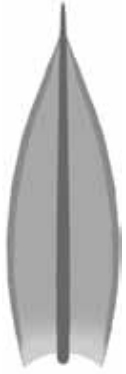
border: 3–6 rows of linear, thick-walled cells

margin: entire to minutely denticulate, ± recurved at margins

cells: 50–75 × 15–18 μm, oblong-hexagonal, thin-walled, smooth

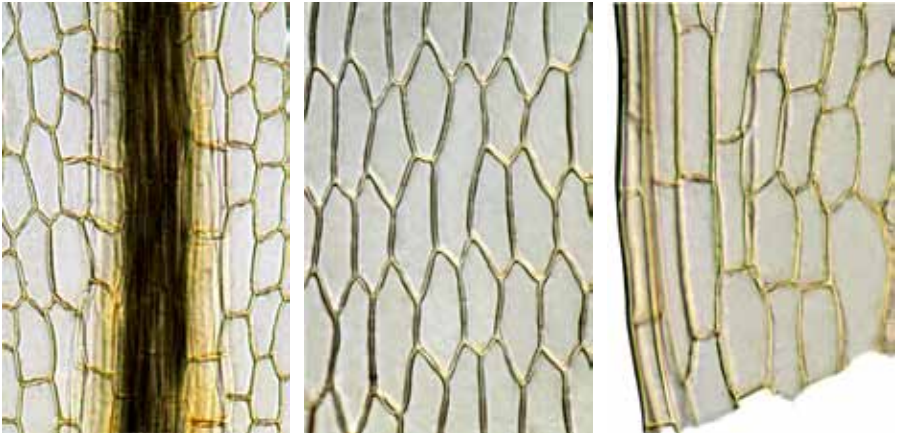
capsule: to 4 mm long, half of it neck, pendent, clavate, reddish; operculum conic; exostome brownish, acuminate, lamellate; endostome from a high membrane, the segments fenestrate, as tall as the exostome, lacking cilia

note: inflorescences are irregular mixtures of male and female (synoicy)



vegetative shoots (dry), leaf apex (2), subapex, leaf outline, and margin above midleaf

■ 1 mm, ■ 1 mm, ■ 50 μm, ■ 10 μm, ■ 10 μm, ■ 1 mm, ■ 10 μm



costa, lamina cells, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 10 μm

continued next page



Bryum amblyodon midleaf border
10 μm

Bryum argenteum Hedw.

form: cushions of erect, julaceous stems, 5–20 mm, leaves silvery green

habitat: soil, rock, concrete, asphalt, tiles, in disturbed sites, to 2300 m

leaf: size: 0.6–0.9 × 0.4 mm

shape: ovate, concave, the upper third of the leaf hyaline

tip: acute to acuminate

base: not decurrent; basal cells mostly quadrate, thin-walled

costa: failing below the apex or disappearing in the acumen

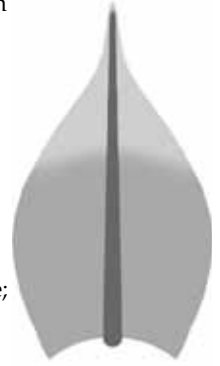
border: not differentiated

margin: entire, plane

cells: 40–70 × 12–15 μm, rhombic, thin-walled, smooth

capsule: 0.9–2.0 mm, oblong-cylindric, reddish, ± pendent, the neck short and wrinkled; seta 8–20 mm, red; operculum convex, apiculate; peristome double, the exostome teeth 16, bordered, endostome segments 16, with cilia; spores 9–15 μm in diam., smooth

notes: cosmopolitan; said to be the most abundant plant in the world



fertile habit, vegetative habit, and julaceous shoots

■ 1 mm, ■ 1 mm, ■ 1 mm



leaf outline, margin at midleaf, and costa at midleaf

■ 0.1 mm, ■ 10 μm, ■ 10 μm

continued next page



Bryum argenteum vegetative habit (moist)
1 mm

continued next page

Bryum harriottii R.Br.ter

form: curves of branched, julaceous, erect stems, 5–20 mm, the leaves bright green

habitat: damp soil and wet rock or soil-filled crevices, to 1359 m

leaf: size: 0.6–1.0 × 0.4–0.6 mm

shape: ovate to orbicular, strongly concave

tip: rounded

base: not decurrent; basal cells rectangular

costa: red toward the base, failing shortly below the apex

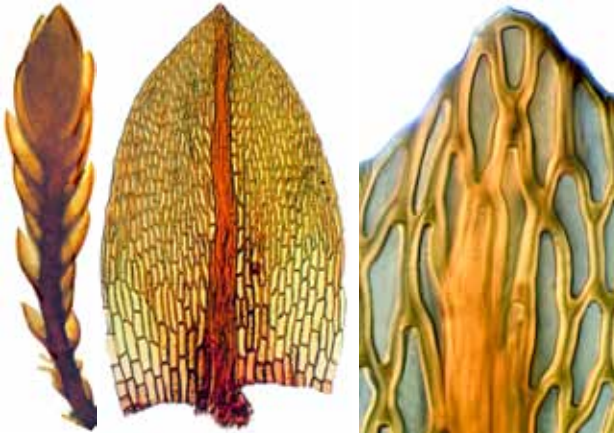
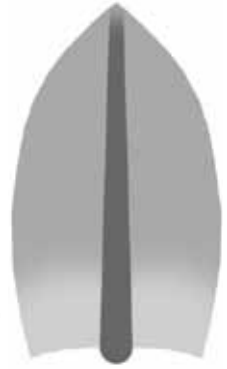
border: not differentiated

margin: entire, plane

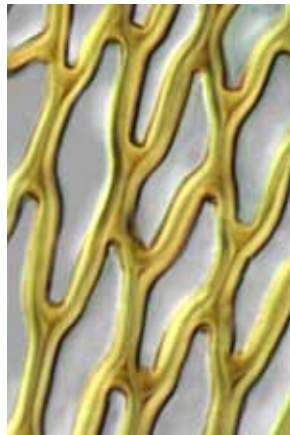
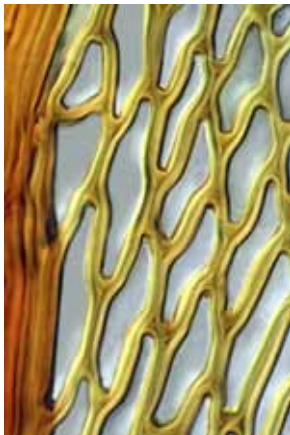
cells: 21–30 × 10–12 μm, rhombic-hexagonal, thick-walled, smooth

capsule: 2–3 mm, ovate-pyriform, narrow-necked, nodding; seta 10–20 mm; peristome bryoid, cilia absent or reduced; spores 22–30 μm in diam.

note: *Bryum argenteum* differs in having a silvery leaf tip



vegetative shoot, leaf outline, leaf apex, and margin midleaf
 0.5 mm, 0.1 mm, 10 μm, 10 μm



costa at midleaf, cells at midleaf, and leaf basal angle
 10 μm, 10 μm, 10 μm

continued next page



Bryum harriottii capsules (dry)

1 mm

continued next page

Bryum mucronatum Mitt.

form: tufts or turves of erect, branched, comose, radiculose stems, to 14 mm
habitat: soil over rock, alpine, 1000–1800 m

leaf: *size:* 2–3 × 1 mm (upper comose leaves)

shape: ovate to oblong-ovate

tip: acute, ± mucronate

base: basal cells rectangular, hyaline

costa: percurrent to shortly excurrent in a mucro

border: 2–3 rows of elongate, firm-walled cells

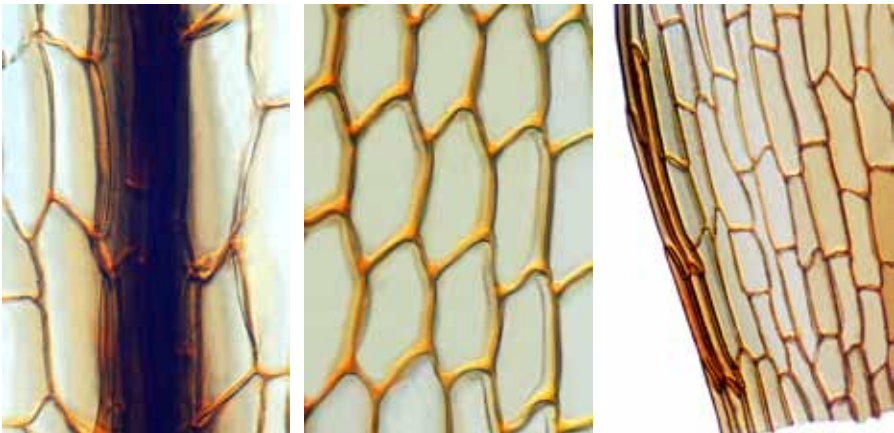
margin: entire, plane above, recurved below

cells: 70–90 × 20–30 μm, rectangular to hexagonal, thin-walled, smooth

capsule: 3–5 mm, pyriform, long-necked, ± horizontal, long-exserted, red-brown; seta 15–30 mm; operculum apiculate; peristome double; exostome teeth yellowish; endostome segments perforate; cilia 2–3; spores 21–30 μm in diam.

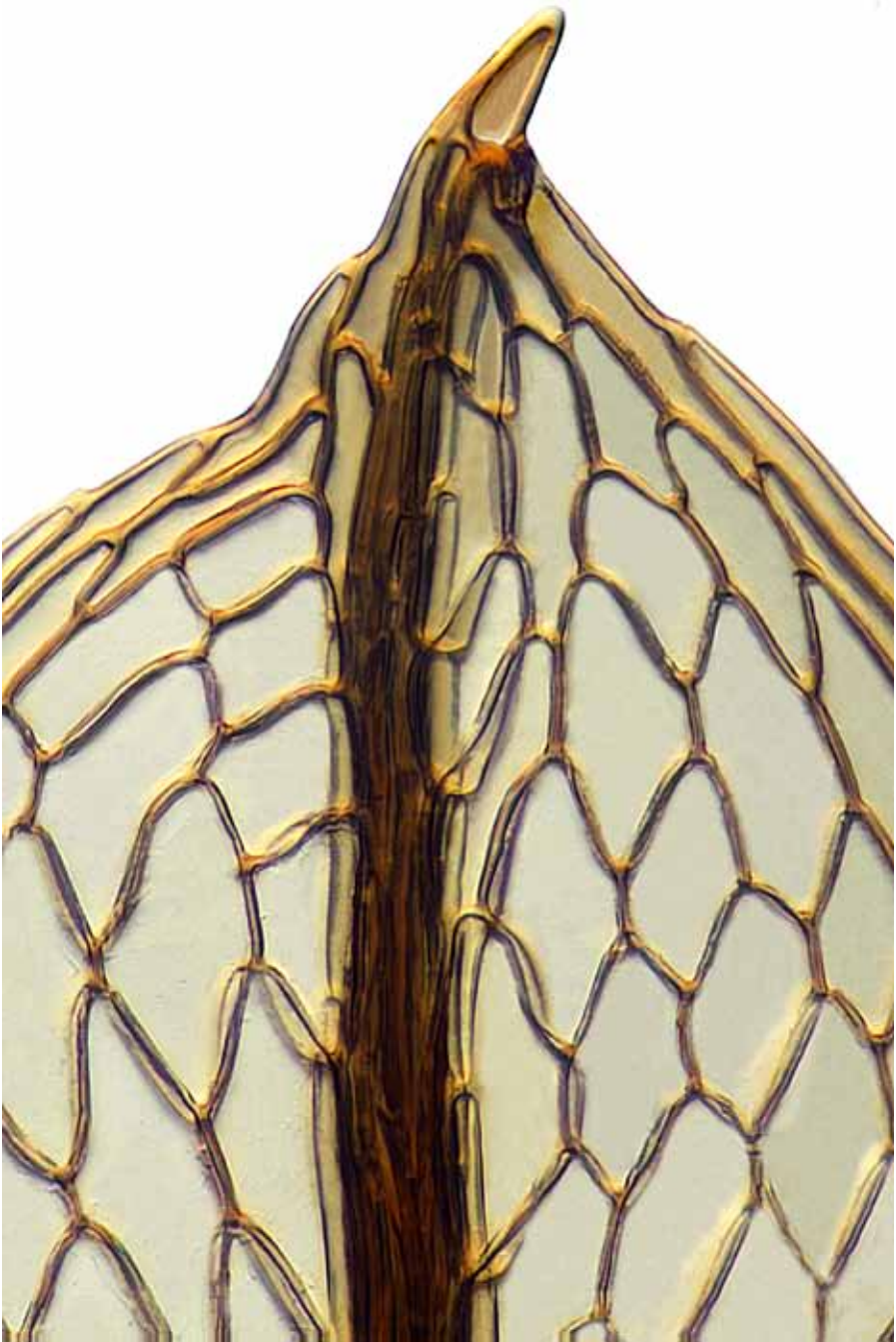


fertile shoot (dry), capsule (dry), leaf outline, leaf apex, and margin midleaf
 5 mm, 1 mm, 0.5 mm, 50 μm, 50 μm



costa at midleaf, cells at midleaf, and leaf basal angle
 50 μm, 50 μm, 50 μm

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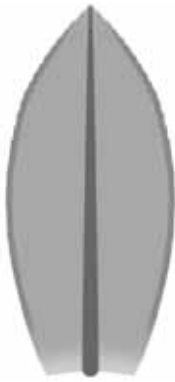


Bryum mucronatum leaf apex
10 μm

Key* to the New Zealand species of *Gemmabryum* (14)

- 1 Cells in the upper third of the lamina angled away from the costa at 20–45°; lower lamina cells rectangular; transition from upper to lower cells gradual; asexual gemmae usually lacking 2
- 1: Cells in the upper third of the lamina not angled away from the costa; lower lamina cells subquadrate to short-rectangular; transition from upper to lower cells abrupt; asexual gemmae usually present (rhizoidal or stem tubers or axillary bulbils) 4
- 2(1) Stems taller than 20 mm; costa percurrent; leaf apex obtuse to broadly acute ● *Gemmabryum laevigatum*
- 2: Stems shorter than 20 mm; costa excurrent as a short stout point; leaf apex acute 3
- 3(2): At least the lower half of the leaf bordered, weakly concave; leaves equidistant on the stem; plants often encrusted with carbonates ● *Gemmabryum clavatum*
- 3: Leaf not bordered, strongly concave; leaves in imbricate comal tufts on the stem; plants not encrusted with carbonates ● *Gemmabryum crassum*
- 4(1): Rhizoidal tubers present 5
- 4: Rhizoidal tubers lacking 11
- 5(4) Leaves strongly imbricate when moist ● *Gemmabryum australe*
- 5: Leaves erect-spreading when moist 6
- 6(5): Tubers mostly < 100 μm long ● *Gemmabryum sauteri*
- 6: Tubers mostly > 120 μm long 7
- 7(6): Leaves bordered; plants usually tinted red ● *Gemmabryum rubens*
- 7: Leaves not bordered; plants green, brown, or golden 8
- 8(7): Tuber cells distinctly protuberant ● *Gemmabryum chrysonuron*
- 8: Tuber cells not protuberant 9
- 9(8): Tubers golden-yellow *Gemmabryum tenuisetum*
- 9: Tubers red, red-purple, or red-brown 10
- 10 Rhizoids yellowish to brown ● *Gemmabryum radiculosum*
- 10: Rhizoids deep violet or purple, rarely reddish ● *Gemmabryum ruderale*
- 11(4): Bulbils in axils of upper leaves of sterile stems 12
- 11: Bulbils lacking 13
- 12(11) Leaves ovate-lanceolate; capsule neck gradually tapered to the seta ● *Gemmabryum dichotomum*
- 12: Leaves lanceolate to triangular; capsule neck abruptly contracted to the seta ● *Gemmabryum coronatum*
- 13(11): Leaves comose, 2–3 mm long; costa thin; border 3–5 rows of firm-walled cells that fuse with the acumen at the leaf tip; lamina cells $45\text{--}60 \times 12\text{--}15 \mu\text{m}$ ● *Gemmabryum caespiticium*
- 13: Leaves not comose, 0.4–1.0 mm long; costa stout; border weak, with cells slightly narrower than other lamina cells; lamina cells $30\text{--}40 \times 2\text{--}4 \mu\text{m}$ ● *Gemmabryum preissianum*

* based on Spence, JR; Ramsay, HP (2006): *Bryaceae. Flora of Australia* 51, 288



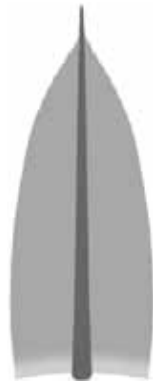
*Gemmabryum
laevigatum*



*Gemmabryum
dichotomum*



*Gemmabryum
clavatum*



*Gemmabryum
rubens*



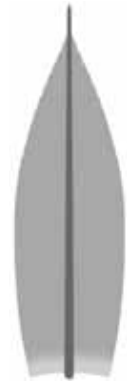
*Gemmabryum
crassum*



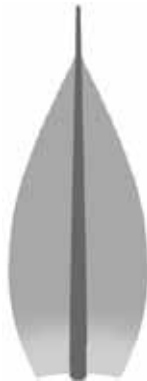
*Gemmabryum
australe*



*Gemmabryum
sauteri*



*Gemmabryum
chrysoneuron*



*Gemmabryum
coronatum*



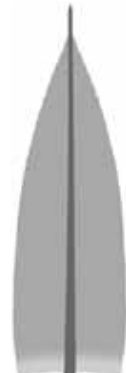
*Gemmabryum
caespiticium*



*Gemmabryum
radiculosum*



*Gemmabryum
ruderale*



*Gemmabryum
tenuisetum*



*Gemmabryum
preissianum*

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Gemmabryum sp. male shoots
1 mm

continued next page

Gemmabryum australe (Hampe) J.R.Spence & H.P.Ramsay

form: densely tufted, erect, ± branched, imbricate stems, 10–20 mm tall
habitat: silty soil in open stony river beds

leaf: size: 1.5 mm

shape: ovate-lanceolate

tip: narrowly acuminate

base: basal cells short-oblong to subquadrate; alar cells not differentiated

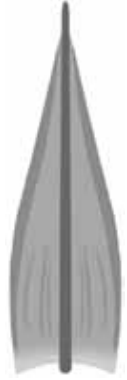
costa: excurrent in a weakly denticulate arista

border: weak, 1–2 rows of long, narrow cells

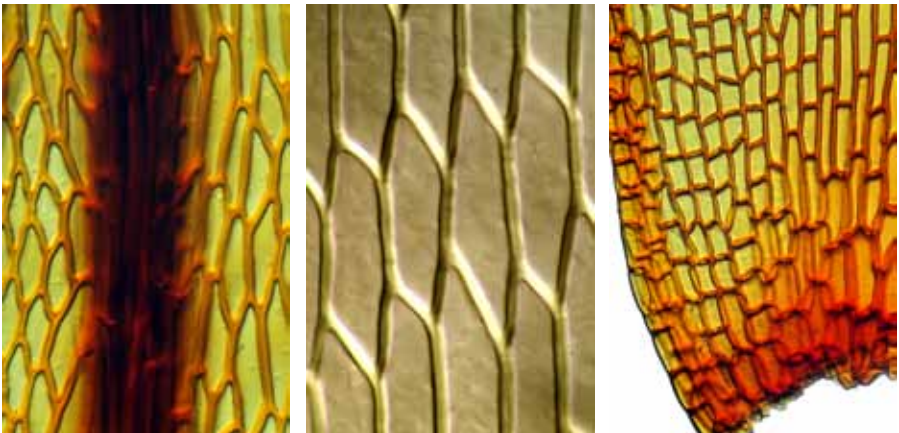
margin: entire, revolute throughout

cells: 25–35 × 6–12 μm, rhombic-hexagonal, firm-walled, smooth

capsule: 2–2.5 mm, pyriform or oval, pendent, long-exserted, purple-brown; seta 15–25 mm, slender, flexuose, purplish; operculum apiculate, deep purple, glossy; peristome double, exostome teeth orange-yellow, hyaline-bordered, endostome segments perforate, cilia 2–3; spores 7–8 μm in diam., smooth

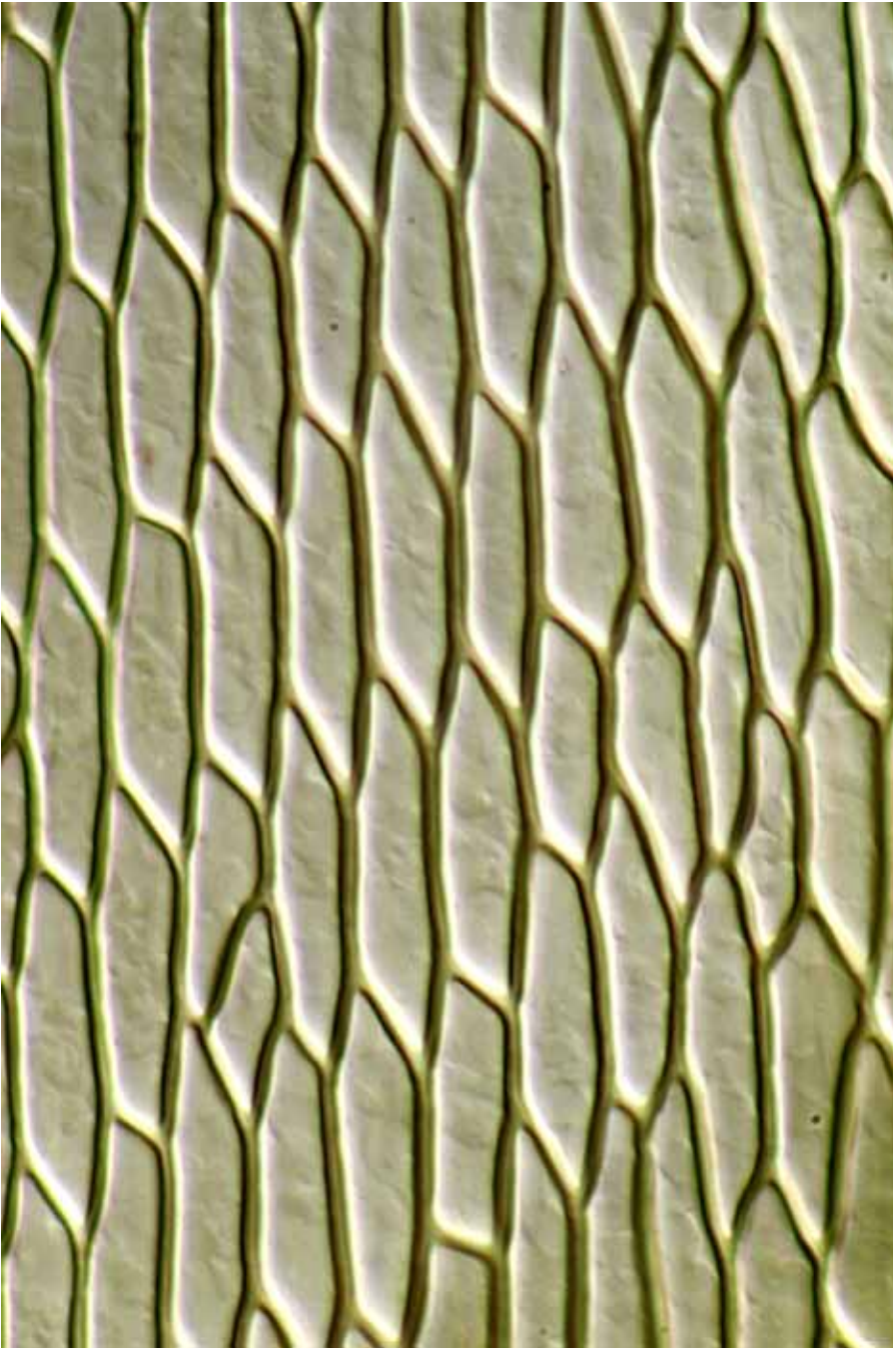


vegetative shoots (dry) (2), leaf outline, leaf apex (2), and revolute margin midleaf
 ■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 50 μm, ■ 50 μm, ■ 10 μm



costa at midleaf, cells at midleaf, and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 10 μm

continued next page



Gemmabryum australe cells midleaf
10 μm

continued next page

Gemmabryum caespiticium (Hedw.) J.R.Spence

form: tufts of simple, erect, comose, radiculose, red stems, to 8 mm, the leaves yellow-green, glossy

habitat: soil of tussockland, riverbeds, lawns, or disturbed sites, to 950 m

leaf: size: 1.5–2.8 mm

shape: oblong to ovate-lanceolate

tip: long-acuminate

base: not decurrent; alar cells inflated, thin-walled, red-pigmented

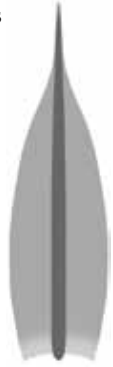
costa: reddish at base; excurrent in the acumen

border: 3–5 rows of elongate, firm-walled cells that fuse with the acumen cells

margin: entire below, minutely denticulate above, ± recurved

cells: 45–60 × 12–15 μm, rhombic-hexagonal, firm-walled, smooth

capsule: 2–3 mm, clavate, short-necked, pendent, long-exserted, reddish; seta 20–45 mm; operculum conic, apiculate; peristome double; exostome teeth yellow; endostome segments perforate; cilia 2–3; spores 9–16 μm in diam.



vegetative shoot (dry), leaf outline, leaf apex, leaf subapex, and margin midleaf
 1 mm, 0.5 mm, 50 μm, 50 μm, 10 μm



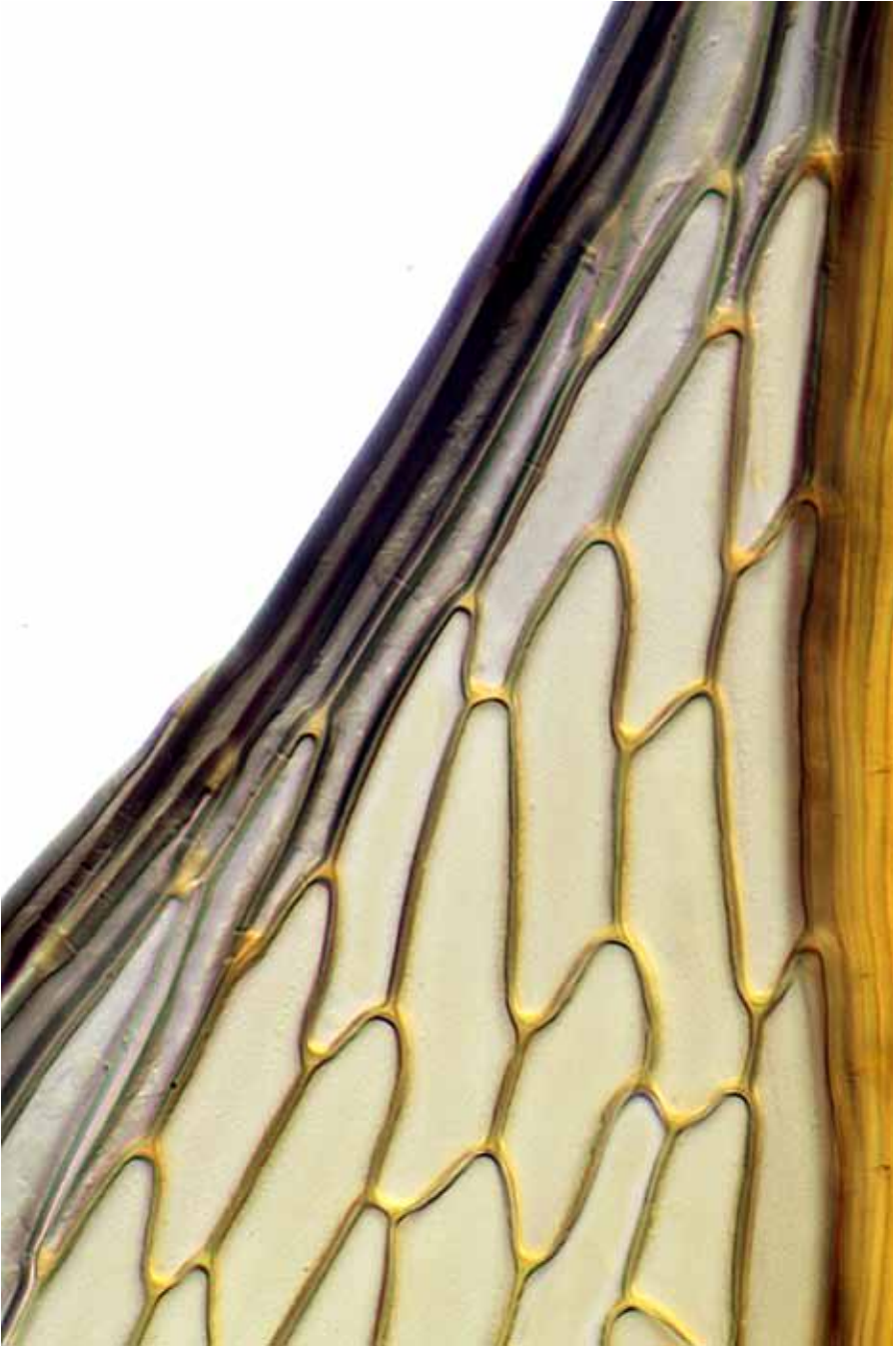
costa midleaf, juxtacostal cells midleaf, and leaf basal angle
 10 μm, 10 μm, 50 μm

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Bryum caespiticium vegetative shoots (dry)
1 mm

continued next page



Bryum caespiticium margin of upper leaf
10 μm

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

form: tufts of erect, yellowish, red-tinged, glossy stems, 5–15 mm; tubers red, > 500 μm long, with bulging cells

habitat: soil or soil over rock, often coastal

leaf: size: 1.0–1.5 mm

shape: ovate-lanceolate to narrowly lanceolate

tip: acute to acuminate

base: juxtacostal basal cells short-rectangular, marginal cells quadrate

costa: strong, long-excurrent in a cusp, yellow

border: absent or weak, 1–2 rows of long, narrow cells

margin: entire below, finely serrulate above, plane to revolute below

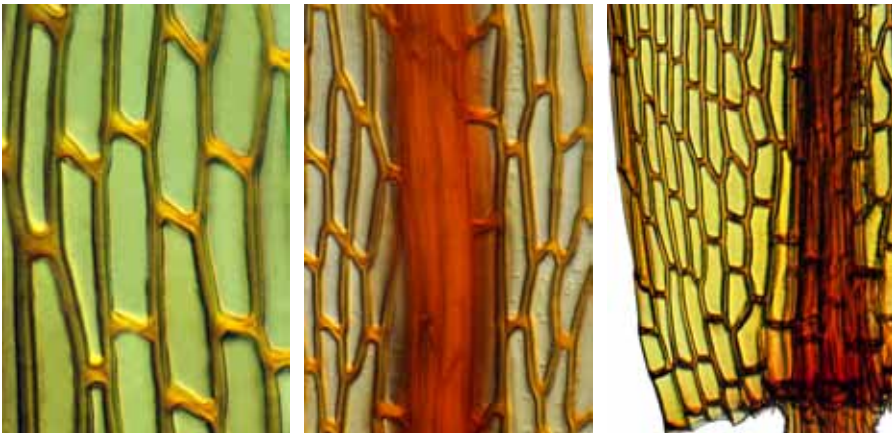
cells: 40–60 \times 10–15 μm , rhombic, firm-walled, smooth

capsule: 2–3 mm, clavate, pendent, exserted, red-brown; seta 15–40 mm, purple-red; operculum apiculate; peristome double, exostome teeth hyaline-bordered, endostome basal membrane tall, segments gaping, cilia 2; spores 10–13 μm in diam., smooth



vegetative shoot (dry), leaf outline, leaf apex, and margin midleaf

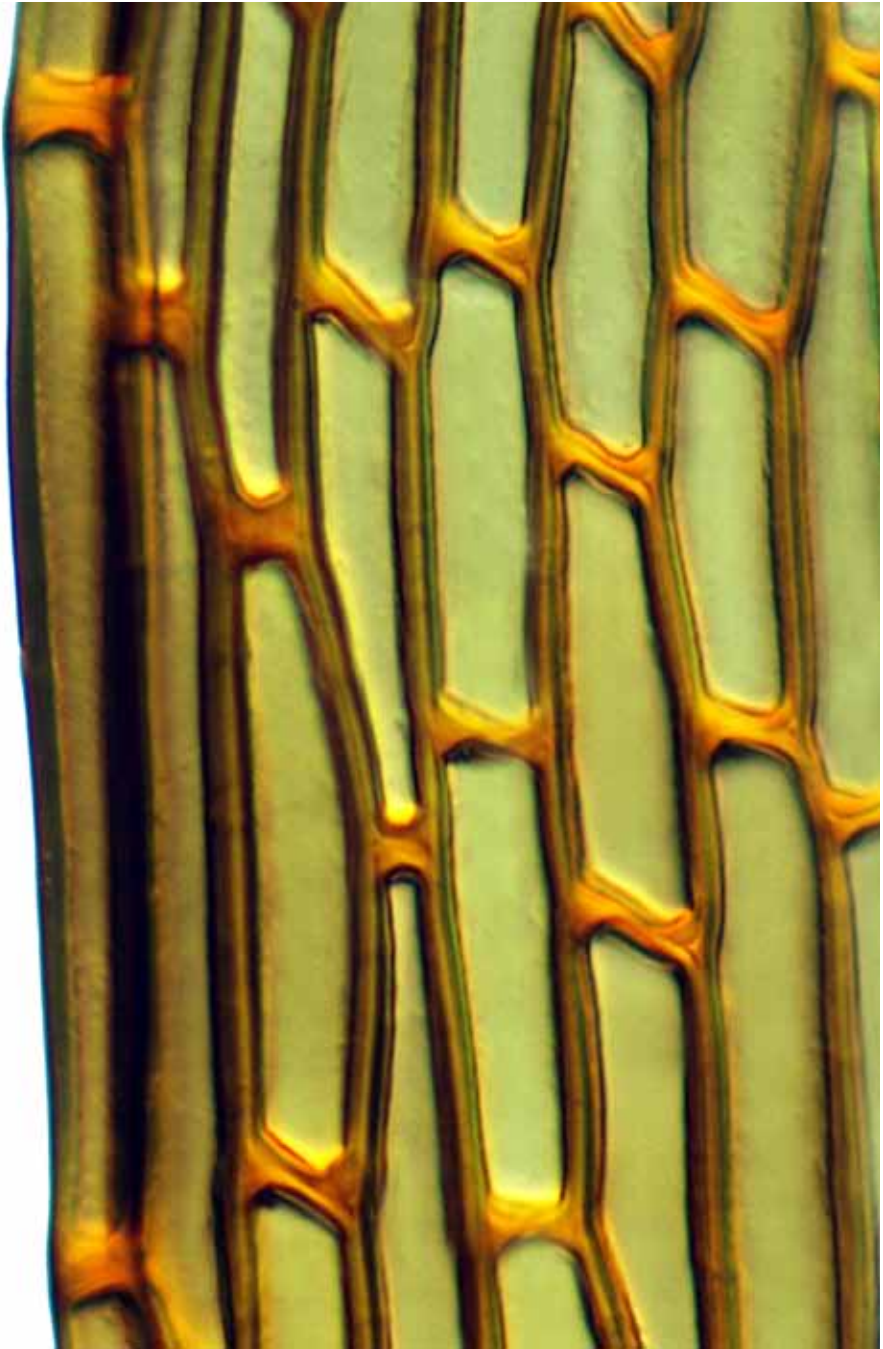
■ 1 mm, ■ 0.1 mm, ■ 100 μm , ■ 10 μm



cells at midleaf, costa at midleaf, and leaf basal angle

■ 10 μm , ■ 10 μm , ■ 10 μm

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Gemmabryum chryseurum margin midleaf
10 μm

continued next page

Gemmabryum clavatum (Schimp.) J.R.Spence & H.P.Ramsay

form: cushions or tufts of erect, branched, tomentose, red-tinged stems, 10 mm; tubers globose, red-brown, 75–150 μm long

habitat: soil or rock in open, \pm wet sites, with other mosses, to 1220 m

leaf: size: 1.0–2.0 \times 0.5–0.9 mm

shape: oblong-lanceolate, \pm concave

tip: acute, cuspidate

base: basal cells quadrate

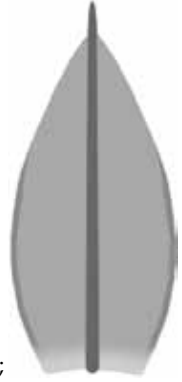
costa: shortly excurrent as a rigid reddish or brownish cusp

border: 1–3 midleaf rows of narrow, incrassate, \pm pigmented cells

margin: entire, plane

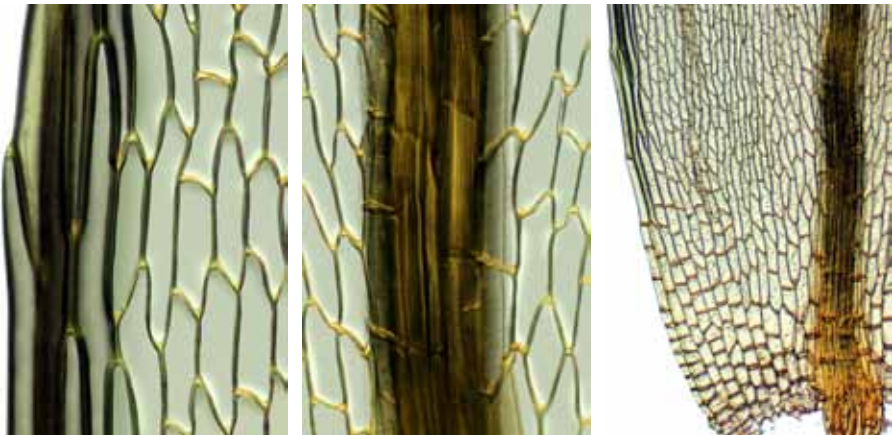
cells: 27–45 \times 9–12 μm , oblong-hexagonal, firm-walled, smooth

capsule: 2–4 mm, elongate-clavate, subpendent, curved, apophysate, exserted, red-purple; seta 10–20(–40) mm; operculum conic; peristome double, endostome cilia variable from rudimentary to fully developed; spores 12–27 μm in diam.



vegetative shoots (dry) (2), capsule (dry), leaf outline, and leaf apex

1 mm, 1 mm, 0.5 mm, 0.5 mm, 50 μm



margin at midleaf, costa at midleaf, and leaf basal angle

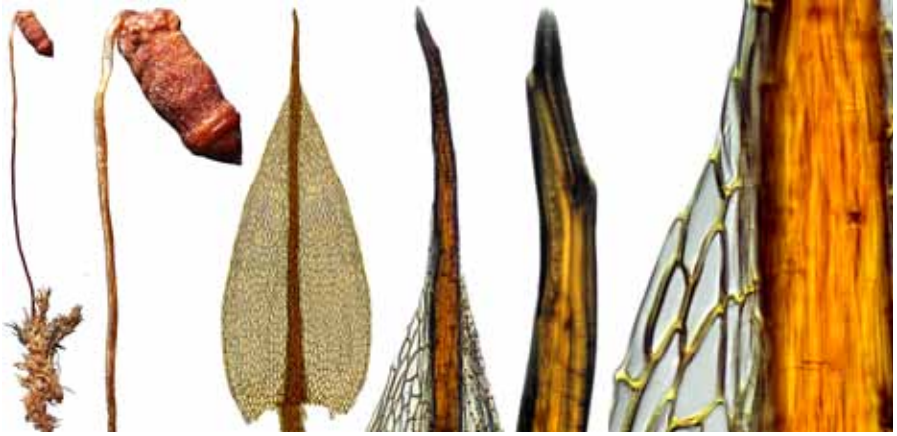
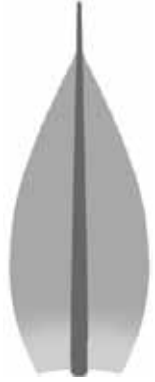
50 μm , 50 μm , 100 μm

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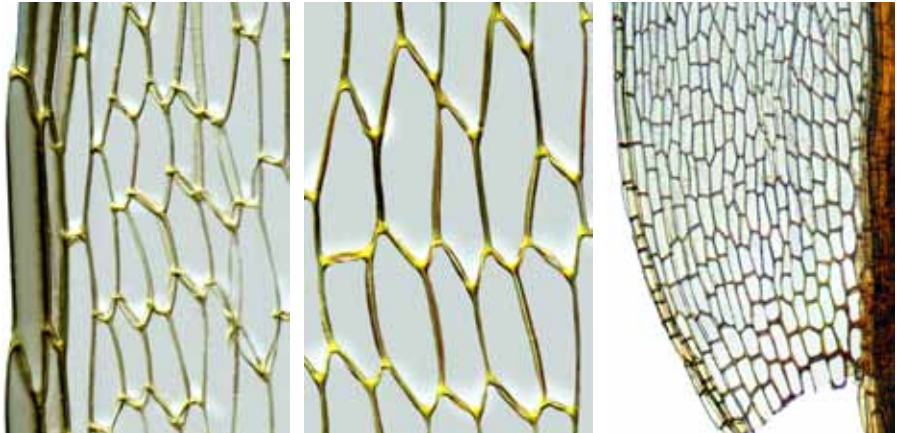
Gemmabryum clavatum margin midleaf
10 μ m

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Gemmabryum coronatum (Schwägr.) J.R.Spence & H.P.Ramsay**form:** curves of erect, sparsely branched, radiculose stems, 5–15 mm**habitat:** soil, lignum, or rock in open, disturbed or burnt sites, to 500 m**leaf:** size: 0.6–1.5 × 0.4–0.6 mm*shape:* oblong to ovate-lanceolate, ± concave*tip:* acute to acuminate, ending in a nearly smooth hair-point*base:* not decurrent; basal cells ± quadrate; leafy bulbils in axils*costa:* excurrent in the cusp*border:* weak, 2–4 rows of narrow, dark cells*margin:* entire to weakly serrulate above, recurved in the lower half*cells:* 30–60 × 8–12 μm, ± rhombic, firm-walled, smooth**capsule:** 1.6–1.8 mm, oblong, cernuous to pendent, exserted, reddish brown, the neck wider than the urn, warty when dry; seta 8–14 mm, reddish brown; operculum domed, minutely apiculate; peristome double, exostome teeth 500 μm tall, orange-red below, hyaline above, endostome segments perforate, cilia 2–3; spores 8–10 μm in diam.

fertile shoot (dry), capsule (dry), leaf outline, leaf apex (2), and margin midleaf

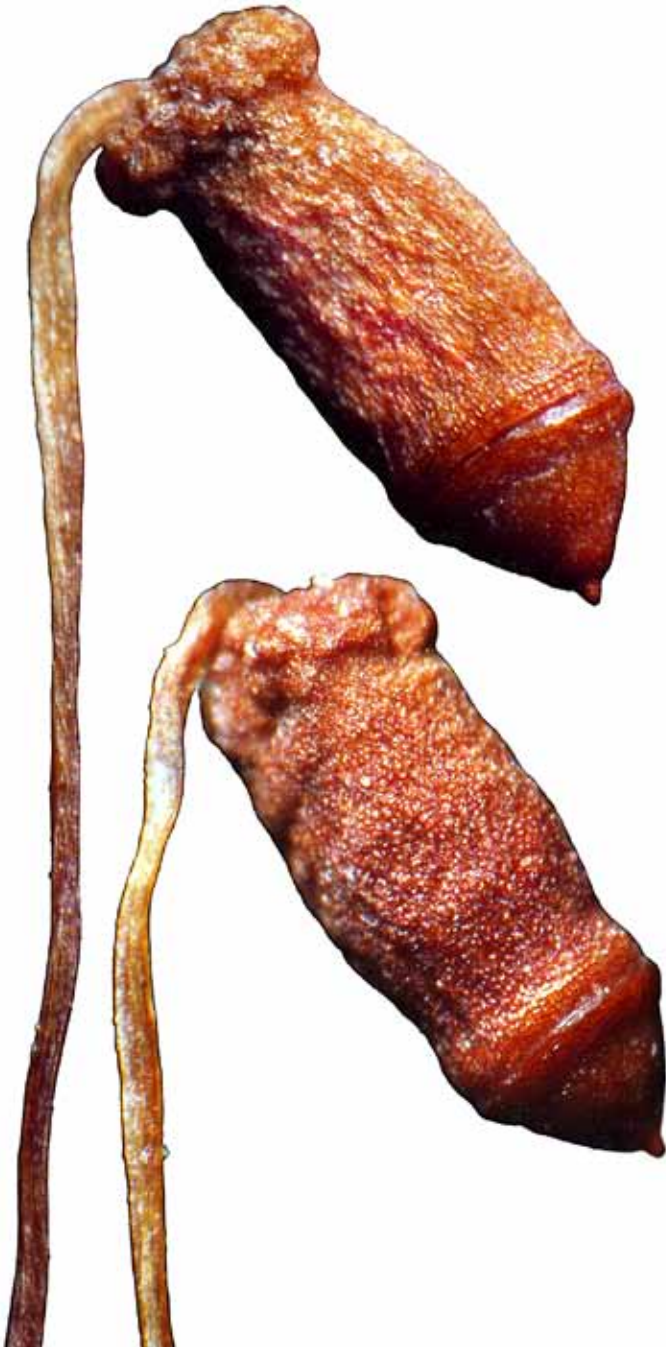
1 mm, 1 mm, 0.5 mm, 50 μm, 10 μm, 10 μm



margin at midleaf, cells at midleaf, and leaf basal angle

10 μm, 10 μm, 50 μm

continued next page



Gemmabryum coronatum capsules (dry) with coronate necks and apiculate opercula
— 0.1 mm

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Gemmabryum crassum (Hook.f. & Wilson) J.R.Spence & H.P.Ramsay

form: turves of erect, comose stems, to 20 mm, red-tomentose below

habitat: sand or rock in exposed sites, wet or dry

leaf: size: 2.0–2.5 × 0.6–0.8 mm

shape: oblong-ovate, strongly concave

tip: acute or cuspidate

base: basal cells longer than the other lamina cells

costa: stout, prominent abaxially, excurrent in the cusp

border: weak, 5 rows of linear cells

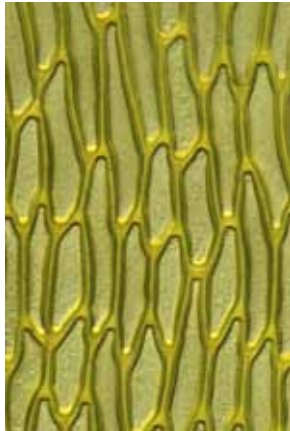
margin: ± denticulate, narrowly revolute from base to nearly the apex

cells: 25–60 × 12–20 μm, ± rhombic with round ends, firm-walled, smooth

capsule: to 2 mm, oblong to clavate, horizontal to pendent, exerted, brown, short-necked, wide-mouthed when empty; seta 15–25 mm, curved just below capsule; operculum apiculate; peristome double, exostome teeth orange-red, endostome segments white from a tall basal membrane, split; cilia 1–3; spores 8–10 μm in diam.

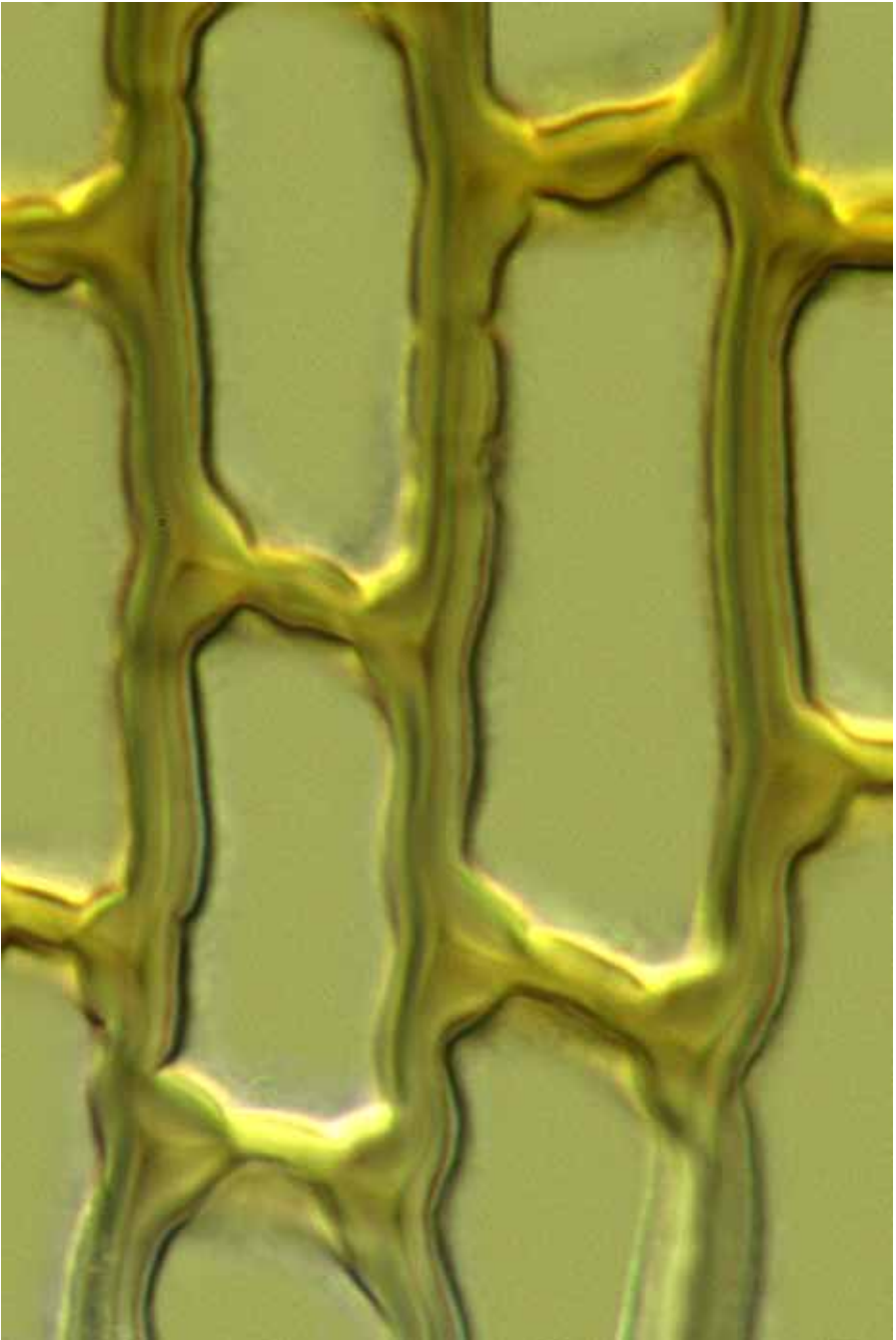


vegetative shoot (dry), leaf outline, leaf apex, mature capsule (dry), and apical margin
 ■ 1 mm, ■ 0.1 mm, ■ 50 μm, ■ 1 mm, ■ 10 μm



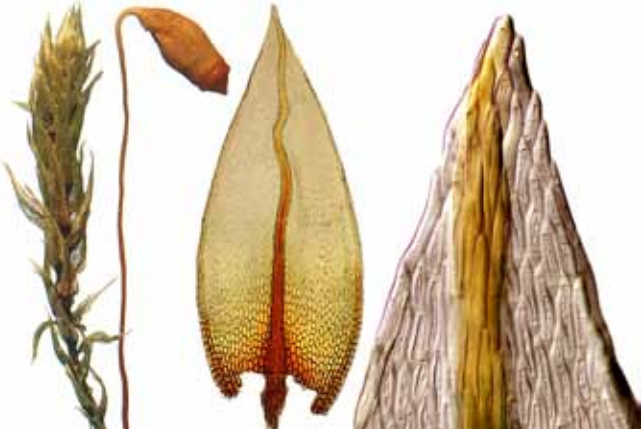
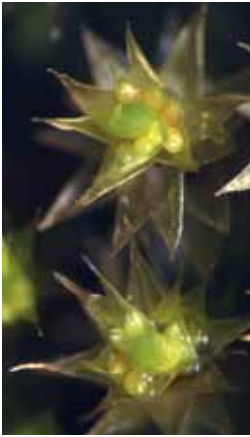
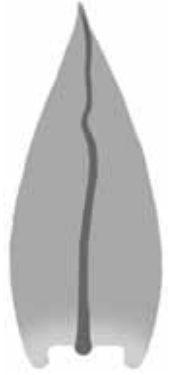
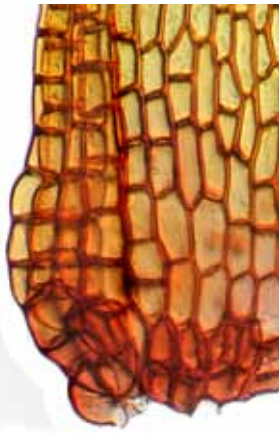
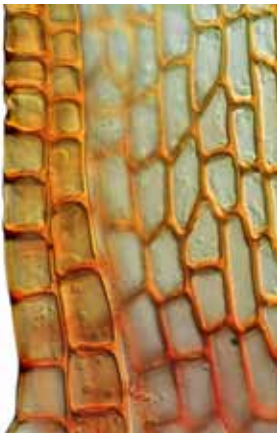
recurved midleaf margin, cells at midleaf, and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 50 μm

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Gemmabryum crassum porose basal leaf cells
— 10 μm

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Gemmabryum dichotomum (Hedw.) J.R.Spence & H.P.Ramsay**form:** turves of erect, comose, branched, radiculose stems, 5(–20) mmtall, rhizoids reddish, with numerous axillary gemmae to 430 μm long**habitat:** soil of roadcuttings, dunes, or rarely rock, often urban, to 730 m**leaf:** size: comal leaves 0.7–1.6 \times 0.3–0.7 mm*shape:* ovate-lanceolate, \pm concave*tip:* acute*base:* basal cells short, oblong*costa:* \pm sinuose, percurrent to long-excurrent in a rigid point*border:* weak, 2–4 rows of long, narrow cells*margin:* entire, plane to \pm revolute below*cells:* 30–60 \times 10–15 μm , \pm rhombic, firm-walled, smooth**capsule:** 1.5–2.5 mm, obovoid, horizontal to pendent, dark, strangulate at maturity, the neck shrunk; annulus of 3–4 rows of cells; seta 6–10 mm, \pm flexuose, reddish; operculum conic, glossy; peristome double, endostome pale yellow; spores 15–18 μm in diam.axillary propagules, shoot (dry), mature capsule (dry), leaf outline, and leaf apex
 0.5 mm, 1 mm, 1 mm, 0.1 mm, 50 μm recurved margin near leaf base, leaf basal angle, and bud-like axillary propagule
 10 μm , 10 μm , 50 μm

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Gemmabryum laevigatum (Hook.f. & Wilson) J.R.Spence & H.P.Ramsay

form: curves of erect, ± branched, radiculose stems, 10–40(–100) mm

habitat: damp soil or rock in boggy lake and creek margins, to 2300 m

leaf: size: 1.6–2.8 mm

shape: oblong-elliptic to elliptic

tip: broadly acute to obtuse, ± cucullate

base: alar cells ± quadrate

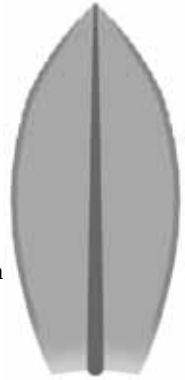
costa: percurrent to shortly excurrent

border: 1–5 rows of narrow cells below

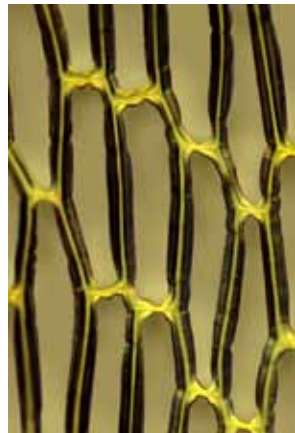
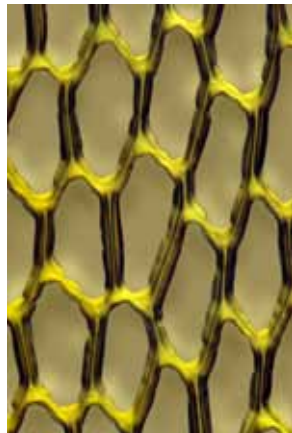
margin: entire below, serrulate near the apex, plane to recurved below

cells: 25–50 × 12–25 μm, ± rhombic, incrassate, ± porose, smooth

capsule: 2.5–3.5 mm, obovoid-cylindric, ± pendent, exserted, brown; seta to 30 mm; operculum apiculate; peristome double, the exostome teeth hyaline-margined, endostome segments widely split, cilia 2–3; spores 12–18 μm in diam.

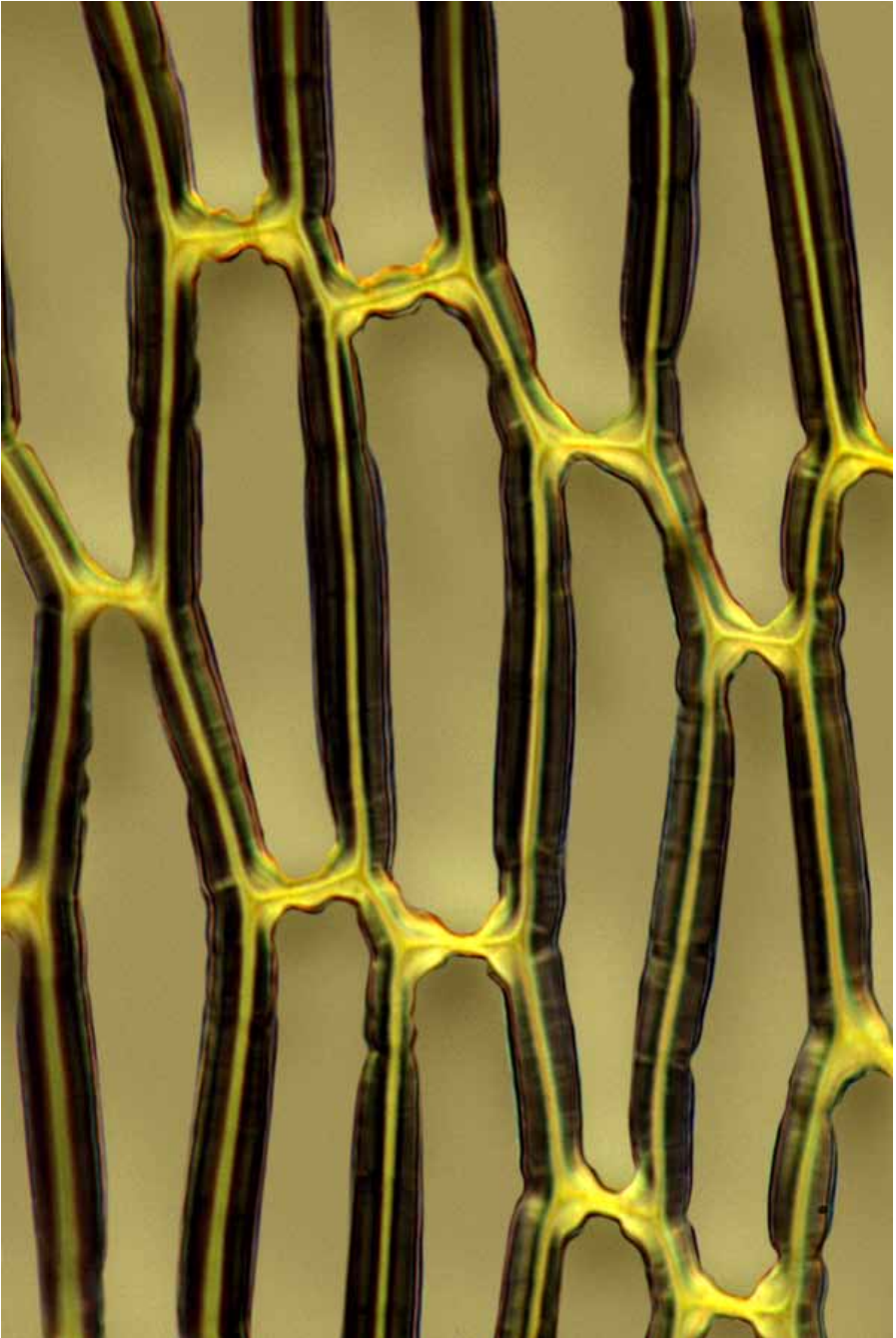


vegetative shoot (2, dry on left), papillose rhizoid, and leaf outline and apex
 5 mm, 5 mm, 10 μm, 0.1 mm, 50 μm



margin at midleaf, cells at midleaf, and cells in lower leaf
 10 μm, 10 μm, 10 μm

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Gemmabryum laevigatum cells toward leaf base
10 μm

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Gemmabryum preissianum (Hampe) J.R.Spence & H.P.Ramsay
formerly *Brachymenium preissianum* (Hampe) A.Jaeger

form: turves of erect, sparsely radiculose, yellow-green stems, 4 mm

habitat: calcareous rock or clayey soil, to 350 m

leaf: size: 0.7–0.8 × 0.3 mm

shape: lanceolate from a wide base, concave

tip: acute, aristate

base: basal cells quadrate

costa: excurrent in a stout arista, yellow-brown

border: weak, 1–2 rows of cells narrower and longer than the blade cells

margin: entire, plane

cells: 20–40 × 6–9 μm, rhombic-hexagonal, firm-walled, smooth

capsule: 2–2.5 mm, oblong-ovoid, with a narrow mouth and distinct neck; seta to 10 mm, flexuose; operculum high-conic; peristome double, exostome teeth 16, yellow above; spores 9–12 μm in diam., smooth



fertile shoot, leaf outline, and leaf apex (2)

1 mm, 100 μm, 20 μm, 20 μm



leaf apices, costa at midleaf, and leaf basal angle

50 μm, 50 μm, 50 μm

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Gemmabryum preissianum capsule (moist)
1 mm

continued next page

Gemmabryum radiculosum (Brid.) J.R.Spence & H.P.Ramsay

form: tufts of erect, radiculose stems, 3–10 mm, tubers globose, red-brown, 100–200 μm long

habitat: calcareous soil, limestone, or mortar, coastal and low inland sites

leaf: size: 1.0 \times 0.3 mm

shape: ovate-lanceolate

tip: acute

base: not decurrent; basal cells \pm quadrate

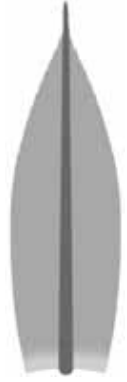
costa: strong, excurrent, yellow or red in old leaves

border: none or weak, 1–2 rows of long, narrow cells

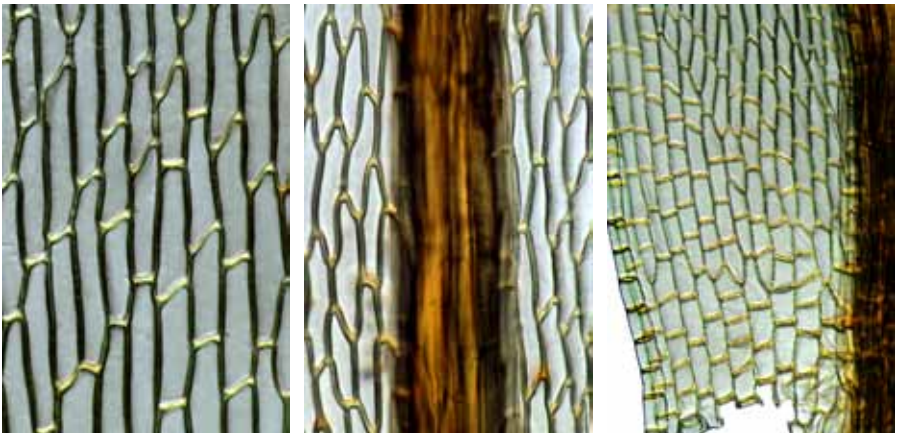
margin: entire below, weakly denticulate above, recurved below

cells: 30–45 \times 8–10 μm , rhombic, firm-walled, smooth

capsule: 2–3 mm, narrowly ellipsoid, nodding, long-exserted, brown; seta 10–20 mm, reddish; operculum low-conic; peristome double, exostome teeth yellow or brown; endostome basal membrane tall, and the segments perforate, cilia 2–3; spores 9–12 μm in diam.



fertile and vegetative shoots (dry), leaf outline, capsule, leaf apex, and margin midleaf
 1 mm, 0.5 mm, 0.5 mm, 1 mm, 50 μm , 10 μm



cells at midleaf, costa at midleaf, and leaf basal angle
 10 μm , 10 μm , 50 μm

continued next page

Gemmabryum rubens (Mitt.) J.R.Spence & H.P.Ramsay

form: tufts of erect, radiculose, ± reddish stems, 10–20 mm, globose tubers abundant, to 300 μm long

habitat: disturbed soil, soil over concrete, or pasture, to 60 m

leaf: size: 1.5–2.4 × 0.5 mm

shape: ovate-lanceolate to subtriangular, abruptly tapering to an acumen

tip: long, slender, weakly denticulate acumen

base: basal cells ± rectangular

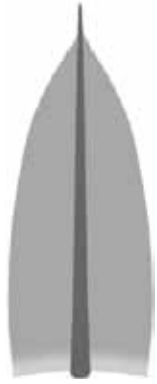
costa: wide below, slender above, excurrent in acumen

border: 2–4 rows of long, narrow, thick-walled, pigmented cells

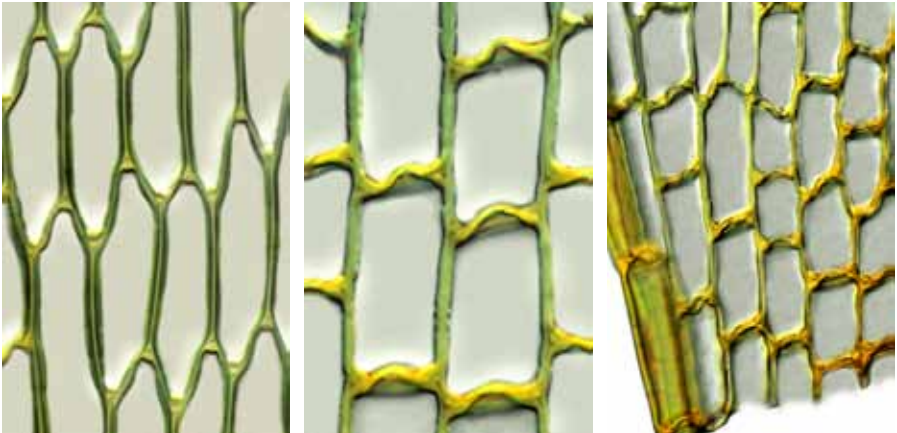
margin: entire below, denticulate above, plane above, recurved below

cells: 70–105 × 14–18 μm, fusiform-rhombic, thin-walled, smooth

capsule: capsules not seen in New Zealand; 2–3 mm, clavate to pyriform, pendent, exserted, brown; seta 20 mm, reddish brown; operculum low-conic; peristome double, exostome teeth yellow-brown, endostome segments perforate, cilia 2–3

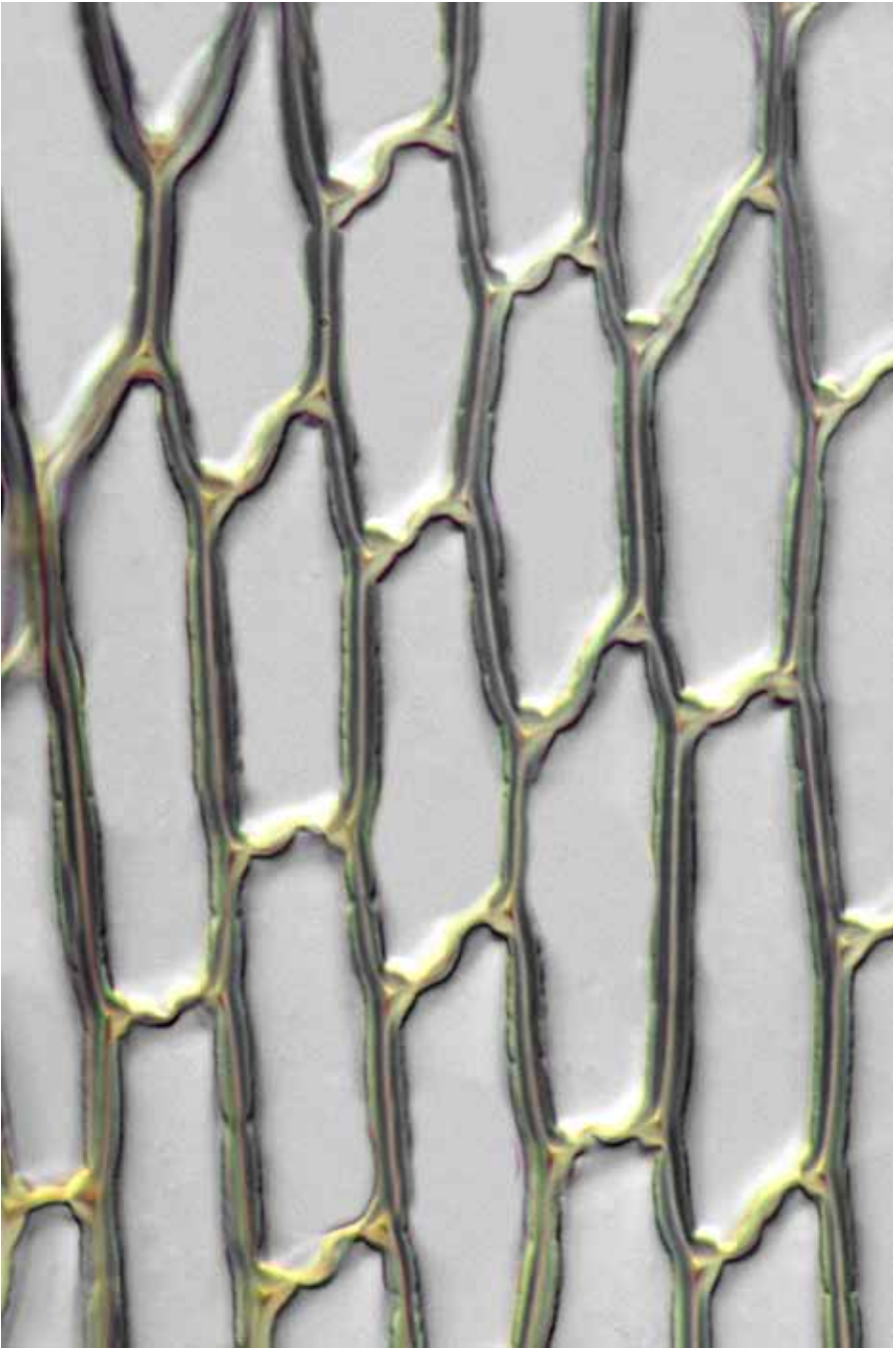


vegetative shoot (dry), leaf outline, leaf apex, tip of acumen, and margin midleaf
 1 mm, 0.5 mm, 50 μm, 50 μm, 10 μm



cells at midleaf, cells in lower leaf, and leaf basal angle
 10 μm, 10 μm, 10 μm

continued next page



Gemmabryum rubens porose cells lower leaf
10 μm

continued next page

Gemmabryum ruderale (Crundw. & Nyholm) J.R.Spence & H.P.Ramsay

form: tufted, erect, stems, 5–8 mm; rhizoids violet and papillose; tubers red, ± spherical, 125–250 μm long, orange

habitat: soil, basic or mildly acidic, disturbed sites such as earthen banks, roadsides, agricultural fields, and coastal sand dunes

leaf: size: 0.7–1.3 × 0.2–0.5 mm

shape: ovate- or elliptic-lanceolate

tip: acute

base: not decurrent; basal cells quadrate to short-rectangular

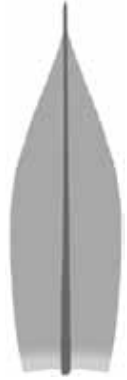
costa: excurrent in a stout point

border: weak, 2–3 rows of cells longer and narrower than nearby cells

margin: entire below, finely denticulate above, plane

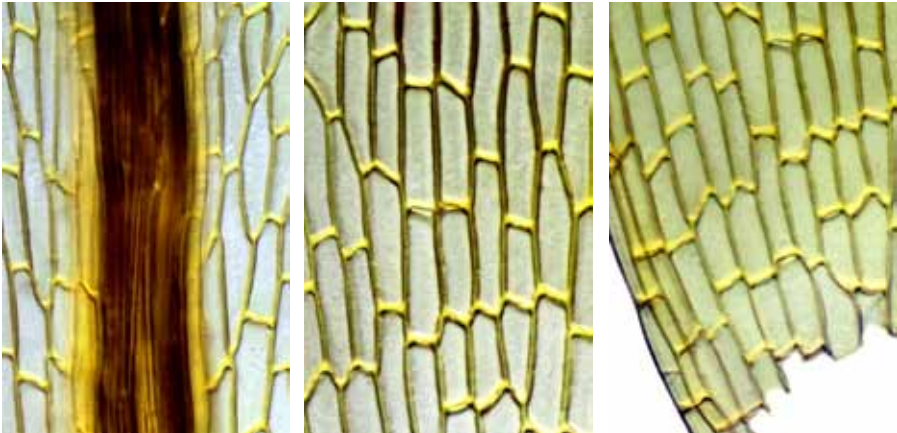
cells: 40–60 × 10 μm, rhombic, firm-walled, smooth

capsule: to 2.3 mm, rare; urn pyriform, pendent; seta 10–20 mm; operculum mammillate; peristome bryoid, teeth fused at the base up to the mouth of the urn; spores 9–11 μm in diam.



vegetative shoots (dry) (2), leaf outline, leaf apex, margin midleaf

1 mm, 1 mm, 1 mm, 50 μm, 10 μm



costa midleaf, cells midleaf, and leaf basal angle

10 μm, 10 μm, 10 μm

continued next page



Gemmabryum ruderale underground tuber
100 μm

continued next page

Gemmabryum sauteri (Bruch & Schimp.) J.R.Spence & H.P.Ramsay

form: tufts of erect, ± branched, radiculose stems, to 15 mm, rhizoidal tubers reddish, 60–140 μm long

habitat: soil or soil over rock on roadsides and stream banks

leaf: size: 1.0–1.8 × 0.5–0.7 mm

shape: ovate- or elliptic-lanceolate

tip: acute

base: basal cells ± rectangular, not pigmented

costa: stout, excurrent

border: 2–5 rows of cells narrower than the other lamina cells

margin: entire below, denticulate above, plane above, recurved below

cells: 20–70 × 10–12 μm, rhombic, firm-walled, smooth

capsule: 1.5–3.0 mm, narrowly pyriform, inclined to nodding, exserted, red-brown; seta 10–20 mm, red; operculum low-conic; peristome double, exostome teeth yellow to brown; endostome basal membrane tall, segments perforate, cilia 2–3; spores 14–20 μm in diam.

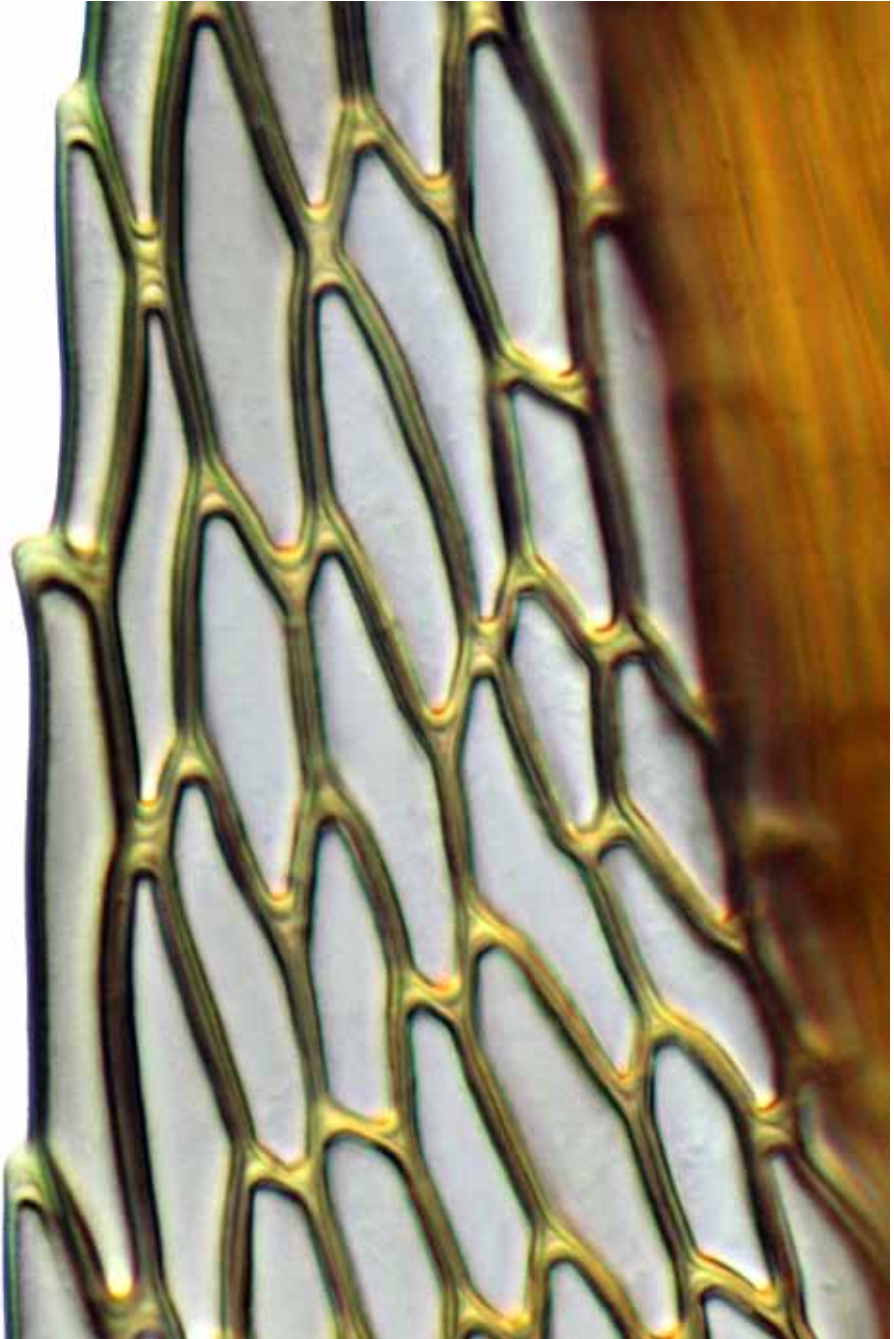


vegetative shoots (dry) (2), leaf outline, rhizoidal tuber, and leaf subapex and apex
 1 mm, 1 mm, 0.1 mm, 10 μm, 50 μm, 50 μm



margin of upper leaf, costa in midleaf, and leaf basal angle
 10 μm, 10 μm, 10 μm

continued next page



Gemmabryum sauteri margin upper leaf
10 μ m

continued next page

Plagiobryum novae-seelandiae Broth.

form: tufts or mats of soft, erect, radiculose branched stems, 3–6 mm, the branches julaceous, red- and silver-tinged

habitat: damp soil over calcareous rock, in forest or grassland, to 1650 m

leaf: size: stem leaves 0.5–0.7 mm, leaves of innovations smaller

shape: oblong to lingulate, cochleariform

tip: obtuse or rounded

base: basal cells rectangular, thin-walled

costa: thin, failing below the apex

border: not differentiated

margin: entire, plane

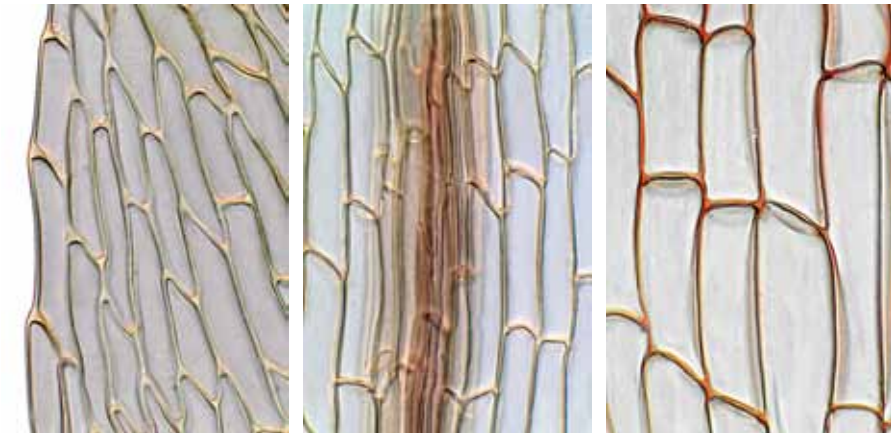
cells: 45–75 × 21–30 μm, rhombic to rectangular, thin-walled, smooth

capsule: 5–6 mm, clavate-pyriform, pendent, necked, ± asymmetric, gibbous, mouth small, orange; seta 10–17 mm, pale red, curved; operculum mammillate; peristome double, exostome teeth shorter than endostome, cross-striate below; spores 27–33 μm, reniform



vegetative shoots (dry), fertile shoot, leaf outline, and leaf apex

1 mm, 1 mm, 0.1 mm, 50 μm



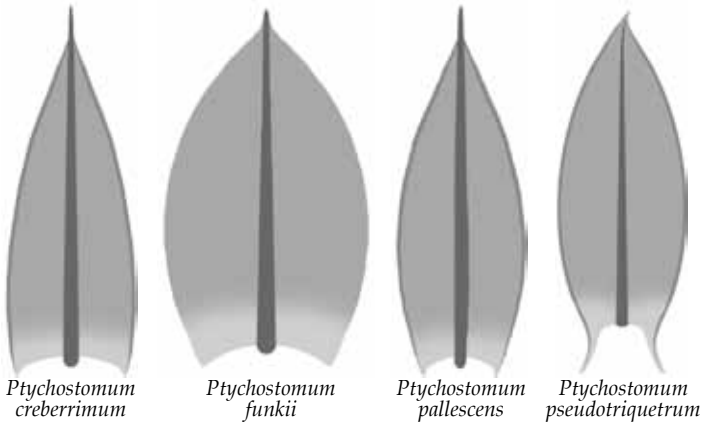
margin at midleaf, costa at midleaf, and leaf base cells

50 μm, 50 μm, 50 μm

Key* to the New Zealand species of *Ptychostomum* (4)

- 1 Leaves strongly imbricate ● ***Ptychostomum funkii***
 1: Leaves not strongly imbricate 2
- 2(1:) Leaves equidistant on the stem, decurrent; lamina cells incrassate; upper margin denticulate ● ***Ptychostomum pseudotriquetrum***
 2: Leaves densely comose on the stem, not decurrent; lamina cells thin-walled; upper margin usually entire or finely serrulate 3
- 3(2:) Synoicous; leaf border distinct ● ***Ptychostomum creberrimum***
 3: Dioicous or autoicous; leaf border weak to nearly absent ● ***Ptychostomum pallescens***

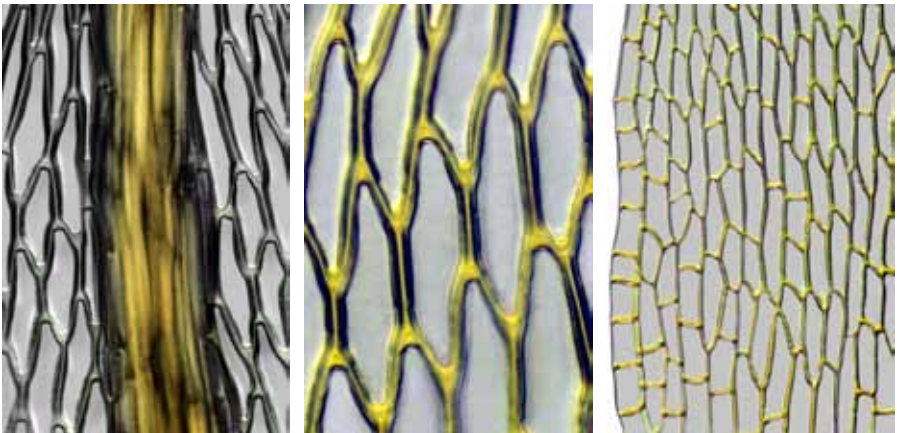
* based partly on Spence, JR; Ramsay, HP (2006): *Bryaceae. Flora of Australia* 51, 324.



Ptychostomum creberrimum (Taylor) J.R.Spence & H.P.Ramsay**form:** curves of erect, branched, tomentose, comose stems, 10–30 mm**habitat:** sandy soil or basic rock and rock crevices, to 610 m**leaf:** size: 1.3–2.3 mm*shape:* ovate-lanceolate*tip:* acuminate, ending in a denticulate awn*base:* not decurrent; basal cells long-rectangular, thin-walled*costa:* strong, excurrent in the awn*border:* 3–5 rows of linear, thick-walled cells reaching to the apex*margin:* entire below, denticulate near apex, strongly recurved to near apex*cells:* 40–70 × 10–15 μm, rhombic-hexagonal in midleaf, firm-walled, smooth, ± porose**capsule:** 2.5–3.0 mm, oblong-cylindric, pendent, necked, exserted; seta 25–35 mm, slender; peristome well-developed; operculum apiculate; endostome segments with long perforations; cilia 2; spores 10–24 μm in diam.

fertile and vegetative shoots (dry), leaf outline, leaf apex (2), and border midleaf

■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 0.1 mm, ■ 10 μm, ■ 10 μm



costa at midleaf, cells at midleaf, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 10 μm

continued next page

Ptychostomum funkii (Schwägr.) J.R.Spence

form: gregarious, erect, light green stems, 7 mm, julaceous (sterile)
habitat: naturally disturbed sites such as gravelly streamsides

leaf: size: 0.8–1.2 mm

shape: ovate, concave

tip: acute

base: alar cells none; basal cells short-rectangular, thin-walled

costa: shortly excurrent as a stout cusp

border: weak, 1–3 rows of ± elongate cells

margin: entire, plane

cells: 45–55 × 12–15 μm, rhombic-hexagonal, thin-walled, smooth

capsule: 2.5–3 mm, pyriform, necked, pendent, long-exserted, brown; seta to 40 mm, reddish; operculum apiculate; peristome double; exostome teeth narrowly lanceolate, papillose above; endostome segments perforate, as long as the exostome teeth; spores 12–15 μm in diam.



fertile and vegetative shoots (dry), exostome tooth, capsule, leaf outline, and leaf apex
 5 mm, 0.5 mm, 100 μm, 0.5 mm, 0.1 mm, 10 μm



margin at midleaf, costa at midleaf, and leaf basal angle
 10 μm, 10 μm, 10 μm

continued next page

Ptychostomum pallescens (Schwägr.) J.R.Spence
formerly *Bryum pallescens* Schwägr.

form: cushions or turves of branched, radiculose, erect, comose stems, 15 mm

habitat: soil or in rock crevices, montane grassland, to 1630 m

leaf: size: 1.4–2.4 × 0.8 mm

shape: oblong-ovate, concave

tip: acute or acuminate, cuspidate

base: basal cells ± rectangular, longer than other lamina cells

costa: excurrent in the cusp

border: 1–2 rows of elongate, firm-walled cells

margin: entire below, denticulate above, recurved at margins

cells: 40–60 × 12–18 μm, rhombic-hexagonal, thin-walled, smooth

capsule: 1.8–2.5 mm, pyriform, necked, symmetric, inclined to pendent, exserted, brown; seta 15–30 mm; peristome double, exostome teeth reddish, endostome segments long-perforate, cilia 2; spores 21–24 μm in diam.



vegetative shoots (dry) (2), leaf outline, apex (2), and recurved margin (abaxial view)

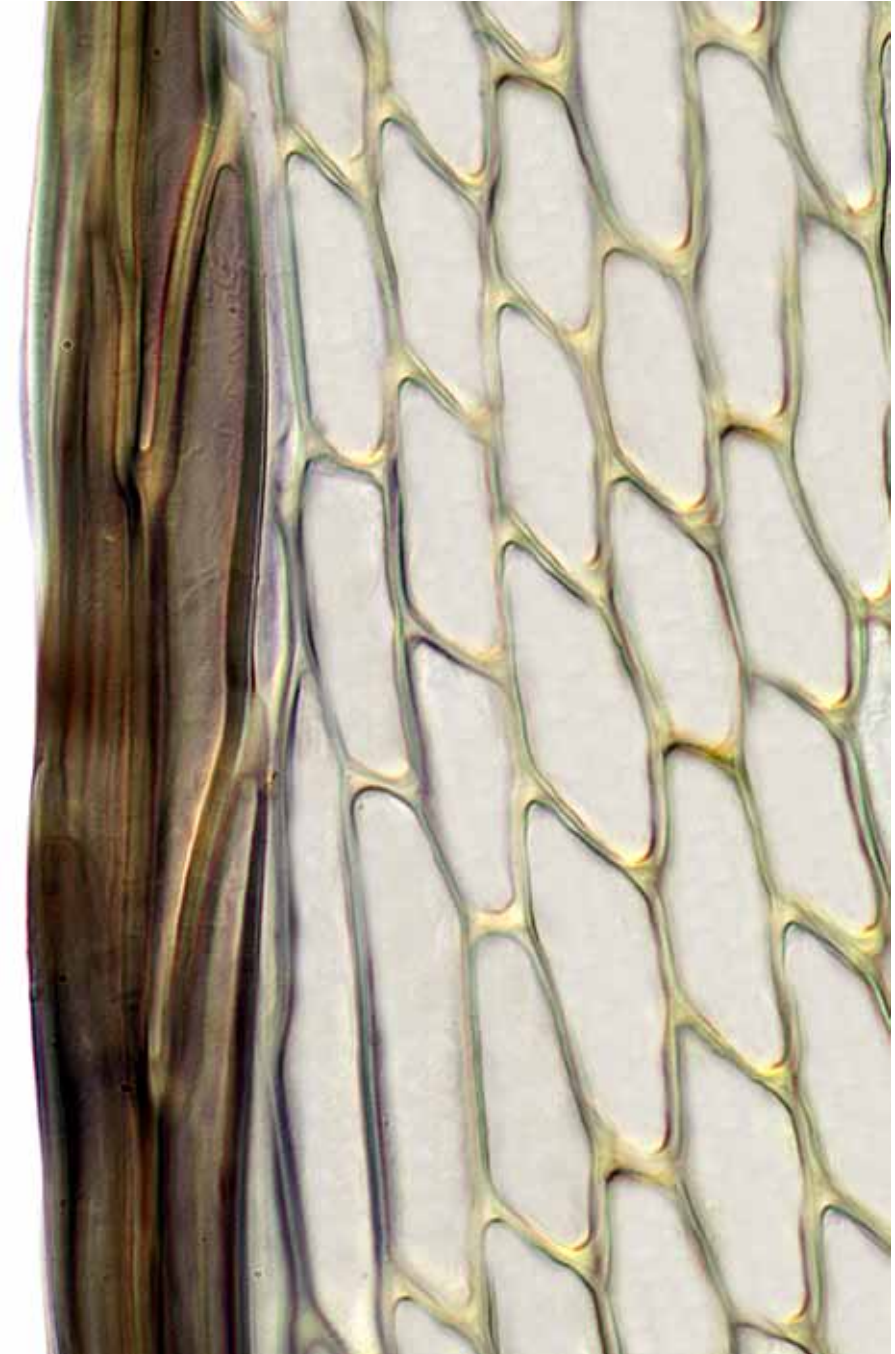
1 mm (2), 1 mm, 50 μm, 10 μm, 10 μm



cells at midleaf, costa at midleaf (adaxial view), and leaf basal angle

10 μm, 10 μm, 50 μm

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Ptychostomum pallescens recurved margin, abaxial surface
10 μ m

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Ptychostomum pseudotriquetrum (Hedw.) J.R.Spence & H.P.Ramsay

form: tufts of robust, erect, tomentose, sparsely forked, red-tinged stems, 10–50 mm tall

habitat: wet soil or rock in mineral-rich swamps, seeps, ponds, to 2000 m

leaf: size: 1.5–3.0 × 0.9–1.4 mm

shape: ovate-lanceolate to elliptic

tip: acute to cuspidate or acuminate

base: narrowly decurrent; basal cells coloured, subquadrate near the margin

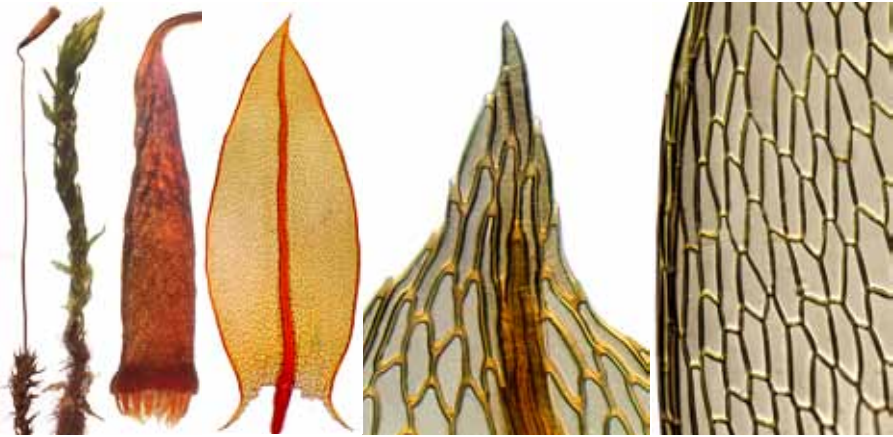
costa: strong, red below, percurrent or excurrent in a short cusp

border: 5 rows of thick-walled, linear cells (200–250 μm long)

margin: entire below, denticulate above, plane above, recurved ± throughout

capsule: 3–4 mm, pyriform, straight, necked, inclined to pendent; seta 25–50 mm; peristome bryoid, endostome segments perforate, cilia 2–3, filiform; spores 15–18 μm in diam.

note: both widespread and common



shoots (dry) (2) and capsule (dry), leaf outline, leaf apex, and margin midleaf
 ■ 5 mm, ■ 1 mm, ■ 0.5 mm, ■ 0.1 mm, ■ 10 μm, ■ 10 μm

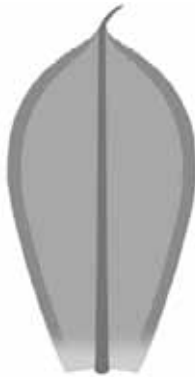


cells at midleaf, costa at midleaf, and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 10 μm

Key* to the New Zealand species of *Rosulabryum* (7)

- 1 Papillose filamentous brood-bodies in the leaf axils .. ● *aff. Rosulabryum crassinerve*
 1: No brood-bodies in the leaf axils 2
- 2(1): Excurrent costa an eighth or less of the length of the lamina 3
 2: Excurrent costa more than a fifth of the length of the lamina 4
- 3(2) Seta straight ● *Rosulabryum billardierei*
 3: Seta usually hooked below the capsule 4
- 3(2) Upper to middle lamina cells incrassate ● *Rosulabryum perlimbatum*
 3: Upper to middle lamina cells thin- to firm-walled ● *Rosulabryum subtomentosum*
- 3(2): Tubers bright orange or crimson ● *Rosulabryum torquescens*
 3: Tubers red-brown 4
- 4(3): Most leaves < 3 mm long; tubers mostly < 300 µm wide ● *Rosulabryum capillare*
 4: At least some leaves 4–10 mm long; tubers mostly > 500 µm wide
 ● *Rosulabryum campylothecium*

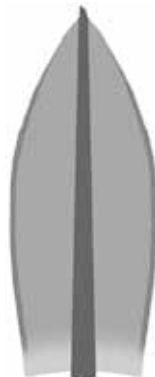
* based partly on Spence, JR; Ramsay, HP (2006): *Bryaceae. Flora of Australia* 51, 332.



Rosulabryum
perlimbatum



Rosulabryum
billardierei



Rosulabryum
aff. crassinerve



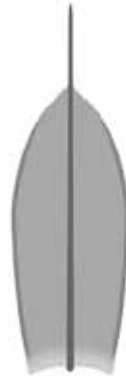
Rosulabryum
subtomentosum



Rosulabryum
capillare



Rosulabryum
torquescens



Rosulabryum
campylothecium

continued next page

Rosulabryum billardierei (Schwägr.) J.R.Spence

form: curves of erect, sparsely branched stems, 10–50 mm tall, yellow-green above, radiculose below; gemmoid tubers 500–1000 μm long

habitat: rock, soil, or coastal sand in dunes or forest, to 400 m

leaf: size: 1.5–5 mm

shape: obovate

tip: \pm cuspidate

base: lower cells rectangular, thin-walled, nodulose

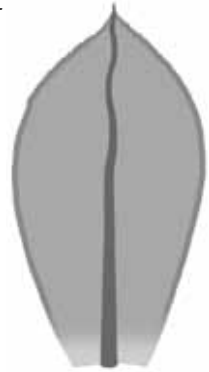
costa: excurrent in the cusp

border: 1–5 rows of narrow, elongate, incrassate cells

margin: sharply toothed above, plane above, recurved below

cells: 40–80 \times 12–20 μm , rhombic-hexagonal, firm-walled, smooth, \pm porose

capsule: 2.0–3.5 mm, oblong-cylindric, necked, pendent, exserted; seta 20–35 mm, cygneous; peristome bryoid; spores 11–18 μm in diam.

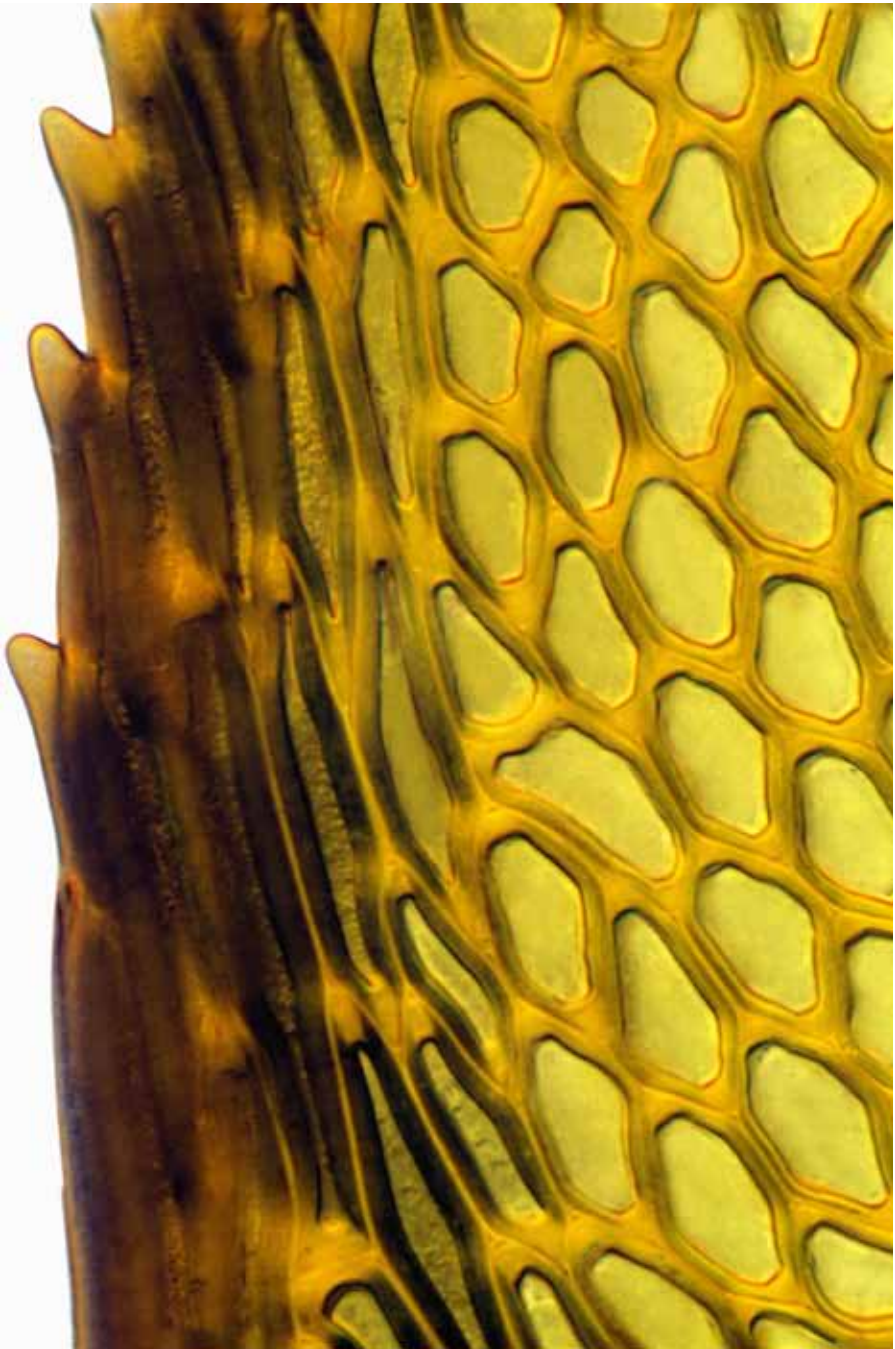


vegetative shoot (dry) (2), leaf outline, and leaf apex
 ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 50 μm



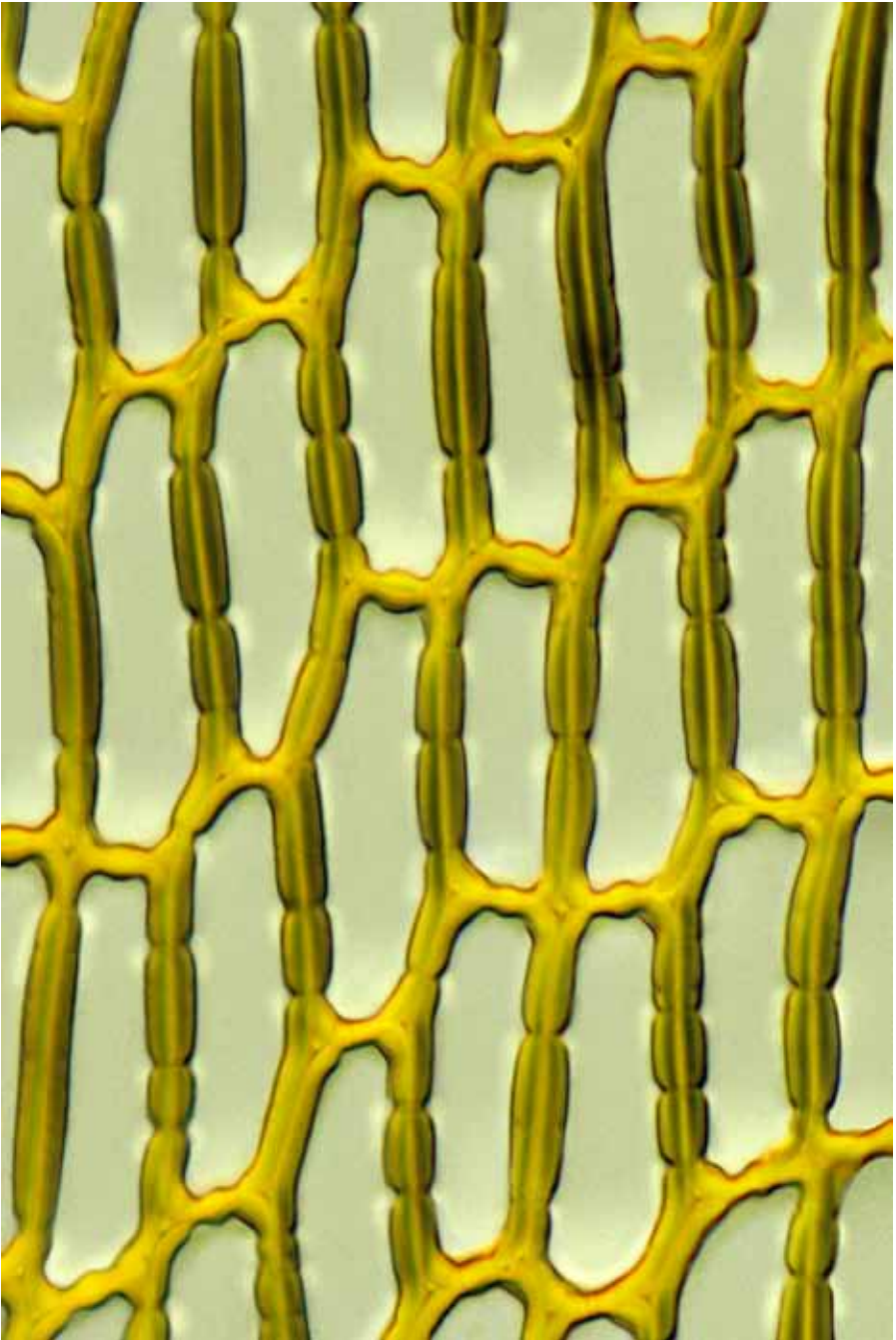
margin at midleaf, cells at midleaf, and leaf basal angle
 ■ 10 μm , ■ 10 μm , ■ 100 μm

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Rosulabryum billardieri margin midleaf
10 μm

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Rosulabryum billardieri cells midleaf
10 μm

continued next page

Rosulabryum campylothecium (Taylor) J.R.Spence

form: tufts of erect, comose 10–25 mm stems, ± red-tomentose below, lacking tubers, the leaves closely imbricate, comose, golden green

habitat: coastal sand, or soil over rock, in dunes and scrub, to to 400 m

leaf: size: 2–3.2 × 0.8–1.3 mm

shape: ovate to obovate, concave

tip: acute, ending in a long hyaline awn

base: basal cells rectangular

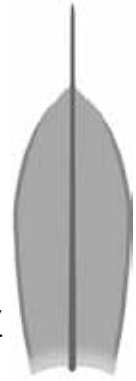
costa: long-excurrent in a denticulate, hyaline awn

border: weak, 1–2 rows of elongate cells

margin: entire below, denticulate above, plane above, recurved in lower 3/4

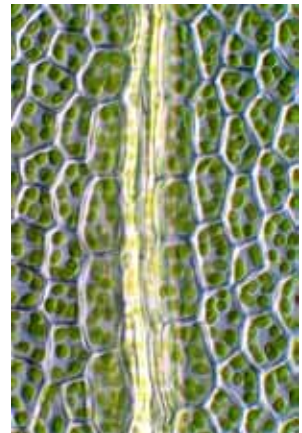
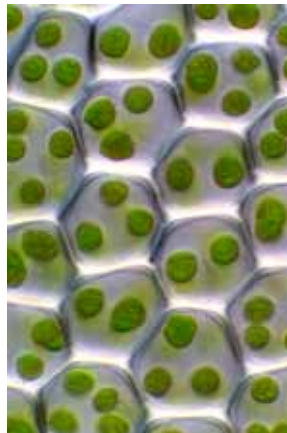
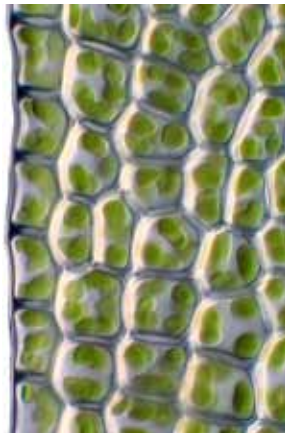
cells: 30–45 × 12–15 μm, hexagonal, firm-walled, smooth

capsule: 2.8–3.5 mm, oblong-cylindric, necked, pendent, ± curved, exserted, brown; seta 17–20 mm; operculum mammillose; spores 16–20 μm in diam.



habit on disused waterpipe, leaf outline and apex, and base of hair-point

■ 5 mm, ■ 0.1 mm, ■ 0.1 mm, ■ 10 μm



margin at midleaf, cells at midleaf, and costa at midleaf

■ 10 μm, ■ 10 μm, ■ 10 μm

continued next page

Rosulabryum capillare (Hedw.) J.R.Spence

form: curves of erect, comose, branched stems, 7–12 mm, tomentose below, the leaves dark green, matt; rhizoidal tubers gemmoid, 180–360 μm long
habitat: soil, sand, rock, concrete, logs, and bark in shaded sites, to 1220 m

leaf: size: 3.5 \times 1.5 mm

shape: elliptic to spatulate, spirally twisted around the stem when dry

tip: tapering to a long, denticulate awn

base: not decurrent, not pigmented; basal cells \pm rectangular

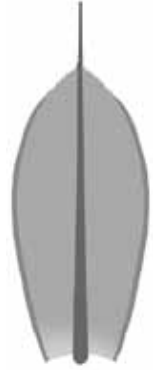
costa: excurrent in the arista

border: 2–4 rows of narrow, firm- to thick-walled cells

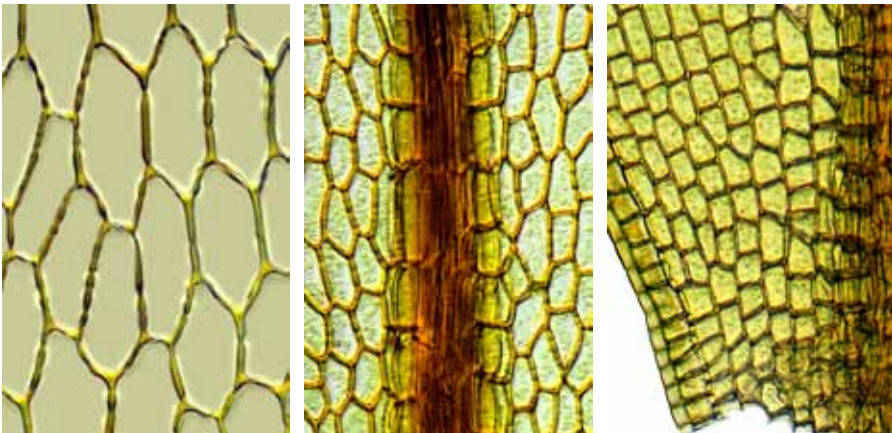
margin: entire below, serrulate to serrate above, recurved to near the apex

cells: 50–60 \times 18 μm , hexagonal-rhombic, thin-walled, smooth

capsule: 3–5 mm, clavate-cylindric, pendent, exserted, brown; seta 20–55 mm, red; operculum apiculate; peristome double, the exostome teeth yellow with a hyaline border; spores 11–14 μm in diam., smooth

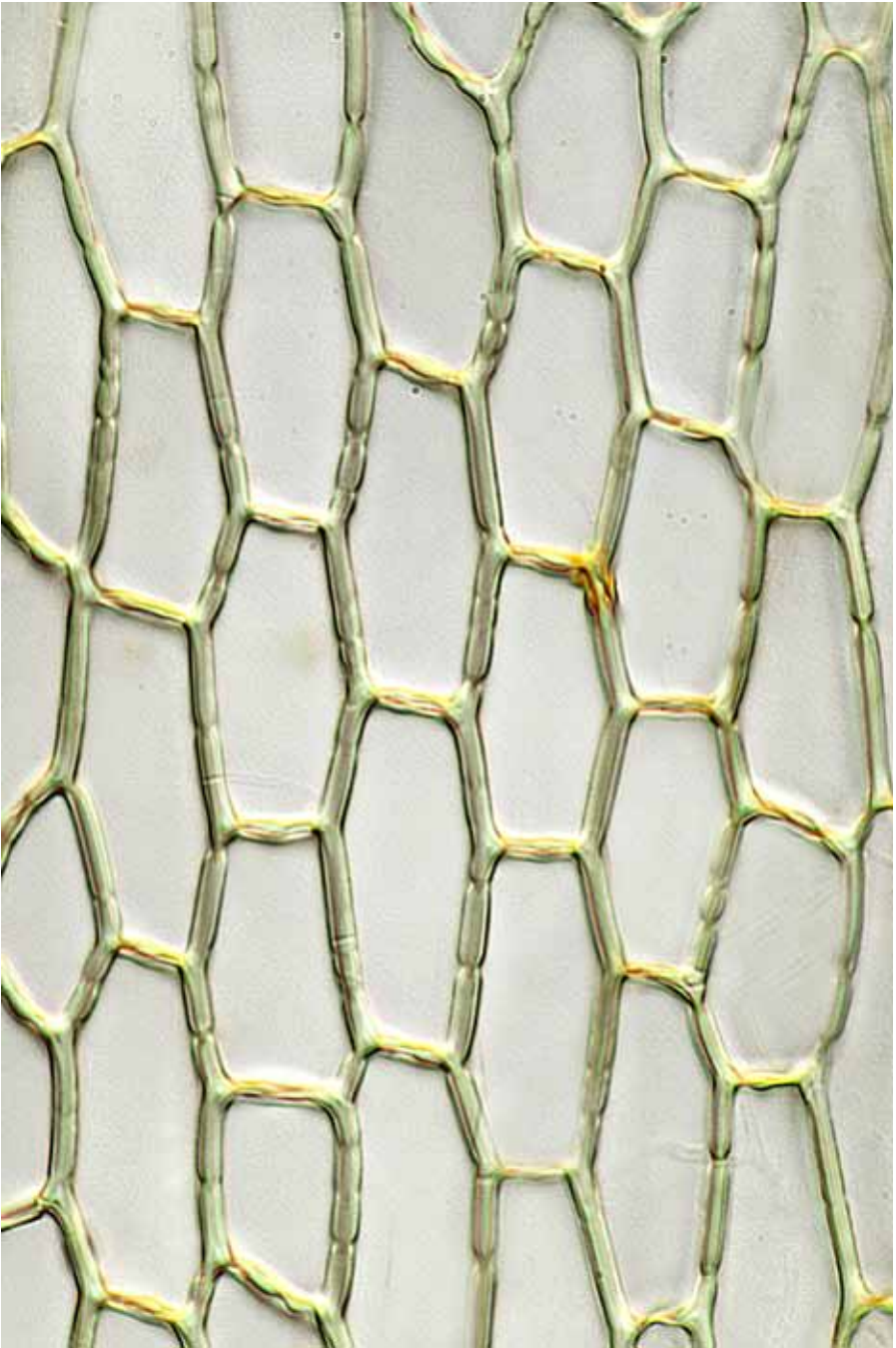


vegetative shoot (dry), leaf outline, capsule (dry), leaf apex, and margin midleaf
 1 mm, 1 mm, 1 mm, 50 μm , 10 μm



cells at midleaf, costa at midleaf, and leaf basal angle
 10 μm , 50 μm , 50 μm

continued next page



Rosulabryum capillare leaf cells
10 μm

continued next page

Rosulabryum aff. **crassinerve** Hook.f. & Wils.

form: turves of erect, branched, radiculose stems, the leaves \pm rosulate, with abundant long-filamentous, papillose brood bodies in leaf axils

habitat: soil-covered rock in shady, damp sites

leaf: size: 1.5–2.0 mm

shape: narrowly ovate, concave

tip: acute

base: basal cells rectangular, 30–80 \times 15–30 μm , \pm porose

costa: strong, shortly excurrent in a thick mucro

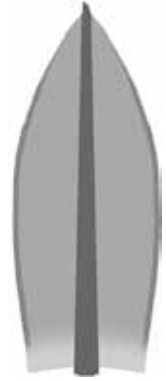
border: weak, 1–2 rows of long, narrow cells

margin: entire below, serrulate above, narrowly recurved below

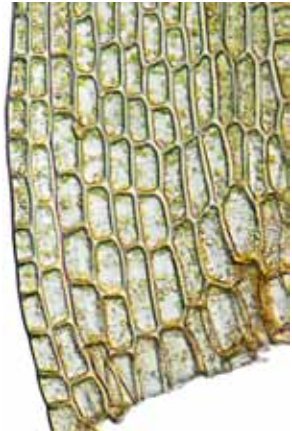
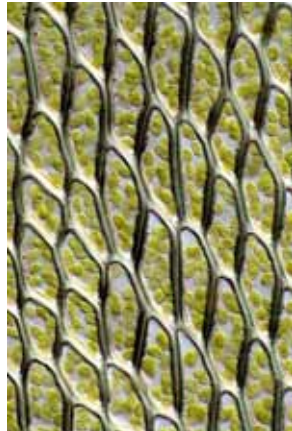
cells: 30–60 \times 15–30 μm , rhombic-hexagonal, firm-walled, smooth

capsule: 2–4 mm, \pm cylindrical, inclined to nodding, long-exserted; seta 15–25 mm, red

notes: underground tubers orange, to 1.1 mm in diam.; axillary brood-bodies filiform, coarsely papillose, red-brown, terminal cell \pm hyaline



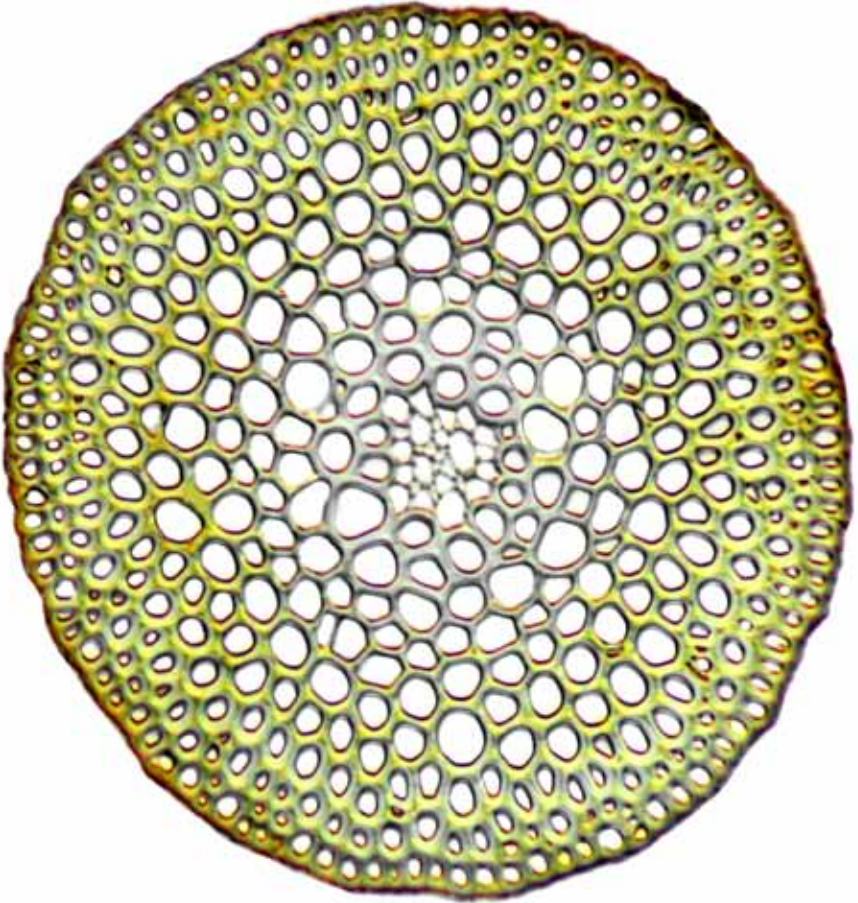
fertile shoot (moist), capsule, vegetative shoot (moist), brood-body, leaf outline and apex
 5 mm, 5 mm, 1 mm, 50 μm , 0.5 mm, 50 μm



margin midleaf, cells midleaf, and leaf basal angle

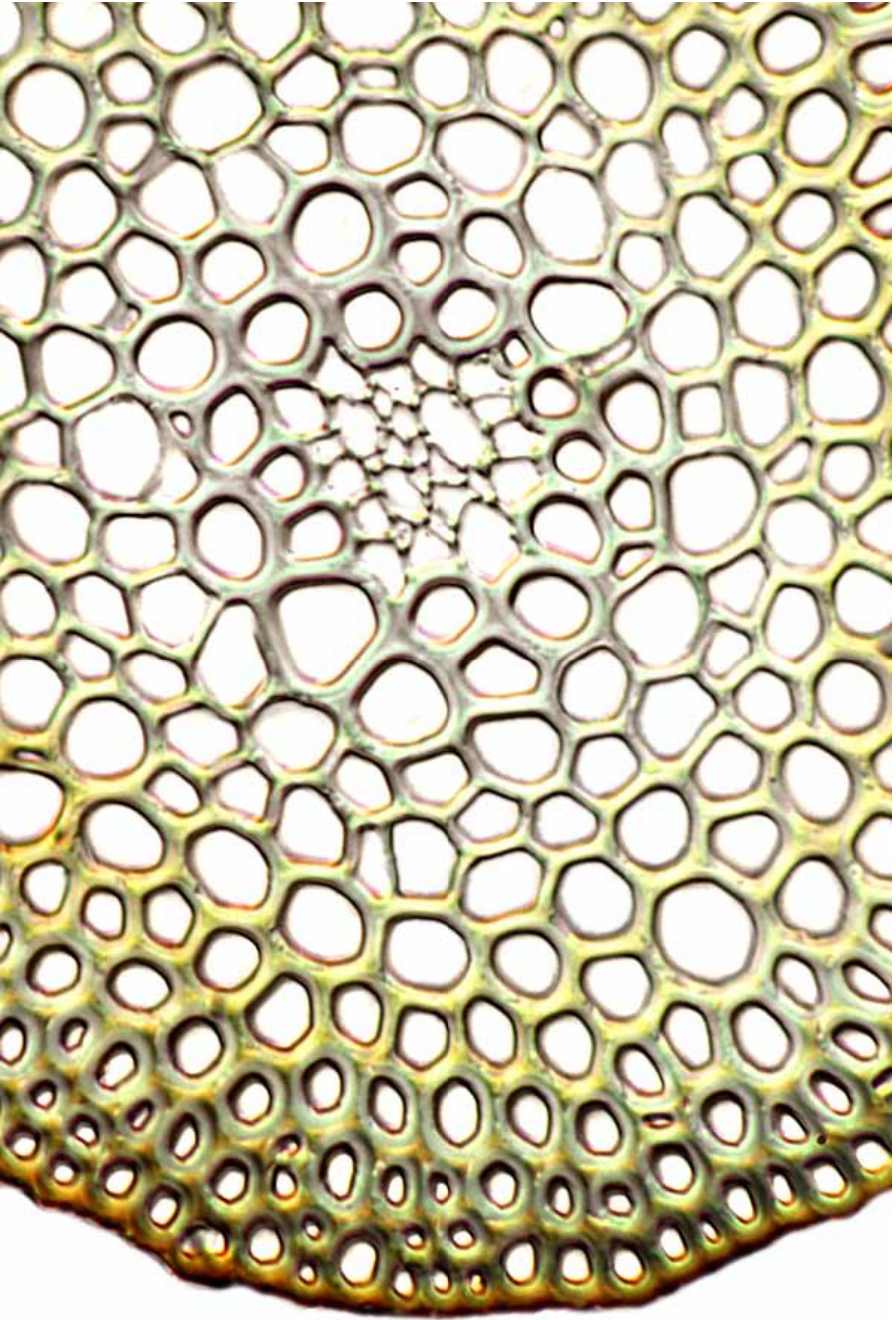
10 μm , 10 μm , 10 μm

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Rosulabryum aff. *crassinerve* seta cross-section
50 μ m

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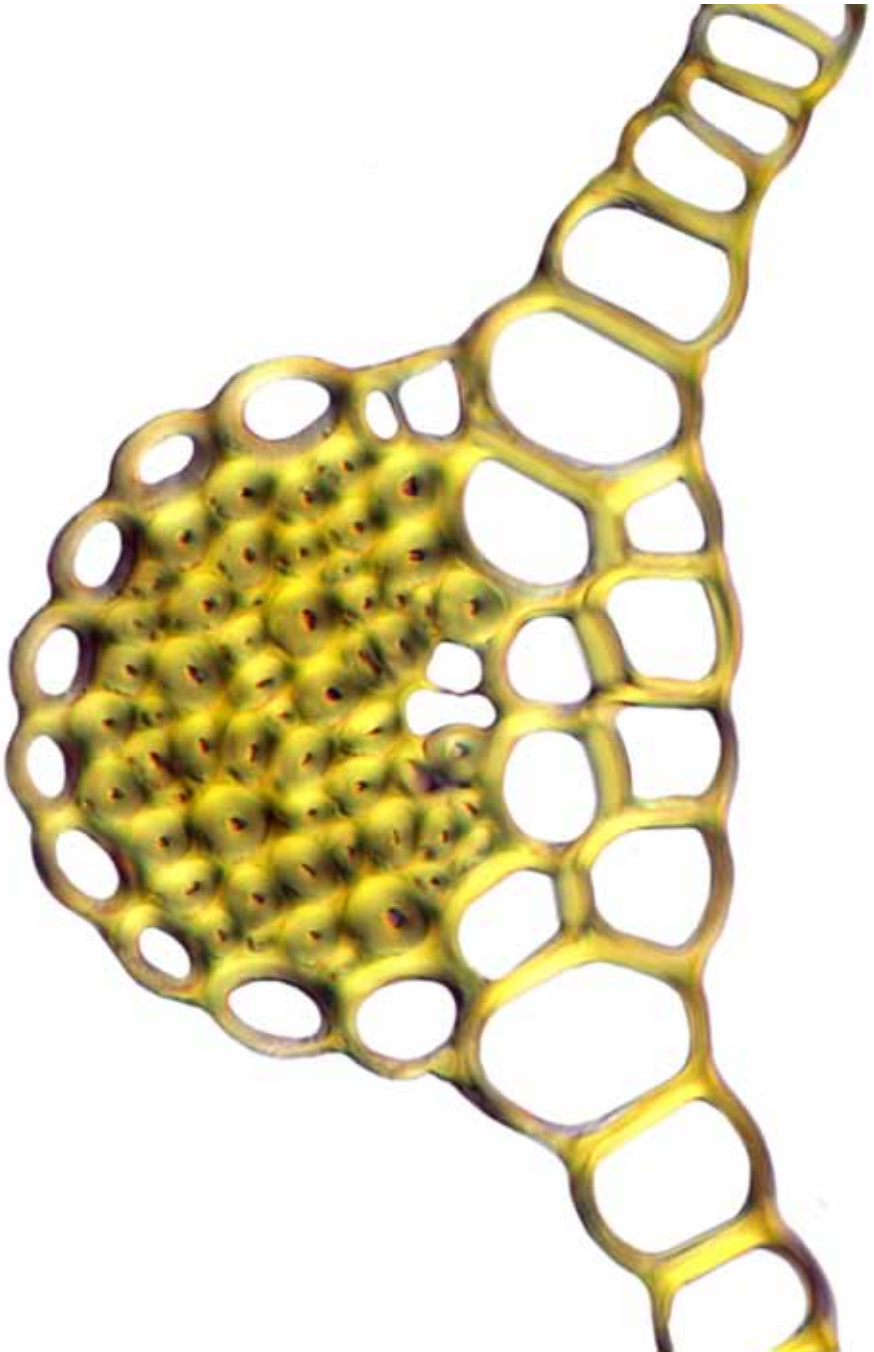
Rosulabryum cf. *crassinerve* seta cross-section detail
10 μ m

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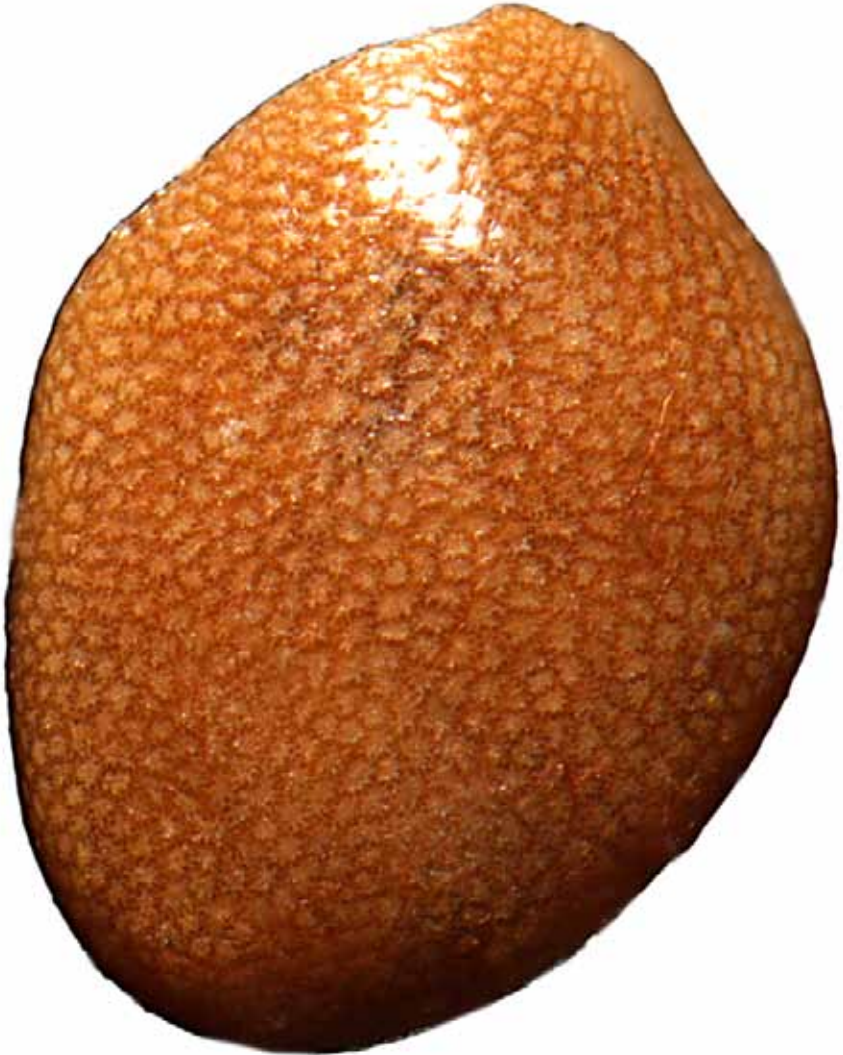
Rosulabryum cf. crassinerve leaf xs showing narrowly recurved margin, prominent costa
50 μm , 10 μm

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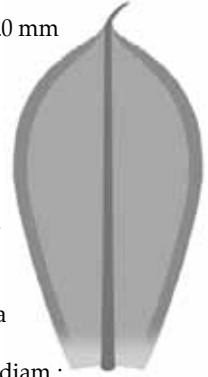
Rosulabryum cf. *crassinerve* leaf cross-section
10 μm

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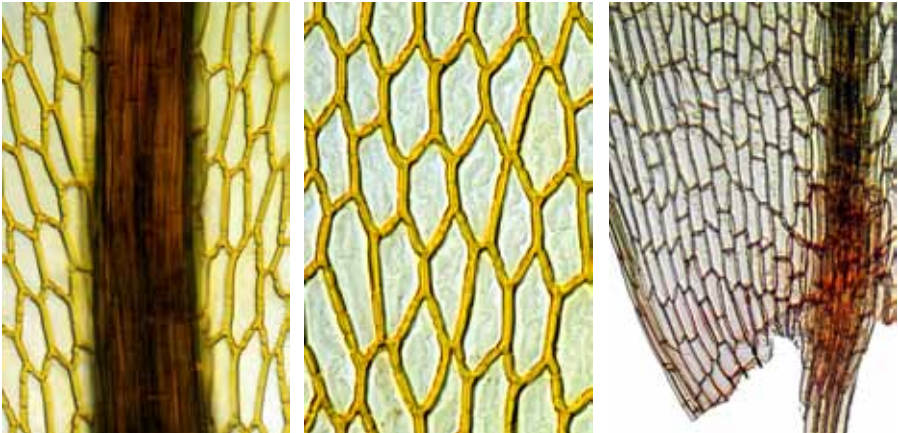
Rosulabryum cf. *crassinerve* tuber
100 μ m

continued next page

Rosulabryum perlimbatum (Cardot) Ochyra**form:** curves of erect, ± branched, comose, red-radiculose stems, 15–20 mm**habitat:** mostly lowland, peatlands and herbfields, to 1020 m**leaf:** size: 2.5–4.5 × 1–1.3 mm**shape:** obovate to spatulate**tip:** acute, with short, narrow, denticulate cusp**base:** alar cells not differentiated; basal cells broadly rectangular**costa:** excurrent or fusing with borders at the apex**border:** 6–12 rows of pale, elongate, thick-walled cells**margin:** entire below, denticulate above, plane above, recurved below**cells:** 40–60 × 12–16 μm, rhombic-hexagonal, firm-walled, porose**capsule:** 2.5–4.5 mm long, clavate-cylindric, pendent, long-exserted, brown, large-mouthed, contracted below the mouth when dry; seta 7–15 mm long, hooked near tip**notes:** rhizoidal tubers common, orange to red, ± globose, to 0.3 mm diam.; differs from *R. billardierei* in having a wider border and a hooked seta

vegetative shoot (dry), leaf outline, leaf apex, and bordered margin midleaf

1 mm,
 1 mm,
 50 μm,
 10 μm



costa at midleaf, cells at midleaf, and leaf basal angle

10 μm,
 10 μm,
 50 μm

continued next page



Rosulabryum perlimbatum wide leaf border (limbidium) near apex.
10 μm

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Rosulabryum subtomentosum (Hampe) J.R.Spence

form: tufted, sparingly branched stems, green to yellow-green, to 35 mm tall, comose, denuded and radiculose below, stacked innovations often arising from the perichaetia; gemmoid tubers 500–1000 μm

habitat: soil, sand, rock, or rotting logs in forest or scrub, coastal to inland

leaf: size: 3.7–7 \times 1.2–1.7 mm

shape: obovate to spatulate, twisted around the leaf axis when dry

tip: a narrow, \pm curved, smooth, sharp-tipped awn

base: lower cells rectangular, thin- to firm-walled, porose

costa: moderately to long-excurrent

border: 4–8 rows of narrow, elongate, incrassate cells

margin: sharply toothed above, plane above, recurved below

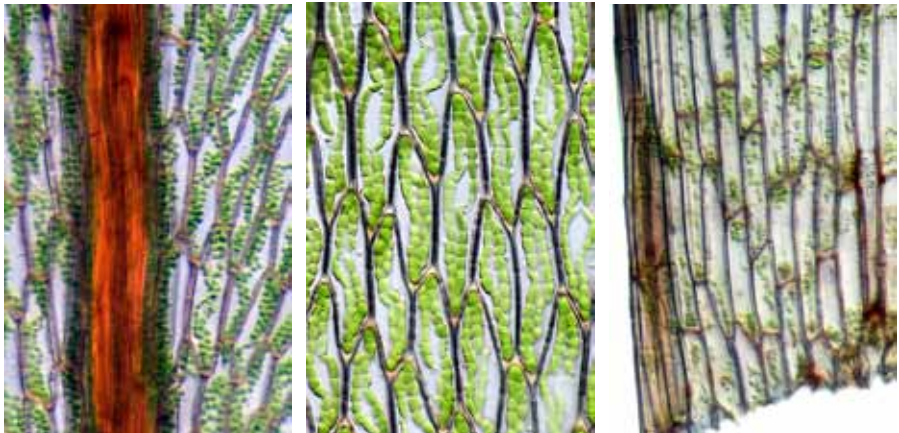
cells: 40–80 \times 12–20 μm , rhombic-hexagonal, firm-walled, porose, smooth

capsule: 3–6 mm, oblong-cylindric, strongly necked, horizontal to cernuous, \pm curved, exserted; setae multiple, 20–50 mm, red; peristome bryoid; spores 12–18 μm in diam., finely papillose



vegetative shoot (dry), leaf outline, apex and cusp, and serrate and bordered margin

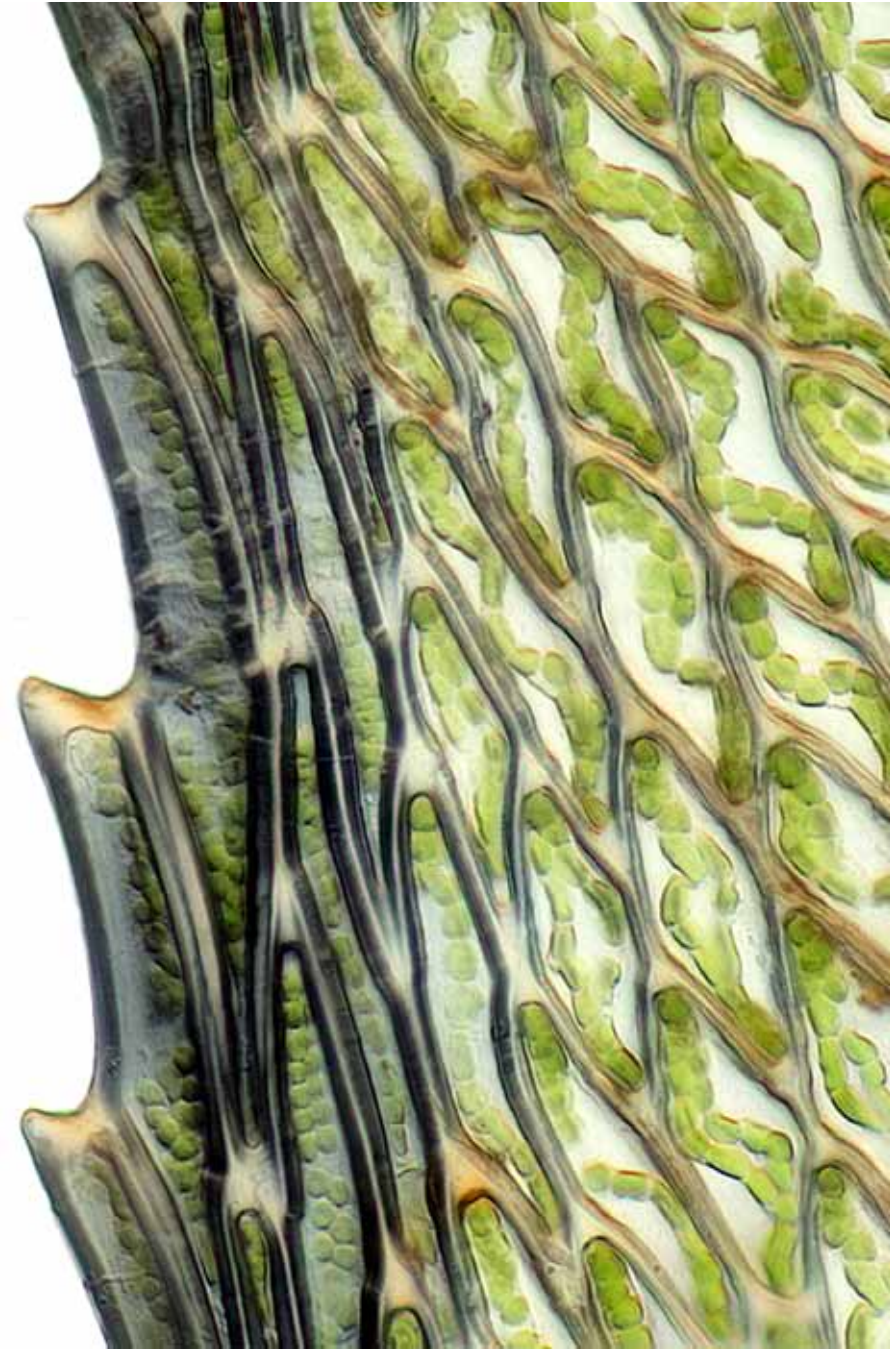
1 mm, 1 mm, 50 μm , 50 μm



costa, lamina cells, and leaf basal angle

50 μm , 50 μm , 50 μm

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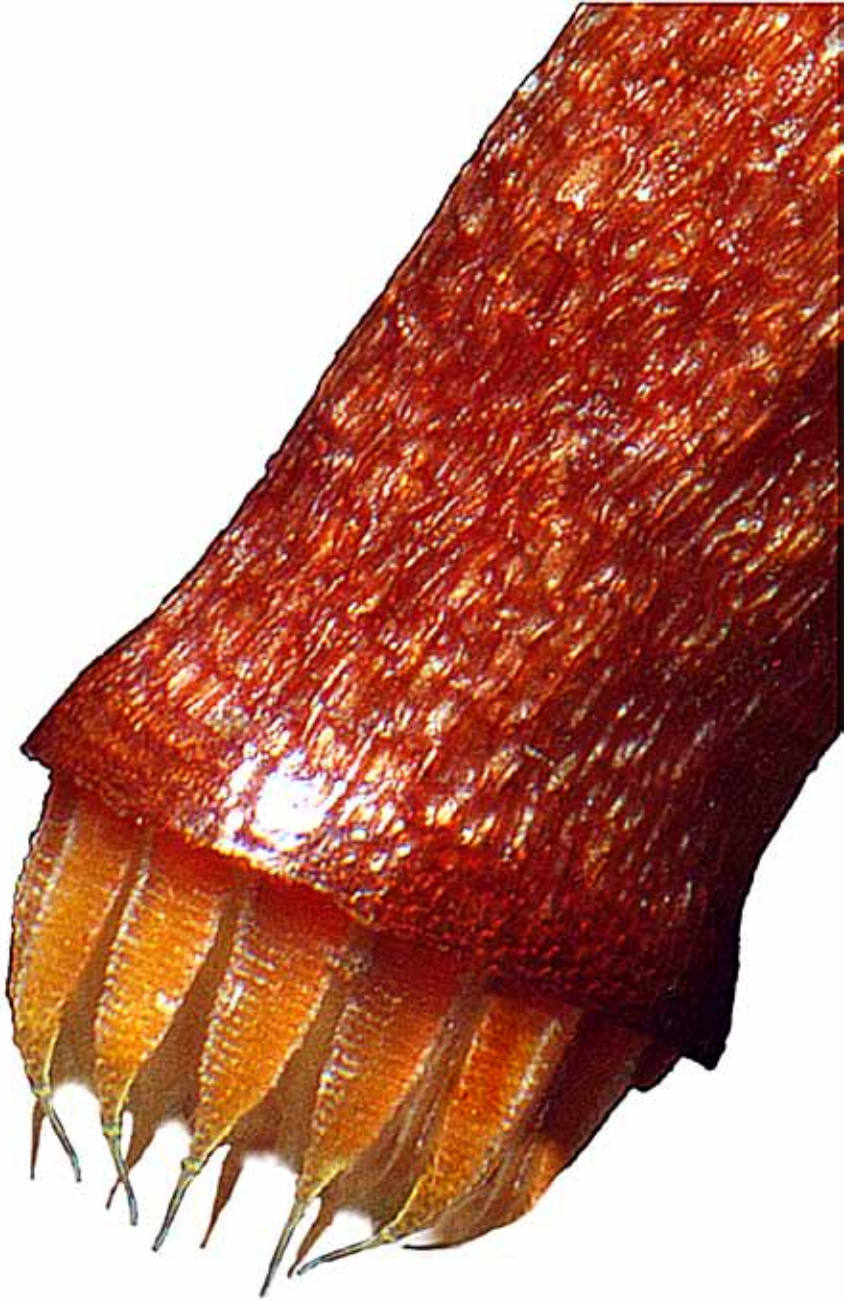
Rosulabryum subtomentosum serrate and bordered margin
10 μm

continued next page



Rosulabryum subtomentosum lamina cells
10 μm

continued next page



Rosulabryum subtomentosum peristome
50 μm

Rosulabryum torquescens (Bruch ex De Notaris) J.R.Spence

form: tufted, soft, radiculose stems, 10–25 mm tall, the leaves dark to reddish green, not glossy, rhizoidal gemmae 75–255 mm long

habitat: soil, soil over rock, or rotting wood

leaf: size: 3×1.5 mm

shape: obovate to spatulate, \pm concave

tip: short-acuminate, abruptly aristate

base: basal cell shorter and more rectangular than the blade cells

costa: long-excurrent in a flexuose arista

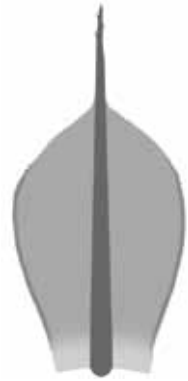
border: several rows of thick-walled, linear, incrassate cells

margin: entire below, serrulate above, recurved to midleaf

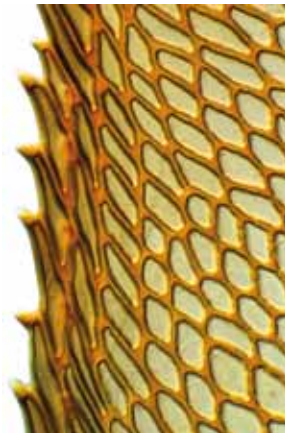
cells: $50\text{--}80 \times 10\text{--}20$ μm , rhombic, firm-walled, smooth

capsule: 3–6 mm, pyriform to cylindric, horizontal to pendent, long-necked; seta 20–35 mm, straight, often several per stem; peristome bryoid, endostome segments apiculate; spores 11–15 μm

note: highly variable



vegetative habit (moist), shoot (dry), leaf outline, hair-point, and leaf apex
 ■ 1 mm, ■ 1 mm, ■ 0.25 mm, ■ 100 μm , ■ 100 μm



border in upper leaf, costa at midleaf, and recurved margin at midleaf
 ■ 50 μm , ■ 50 μm , ■ 50 μm

Epipterygium opararens Fife & A.J.Shaw

form: loosely tufted, erect, unbranched stems, to 15 mm tall, strongly complanate, the leaves distichous, lustrous with a metallic sheen

habitat: moist or wet shaded soil, lowland

leaf: size: 1.5–2.1 × 0.7–0.9 mm; dorsal leaves smaller
shape: ± asymmetric, broadly elliptic from a narrow base

tip: broadly acute

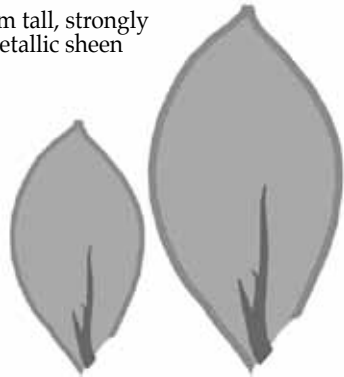
base: basal cells little differentiated

costa: reaching to two-thirds up the blade

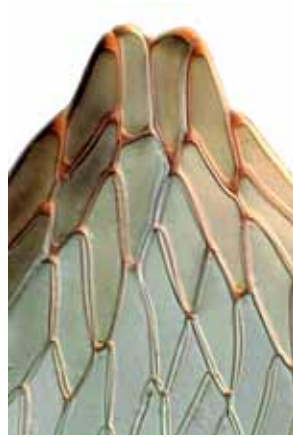
border: 1–2 rows of dark, firm-walled cells

margin: entire to slightly crenulate, plane
cells: 90–200 × 20–30 μm, linear, thin-walled, smooth

capsule: capsules not seen in New Zealand



dorsal leaf



vegetative habit, leaf outline, and leaf apex

■ 1 mm, ■ 0.5 mm, ■ 10 μm



margin at midleaf, cells at midleaf, and costa terminus

■ 10 μm, ■ 10 μm, ■ 10 μm

Ochiobryum blandum (Hook.f. & Wilson) J.R.Spence & H.P.Ramsay

form: densely tufted, branched, erect stems, 10–60 mm tall, radiculose, pinkish below, the leaves glossy, lurid green

habitat: moist soil or rock, especially in splash-zones near streams

leaf: size: 1–3 mm

shape: ovate to oblong, concave, ± complanate

tip: obtuse to broadly acute

base: basal cells shorter than the other laminal cells, ± pigmented

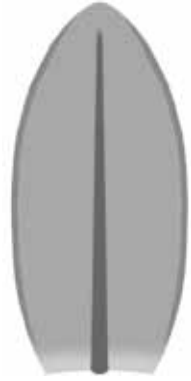
costa: subpercurrent to shortly excurrent

border: 3–4 rows of narrow, thick-walled cells

margin: entire, plane

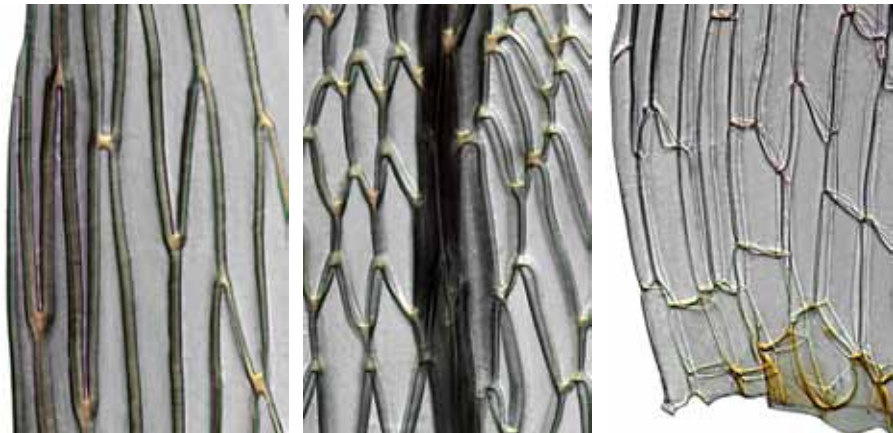
cells: 50–120 × 5–16 μm, narrowly elongate, firm-walled, smooth

capsule: 3–4 mm, pyriform with tapered neck, suberect to inclined, dark brown; seta 20–45 mm, slender, flexuose, reddish; peristome bryoid, exostome and endostome well-developed, cilia appendiculate; spores 10–18 μm in diam., smooth



fertile shoot and capsule (moist) (3), leaf outline, and leaf apex

■ 5 mm, ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 10 mm



margin in upper leaf, costa in midleaf, and leaf basal angle

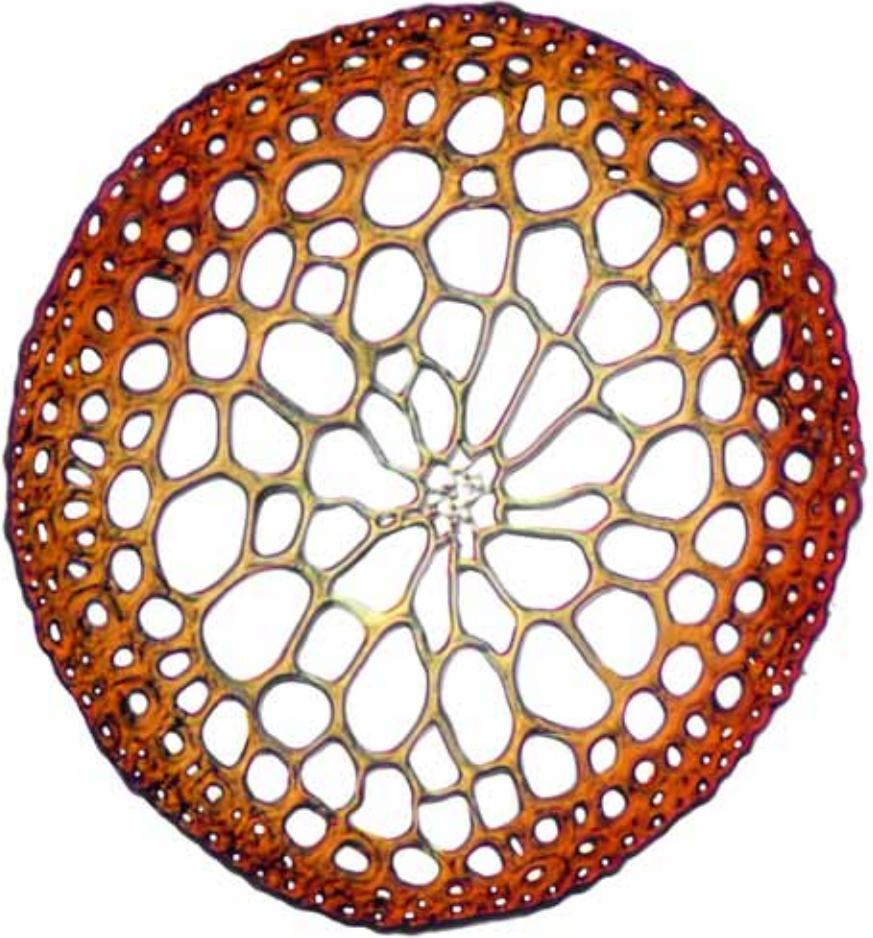
■ 10 mm, ■ 10 μm, ■ 10 μm

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Ochiobryum blandum vegetative habit
1 mm

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Ochiobryum blandum seta cross-section
— 10 μm

Plagiomnium novae-zelandiae (Colenso) T.J.Kop.

form: tufts or mats of erect or decumbent, complanate stems, to 50 mm long, tomentose, appearing 2-ranked
habitat: damp, shaded soil, humus, or rotting logs, rarely rock, stream or lake margins, to 1000 m

leaf: size: 5.5–7.0 × 3–4 mm

shape: broadly elliptic-oblong from a narrow insertion

tip: rounded or refuse, shortly mucronate, ± undulate

base: decurrent; basal cells not differentiated

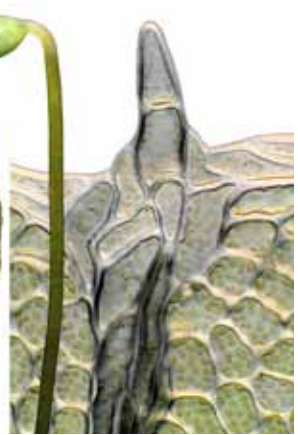
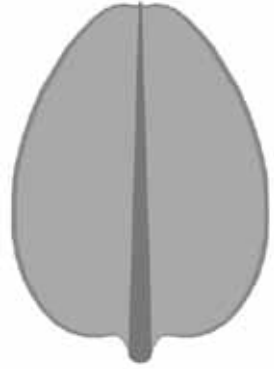
costa: wide at the base, percurrent, confluent with the border

border: 3–4 rows of elongate cells

margin: obscurely denticulate, plane

cells: 30 μm, rounded-hexagonal, thin-walled, smooth

capsule: 3–3.5 mm, ovate or oblong, horizontal to pendent, pale, glaucous, mouth wide, red; seta 20–30 mm, often aggregated; peristome bryoid; spores to 32 μm in diam.



vegetative habit, leaf outline, immature capsule, and leaf apex
 ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 50 μm



border at midleaf, cells at midleaf, and costa at midleaf
 ■ 50 μm, ■ 50 μm, ■ 50 μm



Plagomnium novae-zelandiae vegetative habit
■ 1 mm

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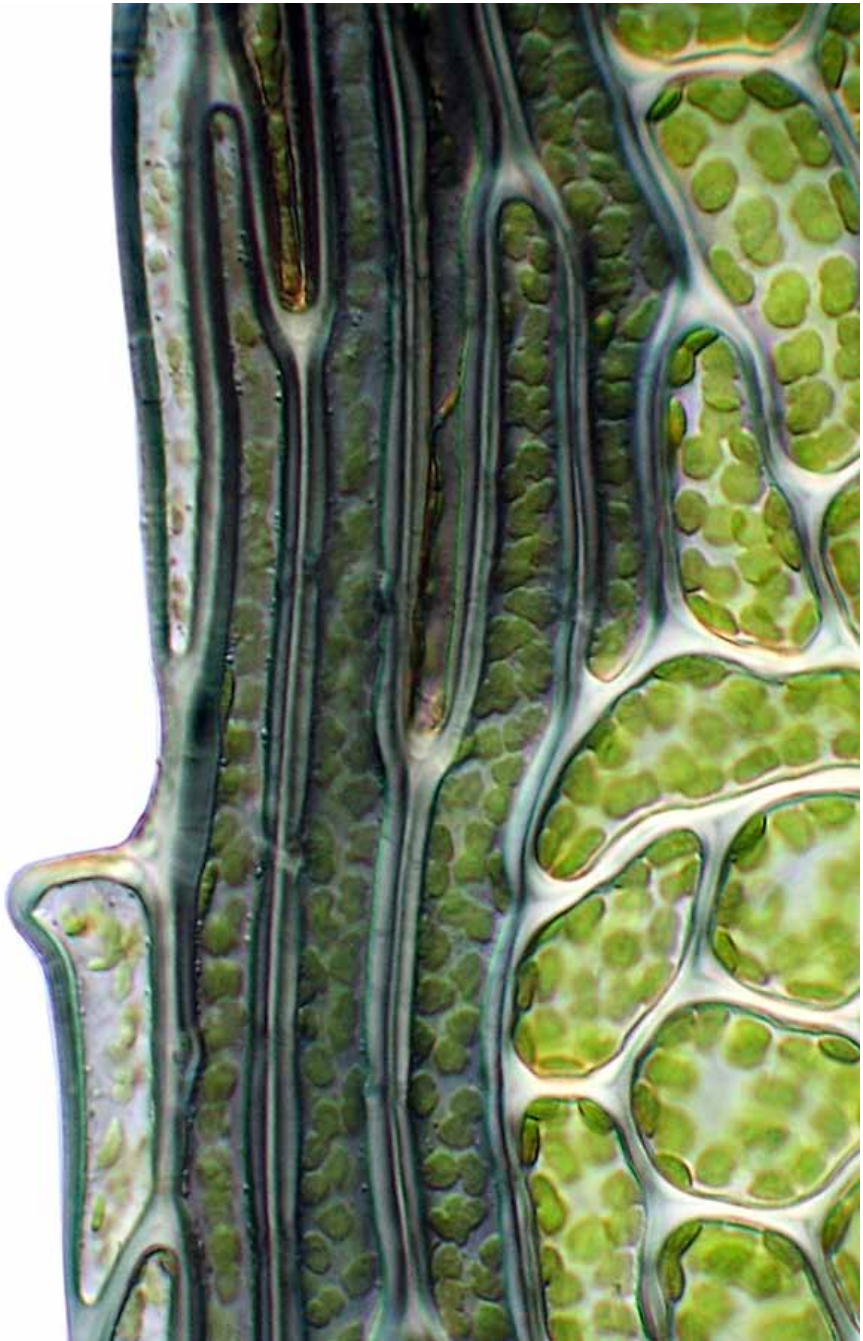
Plagiomnium novae-zelandiae vegetative shoot
1 mm

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Plagiomnium novae-zelandiae immature capsules
1 mm

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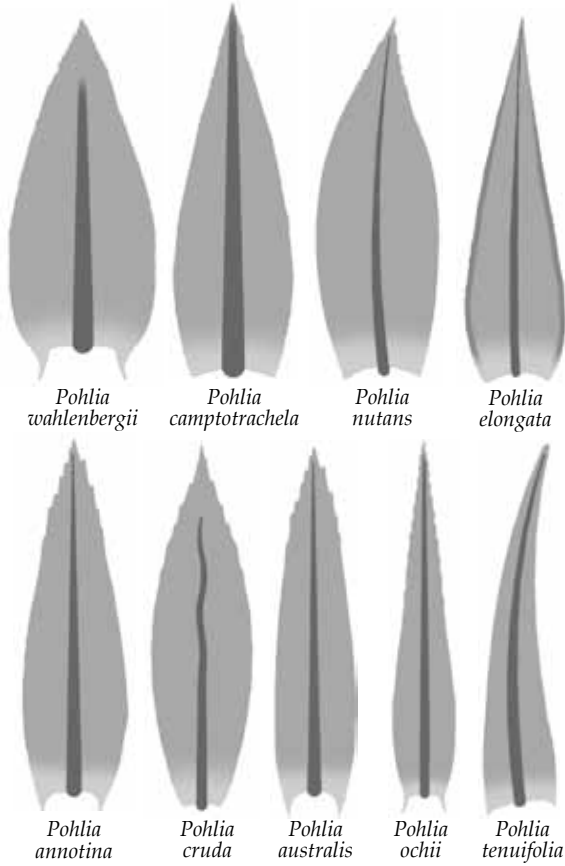


Plagiomnium novae-zelandiae leaf border
10 μm

Key* to the New Zealand species of *Pohlia* (9)

- 1 Plants with axillary gemmae 2
 1: Plants without axillary gemmae 5
- 2(1) Plants glossy; gemmae > 500 μm long, with 1–2 leaf primordia ● ***Pohlia ochii***
 2: Plants dull; gemmae < 400 μm long, with 3–9 leaf primordia 3
- 3(2): Leaves 1.5–2.0 mm long, strongly decurrent; gemmae oblong 4
 3: Leaves 0.8–1.4 mm long, not or only weakly decurrent; gemmae spherical
 ● ***Pohlia camptotrachela***
- 4(3) Gemmae orange; midleaf cells mostly < 100 μm long; plants usually fertile
 ● ***Pohlia annotina***
 4: Gemmae green or brown; midleaf cells mostly > 100 μm long; plants never fertile
 ● ***Pohlia australis***
- 5(1): Gametophytes < 5 mm tall; lower leaves linear-lanceolate ● ***Pohlia tenuifolia***
 5: Gametophytes 8–50 mm tall; leaves lanceolate to ovate-lanceolate 6
- 6(5): Plants whitish green; leaf cells 10–18 μm wide ● ***Pohlia wahlenbergii***
 6: Plants green; leaf cells 6–10 μm wide 7
- 7(6): Leaves with a metallic sheen; leaf cells thin-walled, rhombic to linear-rhombic
 ● ***Pohlia cruda***
 7: Leaves without a metallic sheen; leaf cells firm-walled, elongate-hexagonal 8
- 8(7): Capsule neck at least as long as the urn; endostome segments narrowly perforate
 along the keels; cilia absent or rudimentary ● ***Pohlia elongata***
 8: Capsule neck shorter than the urn; endostome segments broadly perforate along the
 keels; cilia long and nodulose ● ***Pohlia nutans***

* based on Shaw, AJ (2006): A revision of the moss genus *Pohlia* Hedw. (Mniaceae) in Australia. *Systematic Botany* 31, 249, and Shaw, AJ; Fife, AJ (1985): *Pohlia australis* sp. nov. (Musci) from New Zealand with notes on some other austral *Pohlias*. *New Zealand Journal of Botany* 23, 186.



Pohlia annotina (Hedw.) Lindb.

form: loose tufts of erect, simple stems, reddish below, bearing in the leaf axils brood bodies with 3–4 leaf primordia

habitat: soil on roadbanks, tracks, ditches, and other disturbed sites

leaf: size: 1.2–2 mm long

shape: narrowly lanceolate, decurrent, erect-spreading wet or dry

tip: acuminate

base: alar cells not differentiated

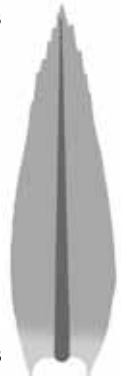
costa: percurrent to subpercurrent

border: not differentiated

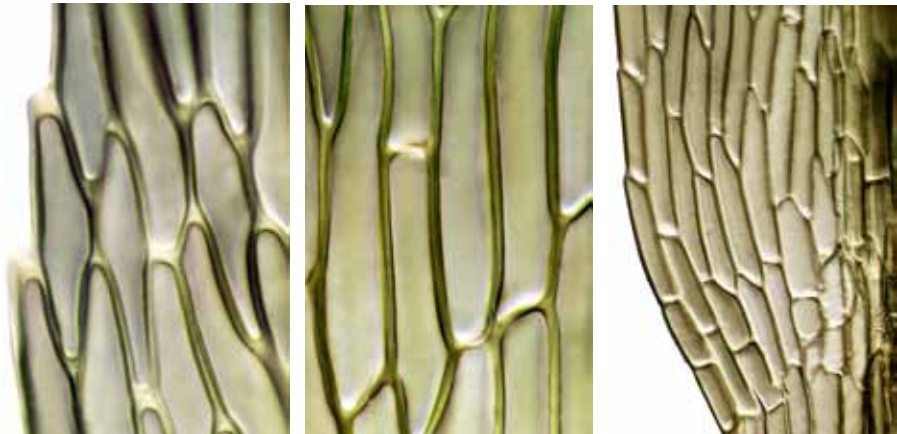
margin: serrulate at the apex, plane above, weakly reflexed when dry

cells: 60–95 × 9–12 μm, long-rhombic, thin-walled, smooth

capsule: 2.5–3 mm, long-pyriform, the neck as long as the urn, horizontal to pendent, brown at maturity; operculum convex; seta 18–35 mm, reddish, flexuose; annulus revoluble; endostome segments perforate, cilia 2–4; spores 18–22 μm in diam., finely papillose



vegetative shoots (wet) (2), leaf outline, leaf apex and subapex showing costa terminus
 1 mm, 1 mm, 1 mm, 10 μm, 10 μm



serrulate margin midleaf, lamina cells, and leaf basal angle
 10 μm, 10 μm, 10 μm

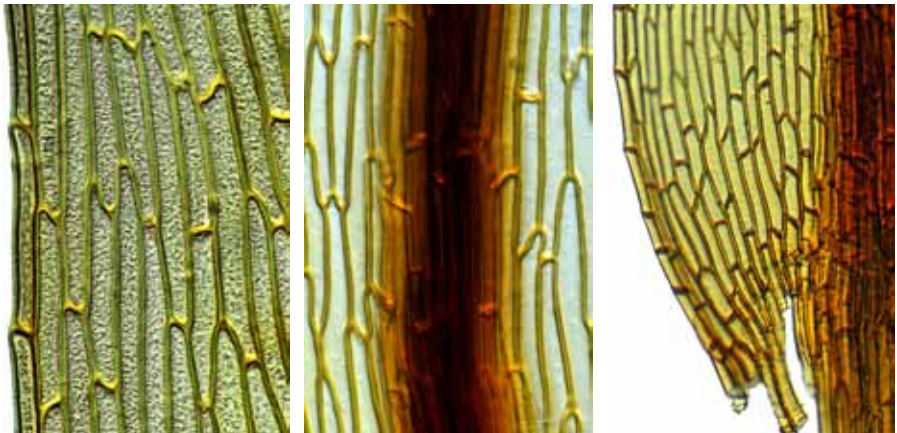
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Pohlia annotina vegetative shoot with axillary propagules, brood body whole-mounts
1 mm, 10 μ m

Pohlia australis Shaw & Fife**form:** loose tufts of simple, slender, erect, red stems, to 10 mm tall**habitat:** damp soil of roadside verges and other \pm exposed, disturbed sites**leaf:** size: 1.4–2.0 \times 0.3–0.4 mm*shape:* lanceolate*tip:* narrowly acute*base:* long-decurrent, alar region not differentiated*costa:* subpercurrent*border:* not differentiated*margin:* entire below, serrulate near the apex, plane to widely recurved*cells:* 100–150 \times 8–11 μm , linear-rhombic, thin- to firm-walled, smooth**capsule:** not known**notes:** gemmae 3–8 in the upper leaf axils, ovate-oblong, 200–380 \times 200 μm , with 4–9 leaf primordia, yellow-green to yellow-brown, darkening with age

vegetative shoot (dry), leaf outline, leaf apex, and axillary gemma with leaf primordia
 1 mm, 5 mm, 0.5 mm, 50 μm , 10 μm , 50 μm



margin at midleaf, costa at midleaf, and leaf basal angle
 10 μm , 10 μm , 50 μm

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Pohlia camptotrachela (Renauld & Cardot) Brotherus

form: small tufts of erect stems, 5–20 mm tall, often with 10–25 bulbils per upper leaf axil, $80\text{--}140 \times 80\text{--}120 \mu\text{m}$

habitat: damp, bare soil in fields or along tracks and around pools

leaf length: $2.0 \times 0.45 \text{ mm}$

shape: narrowly lanceolate

tip: acuminate

base: not differentiated

nerve: failing near the apex

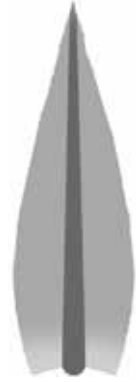
border: not differentiated

margin: serrulate above, entire below, plane

cells: $80\text{--}100 \times 5\text{--}7 \mu\text{m}$ (shorter above), linear, thin-walled, smooth

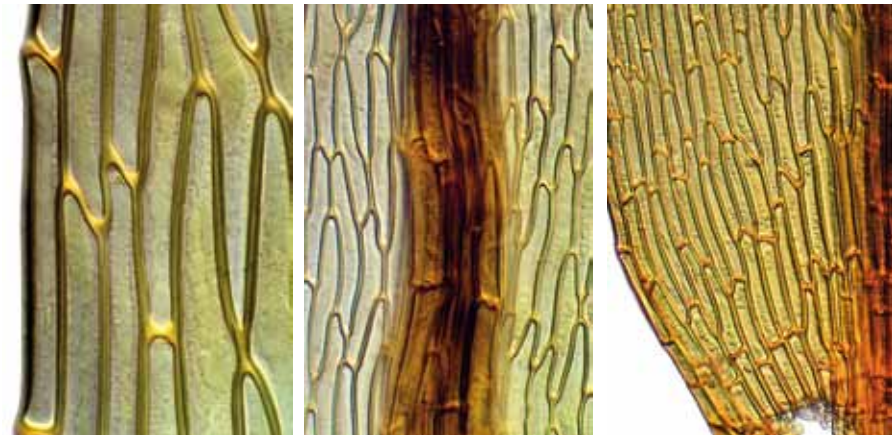
capsule: to 3 mm, oblong, cernuous to pendent; seta 20–25 mm; capsules uncommon; peristome bryoid, endostome cilia reduced or absent

note: a pioneer of damp, bare soil, especially along streambanks



bulbiferous shoots (dry) (3), leaf outline, leaf apex, and axillary bulbils

■ 1 mm (3), ■ 0.1 mm, ■ 10 μm , ■ 10 μm



margin at midleaf, costa at midleaf, and leaf basal angle

■ 10 μm , ■ 10 μm , ■ 10 μm

continued next page

Pohlia cruda (Hedw.) Lindb.

form: tufted, simple or forked stems, 10–50 mm tall, red-radiculose below, the leaves opalescent, glossy

habitat: soil or humus, often in rock crevices or soil under overhanging banks

leaf: size: 2–4 × 0.5–1.0 mm

shape: elliptic to ovate-lanceolate, ± decurrent, reddish below

tip: gradually acuminate

base: not differentiated

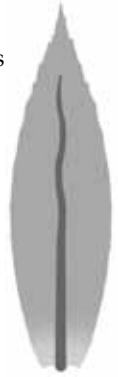
costa: failing well below the apex, ± flexuose above, reddish below

border: not differentiated

margin: distantly serrulate above, plane to narrowly reflexed

cells: 85–120 × 8.5–12 μm, linear, thin-walled, smooth

capsule: 2.5–4 mm, oblong-cylindric, neck up to half the length of the urn, horizontal to pendent, stoma superficial; seta 10–35 mm, flexuose, orange; operculum convex-conic, blunt or umbonate; peristome bryoid, exostome and endostome equal length; spores 13–24 μm in diam.



vegetative shoots (2), leaf outlines (2), and leaf apex

1 mm, 0.5 mm, 0.5 mm (2), 10 μm



margin at midleaf, cells at midleaf, and costa at midleaf

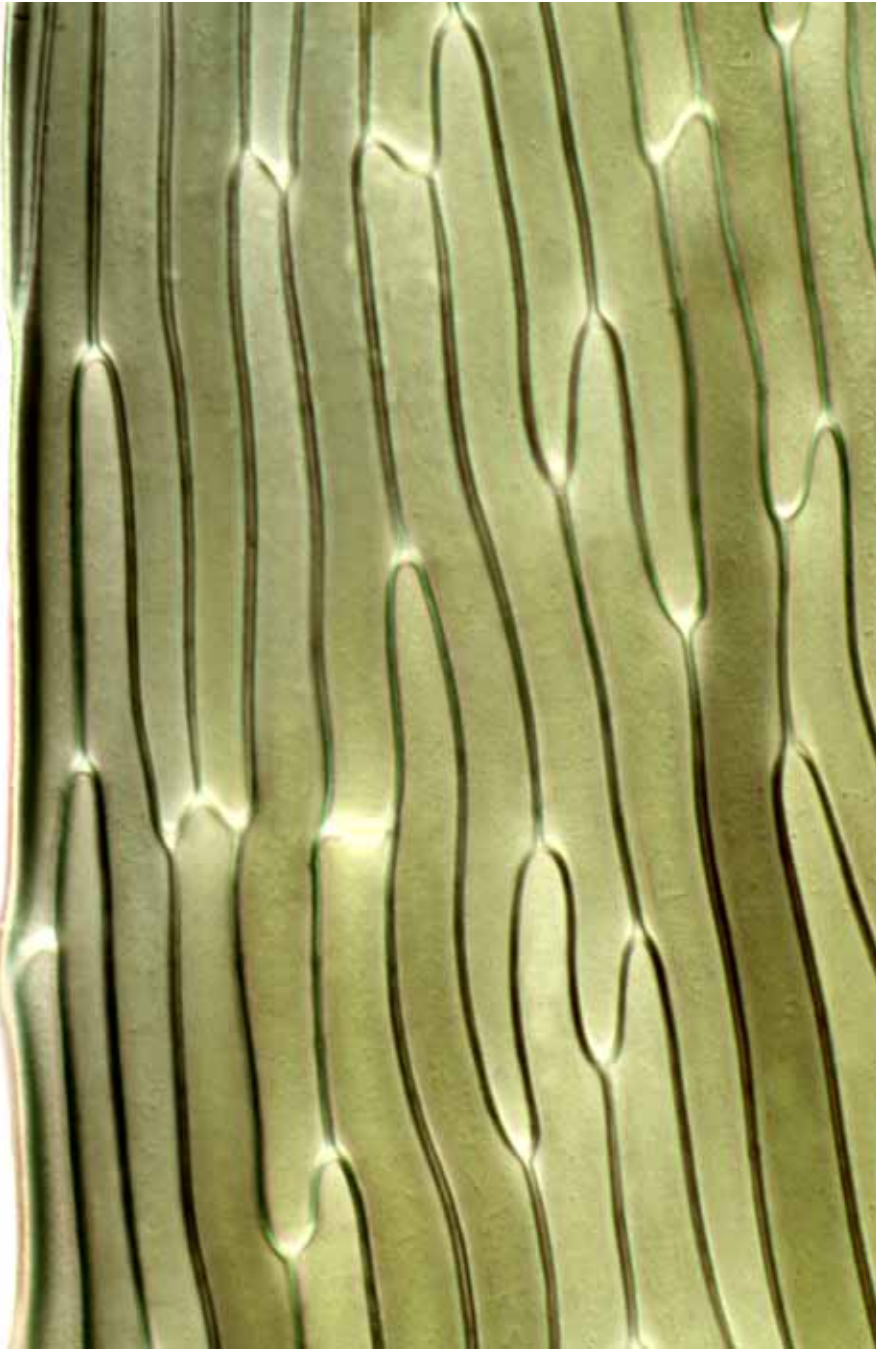
10 μm, 10 μm, 10 μm

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Pohlia cruda leaf apex
10 μm

continued next page



Pohlia cruda margin midleaf
10 μm

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***Pohlia elongata* Hedw.**

form: loosely tufted, erect, simple stems, 3–12 mm tall, the leaves dull green
habitat: soil, rotting logs, and tree bases to high elevations

leaf: size: 0.8–1.7 × 0.3–0.6 mm

shape: ovate-lanceolate to linear-lanceolate, stiff when dry

tip: acuminate

base: ± decurrent, basal cells short-rectangular

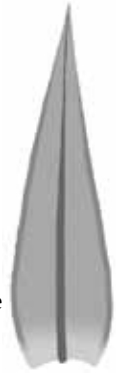
costa: failing 1–4 cells below the apex

border: not differentiated

margin: entire below, serrulate above, recurved in the upper stem leaves

cells: upper cells 40–90 × 7–10 μm, linear, firm-walled, smooth

capsule: to 6.5 mm, cylindric, long-necked, erect to nodding, exserted, light brown; annulus revolvable; seta 20–30 mm; peristome double, the endostome segments keeled and narrowly perforate; operculum high-conic; stomata superficial; spores 16–23 μm in diam., papillose



fertile shoots (dry) (3), capsule (dry) (2), leaf outline, leaf apex, and margin midleaf

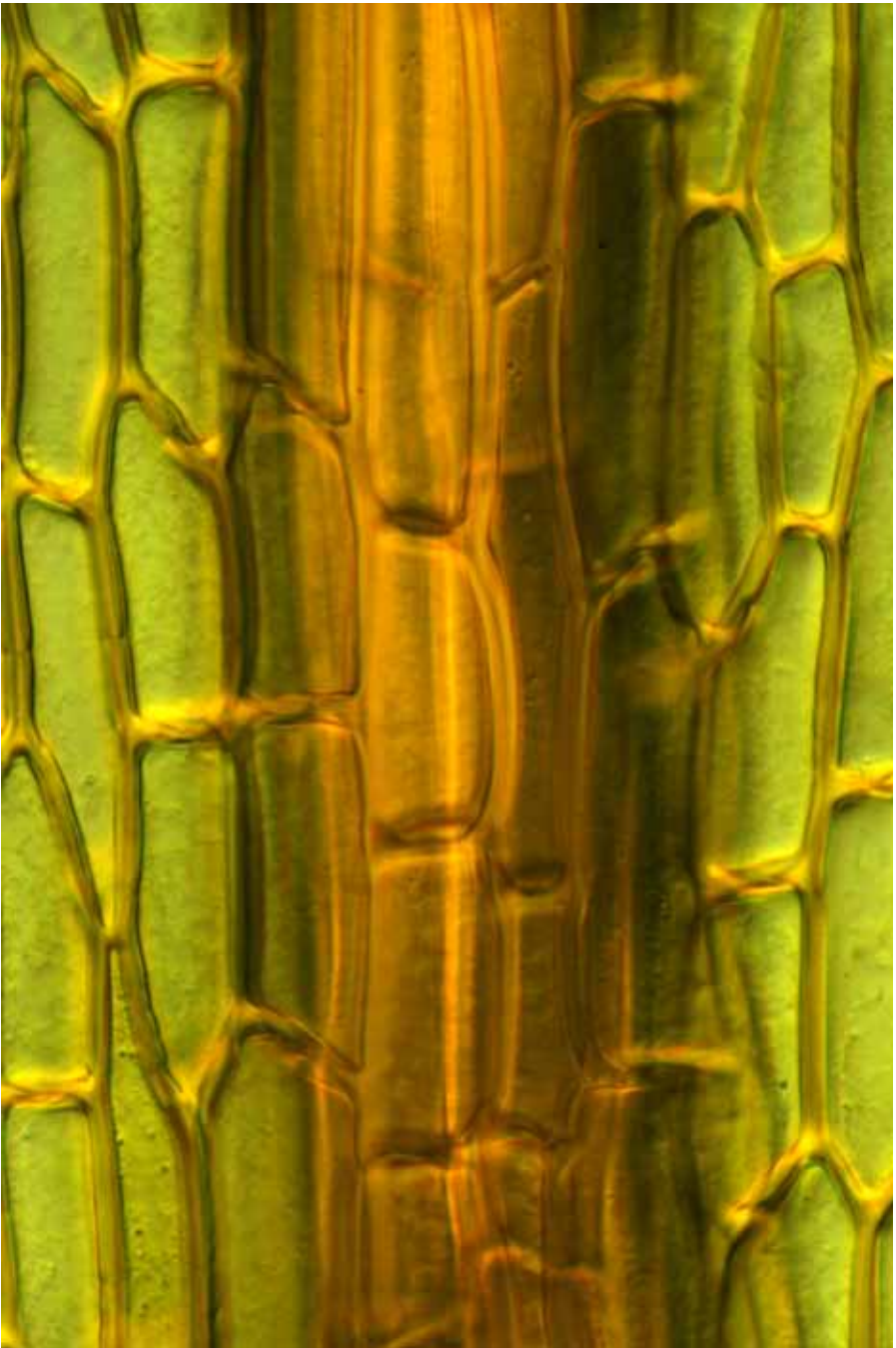
5 mm, 1 mm, 1 mm, 1 mm, 0.1 mm, 50 μm, 10 μm



costa at midleaf, cells at midleaf, and leaf basal angle

10 μm, 10 μm, 50 μm

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Pohlia elongata costa midleaf
10 μ m

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Pohlia nutans (Hedw.) Lindb.

form: tufted, erect, unbranched stems, 10–40 mm tall, the upper leaves crowded and larger

habitat: soil, rotting wood, and old peat hummocks in open or closed forest

leaf: size: 2–3(–4) mm

shape: lanceolate

tip: acuminate

base: not differentiated

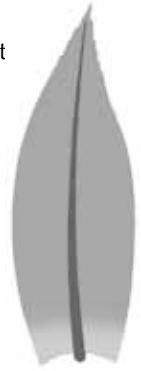
costa: strong below, subpercurrent

border: not differentiated

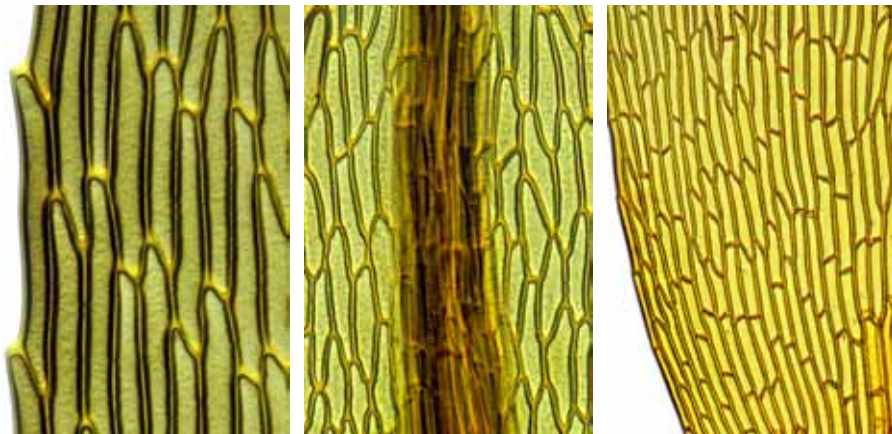
margin: entire below, denticulate near the apex, plane to reflexed

cells: 40–110 × 9–12 μm, linear to narrowly rhombic, firm-walled, smooth

capsule: 2.5–4 mm, narrowly pyriform, necked, horizontal to pendent, exerted, orange; seta 15–45 mm, flexuose, orange; peristome double, endostome cilia 2–3, segments perforate or gaping; operculum conic, rounded to bluntly apiculate; spores 16–21 μm in diam.



vegetative shoots (dry) (3), capsule (moist), leaf outline, and leaf apex
 ■ 1 mm (2), ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 50 μm



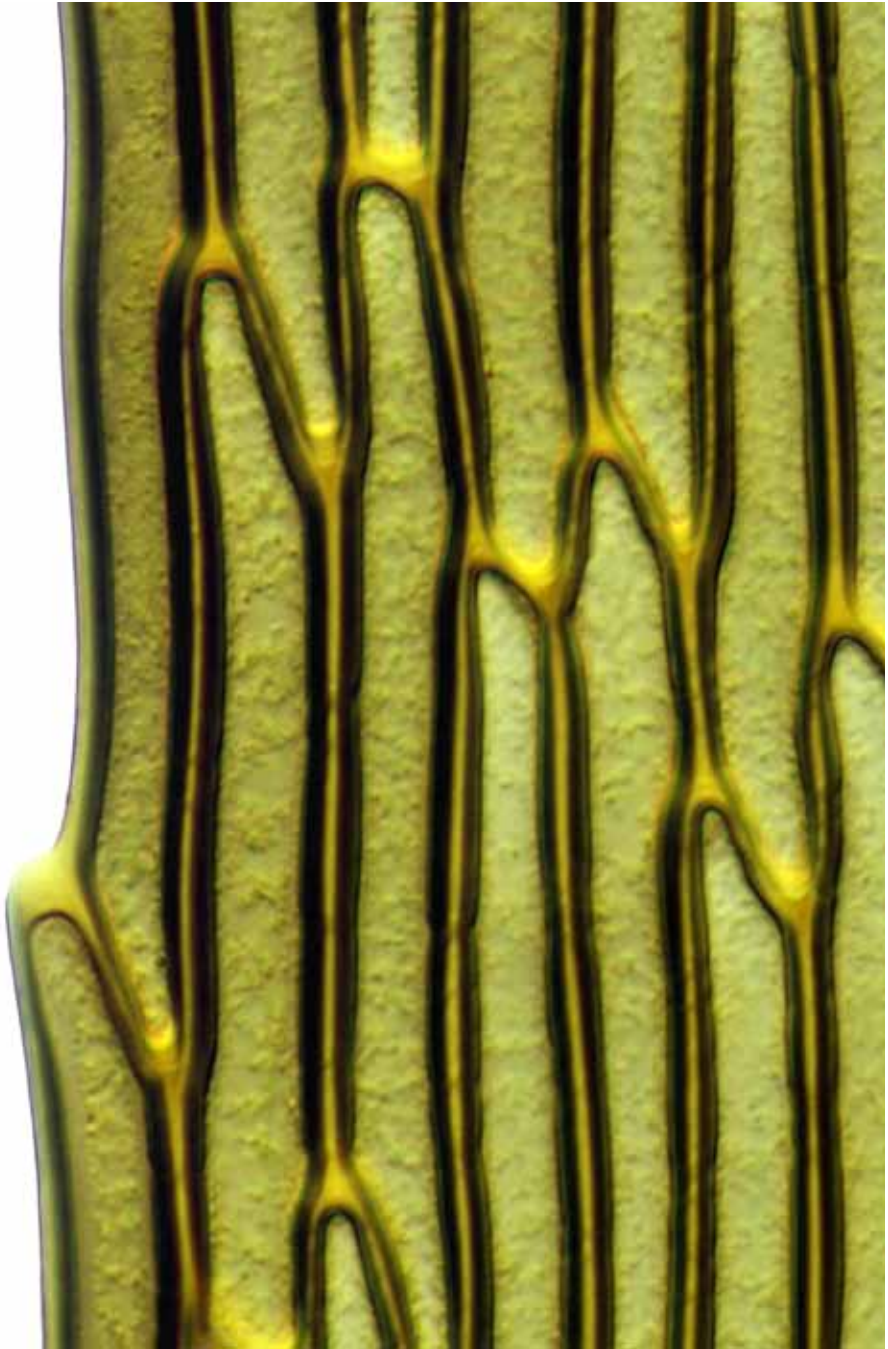
margin midleaf, costa upper leaf, and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 50 μm

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Pohlia nutans immature capsules
1 mm

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Pohlia nutans margin midleaf
10 μ m

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Pohli ochii Vitt

form: slender shoots in tufts, light or yellow-green, dull or lustrous, 7–18 mm tall
habitat: on dripping-wet, protected cliff faces

leaf: size: 2.1–3.4 mm

shape: narrowly lanceolate to linear-lanceolate

tip: attenuate to long-acuminate, twisted (torquate) when dry

base: undifferentiated, narrowly decurrent

costa: slender, ending several cells below the apex

border: not differentiated

margin: reflexed, serrulate from midleaf to the apex, subentire below

cells: upper cells elongate, thin-walled, $105\text{--}260 \times 7\text{--}11 \mu\text{m}$; basal cells shorter

capsule: capsules not known

note: twisted, vermicular propagula common in upper leaf axils, $130\text{--}300 \mu\text{m}$ long, with 1–3 primordia



vegetative shoots (dry) (4), leaf outline, and torquate leaf apex

5 mm, 5 mm, 5 mm, 1 mm, 1 mm, 50 μm



subapex and margin, vermicular gemmae, and leaf basal angle

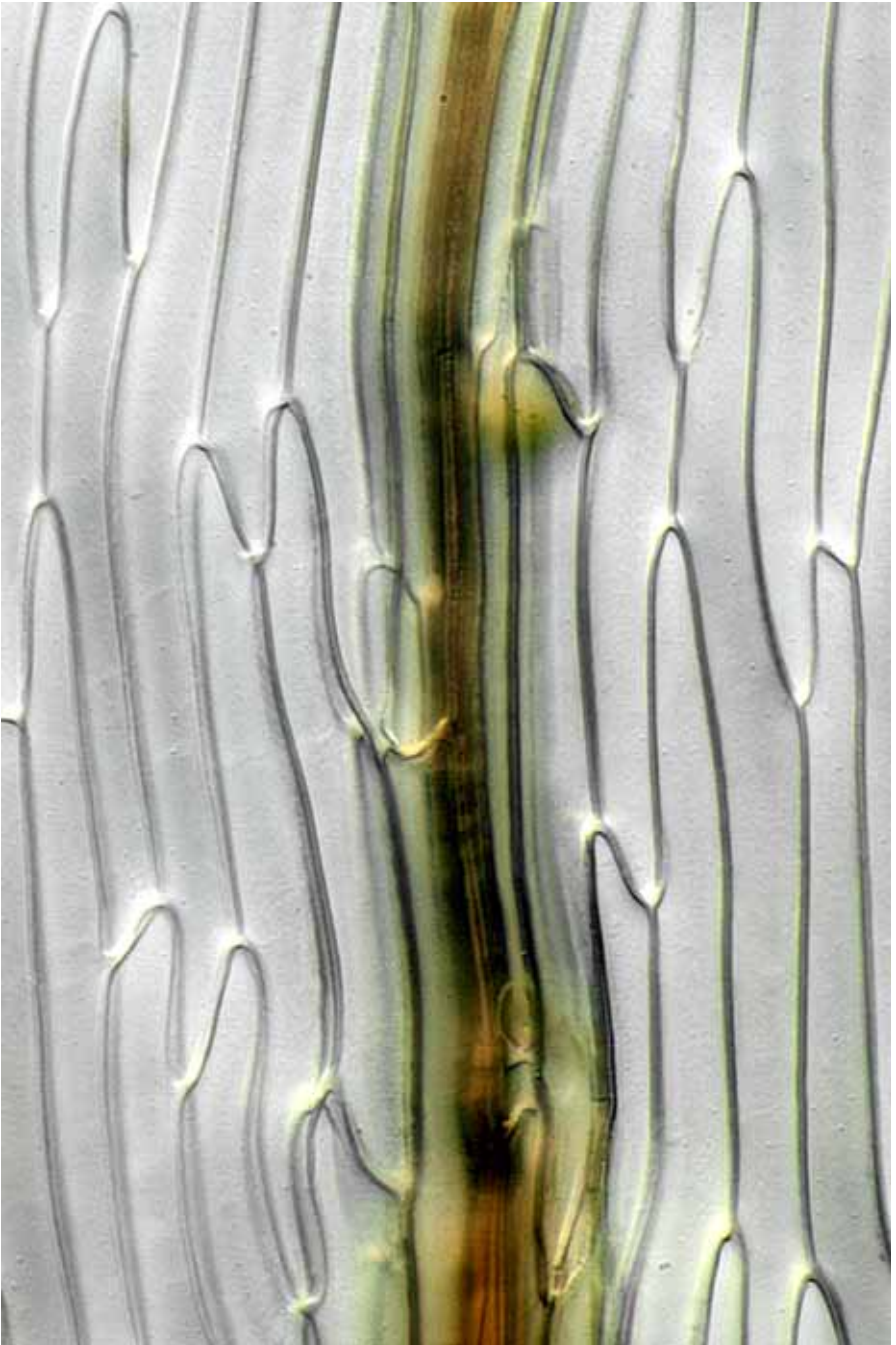
50 μm , 10 μm , 50 μm

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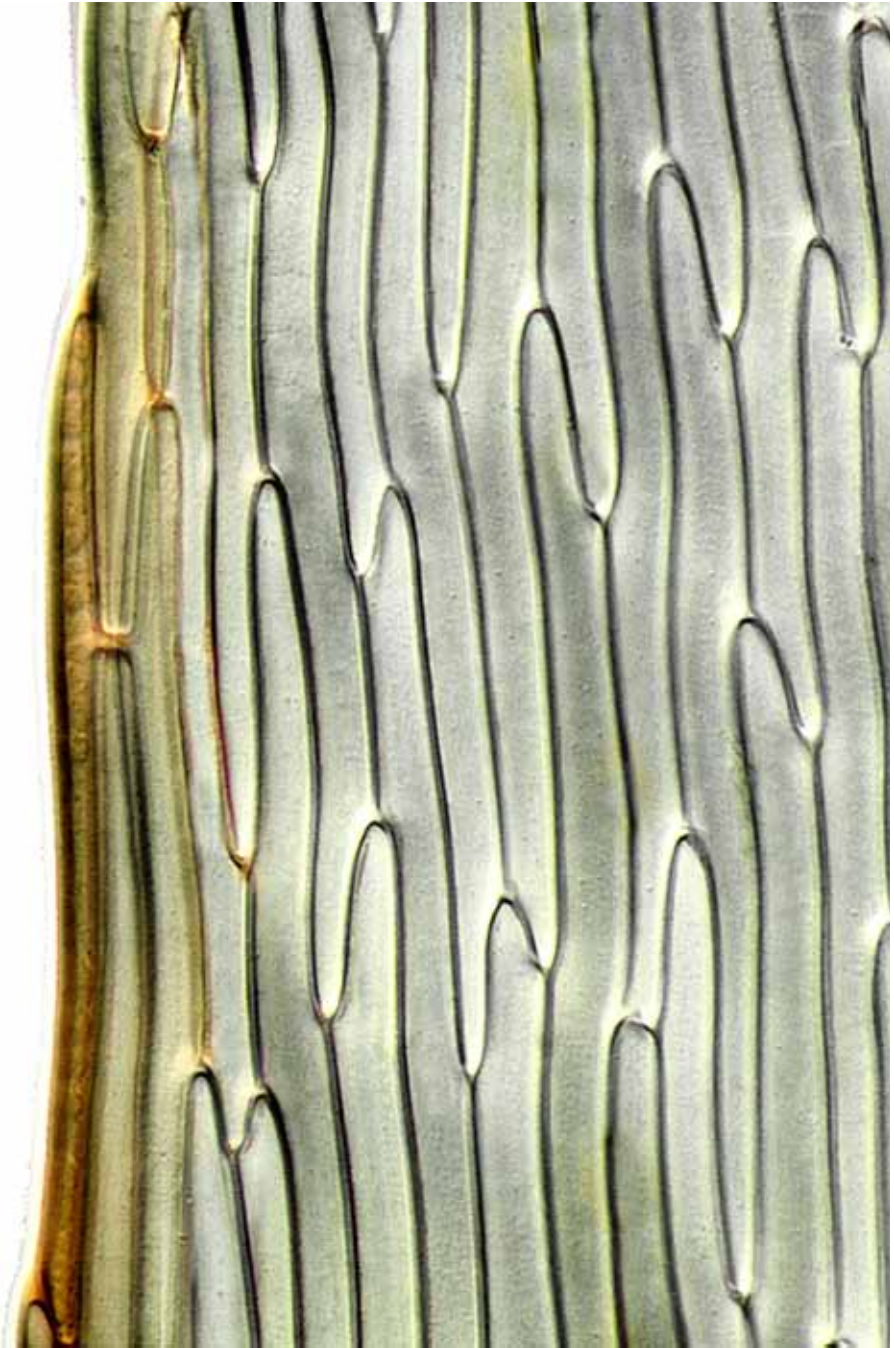
Pohlia ochii vegetative shoot (dry), and twisted (torquate) leaf apex
1 mm (left), 50 μ m (right)

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Pohlia ochii costa upper leaf
10 μm

continued next page



Pohlia ochii margin upper leaf
10 μm

continued next page

Pohlia tenuifolia (A.Jaeger) Broth.

form: tufted or loosely gregarious, erect, simple, slender stems, 3–10 mm tall, the leaves yellowish brown

habitat: soil

leaf: size: 1–2 mm

shape: narrowly linear-lanceolate to triangular, ± curved

tip: acuminate, rounded at the tip

base: not differentiated

costa: percurrent

border: not differentiated

margin: entire, plane to narrowly recurved

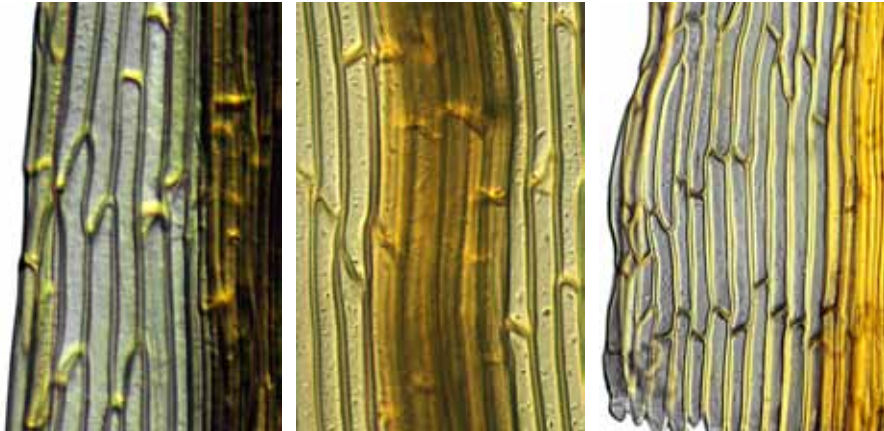
cells: 70–100 × 10 μm, linear-rhombic, firm-walled, smooth

capsule: 1–1.5 mm, narrowly oval or oblong, inclined to pendent, brown; seta 10–20 mm, flexuose, reddish; operculum conic; peristome bryoid, the exostome teeth 16, subulate with numerous lamellae, endostome cilia from rudimentary to long; spores 14–16 μm, smooth



vegetative shoot (dry and moist), leaf outline, and leaf apex (2)

1 mm, 0.5 mm, 0.1 mm, 50 μm, 50 μm



margin midleaf, costa midleaf, and leaf basal angle

10 μm, 10 μm, 10 μm

continued next page

Pohlia wahlenbergii (Weber & D.Mohr) Andrews *in* Grout

form: loosely tufted or matted, erect, unbranched stems 10–50 mm tall, the leaves pale green

habitat: wet soil and humus of springs, meadows, and fens, to 2000 m

leaf: size: 1.0–2.5 × 0.3–1.0 mm

shape: ovate to ovate-lanceolate, concave

tip: acute to obtuse

base: alar cells undifferentiated, base narrowly decurrent

costa: failing well below the apex, reddish

border: not differentiated

margin: serrulate toward the apex, plane or nearly so

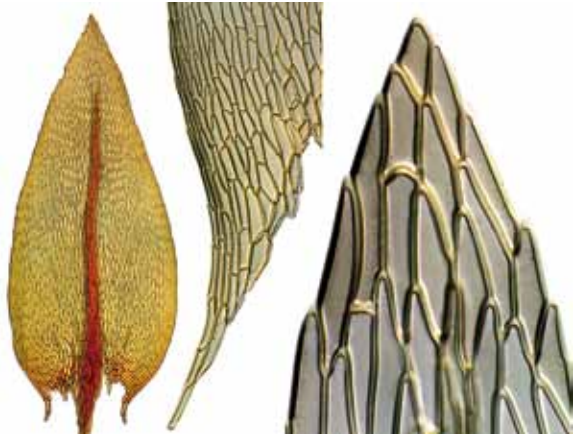
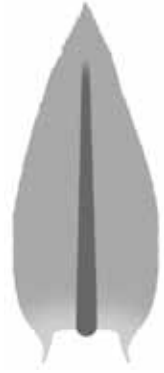
cells: 80–140 × 13–20 μm, long-rhombic, thin-walled, smooth

capsule: 1–2 mm, ovoid, short-necked, pendent, light to dark brown;

seta 10–20 mm; operculum high-conic; annulus none; peristome

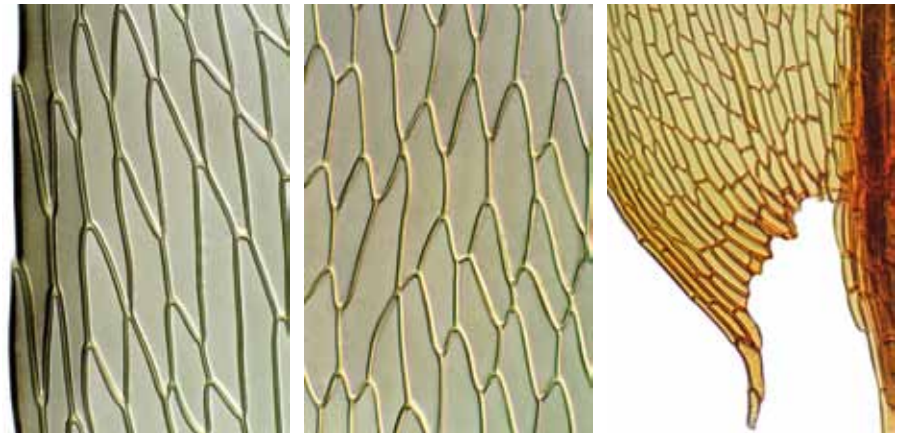
bryoid; spores 14–18 μm in diam.

note: nearly cosmopolitan



vegetative shoots (dry), leaf outline, leaf decurrency, and leaf apex

■ 1 mm, ■ 0.1 mm, ■ 50 μm, ■ 10 μm



margin midleaf, cells midleaf, and leaf basal angle showing decurrency

■ 10 μm, ■ 10 μm, ■ 50 μm

continued next page



Pohlia wahlenbergii margin midleaf
10 μm

Schizymerium bryoides Hook.

form: tufted or scattered, radiculose, irregularly branched stems, to 20 mm tall, the leaves dull yellow, glossy

habitat: soil or rock

leaf: size: 0.8–2 × 0.2–0.5 mm

shape: lanceolate to oblong-lanceolate

tip: acute to acuminate

base: not differentiated

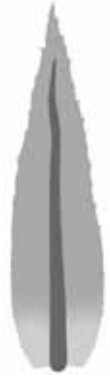
costa: gradually tapering, failing below the apex

border: not differentiated

margin: ± denticulate above, plane

cells: 120 × 6–8 μm, linear-rhombic, firm-walled, smooth

capsule: 2.5–3.5 mm, pyriform to clavate, ± asymmetric, inclined to suberect, wide-mouthed when old; seta 10–30 mm, slender, flexuose, reddish; operculum low-conic, mammillate; exostome absent, endostome processes 16 from a low membrane; spores 16–20 μm in diam, pale brown, smooth



vegetative shoots (dry) (3), leaf outline, and leaf apex (2)

1 mm (2), 1 mm, 0.25 mm, 50 μm, 10 μm



margin midleaf, cells midleaf, and leaf basal angle

10 μm, 10 μm, 50 μm

Key* to the New Zealand species of *Leptostomum* (2)

- 1 Hair-point not branched; cells 12–18 μm , incrassate; seta usually 15–55 mm long ● ***Leptostomum inclinans***
- 1: Hair-point branched; cells 20–30 μm , thin-walled; seta usually 10–15 mm long ● ***Leptostomum macrocarpum***

* based partly on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 238.



Leptostomum inclinans R.Br.

form: erect, simple or forked, matted tomentose stems, in dense cushions, 10–40 mm tall, the leaves pale green to yellow-brown

habitat: bark or rarely rock in montane forest

leaf: size: 2.5–3 (not including the arista) × 0.6–0.7 mm

shape: oblong to ovate-oblong

tip: widely acute to obtuse

base: basal cells slightly larger than the blade cells

costa: stout below, yellow, excurrent in a long, fine, smooth, flexuose arista

border: not differentiated

margin: entire to ± denticulate toward the apex, reflexed, ± undulate

cells: 12–18 μm, isodiametric, incrassate, smooth

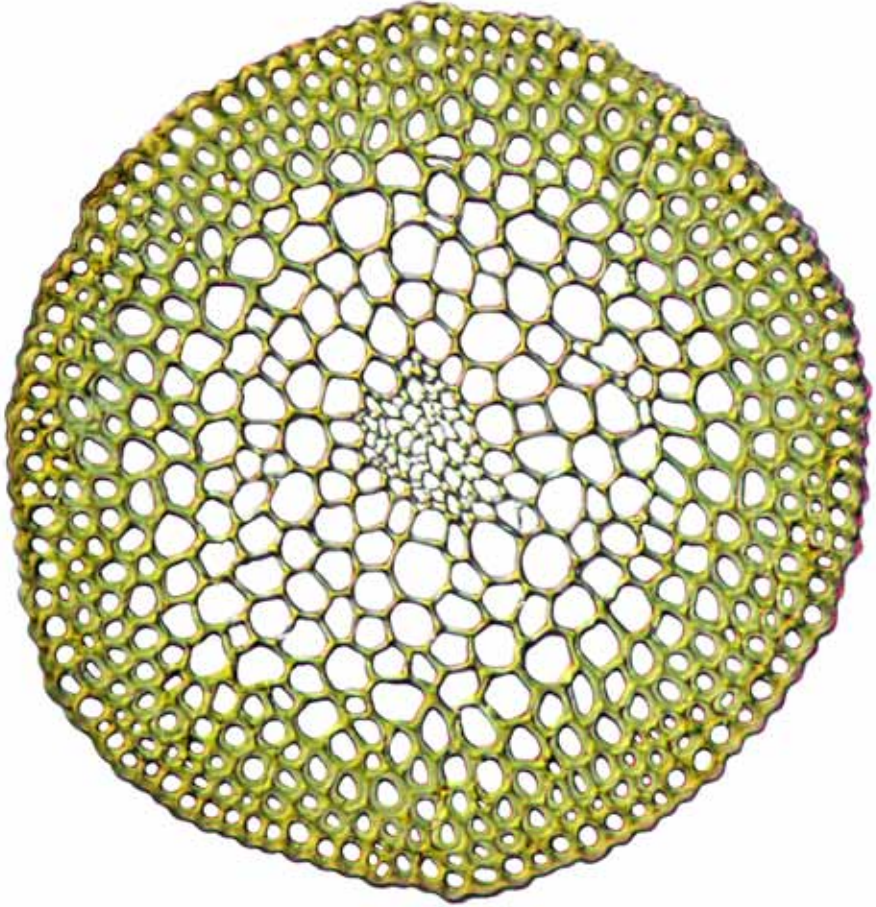
capsule: 3.5 mm, cylindric, long-necked, narrow-mouthed, inclined to erect, brown above, reddish below; seta 15–55 mm, slender, flexuose; operculum short-conic; calyptra cucullate, fugacious; peristome rudimentary



fertile habit, vegetative shoot (moist), leaf outline, leaf apex, and immature capsules (2)
 5 mm, 1 mm, 1 mm, 0.5 mm, 1 mm (2)



margin midleaf, base of arista, and leaf basal angle
 10 μm, 10 μm, 100 μm



Leptostomum inclinans seta cross-section
10 μm

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Leptostomum inclinans margin midleaf
10 μm

continued next page

Leptostomum macrocarpum (Hedw.) Bach.Pyl.

form: densely tufted, erect, heavily red-tomentose stems, 8–20 mm tall
habitat: bark, rock, or rarely soil in lowland to montane forest

leaf: size: 2.3–3.0 mm (excluding the hair-point)

shape: ovate to obovate-oblong

tip: obtuse

base: basal cells short-oblong

costa: excurrent in a branched hair-point

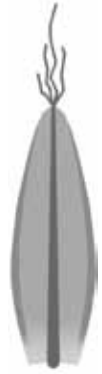
border: not differentiated

margin: entire, revolute from near base to tip

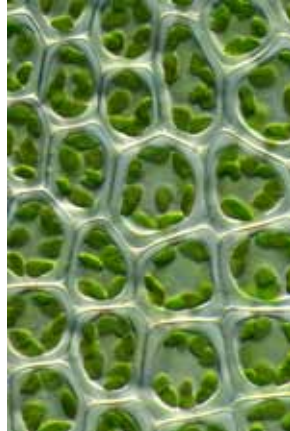
cells: 20–30 μm , subquadrate to wide-hexagonal, thick-walled, smooth

capsule: 3–4.5 mm, ovate-oblong, erect, exserted, pale brown; seta 10–15(–45) mm, yellow to orange, flexuose; peristome rudimentary, only a low, papillose, membranous endostome; operculum high-conic; no annulus

note: differs from *Leptostomum inclinans* in having a branched hair-point and larger leaf cells

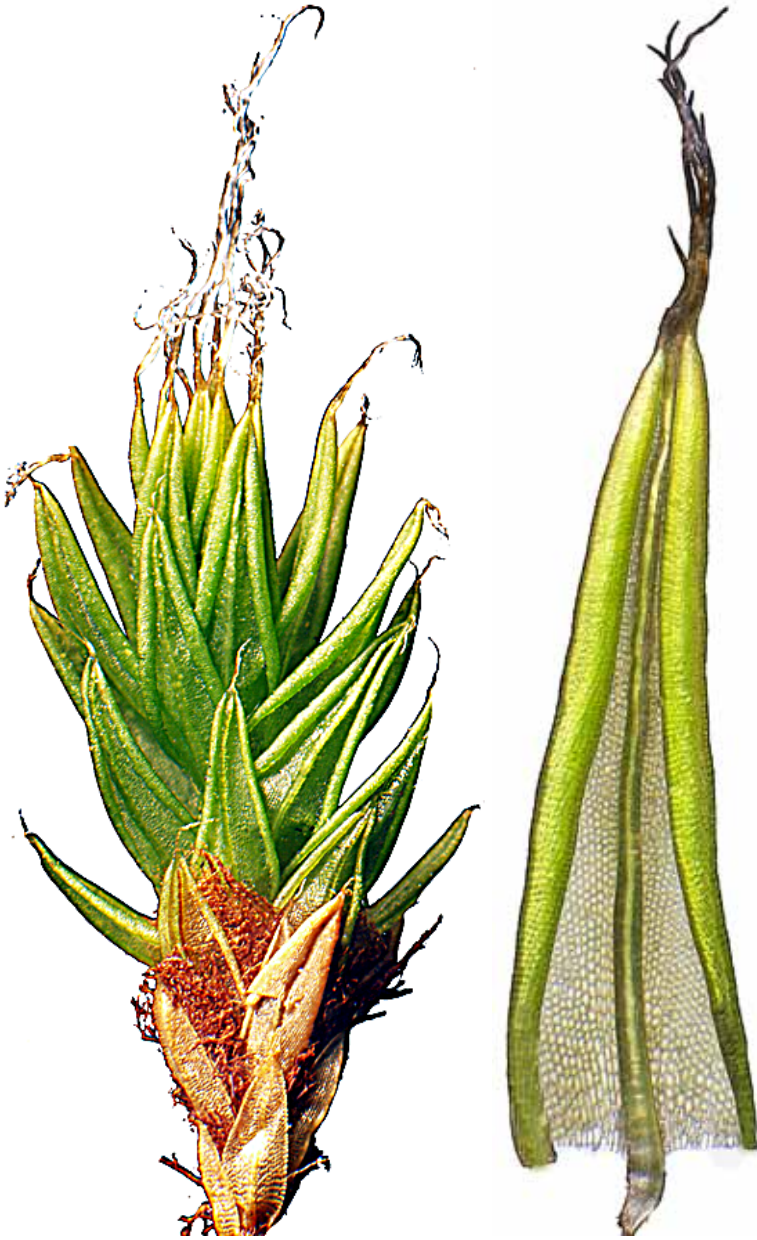


fertile shoots (male on left), capsules (with and without calyptra) (2), and leaf outline
 ■ 1 mm, ■ 1 mm, ■ 1 mm (2), ■ 1 mm



leaf apex, hair-point, cells lower leaf (fresh), and leaf basal angle
 ■ 100 μm , ■ 10 μm , ■ 100 μm

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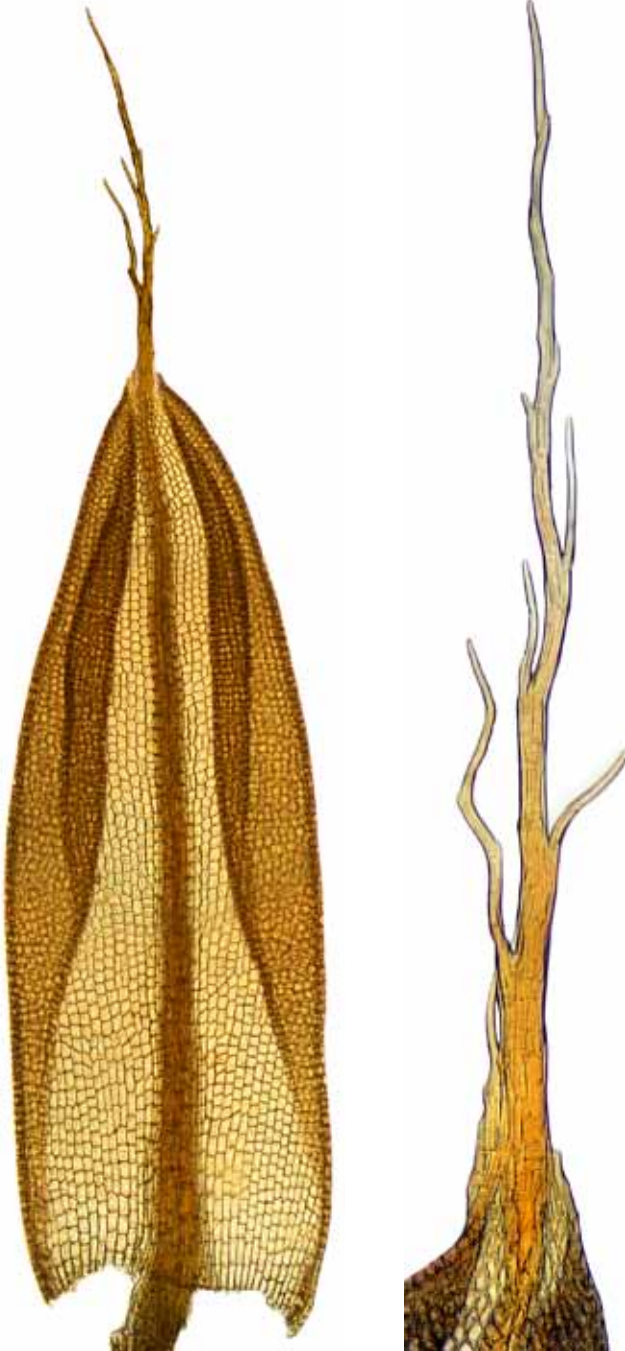


Leptostomum macrocarpum vegetative shoot and leaf (abaxial surface) (moist)

1 mm,

1 mm

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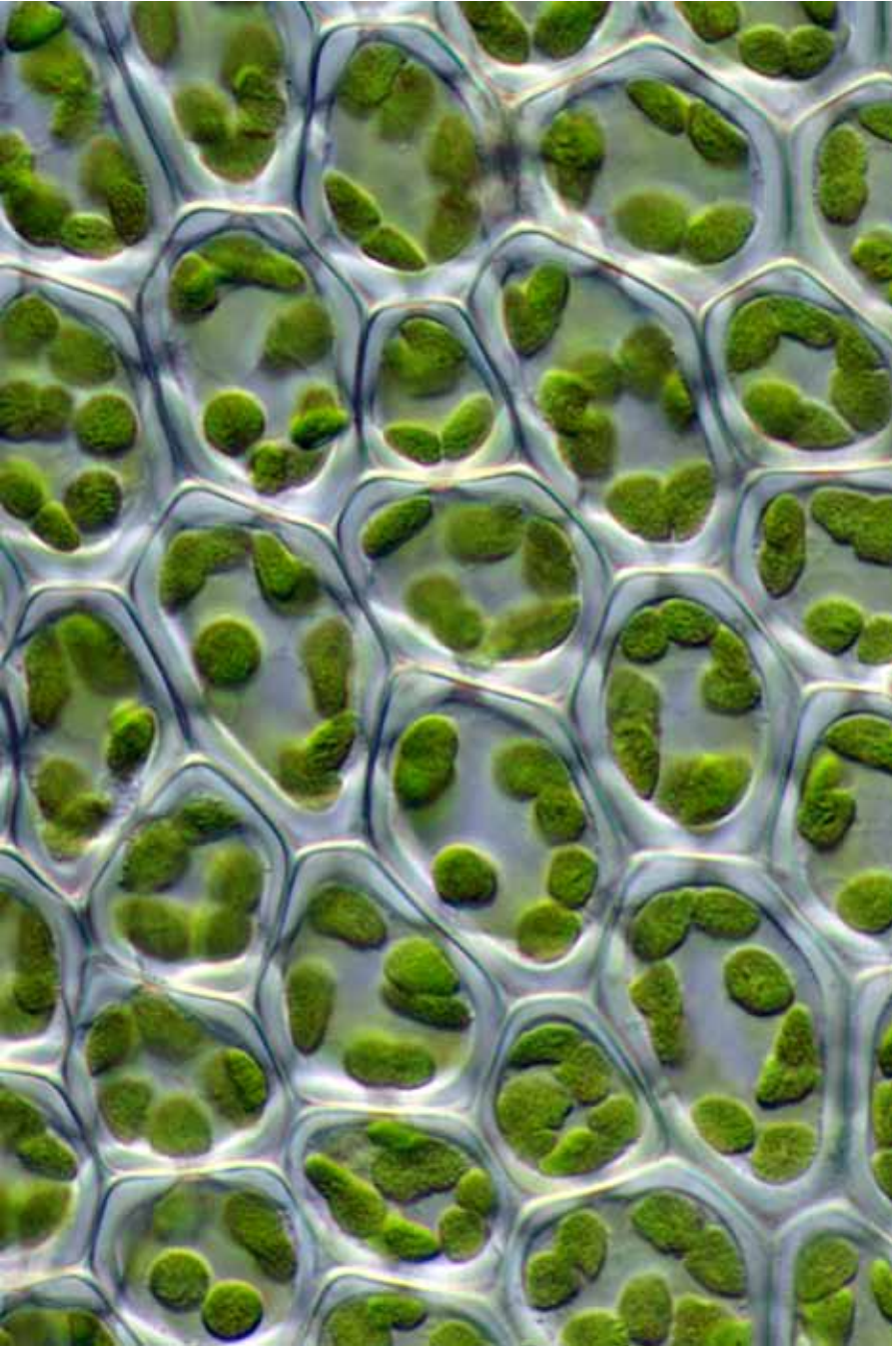


Leptostomum macrocarpum leaf outline and hair-point detail (cleared)

0.5 mm,

0.1 mm

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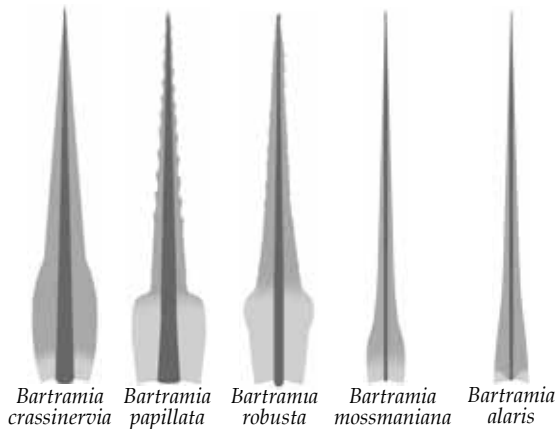


Leptostomum macrocarpum cells lower leaf (fresh)
10 μm

Key* to the New Zealand species of *Bartramia* (5)

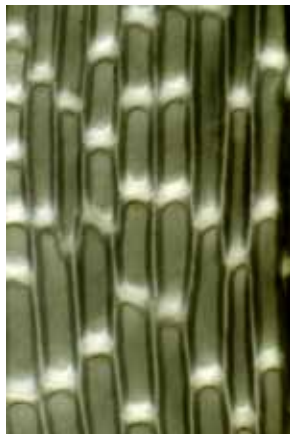
- 1 Angle cells forming a distinct alar group **Bartramia alaris**
 1: Angle cells not differentiated 2
- 2(1:) Upper cells elongate and obscure; leaf base strongly sheathing 3
 2: Upper cells isodiametric and clear; leaf base only weakly sheathing 4
- 3(2) Capsule gymnostomous, erect..... ● **Bartramia robusta**
 3: Capsule peristomate, inclined..... ● **Bartramia papillata**
- 4(2:) Stems 30–100 mm tall; seta 2–8 mm long..... ● **Bartramia mossmaniana**
 4: Stems 6–7 mm tall; seta 10 mm long ● **Bartramia crassinervia**

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bulletin 5, 301.



Bartramia crassinervia Mitt.**form:** tufted, branched stems to 7 mm tall, glaucous green**habitat:** montane beech forest, 800–1100 m**leaf:** *size:* to 2 mm long*shape:* lanceolate, spreading when moist*tip:* acuminate, subula serrulate toward apex*base:* weakly sheathing from a narrowly ovate base*costa:* strong, 1/3 of width of leaf base, excurrent, toothed on back and apex*border:* not differentiated*margin:* serrulate above, recurved*cells:* $7 \times 11 \mu\text{m}$, upper \pm quadrate, lower elongate, firm-walled, smooth to weakly papillose**capsule:** $1.5 \times 0.8 \text{ mm}$, when young subglobose, when mature short-cylindric, asymmetric, and strongly ridged, rust-red; seta to 10 mm, red; operculum convex, apiculate; peristome teeth narrow, reddish**note:** a rare New Zealand endemic

vegetative shoot (moist), mature capsule (dry), leaf, apex, subapex, and upper margin
 1 mm, 1 mm, 0.5 mm, 10 μm , 10 μm , 10 μm



costa and recurved margin, cells near leaf base, and leaf basal angle
 50 μm , 10 μm , 50 μm

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Bartramia crassinervis habit (dry)
10 mm

Bartramia mossmaniana Müll.Hal.

form: robust, loosely tufted, soft, sparingly branched stems, 30–100 mm tall, tomentose below

habitat: bark, soil, or rock crevices in damp forest to high elevation

leaf: size: 5–9 × 0.6–1.0 mm

shape: suddenly contracted to a linear subula from a wide base

tip: long-tapering

base: semi-sheathing

costa: excurrent in a sharply denticulate point, ± serrulate at the back

border: not differentiated

margin: doubly serrate above, narrowly recurved or thickened

cells: 8–15 μm, ± isodiametric, incrassate, mammillose, sheath cells linear

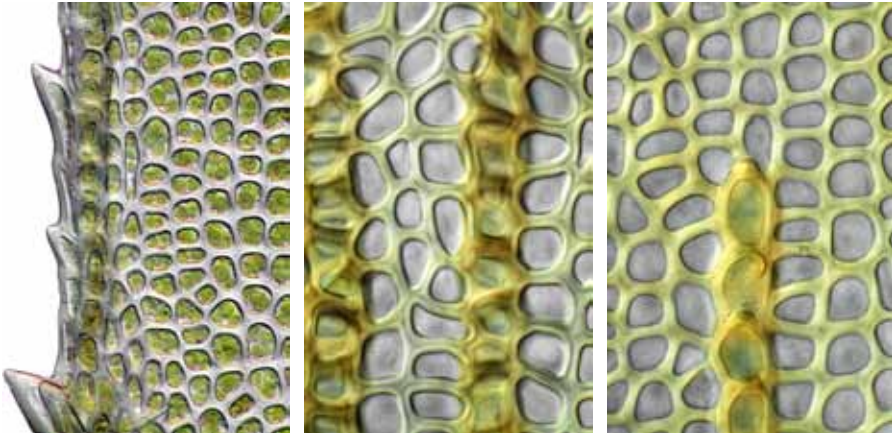
capsule: 1–2 mm, oval-oblong to subglobose, ± curved and furrowed when dry; seta 2–5 mm, often paired

note: resembles *Polytrichadelphus magellanicus*, but differs in having a double peristome and non-lamellate leaves



fertile shoot (2), mature capsule (dry), leaf outline, leaf apex, and subapex

5 mm, 5 mm, 1 mm, 1 mm, 10 μm, 10 μm



toothed subula margin and cells midleaf (2)

10 μm, 10 μm, 10 μm

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Bartramia mossmaniana vegetative shoot (moist) and peristome (top view) (dry)
■ 1 mm (shoot), ■ 0.5 mm (peristome)

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Bartramia papillata Hook.f. & Wilson

form: tufted, erect, heavily tomentose stems, 10–30 mm tall, the leaves yellowish brown or green

habitat: soil or rock

leaf: size: 3.5–8 mm

shape: setaceous from a wide semi-sheathing base

tip: acute

base: cells of silvery basal sheath hyaline, smooth, thin-walled

costa: percurrent or excurrent, ill-defined

border: not differentiated

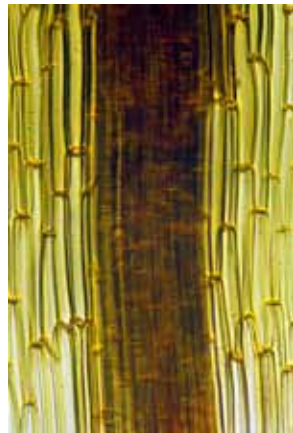
margin: serrulate above, plane or slightly reflexed, ± bistratose

cells: 16–30 μm long, rectangular, firm-walled, papillose

capsule: 1–3 mm, subglobose slightly asymmetrical, oblong to subglobose, erect to inclined, furrowed or wrinkled when dry; seta 3–20 mm, orange; operculum conic; peristome double, exostome teeth 16, red, endostome cilia reduced; spores 18–24 μm

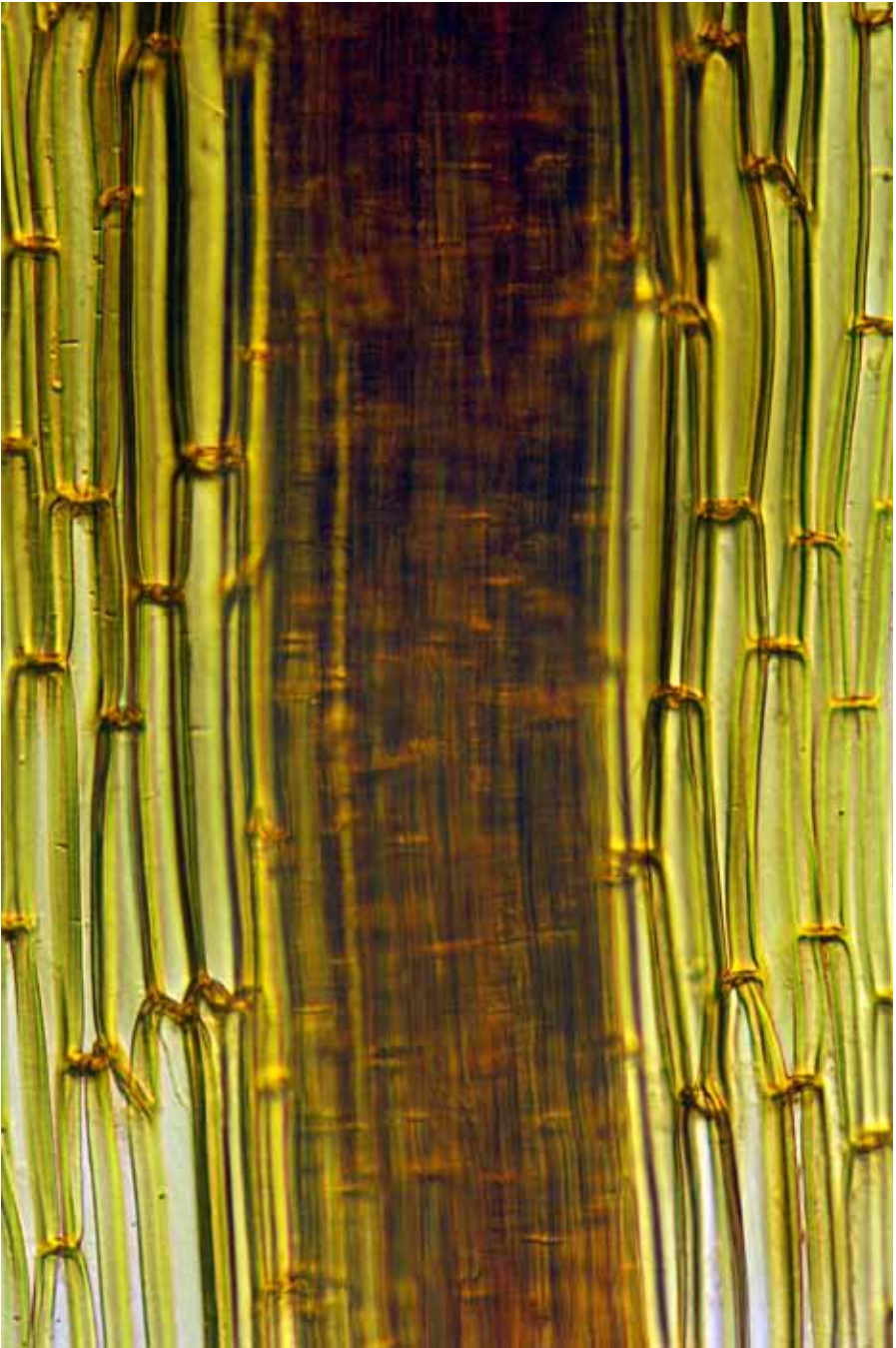


fertile shoot, capsules (2), hyaline sheathing leaf bases, leaf outline, and leaf apex (2)
 ■ 1 mm, ■ 1 mm (2), ■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm



shoulder of sheath, subula margin, and costa near base
 ■ 50 μm , ■ 10 μm , ■ 10 μm

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Bartramia papillata costa near leaf base
10 μ m

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Bartramia robusta Hook.f. & Wilson

form: loosely caespitose, densely rhizomatose stems, to 30 mm tall, the leaves yellow-green

habitat: soil or rock in montane to alpine herbfields, to 1500 m

leaf: size: 3.5–6.3 × 0.5–1.0 mm

shape: narrowly triangular atop an obtuse, sheathing, hyaline base

tip: acute

base: basal cells long-rectangular, 190 × 30 μm, thin-walled

costa: strong, prominent abaxially, percurrent

border: not differentiated

margin: entire below, denticulate above (teeth single or double), plane

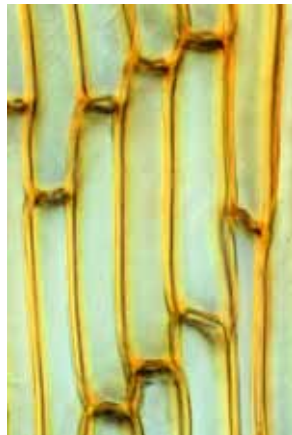
cells: 38 × 8 μm, rectangular, firm-walled, ± prorate

capsule: 2 × 1 mm, subglobose, ± erect, sulcate when dry; seta 10–30 mm; peristome double, exostome teeth orange, endostome segments rudimentary; spores reniform, brown, 35–50 μm in diam., coarsely verrucose



fertile habit, cushion (cutaway view), leaf outline, and leaf apex

1 mm, 1 mm, 1 mm, 10 μm



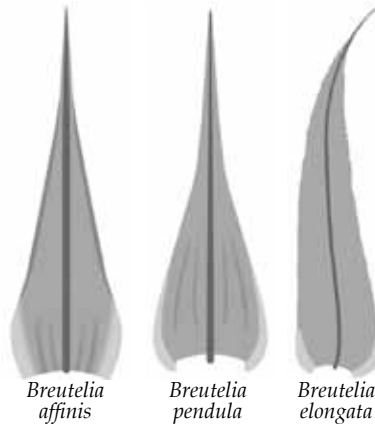
leaf shoulder, leaf basal cells, and immature capsule with calyptra

50 μm, 10 μm, 0.5 mm

Key* to the New Zealand species of *Breutelia* (3)

- 1 Leaves subsecund; stems densely foliate..... ● ***Breutelia elongata***
 1: Leaves radially arranged; stem loosely foliate2
- 2(1:) Leaf plicate at only the base; alar cells in 6–12 rows, firm-walled
 ● ***Breutelia affinis***
 2: Leaf plicate above; alar cells in 3–6 rows, thin-walled ● ***Breutelia pendula***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bulletin 5, 308.



Breutelia affinis (Hook.) Mitt.

form: densely matted, erect, heavily tomentose, ± simple stems, to 70 mm tall
habitat: rock or soil in moist sites, to montane elevations

leaf: size: 1.7–3.8 × 0.4–0.9 mm

shape: ovate-lanceolate to oblong-lanceolate, plicate at the base

tip: long-acuminate

base: basal patch plus many rows of subquadrate alar cells to 1/3 up blade

costa: short- to long-excurrent

border: not differentiated

margin: denticulate above, entire below, recurved midleaf and below

cells: 6–40 × 2–6 μm, irregular, firm-walled, ± papillose

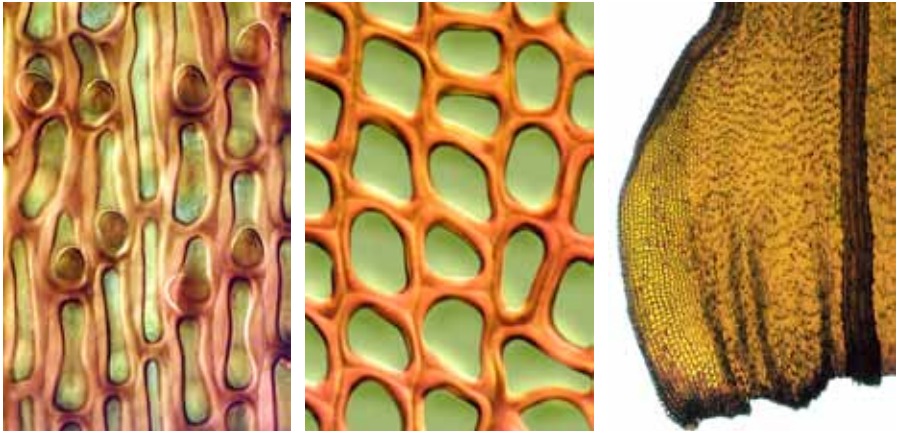
capsule: 2 mm, cylindric, inclined to horizontal, deeply ribbed when dry; seta to 25 mm; peristome double, exostome teeth 16, endostome cilia rudimentary; spores 24–34 μm

note: differs from other species of *Breutelia* in having large numbers of subquadrate alar cells reaching 1/3 up the leaf blade



male shoots (2), leaf outline, leaf apex (2), and margin midleaf

■ 5 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm, ■ 10 μm, ■ 10 μm



cells midleaf, alar cells, and leaf basal angle showing plications

■ 10 μm, ■ 10 μm, ■ 100 μm

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Breutelia affinis habit
1 mm

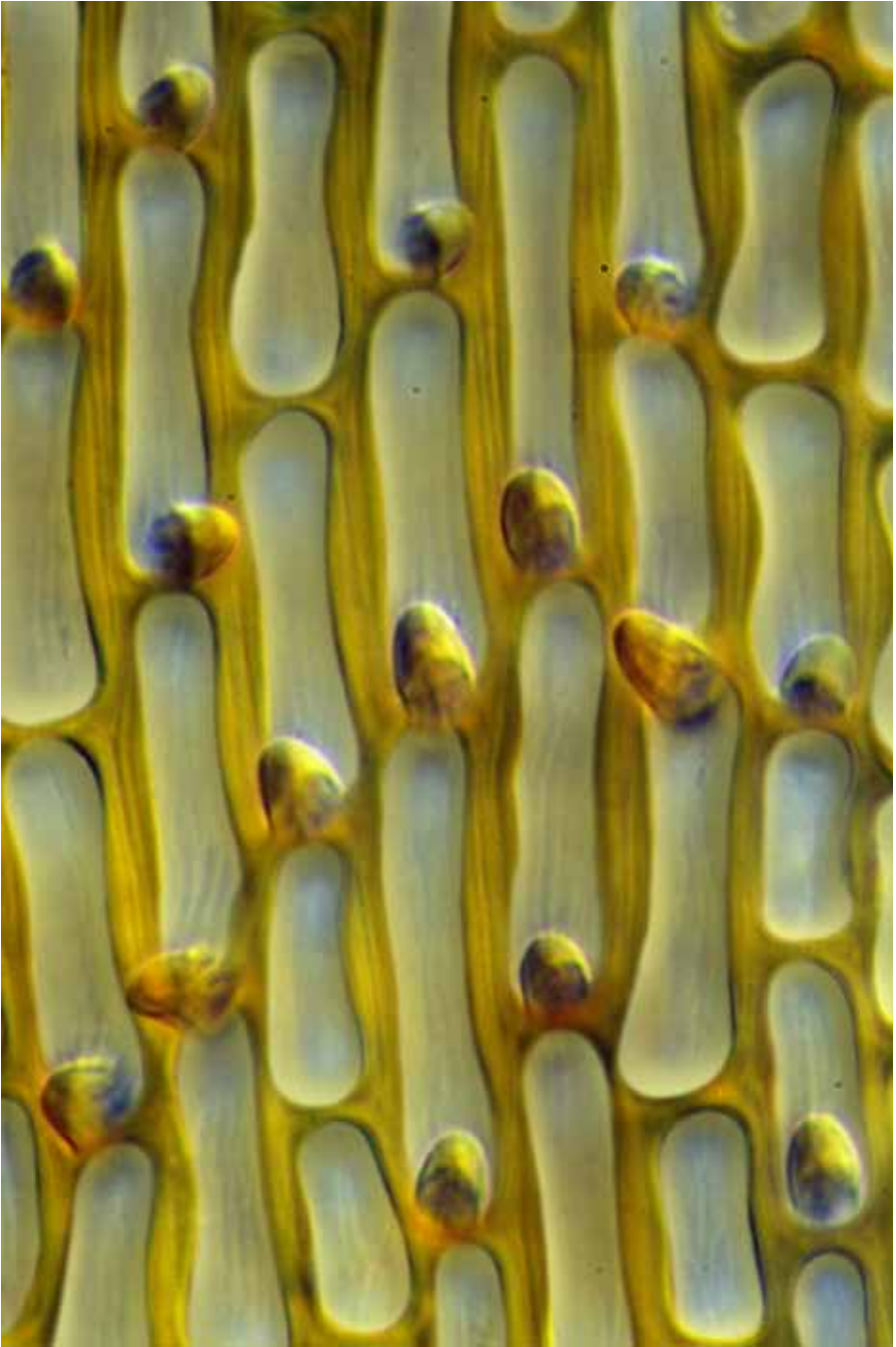
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Breutelia affinis vegetative shoots (dry)

5 mm

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Breutelia affinis cells midleaf
10 μ m

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Breutelia elongata (Hook.f. & Wilson) Mitt.

form: tufted, erect, ± simple stems, to 80 mm long, the leaves secund, golden
habitat: moist soil or occasionally rock, lowland to montane

leaf: size: 5–7 mm

shape: ovate-lanceolate, strongly plicate throughout

tip: acuminate, ending in a filiform hair-point

base: 6–8 rows of short, pigmented cells

costa: percurrent to shortly excurrent in a slender point

border: not differentiated

margin: distantly denticulate, plane

cells: 30–55 μm, narrowly linear, incrassate, papillose at the distal end

capsule: 5 mm, ovate-oblong, erect, ± gibbous, sulcate when dry; seta 20–60 mm; spores 20–22 μm in diam.

note: differs from *Breutelia pendula* in having thicker-walled porose cells, a narrower leaf base and costa, more strongly plicate leaves, and a shorter and wider alar region



vegetative shoots (dry) (2), capsule, leaf plications, leaf outline, and leaf apex
 ■ 5 mm, ■ 1 mm, ■ 5 mm, ■ 1 mm, ■ 1 mm, ■ 10 mm



leaf margin, midleaf cells, and alar region of leaf base
 ■ 10 μm, ■ 10 μm, ■ 100 μm

continued next page

Breutelia pendula (Sm.) Mitt.

form: robust mats of ± simple, densely tomentose stems, to 140 mm long
habitat: soil or rock in moist sites, usually at higher elevations

leaf: size: 2.5–4.0 × 0.8–1.3 mm

shape: ovate-lanceolate from a sheathing base, plicate throughout

tip: finely acuminate

base: alar region 3–6 rows of pellucid cells forming a distinct group

costa: excurrent in a slender, ± flexuose, ± hyaline point

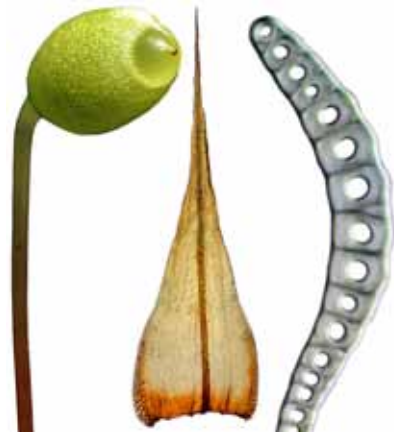
border: not differentiated

margin: serrulate above, ± recurved toward the base

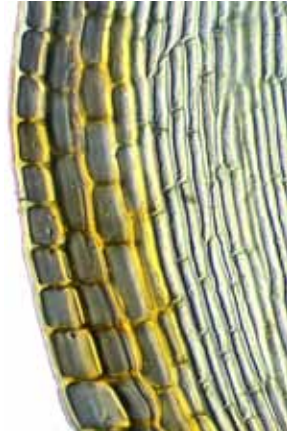
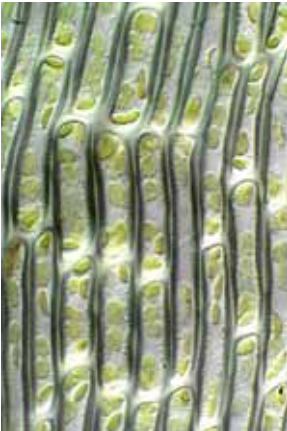
cells: 15–50 μm long, linear to rectangular, firm-walled, smooth

capsule: 2.5–4 mm, ovoid-oblong, ± gibbous, inclined to horizontal, grooved when dry; seta 20–50 mm; peristome double, endostome cilia rudimentary; spores 20–22 μm

notes: can form large, deep mats on rock faces; differs from *Breutelia elongata* in having a wide leaf base and costa and less strongly plicate leaves



habit, tomentose shoot base, immature capsule, leaf outline, and margin cross-section
 10 mm, 1 mm, 1 mm, 0.5 mm, 10 μm



cells midleaf, alar region, alar region xs, and whole leaf xs
 10 μm, 50 μm, 50 μm, 100 μm

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Breutelia pendula vegetative habit (moist)
10 mm

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Breutelia pendula perigonium ("male flower") in top view
1 mm

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Breutelia pendula mature capsule and peristome
— 0.1 mm

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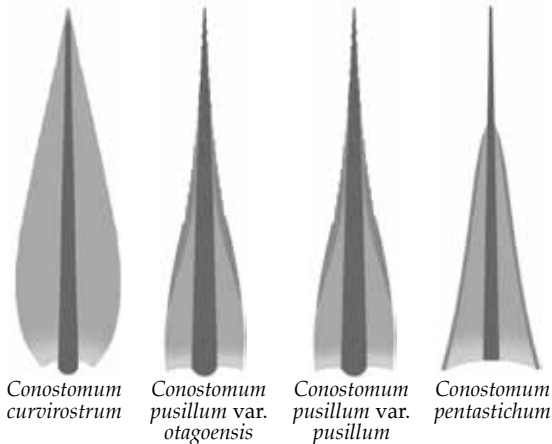


Breutelia pendula leaf cross-section
10 μm

Key* to the New Zealand species and varieties of *Conostomum* (4)

- 1 Peristome present; seta > 9 mm 2
 1: Peristome absent; seta < 6 mm 3
- 2(1) Costa narrow, distinct, and in xs without multistratose wings; capsule < 2.5 mm ● ***Conostomum pentastichum***
 2: Costa wide, indistinct, and in xs with multistratose wings; capsule > 2.5 mm ● ***Conostomum pusillum* var. *pusillum***
- 3(1:) Costa long-excurrent; capsule erect, globose, not sulcate ● ***Conostomum curvirostrum***
 3: Costa percurrent or only short-excurrent; capsule inclined to horizontal, ellipsoidal, sulcate ● ***Conostomum pusillum* var. *otagoensis***

* based partly on Fife, AJ (1998): A synopsis of the New Zealand representatives of *Conostomum* (Musci: Bartramiaceae). *New Zealand Journal of Botany* 36, 606.



Conostomum curvirostrum (Mitt.) Mitt.

form: erect, short-branched, tomentose stems, 2–4 mm tall, tufted or in cushions, the leaves green to reddish brown

habitat: soil at high elevation

leaf: size: 0.5–0.9 × 0.1–0.2 mm

shape: lanceolate to triangular-lanceolate

tip: acuminate

base: basal cells oblong-rectangular, smooth; alar cells little differentiated

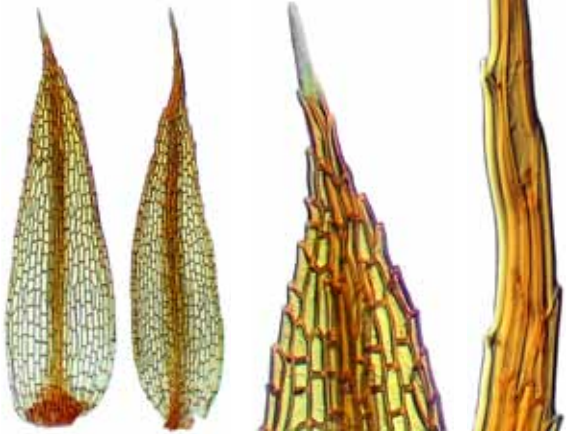
costa: excurrent in a hyaline hair-point, prorate

border: not differentiated

margin: entire, plane or variably recurved

cells: 20–55 × 10–12 μm, rectangular, thin-walled, smooth to prorate

capsule: 1–1.3 mm, globose, erect, wrinkled or furrowed when dry; seta 2–7 mm; peristome absent; spores globose, ovoid, or reniform, densely warted, 36–50 μm in diam.



empty capsules, leaf outlines (2), leaf apex, and hair-point
 1 mm, 0.1 mm (2), 50 μm, 5 μm



subapex (prorate costa), costa in upper leaf, and leaf basal angle showing base of costa
 50 μm, 10 μm, 10 μm

continued next page

Conostomum pentastichum (Brid.) Lindb.

form: densely tufted, tomentose, branched stems, to 20 mm tall, the leaves distinctly five-ranked and glaucous

habitat: damp soil or rock at high altitude

leaf: size: 1–2 × 0.3–0.5 mm

shape: narrowly triangular, the surface prorate

tip: acuminate

base: undifferentiated

costa: wide at the base, indistinct, long-excurrent in a hair-point, prorate

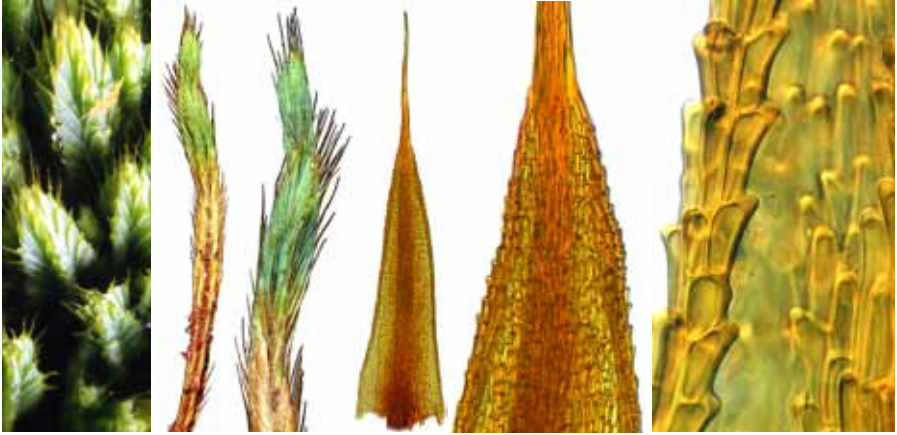
border: absent

margin: prorate, narrowly recurved

cells: 35–60 × 10 μm, linear, firm-walled, smooth to prorate

capsule: 1.5–3.5 mm, globose to ovoid, inclined to ceruuous, sulcate when dry; seta 1–3.5 mm; peristome single, exostome teeth red, the tips fused; spores reniform, to 60 μm long

note: readily identified by its 5-ranked leaves



habit, pentastichous shoots (2), leaf outline and subapex, and recurved margin midleaf
 ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 100 μm, ■ 10 μm



prorate midleaf surface, basal leaf cells, and immature capsules
 ■ 10 μm, ■ 10 μm, ■ 1 mm

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Conostomum pentastichum mature capsule
1 mm

continued next page

Conostomum pusillum var. **otagoensis** Fife

form: tufted, erect, sparsely branched stems with leaves in five rows, 5–20 mm
habitat: damp, exposed soil or rock at high altitude

leaf: size: 0.8–1.8 mm

shape: lanceolate to narrowly triangular, little altered when dry

tip: acuminate

base: alar cells not differentiated

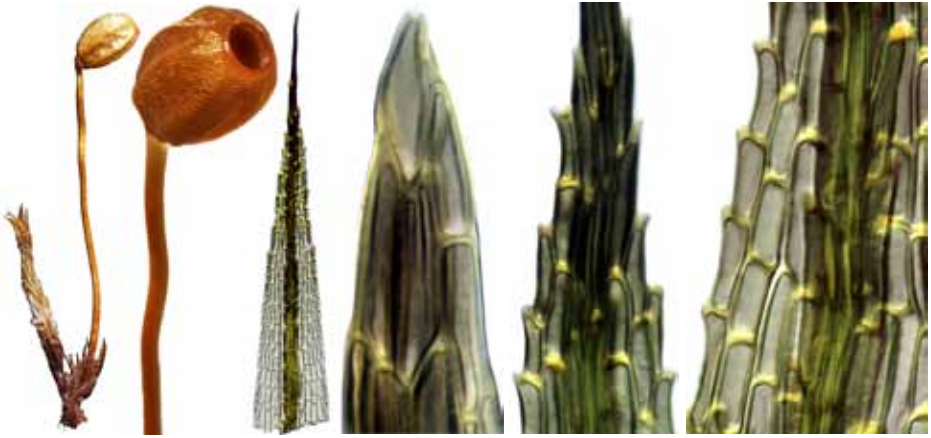
costa: excurrent in a ± hyaline, denticulate arista

border: not differentiated

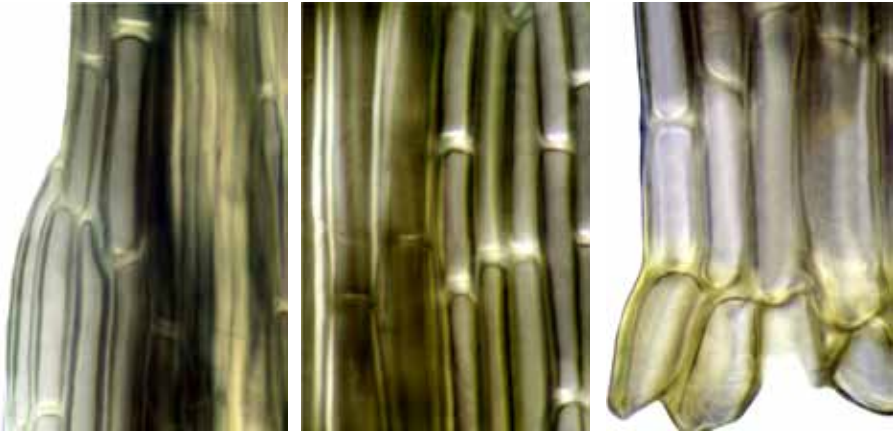
margin: entire to denticulate, plane to narrowly incurved

cells: 40–70 × 10 μm, rhombic-rectangular, firm-walled, smooth or nearly so

capsule: 1.3–2 mm long, subglobose, inclined to horizontal, ribbed when dry,
 brown; seta 5–20 mm long, orange, ± flexuose; peristome none



fertile shoot (dry), mature capsule, leaf outline, apex and subapex, and upper margin
 1 mm, 1 mm, 0.5 mm, 10 μm, 50 μm, 10 μm



margin at midleaf, juxtacostal cells near base, and leaf basal angle
 10 μm, 10 μm, 10 μm

continued next page



Conostomum pusillum var. *otagoensis* mature capsule
0.5 mm

Conostomum pusillum Hook.f. & Wilson var. **pusillum**

form: gregarious, branched, ± tomentose, erect stems, to 6 mm tall
habitat: soil at subalpine and alpine elevations

leaf: size: 0.7–2.0 mm

shape: triangular to linear-lanceolate, unistratose, little altered when dry

tip: acuminate, ending in a hair-point

base: basal cells longer than the other laminal cells

costa: occupying about half the leaf width below, excurrent, prorate above

border: not differentiated

margin: entire below, denticulate above, narrowly recurved

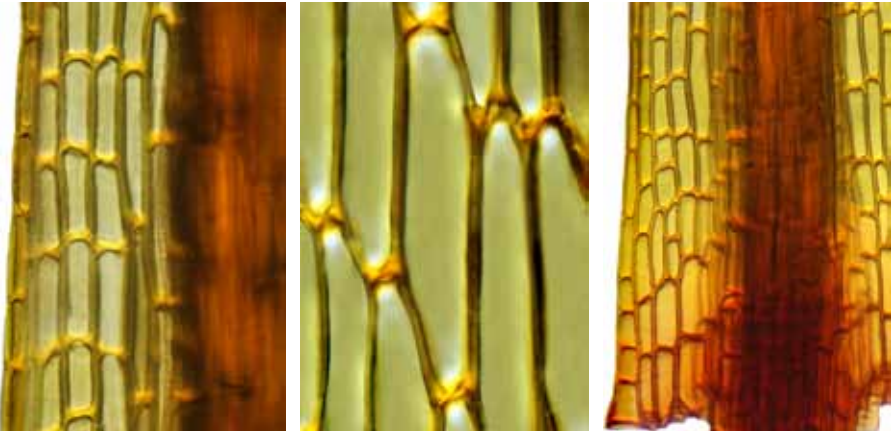
cells: 25–60 × 6–10 μm, rectangular, firm-walled, prorate above

capsule: 1.3–2 mm, globose to ovoid, slightly asymmetric, erect to inclined, exerted, brown, ± sulcate when dry; seta 9–20 mm, orange, flexuose; operculum curved-rostrate; peristome single, exostome teeth red, joined at their tips; spores globose, ovoid, or reniform, to about 60 μm in diam.



fertile shoot (dry) (2), leaf outline, leaf apex (2), and maturing capsules

5 mm, 1 mm, 0.1 mm, 10 μm, 10 μm, 0.5 mm (2)



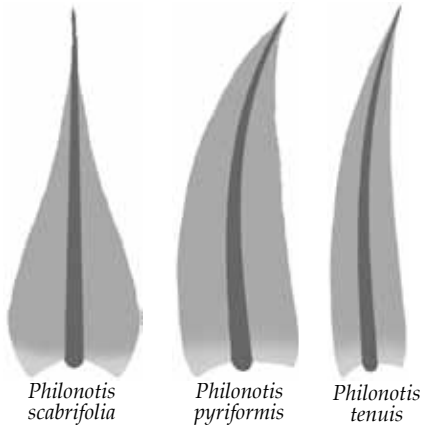
margin midleaf, juxtacostal cells in lower leaf, and leaf basal angle

10 μm, 10 μm, 10 μm

Key* to the New Zealand species of *Philonotis* (3)

- 1 Plants glaucous..... ● ***Philonotis scabrifolia***
 1: Plants not glaucous..... 2
- 2(1:) Stems 10–40 mm tall; costa long-excurrent; margin ± recurved.....
 ● ***Philonotis tenuis***
 2: Stems 40–80 mm tall; costa short-excurrent; margin plane... ● ***Philonotis pyriformis***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bulletin 5, 310.



Philonotis pyriformis (R.Br.bis) Wijk & Margrad.

form: loosely tufted, radiculose stems, ± branched by innovations in whorls, 20–200 mm tall, the leaves ± falcate-secund

habitat: rock in constantly wet sites, lowland to montane elevations

leaf: size: 1.5–2.3 × 0.4–0.8 mm

shape: triangular to lanceolate, ± falcate

tip: attenuate

base: basal angle cells are shorter than the blade cells

costa: short-excurrent, denticulose-papillose above on the back

border: not differentiated

margin: serrulate, plane

cells: 20–30 × 6–12 μm, oblong to rectangular, firm-walled, prorulose

capsule: 2.5–3 mm, ovate, horizontal, asymmetric, ± gibbous, mouth small, oblique, striate when dry; seta 30–50 mm, flexuose, reddish; peristome double, endostome with cilia; spores 20–24 μm in diam., papillose



vegetative shoots (moist on far left), leaf outline, leaf apex, and margin midleaf

■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm, ■ 10 μm



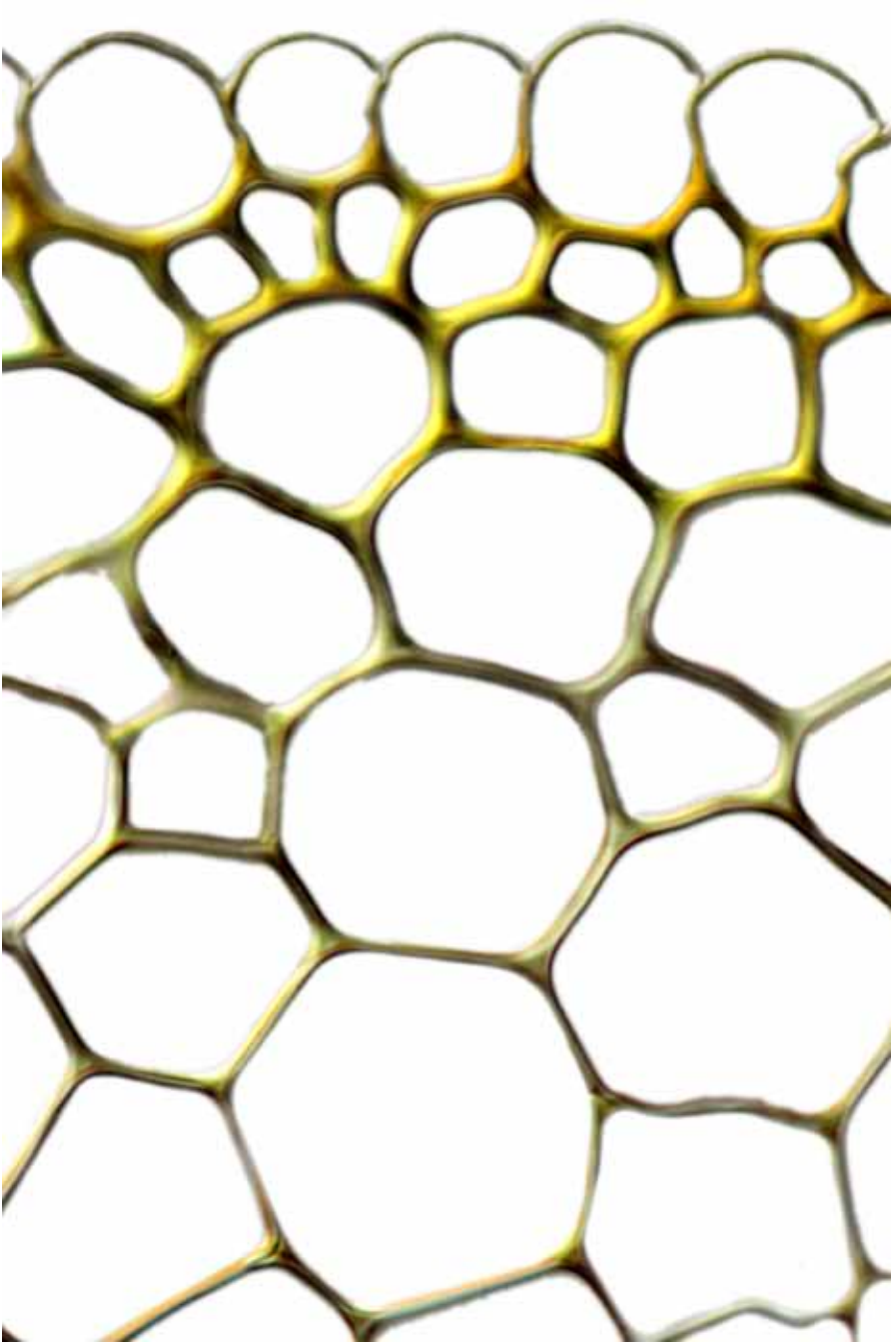
cells midleaf, costa near leaf base, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 10 μm



Philonotis pyriformis vegetative shoot (moist)
1 mm (left), 1 mm (right)

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Philonotis pyriformis stem cross-section showing hyaloderm
10 μm

continued next page



Philonotis pyriformis leaf and costa cross-section (partially diagrammatic)
10 μm , 10 μm

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Philonotis scabrifolia (Hook.f. & Wilson) Braithw.

form: tufted, erect, radiculose stems, to 20 mm tall, the upper branches whorled, the leaves distinctly glaucous

habitat: soil, moist to wet, at montane elevations

leaf: size: stem leaves 1.5–2.0 × 0.5–0.7 mm; branch leaves smaller

shape: lanceolate to ovate-lanceolate

tip: acuminate

base: basal cells shorter than the blade cells

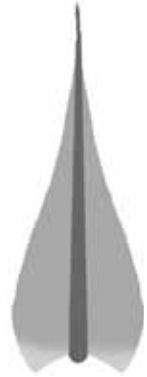
costa: excurrent

border: not differentiated

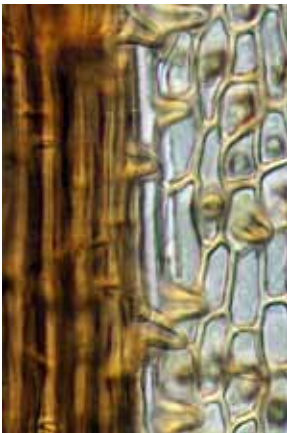
margin: denticulate, slightly recurved toward the apex

cells: 10–26 × 8–10 μm, short-rectangular to subquadrate, firm-walled, unipapillose

capsule: 2 × 1 mm, ovoid, arcuate, inclined to horizontal, sulcate; seta 15–20 mm; operculum convex, umbonate; peristome double; spores 30–34 μm in diam., reniform, papillose



habit showing perigonia, perigonal shoot, leaf outline, leaf apex, and mature capsule
 ■ 5 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm, ■ 0.5 mm



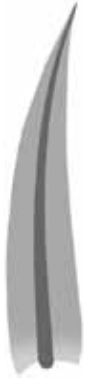
costa midleaf, vegetative shoots, and paraphyses
 ■ 10 μm, ■ 1 mm, ■ 50 μm

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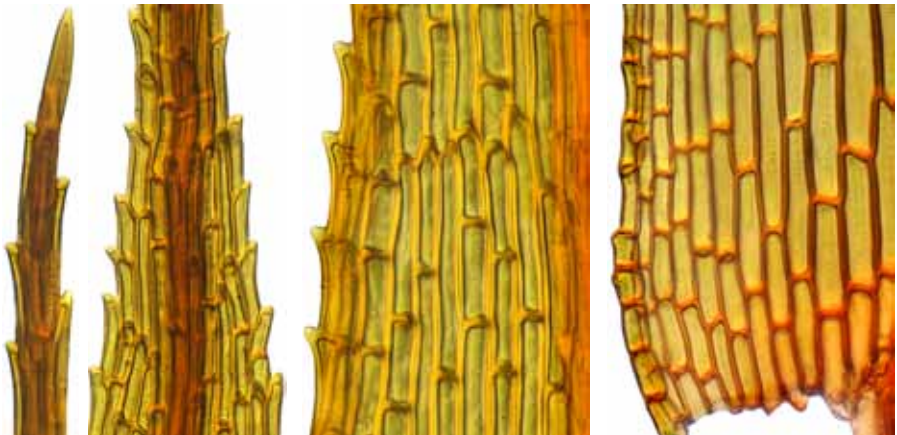


Philonotis scabrifolia perigonal shoot
1 mm

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Philonotis tenuis (Taylor) Reichardt**form:** densely tufted, simple stems, 10–40 mm tall, ± with subfloral innovations**habitat:** damp rock and soil, lowland to montane elevation**leaf:** size: 0.8–1.8 × 0.3–0.7 mm, water-repellent (hydrophobic), tomentose below
shape: narrowly triangular, ± falcate*tip:* attenuate*base:* the basal cells are shorter and broader than the blade cells*costa:* percurrent to long-excurrent in an arista, denticulate on the back above*border:* not differentiated*margin:* denticulate, ± reflexed*cells:* 20–30 × 5–15 μm, oblong, firm-walled, distally prorulose**capsule:** 1.3–2.7 mm, subglobose, cernuous to horizontal, sulcate (16-ribbed)
when dry; seta 10–25 mm; peristome double, endostome cilia rudimentary;
spores 20–24 μm in diam., brown**note:** highly variable—the leaf can range from straight to falcate, the costa from percurrent to long-excurrent, and the margin from weakly to strongly reflexed

vegetative shoots (moist on left), capsules, leaf outlines (2), and propagule (surculus)
 ■ 1 mm, ■ 1 mm, ■ 1 mm (2), ■ 0.5 mm (2), ■ 50 μm



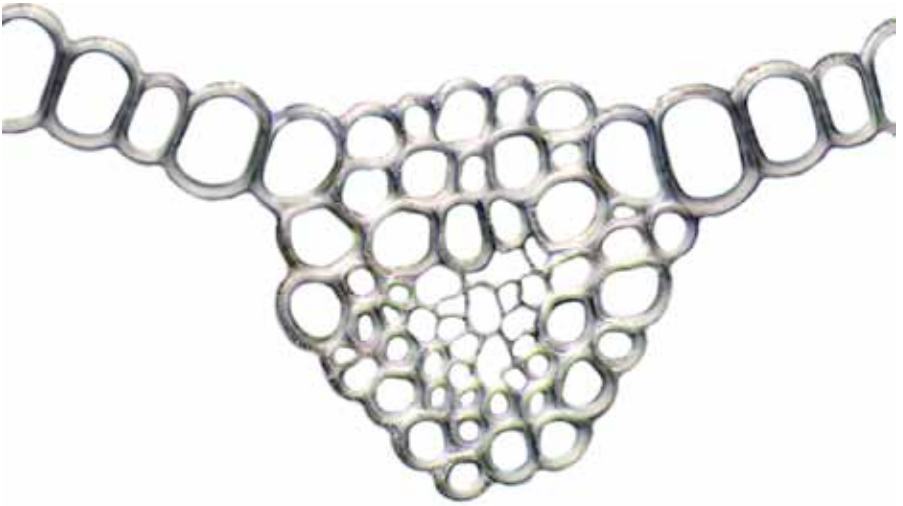
leaf apex and subapex, margin midleaf, and leaf basal angle
 ■ 10 μm (2), ■ 10 μm, ■ 10 μm

continued next page



Philonotis tenuis habit
1 mm

continued next page



Philonotis tenuis costa cross-section
10 μm



Philonotis tenuis leaf margin cross-section
10 μm

Plagiopus oederiana (Sw.) H.A.Crum & L.E.Anderson

form: tufted, erect, tomentose stems, 20–100 mm tall, triangular in xs, the leaves dull green to yellow-brown

habitat: moist shaded cliffs and boulders, usually calcareous

leaf: size: 2–3.5 mm

shape: narrowly lanceolate

tip: acuminate

base: basal cells not differentiated

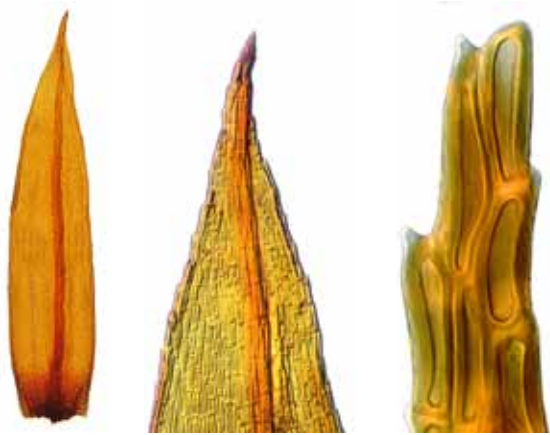
costa: percurrent to shortly excurrent, ± serrulate on the back above

border: not differentiated

margin: entire, revolute nearly to the apex

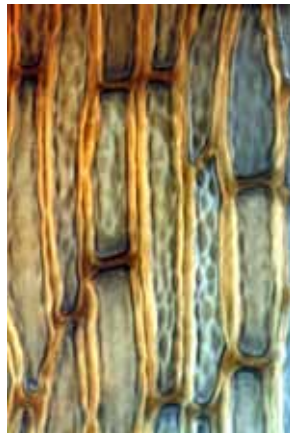
cells: $9 \times 5 \mu\text{m}$, subquadrate to short-rectangular, firm-walled, striolate

capsule: 1–2 mm, globose, inclined to horizontal, furrowed when dry; seta 7–18 mm, ± flexuose, smooth; operculum low-convex; peristome double, exostome teeth golden to reddish, endostome pale brown; spores 20–26 μm in diam., brown, coarsely papillose



vegetative habit (dry), leaf outline, and leaf apex (2)

■ 1 mm, ■ 0.5 mm, ■ 50 μm , ■ 10 μm



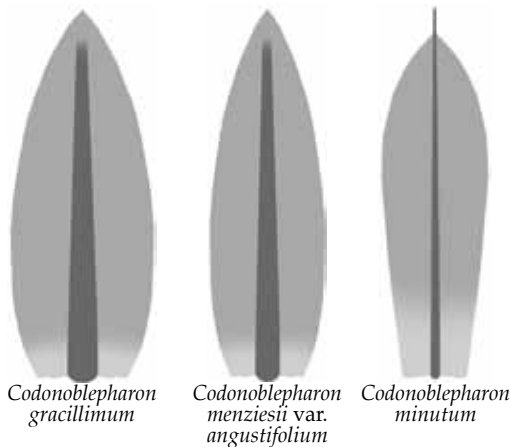
margin midleaf, striolate leaf cells, and leaf basal angle

■ 10 μm , ■ 10 μm , ■ 10 μm

Key* to the New Zealand species of *Codonoblepharon* (3)

- 1 Costa excurrent; cells in stem xs all thin-walled ● ***Codonoblepharon minutum***
 1: Costa failing below the apex; at least some cells in stem xs thick-walled 2
- 2(1:) Leaves < 0.6 mm; stems filiform..... ● ***Codonoblepharon gracillimum***
 2: Leaves > 1.2 mm; stems not filiform
 ● ***Codonoblepharon menziesii* var. *angustifolium***

* based on Lewinsky-Haapasaari, J; Ramsay, HP (2006): *Zygodon. Flora of Australia* 51, 238, and Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bulletin 5, 199.



Codonoblepharon gracillimum (Broth. ex M.Fleisch.) Matcham & O'Shea

form: densely tufted, rhizomatous, erect, branched stems, to 7 mm tall

habitat: bark in partially shaded lowland forest

leaf: size: 0.3–0.6 × 0.1–0.2 mm

shape: ± lanceolate; gemmae clustered on stalks in axils

tip: acute

base: basal marginal cells quadrate

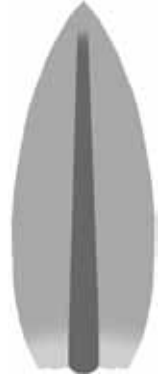
costa: failing below the apex

border: not differentiated

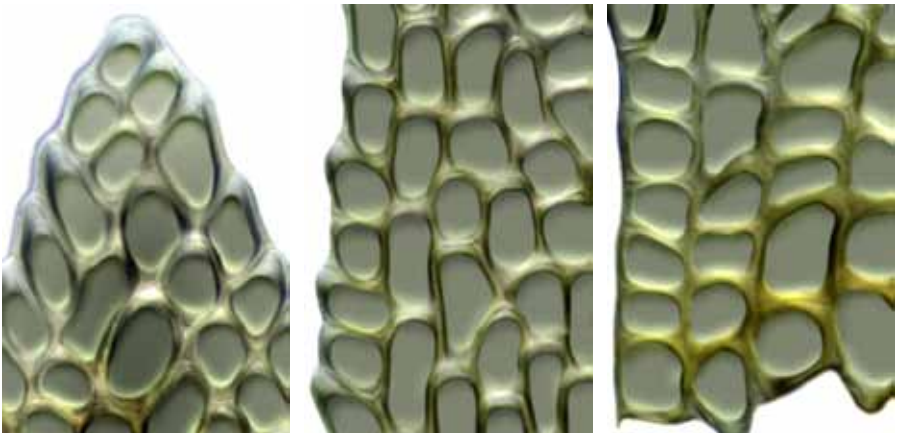
margin: entire below, ± crenulate near apex, plane

cells: 6–12 × 6–9 μm, rounded-quadrate to rhombic, firm-walled, smooth

capsule: 1.0–1.2 mm, cylindric, long-necked, ribbed when dry, erect, long-exserted, pale to reddish brown; seta 3–5 mm; peristome double, exostome teeth pale yellow to hyaline, 8 pairs, reflexed when dry, endostome segments hyaline, up to 3/4 the length of the exostome teeth; spores 12–14 μm in diam., finely papillose



vegetative and fertile shoots (dry) (3), capsule (dry), gemma, leaf outline, and leaf apex
 0.5 mm (3), 0.5 mm, 10 μm, 0.1 mm, 10 μm



apex detail, margin midleaf, and leaf basal angle
 10 μm, 10 μm, 10 μm

continued next page

Codonoblepharon menziesii var. **angustifolium** (Broth. ex M.Fleisch.) Matcham & O'Shea

form: dense tufts of erect, \pm radiculose, branched stems, 10–20 mm, the leaves olive-green, gemmoid brood bodies 7–8-celled, short-filamentous

habitat: basic rock, concrete, bark, rotting logs, or tree trunks, to 1350 m

leaf: size: 1–2 \times 0.3–0.6 mm; filiform to clavate gemmae at base

shape: lanceolate to ovate-lanceolate, distally keeled, \pm undulate and twisted around the stem when dry

tip: acute to obtuse, \pm cucullate

base: basal cells hyaline, firm-walled, rhombic to rectangular

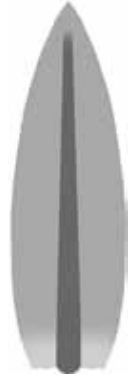
costa: strong and wide below, reaching nearly to the apex

border: absent

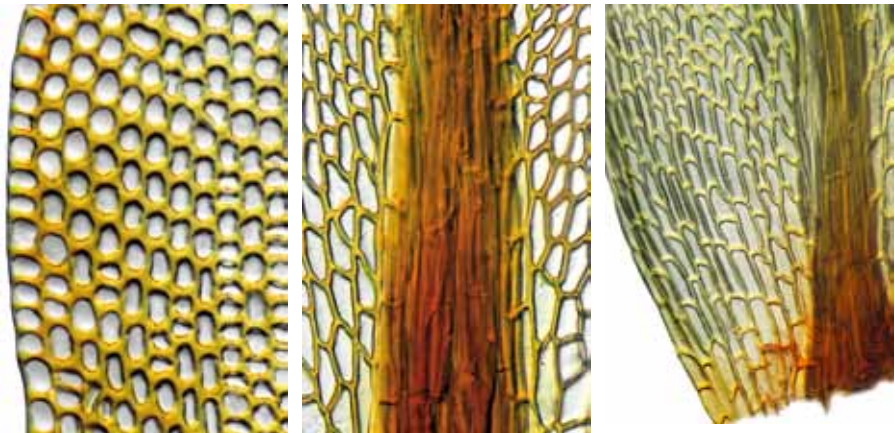
margin: entire, revolute to above midleaf

cells: 8–13 μ m, quadrate to rhombic, in oblique rows, thick-walled, smooth

capsule: 1.5–2.0 mm, ovoid to pyriform or cylindric, deeply 8-ribbed when dry, seta to 6 mm; calyptra smooth; operculum red-bordered, short-rostrate; peristome double, exostome teeth 8, double, papillose, endostome of 16 narrow processes; spores 15–18 μ m in diam., smooth



shoot (wet), capsule (young, mature), leaf outline, leaf apex, and gemma whole-mount
 1 mm, 0.5 mm, 0.5 mm, 0.1 mm, 10 μ m, 10 μ m



margin midleaf, costa lower leaf, and leaf basal angle
 10 μ m, 10 μ m, 50 μ m

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Codonoblepharon menziesii var. *angustifolium* vegetative shoot (moist)

1 mm

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Codonoblepharon menziesii var. *angustifolium* immature (moist) and mature (dry) capsules
0.5 mm

continued next page

Codonoblepharon minutum (Müll.Hal. & Hampe) Matcham & O'Shea

form: dense tufts of simple, radiculose, erect stems, 1–3 mm, the leaves olive-green; gemmae clustered in leaf axils, clavate, 4–8-celled, 50–120 μm long

habitat: bark, lignum, limestone, and concrete, coastal and inland to 160 m

leaf: size: 0.8–1.5 mm

shape: oblong- to elliptic-lanceolate

tip: apiculate

base: basal cells rectangular

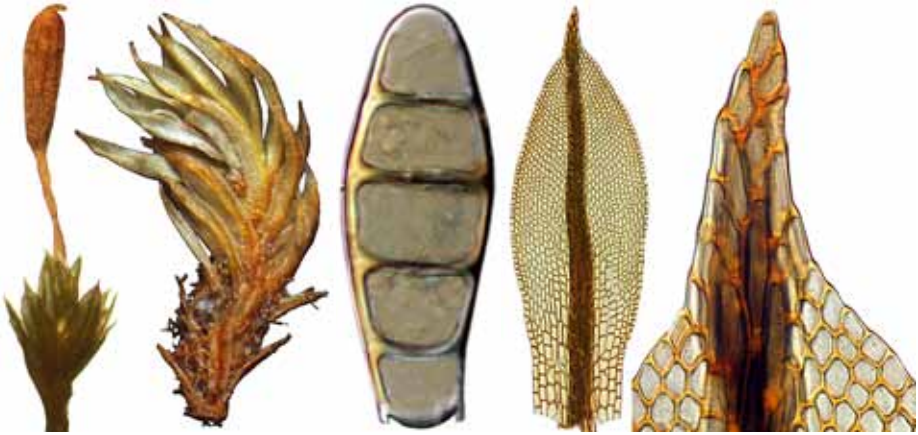
costa: excurrent in the apiculus

border: not differentiated

margin: entire, plane to \pm reflexed below

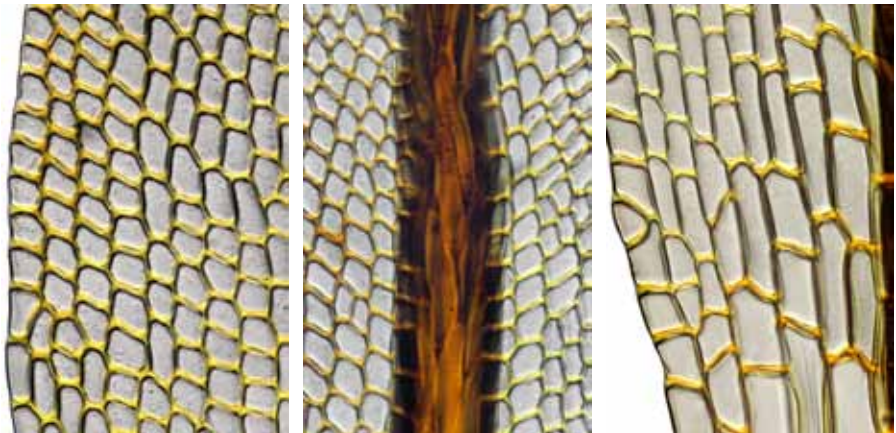
cells: 8–12 \times 6–9 μm , quadrate to rhombic, firm-walled, smooth

capsule: 1.0–1.5 mm, pyriform to ovoid, 8-ribbed when dry; seta 1.5–3.0 mm; calyptra smooth; stomata superficial; peristome double, exostome teeth in 8 pairs, reflexed when dry; endostome segments 8, sometimes alternating with 8 rudimentary segments; spores 15–20 μm in diam.



shoots and capsule, axillary propagule, leaf outline, and leaf apex

1 mm, 0.5 mm, 10 μm , 0.1 mm, 10 μm



margin midleaf, costa midleaf, and leaf basal angle

10 μm , 10 μm , 10 μm

Leratia obtusifolia (Hook.) Goffinet

form: tufts of branched stems, 5–10 mm, dull, radiculose below, the leaves olive-green or brownish above, brown to blackish below

habitat: bark, exposed roots, rotting logs, and less commonly rock, to 760 m

leaf: size: 0.6–1.0 × 0.2–0.3 mm

shape: ligulate to ovate-oblong, keeled, gemmae in axils

tip: obtuse to rounded

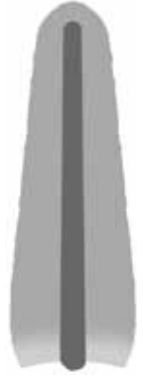
base: not decurrent; a few smooth, rectangular cells in the basal angles

costa: ending below the apex, covered adaxially by lamina cells

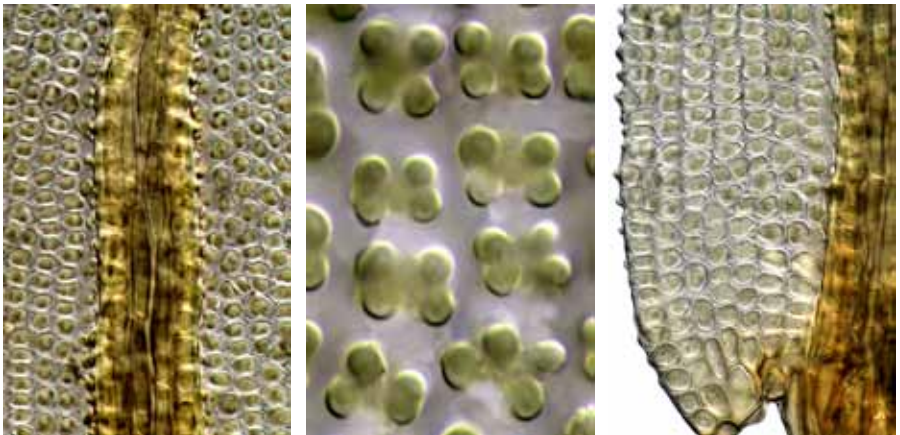
border: not differentiated

margin: crenulate from projecting papillae, ± recurved to revolute below

capsule: 1–1.5 mm, 8-grooved when dry, cylindric to obovoid; seta 2–4 mm; operculum obliquely rostrate; calyptra prorulose; peristome double, exostome teeth in 8 pairs, reflexed when dry; endostome segments 8 or 16, white; spores 12–15 μm in diam., finely papillose



shoots (dry) (2), mature capsule (dry), leaf outline, leaf apex, and margin midleaf
 1 mm, 0.5 mm, 0.5 mm, 0.1 mm, 50 μm, 10 μm



costa midleaf, papillae, and leaf basal angle

50 μm, 10 μm, 50 μm

Macrocoma tenuis (Hook. & Grev.) Vitt subsp. **tenuis**

form: matted, tangled, dull, brownish, creeping stems, the secondary stems suberect, slender, ± julaceous when dry, 5–15 mm long

habitat: bark and branches on forest margins and in scrub, to 1200 m

leaf: size: 1.0–1.3 × 0.2–0.5 mm

shape: lanceolate, concave

tip: bluntly acute to obtuse

base: basal cells somewhat larger, mammillose, and elongated near the costa

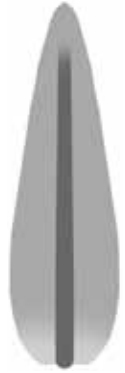
costa: failing below the apex to percurrent

border: not differentiated

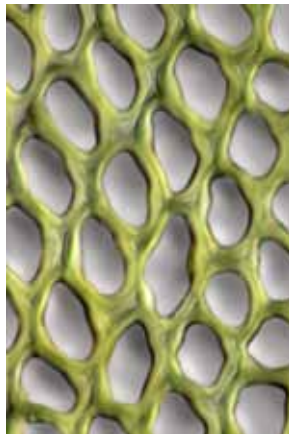
margin: entire, plane to ± recurved

cells: 6–10 μm, isodiametric, firm-walled, bulging or mammillose

capsule: 1.5–2 mm, cylindric-ellipsoid, erect, deeply 8-plicate at the mouth when dry, stomata superficial; seta 3–6 mm; operculum rostrate; calyptra densely hairy; peristome double, endostome reduced to a low papillose membrane; spores to 40 μm in diam.



emerging capsules (moist), mature capsules (dry), leaf outline, leaf xs, and leaf apex
 ■ 1 mm, ■ 1 mm, ■ 0.25 mm, ■ 10 μm, ■ 50 μm



margin midleaf, cells midleaf, and costa midleaf
 ■ 10 μm, ■ 10 μm, ■ 50 μm

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Macrocoma tenuis emerging calyptra-covered sporophytes (moist)

1 mm

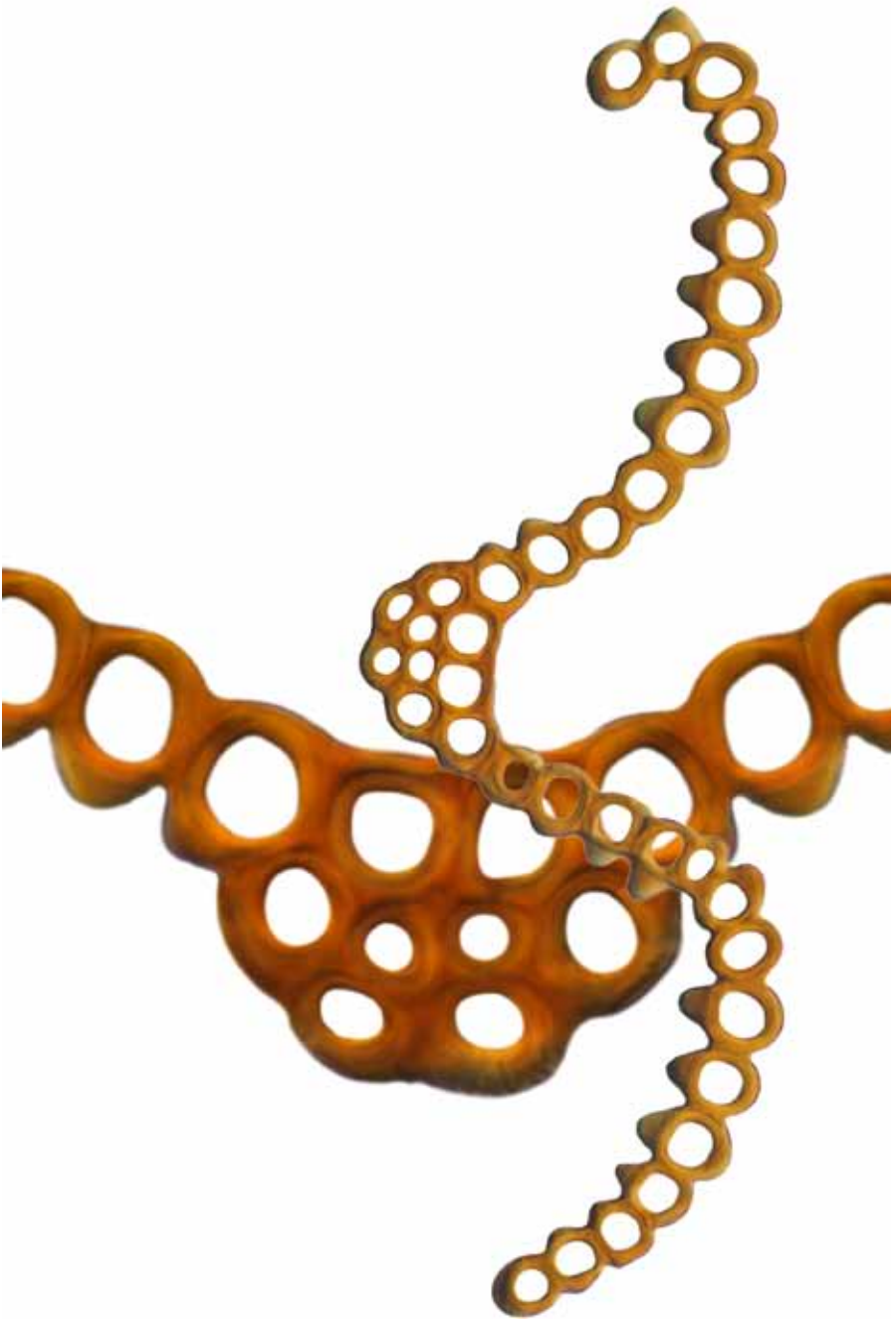
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Macrocoma tenuis emerging calyptra-covered sporophytes (dry)

1 mm

continued next page



Macrocoma tenuis leaf cross-sections

10 μm (whole leaf),

10 μm (costa)

Key* to the New Zealand species of *Macromitrium* (14) (see next page for another key)

- 1 Upper leaf cells papillose or strongly bulging..... 2
 1: Upper leaf cells smooth or only slightly bulging 9
- 2(1) Branches ending in brush-like tufts; mature leaves muticous and retuse
 ● ***Macromitrium helmsii***
 2: Branches not ending in tufts; mature leaves sometimes muticous but not retuse 3
- 3(2): Leaves lanceolate; perichaetial leaves much longer than the vegetative leaves and strongly sheathing ● ***Macromitrium gracile***
 3: Leaves ligulate to oblong; perichaetial leaves no longer than the vegetative leaves and only weakly sheathing 4
- 4(3): All leaf cells about as long as wide; seta papillose; calyptra hairs papillose.....
 ● ***Macromitrium angulatum***
 4: Some leaf cells at least three times as long as wide; seta smooth; calyptra hairs naked or smooth, not papillose 5
- 5(4): Upper leaf margin crenulate-bulging..... 6
 5: Upper leaf margin entire or papillose 7
- 6(5) Peristome reduced to a low basal membrane; capsule rim 8-plicate.....
 ● ***Macromitrium ligulaefolium***
 6: Peristome of 16 erect teeth; capsule rim not plicate ● ***Macromitrium ligulare***
- 7(5): Costa failing below the apex; not peristomate; calyptra lacerate but not plicate
 ● ***Macromitrium grossirete***
 7: Costa percurrent or excurrent as a mucro or cusp; peristomate; calyptra plicate 8
- 8(7): Interior basal cells to 16 μm long, the lumen rounded to elliptic.....
 ● ***Macromitrium brevicaulle***
 8: Interior basal cells to 40 μm long, the lumen elongate ... ● ***Macromitrium prorepens***
- 9(1): Branches ending in brush-like tufts; mature leaves muticous and retuse
 ● ***Macromitrium retusum***
 9: Branches not ending in brush-like tufts; mature leaves not muticous, not retuse 10
- 10(9:): Leaf cells just above insertion up to 15 μm long; plant restricted to Chatham Islands.....
 ● ***Macromitrium ramsayae***
 10: Leaf cells just above insertion up to 40 μm long; plant widespread 11
- 11(10:): Leaves \pm straight; spores anisoporous, 16–42 μm in diam.....
 ● ***Macromitrium orthophyllum***
 11: Leaves strongly twisted-curved; spores isoporous, 25–65 μm in diam. 12
- 12(11:): Costa with two stereid bands; peristome double . ● ***Macromitrium longirostre***
 12: Costa with only one stereid band; peristome single (exostome only)..... 13
- 13(12:): Leaves 1.5–2.5 mm long; midleaf cell lumina strongly curved to sigmoid.....
 ● ***Macromitrium longipes***
 13: Leaves 1.0–1.5 mm long; midleaf cell lumina straight to only slightly curved.....
 ● ***Macromitrium microstomum***

* based on Vitt, DH (1983): The New Zealand species of *Macromitrium*. *Journal of the Hattori Botanical Laboratory* 54, 6.

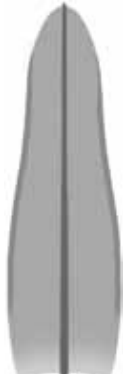
Key* to the New Zealand species of *Macromitrium* (14)

- 1 Surface of midleaf cells smooth 2
 1: Surface of midleaf cells papillose 7
- 2(1) Dry branch leaves twisted along their own length; seta twist sinistrorse; peristome single (exostome only) 3
 2: Dry branch leaves wound around the stem; seta twist dextrorse; peristome double.. 5
- 3(2) Lumina of basal cells curved or sinuose ● ***Macromitrium longipes***
 3: Lumina of basal cells ± straight 4
- 4(3): Costa xs homogeneous ● ***Macromitrium orthophyllum***
 4: Costa xs guide cells and an abaxial stereid band ● ***Macromitrium microstomum***
- 5(2): Branching penicillate; branch leaves muticous and retuse, the costa excurrent
 ● ***Macromitrium retusum***
 5: Branching simple; branch leaves not fragile, the costa subpercurrent to percurrent .. 6
- 6(5): Branch leaves unistratose throughout ● ***Macromitrium ramsayae***
 6: Branch leaves partly bistratose ● ***Macromitrium longirostre***
- 7(1): Midleaf cells 1–2-papillose (low) 8
 7: Midleaf cells 1–2-papillose (tall or branched) or pluri- to multipapillose 10
- 8(7) Seta papillose; calyptra densely hairy ● ***Macromitrium angulatum***
 8: Seta smooth; calyptra glabrous 9
- 9(8): Peristome reduced to a low basal membrane; capsule rim 8-plicate
 ● ***Macromitrium ligulaefolium***
 9: Peristome of 16 erect teeth; capsule rim not plicate ● ***Macromitrium ligulare***
- 10(7:): Upper cells 1–2-papillose (tall or branched) 11
 10: Upper cells pluri- to multipapillose 12
- 11(10) Branch leaf wound around the stem when dry ● ***Macromitrium prorepens***
 11: Branch leaf twisted along its own length when dry ● ***Macromitrium grossirete***
- 12(10): Branch leaves fragile (muticous) 13
 12: Branch leaves not fragile ● ***Macromitrium brevicaulis***
- 13(12) Branch leaves muticous and retuse ● ***Macromitrium helmsii***
 13: Branch leaves muticous but not retuse ● ***Macromitrium gracile***

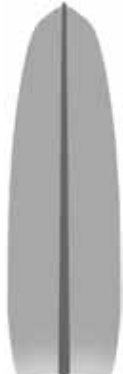
* based on a key generated by DELTA from a 26-character database of New Zealand *Macromitrium* species, plus (for couplet 9) Vitt, DH (1983): The New Zealand species of *Macromitrium*. *Journal of the Hattori Botanical Laboratory* 54, 6.



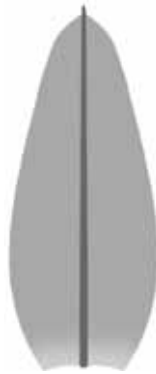
Macromitrium gracile



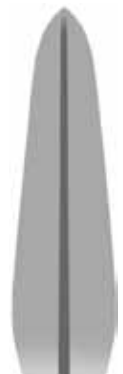
Macromitrium prorepens



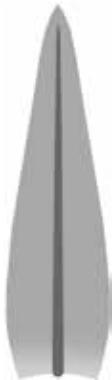
Macromitrium brevicaule



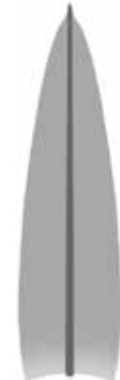
Macromitrium angulatum



Macromitrium ramsayae



Macromitrium longipes



Macromitrium orthophyllum



Macromitrium microstomum



Macromitrium grossirete



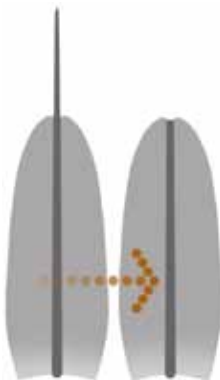
Macromitrium longirostre



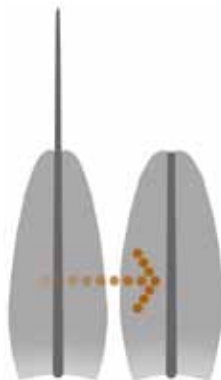
Macromitrium ligulare



Macromitrium ligulaefolium



Macromitrium retusum



Macromitrium helmsii

Macromitrium angulatum Mitt.

form: primary stems creeping; secondary stems erect, branching, to 13 mm long, the leaves dull olive-green

habitat: bark in *Nothofagus* forest

leaf: size: 0.9–1.5 mm

shape: oblong to ovate-lanceolate; reaction in KOH deep red

tip: broadly acute, ending in a stout mucro

base: little differentiated

costa: excurrent in the mucro

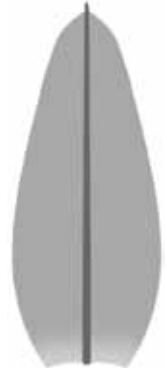
border: not differentiated

margin: entire below, crenulate-papillose above, plane

cells: 8–12 μm , rounded-quadrate, firm-walled, bulging-unipapillose

capsule: 1.4–1.6 mm, ovate, erect, exerted, dark brown; seta 2.3–3 mm, strongly papillose; peristome none; operculum erect-beaked; calyptra lacerate, mitrate, plicate, densely hairy below

note: known from only a single collection near Wellington



fertile shoot and capsule with calyptra (dry), leaf outline, and leaf apex (2)

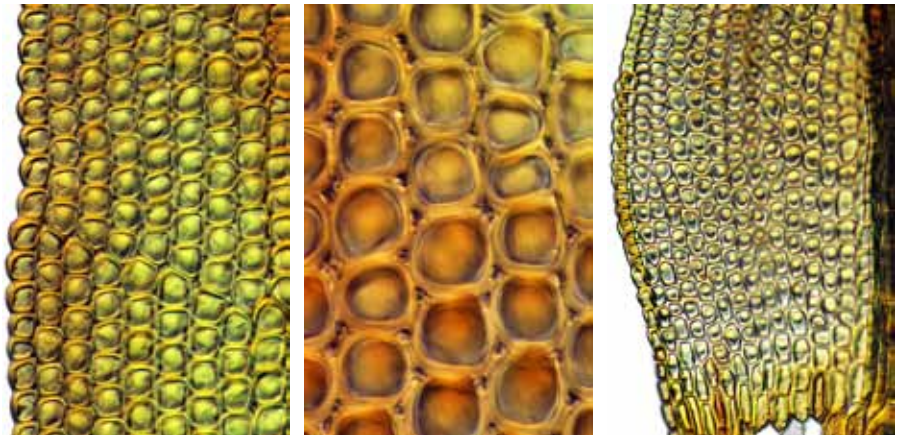
5 mm,

1 mm,

0.1 mm,

50 μm ,

50 μm



margin midleaf, cells midleaf, and leaf basal angle

10 μm ,

10 μm ,

50 μm

continued next page

Macromitrium brevicaule (Besch.) Broth.

form: mats of creeping stems, the branches regular, simple, short, and erect, 3–7 mm tall; leaves spirally twisted when dry

habitat: bark and rock in the salt-spray zone, Auckland and north

leaf: size: stem leaves 0.8–1.2 mm long, branch leaves 1.0–1.8 mm long

shape: stem leaves ovate-lanceolate, branch leaves oblong-ligulate, keeled

tip: stem leaves acute to obtuse, branch leaves obtuse, often mucronate

base: basal marginal cells $10\text{--}24 \times 5\text{--}10 \mu\text{m}$; juxtacostal cells $9\text{--}18 \times 3\text{--}6 \mu\text{m}$

costa: strong, prominent, glossy, excurrent in the mucro or failing just below

border: not differentiated above, indistinct below

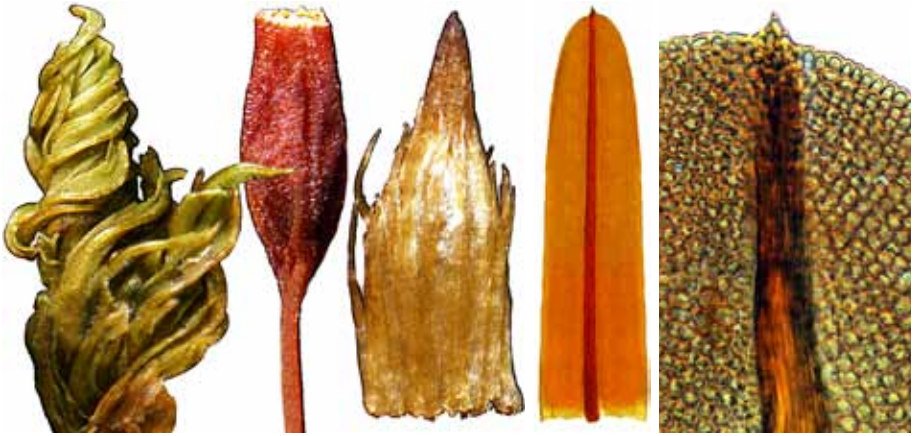
margin: entire below, slightly crenulate above, plane

cells: $6\text{--}12 \mu\text{m}$, rounded to quadrate, firm-walled, pluripapillose, bulging

capsule: 1.3–1.7 mm, oval, erect, exserted, reddish, narrow-mouthed, 8-ribbed; seta 3–5 mm, reddish; calyptra mitrate, fringed, faintly plicate, naked to sparsely hairy; operculum erect-beaked; peristome single, an exostome of 16 teeth; spores $13\text{--}34 \mu\text{m}$ in diam.

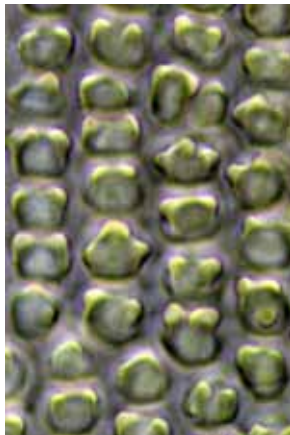


branch leaf



vegetative shoot (dry), capsule (dry), calyptra (dry), leaf outline, mucronate leaf apex

1 mm, 0.5 mm, 0.1 mm, 0.1 mm, 10 μm



margin midleaf, surface papillae midleaf, and margin near leaf base

10 μm , 10 μm , 10 μm

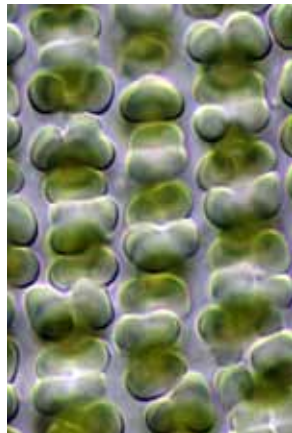
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Macromitrium gracile (Hook.) Schwägr.**form:** matted, creeping, dull, wiry, mostly simple stems, 20–40 mm**habitat:** bark or rarely rock, scrub and montane forests, to 1000 m**leaf: size:** stem leaves 0.8–1.0 mm, branch leaves 1.8–2.8 mm**shape:** stem leaves ovate-lanceolate, branch leaves lanceolate, ovate base**tip:** branch leaves narrowed to a bistratose subula, often broken off**base:** lower cells incrassate, with \pm sinuose lumina, $20\text{--}50 \times 8\text{--}10 \mu\text{m}$ **costa:** \pm excurrent in the subula or failing just below**border:** not differentiated**margin:** papillose-crenulate, plane above \pm reflexed below on one side**cells:** $6\text{--}10 \mu\text{m}$, isodiametric, mostly incrassate, multipapillose (low)**capsule:** 1.0–2.2 mm, ovoid, plicate, \pm narrowed near the mouth when dry; seta 2.5–7.0 mm, \pm flexuose; calyptra golden, glossy, naked or with a few hairs, mitrate, strongly plicate, 3–5-lacerate; operculum long-rostrate, erect; peristome single, exostome teeth 16, pale, papillose; spores $16\text{--}40 \mu\text{m}$ in diam., anisoporous

branch leaf



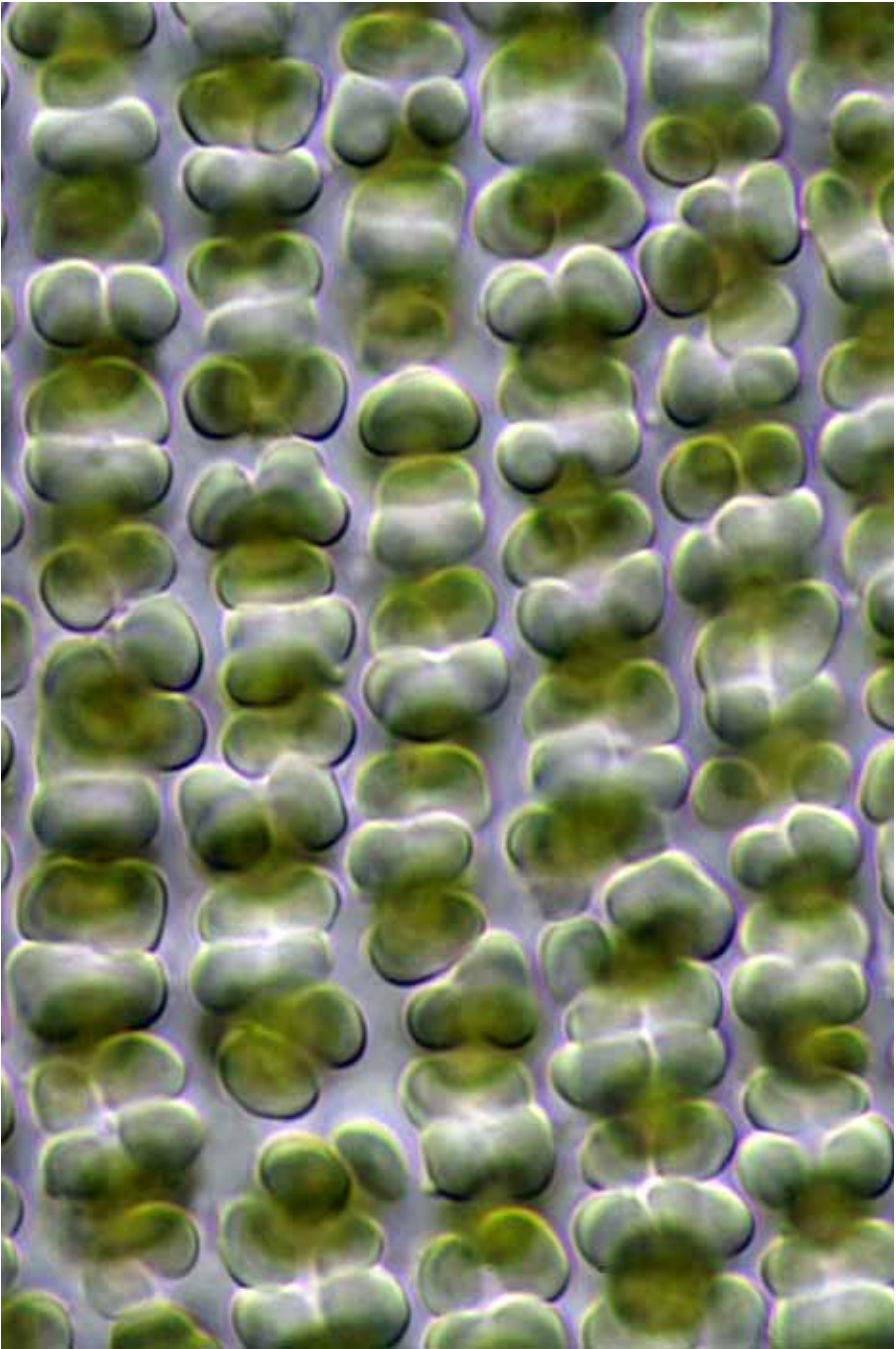
vegetative shoots (2), capsule with calyptra, leaf outline, and leaf apex

 1 mm, 1 mm, 0.5 mm, 0.1 mm, 10 μm


margin upper leaf, papillose cells in upper leaf, and margin of lower leaf

 10 μm , 10 μm , 10 μm

continued next page



Macromitrium gracile leaf surface papillae
10 μm

continued next page

Macromitrium grossirete Müll.Hal.

form: primary stems matted, creeping; secondary stems erect, sparsely branched, to 10 mm tall, the leaves yellow- to olive-green

habitat: tree bark in high-montane forest, mostly South Island, to 1200 m

leaf: size: branch leaves 2.5–4.5 mm

shape: stem lanceolate, branch ligulate-lanceolate, ± twisted when dry

tip: stem leaves acuminate, branch leaves ± cuspidate

base: basal cells $20\text{--}40 \times 11\text{--}16 \mu\text{m}$, rectangular, the lumina nodose

costa: ending a few cells below the apex

border: not differentiated

margin: subentire to crenulate, broadly reflexed on one side

cells: upper cells $10\text{--}16 \mu\text{m}$, isodiametric-rounded, firm-walled, unipapillose

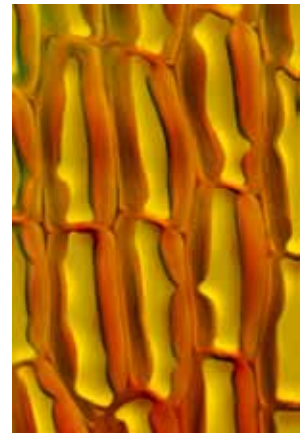
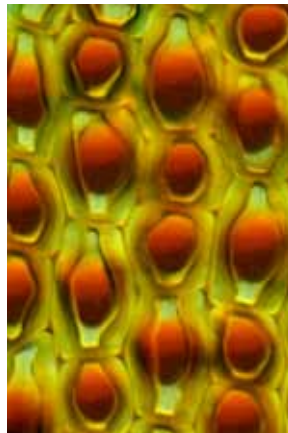
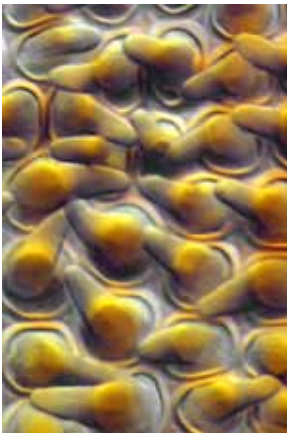
capsule: 1.5–2 mm, oblong-elliptic, erect to horizontal, exserted, light brown, furrowed and reddened at the mouth; seta 2.5–4.5 mm, erect to flexuose, twisted when dry; peristome none; operculum beaked; calyptra mitrate, 1–3-slits below, hairy; spores $18\text{--}40 \mu\text{m}$ in diam., anisosporous



branch leaf

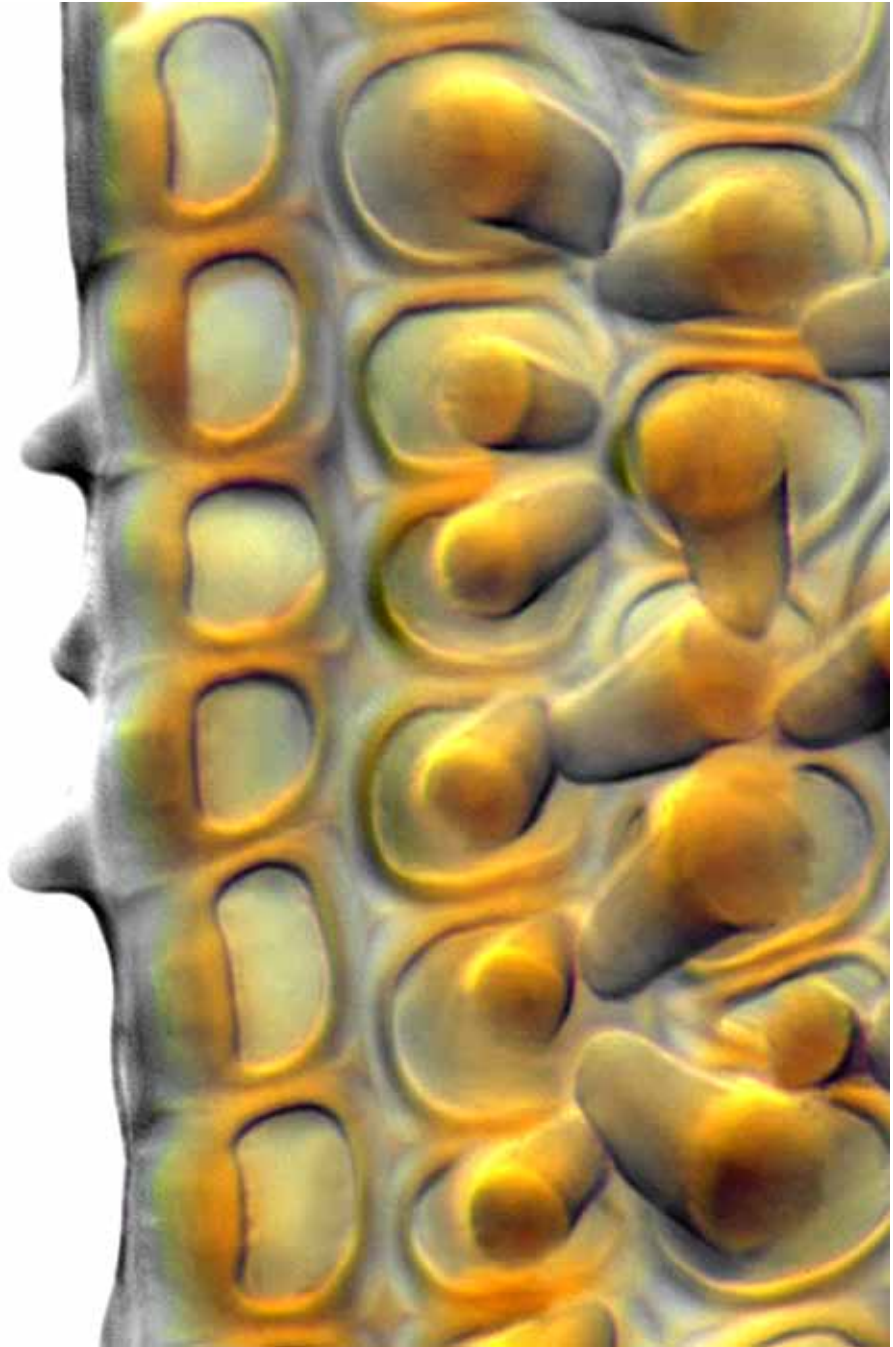


fertile shoot (dry), calyptra, mature capsule, leaf outline, leaf apex, and margin midleaf
 5 mm, 1 mm (2), 1 mm, 10 μm , 10 μm



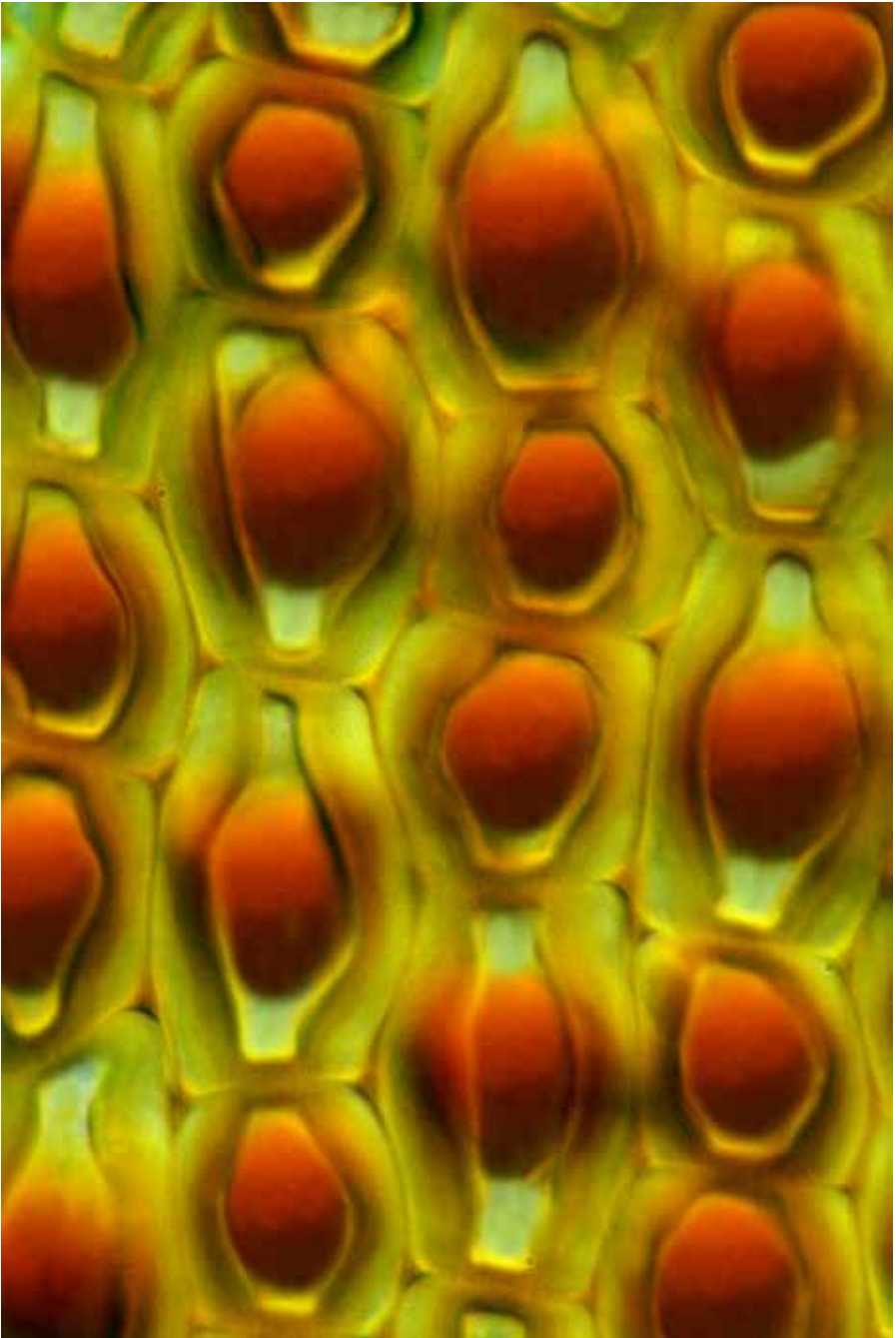
unipapillose cells midleaf, transition cells in lower leaf, and cells near leaf base
 10 μm , 10 μm , 10 μm

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Macromitrium grossirete margin midleaf
10 μ m

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Macromitrium grossirete transition cells in lower leaf
10 μ m

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Macromitrium helmisii Paris

form: loose spreading mats of olive-green, creeping primary stems with erect, regularly spaced penicillate branches to 25 mm long, the leaves dull olive-green to yellow-brown

habitat: bark in lowland podocarp-hardwood forest, to 760 m

leaf: size: 1.2–2.5 mm

shape: stem lanceolate-acuminate, branch ligulate to oblong

tip: obtuse to retuse, ending in a deciduous, linear, flexuose arista

base: basal cells long-rectangular to linear, $20\text{--}40 \times 5\text{--}10 \mu\text{m}$

costa: excurrent into the arista

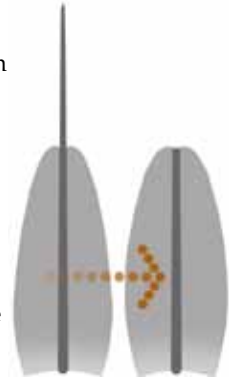
border: not differentiated

margin: entire, plane to weakly curved on one side

cells: $5\text{--}9 \mu\text{m}$, rounded-quadrate, thick-walled, low-multipapillose

capsule: not seen in New Zealand

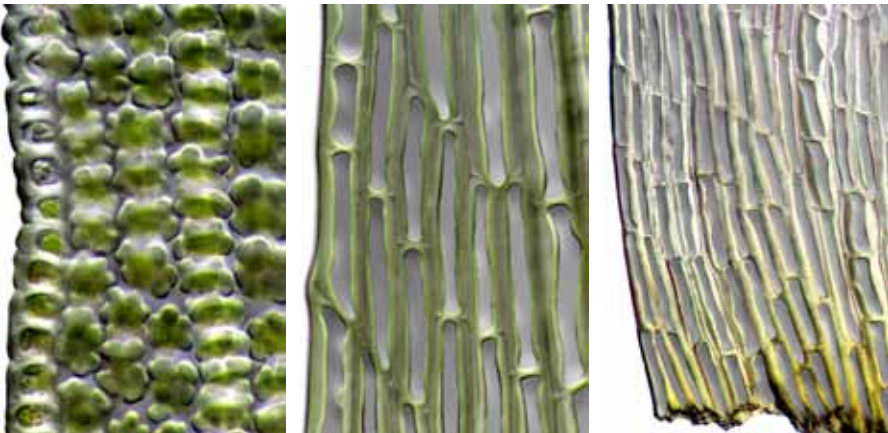
note: differs from *Macromitrium retusum* in having papillose cells



branch leaf



vegetative shoots with aristae (moist), arista, arista tip, leaf outline, and retuse leaf apex
 5 mm (2), 1 mm, 100 μm , 100 μm , 0.5 mm, 50 μm



margin and papillae midleaf, margin near leaf base, and leaf basal angle
 10 μm , 10 μm , 50 μm

continued next page

Macromitrium ligulaefolium Broth.

form: creeping primary stems, with closely spaced, short, squarrose branches, 5–10 mm tall, the leaves dull to glossy olive-green to brown

habitat: bark of tree trunks, and rock, to 520 m

leaf: *size:* stem leaves 1.3–1.5 mm, branch leaves 1.5–3.0 mm

shape: stem leaves ovate-lanceolate, branch leaves ± ligulate, strongly keeled

tip: variable, ± acute-apiculate

base: basal cells rectangular, unevenly thick-walled

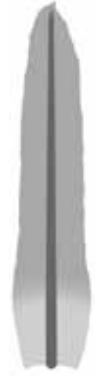
costa: ending below or at the apex, or excurrent in an apiculus

border: one row of smaller cells

margin: minutely crenulate above, entire below, plane to reflexed

cells: 8–12 μm, rounded, thick-walled, strongly bulging, 1–4-papillose

capsule: 1.5 mm, narrowly ovoid to ellipsoid, erect, rim 8-plicate, narrow-mouthed, brown; seta 5–6 mm; operculum erect-rostrate; calyptra weakly plicate, 1–5-laciniate; peristome none or single, exostome a low membrane, endostome none; spores 15–25 μm in diam.

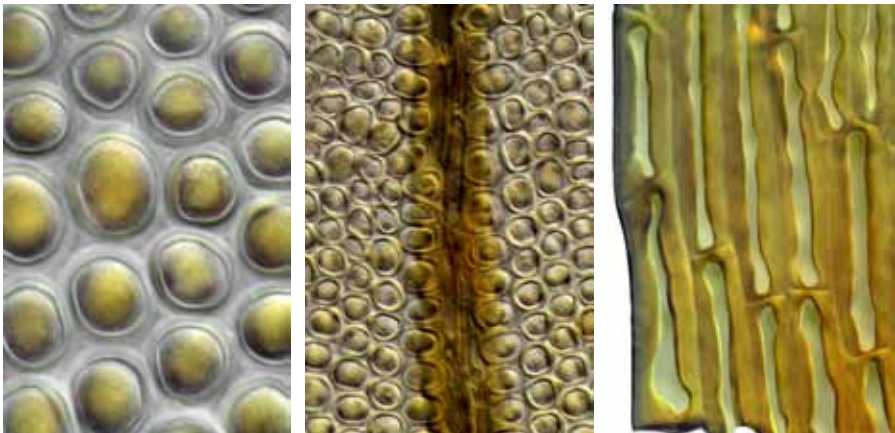


branch leaf



shoot and capsule (dry), leaf outline, leaf apex, and margin midleaf

1 mm, 0.5 mm, 0.5 mm, 10 μm, 10 μm



cells midleaf, costa midleaf, and leaf basal angle

10 μm, 10 μm, 10 μm

continued next page

Macromitrium ligulare Mitt.

form: mats of creeping primary stems, the branches regular, short, and erect, 12–17 mm, the leaves dull, olive-green to yellow-green

habitat: bark of tree trunks and branches in lowland podocarp forest, to 900 m

leaf: size: stem leaves 1.0–1.3 mm long; branch leaves 1.5–2.5 mm long

shape: stem leaves lanceolate, branch leaves ± ligulate, strongly keeled

tip: stem leaves acute or acuminate, branch leaves obtuse, apiculus one-celled

base: inner cells $14\text{--}30 \times 9 \mu\text{m}$, short-rectangular, thick-walled, porose, smooth

costa: prominent, glossy, smooth, failing a few cells below the apex

border: not differentiated

margin: entire below, crenulate above, plane to ± reflexed below

cells: 9–15 μm , rounded-quadrate, thick-walled, 1–4-papillose

capsule: 1.5–2.0 mm, oblong to cylindrical, erect, exserted, light tan; seta 2–8 mm;

stomata superficial; operculum erect-beaked; calyptra weakly plicate, entire

with 1–3 long slits, smooth, naked; peristome single, exostome of 16 teeth;

spores 14–34 μm in diam., anisoporous



branch leaf



fertile and vegetative shoots (dry) (3), paraphyses, leaf outline, and leaf apex
 ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 100 μm , ■ 0.1 mm, ■ 10 μm



margin midleaf, costa midleaf, and leaf basal angle

■ 10 μm , ■ 10 μm , ■ 10 μm

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Macromitrium ligulare costa midleaf
10 μm

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Macromitrium longipes (Hook.) Schwägr.

form: densely matted, golden, ± branched primary stems, with secondary branches 25(–50) mm tall, the leaves golden brown

habitat: bark or rarely rock, lowland to montane forest, to 1400 m

leaf: size: stem leaves 1.5–2.0 mm, branch leaves 1.5–3.0 mm

shape: stem ovate-lanceolate, branch ± ligulate, ± plicate on one side

tip: stem leaves ± subulate, branch leaves acute

base: cells of 1/3–2/3 incrassate, with semilunar to sinuose lumina

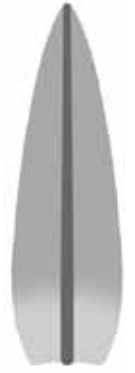
costa: failing just below the apex

border: not differentiated

margin: entire, widely recurved on one or both sides

cells: 7–9 μm , isodiametric, incrassate, smooth, ± bulging

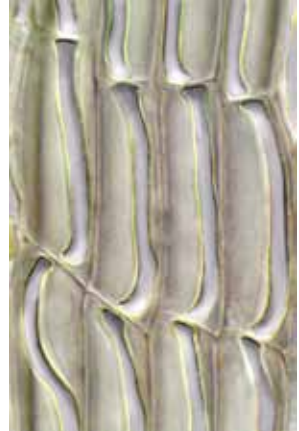
capsule: 1.5–2 mm, elliptic to cylindric, erect, narrowed and finely plicate at the mouth when dry; seta 15–25 mm; calyptra strongly plicate, deeply laciniate, to 5 mm; peristome of 16 pale lanceolate exostome teeth, endostome none; spores 26–66 μm in diam., anisoporous



branch leaf



vegetative shoot (wet and dry), fertile shoot (dry), mature capsules (2), and calyptrae (3)
 ■ 5 mm, ■ 1 mm, ■ 1 mm, ■ 1 mm (2), ■ 1 mm (3)



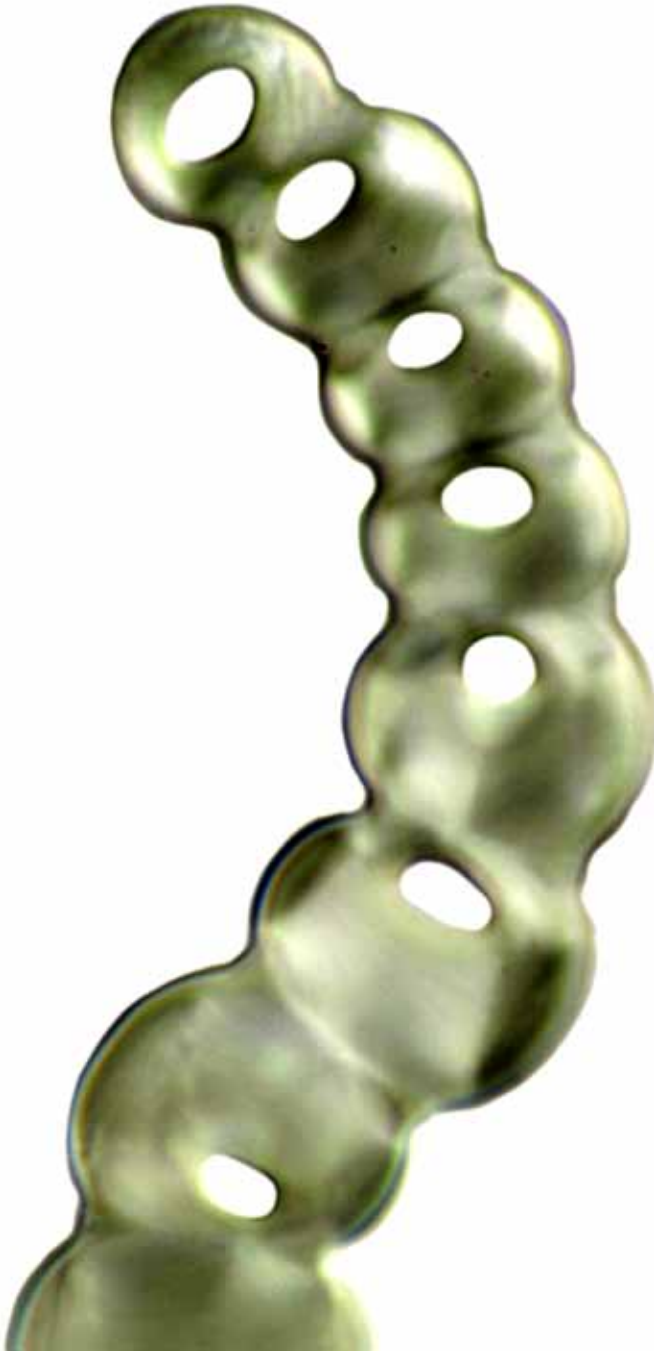
mature capsule (dry), leaf outline, leaf apex, and leaf basal cells
 ■ 1 mm, ■ 0.5 mm, ■ 50 μm , ■ 10 μm

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Macromitrium longipes calyptrae
1 mm

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Macromitrium longipes leaf margin cross-section
10 μ m

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Macromitrium longirostre (Hook.) Schwägr.

form: matted, creeping primary stems, secondary stems erect, ± branched, to 35 mm long, the leaves olive-green above, chestnut brown below

habitat: exposed rock and bark in coastal Chatham Islands; tolerates salt spray

leaf: size: stem leaves 1.0–2.0 mm, branch leaves 1.6–4.0 mm

shape: stem leaves lanceolate, branch leaves lanceolate to oblong, ± bistratose in upper third, flexuose-twisted around the stem when dry, not fragile

tip: stem leaves acuminate, branch leaves acute to cuspidate

base: basal cells short-rectangular, their lumina slit-like and straight or nearly so

costa: keeled above, percurrent, subpercurrent, or rarely excurrent in a cusp

border: not differentiated

margin: entire, plane

cells: 10–15 × 8–10 μm, rounded-quadrate, thick-walled, smooth, bulging

capsule: 1.5–3 mm, ovate to fusiform-cylindric, erect, exserted, brown; seta 5.5–11 mm; operculum long-beaked; calyptra lacerate, mitrate, plicate, naked; exostome teeth 16; endostome a low membrane; spores 20–40 μm in diam.

branch leaf



vegetative shoot (moist on left), leaf outline, leaf apex, and capsules (2)

1 mm, 1 mm, 1 mm, 10 μm, 1 mm (2)



margin lower leaf, cells and costa midleaf, and cells near leaf base

10 μm, 10 μm, 10 μm

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Macromitrium longirostre calyptra
0.5 mm

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Macromitrium microstomum (Hook. & Grev.) Schwägr.

form: spreading mats of primary stems, the secondary branches 4–6(–15) mm, the leaves dull, olive-green

habitat: bark of small branches in forest canopy, to 1200 m

leaf: size: stem leaves 1.2–1.5 mm, branch leaves 1.2–2.0 mm

shape: stem ovate-lanceolate, branch ± ligulate, with a wide plica on one side

tip: stem leaves acuminate-subulate, branch leaves acute, strongly keeled

base: basal cells narrowly linear, with a straight lumen

costa: excurrent to failing just below the apex

border: not differentiated

margin: entire, plane or else recurved on the same side as the plica

cells: upper cells 8–10 μm , oval or isodiametric, rounded, incrassate, smooth;

midleaf cells 10–20 \times 8–10 μm , smooth; basal cells 25–55 μm long, smooth

capsule: 1.0–1.9 mm, ovoid to oblong, narrowed and 8-plicate at the mouth;

seta 4–18 mm, slender, flexuose; calyptra deeply lacerate, plicate, glabrous;

peristome exostome, teeth 16, irregular, blunt; spores 30–54 μm in diam.



fertile shoot (moist), capsule, peristome tooth, shoot (dry), leaf outline, and leaf apex

■ 1 mm, ■ 1 mm, ■ 10 μm , ■ 1 mm, ■ 0.1 mm, ■ 10 μm



costa upper leaf, upper leaf cells, and cells in leaf base

■ 10 μm , ■ 10 μm , ■ 10 μm

continued next page

Macromitrium orthophyllum Mitt.

form: creeping prostrate primary stems, secondary branches to 30 mm, the leaves olive-green, lacking a red or brown tinge

habitat: bark in lowland to low-montane forest, mostly eastern, to 500 m

leaf: size: stem leaves 1.0–1.5 mm, branch leaves 2.0–3.3 mm

shape: stem leaves ovate, branch leaves ovate- to oblong-lanceolate

tip: stem leaves long-acuminate, ± reflexed, branch leaves acute, keeled below

base: basal cells $29\text{--}90 \times 8\text{--}10 \mu\text{m}$, lumina of juxtacostal cells slightly sigmoid

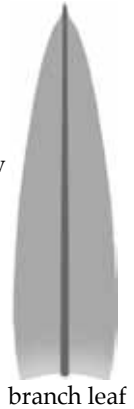
costa: percurrent to shortly excurrent

border: not differentiated

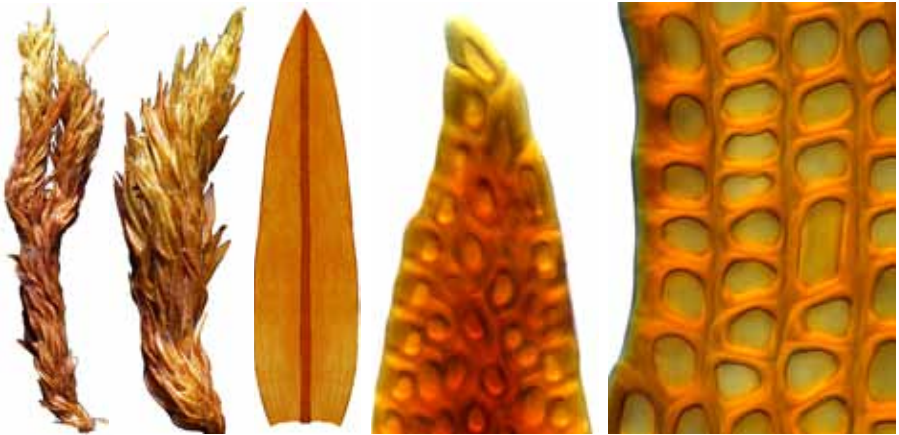
margin: entire, plane

cells: upper cells 5–8 μm , rounded-quadrate, thick-walled, smooth

capsule: 2–3 mm, oblong-ovoid, erect, exserted, brown, 8-plicate above; mouth dark, narrowed, puckered; seta 6–13 mm; operculum long-rostrate, ± oblique; calyptra 2–3-lacerate, naked; peristome single, exostome only, of 16 whitish teeth; spores 16–42 μm in diam., anisoporous

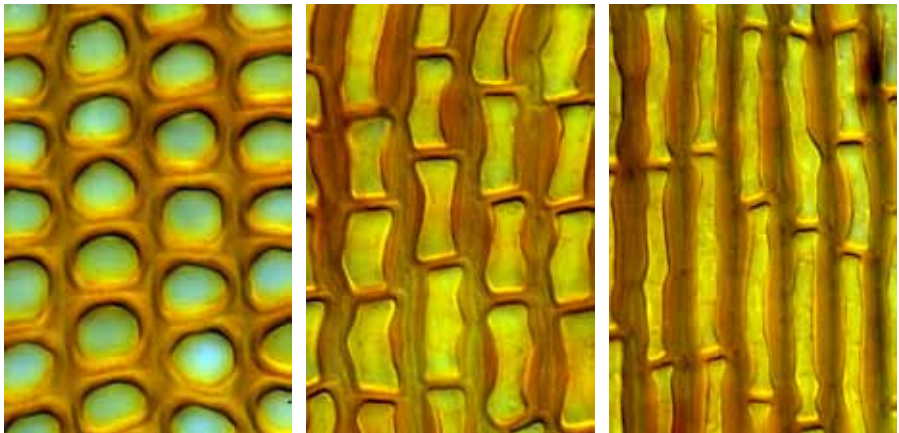


branch leaf



fertile and vegetative shoots (dry), leaf outline, leaf apex, and margin midleaf

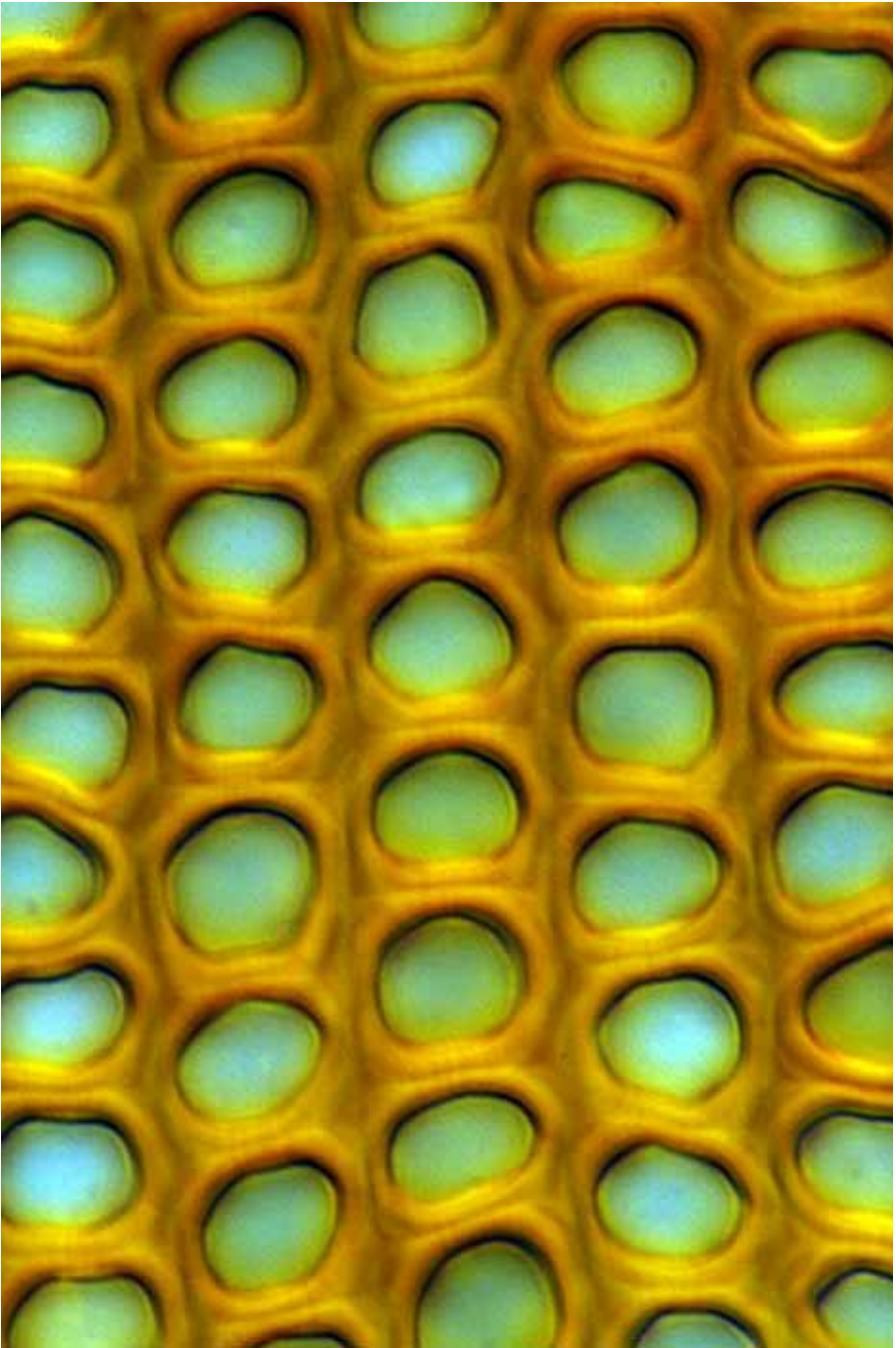
■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 10 μm , ■ 10 μm



upper leaf cells, midleaf cells, and lower leaf cells

■ 10 μm , ■ 10 μm , ■ 10 μm

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Macromitrium orthophyllum upper leaf cells
10 μm

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Macromitrium prorepens (Hook.) Schwäger.

form: primary stems creeping; secondary branches to 20 mm, the leaves dull yellow-green to olive-green

habitat: bark in low elevation, high-rainfall forest, to 1150 m

leaf: size: stem leaves 1.0–1.5 mm, branch leaves 1.2–3.0 mm

shape: stem leaves ovate-lanceolate, branch leaves \pm ligulate, base wider

tip: stem and branch leaves obtuse, abruptly contracted to a stout apiculus

base: inner long-rectangular, to $60\ \mu\text{m}$, \pm smooth, reaching $1/3$ leaf length

costa: percurrent to excurrent in the apiculus

border: not differentiated

margin: \pm papillose, recurved to reflexed below

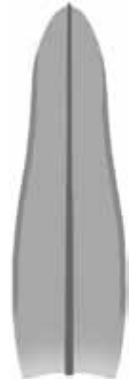
cells: midleaf 6–10 μm , isodiametric-rounded, incrassate, 1–(2–4)-papillose

capsule: 0.8–1.8 mm, ovoid-oblong, erect to horizontal, 4-plicate below the

mouth; seta 2–9 mm, smooth; calyptra lacerate, plicate, sparsely hairy;

peristome single, exostome only, of 16 flexuose, pale, papillose teeth;

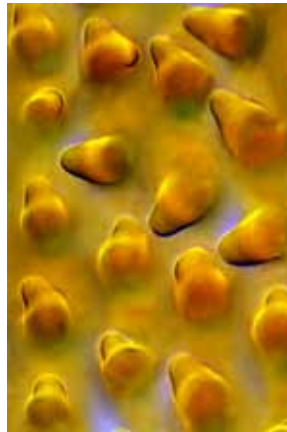
spores 16–44 μm in diam., anisoporous



branch leaf

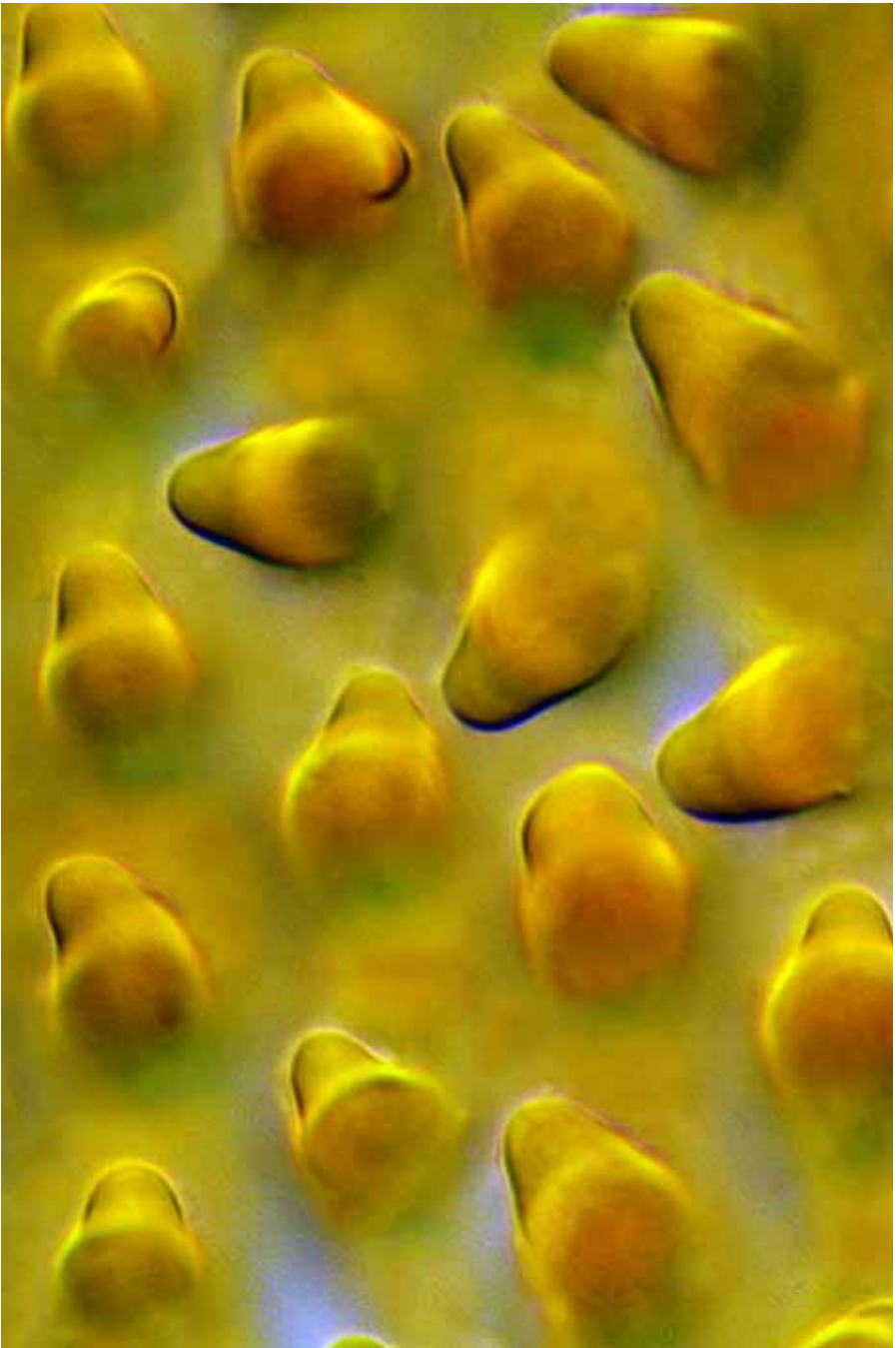


vegetative shoot, fertile shoot, capsule with calyptra, leaf outline, and leaf apex
 5 mm, 1 mm, 1 mm, 0.1 mm, 10 μm



margin midleaf, papillae midleaf, and cells near leaf base
 10 μm , 10 μm , 10 μm

continued next page



Macromitrium prorepens papillae midleaf
10 μm

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Macromitrium prorepens leaf margin cross-section
10 μ m

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Macromitrium prorepens leaf margin cross-section
10 μ m

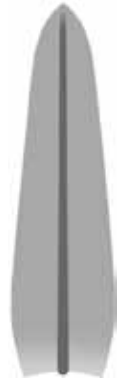
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Macromitrium ramsayae Vitt

form: matted, creeping primary stems, secondary branches up to 8 mm tall
habitat: bark or rock in salt-spray areas of the Chatham Islands, to 250 m

leaf: *size:* stem leaves 1.0–1.5 mm, branch leaves 1.6–2.5 mm
shape: stem: ovate-lanceolate; branch: oblong to lanceolate-oblong
tip: stem leaves gradually acuminate, branch leaves bluntly cuspidate
base: a few cells above the insertion 9–15(–20) μm long, \pm rectangular
costa: broad below, prominent, ending in or just below the apex
border: not differentiated
margin: entire, broadly recurved to nearly the apex
cells: 5–8 μm , rounded-quadrate, in rows, thick-walled, \pm papillose

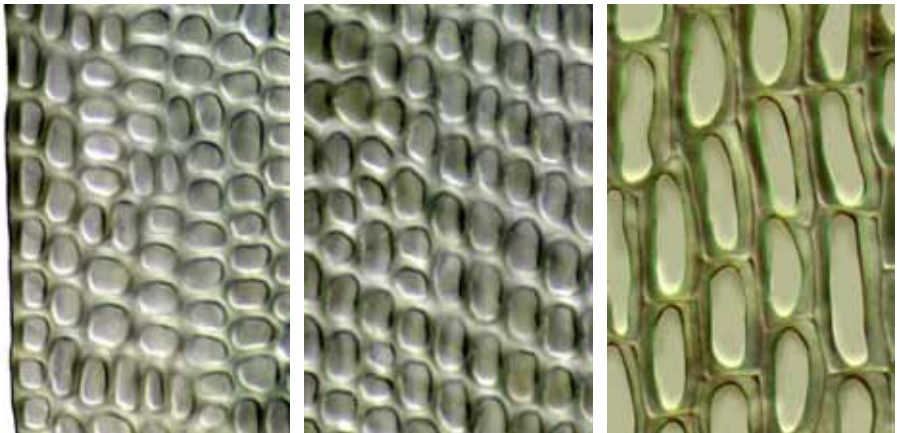
capsule: 1.2–2.3 mm, narrowly ovate to fusiform-cylindric, erect, exserted, slightly curved, brown; seta 2.5–4 mm, thick, smooth; calyptra mitrate, lacerate; operculum long-rostrate; peristome double, exostome of 16 blunt, papillose teeth, endostome a low papillose membrane 1–3 cells tall; spores 20–26 μm in diam., papillose



branch leaf



vegetative and fertile shoots (dry), branch leaf outline, and branch leaf apex
 1 mm, 1 mm, 0.5 mm, 10 μm



margin midleaf, cells midleaf, and cells just above leaf insertion
 10 μm , 10 μm , 10 μm

continued next page



Macromitrium ramsayae vegetative shoots (dry)

1 mm

continued next page

Macromitrium retusum Hook.f. & Wilson

form: mats of creeping primary stems, secondary branches simple, penicillate, to 20 mm, the leaves golden green, glossy

habitat: bark and rock, ± coastal in the salt-spray zone, to 600 m

leaf: size: branch leaves 1.3–2.0 mm after arista is shed

shape: stem lanceolate-acuminate, branch oblong to ligulate

tip: ending in a deciduous arista; tip retuse after the arista is shed

base: basal cells rectangular, $16\text{--}40 \times 7\text{--}10 \mu\text{m}$; lumina $2\text{--}4 \mu\text{m}$ wide

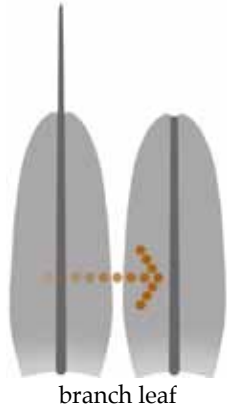
costa: excurrent as an arista 0.7–1.3 mm long

border: not differentiated

margin: entire, plane

cells: $7\text{--}20 \mu\text{m}$, rounded-quadrate, in rows, thick-walled, bulging

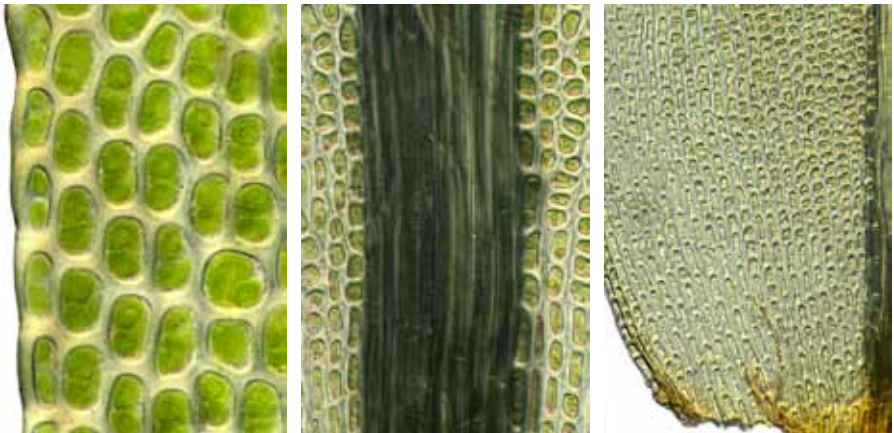
capsule: 2 mm, ovate to cylindrical, erect, exserted, brown; seta 4–7 mm; calyptra deeply lacerate, strongly plicate, mitrate, smooth; peristome double but appearing to be single, exostome teeth 16, warty, recurved when dry



branch leaf



vegetative shoot, branch with arista (dry), arista, arista tip, leaf outline, and retuse apex
 1 mm, 1 mm, 0.1 mm, 50 μm , 0.1 mm, 50 μm

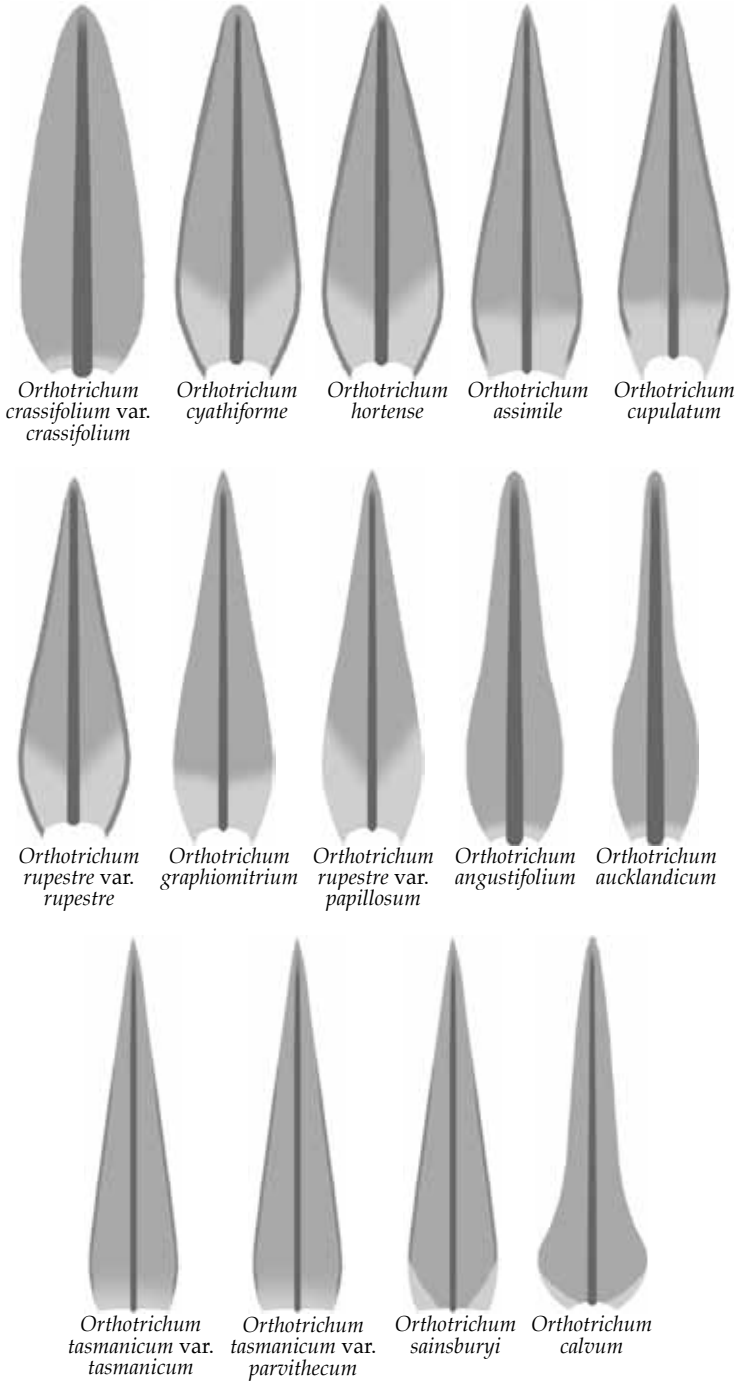


margin midleaf, costa midleaf, and leaf basal angle
 10 μm , 10 μm , 50 μm

Key* to the New Zealand species and varieties of *Orthotrichum* (14)

- 1 Leaf lamina bistratose at least distally; spores > 50 µm in diam.....2
 1: Leaf lamina unistratose throughout; spores < 40 µm in diam.....4
- 2(1) Capsules emergent to exerted; leaves ovate to narrowly ovate-ligulate
 ● ***Orthotrichum crassifolium* subsp. *crassifolium***
 2: Capsules immersed; leaves long-ligulate to ligulate-lanceolate from an ovate base.....3
- 3(2): Capsules ovate when dry; leaves narrowly lanceolate to broadly subulate from an
 oblong-ovate base; restricted to Campbell Island.....● ***Orthotrichum angustifolium***
 3: Capsules oblong when dry; leaves narrowly ligulate from an ovate base; restricted to
 the Auckland Islands.....● ***Orthotrichum aucklandicum***
- 4(1): Capsule stomata immersed.....5
 4: Capsule stomata superficial.....7
- 5(4) Calyptra smooth ● ***Orthotrichum calvum***
 5: Calyptra hairy.....6
- 6(5): Peristome with preperistome..... ● ***Orthotrichum cupulatum***
 6: Peristome without preperistome ● ***Orthotrichum assimile***
- 7(4): Capsule exerted.....8
 7: Capsule immersed to emergent9
- 8(7) Capsules furrowed when dry; up to 7 mm of seta visible; 1(–2–3) capsules per peri-
 chaetium..... ● ***Orthotrichum tasmanicum* var. *tasmanicum***
 8: Capsules smooth when dry; seta not exposed; up to 10 capsules per perichaetium.....
 ● ***Orthotrichum tasmanicum* var. *parvithecum***
- 9(7): Leaves obtuse or rounded.....● ***Orthotrichum cyathiforme***
 9: Leaves ± acute.....10
- 10(9): Processes of inner peristome 16.....● ***Orthotrichum sainsburyi***
 10: Processes of inner peristome 8 or lacking.....11
- 11(10): Processes of inner peristome lacking or rudimentary; plants mostly saxicolous 12
 11: Processes of inner peristome present; plants corticolous.....13
- 12(11) Papillae of midleaf cells branched..... ● ***Orthotrichum rupestre* var. *rupestre***
 12: Papillae of midleaf cells conic● ***Orthotrichum rupestre* var. *papillosum***
- 13(11): Stems 20–30 mm tall, ± creeping; leaves gradually acuminate; processes broad.....
 ● ***Orthotrichum graphiomitrium***
 13: Stems 8–15 mm tall, not creeping; leaves mostly acute; processes narrow
 ● ***Orthotrichum hortense***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bulletin 5, 207, plus Lewinsky-Haapasaari, J; Ramsay, HP (2006): *Orthotrichum*. *Flora of Australia* 51, 219, and Lewinsky, J (1984): The genus *Orthotrichum* Hedw. (Musci) in Australasia, a taxonomic revision. *Journal of the Hattori Botanical Laboratory* 56, 369–460, and Vitt, DH (1976): A monograph of the genus *Muelleriella* Dusén. *Journal of the Hattori Botanical Laboratory* 40, 93.



Orthotrichum assimile Müll.Hal.

form: tufted erect stems, to 15 mm tall, not creeping, olive- or yellow-green above, dark below

habitat: usually bark, but sometimes rock, in humid sites to 1500 m elevation

leaf: size: 1.8–4.0 × 0.4–0.8 mm

shape: ovate-lanceolate to lanceolate, appressed and flexuose when dry

tip: acuminate to acute

base: basal cells rectangular, 15–90 × 10 μm, thin-walled, smooth, not porose

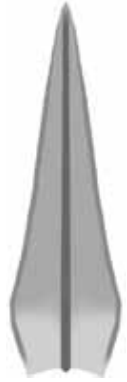
costa: failing below the apex

border: not differentiated

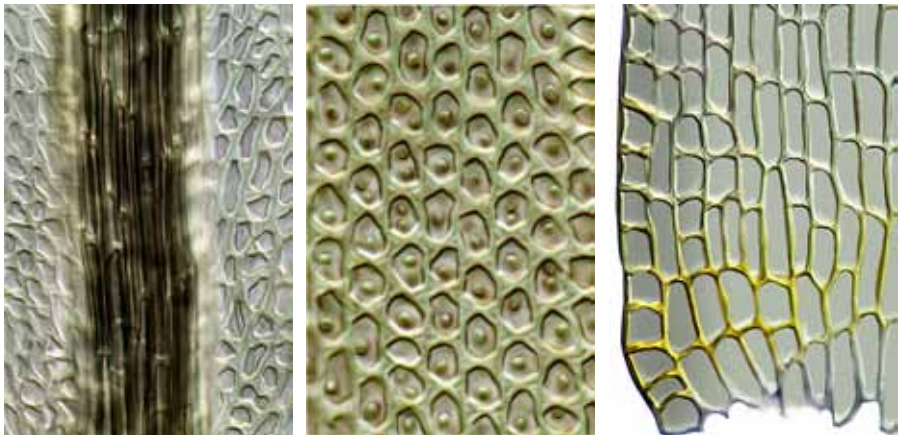
margin: entire, recurved on both sides

cells: 7–20 μm, isodiametric, thick-walled, 1(–2) low, simple-papillose

capsule: 1–2 mm, immersed to emergent, narrowly cylindrical, 8-ribbed and strangulate when dry, stomata immersed; calyptra split, plicate, long-pilose; exostome teeth 8, recurved when dry; endostome segments 8, narrow, well-developed; spores 6–20 μm in diam.



fertile shoot (immersed capsule), calyptra, leaf outline, leaf apex, and margin midleaf
 1 mm, 0.5 mm, 1 mm, 10 μm, 10 μm

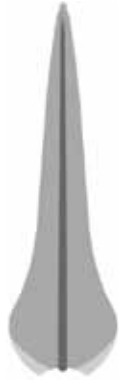


costa (near base), midleaf laminal papillae, and leaf basal angle
 10 μm, 10 μm, 10 μm

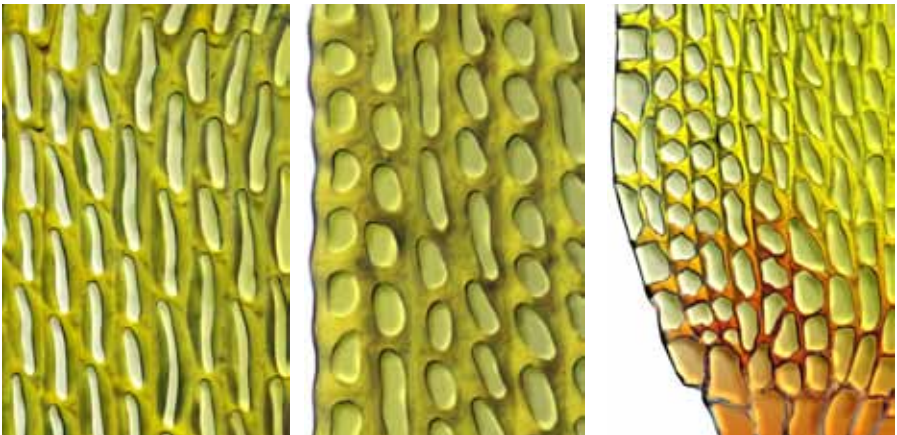
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Orthotrichum assimile cells near leaf base
10 μ m

Orthotrichum calvum Hook.f. & Wilson**form:** cushions of erect, radiculose, branched stems, 4–15 mm, olive-green**habitat:** twig bark in scrub and forest margins, to 1000 m**leaf:** size: 1.6–2.3 × 0.5–0.6 mm**shape:** linear-lanceolate from an ovate base, concave**tip:** bluntly acute to subobtusate**base:** cells rectangular to linear, smooth, pellucid; transverse walls thickened**costa:** failing below the apex, prominent abaxially**border:** not differentiated**margin:** entire, plane to ± recurved midleaf**cells:** 7–10 μm, rounded to irregularly 4–6-angled, ± incrassate, 1–2-papillose**capsule:** 1.3 mm, widely oval or oblong, erect, exserted, brown, 8-ribbed; stomata immersed; seta 2–4 mm; calyptra pale below, dark at apex, smooth; exostome of 8 pairs of pale, lanceolate teeth, later deeply split; endostome 8–16 papillose processes; spores 20–24 μm in diam.**note:** our only *Orthotrichum* with immersed stomata and a smooth calyptra

fertile shoot (moist), capsules, calyptra, operculum, leaf outline, and leaf apex
 ■ 1 mm, ■ 1 mm (3), ■ 0.1 mm, ■ 10 μm



cells lower leaf, margin below midleaf, and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 10 μm

continued next page



Orthotrichum calvum capsules, calyptra, operculum, and exostome (dry)
0.5 mm

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Orthotrichum calvum young and old capsules (dry)

0.5 mm

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Orthotrichum calvum exostome teeth (in KOH)
50 μ m

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Orthotrichum crassifolium Hook.f. & Wils. var. **crassifolium**

form: erect, sparsely branched, brown to blackish stems, to 10 mm tall, in dense tufts or cushions

habitat: cliffs and coastal rock above high-tide mark, and inland to 130 m

leaf: size: 1.4–3.2 × 0.5–1.0 mm

shape: ligulate-lanceolate from a ± ovate base; ± bistratose above

tip: obtuse to acute

base: basal cells short-rectangular, 18–30 × 9 μm, longer near the costa

costa: stout, ending in or just below the apex

border: not differentiated

margin: entire, plane, 2–3-stratose

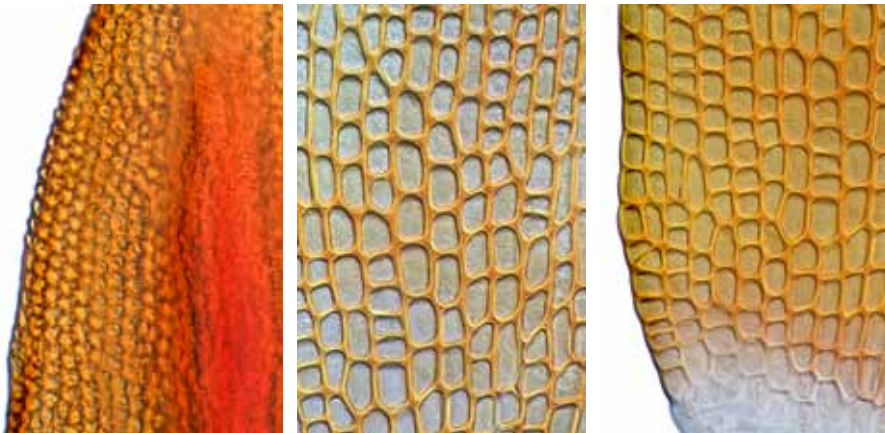
cells: 6–13 μm, rounded-rectangular, thick-walled, smooth to ± papillose

capsule: 1.0–1.8 mm, oblong-cylindric, erect, exserted, stomata immersed; seta 1–2.5 mm, curved; calyptra mitrate, naked; peristome single, the exostome teeth 16, papillose, recurved when dry; spores (30–)40–100 μm long, multicellular



fertile shoot, capsule, peristome tooth, leaf outline, and leaf apex

1 mm, 0.5 mm, 50 μm, 0.5 mm, 50 μm



margin upper leaf, cells midleaf, and leaf basal angle

50 μm, 10 μm, 10 μm

continued next page

Orthotrichum cupulatum Brid.

form: tufts or cushions of erect, ± branched stems, 12–20 mm, glaucous
habitat: basic rock or walls, rarely on bark, in moist sites, to 2000 m

leaf: size: 2.3–3.2 × 0.5–1.0 mm

shape: lanceolate to ovate-lanceolate

tip: acute

base: decurrent, basal cells rectangular, 32–64 × 10–25 μm, smooth

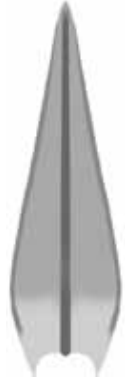
costa: reaching the apex

border: not differentiated

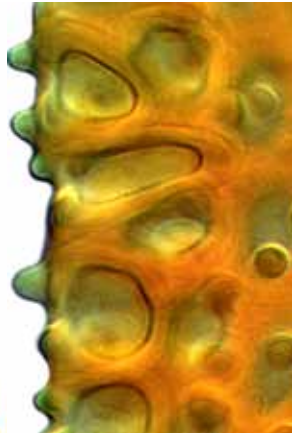
margin: entire, recurved on one side

cells: 8–13 μm, isodiametric, thick-walled, 2–3-papillose

capsule: 1.5 mm, ovoid-urceolate, constricted below the mouth when dry, 8 long and 8 short alternating ribs, immersed to emergent, stomata immersed; seta 0.6–2.0 mm; calyptra mitrate, split, plicate, papillose; peristome single or double, exostome teeth 16; spores 18–23 μm in diam.



fertile shoot (moist), calyptra, mature capsule (dry), leaf outline, and leaf apex
 ■ 1 mm, ■ 0.1 mm, ■ 0.1 mm, ■ 0.5 mm, ■ 10 μm



leaf apex, margin midleaf, and cells midleaf
 ■ 10 μm, ■ 5 μm, ■ 5 μm

continued next page

Orthotrichum graphiomitrium Beckett

form: mats or tufts of erect, branched, radiculose, comose stems, 40 mm

habitat: bark of shrubs and small trees in subalpine scrub, to 900 m

leaf: size: 2.6–4.1 × 0.7–1.3 mm

shape: ovate-lanceolate, little altered when dry

tip: gradually acuminate

base: transverse walls of basal angle cells thickened, pigmented

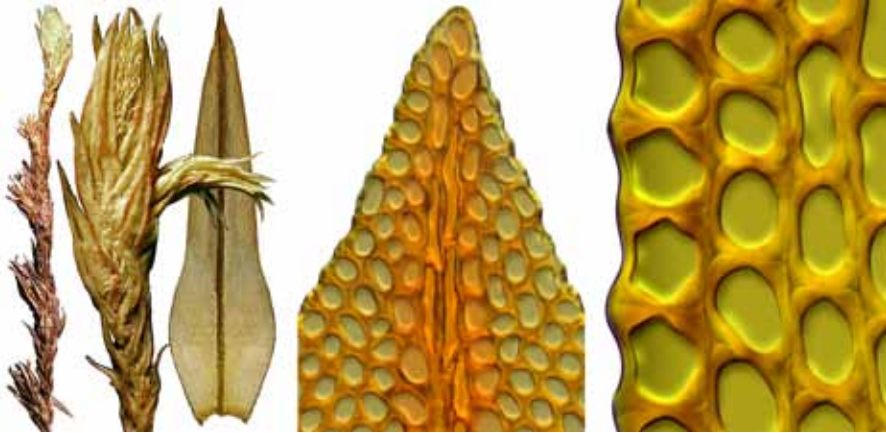
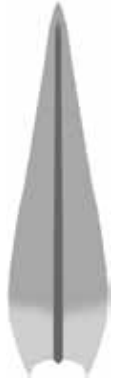
costa: orange to red, prominent abaxially, failing below the apex

border: not differentiated

margin: entire, plane to variably recurved

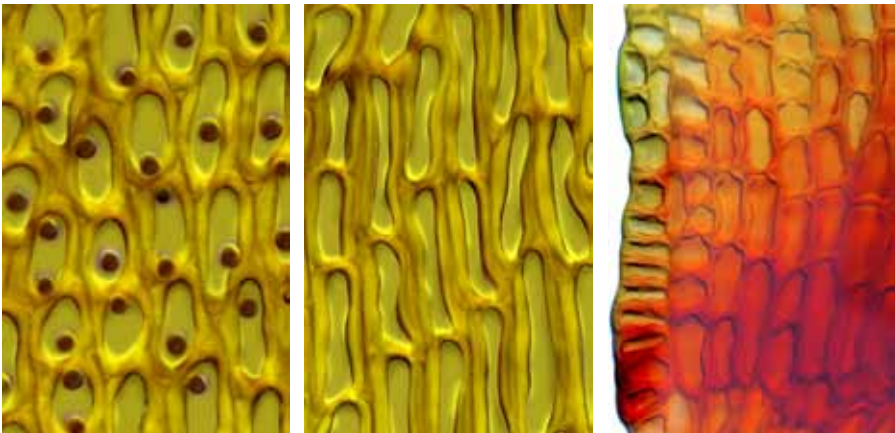
cells: 1.5–2 × 7–13 μm, subrotund to narrowly oval, incrassate, 1–3-papillose

capsule: 1.5–2 mm; broadly ovate, narrowed at the mouth, erect, immersed, appearing lateral, brown, stomata superficial; seta to 1 mm; exostome of 8 pairs of obtuse teeth, reflexed when dry; endostome of 8 processes almost equalling the teeth; calyptra plicate, densely hairy; operculum conico-rostellate, reddish at the base; spores globose, 18–32 μm in diam.



fertile shoot (dry) (2), leaf outline, leaf apex, and margin midleaf

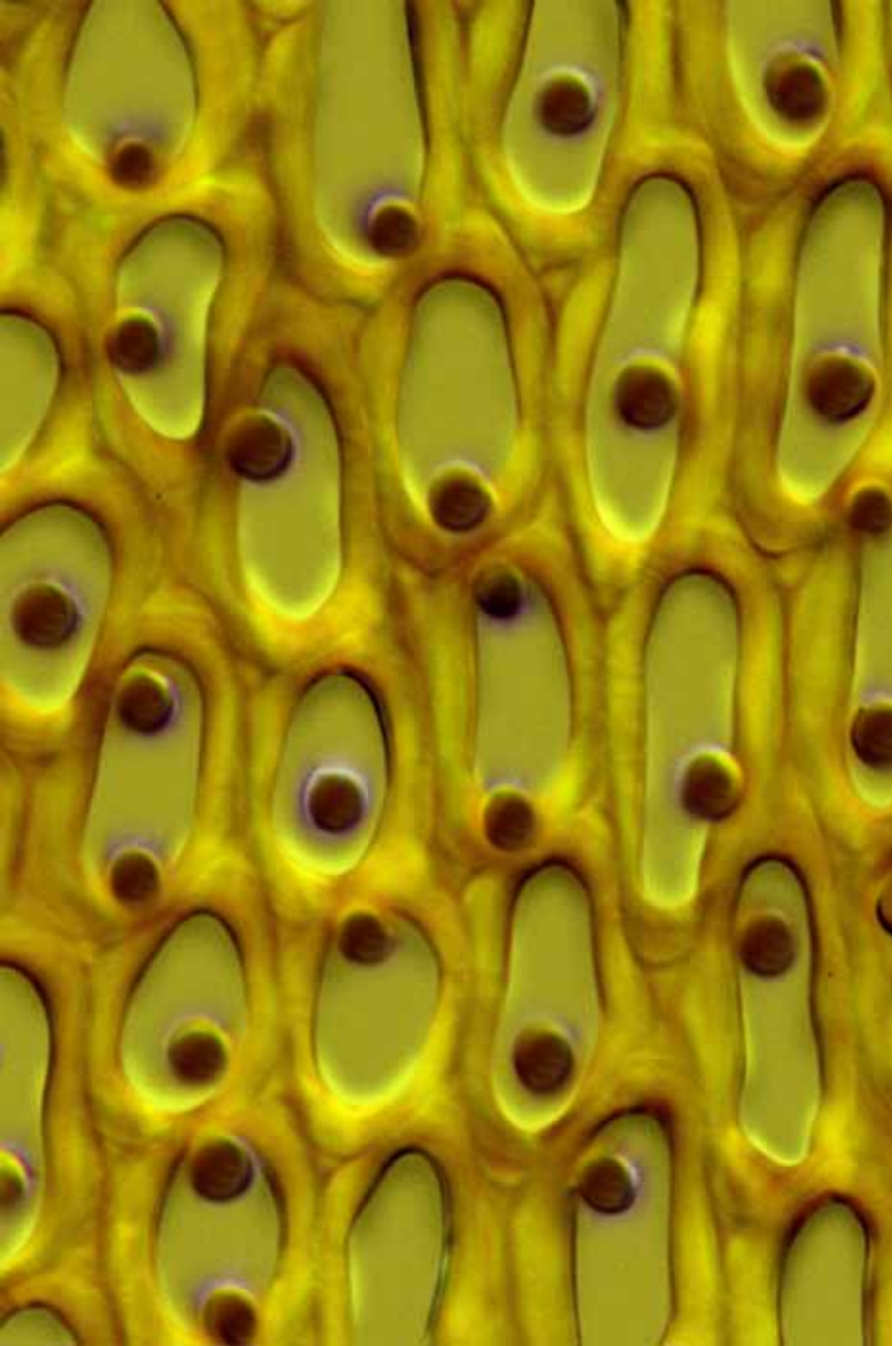
■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 50 μm, ■ 10 μm



papillose cells midleaf, cells near leaf base, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 10 μm

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Orthotrichum graphiomitrium cells midleaf
10 μ m

continued next page

Orthotrichum hortense Bosw.

form: tufts of erect, branched, often fertile stems, to 15 mm tall, dark below

habitat: mostly bark (often willow) but sometimes rock, often in humid sites

leaf: size: about 3 mm long

shape: ovate-lanceolate to oblong-lanceolate, concave, carinate below, spreading when moist, imbricate when dry but otherwise little altered

tip: acute, shortly acuminate, or subobtuse

base: basal cells \pm rectangular, thin-walled, smooth; marginal cells \pm quadrate

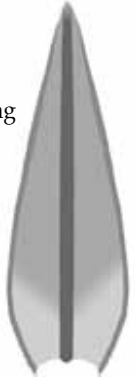
costa: percurrent or failing near the apex

border: not differentiated

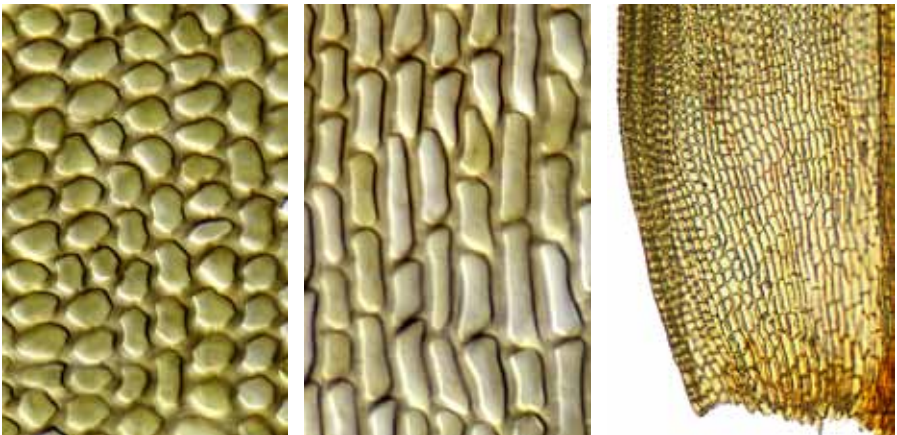
margin: entire, recurved or revolute almost to the apex on both sides

cells: 9–12 μm , \pm isodiametric, incrassate, \pm papillose

capsule: to 2 mm long, cylindrical, 8-ribbed, brown, stragulate when empty, immersed to emergent; stomata superficial; seta < 1 mm; operculum short-beaked; calyptra pilose above, plicate, pale below, apex dark red; exostome teeth 8, pale, reflexed when dry; spores 14–20 μm in diam., brown, papillose



fertile shoot (dry), mature capsule (dry), leaf outline, apex, costa, and recurved margins
 1 mm, 0.5 mm, 0.5 mm, 0.5 mm, 100 μm



lamina cells midleaf, cells near leaf base, and leaf basal angle
 10 μm , 10 μm , 50 μm

continued next page



Orthotrichum hortense fertile shoot (dry) and mature capsule (dry)
1 mm, 0.1 mm

Orthotrichum rupestre Schleich. ex Schwägr. var. **rupestre**

form: tufts or mats of erect, \pm curved, branched, radiculose stems, 15–60 mm, brownish, not glaucous when dry

habitat: non-calcareous rock or rarely smooth bark, in dryish sites, to 2300 m

leaf: size: 2–5 \times 0.7–1.4 mm

shape: variable, lanceolate to broadly lanceolate, partially bistratose above

tip: acute to acuminate

base: transverse walls of basal cells thickened and porose

costa: ending in the apex

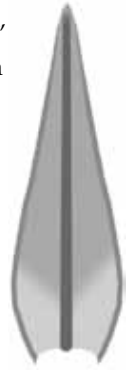
border: not differentiated

margin: entire, strongly recurved to near the apex

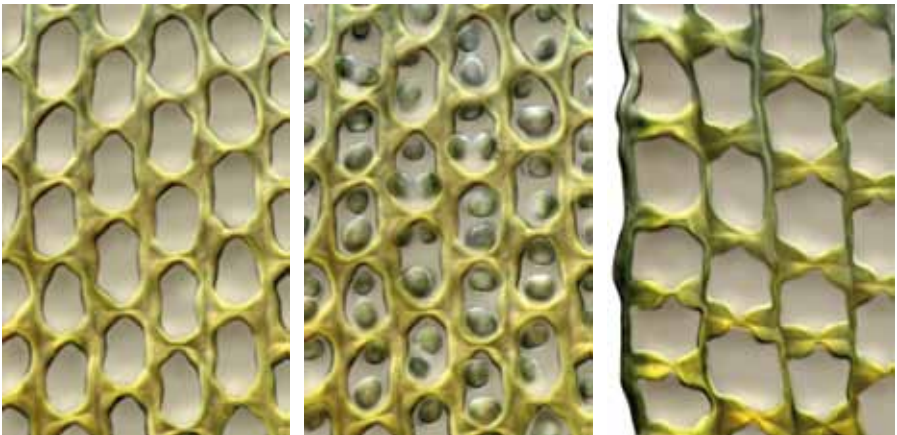
cells: 7–21 \times 2–15 μ m, rounded to \pm elongate, thick-walled, 1–3-papillose

capsule: 1.5–3 mm, ellipsoid to ovoid, immersed to emergent, striate, not flared, stomata superficial; seta 0.8–2 mm; calyptra hairy; peristome teeth paired; spores 20–26 μ m in diam.

notes: highly variable; cosmopolitan



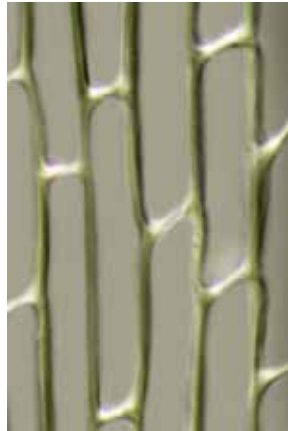
fertile shoot (dry), mature capsule (dry), leaf outline, leaf apex, and upper leaf margin
 1 mm, 0.5 mm, 0.5 mm, 50 μ m, 10 μ m



cells midleaf, leaf papillae, and margin near leaf base
 10 μ m, 10 μ m, 10 μ m

Orthotrichum tasmanicum var. **parvithecum** (R.Br.bis) Lewinsky**form:** loose tufts of erect stems to 30 mm tall, yellowish or olive-green**habitat:** bark or occasionally siliceous rock in humid sites to 2000 m elevation**leaf:** size: 2.5–3.7 × 0.6–0.9 mm, unistratose*shape:* ± lanceolate, crisped when dry*tip:* acuminate to acute*base:* basal cells rectangular, 50–70 × 8–15 μm, thin-walled, smooth*costa:* failing below the apex*border:* not differentiated*margin:* entire, ± undulate, recurved*cells:* 6 × 13 μm, rounded-isodiametric, thick-walled, 1(–2) papillate**capsule:** 1–2 mm, 2–3 per perichaetium, cylindric to short-ovoid, immersed to emergent, smooth, stragulate when dry; seta short; calyptra mitrate, ± pilose**notes:** differs from var. *tasmanicum* in having short setae and clustered and weakly ribbed capsules

fertile shoots, calyptra, leaf outline, and leaf apex (2)



margin midleaf showing laminal papillae, cells near leaf base, and leaf basal angle

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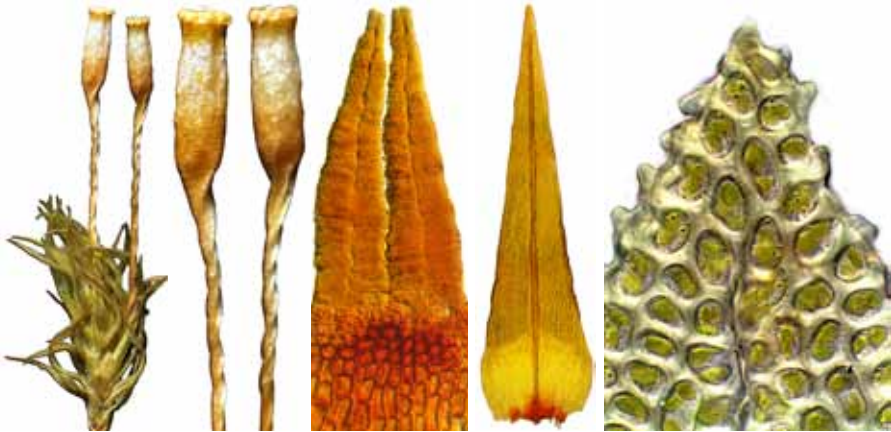
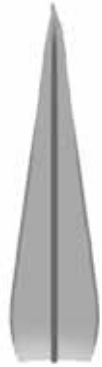
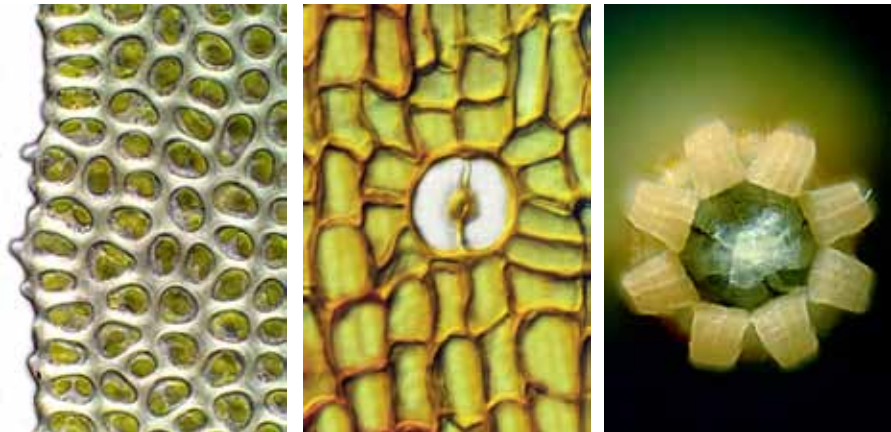
Orthotrichum tasmanicum var. *parvithecum* fertile shoots with clustered capsules (dry)

1 mm

continued next page



Orthotrichum tasmanicum var. *parvithecum* spores and reflexed exostome teeth
0.1 mm

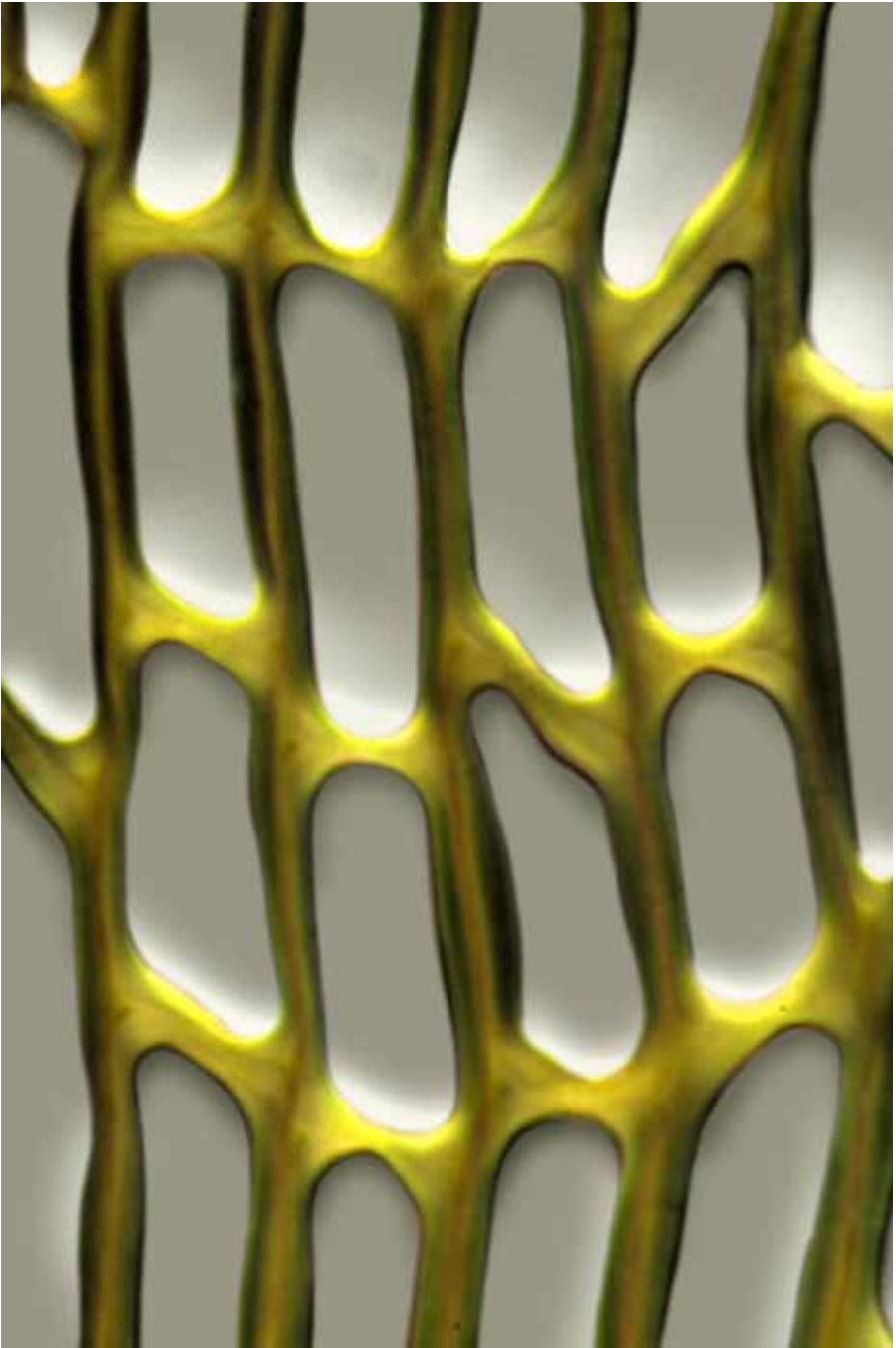
Orthotrichum tasmanicum Hook.f. & Wilson var. **tasmanicum****form:** tufts of erect, branched, radiculose stems, 10–30 mm, yellowish green**habitat:** bark or rarely non-calcareous rock, in damp sites, to 1650 m**leaf:** size: 2.4–3.5 × 0.7–0.8 mm*shape:* ± lanceolate*tip:* acute*base:* inner cells long, narrow, incrassate; outer cells quadrate, hyaline, transverse walls thickened*costa:* failing below the apex*border:* weak, hyaline toward the base*margin:* entire to denticulate above, recurved on both sides*cells:* 8–14 × 7–13 μm, isodiametric, incrassate, smooth to 1–2-papillose**capsule:** 1.5–2.5 mm, ovoid to cylindric, erect, long-exserted, pale brown, 8-grooved dry, stomata superficial; seta 4–7 mm; calyptra campanulate, usually hairy; peristome double, exostome teeth 8, recurved when dry, endostome segments 8, papillose; spores 18–32 μm in diam.fertile shoot, mature capsules (2), peristome teeth, leaf outline, and leaf apex
 1 mm, 1 mm (2), 100 μm, 0.1 mm, 10 μmmargin midleaf, capsule stoma (superficial), and peristome
 10 μm, 50 μm, 0.5 mm

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Orthotrichum tasmanicum var. *tasmanicum* fertile shoots (dry) and mature capsule (dry)
1 mm, 1 mm

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Orthotrichum tasmanicum var. *tasmanicum* cells of lower leaf
10 μ m

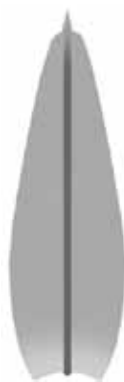
Key* to the New Zealand species of *Schlotheimia* (2)

- 1 Branch leaf apex a stout cusp filled by the excurrent costa; upper margins weakly bordered by oblong (2–3:1) cells ● ***Schlotheimia campbelliana***
- 1: Branch leaf apex a short and wide mucro of bistratose costal cells plus unistratose quadrate to elongate laminal cells; upper margins not bordered..... ● ***Schlotheimia knightii***

* based on Vitt, DH (1989): The genus *Schlotheimia* (Orthotrichaceae: Bryopsida) in Australia and New Zealand. *Bryologist* 92, 283.



Schlotheimia campbelliana



Schlotheimia knightii

Schlotheimia campbelliana Müll.Hal.

form: spreading mats of creeping stems with erect, glossy branches to 10 mm long, densely red-tomentose below

habitat: on bark or rock, on Campbell, Stewart, and South Island, to 400 m

leaf: size: 2.0–2.6 × 0.7 mm

shape: oblong-lanceolate, spirally twisted when dry, keeled, ± rugose

tip: acuminate to acute, stoutly cuspidate, the cusp 0.5–1.0 mm long

base: basal cells 20–50 × 6–8 μm, curved, long-rectangular, incrassate, porose

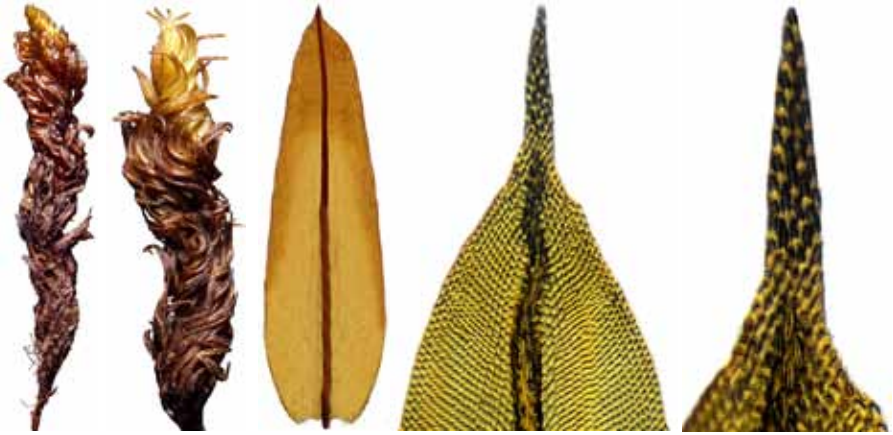
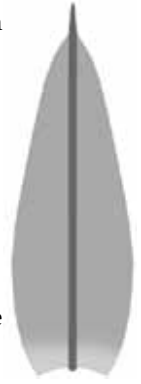
costa: strong, excurrent, filling the cusp

border: weak, 1–2 rows of cells 10–24 × 3–6 μm

margin: entire, plane above, plane to recurved below

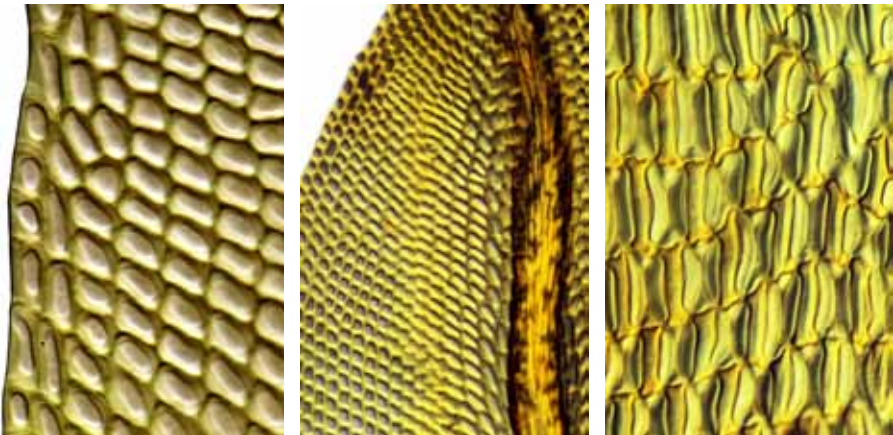
cells: midleaf 9–12 μm, oval-oblong, in oblique rows, incrassate, smooth

capsule: to 2 mm, ± cylindric, exserted, 8-ribbed; seta 6–8 mm long; calyptrae campanulate, dark above, 4–5-lobed below, naked, smooth; operculum long-rostrate; exostome teeth 16, orange, reflexed when dry; spores spherical, 20–36 μm in diam.



vegetative shoots (dry) (2), leaf outline, cuspidate leaf apex, and cusp

1 mm, 1 mm, 1 mm, 100 μm, 100 μm



midleaf margin, upper margin and costa, and cells near base

10 μm, 50 μm, 10 μm

continued next page



Schlotheimia campbelliana campanulate calyptrae
1 mm

Schlotheimia knightii Müll.Hal.

form: cushions of creeping, glossy, red-brown stems, branches to 70 mm

habitat: bark, less commonly rock, in forest, to 1200 m

leaf: size: 1.5–2.5 mm

shape: oblong to ovate-oblong, keeled, ± rugose

tip: obtuse to acute, abruptly ending in a wide mucro of bistratose costal cells plus unistratose quadrate to elongate laminal cells

base: basal cells $20\text{--}50 \times 6\text{--}8 \mu\text{m}$, ± yellowish, thick-walled, porose, ± curved

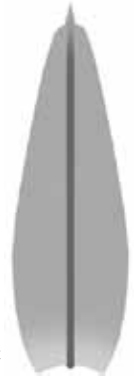
costa: failing below the mucro

border: some leaves with a weak border of elongate cells

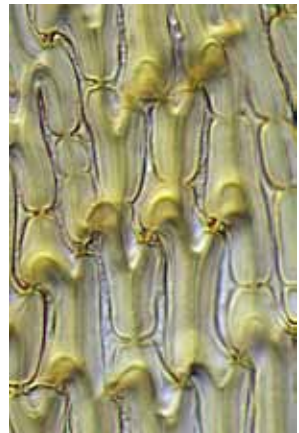
margin: entire, plane to recurved below

cells: $10\text{--}20 \times 4\text{--}6 \mu\text{m}$, oval to oblong, thick-walled, porose, ± papillose

capsule: 1.6–2.3 mm, erect to curved, cylindrical, inclined, exserted, 8-ribbed when dry, brown; seta 6–8 mm; calyptra not plicate or pilose, the lobes abruptly flared at the base; exostome teeth 16, orange, reflexed when dry; spores $21\text{--}40 \mu\text{m}$ in diam.



vegetative shoot, capsules and calyptra (dry), leaf outline, and mucronate leaf apex
 1 mm, 1 mm, 0.1 mm, 0.5 mm, 0.1 mm, 10 μm



margin midleaf, juxtacostal cells, and surface praeae at leaf base
 10 μm , 10 μm , 10 μm

continued next page

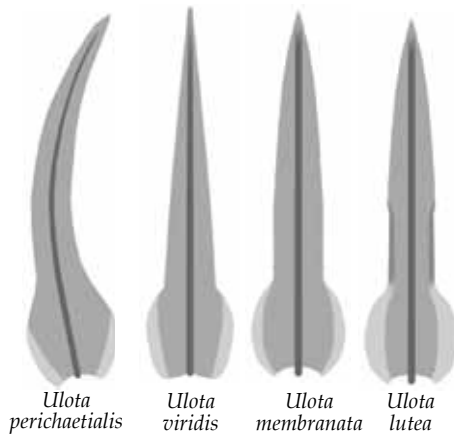


Schlotheimia knightii habit
■ 1 mm

Key* to the New Zealand species of *Ulota* (4)

- 1 Spores 70–90 μm in diam., often multicellular; capsules pyriform ● *Ulota membranata*
 1: Spores 20–50 μm in diam., unicellular; capsules not pyriform 2
- 2(1:) Leaves < 2 mm long ● *Ulota viridis*
 2: Leaves > 2 mm long 3
- 3(2:) Capsule exerted on seta 3–6 mm long ● *Ulota lutea*
 3: Capsule immersed on very short seta ● *Ulota perichaetialis*

* based on Ramsay, HP (2006): *Ulota*. *Flora of Australia* **51**, 229.



Ulota lutea (Hook.f. & Wilson) Mitt.**form:** tufts or cushions of erect, \pm unbranched, brownish stems, 10–25 mm**habitat:** bark of branches and twigs in humid forest, to 1300 m**leaf:** size: 1.0–2.5 \times 0.4–0.5 mm*shape:* linear-lanceolate from an ovate or elliptic base, crisped when dry*tip:* acute or shortly acuminate*base:* transverse walls of the outer 4–5 rows of basal cells strongly thickened;

inner basal cells thick-walled, sinuose

costa: vanishing below the apex*border:* not differentiated*margin:* entire, recurved on both sides for a short distance above the base*cells:* 9–12 μm , irregularly rounded above, thick-walled, mammillose; basal

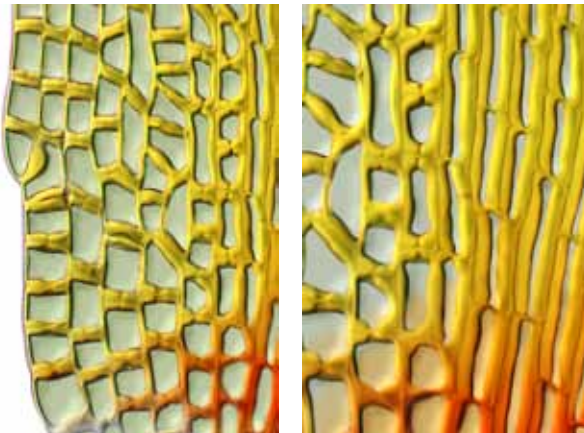
inner cells vermicular; basal outer cells quadrate

capsule: 1.5–2 mm, cylindric to oblong, long-necked, 8-ribbed when dry; seta

3–6 mm, yellow; operculum beaked; exostome teeth paired, cross-striate;

endostome segments 8; spores 39–42 μm in diam., papillose

habit, fertile and vegetative shoots (dry), capsule, calyptra, leaf outline, and leaf apex
 ■ 5 mm, ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 0.1 mm, ■ 10 μm



leaf basal angle, outer and inner basal cells, and peristome
 ■ 10 μm , ■ 10 μm , ■ 0.1 mm

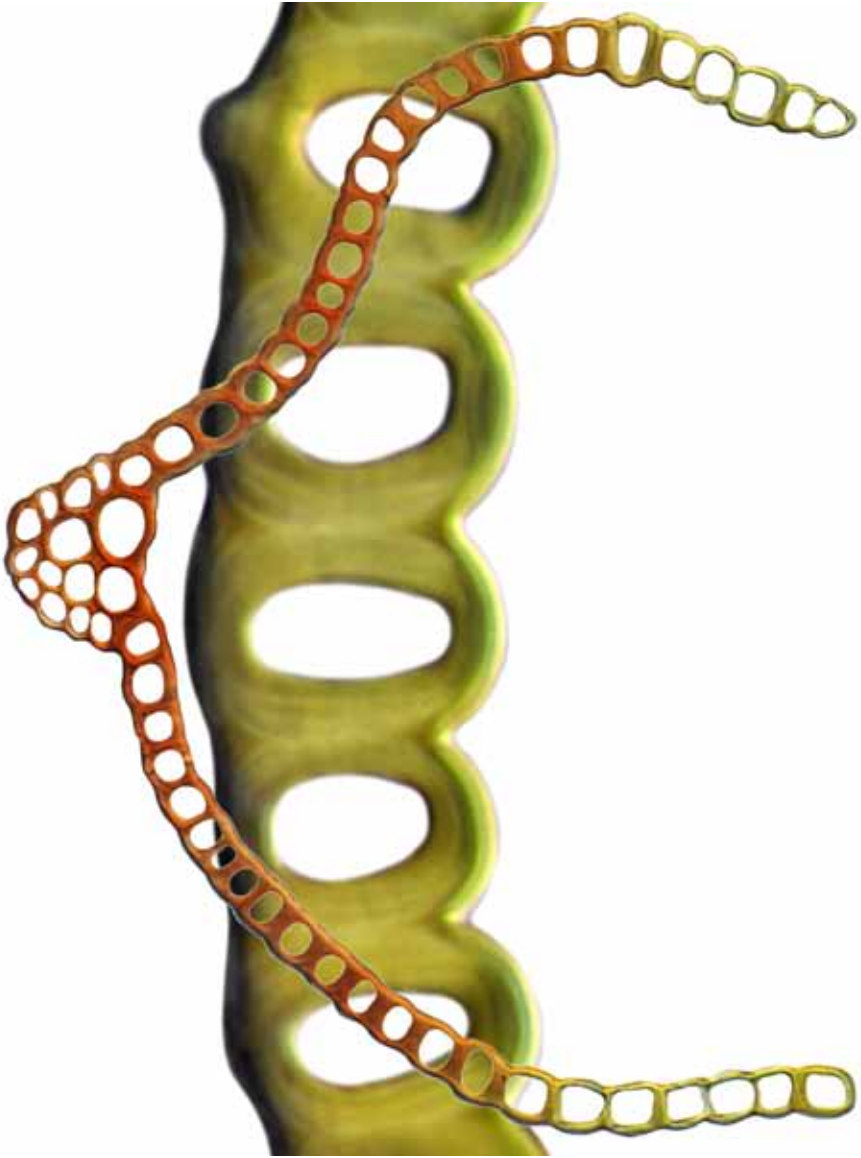


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Ullota lutea mature capsules showing opercula and peristomes
0.1 mm

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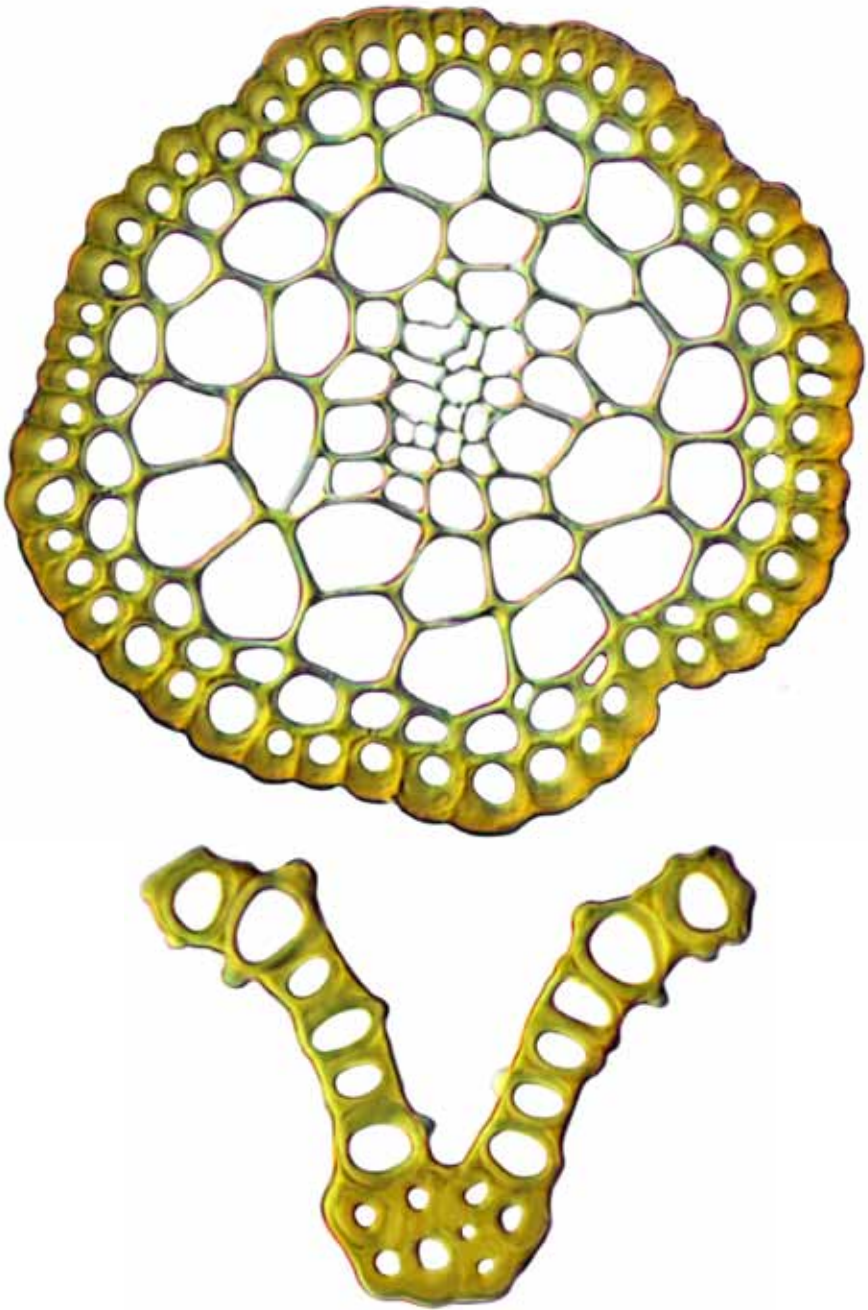


Ullota lutea leaf cross-sections

50 μm (whole leaf, alar region),

10 μm (detail)

continued next page



Ullota lutea seta and upper leaf cross-sections
10 μm (above), 10 μm (below)

continued next page

Ulota membranata Malta

form: tufts of erect stems, yellowish, dark below, branches to 15 mm

habitat: bark, mostly beech in wet montane forest, to 130 m

leaf: size: 1.6–2.1 × 0.4 mm long, not crisped when dry

shape: narrowly lanceolate from an ovate base

tip: acuminate

base: inner basal cells narrowly oval, thick-walled, reddish toward base

costa: failing below or in the apex

border: base only, 4–6 rows of cells transversely thickened

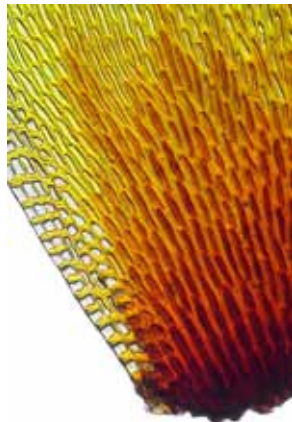
margin: entire, mostly plane but reflexed on both sides just above the base

cells: upper cells 8–12 μm, isodiametric, thick-walled, mammillose

capsule: 1.0–1.5 mm, ± pyriform, erect, exserted, brown, narrowed at the mouth, strongly 8-ribbed when dry; seta 3–4 mm, yellowish; calyptra campanulate, laciniated, hairy; exostome teeth 8, yellowish, with transverse bars and median zig-zag; endostome segments 16, irregular; spores multicellular, 70–120 μm in diam.



vegetative shoot (dry), capsules (dry) (2), leaf outline, leaf apex, and margin midleaf
 0.5 mm, 0.5 mm (2), 0.5 mm, 50 μm, 10 μm



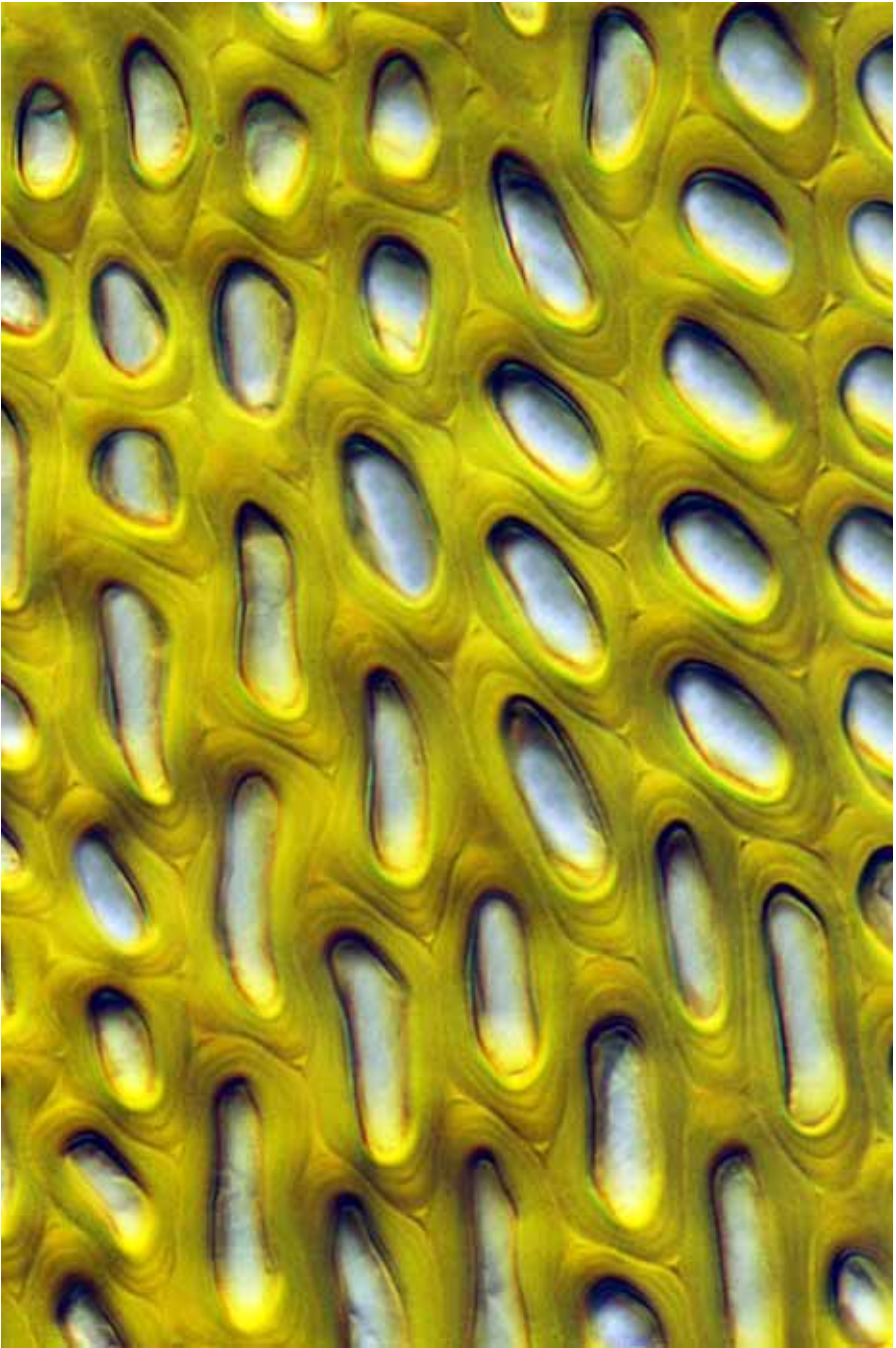
costa midleaf, leaf basal angle, and spore (alongside *Ulota lutea* spore)
 10 μm, 50 μm, 50 μm

continued next page



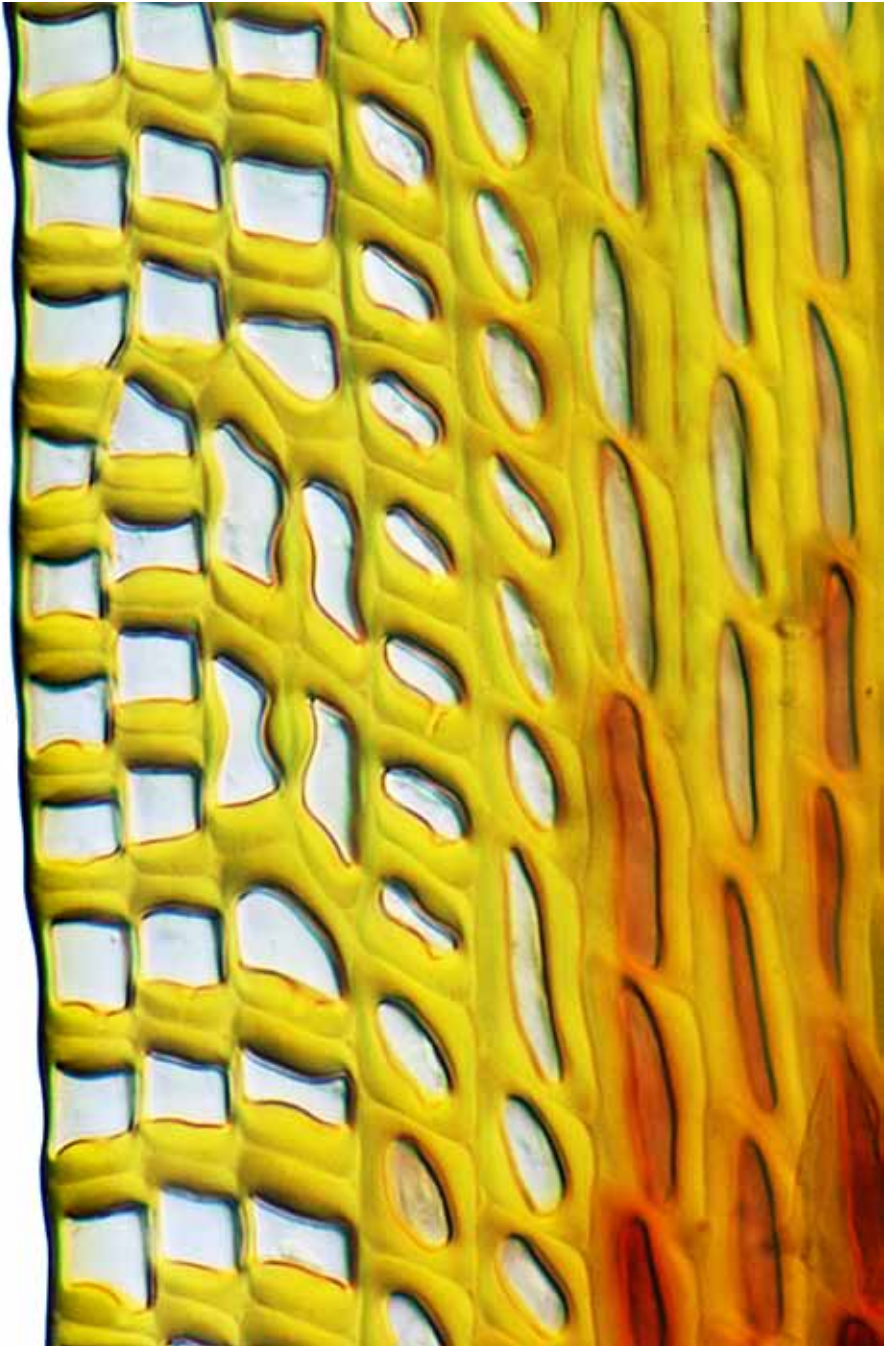
Ullota membranata mature capsules (dry), showing recurved exostome teeth
1 mm

continued next page



Ulota membranata cells below midleaf
10 μm

continued next page



Ullota membranata margin near leaf base
10 μm

continued next page

Ulota perichaetialis (Sainsbury) Goffinet

form: tufts or cushions of creeping primary stems, secondary stems to 30 mm, branched, erect, yellow-brown above, dark brown and denuded below

habitat: bark in subalpine scrub and forest, to 1300 m

leaf: size: 2–3 × 0.4–0.5 mm

shape: narrowly lanceolate from an ovate base, ± curved, crisped when dry

tip: long-acuminate

base: transverse walls of the outer 3–6 rows of basal cells heavily thickened; inner basal cells elongate, thick-walled

costa: strong below, prominent abaxially, failing just below the apex

border: differentiated only in the leaf basal angles, 6–8 rows wide

margin: entire or nearly so, plane or recurved on one side

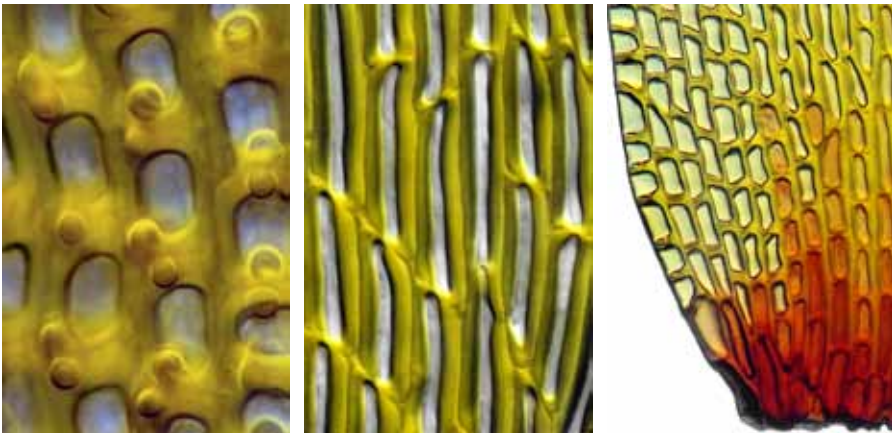
cells: upper 7–10 μm, isodiametric, thick-walled, mammillose

capsule: 2 mm, oval, erect, immersed, 8-ribbed when dry; seta 0.2 mm; calyptra campanulate, laciniated, hairy; operculum beak short, erect; peristome single, teeth 16, pale, papillose with median zig-zag; spores 40–50 μm in diam., green



fertile shoot (dry) (2), leaf outline, capsule (dry), leaf apex, and margin upper leaf

1 mm, 1 mm, 0.5 mm, 0.5 mm, 50 μm, 10 μm



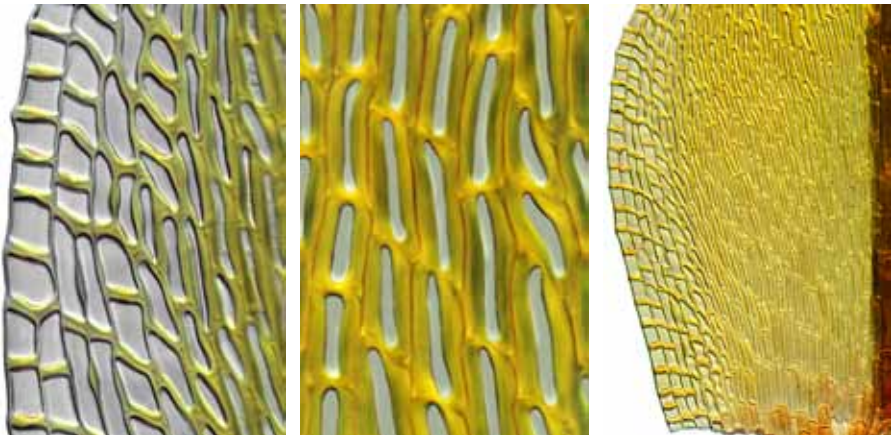
papillae upper leaf, cells of lower leaf, and leaf basal angle

10 μm, 10 μm, 50 μm

continued next page

Ulota viridis Venturi**form:** primary stems creeping; secondary branches erect, 8–13 mm**habitat:** tree bark (mostly beech) or rarely rock in montane forest, to 1400 m**leaf:** size: 1.5–2.1 mm*shape:* long-lanceolate from an ovate, pigmented base*tip:* acute*base:* basal marginal cells in 4–6 rows, hyaline, with thickened transverse walls*costa:* subpercurrent*border:* not differentiated*margin:* entire, plane except for recurving on both sides just above the base*cells:* upper cells 9–12 μm , rounded-isodiametric, thick-walled, mammillose**capsule:** to 1.9 mm, oblong, short-necked, erect, exserted, light brown, 8-ribbed when dry; seta 3–4 mm, strongly twisted when dry; calyptra hairy; operculum yellow-rimmed, long-rostrate; exostome teeth paired, 8, not split, with median zig-zag; endostome processes filiform, smooth; spores 24–42 μm in diam., coarsely papillose, green

vegetative shoot (dry), capsule (dry), leaf outline, leaf apex (2), and margin upper leaf
 1 mm, 1 mm, 0.1 mm, 50 μm , 10 μm , 10 μm



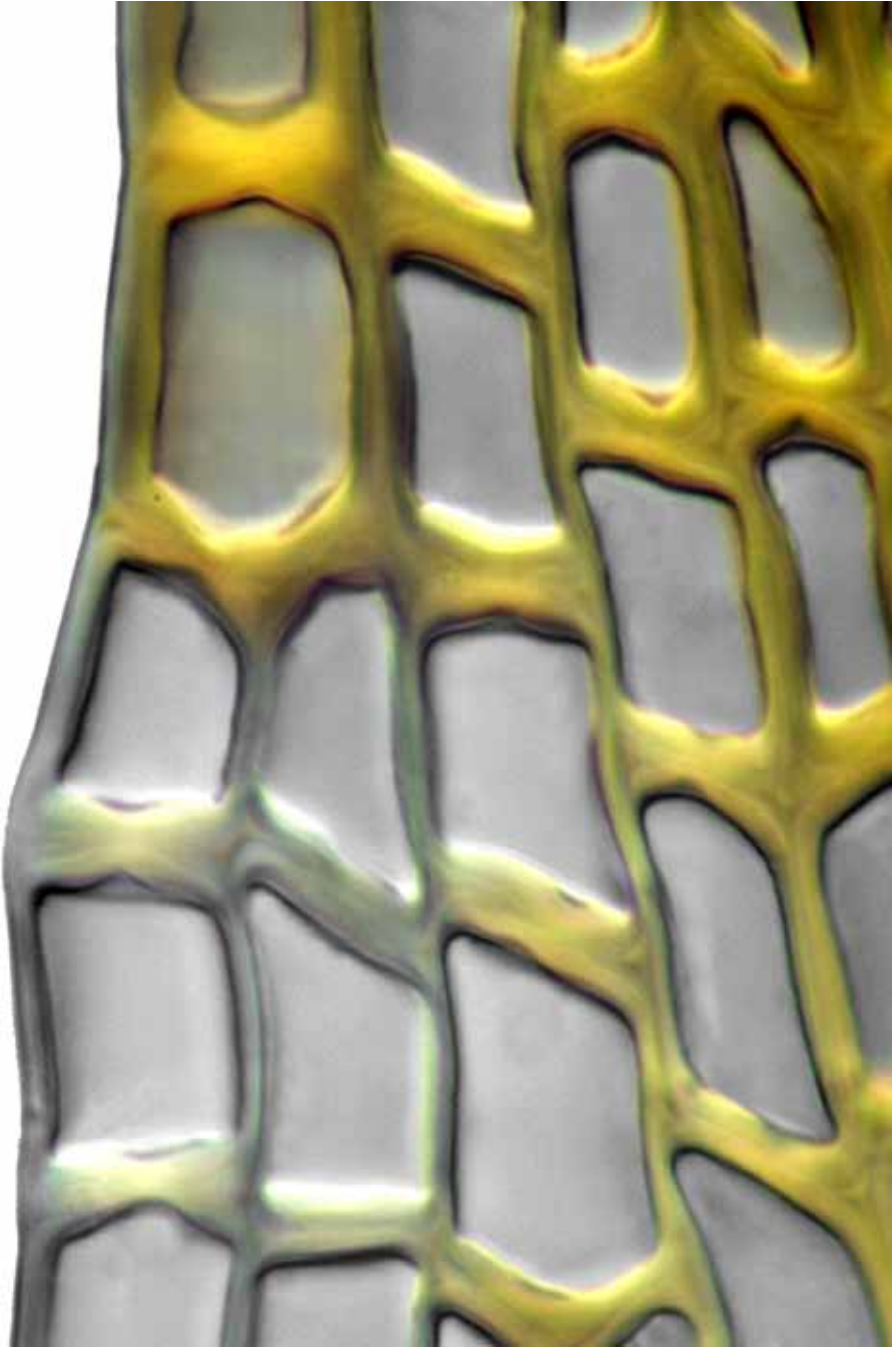
margin of lower leaf, central cells of leaf base, and leaf basal angle
 10 μm , 10 μm , 50 μm

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Ulotrichaceae coarsely pilose calyptra and mature capsule
1 mm

continued next page



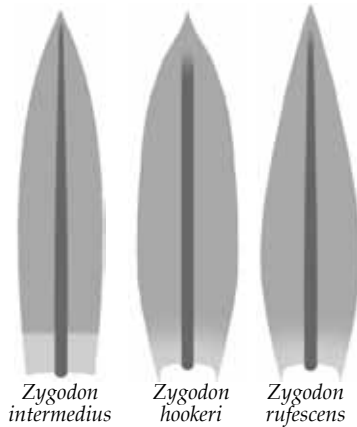
Uloa viridis margin of lower leaf
10 μm

Key* to the New Zealand species of *Zygodon* (3)

- 1 Leaves strongly squarrose when moist..... ● ***Zygodon rufescens***
 1: Leaves recurved but not squarrose when moist..... 2

- 2(1): Apical teeth formed by only part of a cell; seta 2.5–10 mm long; capsules 1.0–1.5 mm long; spores 13–20 μm in diam. ● ***Zygodon intermedius***
 2: Apical teeth formed by entire cells; seta 10–15 mm long; capsules 1.5–2.0 mm long; spores 20–25 μm in diam. ● ***Zygodon hookeri***

* based on Lewinsky-Haapasaari, J; Ramsay, HP (2006): *Zygodon*. *Flora of Australia* 51, 238, and Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bulletin 5, 199.



Zygodon hookeri Hampe

form: tufts or mats of radiculose stems, 10–30 mm, green to yellowish above, reddish brown below, glossy when dry, with axillary gemmae

habitat: bark, less often rock, usually in wettish habitats, 400–1000 m

leaf: size: 1.4–2.4 × 0.3–0.5 mm

shape: lanceolate to linear-lanceolate, keeled

tip: sharply acute

base: undifferentiated, slightly decurrent

costa: ending below the apex

border: not differentiated

margin: entire to dentate, undulate, but plane at margins

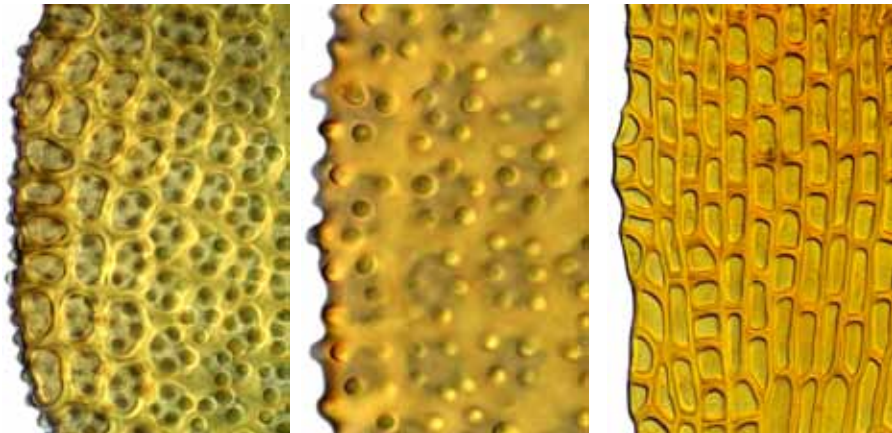
cells: 6–12.5 × 4.5–11.0 μm, isodiametric, thick-walled, 4–7-papillose

capsule: 1.5–2.2 mm, oblong or cylindric, exserted, erect, deeply 8-ribbed when dry; seta 5–20 mm; calyptra cucullate, naked, smooth; operculum obliquely long-rostrate; endostome only, segments 8, filiform, smooth, hyaline; spores 20–25 μm in diam., papillose



vegetative shoot (dry) (2), capsule, operculum, margin xs, leaf outline, and leaf apex

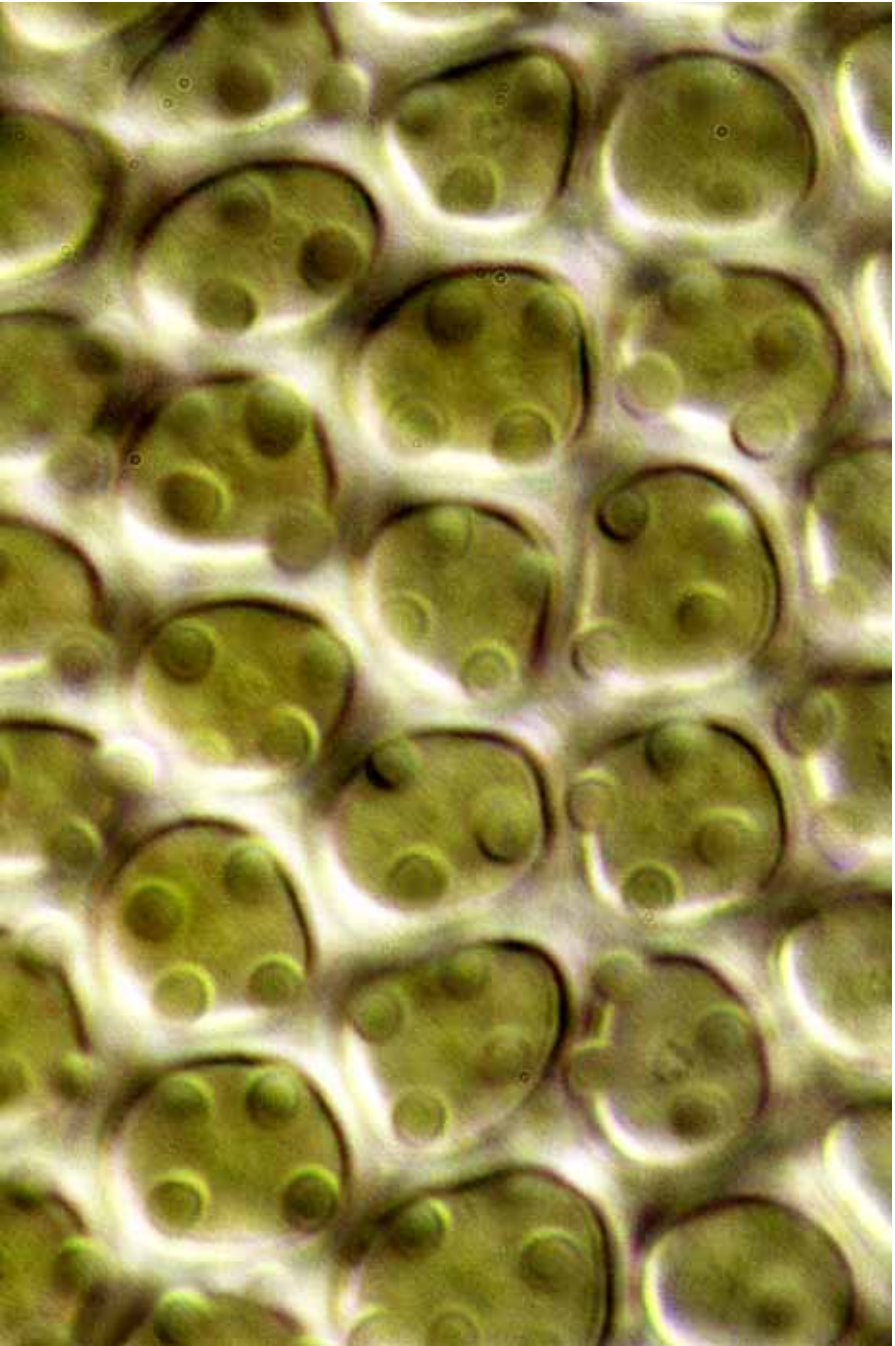
■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 0.1 mm, ■ 10 μm, ■ 0.1 mm, ■ 10 μm



margin midleaf and surface papillae, and margin near leaf base

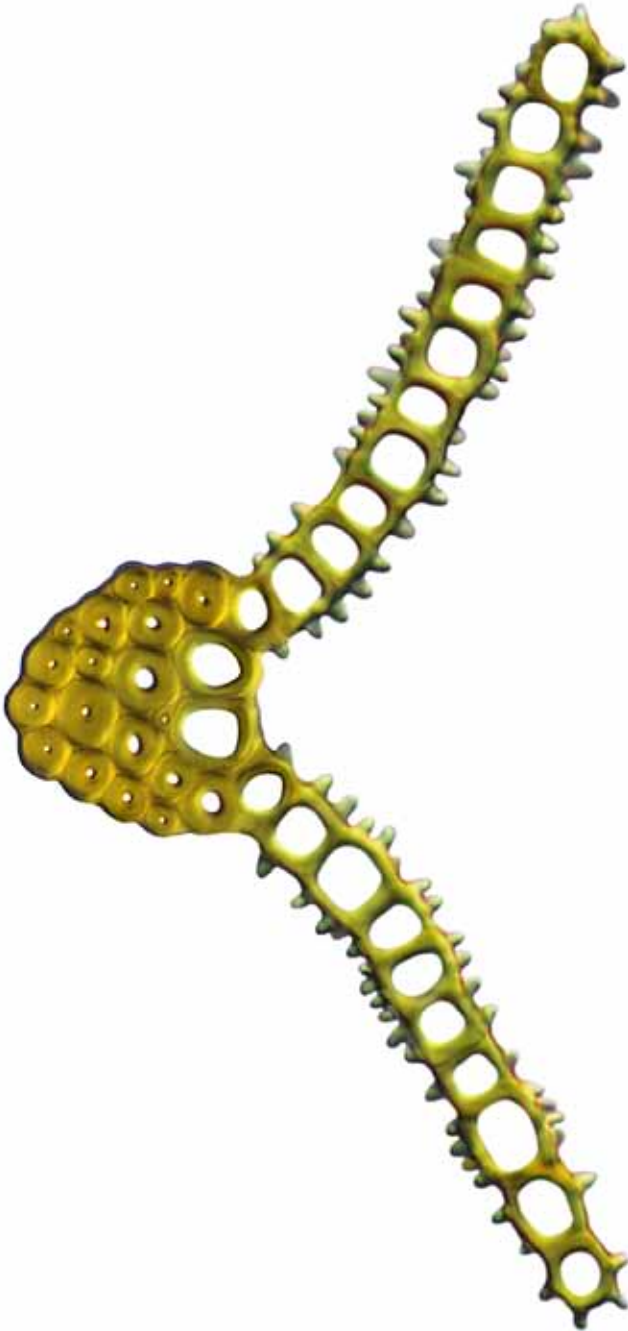
■ 10 μm, ■ 10 μm, ■ 10 μm

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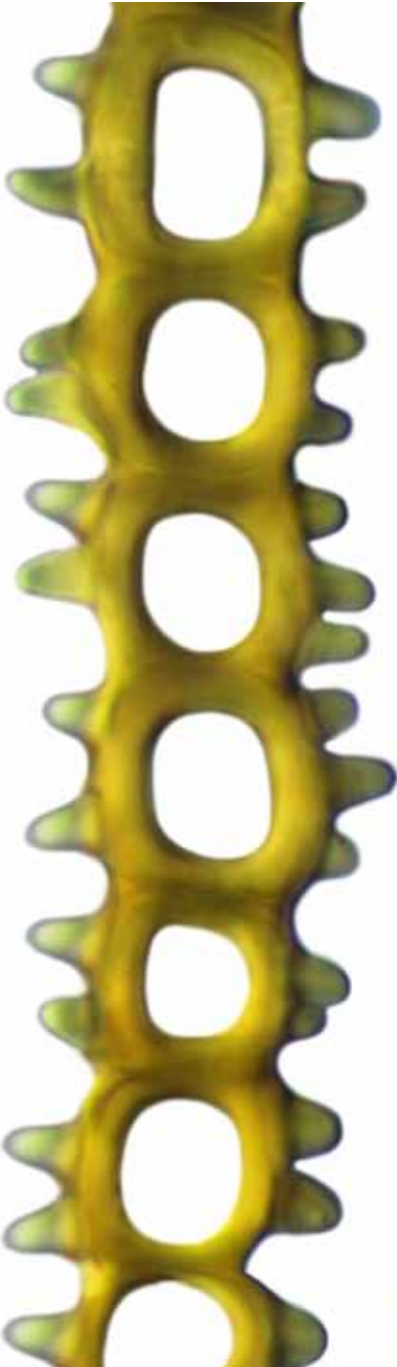
Zygodon hookeri papillose cells midleaf
10 μm

continued next page



Zygodon hookeri leaf cross-section
10 μm

continued next page



Zygodon hookeri leaf cross-sections

10 μm (whole leaf),

10 μm (detail)

continued next page

Zygodon intermedius Bruch & Schimp.

form: tufts or turves of erect, radiculose, branched stems, 5–25(–55) mm, the leaves yellowish green above, red-brown below, glossy when dry

habitat: bark or rock in moist to semi-arid sites, sea level to 1500 m

leaf: size: 0.6–1.8 × 0.2–0.3 mm

shape: lanceolate to linear-lanceolate

tip: acute, often ending with a single smooth cell

base: basal cells rectangular, smooth

costa: failing shortly below the apex

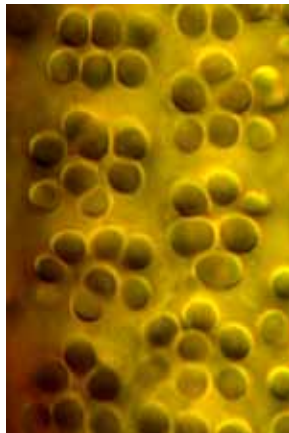
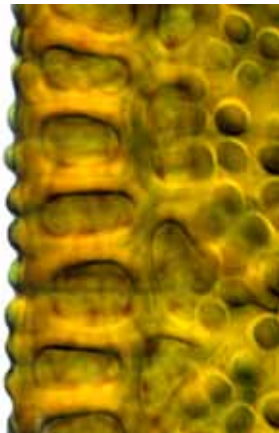
border: not differentiated

margin: minutely crenulate from papillae, rarely denticulate above, plane
cells: 4–10(–15) μm , \pm isodiametric, rounded, thick-walled, 4–8-papillose

capsule: 1.0–1.5 mm, cylindric to pyriform, 8-ribbed when dry, brown, exserted; seta 2.5–10 mm; calyptra smooth; peristome double, the exostome sometimes reduced or absent, the endostome segments 8, reduced and hyaline; spores 13–20 μm in diam., papillose

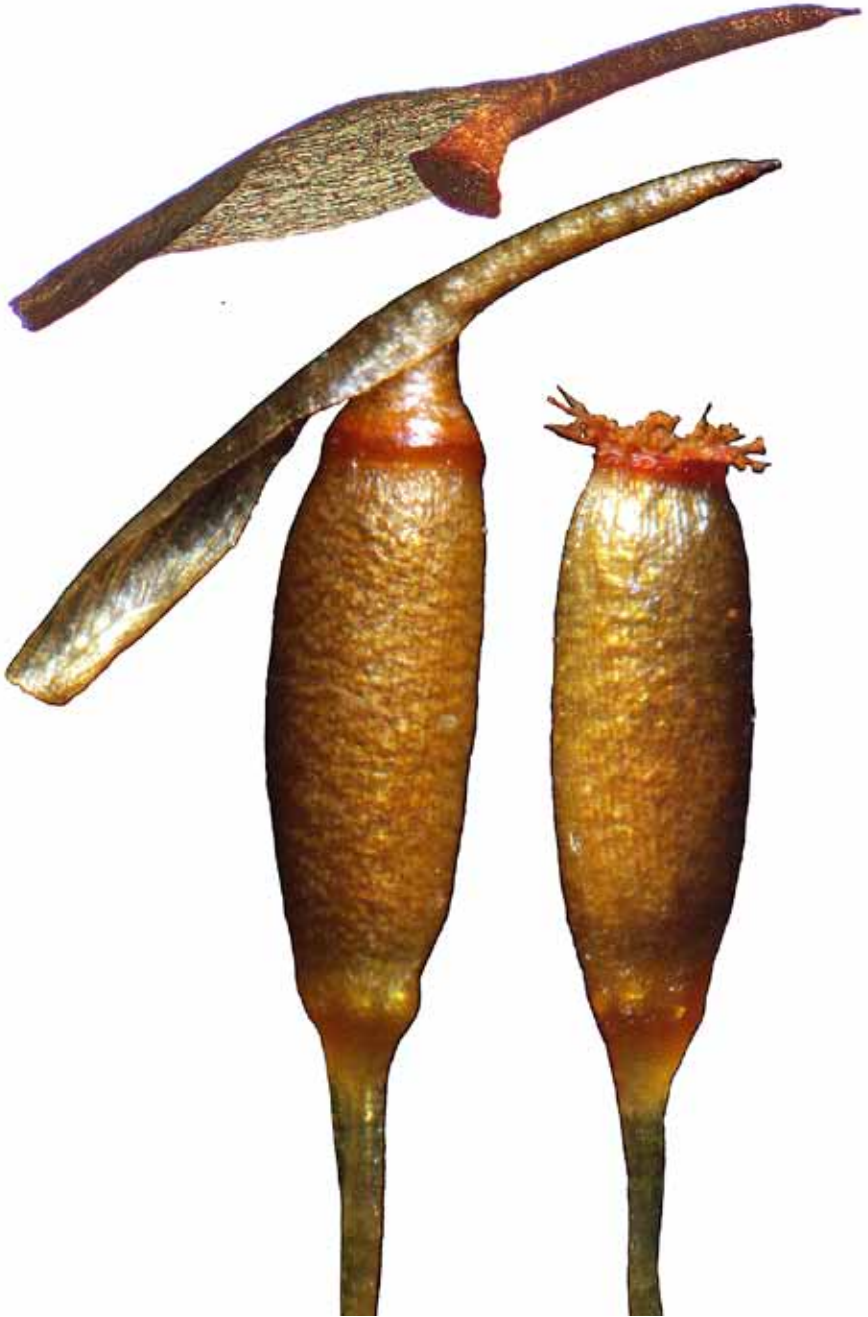


fertile shoot (dry), capsule (dry), leaf outline, leaf apex, and margin midleaf
 1 mm, 0.1 mm, 0.1 mm, 10 μm , 10 μm



margin midleaf (detail), papillae midleaf, and leaf basal angle
 10 μm , 10 μm , 10 μm

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Zygodon intermedius capsule, calyptra, operculum, peristome, and spores
0.5 mm

Zygodon rufescens (Hampe) Broth.

form: tufts of erect, sparsely branched stems, to 20 mm tall, red-radiculose
habitat: bark of trees and shrubs in moist or humid sites

leaf: *size:* to 2 mm long

shape: lanceolate, shortly decurrent, crisped when dry, squarrose when moist

tip: acute

base: basal cells rectangular, hyaline, thin-walled, smooth

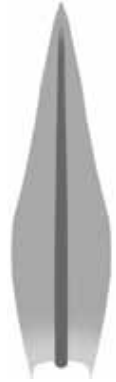
costa: failing below the apex, rough on the abaxial surface

border: not differentiated

margin: entire except for projecting papillae, plane

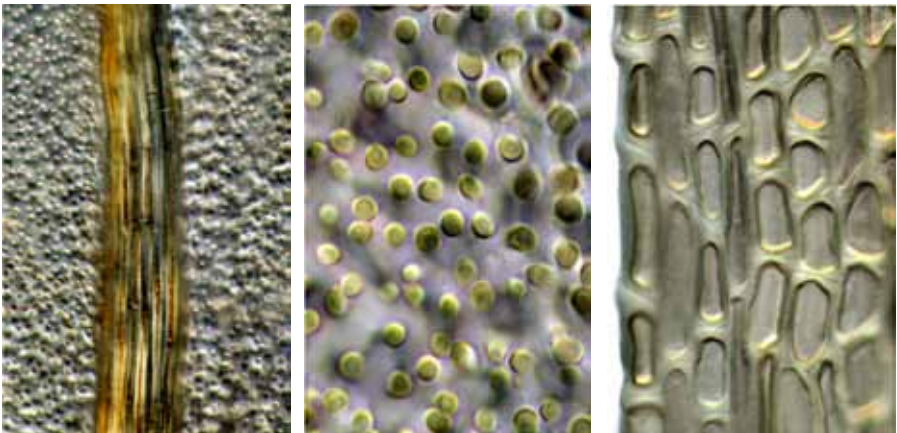
cells: 8–10 μm , \pm rounded-isodiametric, thick-walled, densely papillose

capsule: capsules unknown



vegetative shoot (dry), leaf outline, leaf apex (2), and leaf margin

1 mm, 0.5 mm, 50 μm , 50 μm , 10 μm



costa midleaf, lamina papillae, and margin just above basal angle

50 μm , 10 μm , 10 μm

continued next page



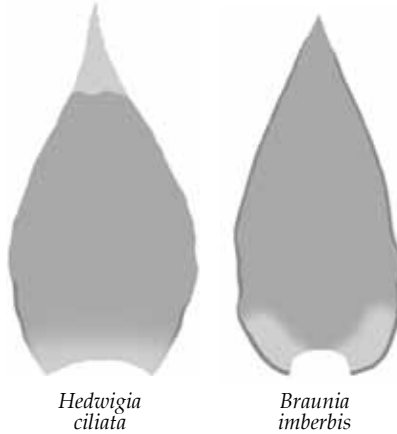
Zygodon rufescens leaf outline and vegetative shoot (dry)

0.1 mm,

1 mm

Key to the New Zealand species of the Hedwigiaceae (2)

- 1 Leaf tips abruptly white-tipped; midleaf margin plane..... ● **Hedwigia ciliata**
 1: Leaf tips not white-tipped; midleaf margin reflexed..... ● **Braunia imberbis**



Braunia imberbis (Sm.) N.Dalton & D.G.Long

form: mats of creeping, irregularly branched, tapered stems, to 60 mm, the leaves pale green above, darker below, julaceous when dry

habitat: acidic dry rock at low to middle elevations, to 900 m

leaf: size: 1.3–2.0 × 0.6–0.8 mm

shape: ovate to oblong-ovate, concave, ± plicate

tip: acute to acuminate

base: cordate-auriculate; outer cells isodiametric in 12–15 rows, smooth

costa: none

border: not differentiated

margin: entire, narrowly recurved throughout, ± decurrent

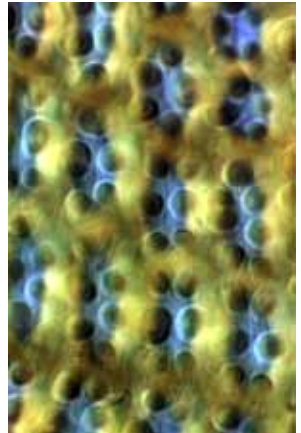
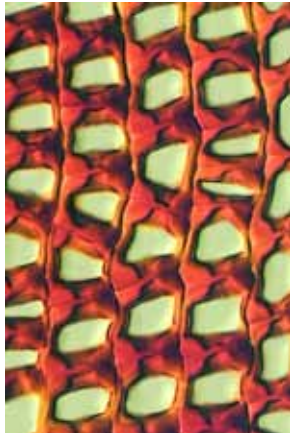
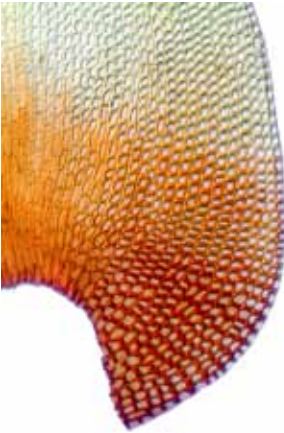
cells: 9–15 × 6 μm, subquadrate to oblong, incrassate, low-papillose

capsule: 1.5 × 1.0 mm, cylindric, deeply grooved when dry, immersed, gymnostomous; seta 0.5–1.0 mm; spores 27–33 μm in diam.

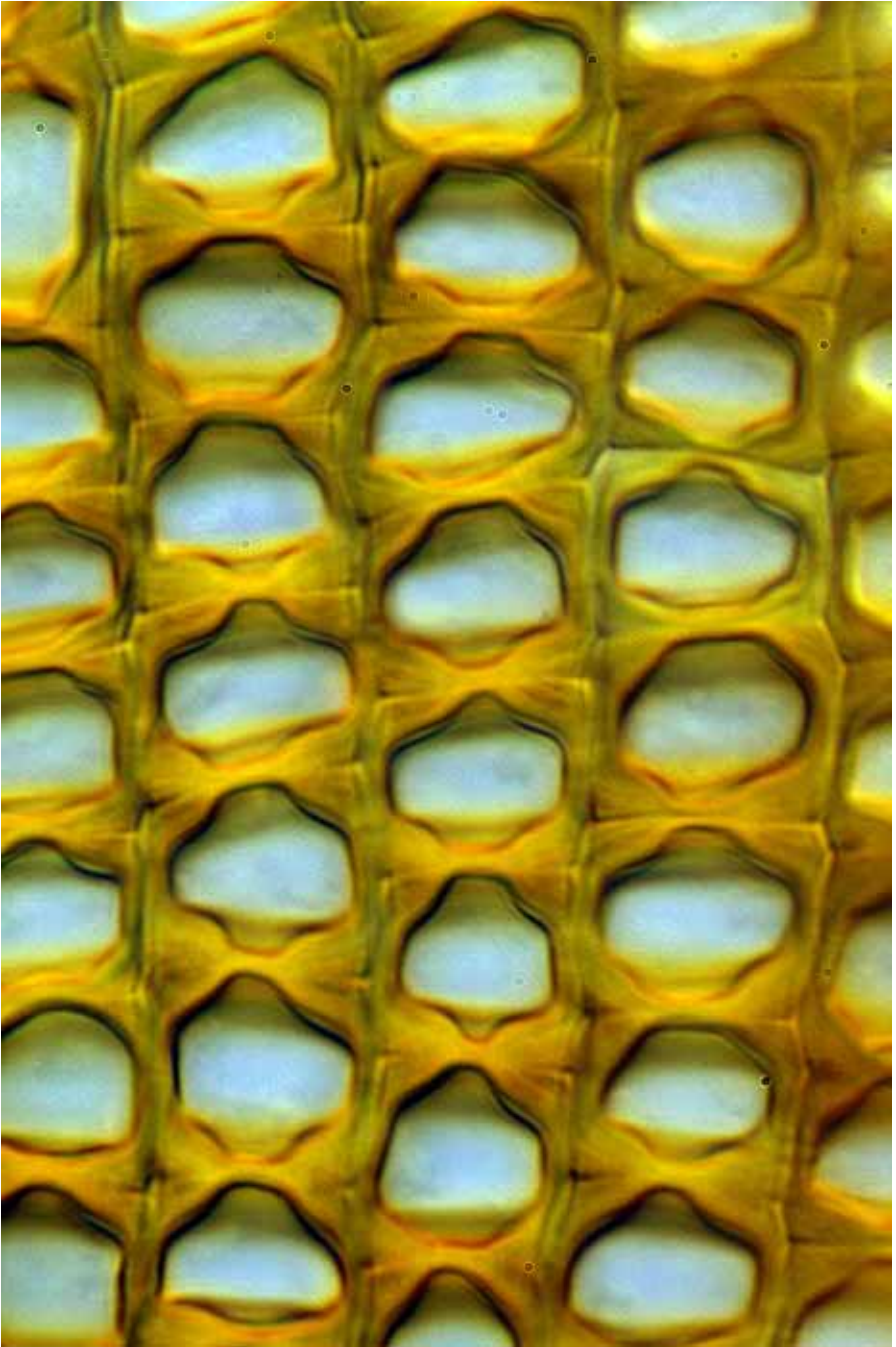
note: differs from *Hedwigia ciliata* in not having hyaline leaf tips and forked surface papillae



vegetative habit and shoot (dry), leaf outline, and leaf apex
 1 mm, 1 mm, 0.5 mm, 10 μm



leaf basal angle, outer cells of leaf base, and leaf cell papillae
 50 μm, 10 μm, 10 μm



Braunia imberbis cells of leaf basal angle
10 μm

Hedwigia ciliata (Hedw.) P.Beauv.

form: loose mats of branched stems, to 50 mm, hoary, dull
habitat: dryish rock or gravel, lowland to alpine, to 1200 m

leaf: size: 1.5–2.5 × 0.7–1.3 mm

shape: oblong-ovate to broadly ovate, weakly decurrent

tip: acute to acuminate, hyaline

base: alar cells quadrate to rectangular, 7–15 × 6–7 μm

costa: none

border: not differentiated

margin: entire to irregularly serrate toward the apex, mostly plane

cells: 10–15 × 6–7 μm, subquadrate to rhombic, walls thick and sinuose,
 pore toward base, surface papillae simple, stellate, or 1–2-forked

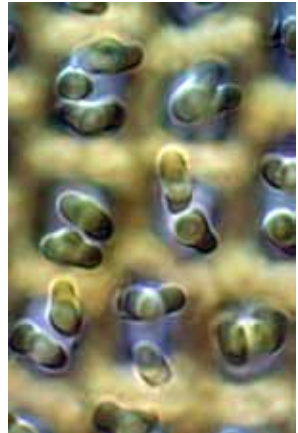
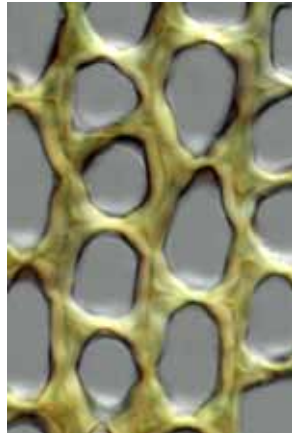
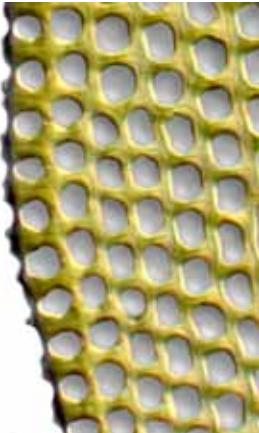
capsule: 1 × 0.8 mm, obovoid to subglobose, wide-mouthed, deeply immersed, glossy when dry; seta 0.4–1.5 mm; calyptra conic-mitrate, hairy; spores 20–30 μm long, reniform

note: its hyaline leaf tips readily distinguish it from *Braunia imberbis*



habit and vegetative shoot (dry), leaf outline, and hyaline leaf apex

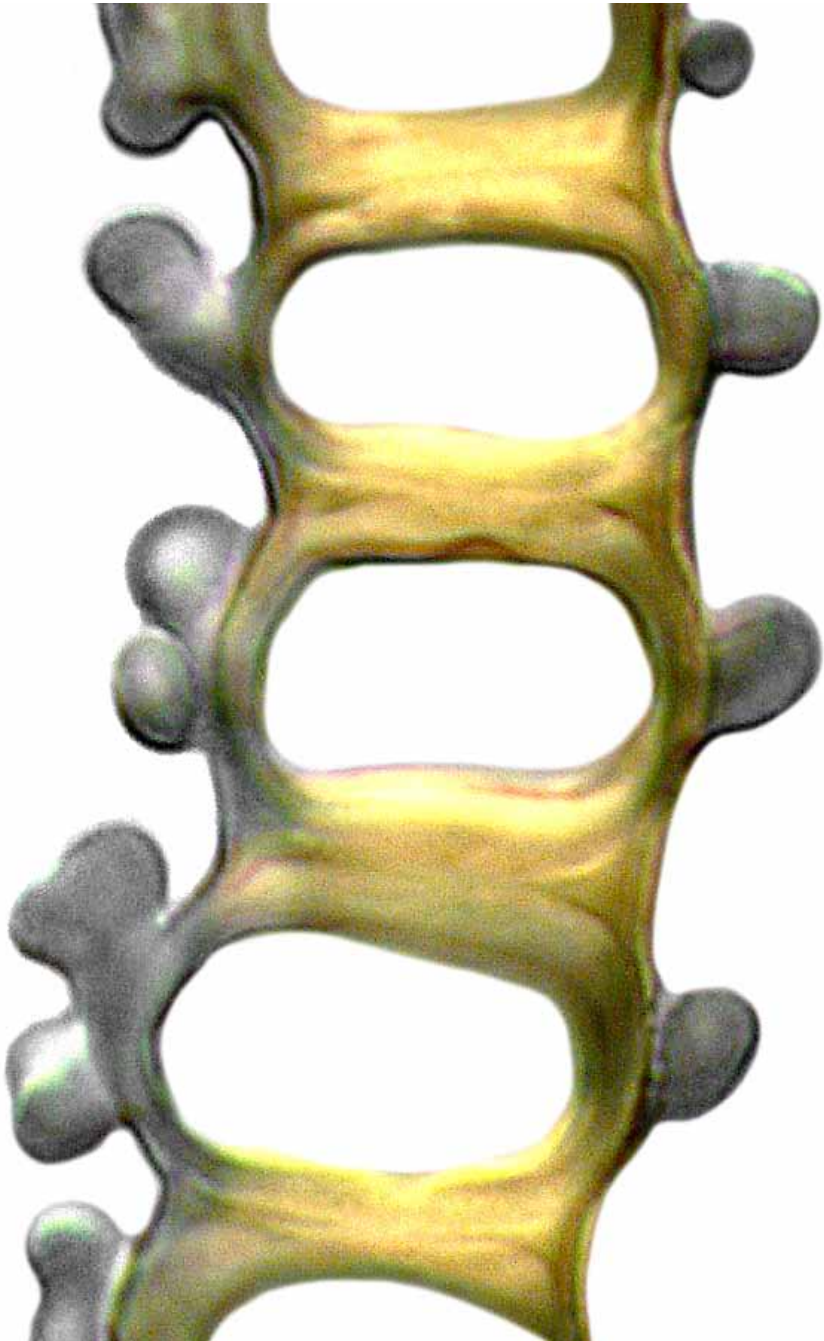
1 mm, 1 mm, 0.5 mm, 100 μm



margin midleaf, cells midleaf, and leaf cell forked papillae

10 μm, 10 μm, 10 μm

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Hedwigia ciliata midleaf cross-section showing forked and simple surface papillae
5 μ m

Rhacocarpus purpurascens (Brid.) Paris**form:** matted, pinnately branched stems, 60–120 mm, yellowish**habitat:** damp or dripping acidic rock, often near water, to 1700 m**leaf:** *size:* branch leaves $1.5\text{--}2 \times 0.4\text{--}0.5$ mm; stem leaves larger*shape:* oblong-panduriform, concave, glossy when dry*tip:* acuminate, incurved toward the apex; hair-point long, red*base:* angle cells red, incrassate, subquadrate, in large auricles*costa:* none*border:* 3–4 rows of elongate cells, yellow*margin:* denticulate toward the apex, inrolled above*cells:* $30\text{--}42 \times 7\text{--}9$ μm , long-rhombic, thin-walled, opaque, rugulose
surface ornamentation visible also in cross-section**capsule:** 2–2.5 mm, broadly cylindrical, erect, grooved when dry, wide-mouthed, exserted; seta 10–23 mm, flexuose, reddish; calyptra cucullate; operculum obliquely long-rostrate; peristome absent; stomata immersed; spores 20–28 μm in diam., papillose

shoots (dry) (3), leaf xs, fertile shoot and capsule (dry), calyptra, and leaf outline

■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 10 μm , ■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 0.1 mm

margin at midleaf, margin cross-section, and leaf base cells

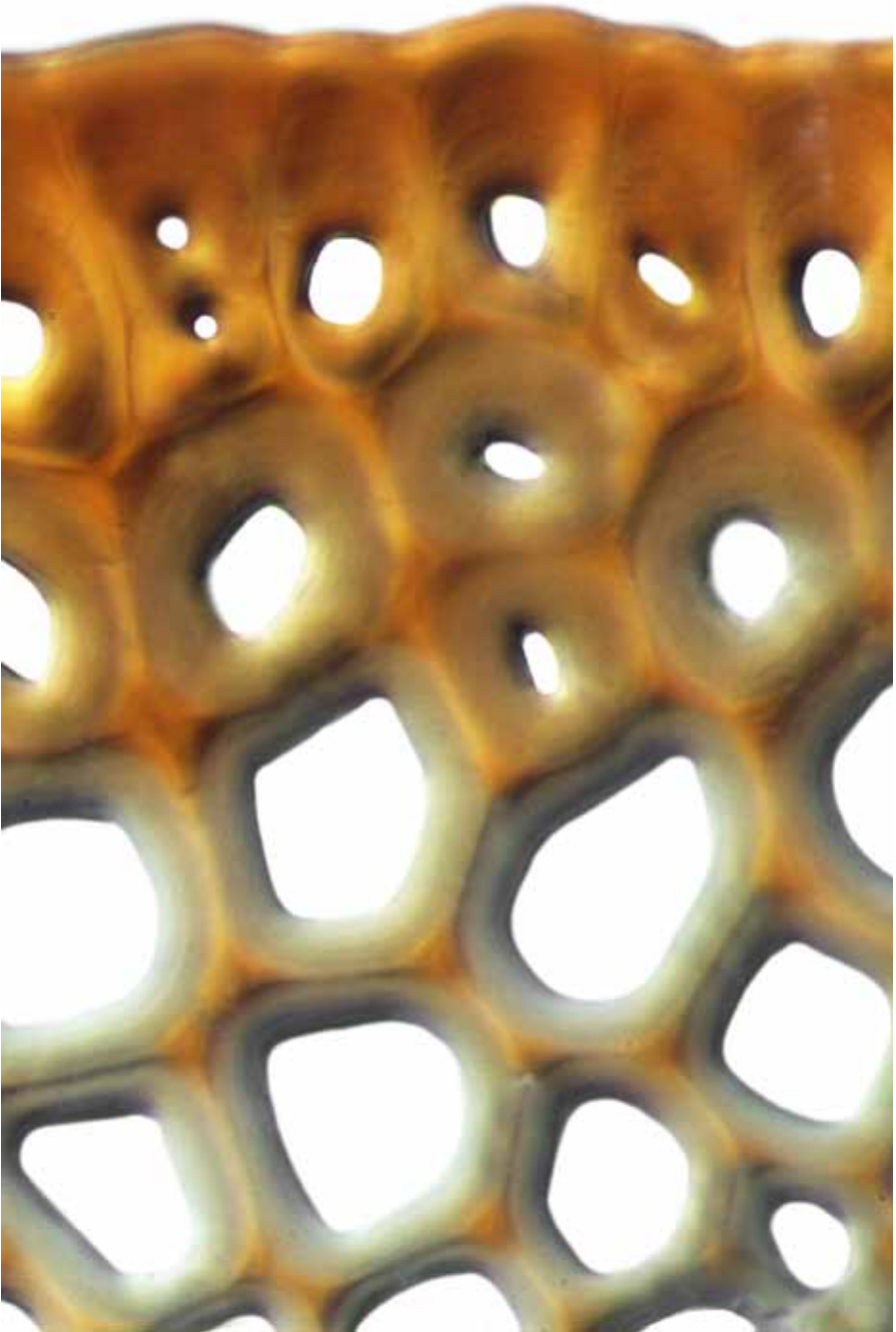
■ 10 μm , ■ 10 μm , ■ 10 μm

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Rhacocarpus purpurascens mature capsules
1 mm

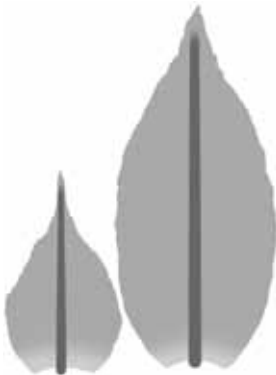
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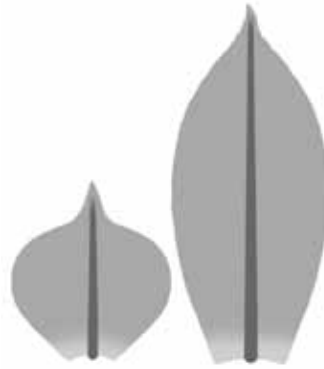
Rhacocarpus purpurascens stem cross-section
10 μm

Key to the New Zealand species of *Calomnion* (2)

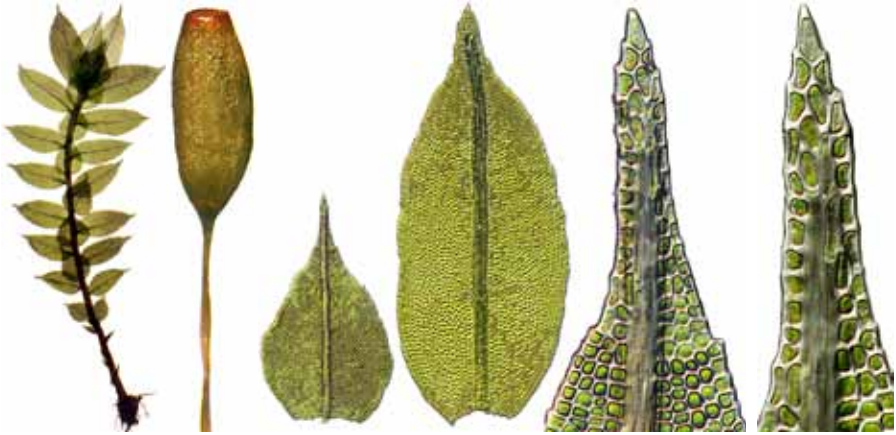
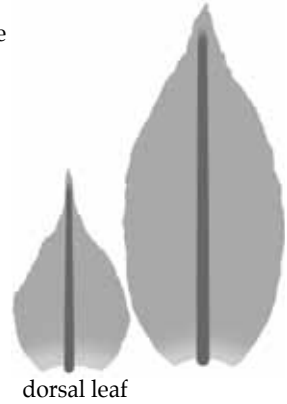
- 1 Leaf margin denticulate ● *Calomnion brownseyi*
 1: Leaf margin entire or minutely crenulate..... ● *Calomnion complanatum*



*Calomnion
brownseyi*

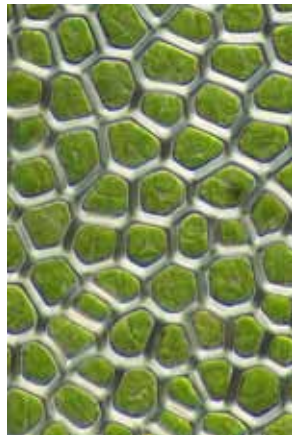
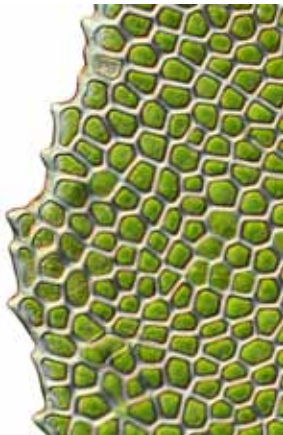


*Calomnion
complanatum*

Calomnion brownseyi Vitt & H.A.Mill.**form:** patchy, erect, creeping stems, to 10 mm tall, complanate**habitat:** tree fern trunks or occasionally limestone**leaf:** size: lateral leaves 0.8–1.3 mm; dorsal leaves 0.4–0.7 mm**shape:** lateral leaves elliptic to oblanceolate, dorsal leaves broadly ovate to orbicular**tip:** lateral leaves acute, dorsal leaves acuminate**base:** not differentiated**costa:** percurrent or failing a few cells below the apex**border:** not differentiated**margin:** denticulate, plane**cells:** 7–10 μm , rounded-hexagonal, firm-walled, smooth**capsule:** 1 mm, oblong-cylindric, erect, exserted, mouth reddish; seta 2–3 mm**note:** differs from *Calomnion complanatum* in having denticulate rather than entire or crenulate leaf margins

vegetative shoot, capsule, dorsal and lateral leaf outlines, and dorsal leaf apex (2)

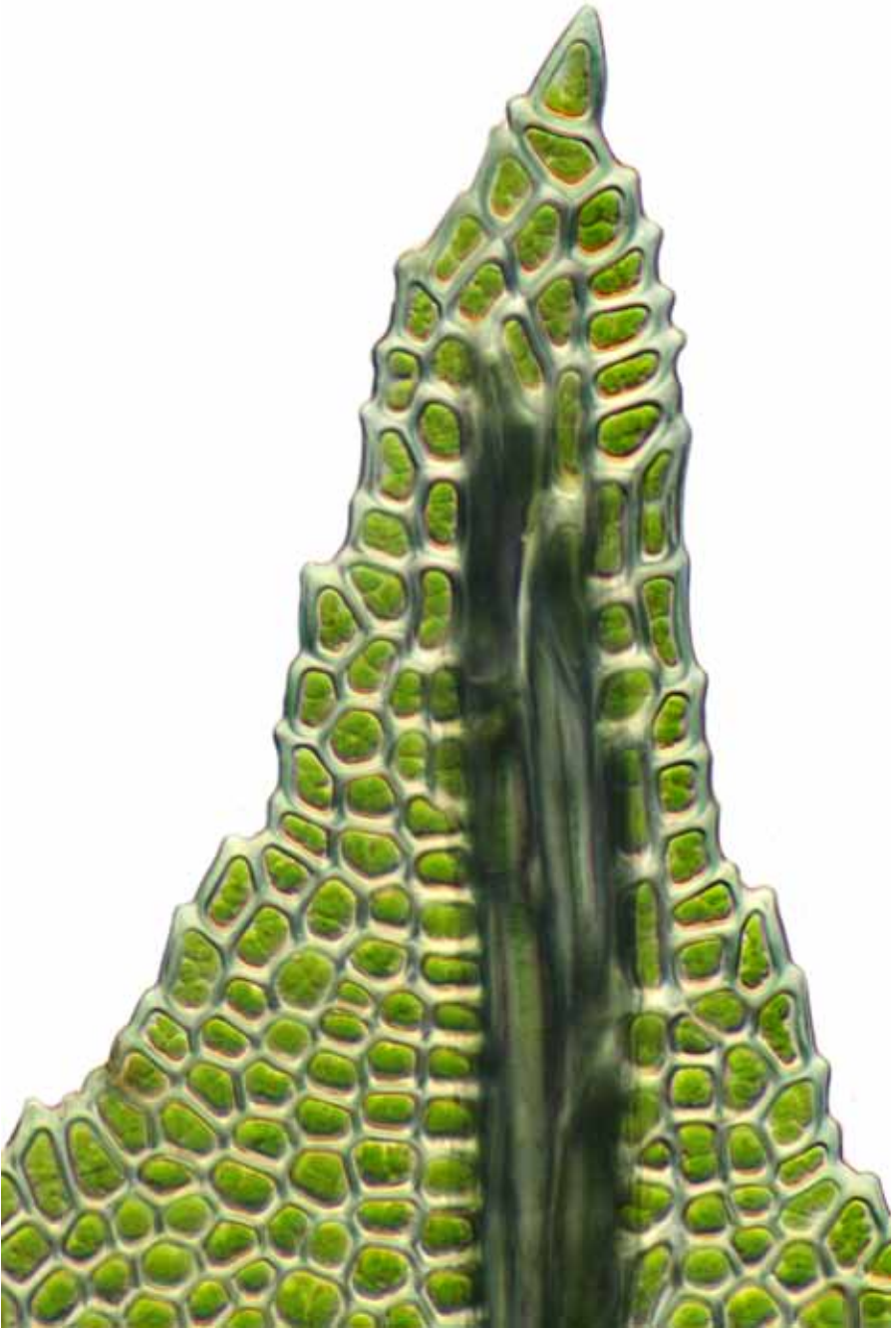
1 mm,
 0.5 mm,
 0.1 mm (2),
 50 μm ,
 50 μm



margin at midleaf, cells at midleaf, and costa at midleaf

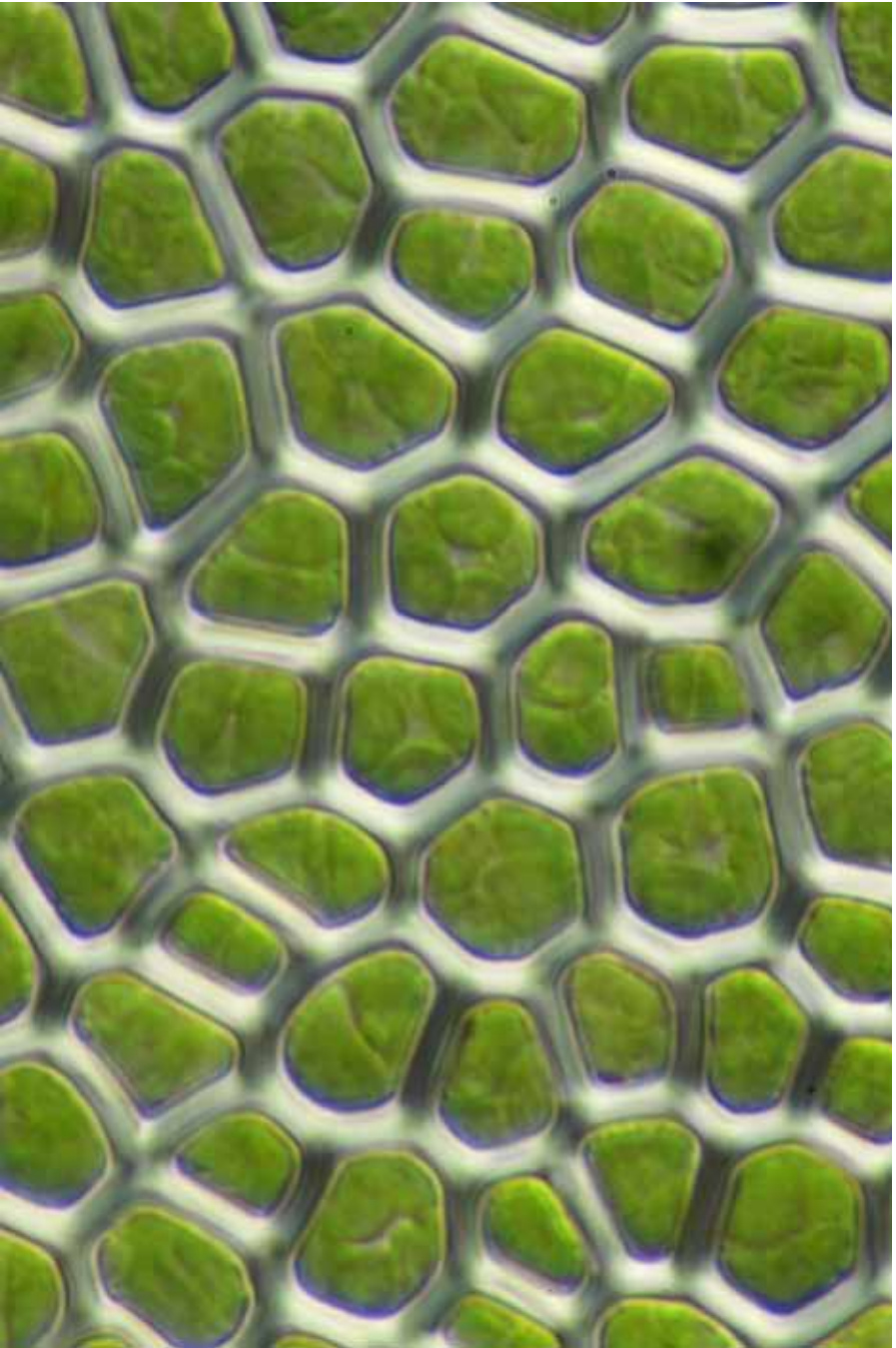
10 μm ,
 10 μm ,
 10 μm

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Calomnion brownseyi leaf apex
10 μm

continued next page



Calomnion brownseyi leaf cells
10 μm

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Calomnion complanatum (Hook.f. & Wilson) Lindb.

form: matted, unbranched, radiculose stems, to 12 mm tall, yellowish, glossy, arising from a persistent protonema

habitat: tree fern trunks in humid gullies

leaf: *size:* lateral leaves 0.7–1.1 mm; ventral leaves 0.4–0.7 mm

shape: lateral leaves oblong-lanceolate; ventral leaves suborbicular

tip: lateral leaves acute, mucronate, or acuminate; ventral leaves acute to acuminate

base: not differentiated

costa: failing in the apex to excurrent in the mucro

border: not differentiated

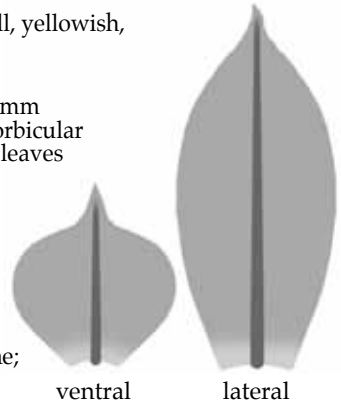
margin: entire or crenulate, plane

cells: 6–11 μm , \pm hexagonal, firm-walled, smooth

capsule: 1 mm, ovate-oblong, symmetrical, erect, mouth

reddish; seta 2–6 mm, terminal, flexuose; peristome none;

spores 14 μm in diam., brown



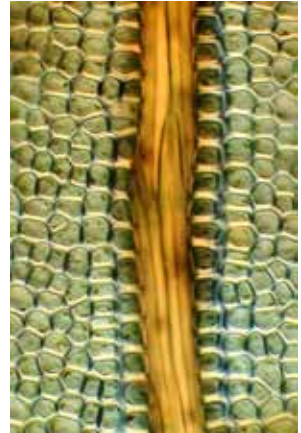
ventral

lateral



vegetative shoots (3), capsule, and dorsal and lateral leaf outlines

■ 1 mm, ■ 0.5 mm, ■ 0.1 mm, ■ 0.5 mm, ■ 0.1 mm (2)



lateral leaf apex, margin at midleaf, and costa at midleaf

■ 10 μm , ■ 10 μm , ■ 10 μm

Cryptopodium bartramioides (Hook.) Brid.

form: tufted, branched, \pm dendroid, radiculose stems, 50–250 mm, orange- or brown-tinged, curved or flexuose, densely foliate

habitat: bark or rock, moist lowland forest, to 1230 m

leaf: size: 7–12 \times 0.7–0.9 mm

shape: narrowly subulate from a lanceolate base, carinate, \pm falcate

tip: subulate

base: basal cells rectangular; alar cells little differentiated

costa: percurrent to excurrent, doubly toothed on abaxial surface

border: not differentiated

margin: bistratose, spinose-serrulate above with double teeth, \pm reflexed below

cells: 10–15 μ m, irregularly rounded, thick-walled, smooth

capsule: to 2 mm, oblong-oval, short-necked, erect, immersed, reddish brown, smooth; seta 2–3 mm, often aggregated in 2–3; annulus broad, revoluble; operculum low-conic; peristome double; exostome teeth lanceolate, \pm yellow; endostome with cilia; spores 12–15 μ m in diam.



fertile shoots (moist), vegetative shoots (dry) (2), mature capsules (2), and leaf outline
 5 mm, 5 mm, 5 mm, 0.5 mm (2), 1 mm



margin at midleaf (2), and basal leaf cells
 10 μ m, 10 μ m, 10 μ m



Cryptopodium bartramioides leaf cross-sections showing margin and costa
10 μm (above), 10 μm (below)

Goniobryum subbasilare (Hook.) Lindb.

form: tufted or matted, glossy, ± unbranched, radiculose stems, 10–45 mm tall

habitat: soil, bark, rotting logs, or tree fern trunks, montane forest, to 1100 m

leaf: size: 2–3.5 × 0.5–0.7 mm

shape: oblong or linear-lanceolate, twisted when dry

tip: acute

base: weakly decurrent; basal cells little differentiated

costa: narrow, failing below the apex

border: faint, 1–2 rows of linear cells

margin: singly or doubly toothed in the upper half of the leaf, plane

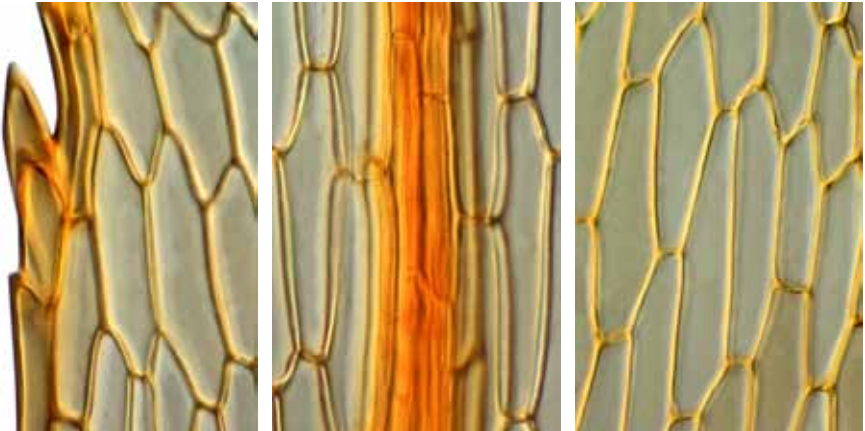
cells: 60–130 × 4–6 μm, hexagonal, thin-walled, smooth

capsule: 2.5–3.5 mm, oblong-cylindric, asymmetrical, horizontal, curved, pale brown, wide-mouthed when empty; seta 20–50 mm, lateral at base of stem, flexuose, orange; operculum conic; calyptra cucullate, to 3 mm; peristome double, exostome teeth papillose, unbordered; endostome segments not split, cilia 2–3, nodulose; spores 13–16 μm in diam.



fertile shoot and capsule (dry), leaf outline, and leaf apex

■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 0.5 mm, ■ 10 μm



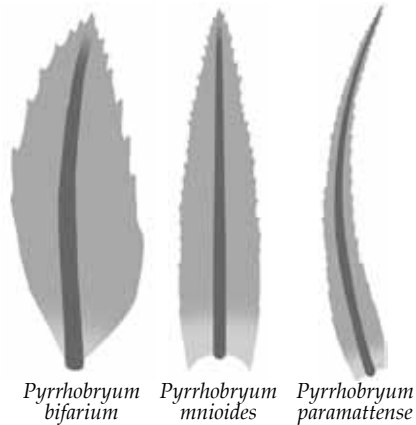
toothed margin at midleaf, costa at midleaf, and cells at midleaf

■ 10 μm, ■ 10 μm, ■ 10 μm

Key* to the New Zealand species and subspecies of *Pyrrhobryum* (3)

- 1 Stems dendroid; branch leaves 2-ranked..... ● ***Pyrrhobryum bifarium***
 1: Stems never dendroid; branch leaves not 2-ranked..... 2
- 2(1:) Leaves strongly curled and twisted when dry; leaf size not varying much along the stem; stems tomentose on lower half to one-third.....
 ● ***Pyrrhobryum mnioides* subsp. *contortum***
- 2: Leaves merely curved when dry; leaf size varying markedly along the stem; stems tomentose at only the base ● ***Pyrrhobryum paramattense***

* based on Gilmore, SR (2006): Rhizogoniaceae. *Flora of Australia* 51, 359.



Pyrrhobryum bifarium (Hook.) Manuel

form: turves of dendroid, tomentose stems, 12–22 mm; leaves complanate,
habitat: logs, humus, tree trunks, rock in damp montane forests, to 1100 m

leaf: *size:* stem 1.6–2.2 × 0.4–0.5 mm; branch 1.0–1.8 × 0.3–0.4 mm

shape: stem leaves ± lanceolate; branch leaves ovate-lanceolate

tip: stem leaves acuminate; branch leaves acute

base: stem leaves long-decurrent

costa: stem leaves: excurrent in the acumen; branch leaves: failing, toothed
border: narrow

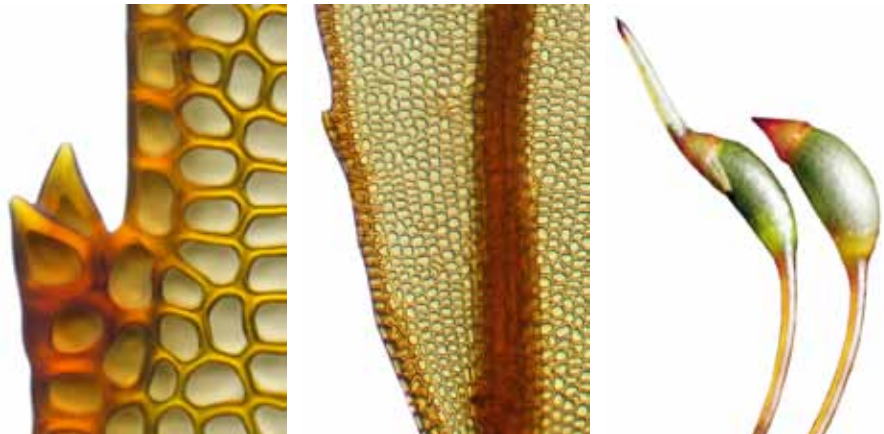
margin: thickened and doubly toothed, plane above, recurved below

cells: 10–15 μm, isodiametric, firm-walled, smooth

capsule: 1.5–1.8 mm, ovoid, asymmetric, curved, horizontal, mouth reddish; seta 14–35 mm, flexuose, reddish; operculum conic; calyptra cucullate, smooth; peristome double, exostome orange, cross-striolate below, papillose above; endostome basal membrane half the segment height; segments not split; cilia 2, nodulose; spores 15 μm in diam.



fertile shoot, branch apex, branch leaf outline, and leaf apex
 ■ 1 mm, ■ 0.5 mm, ■ 0.5 mm, ■ 50 μm



paired marginal teeth, leaf basal angle, and capsules and calyptra
 ■ 10 μm, ■ 50 μm, ■ 1 mm

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Pyrrhobryum bifarium vegetative habit
1 mm

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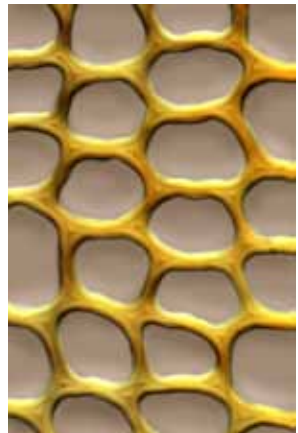
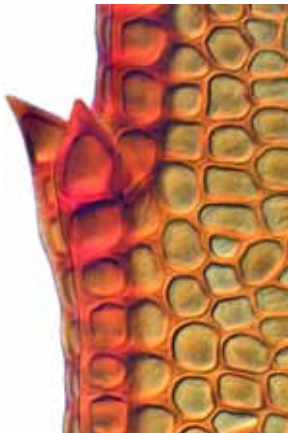
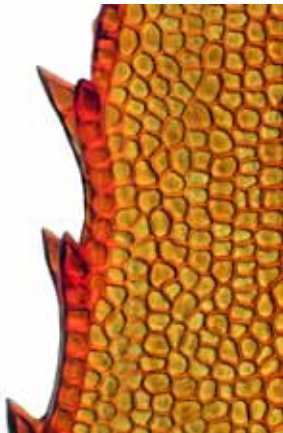


Pyrrhobryum bifarium shoot
1 mm

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Pyrrhobryum mnioides* subsp. *contortum (Hook.f. & Wilson) Fife**form:** turves of flexuose, radiculose, \pm unbranched stems, 30–70 mm**habitat:** soil, rarely bark, damp forest from sea level to high montane, to 1340 m**leaf:** *size:* 3–5 \times 0.8–1.2 mm*shape:* lanceolate, concave, contorted when dry*tip:* acute*base:* weakly auriculate and decurrent; alar cells not differentiated*costa:* failing just below the apex, toothed on the back*border:* thickened, pigmented*margin:* doubly toothed, plane*cells:* 8–13 μm , \pm subquadrate, firm-walled, smooth**capsule:** 2.0–2.5 mm, ovoid, horizontal, asymmetrical, \pm curved, brown, mouth reddish; seta 30–50 mm, lateral, flexuose, red, \pm multiple; calyptra cucullate, smooth; operculum obliquely conic-rostrate; peristome double, exostome teeth lanceolate, hyaline-margined, papillose, endostome processes split, cilia 2–4, nodulose; spores 18–21 μm in diam.

fertile and vegetative shoots (3), young and mature capsules, and leaf outline and apex
 ■ 5 mm, ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 1 mm, ■ 0.5 mm, ■ 50 μm

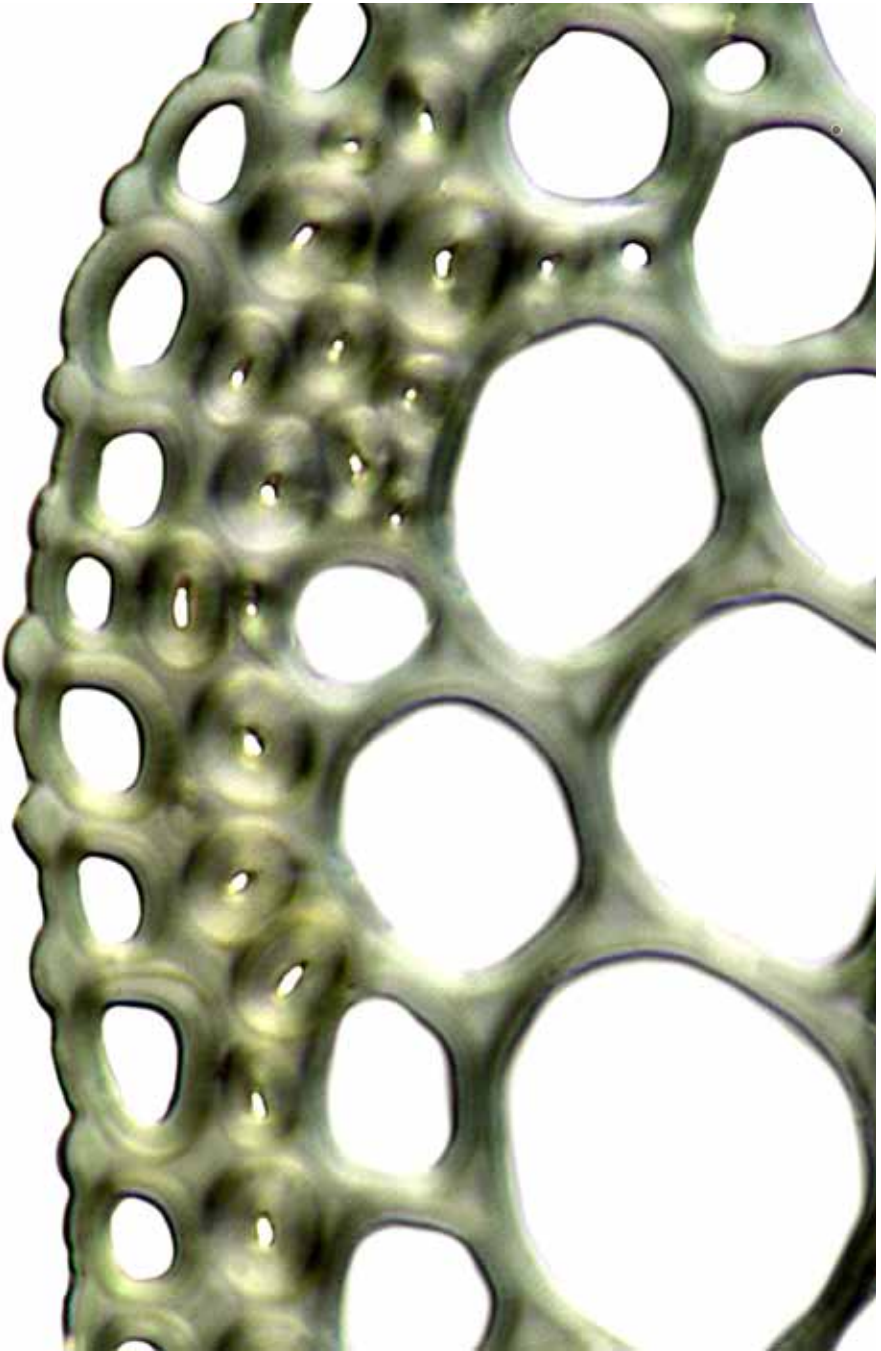


doubly toothed margin (2), and cells at midleaf
 ■ 50 μm , ■ 10 μm , ■ 10 μm



Pyrrhobryum mnioides subsp. *contortum* mature capsule
1 mm

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Pyrrhobryum mnioides subsp. *contortum* stem cross-section (portion)
10 μ m

continued next page



Pyrrhobryum mnioides subsp. *contortum* leaf cross-section showing bistratose margin
10 μm (left), 10 μm (right)

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Pyrrhobryum paramattense (Müll.Hal.) Manuel

form: tufts of unbranched, ± comose, basally radiculose stems, to 50 mm, the leaves pale to dark olive-green

habitat: moist soil, rotting wood, or occasionally rock, damp forests, to 500 m

leaf: size: 4.5–6.0 × 0.3 mm

shape: linear-lanceolate, ± falcate

tip: acuminate

base: not decurrent; alar cells not differentiated

costa: excurrent, doubly toothed on the back above

border: 2–4-stratose, pigmented

margin: doubly toothed, plane

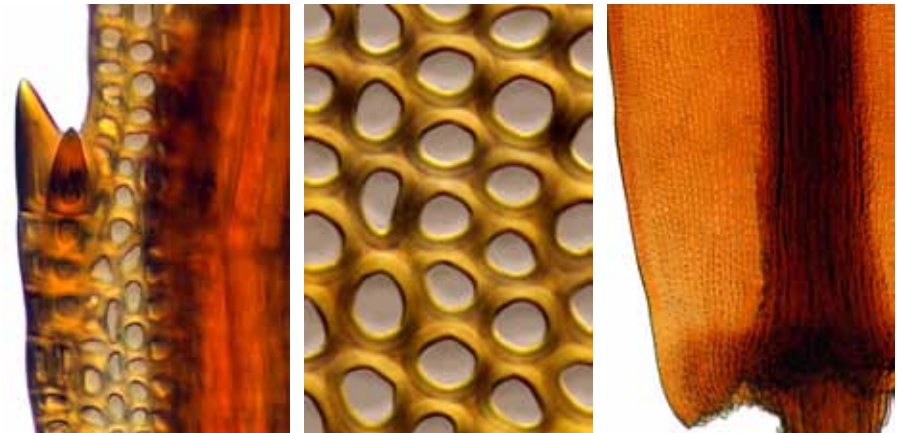
cells: 6–15 μm, ± isodiametric, firm-walled, smooth

capsule: 2.3–2.6 mm, elongate to cylindric, asymmetric, inclined, dark red; seta to 42 mm, erect to curved, from near stem base; operculum obliquely conic-rostrate; calyptra cucullate, smooth; peristome double, exostome teeth lanceolate, endostome cilia 3, papillose; spores 15–18 μm in diam.



fertile shoot (dry) (2), leaf outline, leaf apex, leaf subapex, and upper margin

5 mm, 1 mm, 0.5 mm, 50 μm, 50 μm, 50 μm



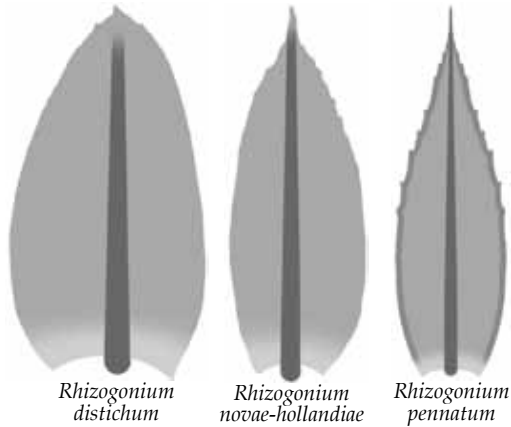
doubly toothed margin, cells at midleaf, and leaf basal angle

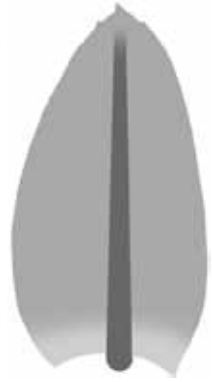
50 μm, 10 μm, 100 μm

Key* to the New Zealand species of *Rhizogonium* (3)

- 1 Leaves bordered by elongate cells ● ***Rhizogonium pennatum***
 1: Leaves not bordered by elongate cells 2
- 2(1:) Costa failing below the apex; leaf apex coarsely toothed; leaves wider than 0.6 mm
 ● ***Rhizogonium distichum***
 2: Costa excurrent; leaf apex not coarsely toothed; leaves narrower than 0.6 mm
 ● ***Rhizogonium novae-hollandiae***

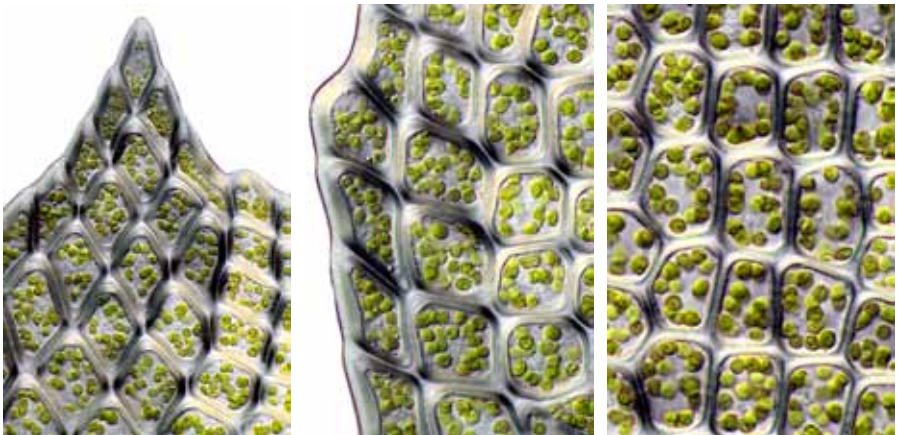
* based on Gilmore, SR (2006): Rhizogoniaceae. *Flora of Australia* 51, 364.



Rhizogonium distichum (Sw.) Brid.**form:** turves of simple, tomentose stems, 10–25 mm, distichous**habitat:** rotting logs, soil, or tree fern trunks, damp forest, to 1200 m**leaf:** size: 1.5–2.2 × 0.9–1.2 mm**shape:** oblong to ovate-oblong, distichous, ± asymmetric at base**tip:** obtuse to subacute, apiculate, ending with a single large cell**base:** undifferentiated, weakly decurrent**costa:** stout, failing below the apex**border:** not differentiated**margin:** entire below, coarsely serrate toward the apex, plane**cells:** 12–20 μm, rounded-hexagonal, incrassate, smooth**capsule:** 2 mm, oblong to cylindric, inclined to pendent, red-mouthed; seta 20–35 mm; calyptra cucullate; operculum short-rostrate; peristome double; cilia 2–3; spores 15–19 μm in diam.**note:** differs from other *Rhizogonium* species in having a costa that fails below the apex, and an apical tooth ending with a large cell

habit, shoot (moist), capsule with calyptra, peristome, and leaf outline

1 mm, 1 mm, 1 mm, 0.1 mm, 0.1 mm



leaf apex, margin at midleaf, and cells at midleaf

10 μm, 10 μm, 10 μm

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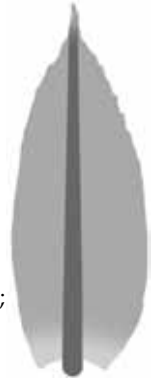
Rhizogonium distichum habit
1 mm

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Rhizogonium distichum leaf margin cross-section
10 μ m

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Rhizogonium novaehollandiae (Brid.) Brid.**form:** curves of simple, tomentose stems, 8–15 mm, distichous**habitat:** tree fern trunks, tree bases, exposed roots, logs, or soil, to 1200 m**leaf:** size: 1.0–1.6 × 0.3–0.4 mm**shape:** ovate to oblong-ovate, slightly asymmetric at base**tip:** acute**base:** not decurrent; basal cells subquadrate**costa:** excurrent in a stout arista**border:** 2–3 rows of slightly narrower cells**margin:** irregularly serrate above, the teeth unicellular, plane**cells:** 10–14 μm, hexagonal, firm-walled, smooth or striolate**capsule:** 1.5–2.5 mm, cylindric, neck tapered, inclined to cernuous, mouth red-rimmed; seta 10–20 mm; calyptra cucullate; operculum short-rostrate; peristome double, exostome teeth 16, endostome processes cracked; spores 15–18 μm in diam., brown**note:** differs from *Rhizogonium distichum* in having an excurrent costa

vegetative habit and shoot, leaf outline, mature capsule, and leaf apex

1 mm,
 1 mm,
 0.5 mm,
 1 mm,
 50 μm



leaf insertions, margin at upper leaf, and cells at midleaf

50 μm,
 10 μm,
 10 μm

continued next page

Rhizogonium pennatum Hook.f. & Wilson

form: curves of simple, radiculose, erect, complanate stems, 15–35 mm, the leaves distichous, pale yellow-green, glossy

habitat: soil, bark, tree ferns, or rotting wood, in damp forest, to 960 m

leaf: size: 1.5–2.5 × 0.3–0.5 mm

shape: ovate-lanceolate, little altered when dry

tip: ± toothed arista

base: not decurrent; alar cells not differentiated

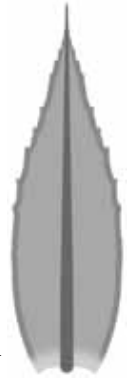
costa: excurrent in a stout toothed arista

border: 3–5 rows of thick-walled, bistratose cells

margin: entire below, distantly toothed above, ± incurved below

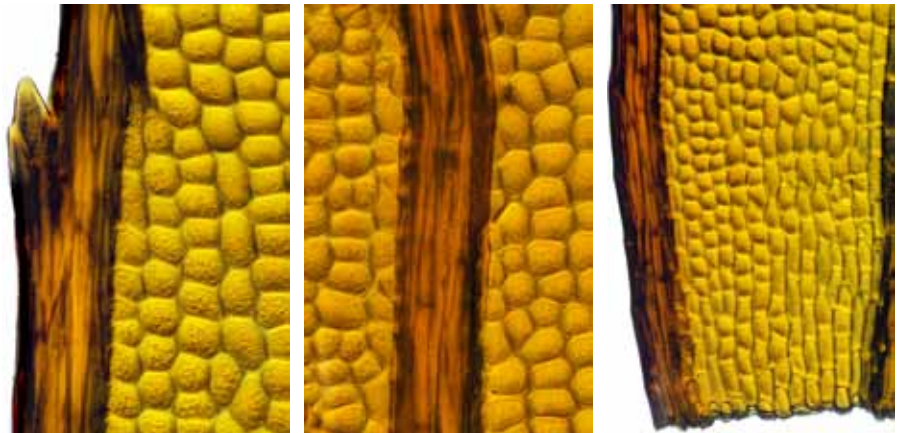
cells: 12–15 μm, isodiametric to hexagonal, firm-walled, smooth

capsule: to 2 mm, ± oblong, suberect to horizontal, exserted, brown, with red mouth; seta to 25 mm, basal, red, twisted when dry; operculum beak half the length of the capsule, curved; peristome double, the 16 outer teeth distally hyaline, papillose



vegetative shoot (dry), capsule (dry), leaf outline, apex (2), and subapex

■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 50 μm, ■ 50 μm, ■ 50 μm



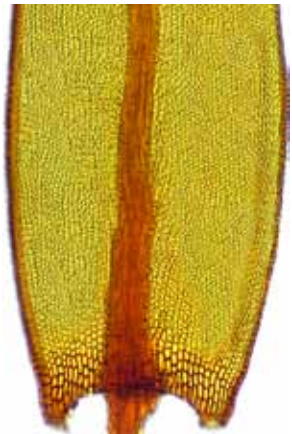
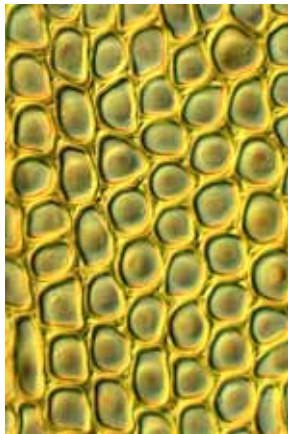
margin at midleaf, costa at midleaf, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 50 μm

Aulacomnium palustre (Hedw.) Schwägr.**form:** dense tuves of ± branched, tomentose stems, 40–150 mm, yellow**habitat:** soil and rotting wood in grassy subalpine swamps, tarns, to 1800 m**leaf:** size: 1.8–4 × 0.6–0.9 mm*shape:* oblong-lanceolate to ovate-lanceolate*tip:* acute, acuminate, or obtuse*base:* alar cells not differentiated; basal cells thick-walled, inflated, coloured*costa:* stout, sinuose above, failing below the apex, two stereid bands in xs*border:* not differentiated*margin:* entire to ± serrulate above, recurved in the basal three-quarters*cells:* 11–15 μm, ± rounded, incrassate, collenchymatous, unipapillose**capsule:** not known in New Zealand; 2.5–4 mm, oblong to cylindric, slightly curved, sulcate when dry; seta 25–45 mm; peristome bryoid**notes:** multicellular gemmae 0.1–0.2 mm long produced on leafless terminal pseudopodia (the gemmae soon falling, dispersed by birds or livestock); dwarf plants often seen in plant nurseries, perhaps introduced in peat.

vegetative shoots (dry) (2), leaf outline, and leaf apex

1 mm, 1 mm, 0.5 mm, 10 μm



revolute margin in lower leaf, unipapillose cells at midleaf, and leaf base

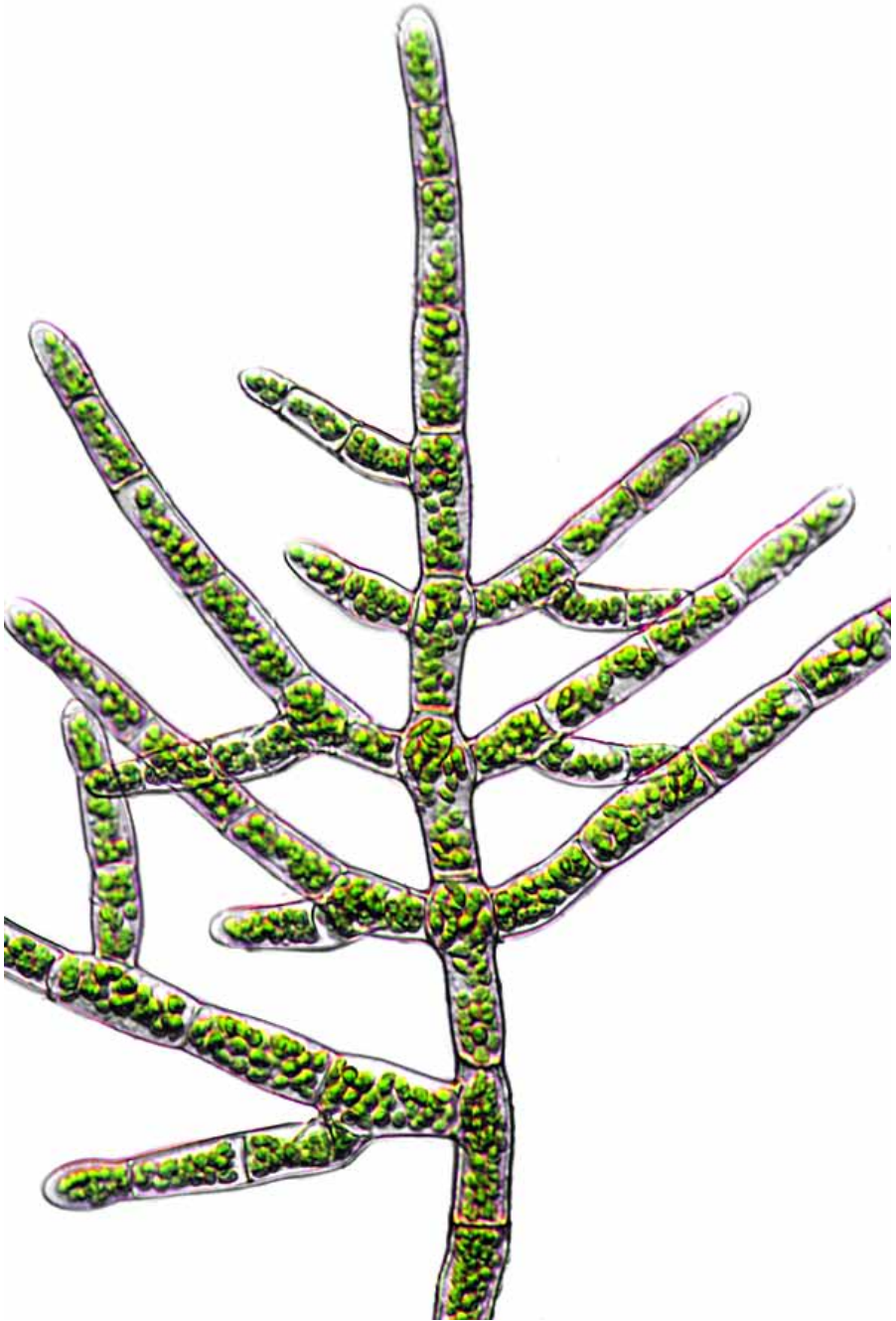
10 μm, 10 μm, 100 μm

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Aulacomnium palustre young shoot with gemmae, and single gemma
1 mm, 10 μ m

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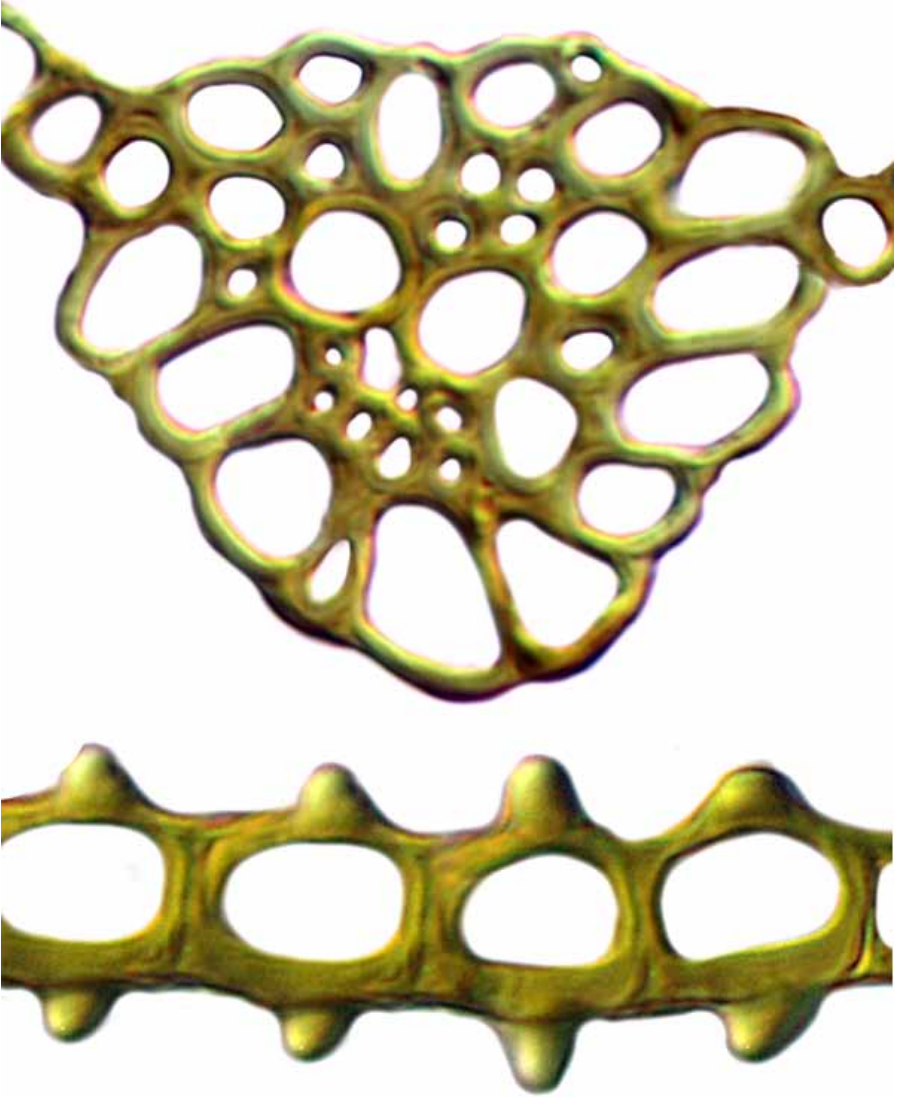
Aulacomnium palustre protonema
10 μm

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Aulacomnium palustre leaf cross-section
50 μm

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Aulacomnium palustre costa and leaf cross-sections
10 μm , 10 μm

Hymenodon pilifer Hook.f. & Wilson

form: tufted, erect, filiform, branched, tomentose stems, to 10 mm tall, the leaves appearing to be two-ranked

habitat: bark or rock in damp forest

leaf: size: 1.0–1.3 × 0.4–0.6 mm

shape: elliptic-oblong, little altered when dry, hydrophobic when fresh

tip: obtuse, with a long, thin, smooth hair-point

base: not differentiated

costa: appearing to be interrupted just below the apex

border: not differentiated

margin: entire below, crenulate above, plane

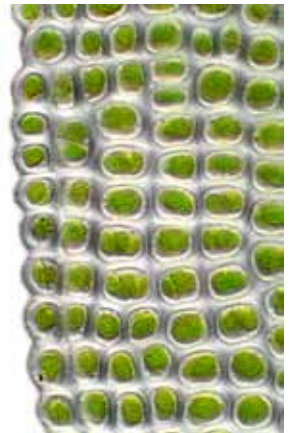
cells: 10–12 μm, rounded, incrassate, strongly mammillose

capsule: 1–2 mm, ovoid to oblong, erect to inclined, short-necked, stomatose below; seta 10–15 mm, slender, lateral from base of stem; operculum conic, umbonate, calyptra cucullate; exostome absent, endostome of 16 tapering processes, to 300 μm; spores 12–16 μm in diam.



vegetative habit, vegetative shoot, leaf outline, capsule, and leaf apex

1 mm, 1 mm, 0.1 mm, 1 mm, 0.1 mm



leaf subapex, costa near leaf base, and margin at midleaf

10 μm, 10 μm, 10 μm

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Hymenodon pilifer vegetative shoot
1 mm

Leptotheca gaudichaudii Schwägr.

form: densely tufted, slender, erect stems, to 30 mm tall, pale, yellowish
habitat: soil, tree roots, logs, or rock, forests and scrubland

leaf: size: 1.5–4 × 0.6–1.6 mm

shape: oblong-lanceolate

tip: acuminate to acute

base: not differentiated

costa: excurrent in a stout point

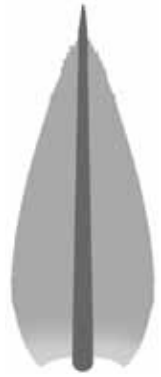
border: not differentiated

margin: toothed at the apex, ± reflexed above

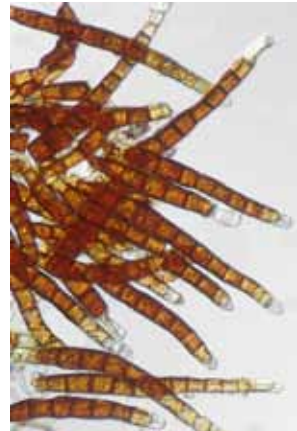
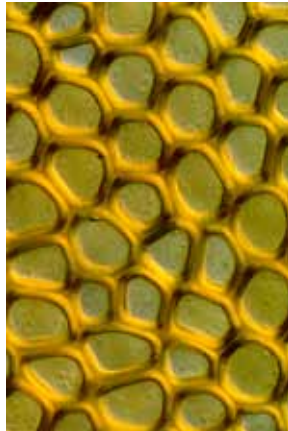
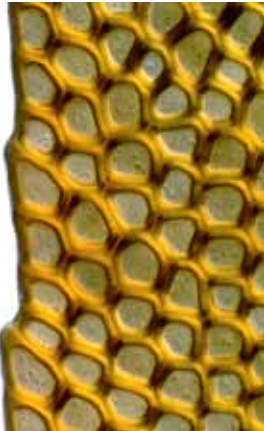
cells: 10–14 μm, ± isodiametric, rounded, incrassate, smooth

capsule: 3–4 mm, narrowly cylindric, neck tapered, ± erect, 8-ribbed
 when dry; seta 20–30 mm, slender; operculum bluntly conic; calyptra
 cucullate, smooth, naked; peristome double, exostome teeth lanceolate,
 endostome cilia 2; spores 10–15 μm in diam.

notes: brood bodies filamentous, multicellular, axillary, reddish brown



shoot with propagules (moist) (2), capsules (young, mature), leaf outline, and leaf apex
 ■ 1 mm, ■ 1 mm, ■ 1 mm (2), ■ 0.5 mm, ■ 50 μm



margin at midleaf, cells at midleaf, and propagules
 ■ 10 μm, ■ 10 μm, ■ 100 μm

Orthodontium lineare Schwägr.

form: tufted, delicate, silky, radiculose stems, to 5 mm tall, the leaves yellowish

habitat: soil, rotting or burnt wood, and rock, moist montane forest

leaf: size: 3.5–5 × 0.4–0.7 mm

shape: linear-subulate

tip: acute

base: basal cells broader and shorter than the blade cells

costa: failing below the apex

border: not differentiated

margin: entire, plane

cells: 80–190 × 7–15 μm, linear-rhombic, firm-walled, smooth

capsule: 1.5–2.5 mm, cylindric, with a tapering neck, erect, ± sulcate when dry; seta 20–35 mm; operculum obliquely short-beaked; peristome double, exostome teeth 16, pale or hyaline, endostome processes 16, filiform; spores 16–20 μm in diam., brown, finely papillose

notes: highly variable; introduced into Europe in the early 1900s



fertile shoot (2), young capsules (2), mature capsule, leaf outline, and leaf apex
 ■ 1 mm, ■ 0.5 mm, ■ 0.5 mm (2), ■ 0.5 mm, ■ 0.5 mm, ■ 10 μm



margin at midleaf, costa at midleaf, and cells in lower leaf
 ■ 10 μm, ■ 10 μm, ■ 10 μm

Braithwaitea sulcata (Hook.) A.Jaeger

form: primary stems naked, scattered, secondary stems bipinnately branched, 50–120 mm long, green or yellow-green, metallic lustre

habitat: tree trunks in moist forest

leaf: size: stem leaves 3–5 mm, branch leaves 2–3 mm

shape: stem leaves ovate-lanceolate, branch leaves ovate-oblong

tip: obtuse with a short acumen

base: angle cells small and quadrate

costa: shortly excurrent, toothed at the back above

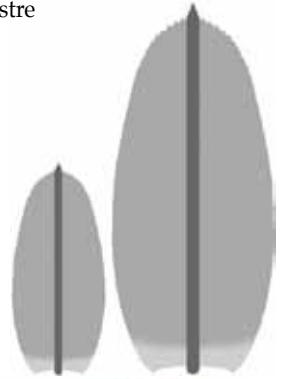
border: not differentiated

margin: finely denticulate toward the apex, plane

cells: 40–60 × 5 μm, linear, firm-walled, prorulose at distal end

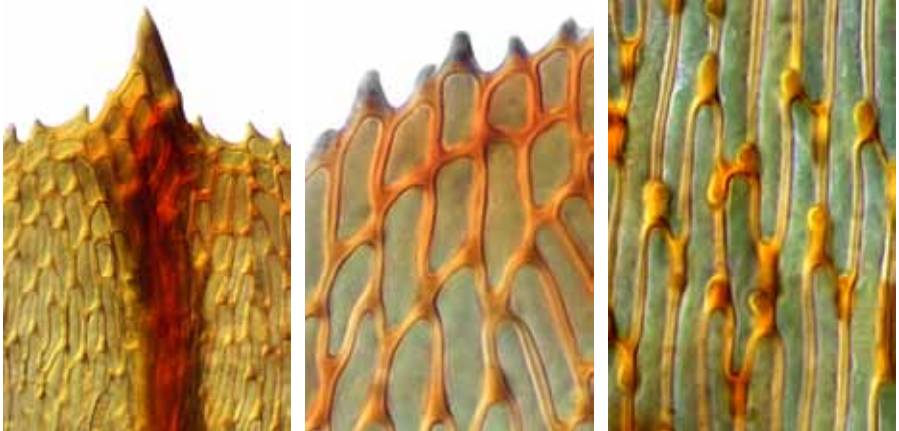
capsule: 3–5 mm, light brown, ± cylindrical, symmetrical, horizontal; seta 6–15 mm, lateral, reddish, curved; peristome teeth filiform, papillose, up to 1 mm long

note: papillose brood-bodies on stem among the upper leaves



fertile habit, branch and stem leaf outlines, and brood body (portion)

■ 10 mm, ■ 5 mm, ■ 1 mm (2), ■ 10 μm



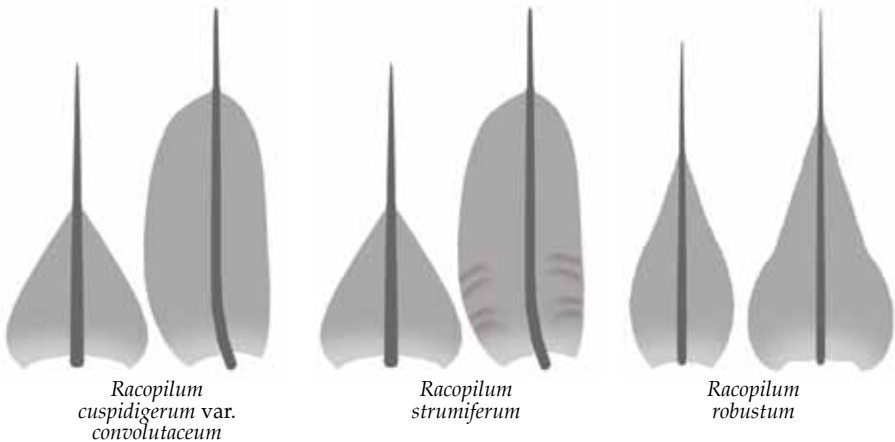
apiculate leaf apex, upper leaf margin, and prorulose midleaf cells

■ 10 μm, ■ 10 μm, ■ 10 μm

Key* to the New Zealand species of *Racopilum* (3)

- 1 Stem and branch leaves \pm similar; leaf cells smooth..... ● ***Racopilum robustum***
 1: Stem and branch leaves different; leaf cells strongly mammillose.....2
- 2(1:) Leaves weakly bordered with 2–3 rows of slightly elongate cells; calyptra mitrate;
 capsule strumose..... ● ***Racopilum strumiferum***
 2: Leaves not bordered; calyptra cucullate; capsule not strumose.....
 ● ***Racopilum cuspidigerum* var. *convolutaceum***

* based partly on van Zanten, BO (2006): *Racopilaceae. Flora of Australia* 51, 374.



Racopilum cuspidigerum var. **convolutaceum** (Müll.Hal.) Zanten & Dijkstra

form: matted, pinnately branched, tomentose stems, 10–100 mm tall, lateral leaves 4-ranked, distichous, dorsal leaves 2-ranked

habitat: soil, rock, or bark in damp shaded forest

leaf: *size:* lateral leaves 1–2 × 0.5–1.0 mm (excluding arista); dorsal leaves smaller

shape: lateral leaves oblong; dorsal leaves triangular

tip: lateral leaves obtuse; dorsal leaves acute

base: not differentiated

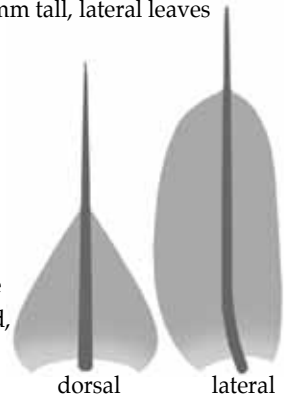
costa: variably excurrent in a hyaline arista

border: not differentiated

margin: serrulate below, serrate above, plane

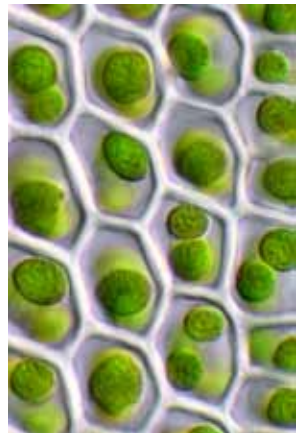
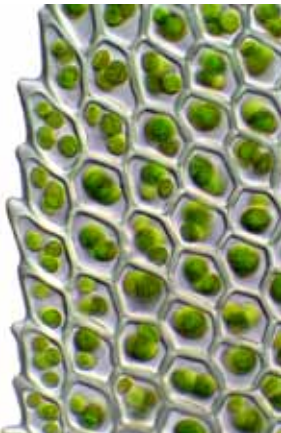
cells: 8–16 μm , \pm hexagonal, firm-walled, strongly mammillose

capsule: 2.5–3.5 mm, cylindric, short-necked, curved, inclined, not strumose, brown; seta 10–25 mm, smooth, orange; operculum rostrate; calyptra cucullate, hairy



vegetative shoot, leaf outlines (dorsal leaf on left), lateral leaf apex, and capsule

1 mm, 0.5 mm (2), 100 μm , 1 mm



costa at midleaf, serrulate margin at midleaf, and leaf cells

10 μm , 10 μm , 10 μm

continued next page



Racopilum cuspidigerum var. *convolutaceum* immature capsules with calyptrae

1 mm

continued next page



Racopilum cuspidigerum var. *convolutaceum* vegetative shoot showing dorsal leaves

1 mm

continued next page



Racopilum cuspidigerum var. *convolutaceum* leaf cross-section (strongly mammillose)
10 μm

continued next page

Racopilum robustum Hook.f. & Wilson

form: matted, creeping, \pm unbranched, radiculose stems, 20–70 mm long, the leaves yellow-green

habitat: rock, soil, rarely bark, moist forest, sea level to 1000 m

leaf: size: 2–3 mm

shape: ovate-cordate, concave, \pm distichous

tip: acuminate

base: basal cells shorter than the other blade cells

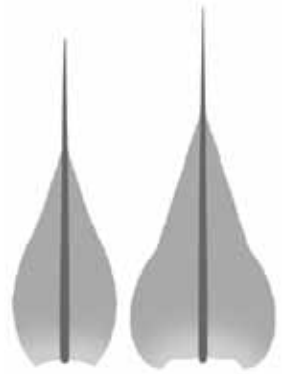
costa: excurrent in a long piliform arista

border: 1–2 rows of elongate cells

margin: entire to \pm serrulate, plane

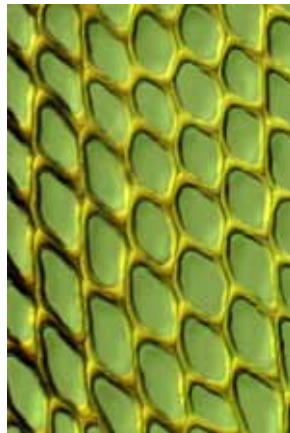
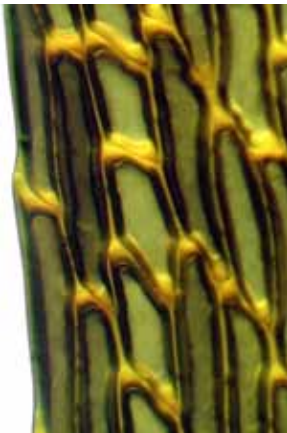
cells: 12–15 \times 10 μm , short-oval, firm-walled, smooth

capsule: 4–5 mm, strumose, \pm cylindric, curved, suberect, stomatose, deeply grooved; seta 13–20 mm, reddish, twisted; calyptra mitrate, hairy; operculum erect-rostrate; peristome double; spores 12–16 μm in diam., smooth



vegetative shoots (dry) (3), leaf outlines (2), and leaf subapex

5 mm, 1 mm, 0.5 mm (2), 0.5 mm, 10 μm



margin at midleaf, cells at midleaf, and leaf basal angle

10 μm , 10 μm , 50 μm

continued next page

Racopilum strumiferum (Müll.Hal.) Mitt.

form: matted, pinnate, tomentose stems, 20–70 mm long, lateral leaves 4-ranked, distichous, dorsal leaves 2-ranked

habitat: soil, rock, bark, or rotting wood, damp forest to 1000 m

leaf: *size:* lateral leaves 1–2 × 0.5–1.0 mm (excluding arista); dorsal leaves smaller

shape: lateral leaves oblong; dorsal leaves triangular

tip: lateral leaves obtuse; dorsal leaves acute

base: not differentiated

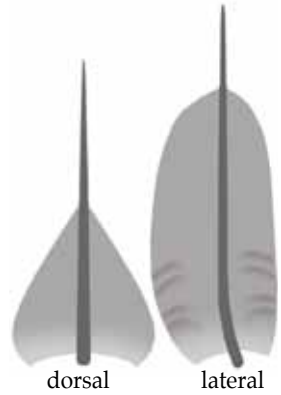
costa: variably excurrent in a hyaline arista

border: weak, 2–3 rows of slightly elongate cells

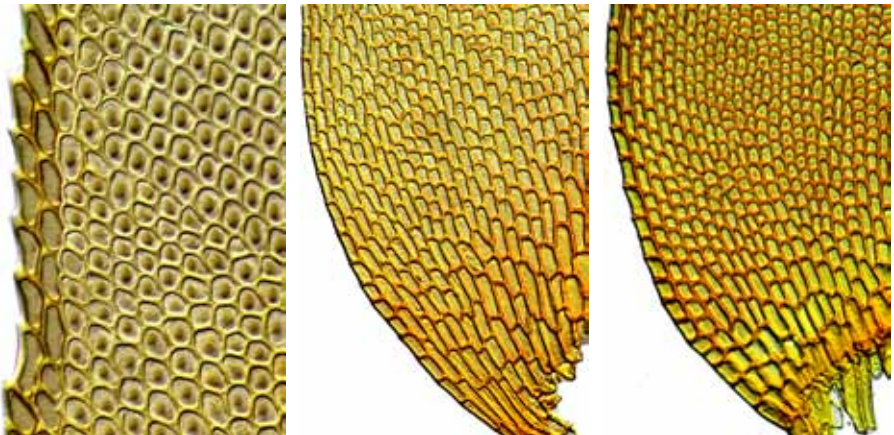
margin: entire to serrulate, plane above, often undulate below

cells: 9–15 μm , \pm hexagonal, firm-walled, strongly mammillose

capsule: 2.5–3.0 mm, cylindric, curved, inclined, exserted, strumose, brown; seta 8–20 mm, smooth; operculum erect-beaked; calyptra mitrate, \pm hairy; peristome double, exostome teeth cross-striolate, endostome cilia 2–4



vegetative shoot (moist), capsule base, leaf outlines (2), and dorsal leaf apex and margin
 1 mm, 1 mm, 0.5 mm (2), 10 μm , 10 μm



lateral leaf margin, lateral leaf basal angle, and dorsal leaf basal angle
 10 μm , 50 μm , 50 μm

continued next page



(left and middle) *Racopilum strumiferum* capsule, operculum, and mitrate calyptra
 (bottom right) *Racopilum cuspidigerum* var. *convolutaceum* cucullate calyptra
 1 mm

continued next page



Racopilum strumiferum vegetative shoot showing dorsal leaves
1 mm

Cyrtopus setosus (Brid.) Hook.f.

form: robust plants, the primary stems loosely tufted, radiculose, secondary stems branched, to 120 mm long, in \pm pendent mats, often golden

habitat: on smooth bark of forest trees, less commonly on vertical rock

leaf: size: 5–7 \times 0.9–1.3 mm

shape: subulate from an oblong base, plane, bistratose patches above

tip: gradually subulate

base: outer cells isodiametric in up to 15 rows; inner cells linear, thick-walled

costa: variably excurrent in an abaxially toothed subula; biconvex in xs

border: not differentiated

margin: entire below, laxly toothed in the subula, plane

cells: 15–25 μm , isodiametric, thick-walled, smooth; inner base cells porose

capsule: 2–3 mm, oblong to cylindrical, straight, erect, exserted; seta 3–4 mm; operculum conic-rostrate; calyptra cucullate; peristome double, exostome red, papillose; endostome processes equalling the teeth in length, subulate; spores 8–10 μm in diam., smooth



fertile shoot, capsule, leaf outline, apex, subapex, and margin in lower leaf
 ■ 1 mm, ■ 0.5 mm, ■ 1 mm, ■ 50 μm , ■ 50 μm , ■ 20 μm

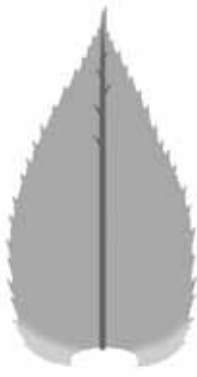


outer isodiametric and inner rectangular cells in lower leaf, and costa and lamina xs
 ■ 20 μm , ■ 20 μm , ■ 10 μm , ■ 10 μm

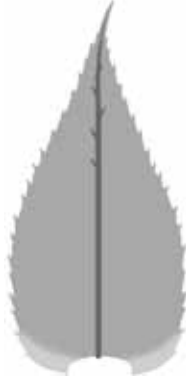
Key* to the New Zealand species of Hypnodendron (3) and Mniodendron (4)

- 1 Square crystals in cells near base of branch leaf costa..... ● **Mniodendron colensoi**
 1: No square crystals in cells near base of branch leaf costa.....2
- 2(1:) Stipe naked or tomentose at only the base3
 2: Stipe tomentose ± throughout5
- 3(2) Stipe naked; stem leaf insertion straight and horizontal4
 3: Stipe tomentose at only the base; stem leaf insertion U- or V-shaped
 ● **Hypnodendron spininervium** subsp. **spininervium**
- 4(3) Branched above into a pinnate complanate frond, glossy and green when dry; stem
 leaves spreading wet or dry ● **Hypnodendron arcuatum**
 4: Branched above into a terminal whorl; not glossy and green when dry; stem leaves
 appressed wet or dry..... ● **Hypnodendron marginatum**
- 5(2:) Leaf border thickened; costa wide; branches straight, not tapering6
 5: Leaf border unistratose; costa narrow; branches curved, tapering
 ● **Mniodendron comatum**
- 6(5) Branch leaves coarsely serrate in the upper third; costa and apex wide
 ● **Mniodendron comosum** var. **sieberi**
 6: Branch leaves only weakly serrate; costa and apex narrow
 ● **Mniodendron comosum** var. **comosum**

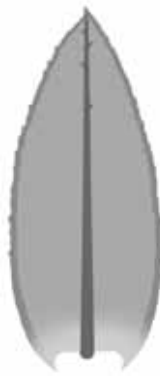
* based on Beaver, J; Allison, KW; Child, J (1992): *The Mosses of New Zealand*. University of Otago Press, Dunedin, 110, plus Scott, GAM; Stone, IG; Rosser, C (1976): *The Mosses of Southern Australia*. Academic Press, London, 341, and Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 314.



*Hypnodendron
spininervium* subsp.
spininervium



*Hypnodendron
arcuatum*



*Hypnodendron
marginatum*



*Mniodendron
comatum*



*Mniodendron
comosum* var.
comosum



*Mniodendron
comosum* var.
sieberi



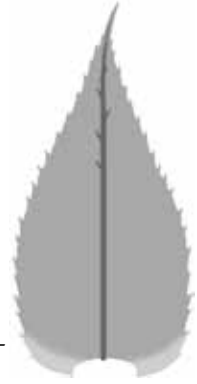
*Mniodendron
colensoi*

Hypnodendron arcuatum (Hedw.) Mitt.

form: primary stem creeping; secondary stems dendroid, to 80 mm
habitat: wet soil or rock near deeply shaded forest streams

leaf: *size:* stem leaves: 1.5–2.5 mm; branch leaves: 1.5–2 mm
shape: stem: ovate-lanceolate; branch: ovate; KOH reaction deep red
tip: stem: subulate; branch: ovate
base: basal cells shorter and wider than the other lamina cells
costa: stem: excurrent, serrate on the back above; branch: percurrent
border: not differentiated
margin: spinulose-serrate, plane
cells: 30–50 × 5–8 μm, rhombic to linear, firm-walled, distally prorose on abaxial surface

capsule: 3–4 mm, oblong-cylindric, ± cernuous, ± curved, exserted, red-brown; setae 1–8 per stem, 15–30 mm, reddish; operculum long-rostrate; peristome double, exostome teeth hyaline-margined, basal membrane half the height of the teeth; cilia 2–4



vegetative shoot (dry), stem and branch leaf outlines, apex, and margin midleaf
 ■ 5 mm, ■ 0.1 mm (2), ■ 10 μm, ■ 10 μm



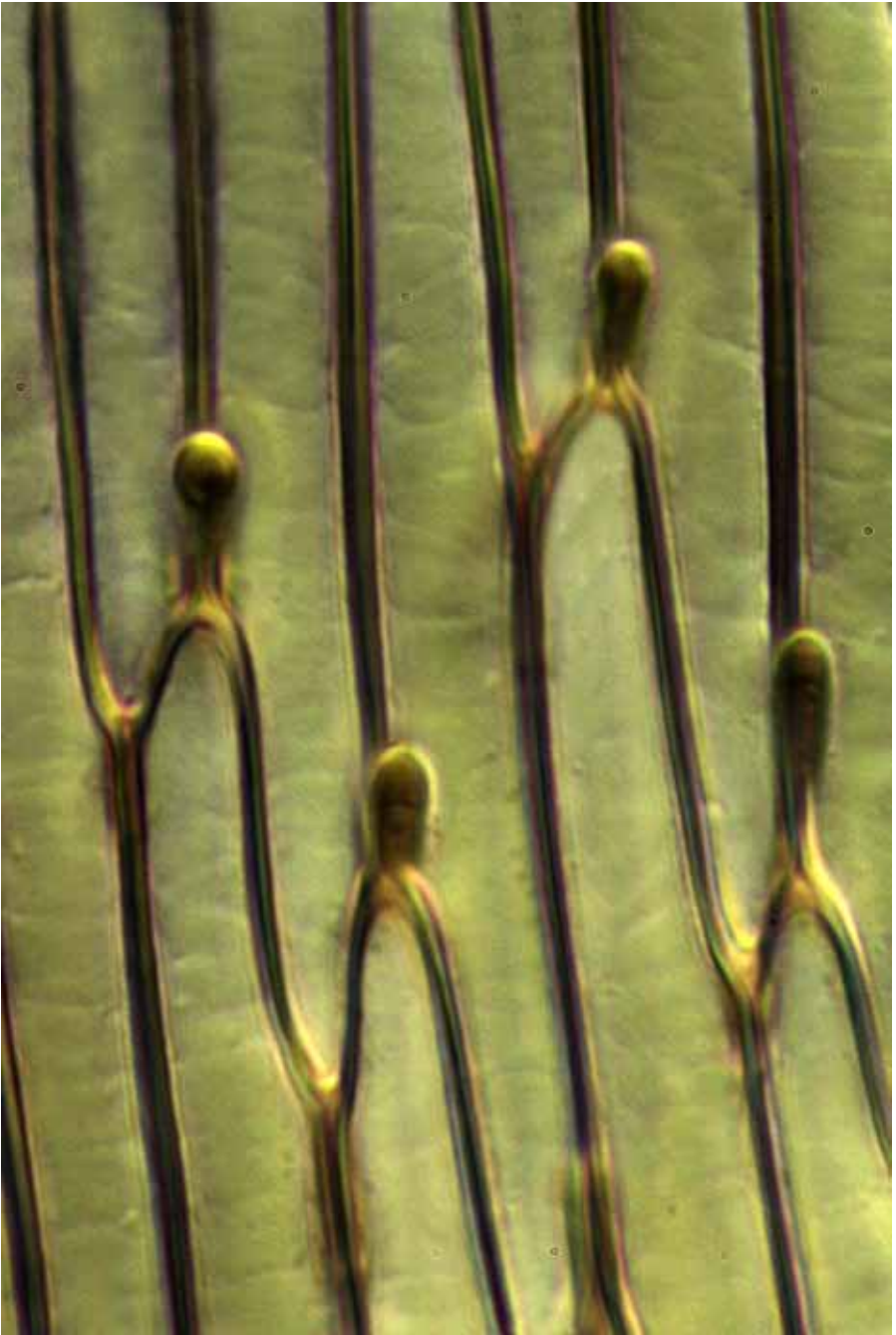
costa at midleaf, branch leaf prorose cells, and branch leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 100 μm

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Hypnodendron arcuatum margin midleaf
10 μm

continued next page



Hypnodendron arcuatum prorse leaf cells midleaf
10 μ m

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Hypnodendron marginatum (Hook.f. & Wilson) A.Jaeger

form: primary stems creeping, secondary stems to 40 mm tall, brittle, black or dark red, branches in a terminal whorl

habitat: damp soil in forest

leaf: size: stem leaves 3 mm; branch leaves 2–3 mm

shape: stem leaves widely triangular-lanceolate; branch leaves oblong-lanceolate to narrowly ovate, ± concave

tip: stem leaves finely tapered; branch leaves acute

base: alar cells little differentiated

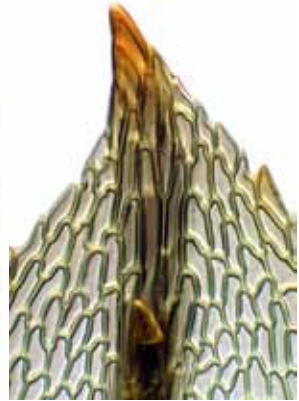
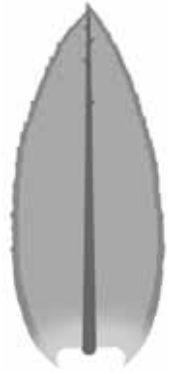
costa: stem leaves excurrent in a rigid point; branch leaves percurrent

border: 4–5 rows of linear, thick-walled cells

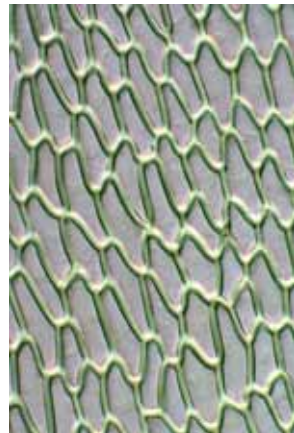
margin: stem leaves entire, plane; branch leaves dentate above, plane

cells: branch leaves $25\text{--}38 \times 5\text{--}9 \mu\text{m}$, ± rhombic, firm-walled, smooth

capsule: 3–4 mm, oblong-cylindric, grooved, horizontal or cernuous; seta 25–30 mm, numerous (to 25), red, flexuose; operculum long-rostrate; peristome double, endostome cilia 2–4; spores $12 \mu\text{m}$ in diam.



vegetative habit, capsule apex, with calyptra, branch leaf outline, and branch leaf apex
 ■ 5 mm, ■ 0.5 mm, ■ 0.5 mm, ■ 10 μm



branch leaf margin at midleaf, midleaf branch cells, and stipe leaves
 ■ 10 μm , ■ 10 μm , ■ 1 mm



Hypnodendron marginatum leaf border cross-section
10 μm

continued next page

Hypnodendron spininervium (Hook.) A. Jaeger subsp. **spininervium**

form: primary stems creeping, secondary stems to 40 mm tall,
branched above in a whorl, 3-ranked, with the upper leaves small

habitat: wet soil and rotting logs in forest

leaf: size: stipe leaves 1–2 × 0.7 mm; branch leaves 1.5–3.0 × 1.0 mm

shape: stem leaves acuminate from a triangular base; branch leaves
ovate-lanceolate

tip: acute

base: angle cells subquadrate, pigmented

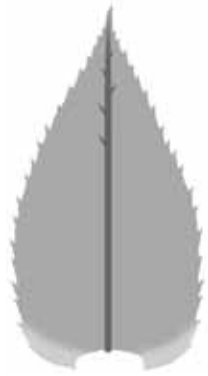
costa: percurrent or slightly excurrent, toothed on the back

border: not differentiated

margin: strongly toothed (sometimes paired), reflexed below

cells: 40–60 × 7 μm, rectangular, thin-walled, prorate-papillose

capsule: 3.5 mm, cylindric, ± curved, horizontal, deeply grooved;
seta 20–30 mm, red, up to 8 per frond; peristome double, well-
developed, the endostome ciliate

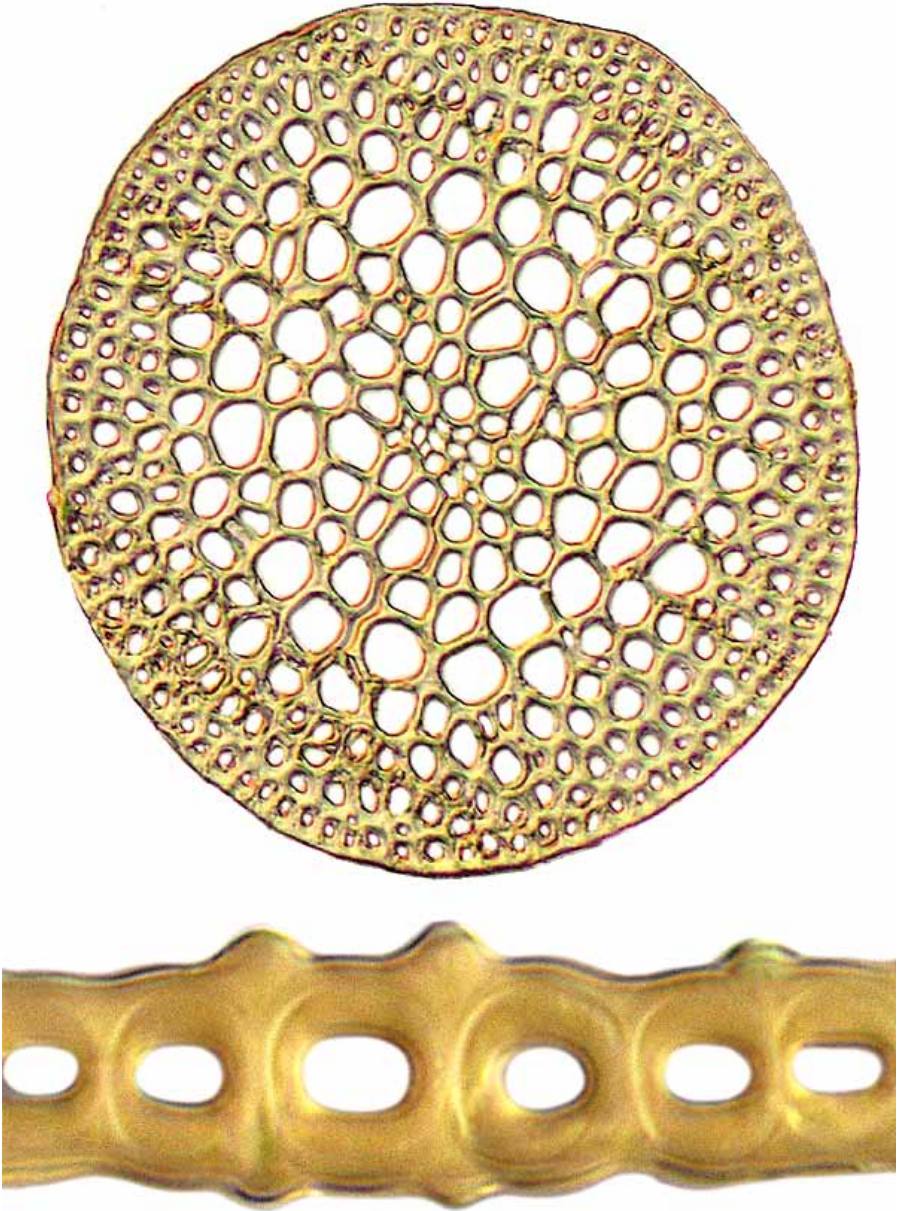


fertile plant, stipe leaves, single branch (dry), branch leaf outline, branch leaf apex
 ■ 5 mm, ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 50 μm



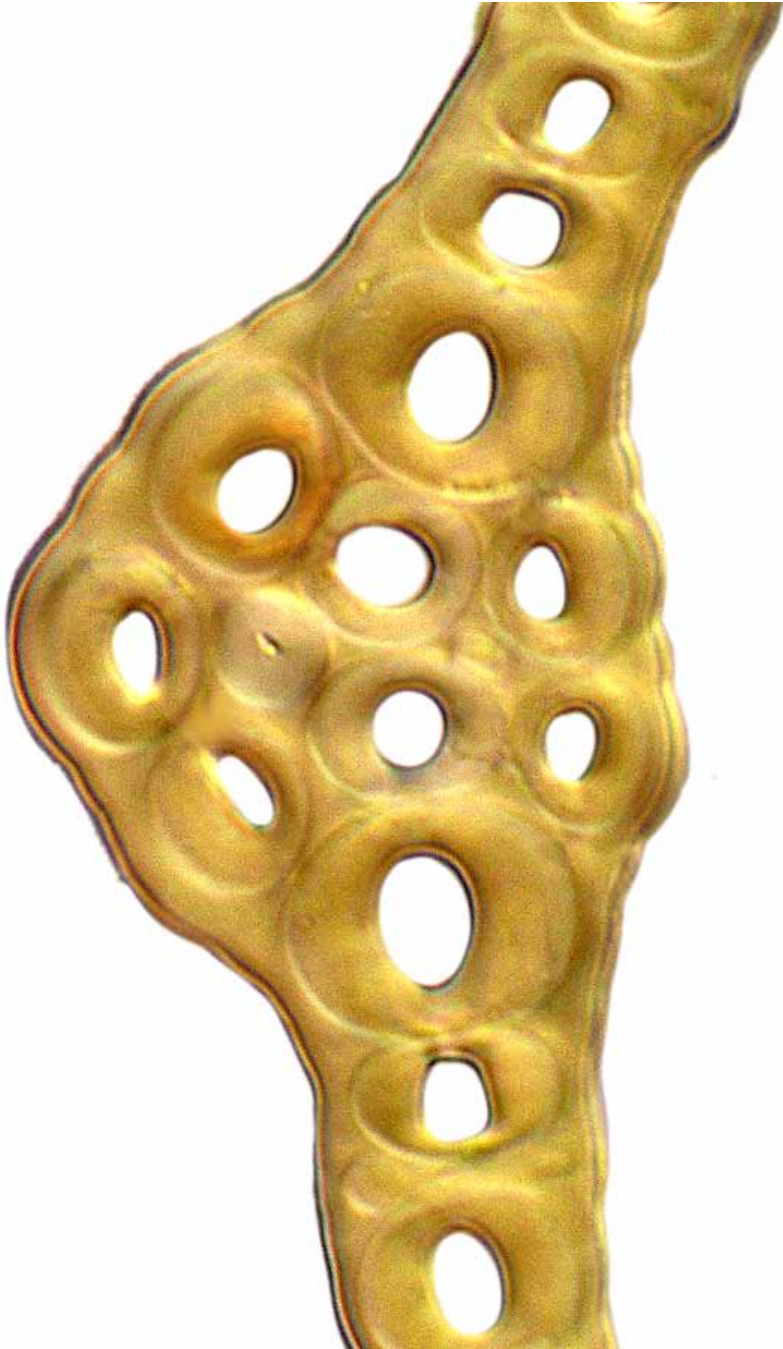
branch leaf margin at midleaf, toothed costa, and prorate leaf cells
 ■ 10 μm, ■ 10 μm, ■ 10 μm

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Hypnodendron spininervium subsp. *spininervium* seta and leaf cross-sections
50 μm (above), 10 μm (below)

continued next page



Hypnodendron spininervium subsp. *spininervium* costa cross-section
10 μ m

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Mniodendron colensoi (Hook.f. & Wilson) Besch.

form: primary stems creeping; secondary stems to 40 mm tall, tip branches whorled; stipes with dense red-brown tomentum; leaves green to golden

habitat: soil or rotting logs in shaded forest

leaf: size: 2.5–3.0 mm

shape: narrowly subulate from a triangular or cordate base

tip: subulate with widely spaced sharp teeth

base: basal angle cells wider and shorter than other lamina cells

costa: excurrent; densely covered with square crystals toward the base

border: not differentiated

margin: ± entire below, sharply lax-dentate above, plane

cells: 50–90 × 10 μm, linear, firm-walled, smooth

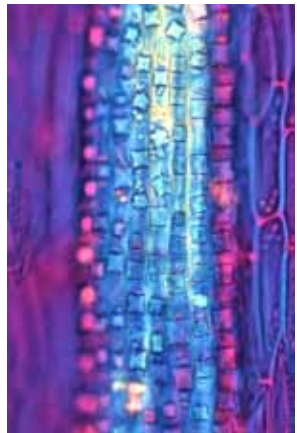
capsule: 3–5.5 mm, cylindric, horizontal to cernuous, grooved, exerted, brown; seta 20–60 mm, single; operulum long-rostrate; peristome double, well-developed, ciliate

note: recognized by the square birefringent crystals at the base of the costa



vegetative habit (moist), leaf outline, leaf apex (2), and margin upper leaf

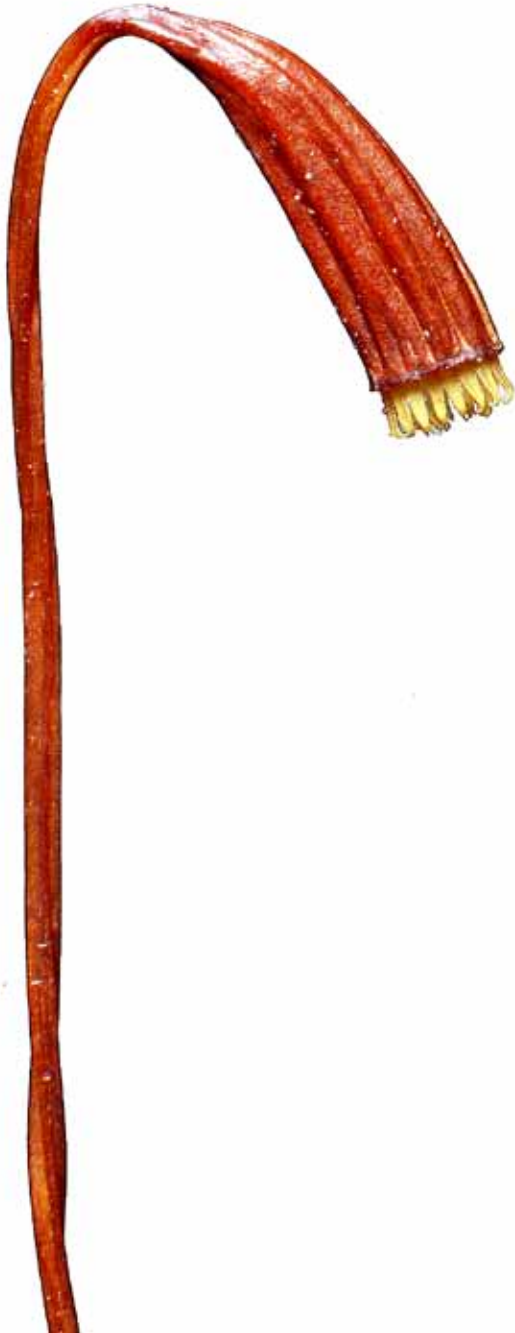
■ 5 mm, ■ 1 mm, ■ 50 μm, ■ 10 μm, ■ 10 μm



cells at midleaf, leaf basal angle, and square crystals at base of costa

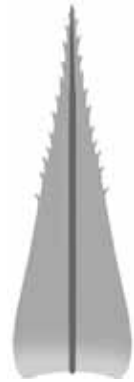
■ 10 μm, ■ 50 μm, ■ 10 μm

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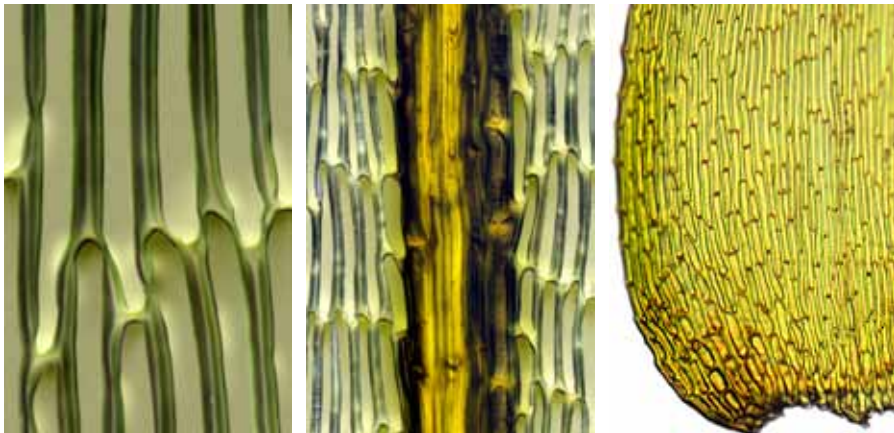


Mniodendron colensoi mature capsule
1 mm

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Mniodendron comatum (Müll.Hal.) Lindb.**form:** slender stems, to 80 mm tall, the branches curved and tapering**habitat:** soil, rotting logs, and rock in damp to wet forest and rainforest**leaf:** *size:* stem leaves 3×1.0 mm; branch leaves smaller*shape:* narrowly triangular*tip:* gradually acuminate, ending in a denticulate arista*base:* cells at the basal angles widened in several rows*costa:* narrow, excurrent*border:* unistratose throughout*margin:* variably and distantly toothed, plane*cells:* $50\text{--}100 \times 3\text{--}7$ μm , narrowly linear, firm-walled, smooth**capsule:** 3.5–5.0 mm, cylindric, horizontal to cernuous, deeply grooved
when mature, reddish; seta 30–60 mm, red, single to multiple; peristome
hypnoid, well-developed, ciliate**note:** differs from *M. comosum* in being less robust, having a unistratose
margin, a narrower costa, and curved and tapering branches

fertile shoot (dry), branch (dry), capsule, leaf outline, leaf apex, and margin midleaf
 ■ 5 mm, ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 50 μm , ■ 10 μm



cells at midleaf, costa at midleaf, and leaf basal angle
 ■ 10 μm , ■ 10 μm , ■ 50 μm

Mniodendron comosum (Labill.) Mitt. var. **comosum**

form: primary stems creeping, secondary stems 40–80 mm tall, umbrella-shaped, heavily tomentose below, the branches straight, not tapering

habitat: soil, rotting logs, and rock in damp to wet forest and rainforest

leaf: *size:* stem leaves 3×1.0 mm; branch leaves $2.2\text{--}2.5 \times 0.7\text{--}0.8$ mm

shape: narrowly subulate from a triangular or cordate base, \pm plicate

tip: a smooth to denticulate subula or arista

base: cells at the basal angles widened in several rows

costa: stout, excurrent, sometimes toothed adaxially near the leaf apex

border: variably bistratose, the cells shorter and wider in 2–3 rows

margin: variably toothed, plane

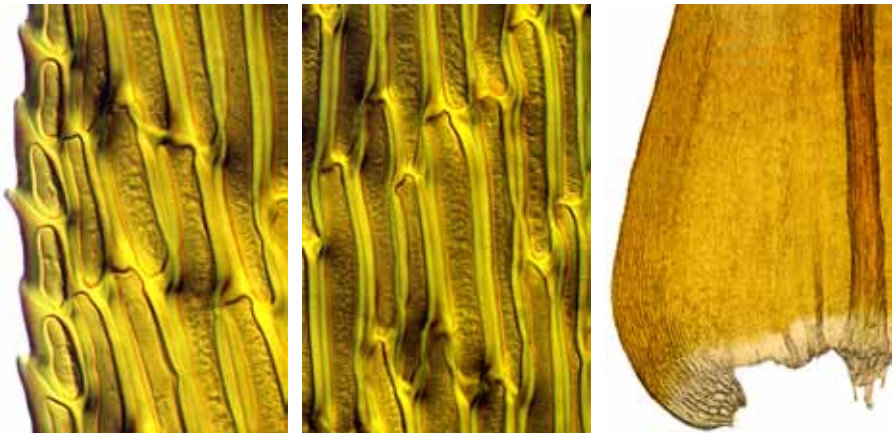
cells: $50\text{--}100 \times 3\text{--}7$ μm , narrowly linear, firm-walled, smooth

capsule: 3.5–5.0 mm, cylindric, horizontal to cernuous, deeply grooved, reddish; seta 30–60 mm, red, single to multiple

note: var. *sieberi* differs in being larger and having a wider costa and more strongly toothed leaves

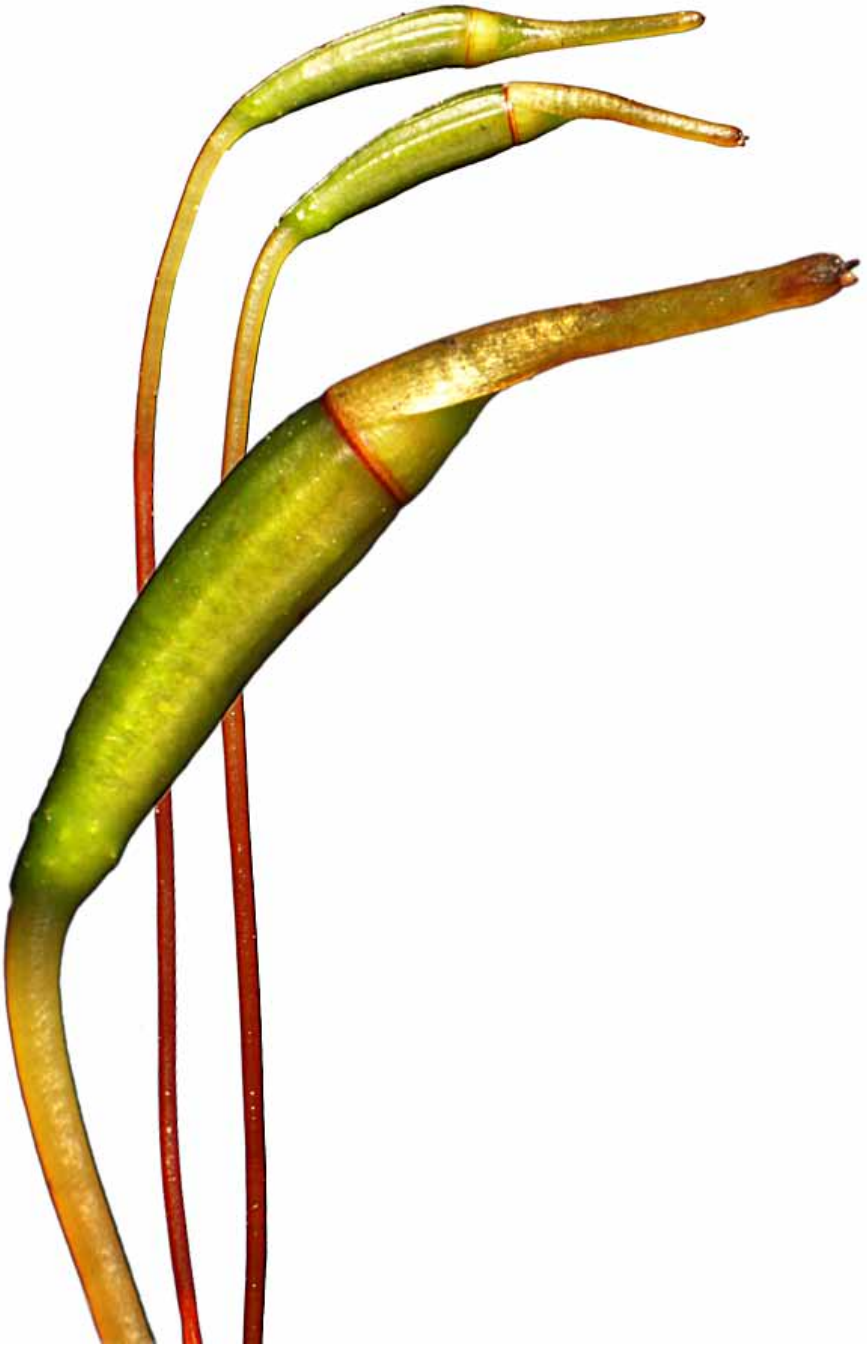


fertile shoot, stipe, mature capsule, leaf outline, leaf apex, and margin midleaf
 ■ 5 mm, ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 5 μm , ■ 10 μm



margin at midleaf, cells at midleaf, and leaf basal angle
 ■ 5 μm , ■ 5 μm , ■ 0.1 mm

continued next page



Mniodendron comosum var. *comosum* capsules and calyptrae
■ 1 mm (above), ■ 1 mm (below)

continued next page



Mniodendron comosum var. *comosum* margin midleaf
10 μ m

continued next page

Mniodendron comosum var. **sieberi** (Müll.Hal.) Touw

form: primary stem creeping, secondary branches 30–60 mm tall, dendroid
habitat: constantly moist soil and rock in forest

leaf: *size:* stipe: 3 mm; branch: 2.2–2.5 mm; *KOH reaction* red

shape: stipe: lanceolate; branch: triangular-lanceolate

tip: stipe: denticulate arista; branch: laxly denticulate subula

base: basal cells shorter and wider than the other lamina cells

costa: excurrent in the arista

border: not differentiated

margin: entire below, coarsely serrate in the upper third, plane

cells: 50–100 × 3–7 μm, linear, firm-walled, prorse at the distal end

capsule: 3.5–5.0 mm, cylindric, horizontal to cernuous, long-exserted, brown; operculum long-rostrate; seta 30–60 mm, red; peristome double, exostome teeth hyaline-margined, striolate, lamellate; basal membrane half the height of the teeth, cilia 2–4

note: the var. *comosum* leaf is smaller, narrow-costate, and weakly toothed

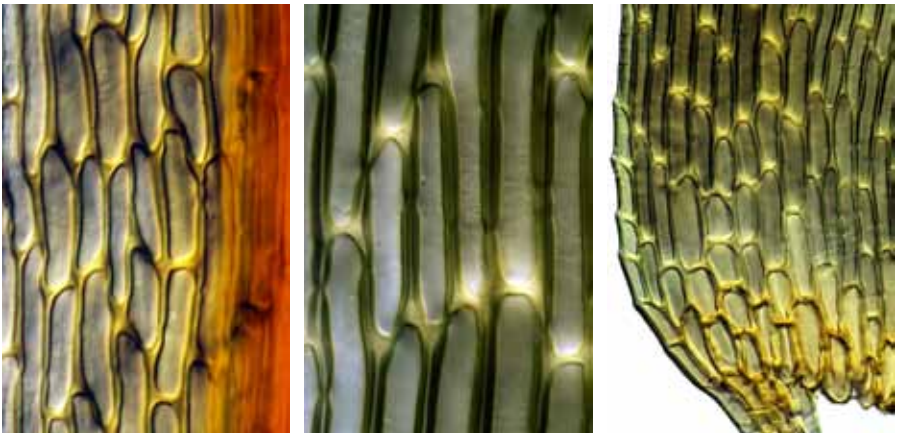


branch leaf



vegetative shoot (dry), branch leaf outline, apex (2), and margin midleaf

10 mm, 0.5 mm, 100 μm, 50 μm, 10 μm



costa at midleaf, cells of lower branch leaf, and branch leaf basal angle

10 μm, 10 μm, 10 μm

continued next page



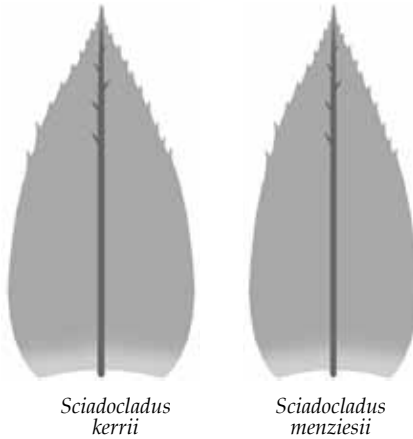
Mniodendron comosum var. *sieberi* branch leaf margin
10 μ m

Key* to the New Zealand species of *Sciadocladus* (2)

- 1 Setae numerous per stem; capsule 2.0–2.5 mm long, asymmetrical..... ● ***Sciadocladus kerrii***

 1: Setae 1–few per stem; capsule 2.5–3.0 mm long, symmetrical..... ● ***Sciadocladus menziesii***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 342.

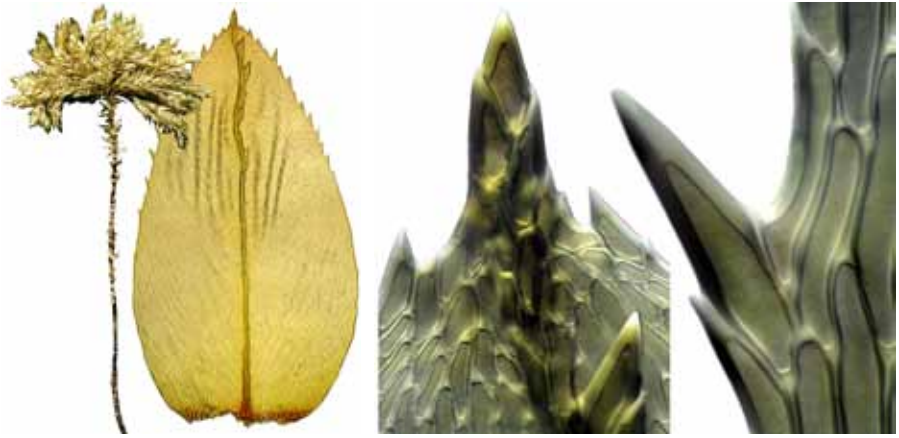
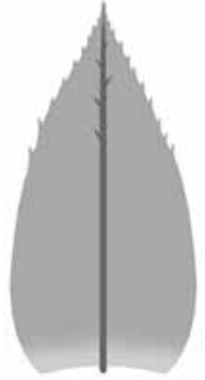


Sciadocladus kerrii (Mitt.) Broth.

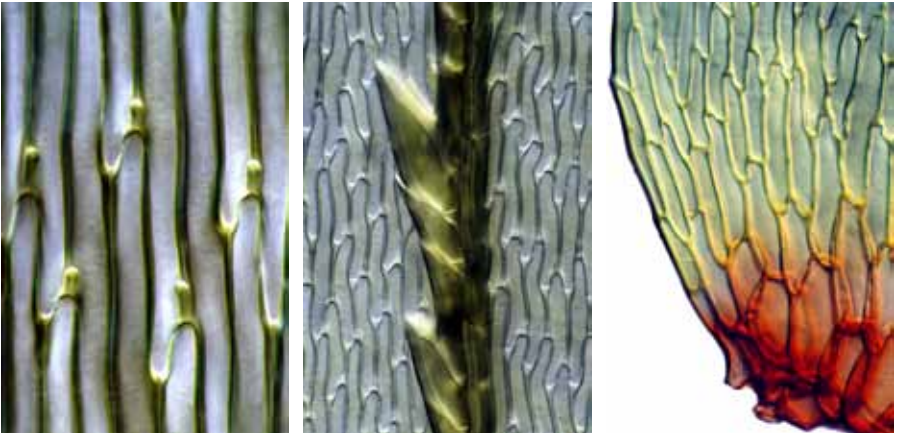
form: primary stems creeping, secondary stems 60–120 mm tall, erect, black, sparingly squarrose-foliate; frond branches in 1(–3) whorls
habitat: soil, damp rotting logs, or rock

leaf: *size:* stem leaves: 2.5–3 mm; branch leaves: 2–2.3 mm
shape: stem leaves: ovate-cordate; branch leaves: ovate, concave
tip: stem leaves: long-acuminate to piliferous; branch leaves: acute
base: basal cells little differentiated
costa: stem and branch leaves: failing below the acumen or percurrent
border: not differentiated
margin: finely denticulate above, ± entire below, plane
cells: 60–100 × 5–8 μm, narrowly linear, firm-walled, prorose

capsule: 2–2.5 mm, ovoid to oblong, horizontal to cernuous, exserted, brown; seta 15–35 mm, multiple (to 18), red, flexuose; teeth of the exostome yellow, joined at their bases; operculum conic and short-rostrate; peristome double, well-developed, endostome cilia 3–4

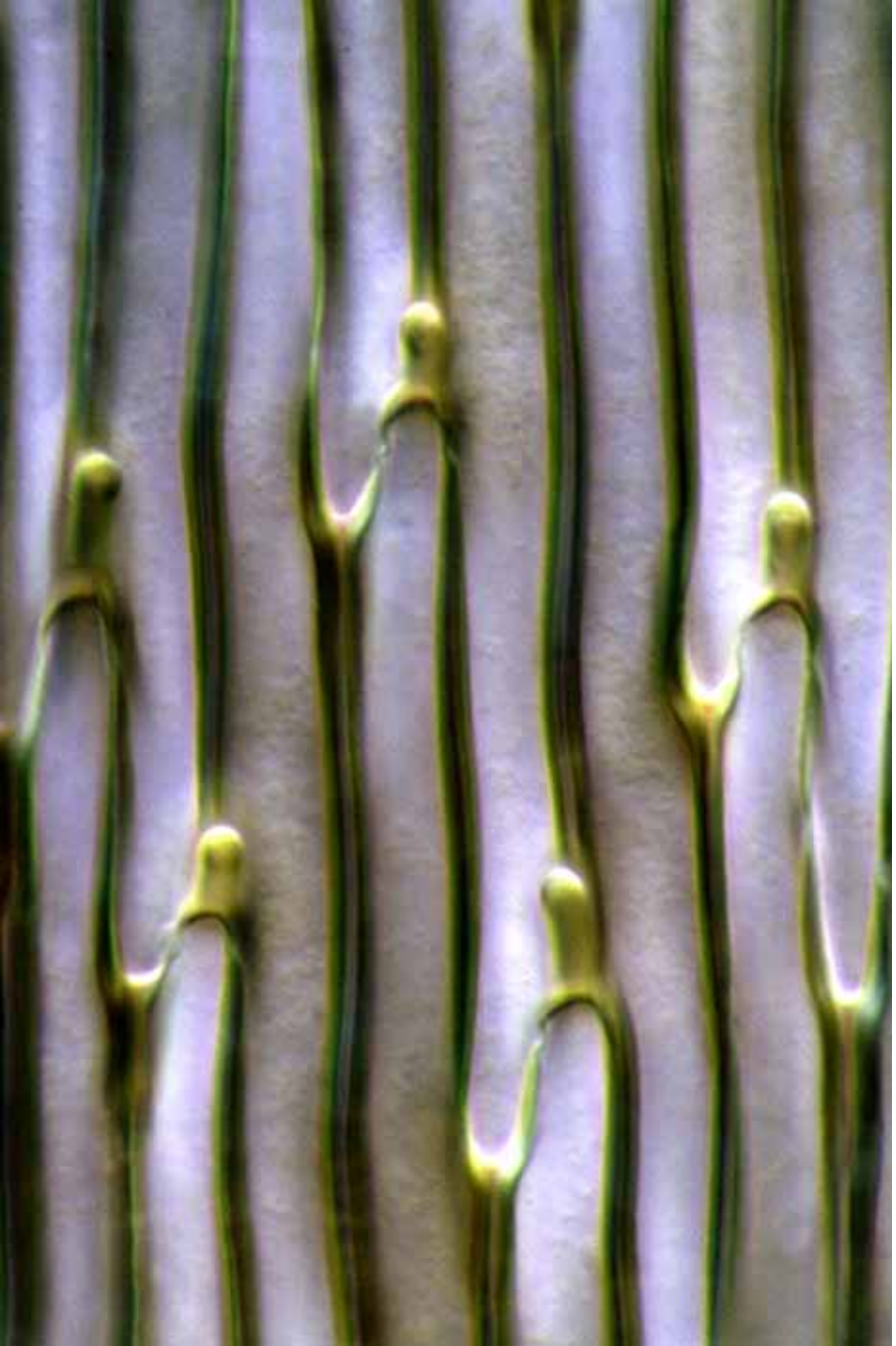


vegetative frond (dry), leaf outline, leaf apex, and spinose margin upper leaf
 — 5 mm, — 1 mm, — 10 μm, — 10 μm



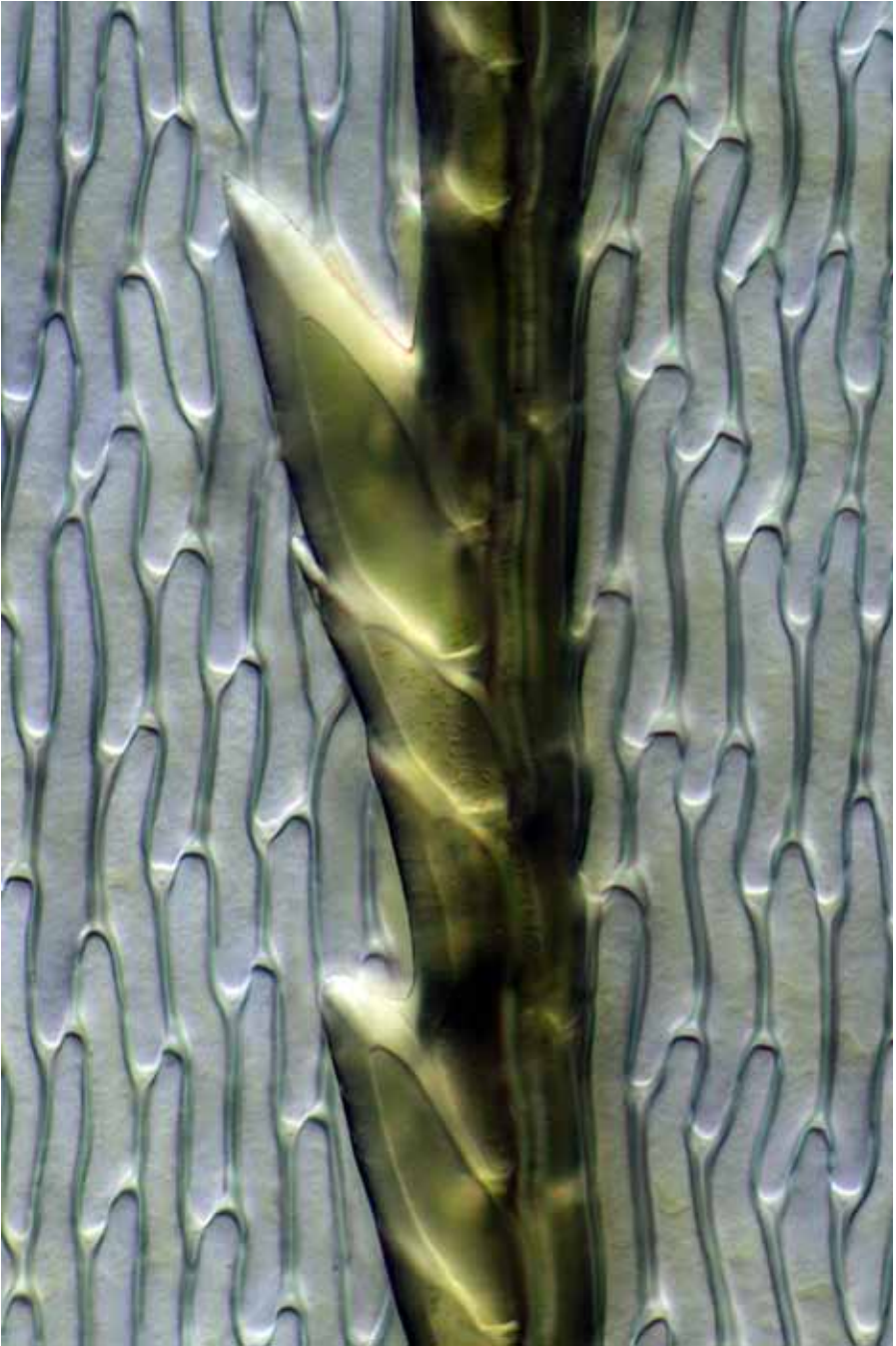
prorose cells at midleaf, spinose upper costa, and leaf basal angle
 — 10 μm, — 10 μm, — 10 μm

continued next page



Sciadocladus kerrii strongly prorse cells midleaf
10 μm

continued next page



Sciaocladus kerrii spinose upper costa
10 μ m

continued next page

Sciadocladus menziesii (Hook.) Broth.

form: primary stems creeping, secondary stems 60–120 mm tall, with 1–2 terminal whorls; stipes black, not tomentose; leaves green to golden

habitat: damp rock, soil, or rotting logs in shaded forest

leaf: size: 2.5–3.0 mm

shape: narrowly ovate

tip: acute, ending in a sharp excurrent costa

base: basal angle cells wider and shorter than other lamina cells

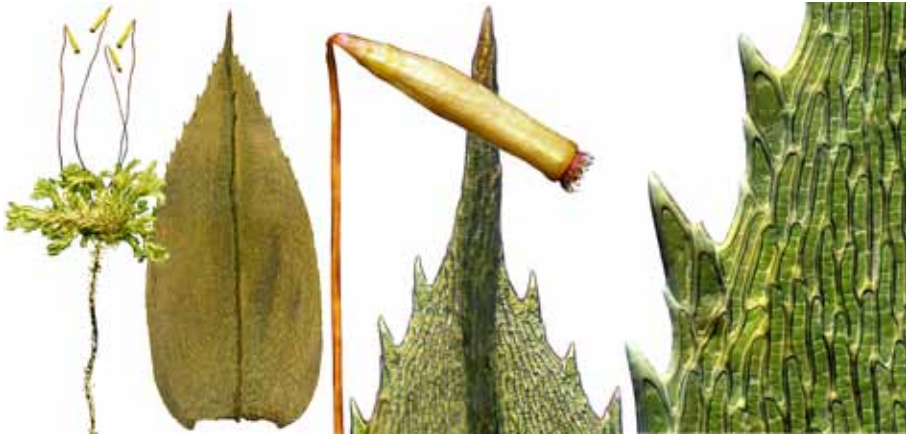
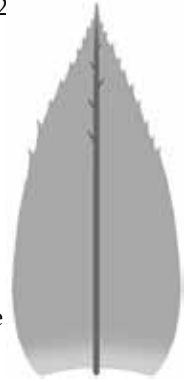
costa: excurrent

border: not differentiated

margin: ± entire below, sharply dentate above, plane

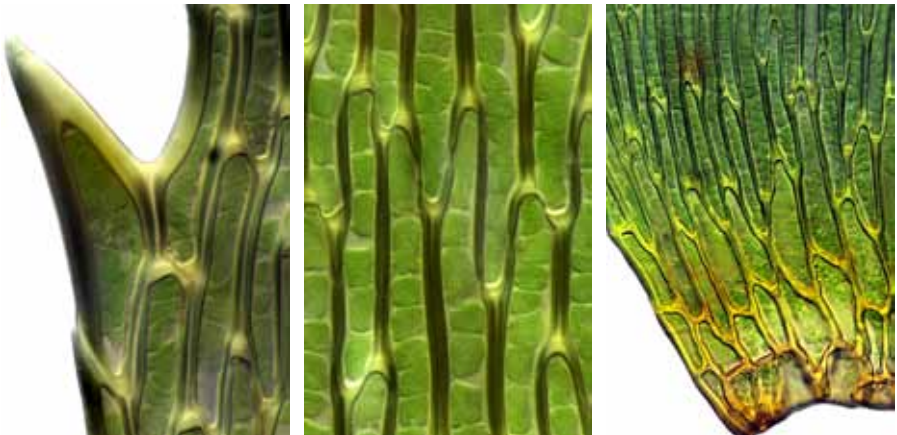
cells: 50–90 × 5–10 μm, linear, firm-walled, ± prorate

capsule: 4–7 mm, cylindrical, horizontal to cernuous, exserted, brown, smooth; seta 60–70 mm, up to 5; operculum curved-rostrate; peristome yellow, endostome cilia 3–4, nodulose; spores 16–18 μm in diam.



fertile shoot (dry), leaf outline, mature capsule, leaf apex, and margin midleaf

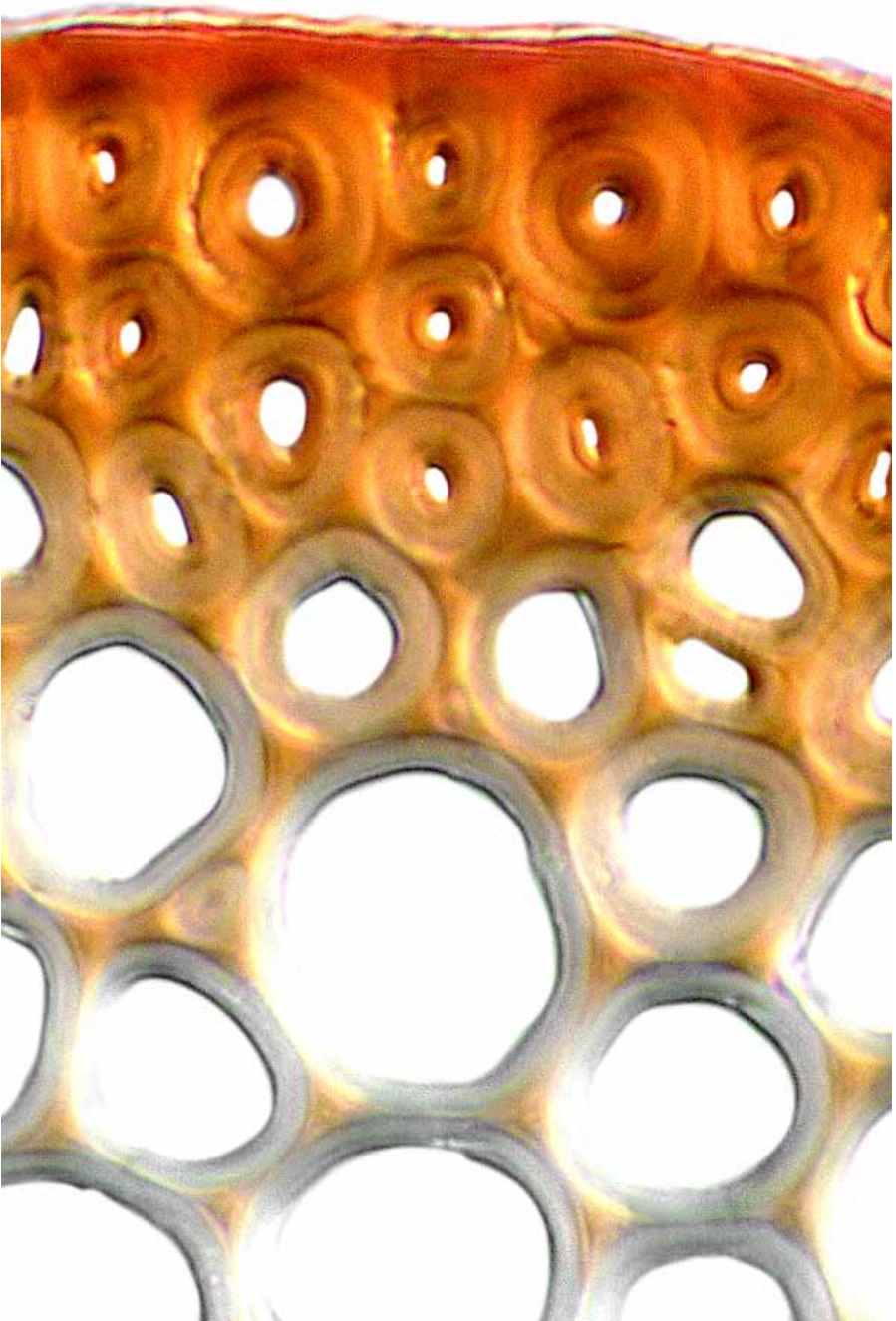
10 mm, 0.5 mm, 0.5 mm, 50 μm, 50 μm



marginal tooth, cells at midleaf, and leaf basal angle

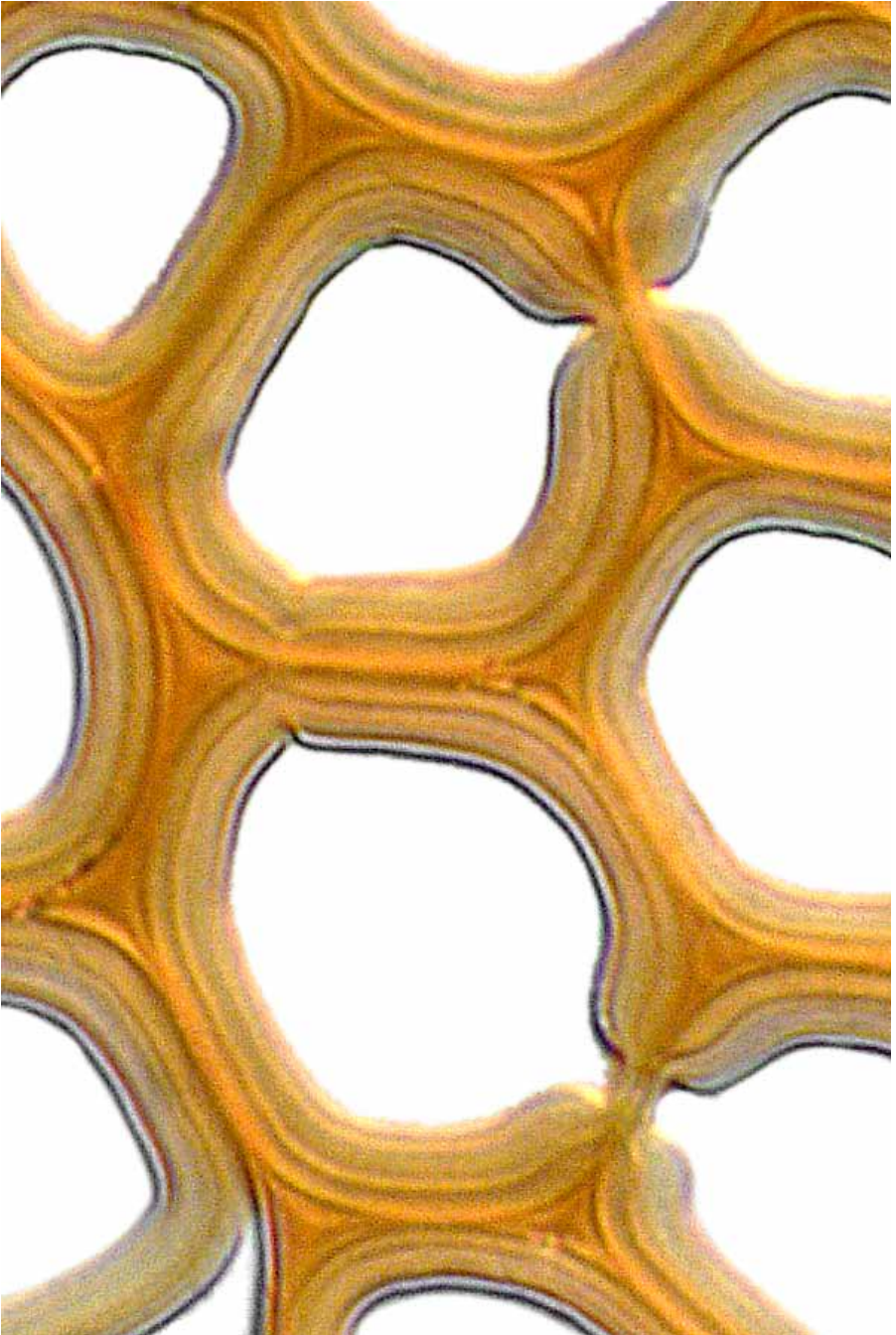
10 μm, 10 μm, 10 μm

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Sciadocladus menziesii stem cross-section
10 μ m

continued next page



Sciadocladus menziesii porose cells in stem cross-section
10 μm

continued next page



Sciadocladus menziesii leaf cross-sections
10 μ m

Cladomnion ericoides (Hook.) Hook.f. & Wilson

form: primary stems creeping, radiculose, secondary stems \pm pendent, flexuose, irregularly branched, with few paraphyllia, 40–120 mm, golden, glossy
habitat: bark in canopy of wet forests, to 1200 m

leaf: size: 3–3.2 \times 1.5–1.7 mm

shape: secondary leaves ovate or elliptic, plicate

tip: bluntly acuminate, the apex strongly reflexed

base: clasping, small auricles of red, quadrate cells

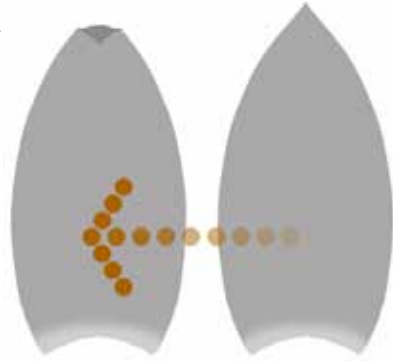
costa: none or short and double

border: not differentiated

margin: toothed below, crenulate above, plane

cells: 30–45 \times 5–6 μ m, linear, incrassate, porose

capsule: 2.5–3 mm, elliptic, ribbed, not necked; seta 5–13 mm; calyptra covering capsule; peristome double; spores multicellular, green, 80–150 μ m

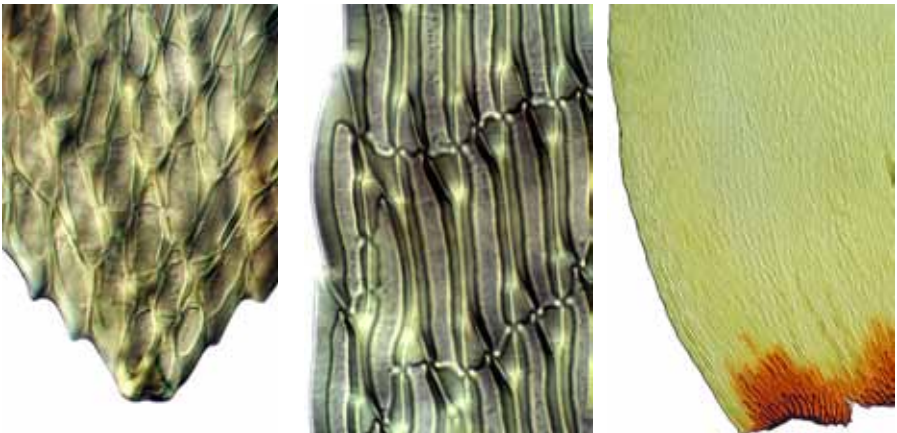


coverslipped



fertile shoot, capsule, reflexed leaf tips (dry) (2), and leaf outline

5 mm, 1 mm, 1 mm, 1 mm, 1 mm



leaf tip (reflexed), margin at midleaf, and leaf basal angle

10 μ m, 10 μ m, 100 μ m

continued next page



Cladomnion ericoides immature capsules, calyptra, exostome tooth, mature capsule
 1 mm (2), 50 μ m, 1 mm

continued next page



Cladomnion ericoides leaf cross-section

50 μm (background),

10 μm (foreground)

Dichelodontium nitidum (Hook.f. & Wilson) Broth.

form: mats of pinnately branched stems, to 40 mm, the leaves imbricate, glossy, pale yellow-green

habitat: smooth bark in damp forest, to 900 m

leaf: size: 0.9–1.2 × 0.3–0.4 mm

shape: elliptic, cochleariform, stem and branch similar

tip: rounded, retuse; apical cells markedly shorter

base: alar cells 6–8, irregular, pigmented

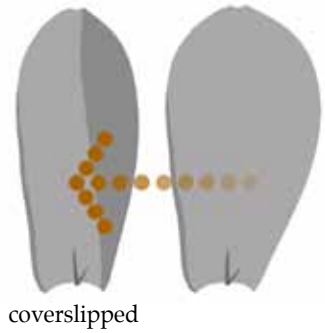
costa: absent or short and double

border: not differentiated

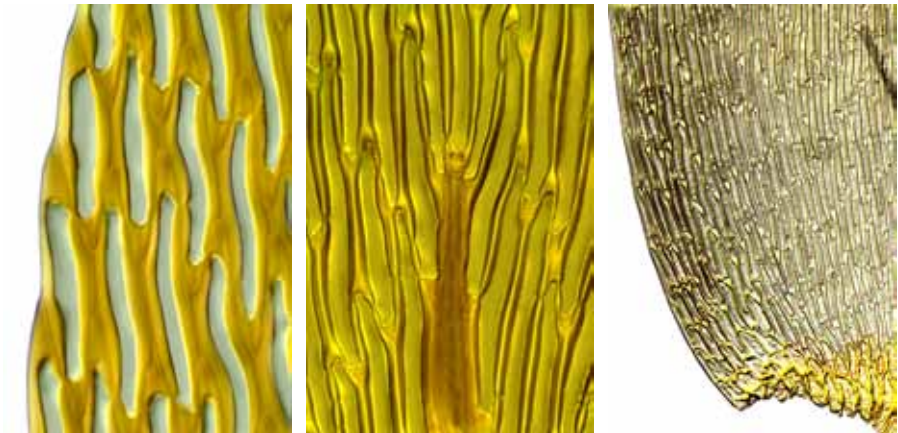
margin: entire, plane or slightly reflexed at the base

cells: 40–50 × 3–4 μm, linear, incrassate, smooth

capsule: 1.3–2 mm, oval-oblong or cylindric, symmetric, erect, 8-ribbed, dark reddish brown; seta 4–6 mm; stomata superficial; peristome endostome only; spores 18–33 μm long, oval, papillose



vegetative shoot (moist) (2), capsule, leaf outline (coverslipped), and retuse apex
 1 mm, 1 mm, 0.5 mm, 0.5 mm, 10 μm



margin at midleaf, costa terminus near leaf base, and leaf basal angle
 10 μm, 10 μm, 50 μm

Glypbothecium sciuroides (Hook.) Hampe

form: wefts of pendent, radiculose, branched stems with upturned tips, 20–40(–80) mm, the leaves glossy, yellow; gemmae 5–8-celled, to 150 μm

habitat: bark or rarely rock in damp forest, to 1100 m

leaf: size: 2–3 \times 0.8–1.2 mm

shape: ovate-lanceolate, slightly concave

tip: gradually acuminate, usually twisted (torquate)

base: dark and well-defined alar region

costa: faint, short and double

border: not differentiated

margin: denticulate above, widely reflexed at the base

cells: 30–40 \times 10 μm , mostly rhombic, incrassate, porose, smooth

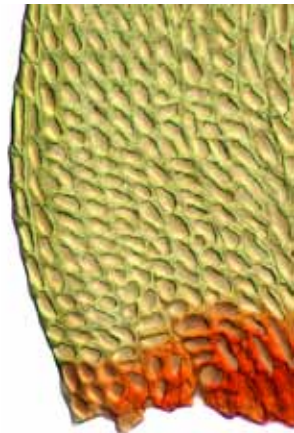
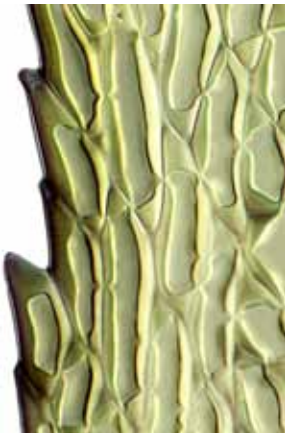
capsule: 1.5–2 mm, ellipsoid, short-necked, erect, exserted, ribbed when dry; seta 5 mm, reddish; operculum beaked; calyptra cucullate; peristome double, endostome rudimentary; spores 15–30 μm in diam.

note: vegetative reproduction by axillary brood bodies



shoots (3), mature capsule, leaf outline, leaf apex, and propagule

■ 5 mm, ■ 1 mm, ■ 1 mm, ■ 0.2 mm, ■ 0.5 mm, ■ 10 μm , ■ 10 μm



denticulate margin at midleaf, cells at midleaf, and leaf basal angle

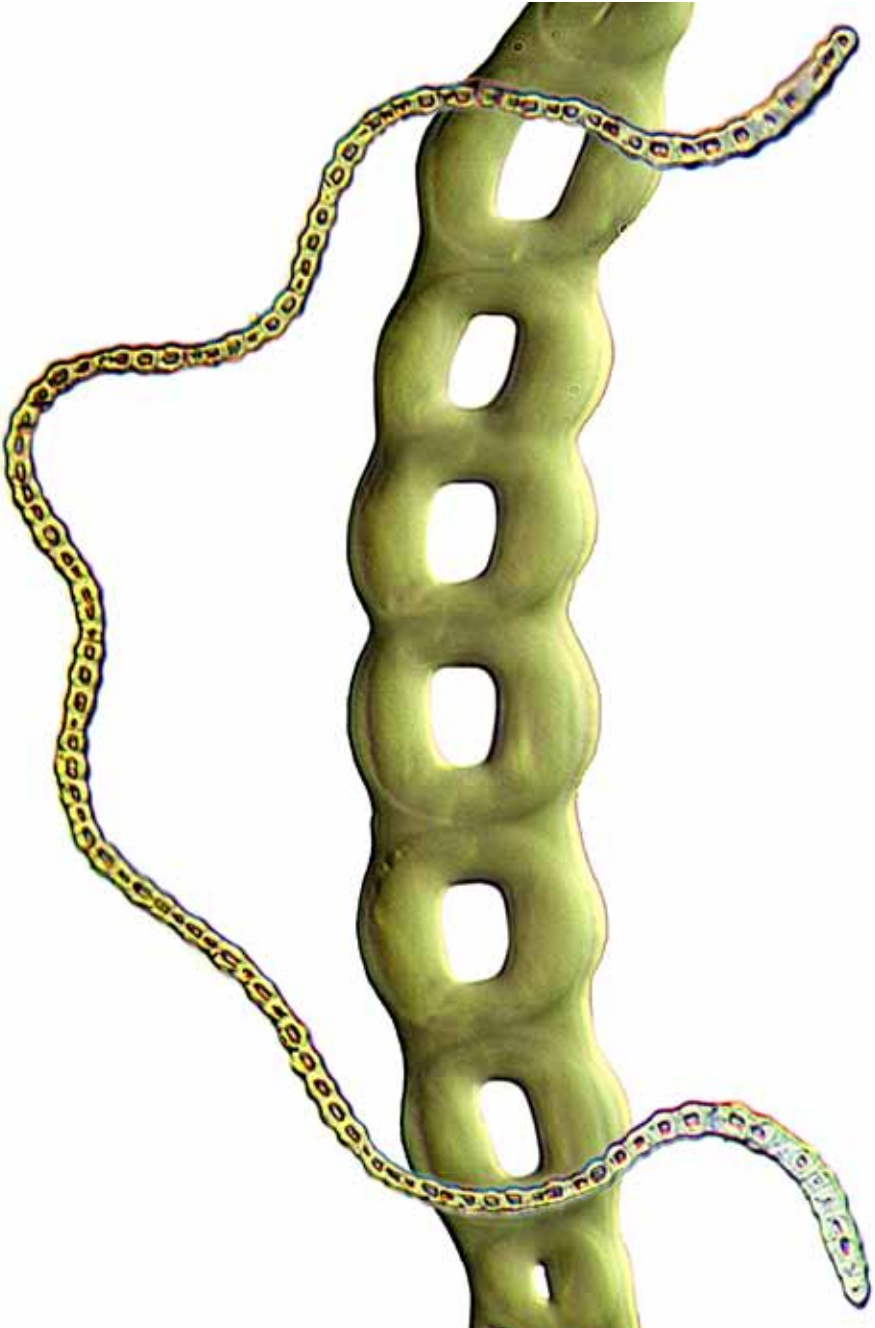
■ 10 μm , ■ 10 μm , ■ 50 μm

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Glyphothecium sciuroides denticulate midleaf margin
10 μ m

continued next page



Glyphthecium sciuiroides leaf cross-sections

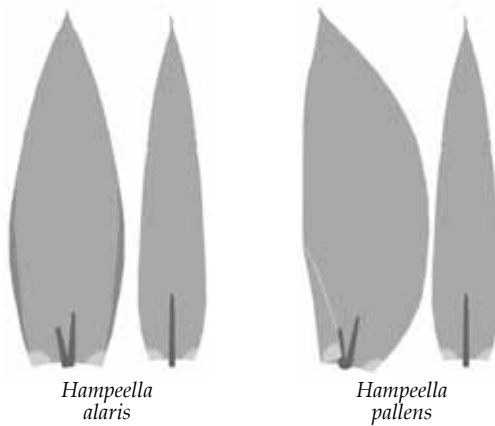
10 μm (background),

50 μm (foreground)

Key* to the New Zealand species of *Hampeella* (2)

- 1 Lower leaves symmetric ● ***Hampeella alaris***
 1: Lower leaves asymmetric ● ***Hampeella pallens***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 342.



Hampeella alaris (Dixon & Sainsbury) Sainsbury

form: tufts of creeping, radiculose stems; secondary stems irregularly branched, 20–30 mm, the leaves yellowish

habitat: bark in damp forest

leaf: size: 1.5–2.2 × 0.4–0.7 mm

shape: lower leaves oblong-oval, concave; upper leaves narrower

tip: lower leaves cuspidate; upper leaves acuminate

base: basal cells subquadrate, incrassate, pigmented, in auricles

costa: none or short and double

border: not differentiated

margin: entire to sharply denticulate, plane or recurved below

cells: 60–80 × 5–8 μm, linear-rhombic, firm-walled, smooth, orange at the insertion

capsule: 2 mm, oblong, necked, erect, strongly 8-ribbed, brown; seta 4–5 mm, ± flexuose

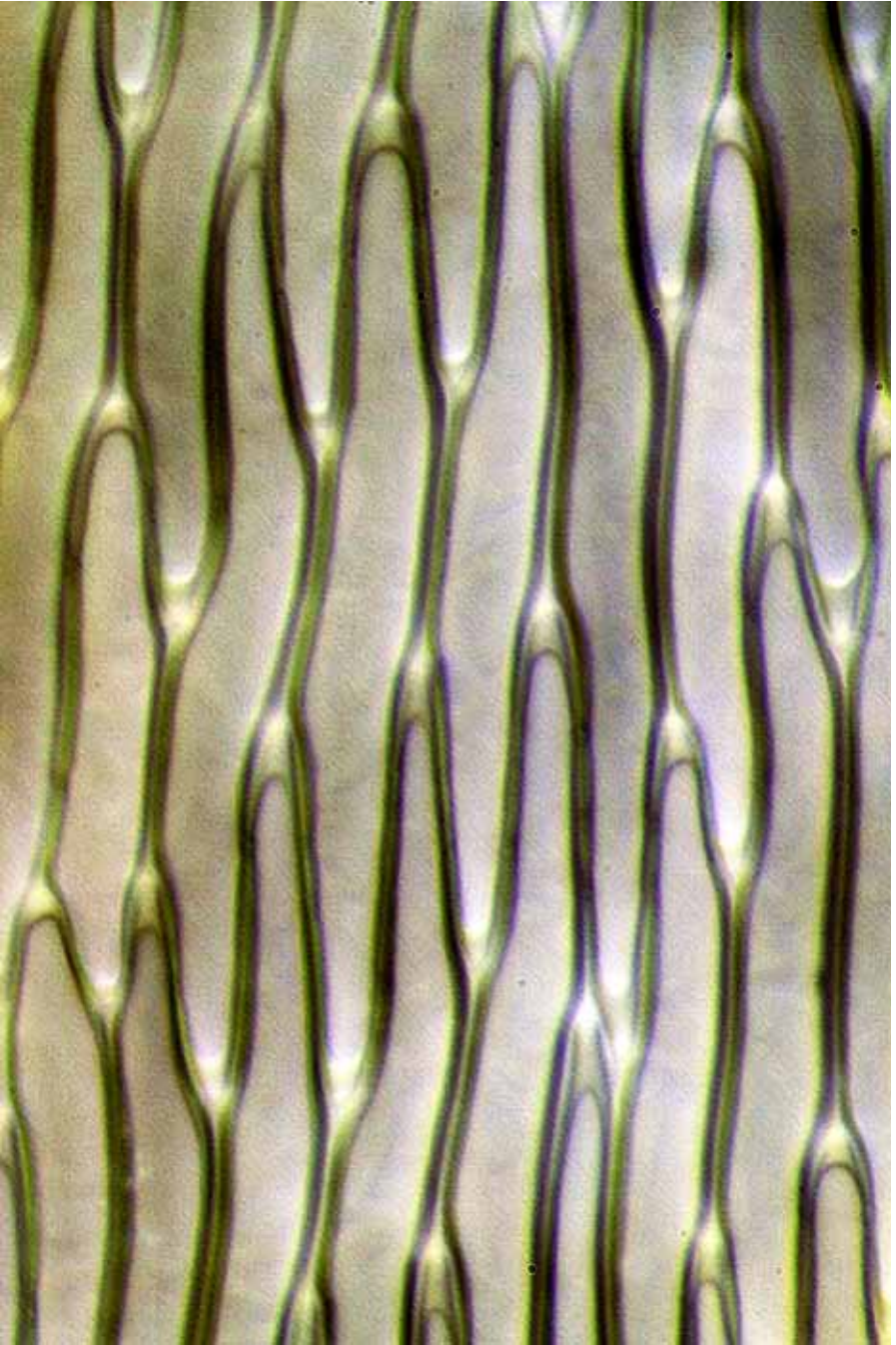
note: *Hampeella pallens* differs in having asymmetric lower leaves



fertile shoot, mature capsule, vegetative shoots, lower and upper leaf outlines, leaf apex
 ■ 1 mm, ■ 0.5 mm, ■ 1 mm, ■ 1 mm, ■ 0.1 mm (2), ■ 100 μm



leaf apex, margin at midleaf, and costa at midleaf
 ■ 10 μm, ■ 10 μm, ■ 10 μm



Hampeella alaris midleaf cells
10 μ m

continued next page

Hampeella pallens (Dixon & Sainsbury) Sainsbury

form: mats of creeping, radiculose stems; secondary stems to 20 mm

habitat: bark in damp forest

leaf: size: to 2 mm

shape: lower leaves ovate-lanceolate, strongly asymmetric; upper leaves narrowly lanceolate, symmetric, \pm decurrent, rugose

tip: acute

base: angle cells sometimes coloured and thick-walled

costa: faint, short, single or double

border: not differentiated

margin: serrulate, plane

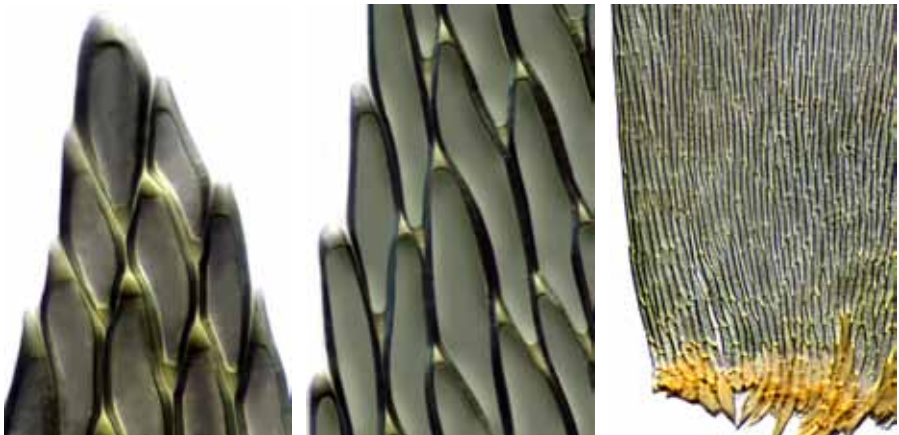
cells: 70–100 \times 10–14 μm , linear-rhombic, firm-walled, smooth

capsule: 2–2.5 mm, oblong to cylindric, suberect, sharply 8-ribbed when dry, exserted; operculum obliquely long-rostrate; annulus none; seta 6–9 mm, lateral, curved, reddish or yellow; exostome teeth hyaline-margined, endostome ecliate; spores 14–32 μm in diam., irregular



vegetative shoot (2) (dry), capsule (dry), lower leaf outline, and lower leaf apex

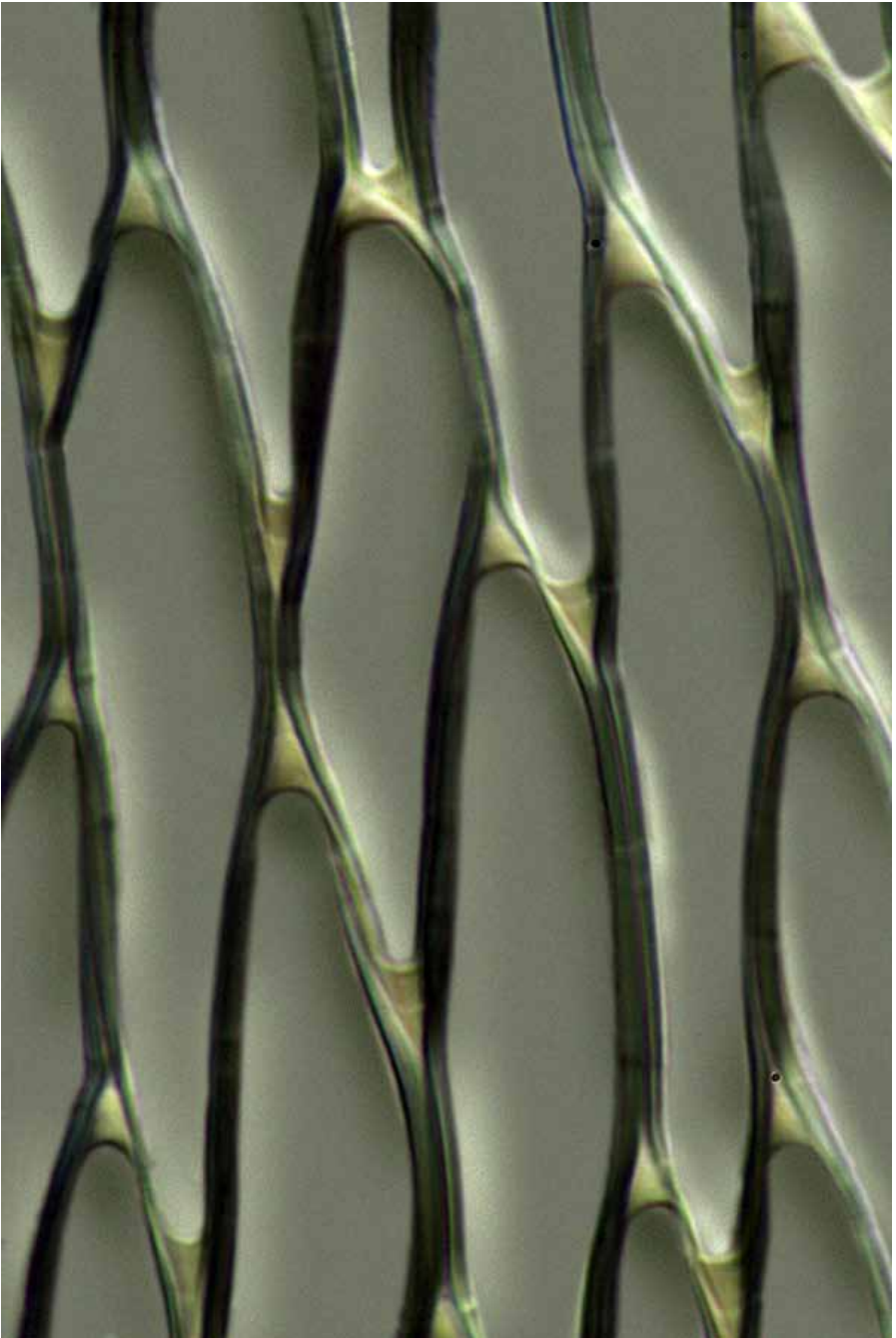
■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 50 μm



apex of lower leaf, margin of upper leaf, and lower leaf basal angle

■ 10 μm , ■ 10 μm , ■ 50 μm

continued next page



Hampeella pallens cells of upper lateral leaf
10 μm

Key* to the New Zealand species of Ptychomnion (2)

- 1 Cell walls narrower than the lumen; leaf apex abruptly elongate with few to many large sharp teeth; sheathing leaf bases rarely overlapping .. ● **Ptychomnion aciculare**
 1: Cell walls wider than the lumen; leaf apex short-acute or -acuminate with marginal serrations; sheathing leaf bases often overlapping ● **Ptychomnion densifolium**

* based on Seppelt, RD (1994): *The Moss Flora of Macquarie Island*. Australian Antarctic Division, Kingston, 238.



*Ptychomnion
aciculare*



*Ptychomnion
densifolium*

Ptychomnion aciculare (Brid.) Mitt.

form: mats of creeping, branched stems, to 100 mm, the leaves golden, papery, translucent, glossy

habitat: soil, bark, and rock in damp beech forest, to 1100 m

leaf: size: 3–5 × 1.2–2.0 mm

shape: ovate from a narrow plicate base, papery, rugose when dry

tip: abruptly long-acuminate, the acumen tooth twisted (torquate)

base: several marginal rows with short, coloured cells

costa: none or faint and double

border: weak, 3–4 rows of enlarged cells

margin: denticulate above, coarsely serrate in the acumen, plane

cells: 30–50 × 7–10 μm, linear, incrassate, porose, smooth

capsule: 3–4 mm, cylindric, deeply grooved when dry, horizontal to cernuous; seta 25–40 mm, slender, flexuose, brown; peristome double, exostome teeth cross-striolate below, papillose above; endostome cilia 2–3; spores 8–12 μm in diam., pale, smooth



habit, vegetative shoot (fully hydrated on right) (2), leaf outline, and leaf acumen
 10 mm, 5 mm (2), 1 mm, 50 μm



margin at midleaf, cells at midleaf, and double peristome
 50 μm, 50 μm, 0.5 mm

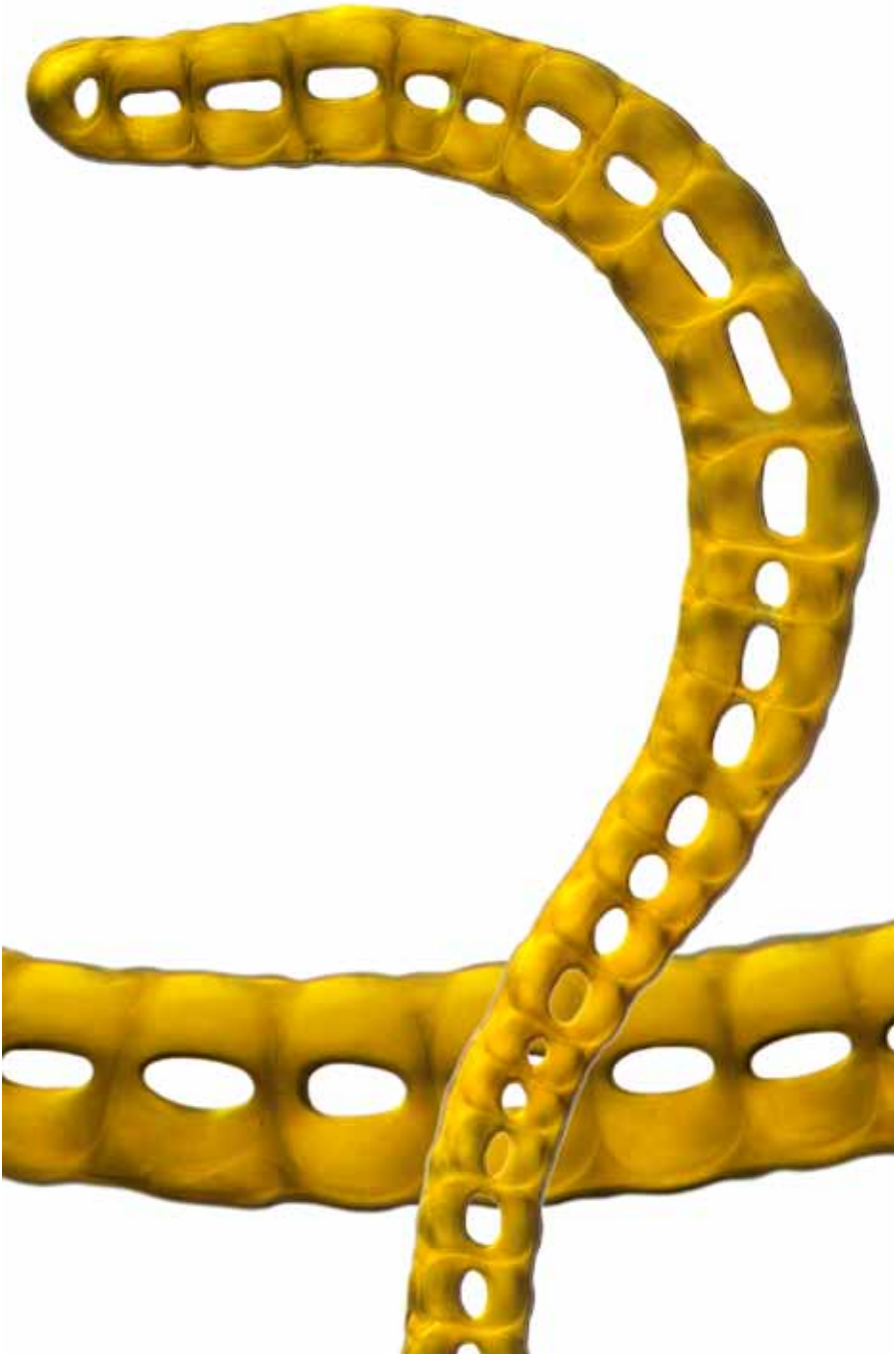
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Ptychomnion aciculare vegetative shoots (dry on left, fully hydrated on right)

1 mm

continued next page



Ptychomnion aciculare cross-section of leaf margin (above) and lamina midleaf (below)
10 μm (above), 10 μm (below)

continued next page

Ptychomnion densifolium (Brid.) A.Jaeger

form: mats of procumbent, creeping, branched stems, 40–100 mm,
leaves papery, translucent, glossy, crumpled, little changed when dry
habitat: soil or rotting logs in grassland or scrub, to 1400 m

leaf: size: 3.5–4.2 × 1.6–2.0 mm

shape: ovate from a plicate, sheathing base

tip: abruptly acuminate, the tip toothed and twisted (torquate)

base: not differentiated; insertion area ± pigmented

costa: none or faint and double

border: not differentiated

margin: denticulate above, ± serrate in the acumen, plane

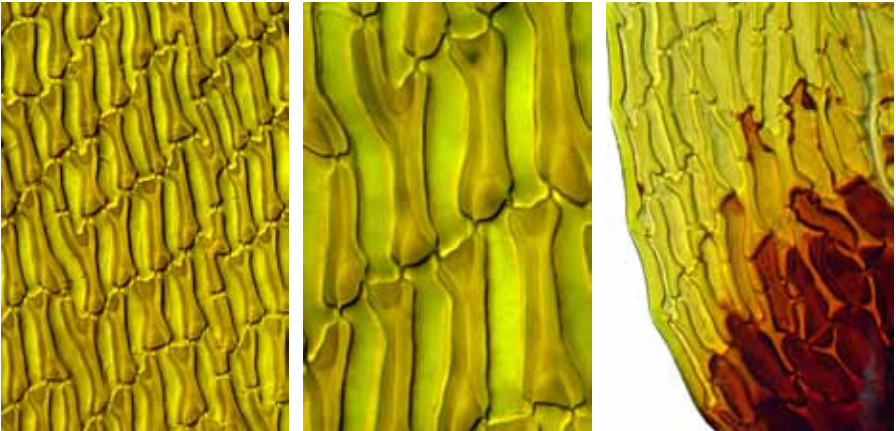
cells: 45–60 × 8–12 μm, rectangular to linear, porose, incassate, smooth

capsule: 3.5 mm, oblong-cylindric, gibbous, exserted, ± horizontal,
brown, deeply grooved when dry; hypophysis strumose; seta to 25
mm; operculum long-rostrate; peristome double, exostome teeth red,
endostome hyaline



vegetative shoot (dry), leaf outline, leaf apex, and margin midleaf

■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 50 μm, ■ 10 μm



cells at midleaf (2), and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 10 μm

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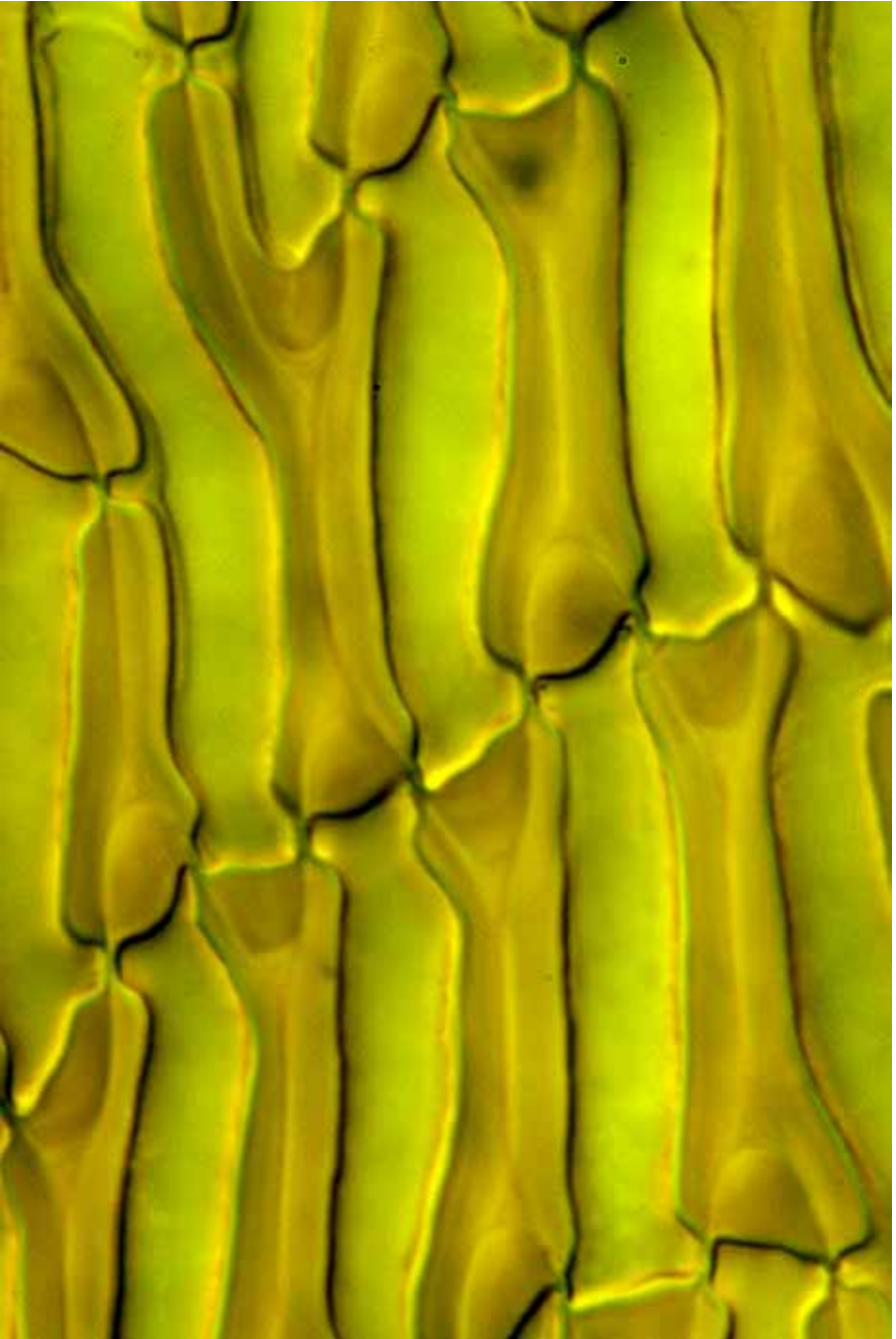
Ptychomnion densifolium vegetative shoot (dry)
1 mm

continued next page



Ptychomnion densifolium margin midleaf
10 μ m

continued next page



Ptychomnion densifolium cells midleaf
10 μm

Tetraphidopsis pusilla (Hook.f. & Wilson) Dixon

form: tufts of erect, unbranched, radiculose stems, 5–40 mm, the leaves glossy, yellowish, 5-ranked; gemmae often clustered on tips of shoots

habitat: bark of twigs or vines, near streams in damp forest, to 760 m

leaf: size: 0.8–1.5 × 0.3–0.4 mm

shape: lanceolate

tip: acute

base: alar cells ± quadrate, pigmented

costa: short, obscure

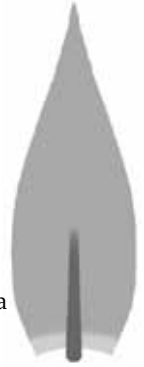
border: not differentiated

margin: entire below, crenulate above, plane or narrowly reflexed

cells: 25–40 × 7–9 μm, rhombic-hexagonal, firm-walled, smooth

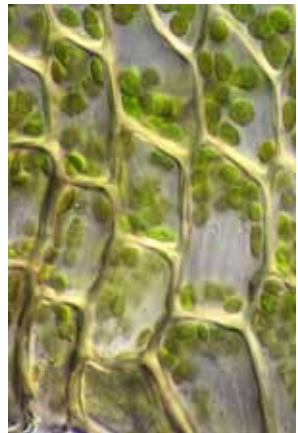
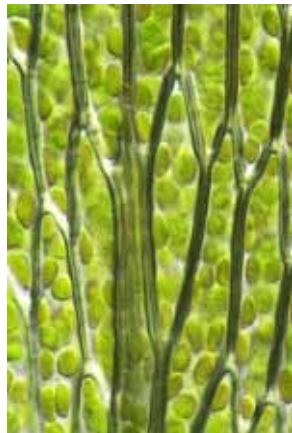
capsule: 1 mm, narrowly elliptic, erect, symmetrical, strongly 8-ribbed; seta 3 mm, reddish; peristome double; spores dimorphic, 30–45 μm in diam.

note: some stems gemmiferous, with a terminal globose cluster of 5-celled filamentous brood bodies



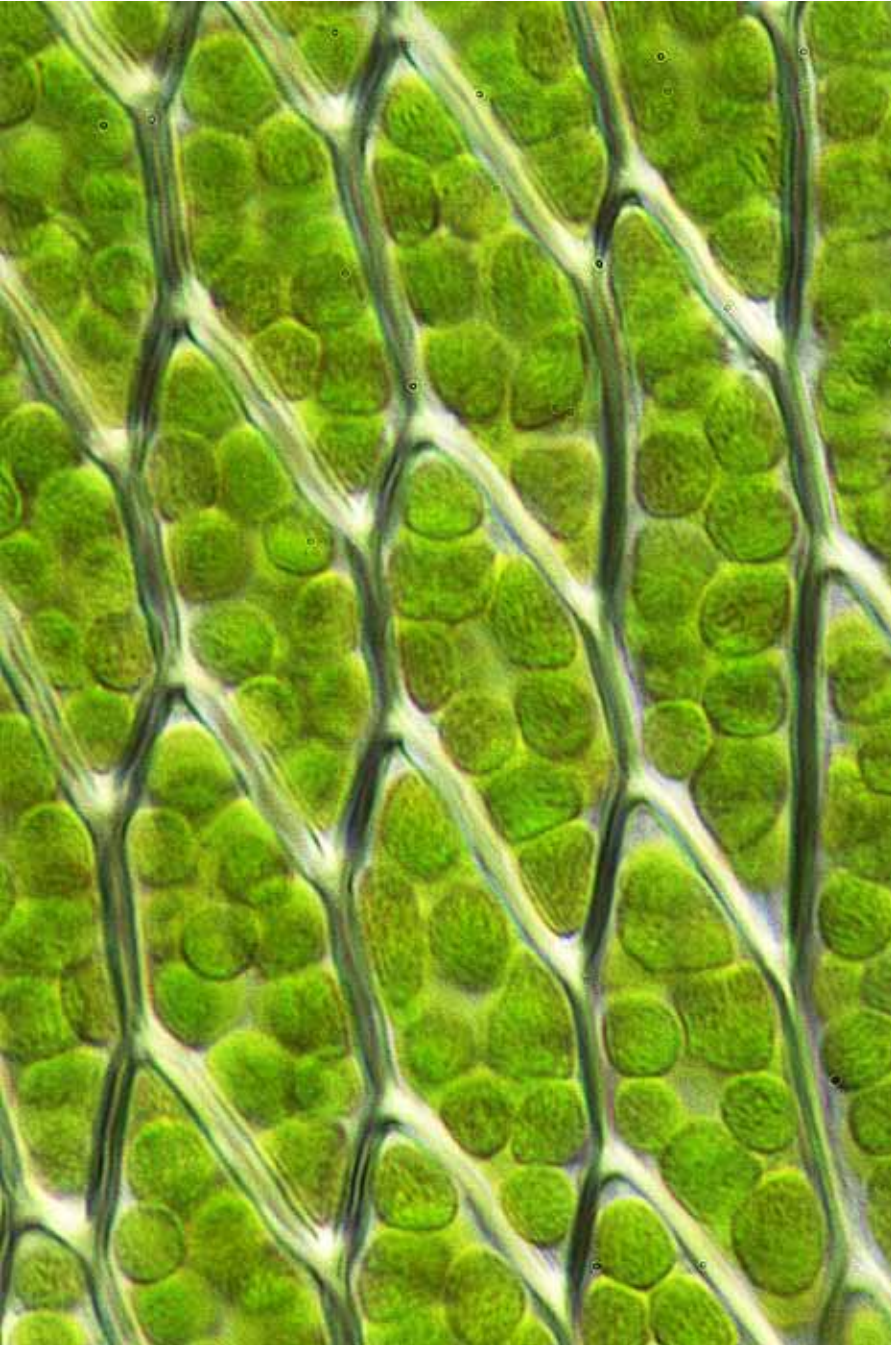
vegetative shoot, terminal brood bodies, leaf outlines (2), and leaf apex

1 mm, 10 μm, 0.1 mm, 10 μm



margin at midleaf, costa at midleaf, and cells near leaf base

10 μm, 10 μm, 10 μm



Tetrarhizidium pusilla cells midleaf
10 μm

Canalhypopterygium tamariscinum (Hedw.) Kruijer

form: primary stems creeping, secondary stems 30–60 mm tall, erect, blackish, naked, glossy, frondose, the leaves whitish green

habitat: moist soil or rock in damp forest

leaf: size: 1–1.5 mm

shape: lateral leaves ovate to triangular-ovate, distichous, asymmetric; amphigastria smaller, dimorphic (either bristle-like or ovate-lanceolate)

tip: bluntly acuminate

base: basal cells larger and laxer than other blade cells

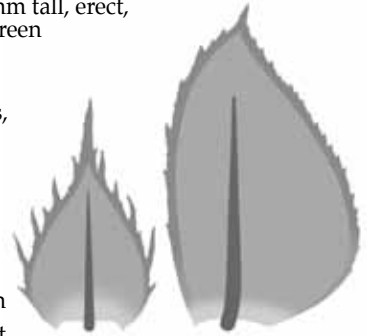
costa: reaching well up the blade

border: 2–3 rows of elongate cells

margin: denticulate to spinulose-ciliate, plane

cells: 14–20 × 6–12 μm, ± hexagonal, firm-walled, smooth

capsule: 2 mm, seta 6–9 mm, stout, red; oblong, pendent, fleshy, pale brown with a darker mouth; peristome double; spores 10–12 μm in diam.



vegetative shoot, amphigastria and rudimentary leaves, and rudimentary leaf

5 mm,

1 mm,

10 μm



leaf outlines (2), margin at midleaf, and cells at midleaf

0.1 mm (2),

10 μm,

10 μm



Canalohipopterygium tamariscinum vegetative shoot
5 mm

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Canaloptygium tamariscinum capsules
1 mm

Catharomnion ciliatum (Hedw.) Hook.f. & Wilson

form: primary stems creeping, tomentose, secondary stems 5–25 mm tall, frondose, bristly, pinnately branched, the leaves soft, yellow-green

habitat: bark

leaf: size: 0.6–1 mm

shape: ovate-orbicular

tip: acuminate, piliferous

base: basal cells laxer than the other blade cells

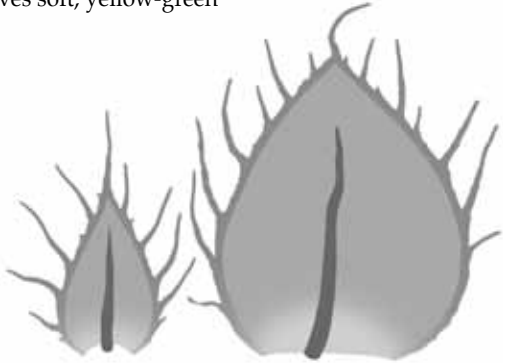
costa: vanishing above midleaf

border: 1–2 rows of narrow, elongate cells

margin: strongly ciliate, plane

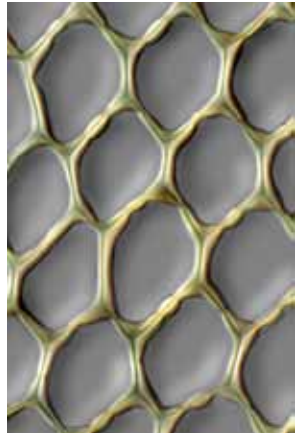
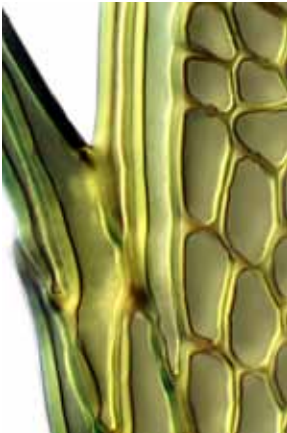
cells: 15–20 × 12 μm, rhombic to hexagonal, firm-walled, smooth

capsule: 1.5–2 mm, oblong-cylindric, erect to inclined, red-brown, exannulate, short-necked; seta 4–6 mm, smooth, red, curved or straight



vegetative habit, leaf outlines (2), and margin midleaf

■ 1 mm, ■ 0.1 mm, ■ 10 μm



margin at midleaf, costa terminus, and cells at midleaf

■ 10 μm, ■ 10 μm, ■ 10 μm

continued next page



Catharomnion ciliatum vegetative habit (moist)
1 mm

continued next page



Catharomnion ciliatum rain-wet (hydrophobic) vegetative frond
1 mm

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Catharomnion ciliatum capsule, calyptra, and peristome
1 mm

Cyathophorum bulbosum (Hedw.) C.M.

form: primary stems creeping, tomentose, secondary stems 40–100(–200) mm long, distichous

habitat: damp humus, logs, or rock in shaded forest

leaf: size: 3–12 × 2.5–7.2 mm; underleaves smaller

shape: obliquely ovate, concave; underleaves orbicular

tip: acuminate; underleaves apiculate

base: not differentiated

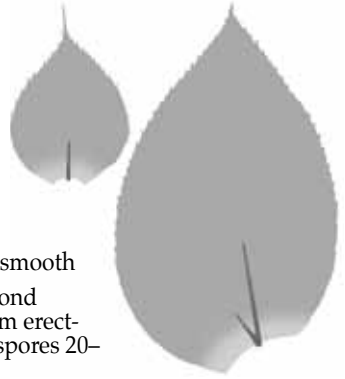
costa: short, single or bifid

border: absent or faint toward the base

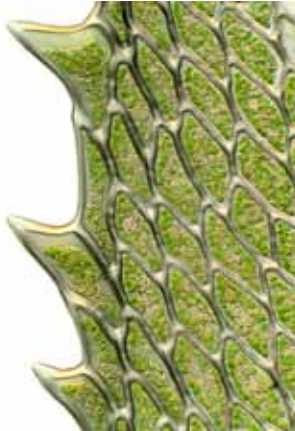
margin: sharply dentate above, plane

cells: 80–100 × 25–35 μm, oblong-hexagonal, firm-walled, smooth

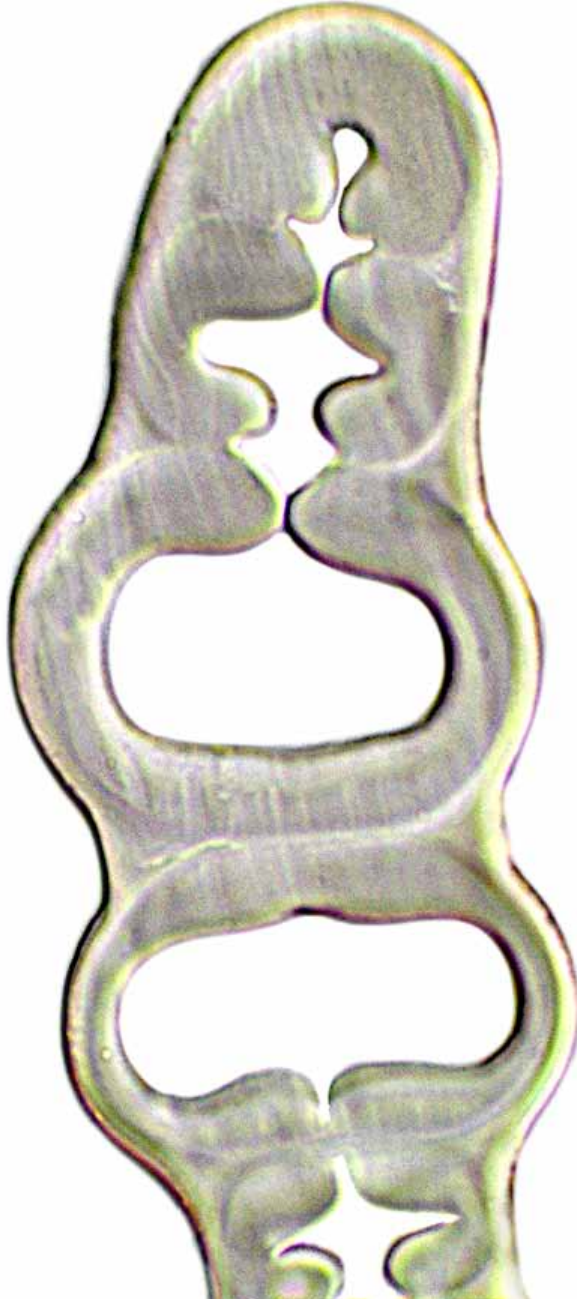
capsule: 1.5 mm, oval or globose, straight, pendent, on frond underside; seta 1 mm; calyptra conic, beaked; operculum erect-rostrate; exostome cross-striolate, endostome cilia 1–3; spores 20–24 μm in diam., smooth



vegetative habit, shoot underside, and leaf and underleaf outlines
 ■ 10 mm, ■ 1 mm, ■ 1 mm (2)

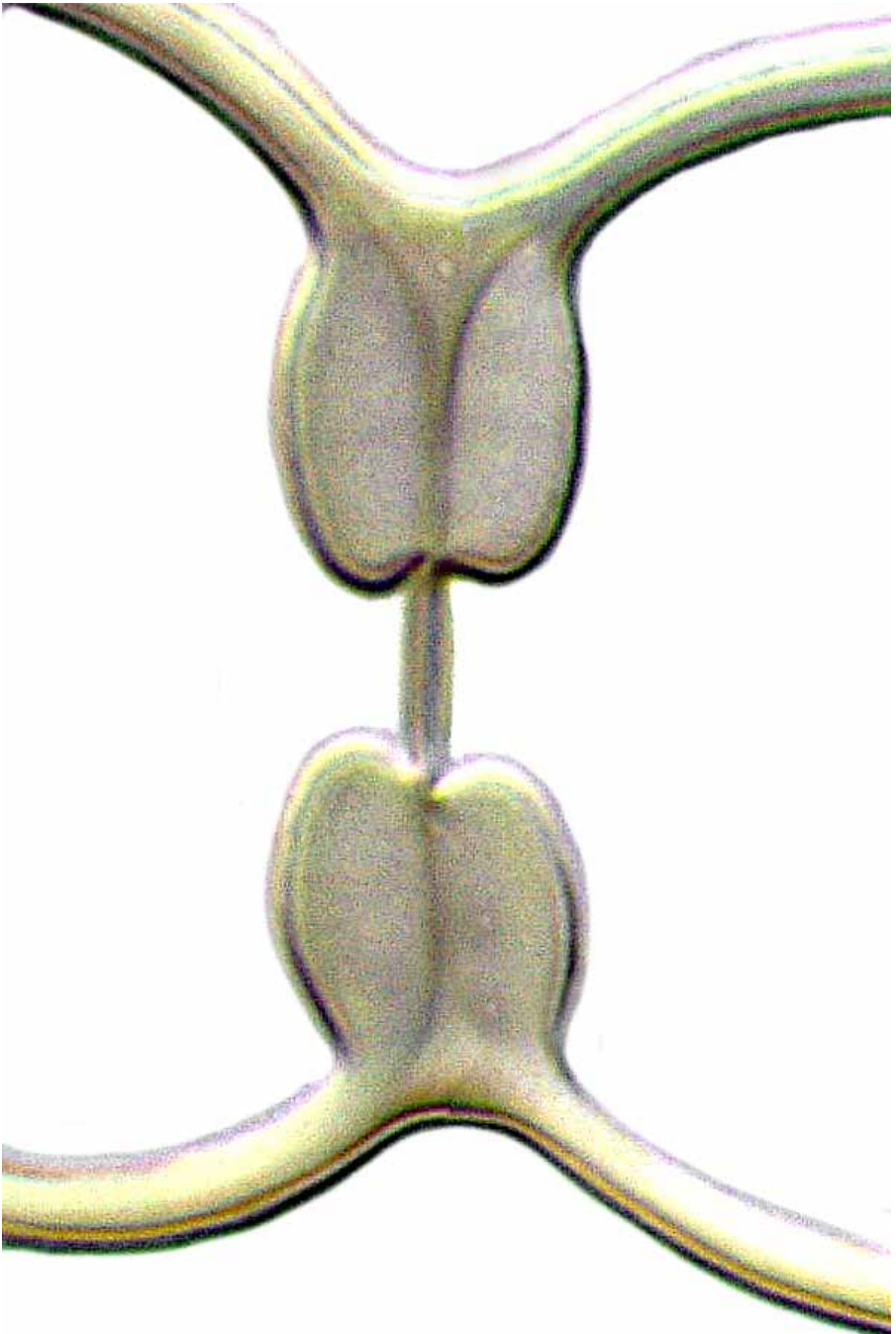


leaf apex, margin at midleaf, and capsules (underside of stem)
 ■ 50 μm, ■ 50 μm, ■ 1 mm



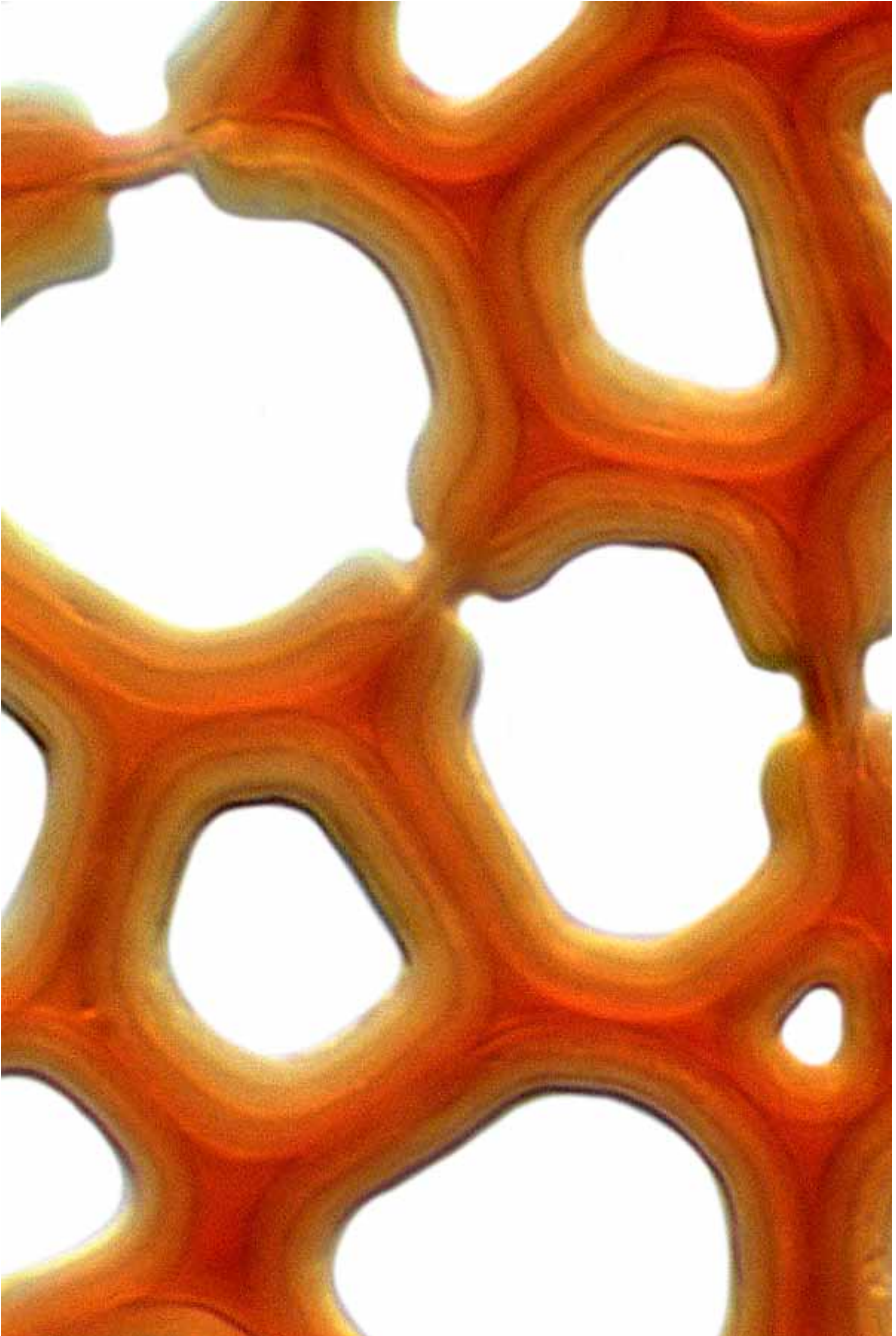
Cyathophorum bulbosum leaf margin cross-section
10 μ m

continued next page



Cyathophorum bulbosum leaf cross-section showing porose cell walls
10 μm

continued next page



Cyathophorum bulbosum stem cross-section showing porose cell walls
10 μm

Dendrohypopterygium filiculiforme (Hedw.) Kruijer

form: primary stem creeping, secondary stems 100–130 mm tall, erect, frondose, tomentose, glabrous when old

habitat: moist shaded soil, rotting logs, and rock in forest

leaf: size: 1–1.5 mm

shape: lateral leaves triangular-ovate; underleaves ovate-lanceolate

tip: stem leaves bluntly acuminate, underleaves sharply acuminate

base: some leaves with basal bristly rhizoids

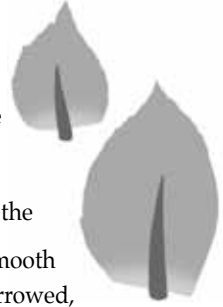
costa: ending well below the leaf apex

border: not differentiated

margin: lateral leaves spinulose-serrate on one side, denticulate on the other, slightly decurved; underleaves spinulose-ciliate, plane

cells: 10–40 × 5–20 μm, hexagonal or wide-rhombic, firm-walled, smooth

capsule: 2 mm, ellipsoid, pendent, the base tubercled, abruptly narrowed, brown; seta 6–9 mm; operculum rostrate; exostome yellow, cilia 1(–3); spores 10–16 μm



vegetative "umbrella" habit, vegetative frond (portion), and leaf outlines (2)

50 mm, 5 mm, 1 mm (2)



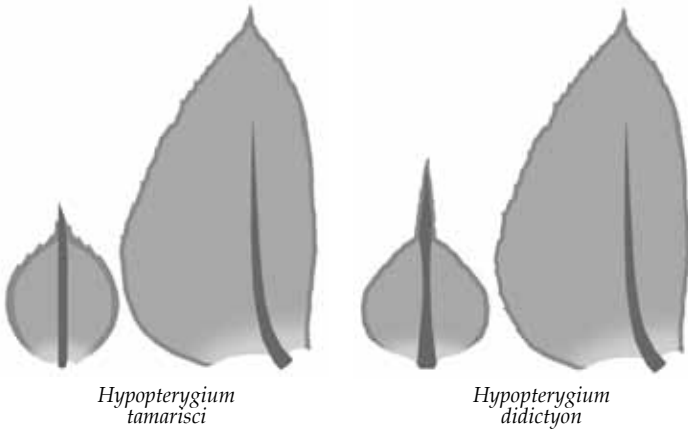
leaf apex (2), and costa terminus

50 μm, 10 μm, 10 μm

Key* to the New Zealand species of Hypopterygium (2)

- 1 Branch leaves in five rows (four flattened lateral rows plus one dorsal row) ● **Hypopterygium didictyon**
 1: Branch leaves in only three rows (two lateral rows plus one dorsal row)..... ● **Hypopterygium tamarisci**

* based on Meagher, D; Fuhrer, B (2003): *A Field Guide to the Mosses and Allied Plants of Southern Australia*. Flora of Australia Supplementary Series Number 20, 158.



Hypopterygium didictyon Müll.Hal.

form: palmate or umbellate fronds atop erect stipes, up to 30 mm, tomentose but glabrous when young, arising from a creeping rhizoid; stipe leaves in 8 ranks, frond leaves dimorphic, in 3 or 8 ranks; to 1660 m elev.

habitat: soil, rock, rotting logs, or tree trunks in humid woodland and scrub

leaf: amphigastria $0.2\text{--}1.5 \times 1.0\text{--}1.5$ mm; lateral leaves $0.5\text{--}3.0 \times 0.2\text{--}1.0$ mm

shape: amphigastria \pm circular; lateral leaves asymmetric, ovate-oblong

tip: amphigastria stoutly cuspidate; lateral leaf \pm apiculate

base: alar cells rectangular, longer than the other lamina cells

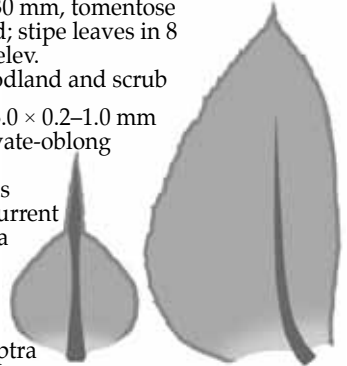
costa: percurrent to excurrent in amphigastria; none to percurrent in lateral leaves, usually reaching about $2/3$ up the lamina

border: 2–4 rows of linear, thick-walled cells in most leaves

margin: entire to coarsely serrate or dentate, plane

cells: $20\text{--}95 \times 5\text{--}30$ μm , hexagonal, firm-walled, smooth

capsule: $1\text{--}2 \times 0.7\text{--}1.5$ mm, ellipsoidal; seta 12–18 mm; calyptra 3–4 mm

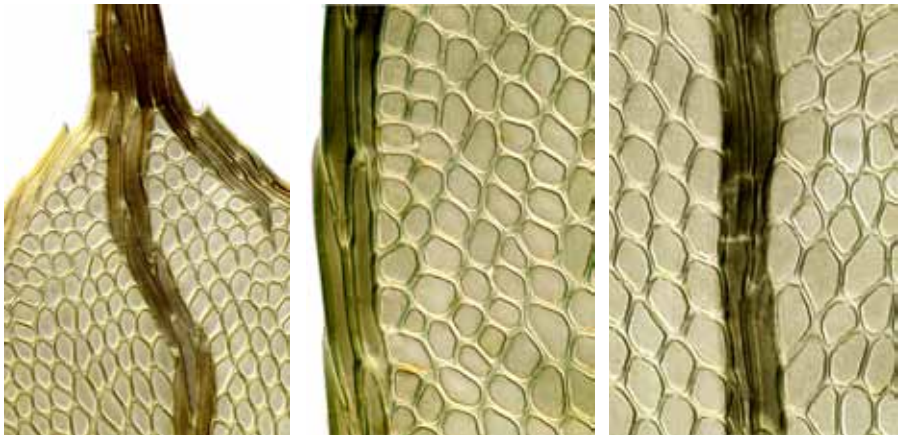


dimorphic frond leaves



vegetative frond (portion, dry) (2), frond leaf outlines (2), and amphigastria apex

1 mm, 1 mm, 1 mm (2), 50 μm



amphigastria subapex, lateral frond leaf margin midleaf and costa midleaf

50 μm , 50 μm , 50 μm

continued next page



Hypopterygium didictyon vegetative shoot (cleared)

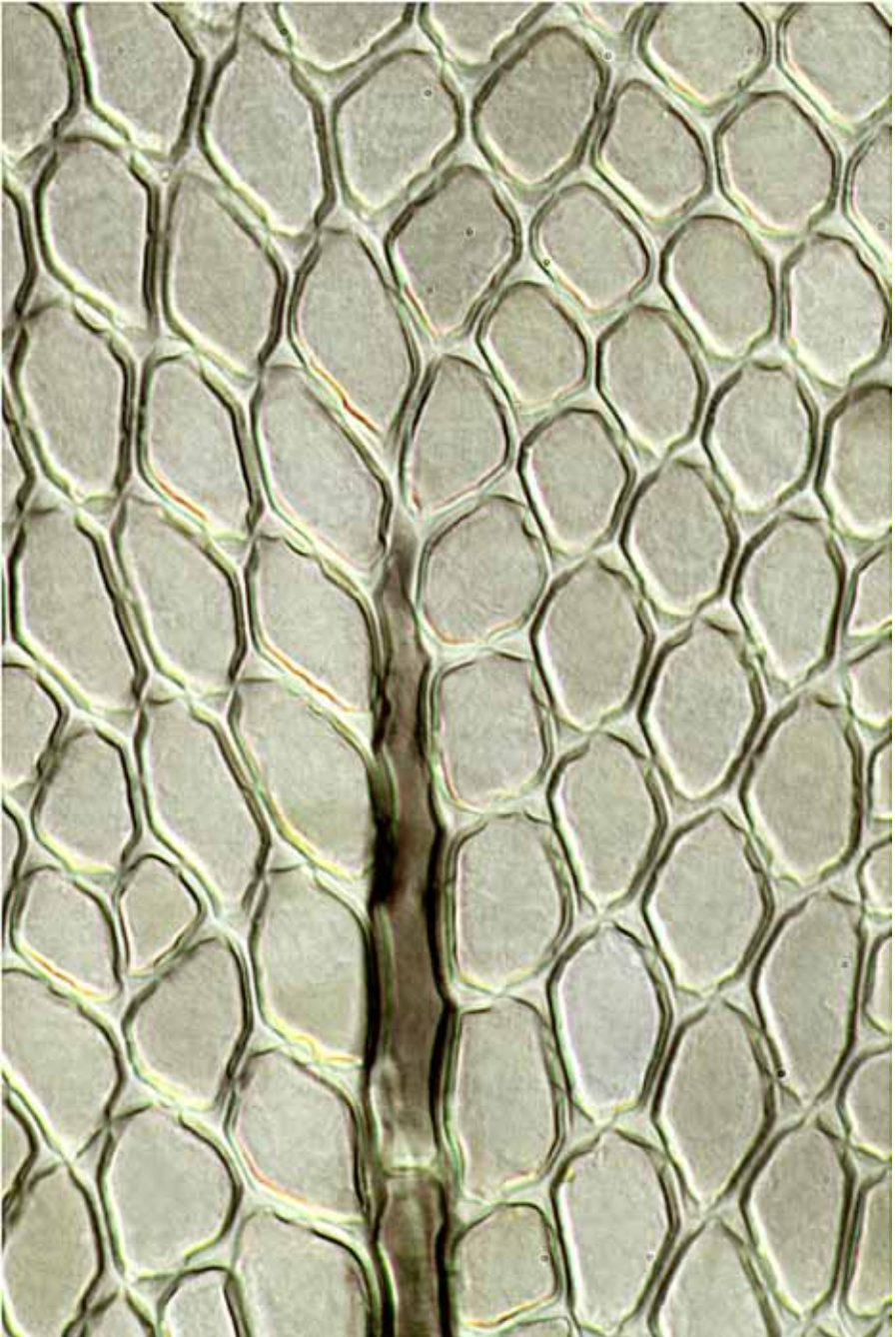
1 mm

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Hypopterygium didictyon bordered amphigastria leaf
10 μm

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Hypopterygium didictyon lateral frond leaf showing lamina cells and costa terminus
10 μm

Hypopterygium tamarisci (Sw.) Müll.Hal.

form: primary stem creeping, stipes tomentose, to 15 mm tall
habitat: rock, bark, and tree ferns, or rotting logs and soil in shaded forests, often near streams, up to 480 m elevation

leaf: size: branch leaves 1.1–1.3 × 0.5–0.7 mm; underleaves 0.6–0.9 × 0.3–0.5 mm; stipe leaves in 3 or 11 ranks; frond leaves in 3 ranks

shape: branch leaves asymmetric; underleaves suborbicular

tip: branch leaves apiculate; underleaves acuminate

base: not differentiated

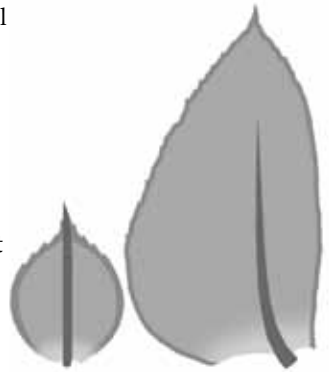
costa: branch leaves 2/3 up leaf blade; underleaves excurrent

border: 1–3 rows of elongate-linear cells $100\text{--}130 \times 6 \mu\text{m}$

margin: entire to serrate-dentate above, plane

cells: $20\text{--}60 \times 10\text{--}25 \mu\text{m}$, \pm hexagonal, firm-walled, smooth

capsule: 1–2 mm, ovoid, horizontal to pendent, pale brown; seta 10 mm



branch leaf



vegetative habit, fertile shoot with mature capsules, young capsule, and leaf outlines (2)
 1 mm, 5 mm, 1 mm, 0.5 mm (2)

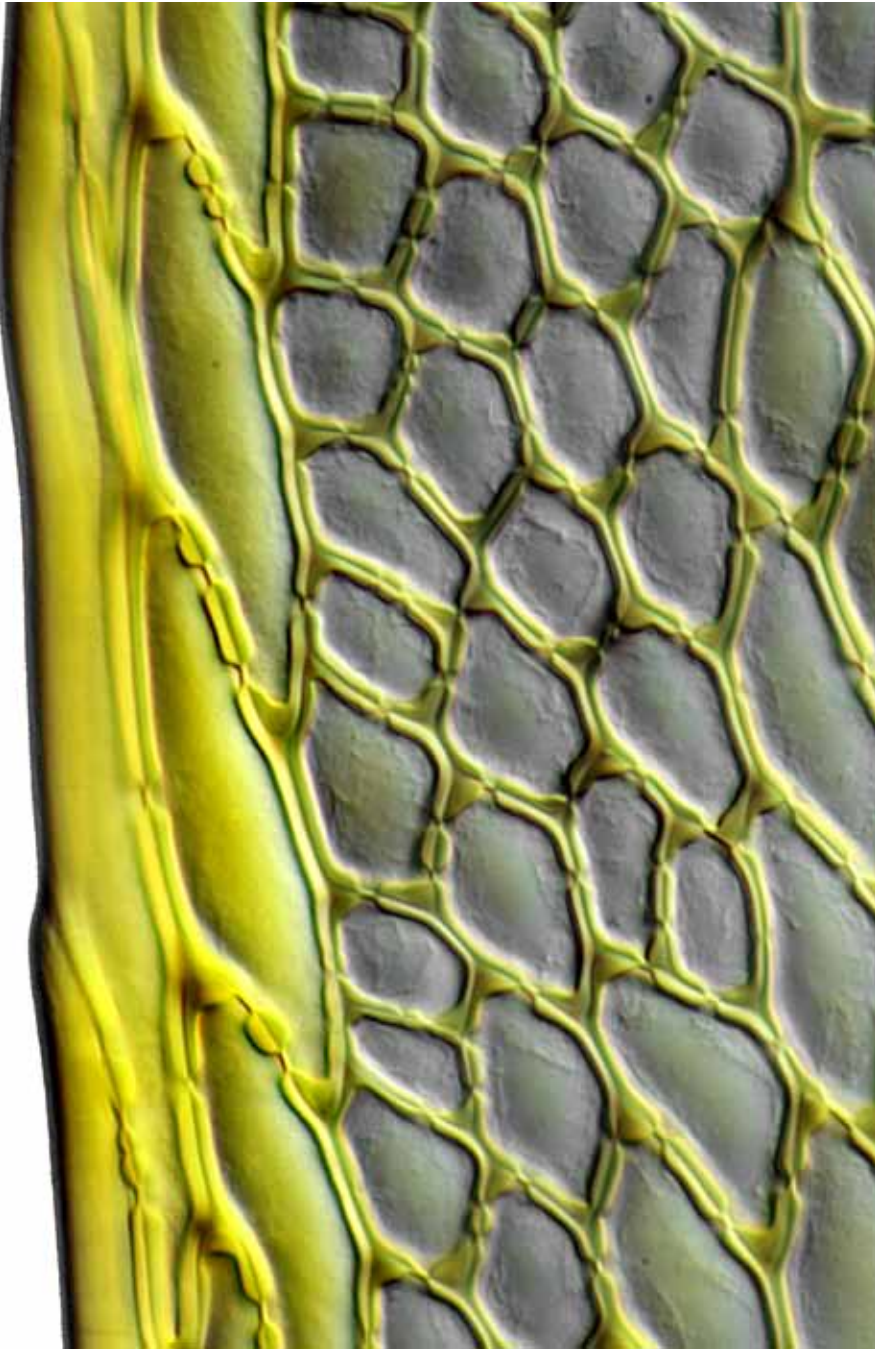


lateral leaf apex, lateral leaf margin, and lateral leaf basal angle
 50 μm , 10 μm , 50 μm



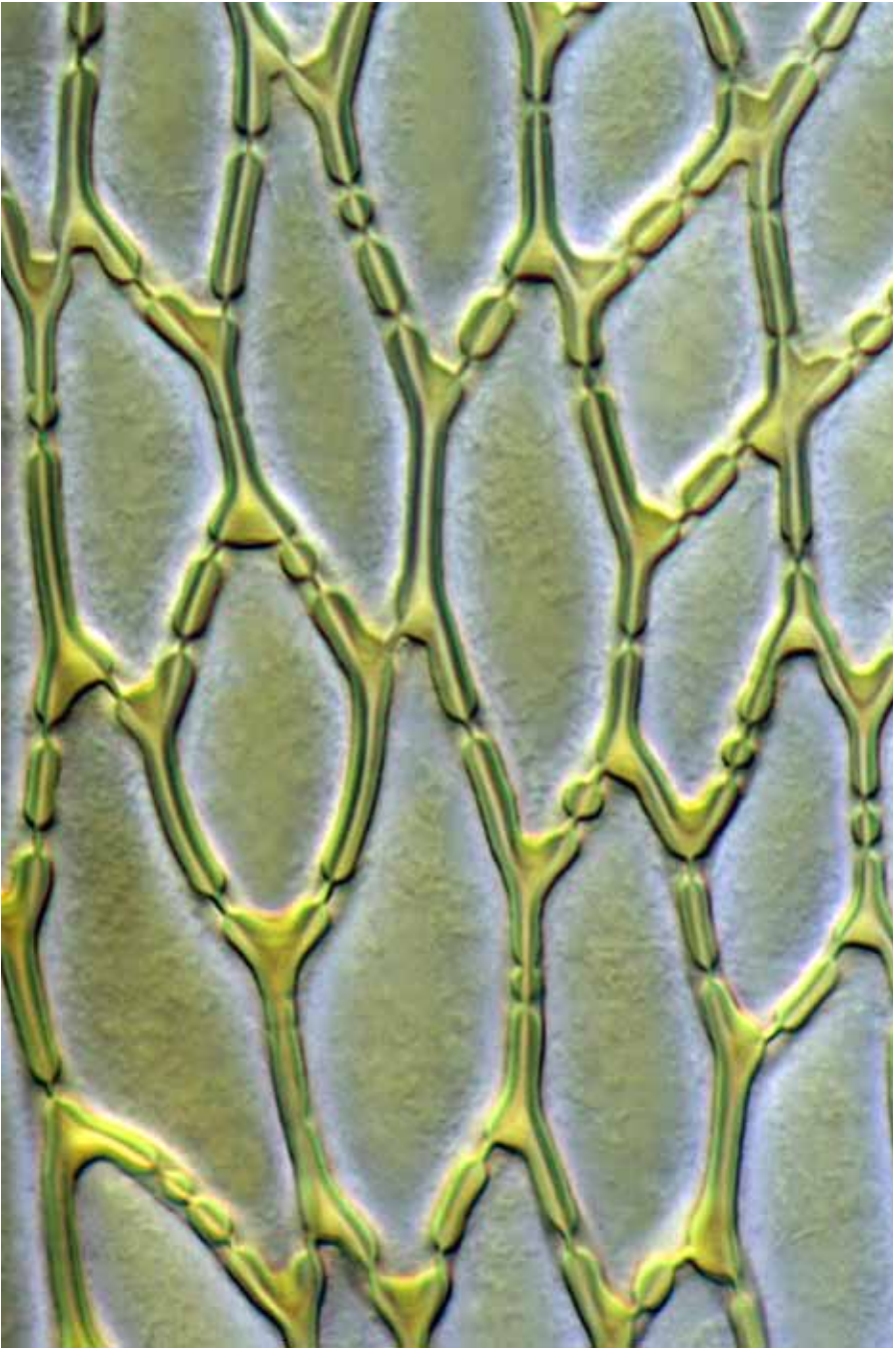
Hypopterygium tamarisci vegetative habit
1 mm

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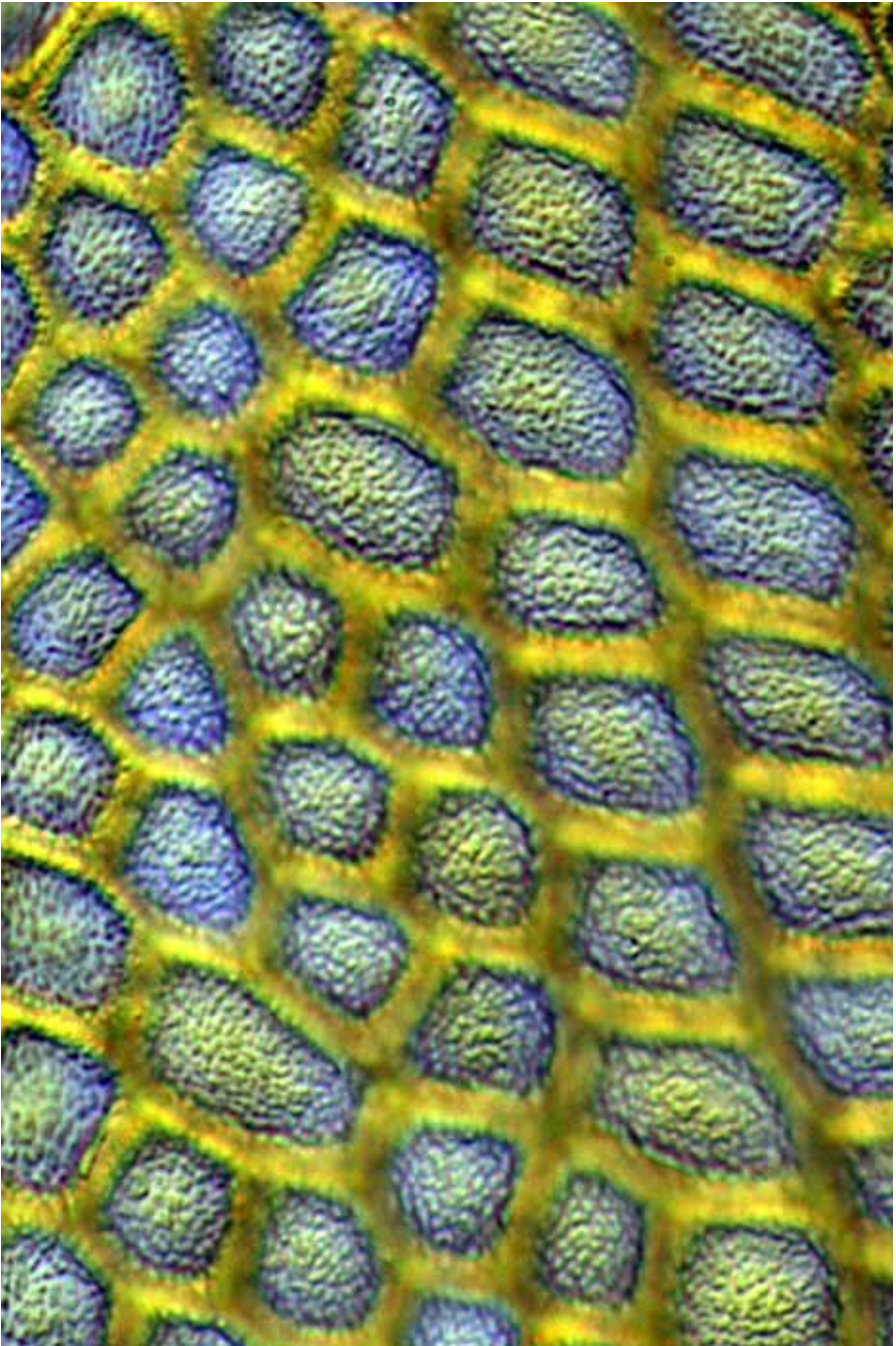
Hypopterygium tamarisci lateral leaf margin
10 μ m

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Hypopterygium tamarisci underleaf cells
10 μm

continued next page



Hypopterygium tamarisci underleaf cells, minutely scabrid surface
10 μm

continued next page



Hypopterygium tamarisci mature capsule and double peristome
0.5 mm

continued next page



Hypopterygium tamarisci leaf margin cross-section
10 μm

continued next page



Hypopterygium tamarisci leaf cross-section
10 μm

Lopidium concinnum (Hook.) Hook.f. & Wilson

form: primary stems creeping, radiculose, secondary stipe 30–100 mm tall, blackish, frondose, pinnately branched, distichous

habitat: soil, damp bark, litter, humus, or rock

leaf: size: branch leaves $1.5\text{--}2 \times 0.5\text{--}0.7$; underleaves $0.8\text{--}1.0 \times 0.5$ mm

shape: branch leaves oblong-lingulate; underleaves ovate-lanceolate

tip: branch leaves short-acuminate; underleaves long-acuminate

base: not differentiated

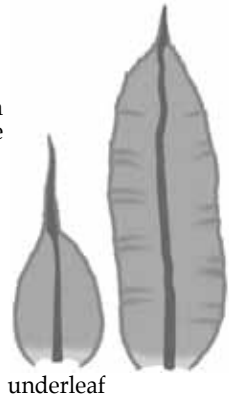
costa: stout, flexuose above, long-excurrent in the acumen

border: 2–3 rows of linear cells

margin: denticulate above, plane to \pm undulate

cells: 10–12 μm , isodiametric, incrassate, \pm mammillose

capsule: 1.5–2 mm, oblong-cylindric, erect, light brown; seta 4–8 mm, flexuose or cygneous, reddish; calyptra cucullate, dark above; operculum erect long-rostrate; exostome teeth striolate, endostome cilia absent; spores 12–14 μm in diam., smooth



underleaf



fertile habit, underleaves, immature capsule with calyptra, and leaf outlines (2)

5 mm,

1 mm,

1 mm,

0.5 mm (2)



leaf apex, margin at midleaf, and costa at midleaf

50 μm ,10 μm ,10 μm



Lopidium concinnum leaf apex
10 μm

Sauloma tenella (Hook.f. & Wilson) Mitt.**form:** matted branched stems, 20–60 μm tall, leaves pale green, glossy**habitat:** bark, rotting wood, soil, or rarely rock in damp sites**leaf:** size: 2–3.5 \times 0.5–0.8 mm*shape:* oblong, \pm triangular, or ovate-lanceolate, 1-plicate in midleaf*tip:* obtuse or rounded to acuminate or acute, strongly reflexed or not*base:* alar cells few; basal cells to 180 \times 20 μm ; cells near margin shorter*costa:* absent, faint, or short and double*border:* not differentiated*margin:* entire, \pm recurved above*cells:* median cells 80–140 \times 10–15 μm , linear-rhombic, thin-walled,porose; lower cells larger; fusiform gemmae in axils, to 120 μm **capsule:** 0.5–1.8 mm, oblong-oval, horizontal to nearly erect, brown;

seta 8 mm, reflexed just below the capsule; calyptra mitrate;

operculum erect conic-rostrate; exostome teeth joined below, cross-

striate, filiform above, endostome as tall; spores 12–14 μm , green

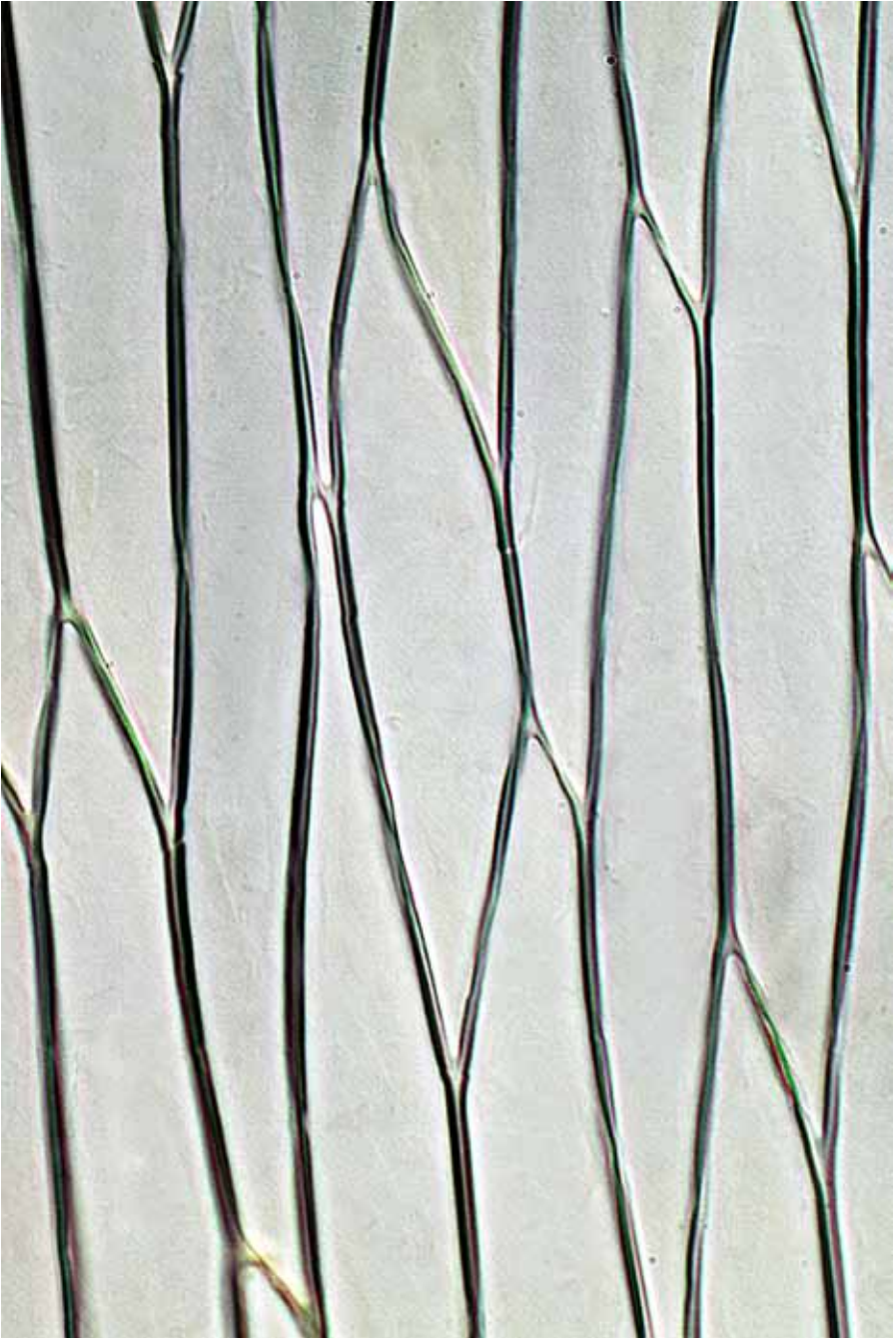
habit, vegetative shoot (moist), leaf outline, and leaf apex

 1 mm, 1 mm, 0.25 mm, 10 μm


cells at midleaf, leaf basal angle, and capsule with peristome

 10 μm , 10 μm , 1 mm

continued next page



Sauloma tenella thin-walled, linear-rhombic cells midleaf
10 μm

Key* to the New Zealand species of *Achrophyllum* (2)

- 1 Midleaf cells 40–60 μm in diam.; marginal teeth 2–4-celled ● ***Achrophyllum dentatum***
 1: Midleaf cells 80–100 μm in diam.; marginal teeth 1-celled ● ***Achrophyllum quadrifarium***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 159.



*Achrophyllum
dentatum*



*Achrophyllum
quadrifarium*

Achrophyllum dentatum (Hook.f. & Wilson) Vitt & Crosby

form: loosely tufted, fleshy, flattened, ascending stems, 5–50 mm long, unbranched, the leaves in 6–8 rows

habitat: damp logs, humus, or damp or wet rock

leaf: size: 2–4 mm in diam.

shape: ovate to nearly circular

tip: rounded

base: ± asymmetric, but otherwise not differentiated

costa: unevenly forked, ending about midleaf

border: not differentiated

margin: laxly toothed (teeth 2–4-celled), plane

cells: 40–60 μm , hexagonal, collenchymatous, smooth

capsule: 1–2 mm, oblong to ovoid, cernuous to pendent, dark brown to nearly black, ± tuberculose at the base, seta 12–20 mm, arcuate above

note: the L-shaped propagules are distinctive

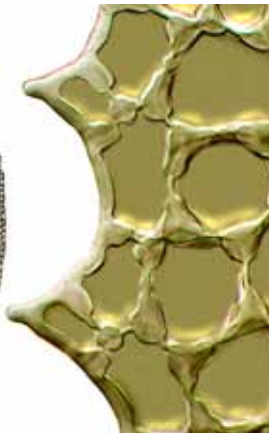


vegetative habit, fully hydrated shoot, and leaf margin brood bodies (2)

5 mm,

5 mm,

50 μm (2)

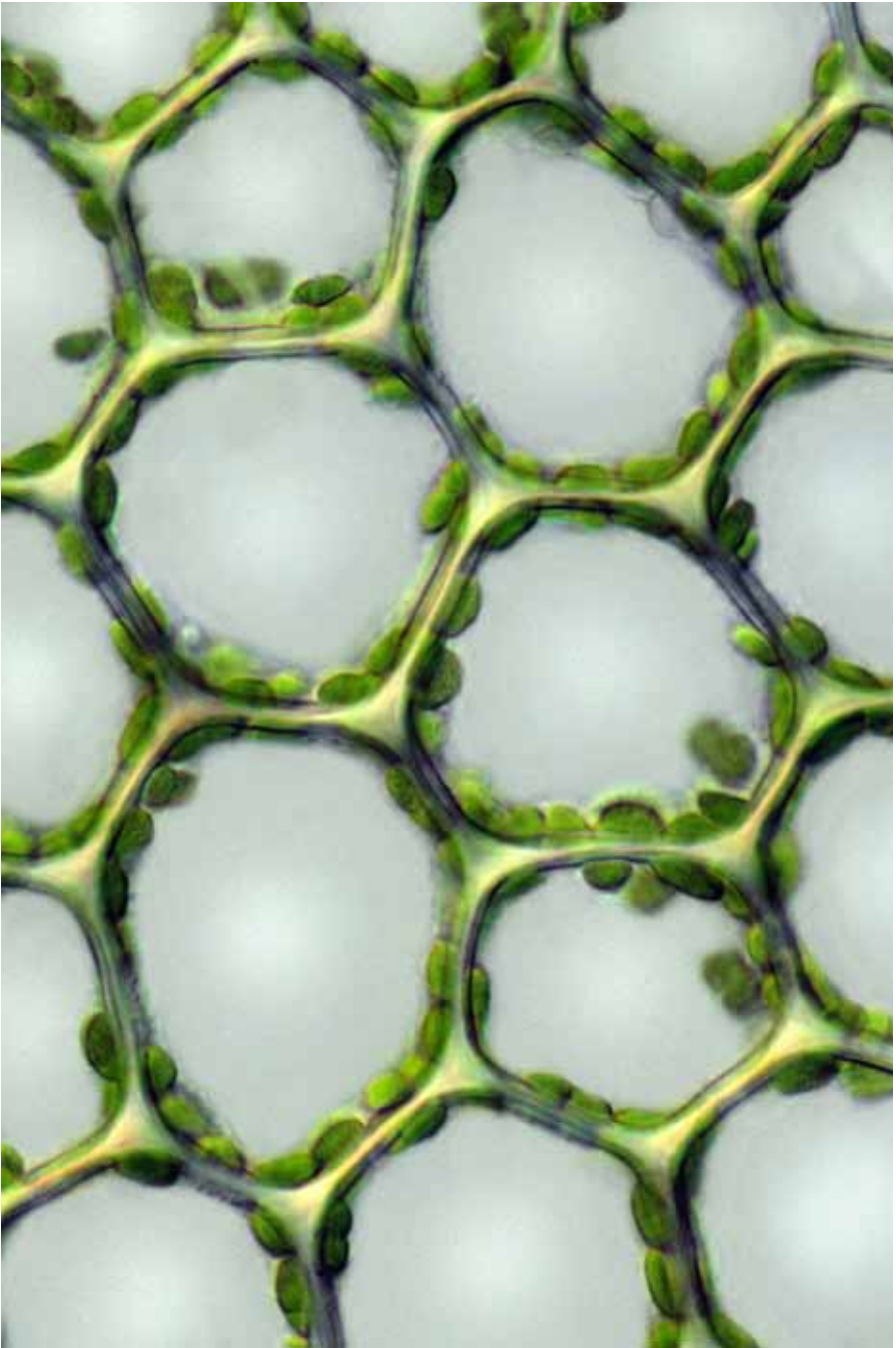


leaf outline, toothed leaf margin, and capsule

1 mm,

50 μm ,

1 mm



Achrophyllum dentatum leaf cells
50 μm

continued next page

Achrophyllum quadrifarium (Sm.) Vitt & Crosby

form: loosely tufted, unbranched, basally radiculose stems, 20–120 mm tall, complanate

habitat: humus or rotting logs or rock in damp forest

leaf: size: 3–7 mm, densely imbricate

shape: ± orbicular; lateral leaves asymmetric near base

tip: rounded

base: not differentiated

costa: strong, unevenly forked, ending about midleaf

border: not differentiated

margin: laxly toothed (teeth mostly 1-celled), plane

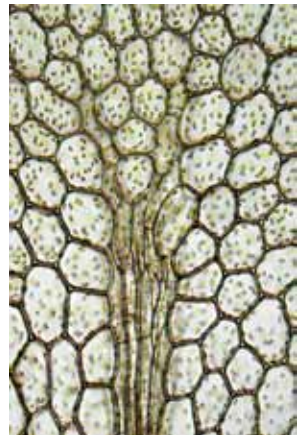
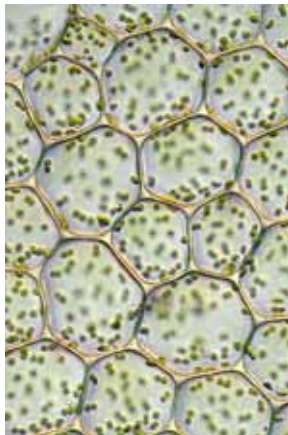
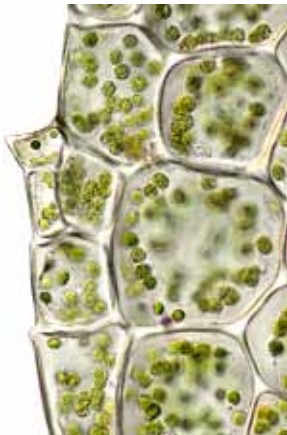
cells: 80–100 μm in diam., hexagonal, thin-walled, smooth

capsule: 1.5–3 mm, oblong or ovoid, cernuous or pendent, dark brown to black; seta 15–35 mm; peristome double; spores 12–18 μm in diam.



vegetative habit (2), and leaf outline (portion)

5 mm, 5 mm, 0.5 mm



margin at midleaf, cells at midleaf, and costa at midleaf

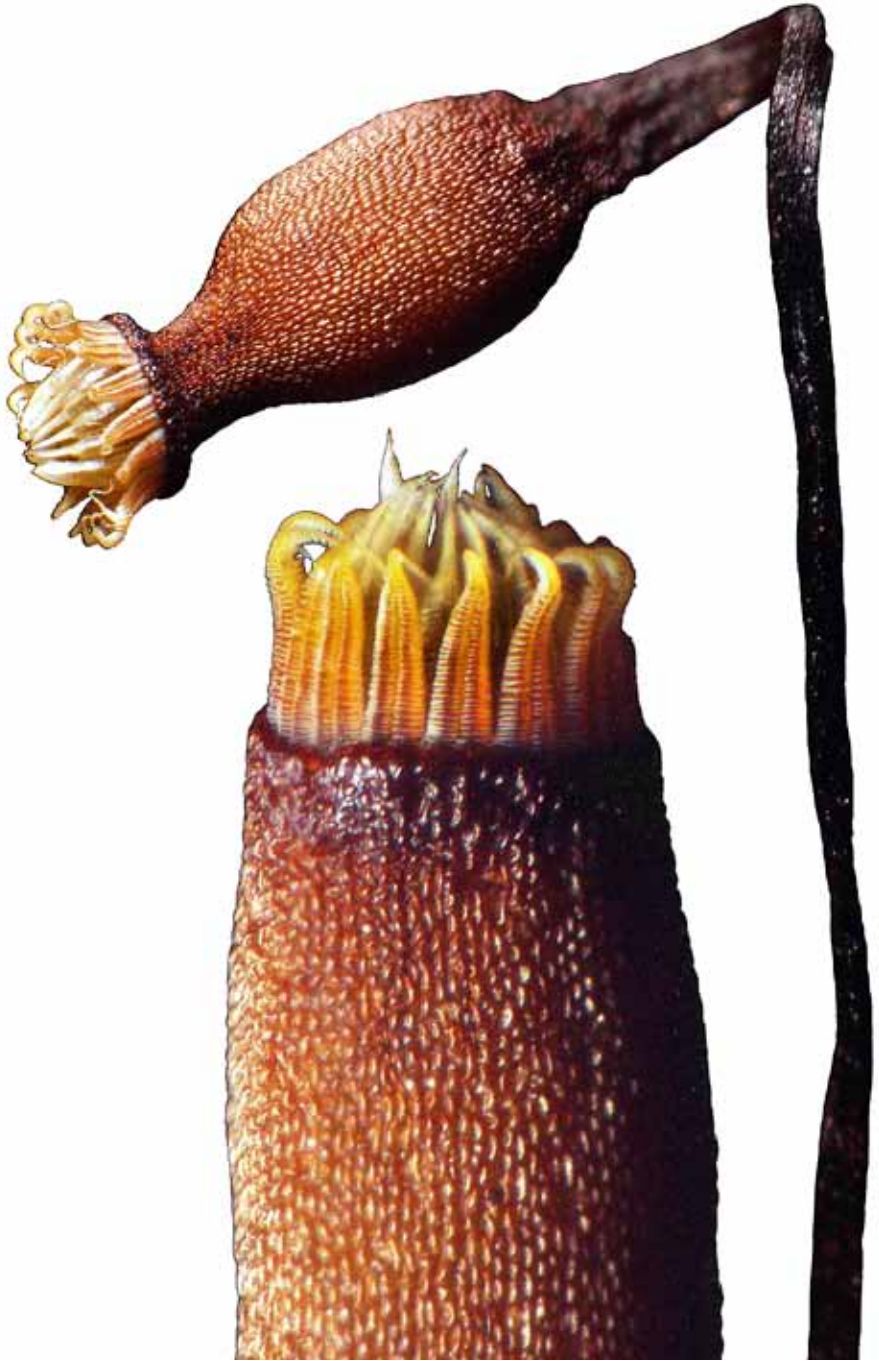
100 μm , 100 μm , 100 μm

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Achrophyllum quadrifarium habit
1 mm

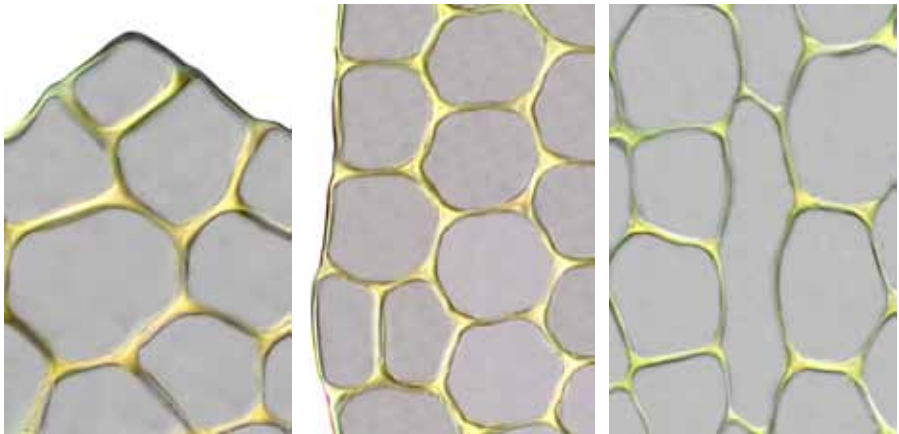
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Achrophyllum quadrifarium mature capsule

0.5 mm (above),

0.5 mm (below)

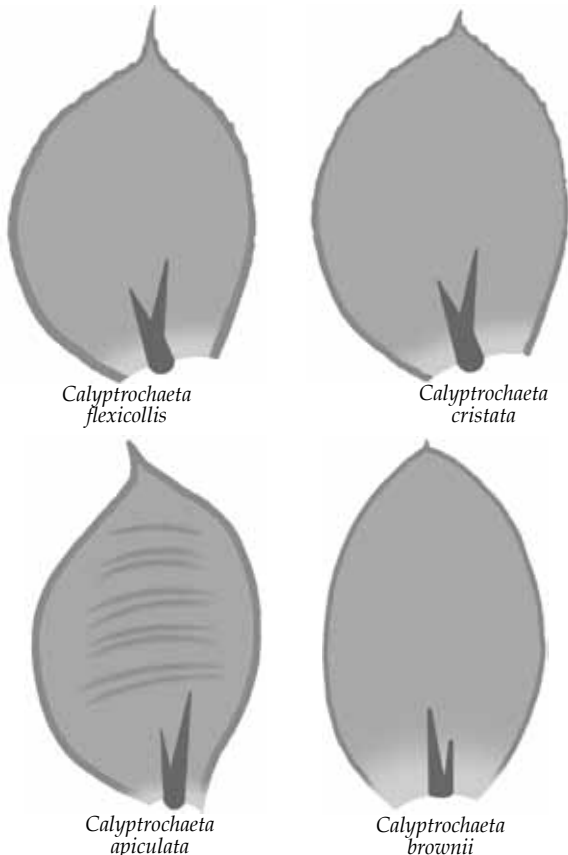
Beeveria distichophylloides (Broth. & Dixon) Fife**form:** prostrate, unbranched stems to 45 mm tall, leaves yellowish**habitat:** moist shaded limestone or clayey soil in damp forest**leaf:** size: 1.3–2.5 mm*shape:* elliptic*tip:* acute or weakly cuspidate*base:* basal cells oblong; alar cells not differentiated*costa:* ill-defined, ending half to three-quarters up the leaf blade*border:* not differentiated*margin:* entire, plane*cells:* 24–42 μm , isodiametric or nearly so, thin-walled, smooth**capsule:** 1–1.5 mm, ovoid, erect, short-necked, reddish; seta 7–11 mm, smooth, red; calyptra mitrate, lobed; operculum erect long-rostrate; peristome double; spores 12 μm **note:** stems often end in leafless pseudopodia 2–3 mm long and tipped with a cluster of narrowly fusiform, 5–9-septate gemmaeshoot and propagules, propagule cluster, propagule wm (apex only), and leaf outline


leaf apex, margin at midleaf, and costa at midleaf

Key* to the New Zealand species of *Calyptrochaeta* (4)

- 1 Leaf border 1–2 cells wide; apiculus 30–50 μm long..... ● ***Calyptrochaeta brownii***
 1: Leaf border 3–7 cells wide; apiculus 35–300 μm long..... 2
- 2(1): Leaf border 5–7 cells wide; apiculus 240–300 μm long; leaves yellowish, crisped or curled when dry..... ● ***Calyptrochaeta apiculata***
 2: Leaf border 3–4(–5) cells wide; apiculus 100–200 μm long; leaves green, nearly straight when dry 3
- 3(2): Upper cells 18–40 μm wide ● ***Calyptrochaeta flexicollis***
 3: Upper cells 50–60 μm wide..... ● ***Calyptrochaeta cristata***

* based partly on Streimann, H (2000): Taxonomic studies on Australian Hookeriaceae (Musci) 3: The genera *Calyptrochaeta*, *Daltonia*, *Hookeriopsis*, and *Sauloma*. *Journal of the Hattori Botanical Laboratory* 88, 103, plus Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bulletin 5, 103.



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Calypstrochaeta apiculata (Hook.f. & Wilson) Vitt

form: tufted, branched, tomentose stems, 15–30 mm tall, complanate, two lateral leaf rows, plus two rows each of dorsal and ventral

habitat: shaded, damp soil, humus, or rock in damp forest

leaf: size: lateral 2.0–2.7 mm long; dorsal and ventral smaller

shape: ovate to orbicular, asymmetric, crisped when dry

tip: abruptly acuminate

base: narrow; basal cells rectangular, thin-walled

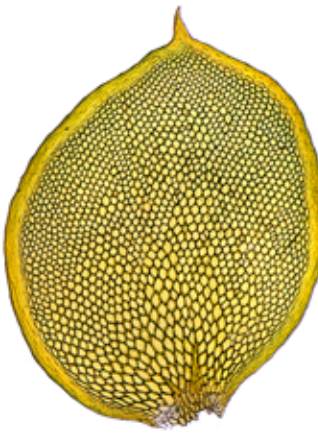
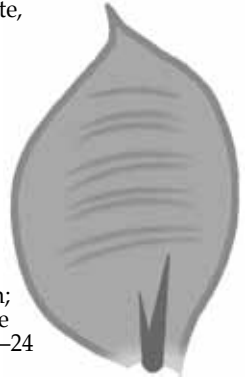
costa: absent or short and double and faint

border: 5–7 rows of porose, linear cells

margin: entire, plane

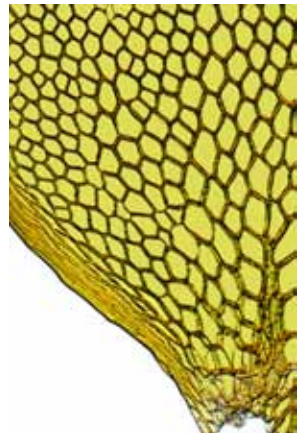
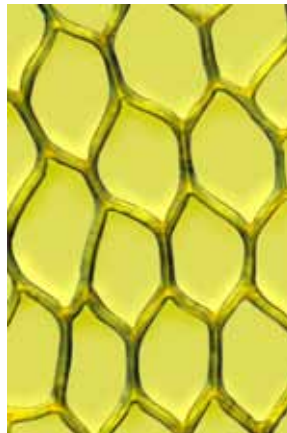
cells: 20–50 μm , hexagonal to isodiametric, firm-walled, smooth

capsule: 1–1.5 mm, ovoid, lateral, erect to inclined, exserted, brown; seta 5–8 mm; calyptra long-fringed; operculum rostrate; exostome teeth cross-striolate, fused at base, endostome reduced; spores 16–24 μm in diam.



vegetative shoot (dry), lateral leaf outline and leaf apex

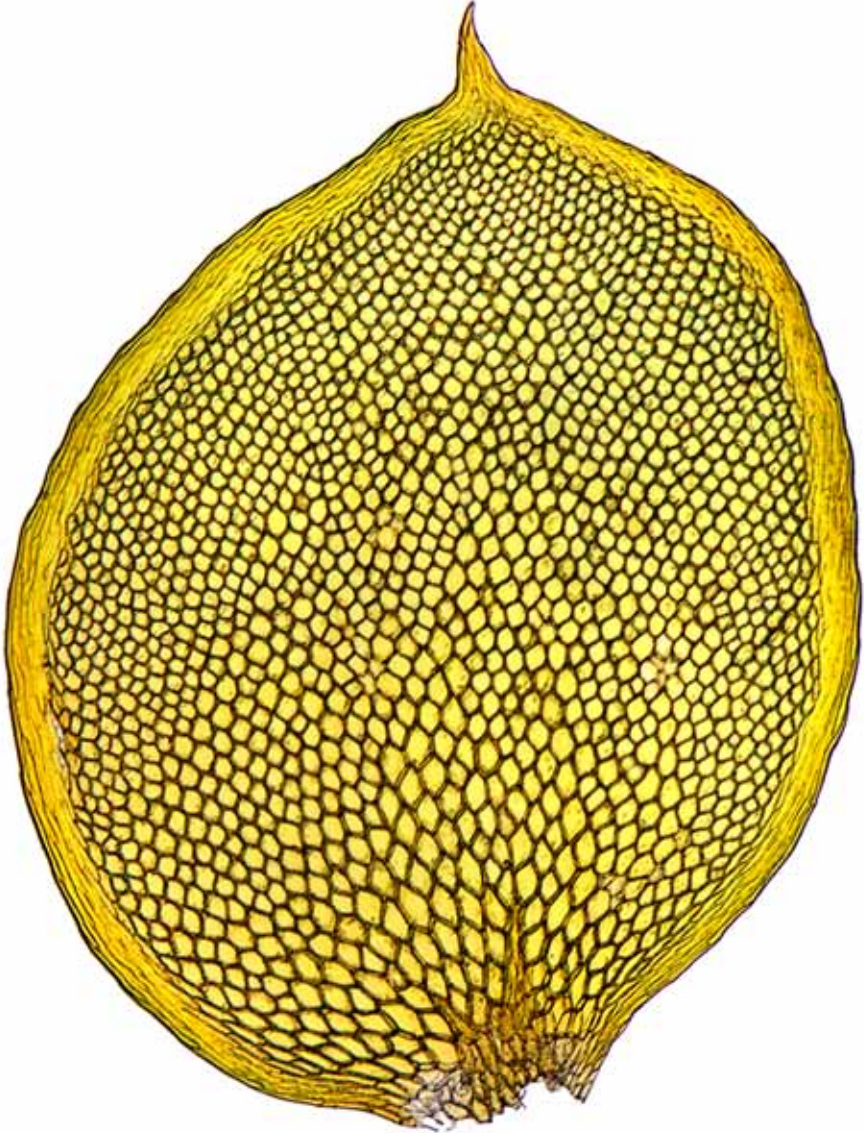
1 mm, 0.1 mm, 10 μm



margin at midleaf, cells at midleaf, and leaf basal angle

10 μm , 10 μm , 10 μm

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Calyptraochaeta apiculata lateral leaf outline
0.1 mm

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Calypstrochaeta brownii (Dixon) J.K.Bartlett

form: tufted, prostrate, branched stems, 8–15 mm tall; complanate, leaves dull dark green

habitat: damp shaded rock or rotting wood in moist forest

leaf: size: 2.0–2.7 mm long; dorsal and ventral leaves smaller

shape: lateral elliptic to obovate, asymmetric

tip: short-apiculate

base: narrow, basal cells elongate, thin-walled

costa: absent or short and double, faint

border: 1–2 rows of firm-walled linear cells

margin: entire, plane

cells: 25–45 × 20–30 μm, rhombic-hexagonal, thin-walled, smooth

capsule: 0.6–1.0 mm, widely oval, lateral, horizontal or pendent, exserted, brown; seta 2–5 mm; operculum erect-rostrate; calyptra campanulate, densely fringed; peristome double, cilia absent; spores 10–16 μm in diam., smooth



vegetative shoot (dry) (2), lateral leaf outline, and lateral leaf apex

1 mm, 1 mm, 0.5 mm, 10 μm



lateral leaf margin, lateral leaf cells, and lateral leaf basal angle

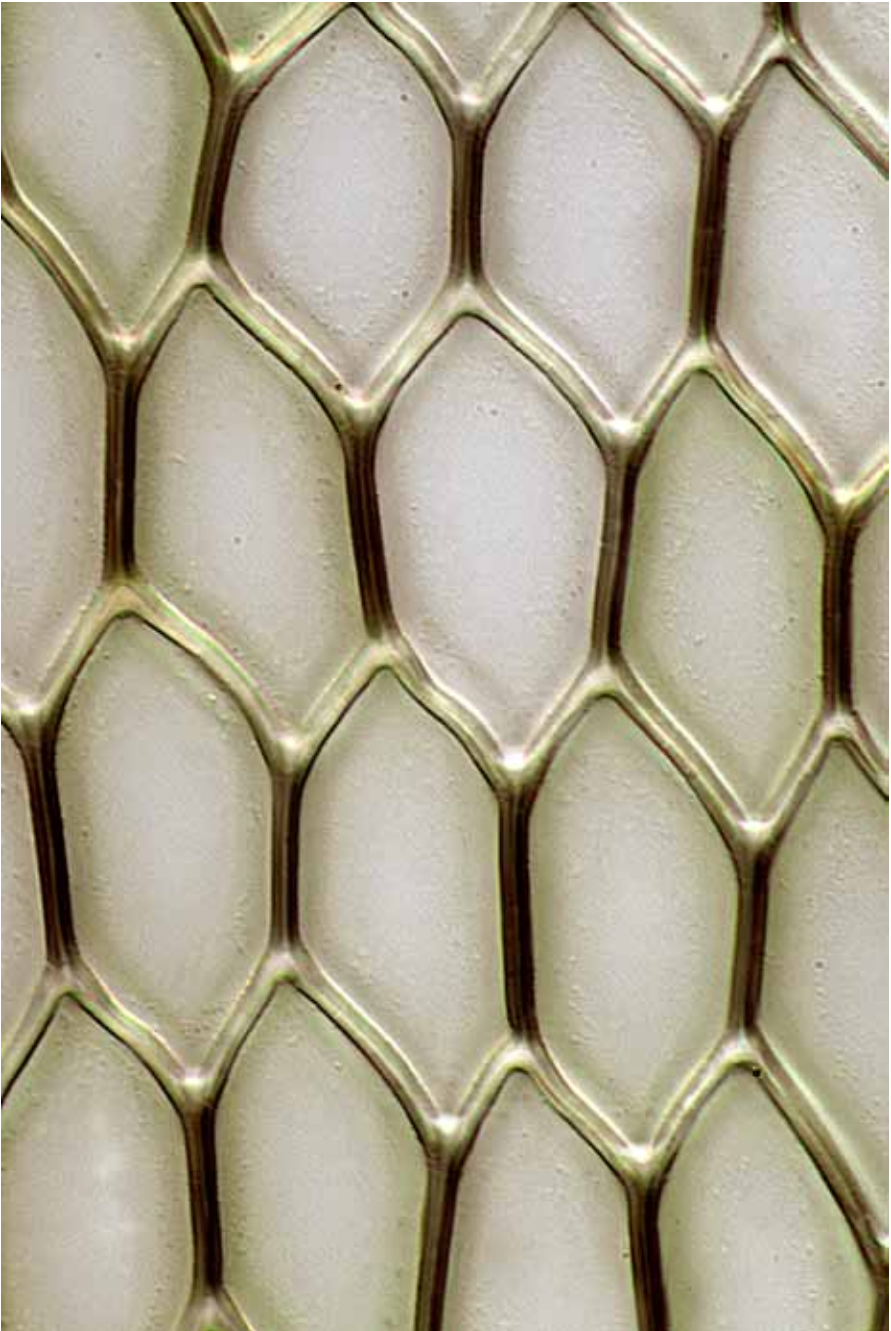
50 μm, 50 μm, 50 μm

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Calypstrochaeta brownii margin midleaf
10 μm

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Calyptraocheta brownii lateral leaf cells
10 μm

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Calypstrochaeta cristata (Hedw.) Desv.

form: matted, radiculose, erect stems, 20–120 mm tall, leaves glossy
habitat: soil, damp logs, or rock in shaded forest

leaf: size: 2.0–4.5 mm

shape: dorsal and ventral leaves ± orbicular; lateral leaves obovate

tip: dorsal and ventral ± obtuse, ± apiculate; lateral subacute

base: basal cells rectangular, thin-walled

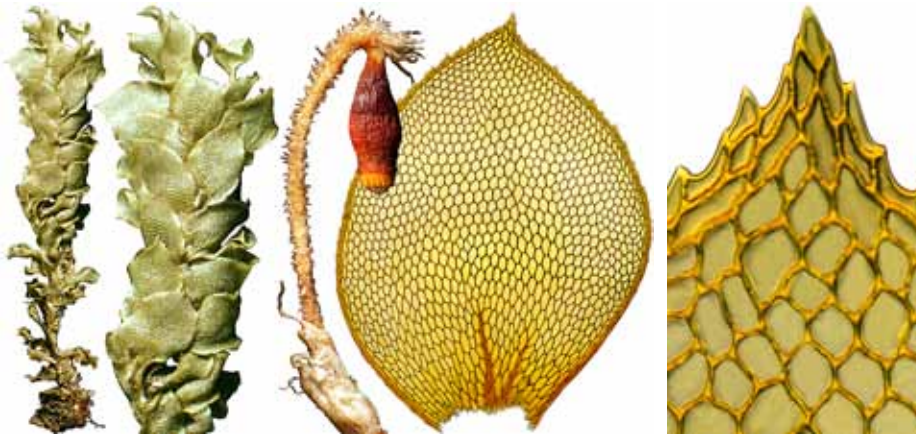
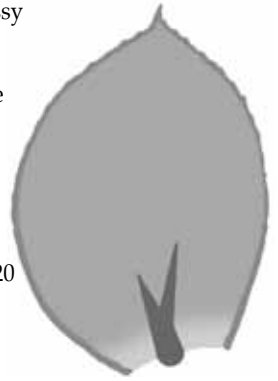
costa: double, one branch reaching about one-third up the leaf

border: 2–4 rows of narrow, elongate, firm- to thick-walled cells

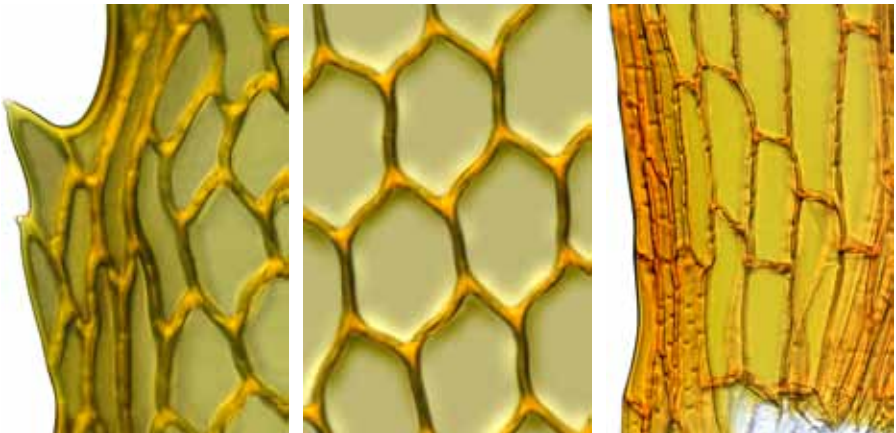
margin: irregularly dentate above, ± entire below, plane

cells: 70–100 × 50–60 μm, ± hexagonal, thin-walled, smooth

capsule: 1.3–2.0 mm, oval, exserted, pendent, red-brown; seta 5–20 mm, fleshy, yellowish, shaggy with hyaline, unicellular hairs; operculum rostrate; calyptra campanulate, shaggy, fringed; exostome teeth yellow, pale-margined, endostome cilia none; spores 12–16 μm in diam., smooth

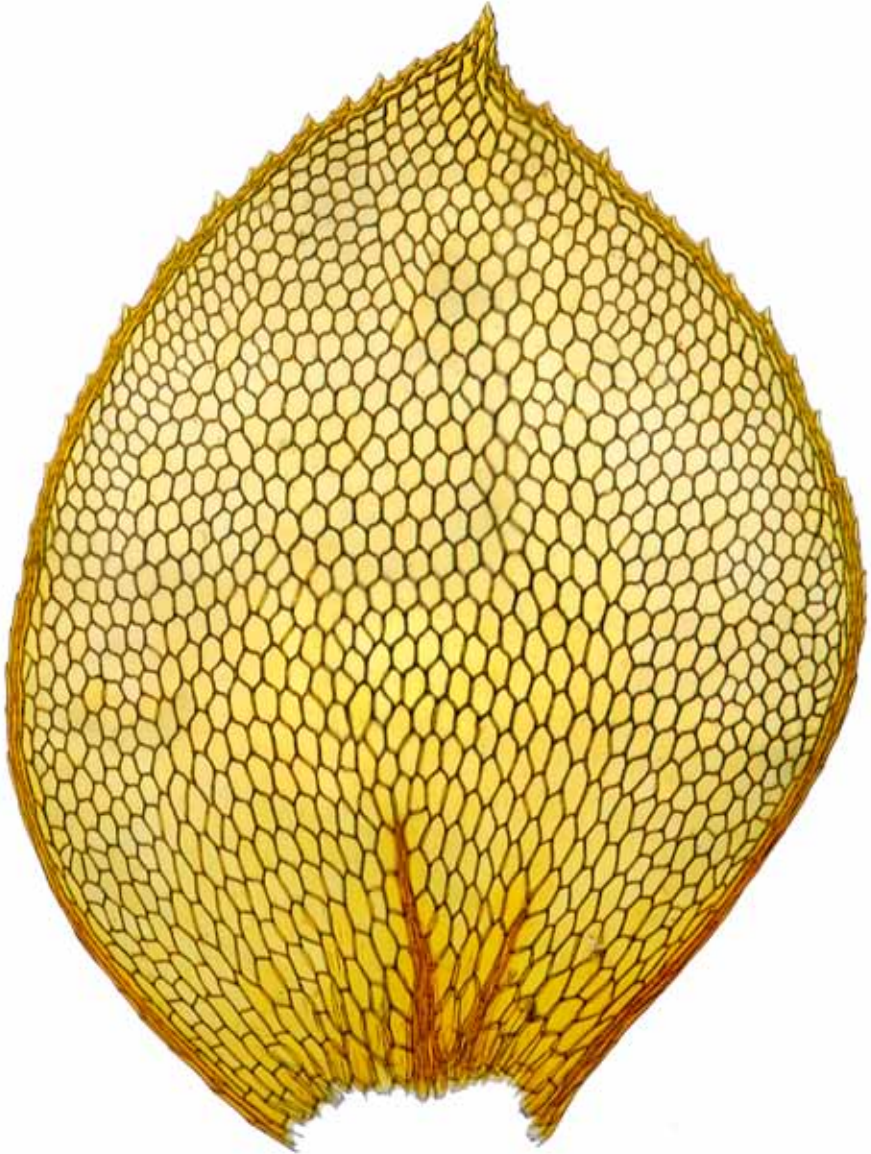


vegetative shoot (dry) (2), mature capsule with shaggy seta, and ventral leaf and apex
 5 mm, 5 mm, 1 mm, 1 mm, 100 μm



margin at midleaf, cells at midleaf, and leaf basal angle
 50 μm, 50 μm, 50 μm

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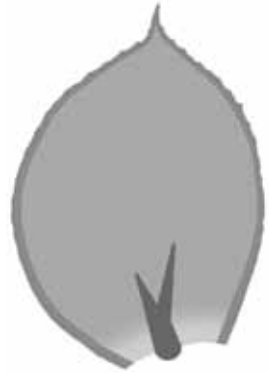
Calypstrochaeta cristata ventral leaf
1 mm

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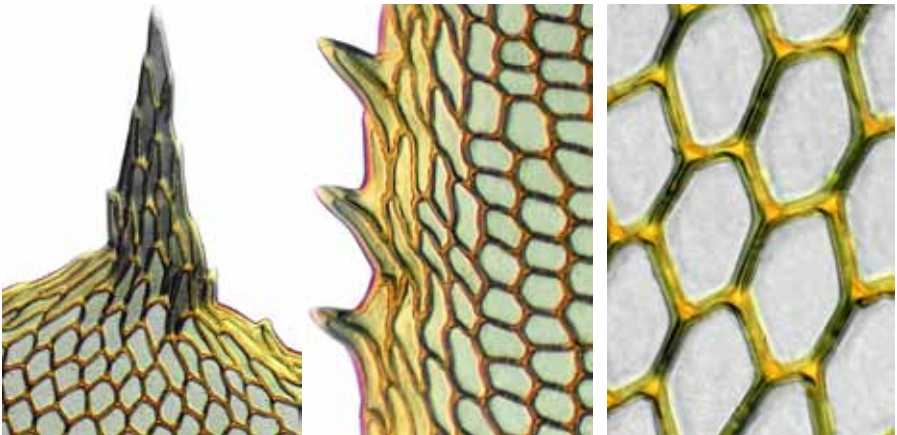


Calyptraochaeta cristata mature capsule with shaggy seta
1 mm

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Calypstrochaeta flexicollis* (Mitt.) Vitt*form:** tufted, unbranched stems, 12–30 mm tall, flattened**habitat:** moist soil, rotting wood, and rock, rarely tree trunks**leaf:** *size:* leaves in 6 rows, lateral leaves $2.3\text{--}2.6 \times 1.0\text{--}1.5$ mm, spreading, dorsal and ventral leaves smaller, appressed*shape:* orbicular to orbicular-ovate, slightly asymmetrical*tip:* rounded to obtuse, acutely apiculate*base:* basal cells longer and wider than the blade cells*costa:* absent or weak, short, and forked*border:* 2–4 rows of narrow, elongate cells*margin:* entire, plane*cells:* 18–40 μm , \pm isodiametric, firm-walled, smooth**capsule:** 1 mm, ovoid, exerted, pendent, brown, narrowed at the mouth; seta 4–10 mm, shaggy, arcuate at the tip

vegetative shoot (dry and moist), and lateral leaf outline and apex

 1 mm, 1 mm, 1 mm, 100 μm


lateral leaf apiculus, toothed border at midleaf, and cells at midleaf

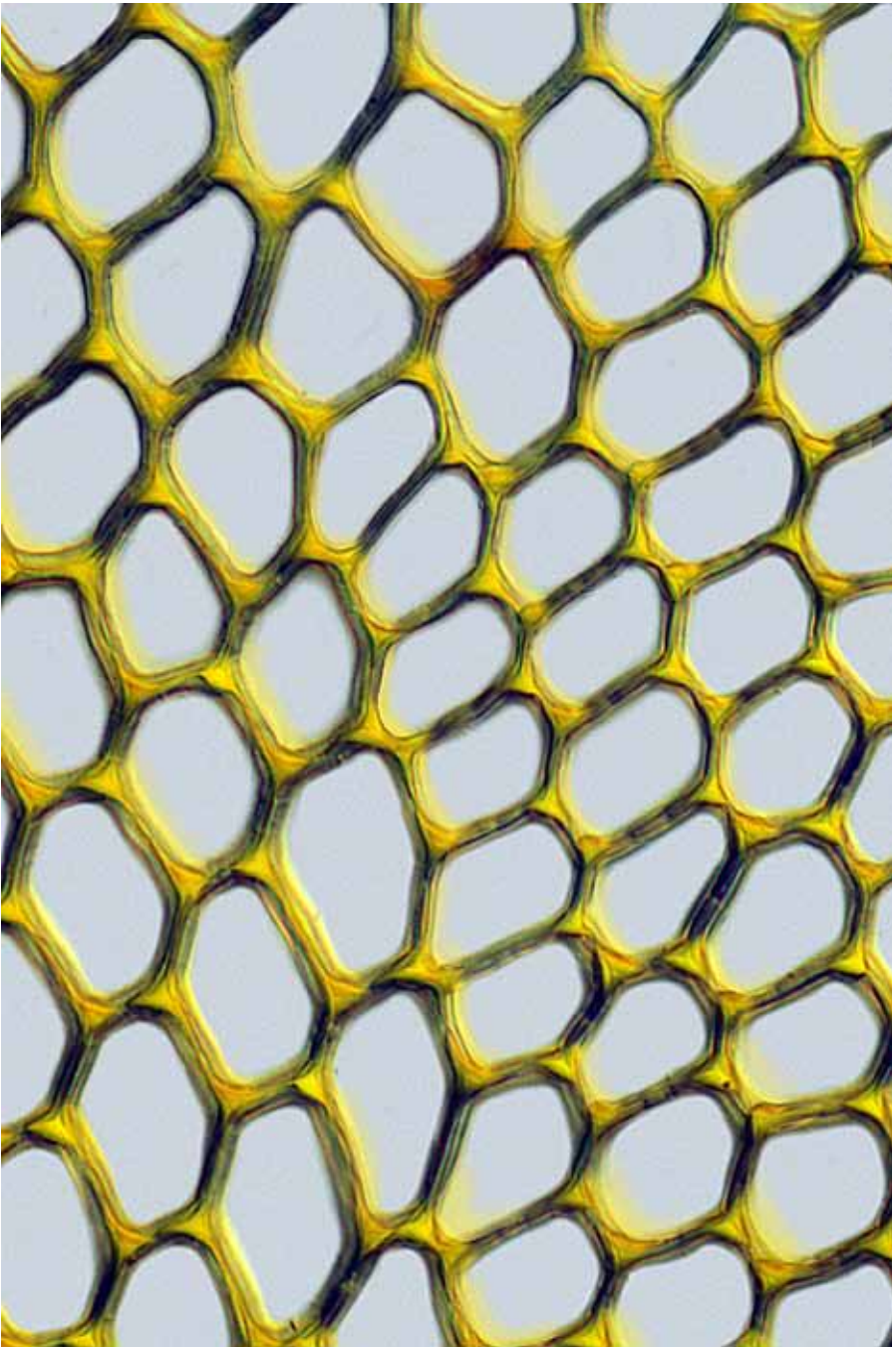
 100 μm , 100 μm , 10 μm

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Calyptra chaeta flexicollis leaf apex
10 μ m

continued next page

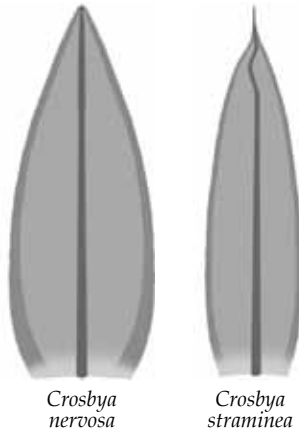


Calyptra chaeta flexicollis midleaf cells
10 μm

Key* to the New Zealand species of *Crosbya* (2)

- 1 Basal leaf cells hyaline, thin-walled, 1–2:1; border the same width throughout its length; apex cuspidate and asymmetric..... ● ***Crosbya nervosa***
 1: Basal leaf cells not hyaline, thick-walled, 5–9:1; border much wider below than above; apex widely acuminate and symmetric..... ● ***Crosbya straminea***

* based on Vitt, DH (1977): A taxonomic study of the genus *Crosbya* (= *Bellia*: Musci). *Canadian Journal of Botany* 55, 2081.



Crosbya nervosa (Hook.f. & Wilson) Vitt

form: matted, erect, branched stems, 15–25 mm tall; leaves golden, glossy
habitat: bark of branches, trunks (rarely rock) in shady lowland forest

leaf: size: 1.5–2.5 mm

shape: ovate- to oblong-lanceolate

tip: acuminate, cuspidate, and asymmetric

base: basal cells $27\text{--}50 \times 12\text{--}25 \mu\text{m}$

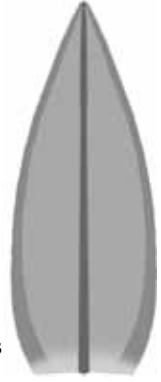
costa: excurrent into the apex, confluent with the border on both sides

border: 2–4 rows midleaf, of linear, thick-walled cells

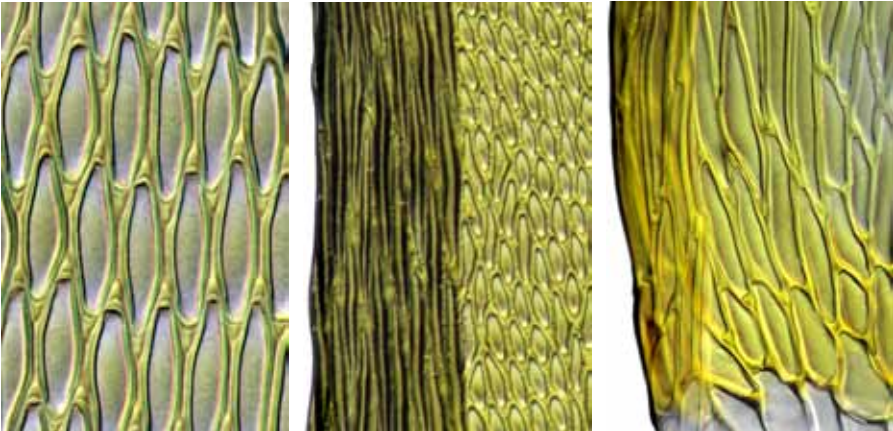
margin: entire, reflexed to recurved

cells: $8\text{--}15 \times 7 \mu\text{m}$, oval-rhombic, firm-walled, smooth

capsule: 0.5–1 mm, oblong-ovate, lateral, exserted, red-brown, erect;
 seta 4–6 mm, red; operculum long-rostrate; calyptra mitriform, deeply
 laciniate below; exostome teeth 16, cross-striolate, tips incurved,
 endostome segments 16, keeled, perforate, papillose, cilia absent; spores
 variable, $15\text{--}38 \mu\text{m}$ in diam.

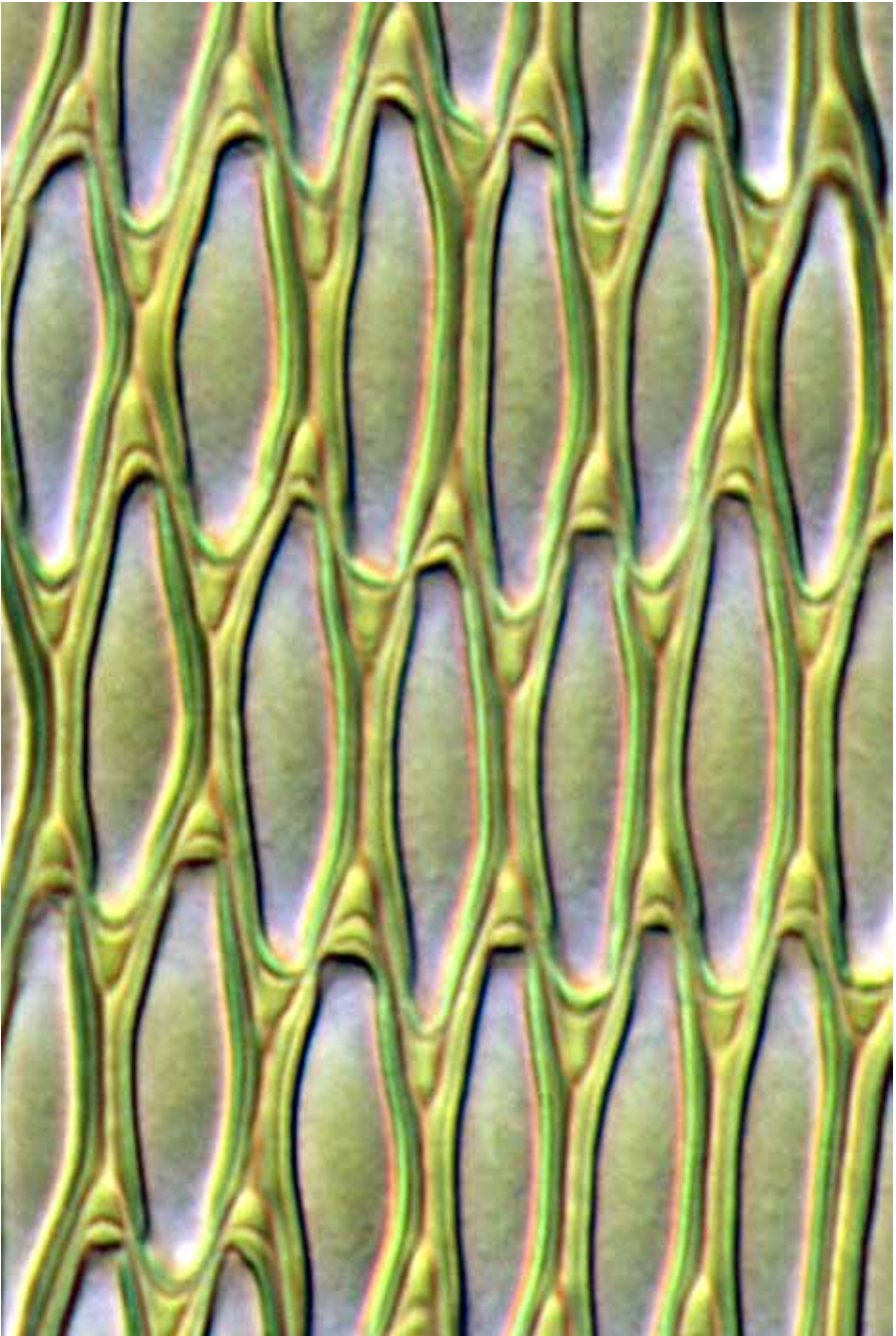


vegetative shoot (dry) (2), leaf outline, capsule (dry) (2), and leaf apex
 1 mm, 1 mm, 0.1 mm, 0.1 mm, 0.1 mm, 10 μm



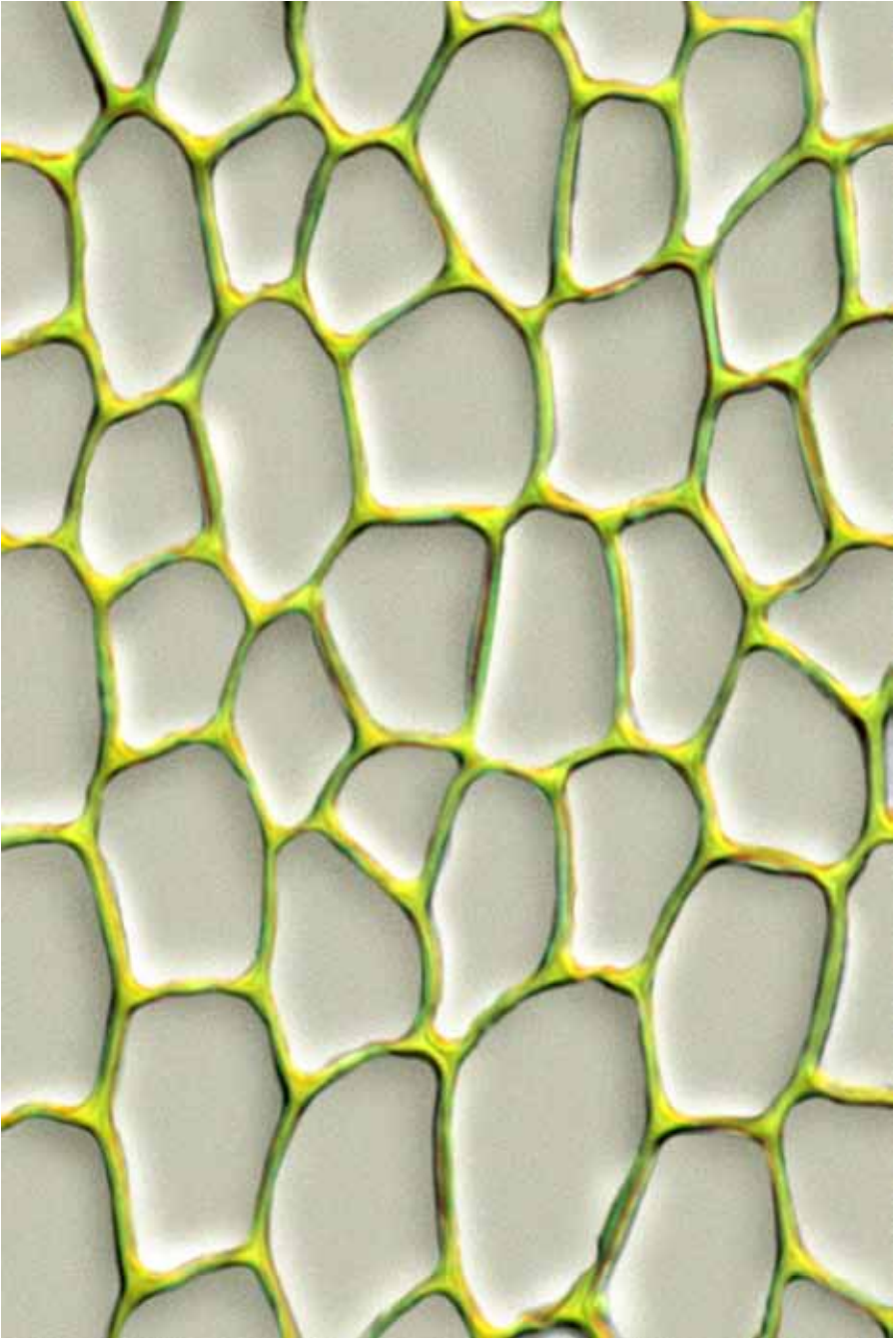
cells at midleaf, border of lower leaf, and leaf basal angle
 10 μm , 50 μm , 10 μm

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Crosbya nervosa cells midleaf
10 μm

continued next page



Crosbya nervosa cells near leaf base
10 μm

continued next page

Crosbya straminea (Beckett) Vitt

form: matted, prostrate, irregularly branched stems, up to 35 mm tall, leaves yellow-green above, darker below, glossy

habitat: bark of tree trunks and branches in moist shaded lowland forest

leaf: size: 1.5–3 mm

shape: oblong-lanceolate, ± keeled, sometimes falcate-secund

tip: abruptly narrowed to an acumen

base: basal cells 30–70 × 4–10 μm

costa: percurrent, confluent with the border

border: at midleaf 8–10 rows of linear, thick-walled cells

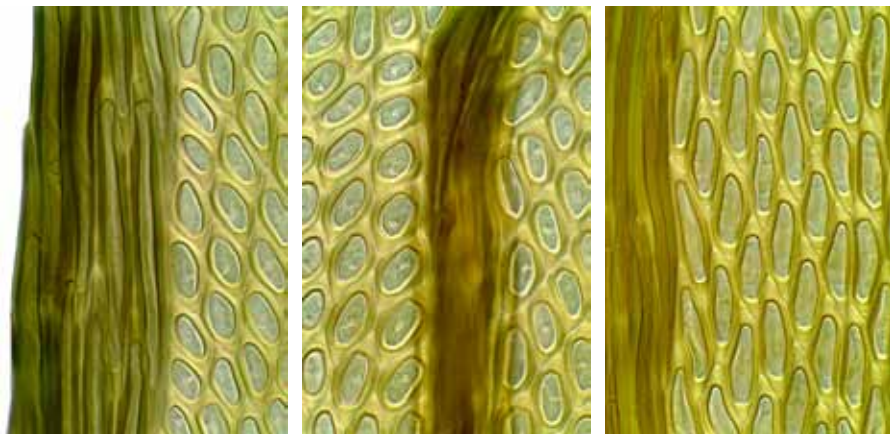
margin: entire to slightly toothed above, reflexed to recurved

cells: upper cells 15–30 × 7 μm, rhombic-hexagonal, thick-walled, smooth

capsule: 1–4 mm, ovate-cylindric, lateral, erect to inclined, smooth; seta 2–4.5 mm, curved or flexuose, red, rough above; calyptra mitriform, deeply laciniate; operculum conico-long-rostrate; exostome teeth 16, tips incurved, cross-striolate, endostome cilia absent; spores 30–50 μm in diam.



vegetative shoot, mature capsule, leaf outline, leaf apex, and leaf subapex
 1 mm, 5 mm, 0.5 mm, 10 μm, 10 μm

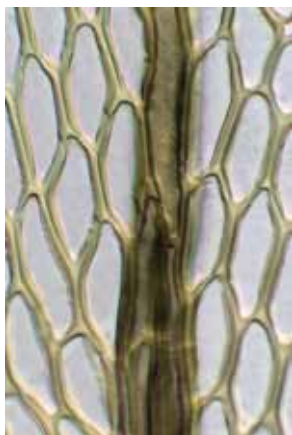


margin of lower leaf, costa at midleaf, and costa in upper leaf
 10 μm, 10 μm, 10 μm

Daltonia splachnoides (Sm.) Hook. & Taylor**form:** densely tufted, radiculose stems, 5–15 mm tall, the leaves pale, glossy**habitat:** bark in damp forest**leaf:** size: 1.5–3.5 × 0.4–0.5 mm*shape:* linear-lanceolate to elliptic-lanceolate, keeled below*tip:* variably acuminate*base:* cells near the insertion isodiametric, inflated, and coloured*costa:* thin, failing below the apex*border:* 2–5 rows of linear cells, markedly wider toward the leaf base*margin:* entire, plane to variably recurved*cells:* 24–32 × 8–9 μm, rhombic, firm-walled, smooth**capsule:** 1.5–2 mm, widely oval, exserted, erect to inclined, neck short, tapered; seta 3–10 mm, lateral, rough; calyptra densely ciliate-fringed; operculum erect long-rostrate; exostome teeth long-subulate, coarsely papillose, endostome segments equalling the exostome teeth, filiform, papillose, cilia absent; spores variable, 10–22 μm in diam., anisoporous

habit, vegetative shoot (dry), capsules (2), leaf outline, and leaf apex

5 mm, 1 mm, 0.5 mm (2), 0.1 mm, 10 μm



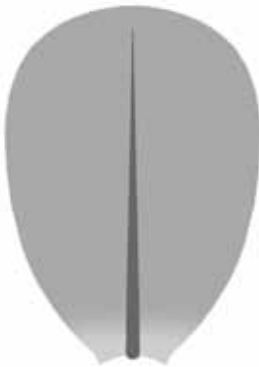
border at midleaf, costa at midleaf, and leaf basal angle

10 μm, 10 μm, 10 μm

Key* to the New Zealand species and varieties of *Distichophyllum* (5)

- 1 Plants epiphyllous (on fern fronds) or corticolous..... ● *Distichophyllum crispulum* var. *adnatum*
 1: Plants terrestrial or saxicolous 2
- 2(1:) Leaves not bordered..... ● *Distichophyllum microcarpum*
 2: Leaves bordered 3
- 3(2:) Leaves obtuse or only weakly apiculate; perichaetial bracts obtuse ● *Distichophyllum pulchellum*
 3: Leaves long-acute or apiculate; perichaetial bracts acute 4
- 4(3) Leaves 0.5–0.9 mm long, sharply denticulate above, stoutly apiculate..... ● *Distichophyllum rotundifolium*
 4: Leaves to 2 mm long, weakly denticulate above, with a long acute point..... ● *Distichophyllum crispulum* var. *crispulum*

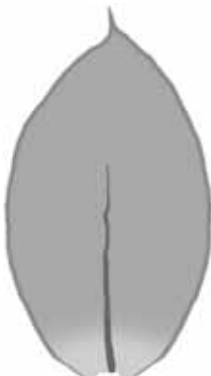
* based partly on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bulletin 5, 397.



*Distichophyllum
microcarpum*



*Distichophyllum
pulchellum*



*Distichophyllum
crispulum* var.
adnatum



*Distichophyllum
rotundifolium*



*Distichophyllum
crispulum* var.
crispulum

continued next page

Distichophyllum crispulum* var. *adnatum (Hook.f. & Wilson) Dixon

form: tufted, prostrate, radiculose, unbranched stems, 5–13 mm tall

habitat: bark or living fern fronds in damp forest

leaf: size: to 2 mm

shape: oval-oblong to obovate-oblong

tip: stoutly apiculate

base: strongly narrowed, alar region not differentiated

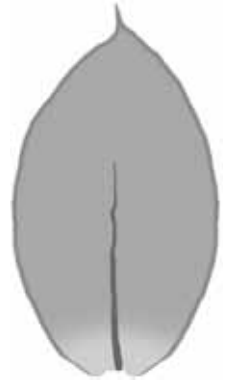
costa: failing above midleaf

border: 2–4 rows of elongate, firm-walled cells

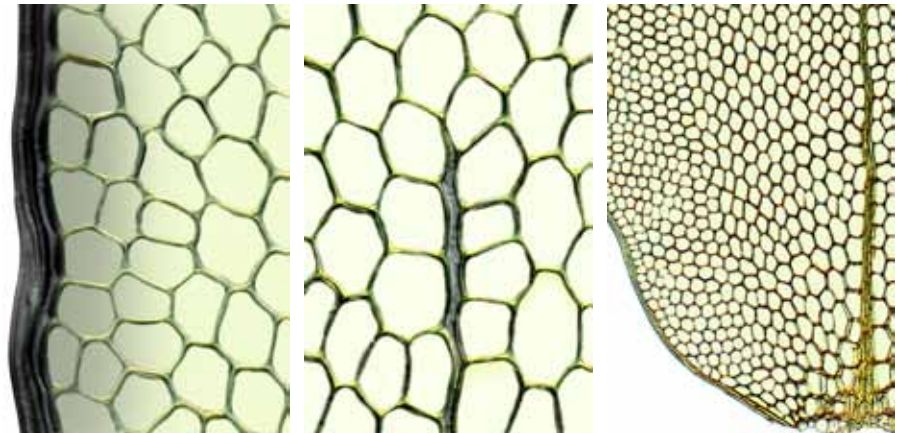
margin: entire, plane

cells: 20–24 μm , isodiametric, \pm hexagonal, thin-walled, smooth

capsule: 1.5 mm, narrowly oblong, inclined to horizontal, exserted, pale brown; seta 5–10 mm, red, slender; calyptra mitriform, pilose above, fringed below; operculum conic-subulate; exostome teeth yellow, endostome segments equalling the exostome teeth; spores 9–12 μm in diam., smooth



vegetative shoot (dry) (2), leaf outline, and leaf apex
 1 mm, 1 mm, 0.1 mm, 50 μm



margin at midleaf, costa terminus, and leaf basal angle
 10 μm , 10 μm , 50 μm

continued next page

Distichophyllum crispulum (Hook.f. & Wilson) Mitt. var. **crispulum**

form: ± unbranched, recumbent stems, to 100 mm long, in cushions,
dark red below, complanate

habitat: soil of shaded vertical stream banks

leaf: size: 1.5–2.0 mm

shape: oval-oblong to oblanceolate

tip: abruptly acutely pointed

base: strongly narrowed, not differentiated; juxtacostal cells $60 \times 30 \mu\text{m}$

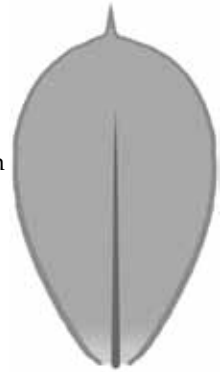
costa: failing about a third down from the apex

border: 2–3 rows of $130 \times 4 \mu\text{m}$ cells, merging with apical apiculus

margin: entire to weakly denticulate, plane

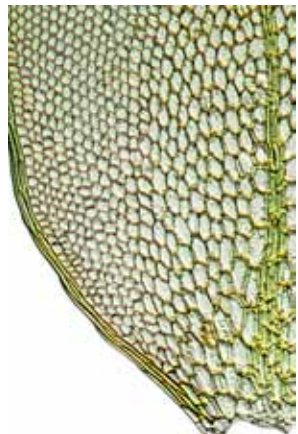
cells: midleaf cells $20 \times 14 \mu\text{m}$, ± hexagonal, firm-walled, smooth

capsule: 1 mm, narrowly oblong, inclined, exserted, pale brown; seta
5–10 mm, reddish, slender; calyptra mitrate, pilose, fringed;
operculum erect conic-subulate; exostome teeth 16, yellow, cross-
striolate; spores $9\text{--}12 \mu\text{m}$ in diam., smooth



habit, vegetative shoot (dry), leaf outline, and leaf apex

1 mm, 1 mm, 0.1 mm, 50 μm



margin at midleaf, costa terminus, and leaf basal angle

50 μm , 50 μm , 50 μm

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Distichophyllum crispulum var. *crispulum* leaf apex
— 10 μ m

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Distichophyllum microcarpum (Hedw.) Mitt.

form: patchy, creeping, radiculose stems, 20–100 mm tall, flattened, leaves in 6–8 rows

habitat: rotten logs, humus, or rock in damp forest

leaf: size: 2–4 × 1.5–1.0 mm

shape: obovate to elliptic-oblong from a narrow insertion

tip: obtuse to rounded

base: undifferentiated

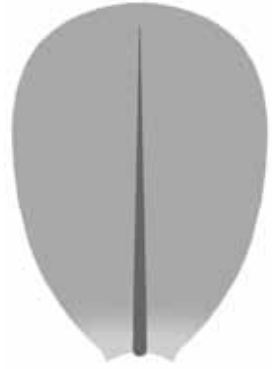
costa: failing near the apex

border: not differentiated

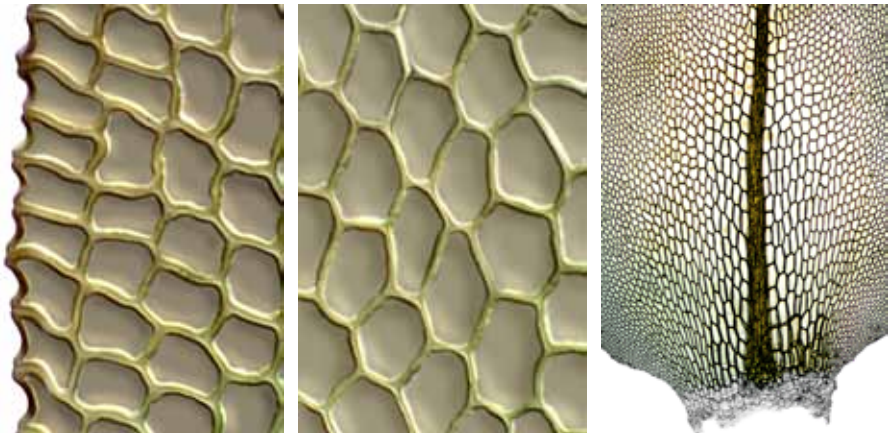
margin: entire, plane

cells: upper cells 10–18 μm, hexagonal, firm-walled, smooth; juxtacostal cells hyaline, larger and thinner-walled than the upper blade cells

capsule: 0.5–1.0 mm, ovoid, erect, dark purple-brown; seta 3–10 mm, purplish red; peristome double

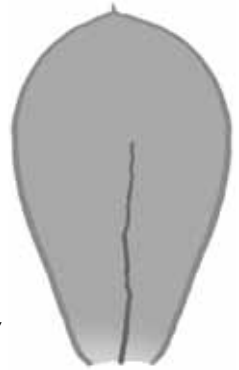


vegetative shoot (dry on far left), leaf outline, and leaf apex
 ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 0.25 mm



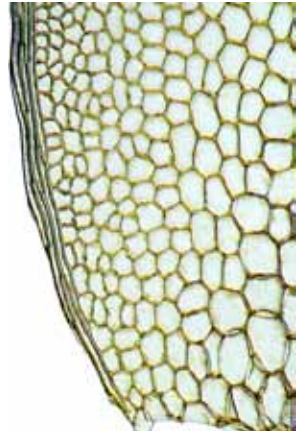
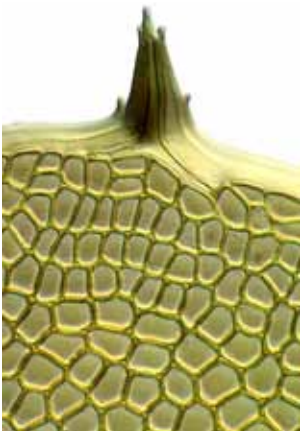
margin at midleaf, cells at midleaf, and enlarged juxtacostal cells in leaf base
 ■ 10 μm, ■ 10 μm, ■ 100 μm

continued next page

Distichophyllum pulchellum (Hampe) Mitt.**form:** creeping, radiculose, ± unbranched stems, 10–50 mm tall**habitat:** moist, loamy soil, or decaying logs in damp forest**leaf:** size: 1.3–1.8 × 0.6–0.8 mm*shape:* obovate to spatulate, crowded, imbricate, distichous*tip:* obtuse to rounded, mucronate to short-apiculate*base:* alar cells little differentiated*costa:* failing about 2/3 up the blade*border:* 2–3 rows of narrow elongate cells*margin:* entire, plane or reflexed toward the apex*cells:* 10–20 μm, isodiametric, firm-walled, smooth**capsule:** 1.5–2.0 mm, oblong, horizontal or cernuous, red-brown, lateral; seta 10–30 mm; calyptra mitriform, fringed; operculum erect, long-rostrate; exostome teeth yellow, striolate, joined basally, deeply furrowed, endostome segments equalling exostome teeth; spores 9–17 μm in diam., smooth

vegetative habit, shoots (moist) (2), capsule, and leaf outline

1 mm, 1 mm, 1 mm, 1 mm, 0.1 mm



mucronate leaf apex, costa terminus, and leaf basal angle

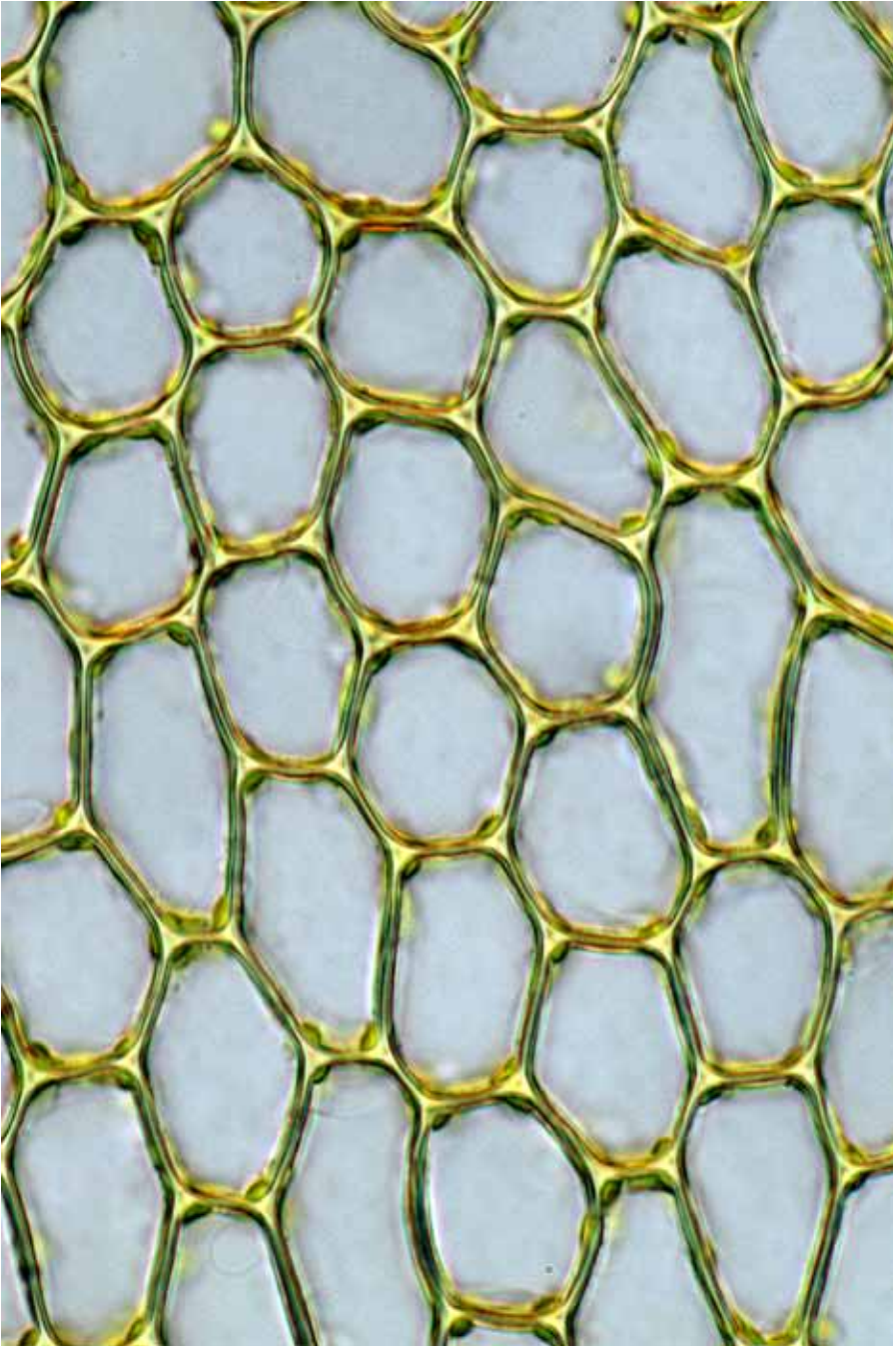
10 μm, 50 μm, 50 μm

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Distichophyllum pulchellum habit (fully hydrated)
1 mm

continued next page



Distichophyllum pulchellum midleaf cells
10 μm

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Distichophyllum rotundifolium (Hook.f. & Wilson) Müll.Hal. & Broth.

form: tufted, ± unbranched, radiculose stems, 5–13 mm tall, yellow-green

habitat: rotting logs and humus or rarely rock in damp forest

leaf: size: 0.5–0.9 mm

shape: ovate-orbicular, crisped when dry

tip: stoutly apiculate

base: basal cells longer and thinner-walled than other blade cells

costa: reaching halfway to two-thirds up the blade, ± flexuose

border: 2–4 rows of elongate, incrassate, hyaline cells

margin: entire below, denticulate above, plane

cells: 16–24 μm , isodiametric, firm-walled, smooth

capsule: 1.5–2 mm, narrowly oblong, inclined to horizontal,

exserted, pale brown; seta 5–10 mm, red, slender; calyptra

mitriform, pilose above, fringed below; operculum conic-

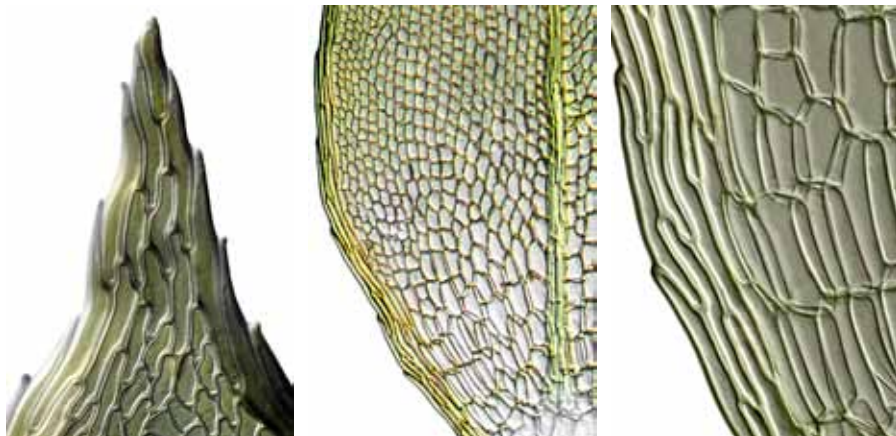
subulate; exostome teeth yellow, endostome segments equalling

the exostome teeth in length; spores 9–12 μm in diam., smooth



vegetative shoots (dry on left) (3), leaf outline and apex

1 mm, 1 mm, 1 mm, 0.1 mm, 100 μm



leaf apex, and leaf basal angle (2)

10 μm , 50 μm , 10 μm

continued next page



Distichophyllum rotundifolium leaf apex detail
10 μm

Ephemeropsis trentepohlioides (Renner) Sainsbury

form: flat tufts of orange, persistent, interwoven protonemata that produce scattered capsules

habitat: bark and living leaves of shaded shrubs and vines

leaf: size: leaves none—persistent protonemata only

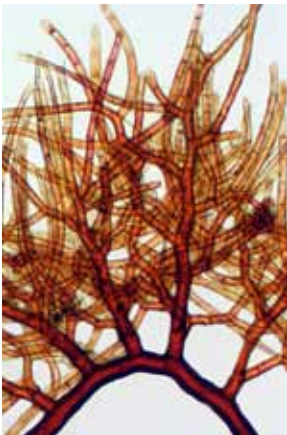
capsule: 0.4–0.9 mm, oblong-ovoid, erect, exserted, brown; seta 1–2 mm, rough; calyptra mitriform, ciliate at the base; operculum erect conico-rostrate; exostome teeth 100 μ m long, reflexed when dry, densely cross-striolate, endostome segments delicate, keeled, shorter than exostome teeth, cilia absent; spores fusiform, 3–5-celled, 100–200 μ m long

note: superficially resembles the green alga *Trentepohlia* in its colour and filamentous form



fertile habit, capsules, and multicellular spores

1 mm, 0.5 mm, 100 μ m



persistent protonema

100 μ m (left two), 50 μ m (right)

Cyclodictyon blumeanum (C.Müll.) C.Kuntze

form: pendent mats of branched, creeping stems, to 40 mm long, shoots complanate, leaves 6-ranked, light green and iridescent when young
habitat: covering wet rocks or submerged in springs; Kermadecs only

leaf: size: 1.6–2 × 0.4–1 mm; pseudoparaphyllia lanceolate, to 400 μm
shape: oblong-lanceolate to oblong-ovate or broadly ovate

tip: acute to ± cuspidate

base: cells ± rectangular, 60–100 × 15–30 μm; alar cells not differentiated

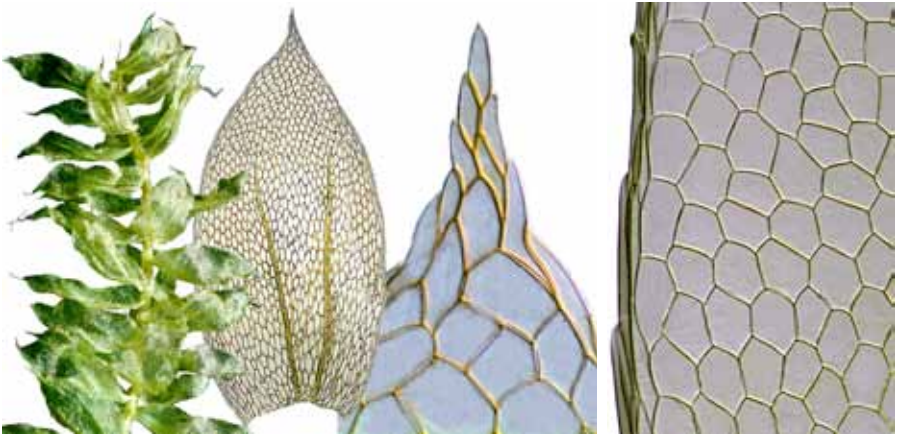
costa: two, narrow but strong, reaching about two-thirds up the blade

border: 2–3 rows of linear cells (125–150 μm long) from base to near apex

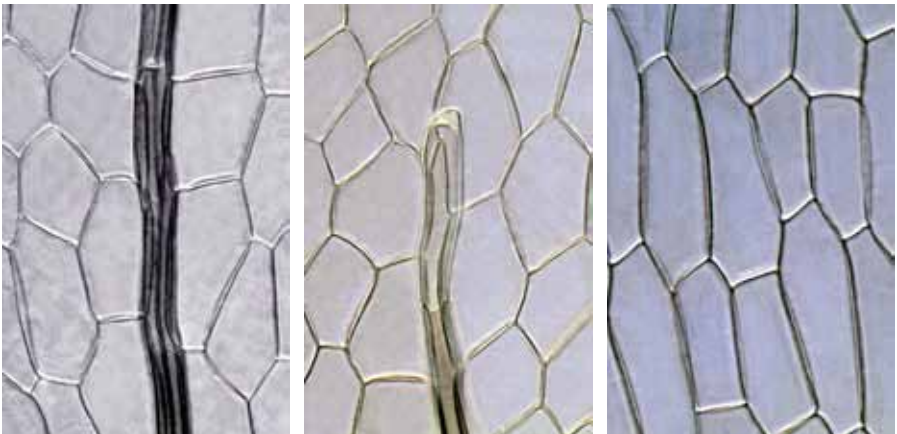
margin: weakly toothed above, plane or nearly so

cells: 30–60(–90) × 24–40 μm, oblong-hexagonal, thin-walled, smooth

capsule: not seen in New Zealand; 1.5–2 mm, ovoid to ovoid-cylindric, slightly curved, suberect to cernuous, dark brown; seta 12–20 mm, reddish; calyptra mitrate, covering the entire capsule; operculum long-rostrate; peristome double; spores 8–12 μm in diam., smooth



vegetative shoot (dry, crisped), bicostate leaf outline, leaf apex, and margin midleaf
 1 mm, 0.5 mm, 50 μm, 50 μm



costa midleaf (only one shown), spicule at a costa terminus, and cells near leaf base
 50 μm, 50 μm, 50 μm

Key* to the New Zealand species of *Trachyloma* (2)

- 1 Gemmiferous axes with large, usually fully developed leaves intermingled with gemmae; anticlinal walls of exothelial cells smooth to slightly undulate ● ***Trachyloma diversinerve***
- 1: Gemmiferous axes with highly reduced leaves that are most easily seen near the base of the axes after most of the gemmae have fallen off; anticlinal walls of exothelial cells nodulose ● ***Trachyloma planifolium***

* based on Miller, NG; Manuel, MG (1982): *Trachyloma* (Bryophytina, Pterobryaceae): a taxonomic monograph. *Journal of the Hattori Botanical Laboratory* 51, 288, and Sainsbury, RGK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 154.



*Trachyloma
diversinerve*



*Trachyloma
planifolium*

Trachyloma diversinerve Hampe

form: patchy, erect, 1–2-pinnately branched, frondose stems, to 25 mm tall, leaves glossy, pseudoparaphyllia narrowly lanceolate

habitat: bark in damp forest

leaf: size: stem leaves 1.3–3.7 × 0.4–1.5 mm; branch leaves smaller

shape: stem and branch leaves ovate to ovate-lanceolate

tip: stem and branch leaves acute to obtuse

base: alar cells not differentiated

costa: none or short

border: not differentiated

margin: irregularly sharply serrulate above, ± entire below, plane

cells: 50–115 × 7–9 μm, linear, firm-walled, sinuose, porose, smooth

capsule: 3–6 mm, long-cylindric, exserted, erect, brown; seta 8–20 mm; calyptra smooth; operculum obliquely long-rostrate; peristome double; spores 12–16 μm, verrucose (coarsely warty)

note: filamentous multicellular gemmae 100–400 × 20 μm, 4–15-celled



vegetative frond (2), gemmiferous shoot (2), propagule, and leaf outline

10 mm, 10 mm, 1 mm, 0.5 mm, 10 μm, 0.5 mm



leaf apex, margin of upper leaf, and leaf basal angle

10 μm, 10 μm, 10 μm

continued next page



Trachyloma diversinerve
vegetative frond
5 mm

continued next page

Trachyloma planifolium (Hedw.) Brid.

form: primary stems radiculose, creeping, leaves rudimentary, secondary stems dendroid, to 30 mm, 1–2-pinnately branched, complanate, leaves glossy, old leaves silvery

habitat: bark in damp forest

leaf: *size:* rachis leaves 2–3.5 × 1.2–1.9 mm; branch leaves smaller

shape: ovate to ovate-lanceolate, slightly asymmetric at the base

tip: obtuse to acuminate

base: basal cells porose and wider than the blade cells

costa: absent or weak and reaching about a quarter up the blade

border: not differentiated

margin: ± denticulate above, plane to incurved on one side

cells: 60–100 × 6–10 μm, linear-fusiform, firm-walled, smooth

capsule: 2–5 mm, narrowly cylindric, ± curved, suberect; seta 10–20 mm; peristome double, of distinctive white, hair-like teeth up to 1 mm long

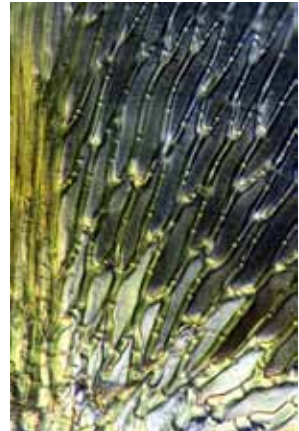
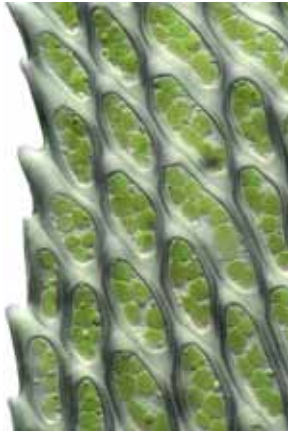
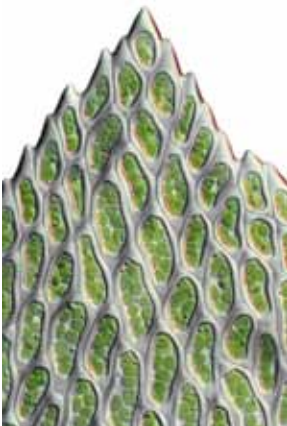


costa can be absent



shoots (2), capsule, peristome, single tooth, calyptra with operculum, and leaf outline

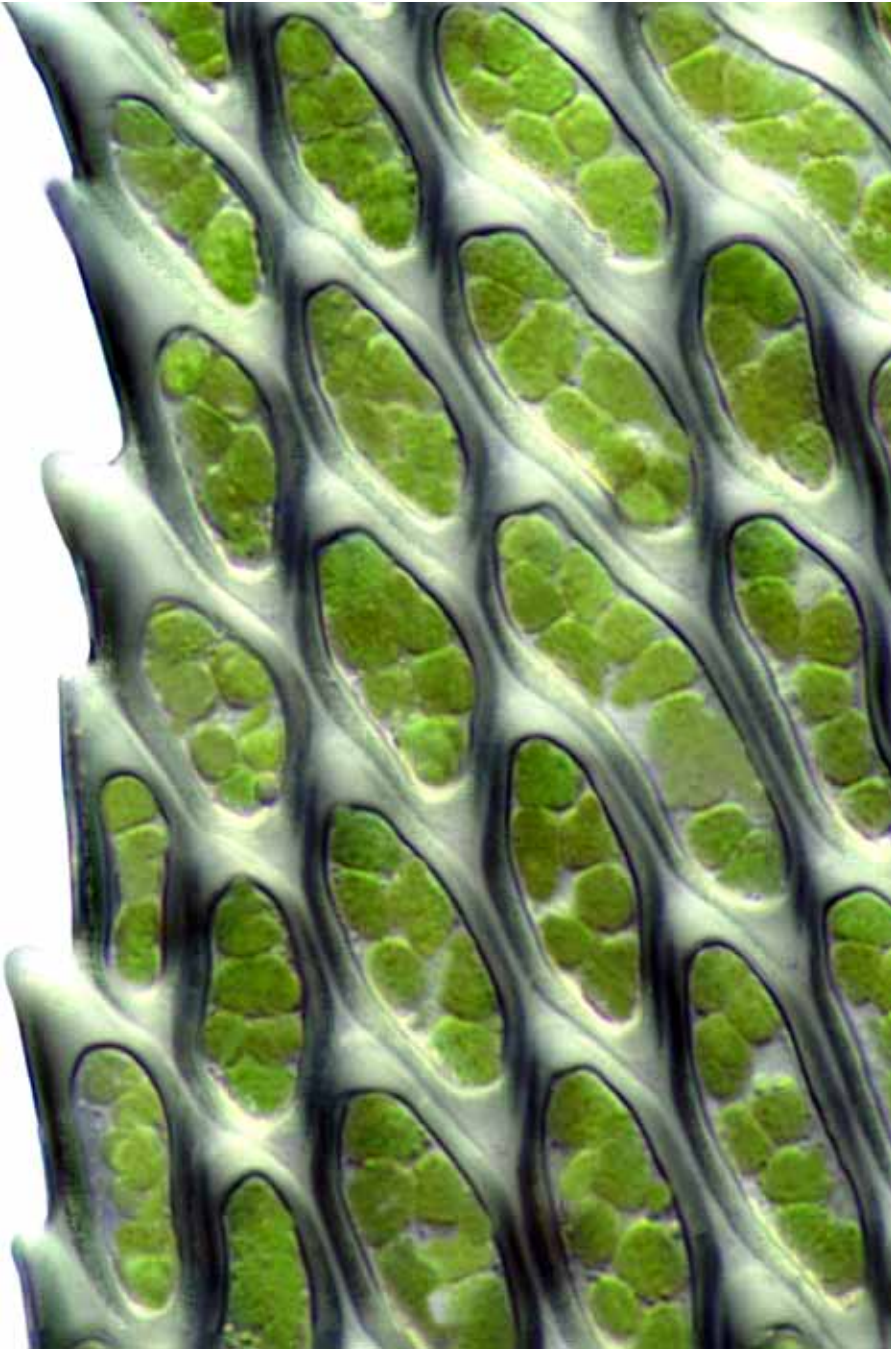
5 mm, 1 mm, 0.5 mm, 0.1 mm, 0.1 mm, 0.5 mm, 0.5 mm



leaf apex, margin of upper leaf, and basal juxtacostal cells

10 μm, 10 μm, 10 μm

continued next page



Trachyloma planifolium margin upper leaf
10 μm

Climacium dendroides (Hedw.) Weber & D.Mohr

form: primary stem creeping; secondary stem dendroid, radiculose, 30–40

mm, the leaves green or golden, glossy when dry; probably adventive

habitat: soil or humus, in swamps or cushion bogs or near streams or pools

leaf: size: stem leaves to $2.3\text{--}2.8 \times 1.8$ mm; branch leaves $2\text{--}3 \times 0.8\text{--}1.2$ mm

shape: ovate-lanceolate to oblong-lanceolate; branched paraphyllia common

tip: obtuse, dentate; stipe leaves mucronate and obscuring the stipe

base: auricles of pale, thin-walled, \pm inflated alar cells

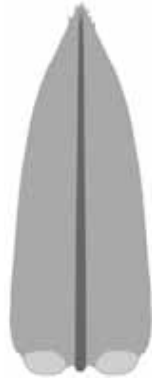
costa: strong, vanishing below the apex; often ending in an abaxial spicule

border: not differentiated

margin: entire below, the tip coarsely serrate to dentate, plane to incurved

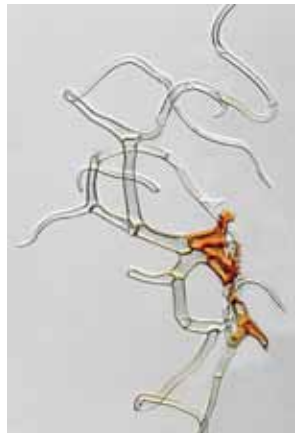
cells: $30\text{--}50 \times 5\text{--}7$ μm , narrowly rhombic, firm-walled, smooth, \pm porose

capsule: not seen in New Zealand; 3–5 mm, oblong-cylindric, \pm arcuate, exserted, erect to inclined; seta 18–45 mm; operculum rostrate; calyptra long, \pm twisted; peristome double; spores 13–22 μm in diam., minutely papillose



vegetative shoots (3) (dry), leaf outline, and leaf apex

10 mm, 1 mm, 1 mm, 1 mm, 10 μm



margin at midleaf, costa at midleaf, and branched paraphyllia

10 μm , 50 μm , 10 μm



Climacium dendroides vegetative shoots (dry)
5 mm (left), 1 mm (right)

continued next page

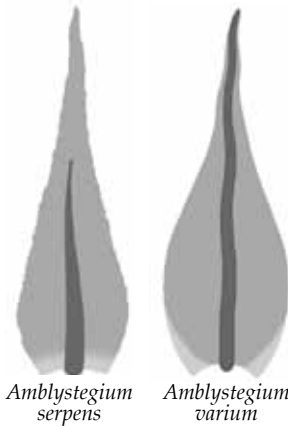


Climacium dendroides leaf cross-sections showing abaxially prominent costa
10 μm (above), 50 μm (below)

Key* to the New Zealand species of *Amblystegium* (2)

- 1 Costa reaching to only about midleaf; upper cells 3–5:1; paraphyllia absent..... ● ***Amblystegium serpens***
 1: Costa reaching the acumen; upper cells 2–3:1; paraphyllia usually present, mostly uniseriate, up to 12 cells and 150 μm long..... ● ***Amblystegium varium***

* based on Sharp, AJ; Crum, HA; Eckel, P (1994): *The Moss Flora of Mexico*. New York Botanical Garden, Bronx, 892.



Amblystegium serpens (Hedwig) Bruch & W.P.Schimper

form: matted, creeping, radiculose stems, to 30 mm long, branches filiform

habitat: moist soil, fallen branches, logs, and rock in swamps or near lakes

leaf: size: 0.5–0.8 × 0.2–0.3 mm (branch leaves slightly smaller and narrower)

shape: lanceolate

tip: tapering to a fine acumen

base: narrowed; basal cells subquadrate, forming a weak alar group

costa: failing above midleaf

border: not differentiated

margin: entire or weakly denticulate, plane

cells: 20–30 × 7–9 μm, irregularly rhombic, firm-walled, smooth

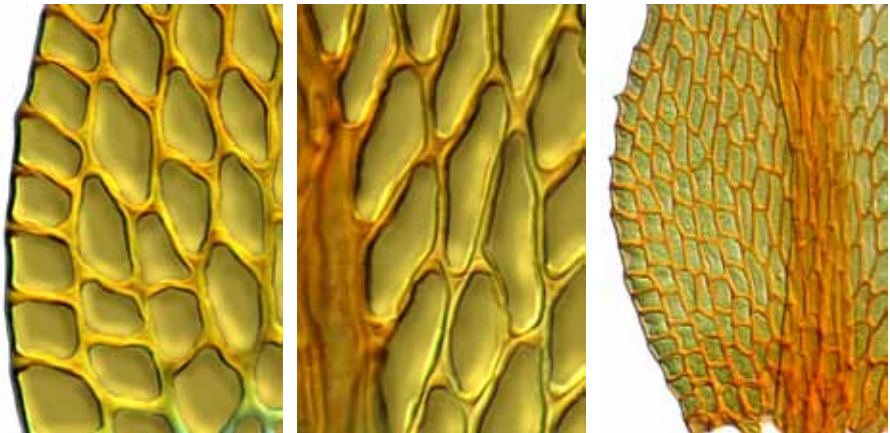
capsule: 1.8–2 mm, cylindrical, arcuate, exserted, inclined to horizontal, strangulate when dry; seta 10–25 mm, flexuose, red; calyptra cucullate, naked, smooth; operculum conic-apiculate; peristome double; spores 12–15 μm in diam., globose

note: widely distributed in both hemispheres



vegetative shoot (dry), capsule (dry), leaf outline, leaf apex, and leaf subapex

1 mm, 1 mm, 0.1 mm, 10 μm, 10 μm



margin at midleaf, costa at midleaf, and leaf basal angle

10 μm, 10 μm, 50 μm

continued next page

Amblystegium varium Hedw.

form: straggling, rigid, radiculose stems, 5–50 mm, leaves dull, yellowish

habitat: soil, humus, logs, bark, and rock in limey streams or marshes, to 800 m

leaf: size: stem leaves $0.4\text{--}1.0 \times 0.2\text{--}0.3$ mm; branch leaves $0.3\text{--}0.7 \times 0.2$ mm

shape: variable, mostly ovate-lanceolate, \pm decurrent

tip: tapered to an acumen

base: alar cells \pm quadrate, firm-walled, often yellowish

costa: flexuose above, disappearing below or in the acumen

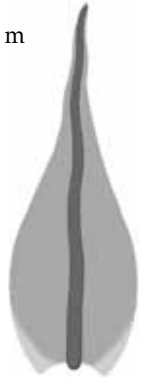
border: not differentiated

margin: entire or weakly serrulate, plane

cells: $12\text{--}20 \times 6\text{--}7$ μm , elongate-hexagonal, firm-walled, smooth, not porose

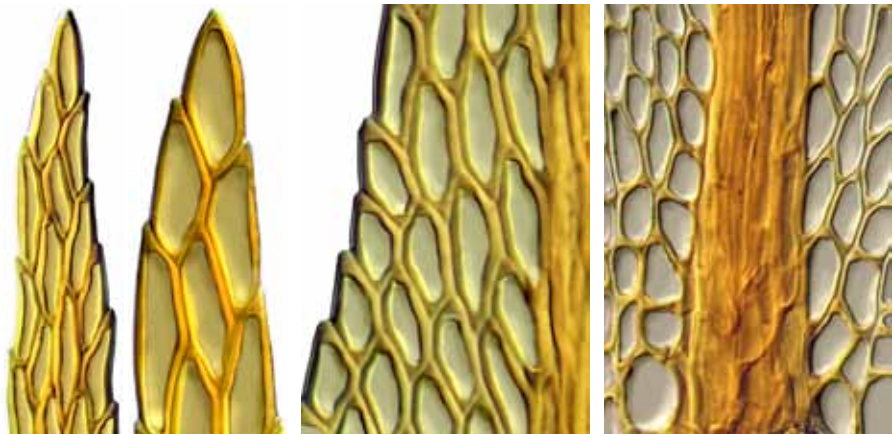
capsule: rare in New Zealand; 1.8 mm, cylindric, strongly curved, exserted, inclined to horizontal, brown; seta 20–32 mm, flexuose; operculum conic-apiculate; peristome double, cilia 1–3; spores 15–18 μm in diam.

note: highly variable



vegetative shoots (3), and leaf outlines (2)

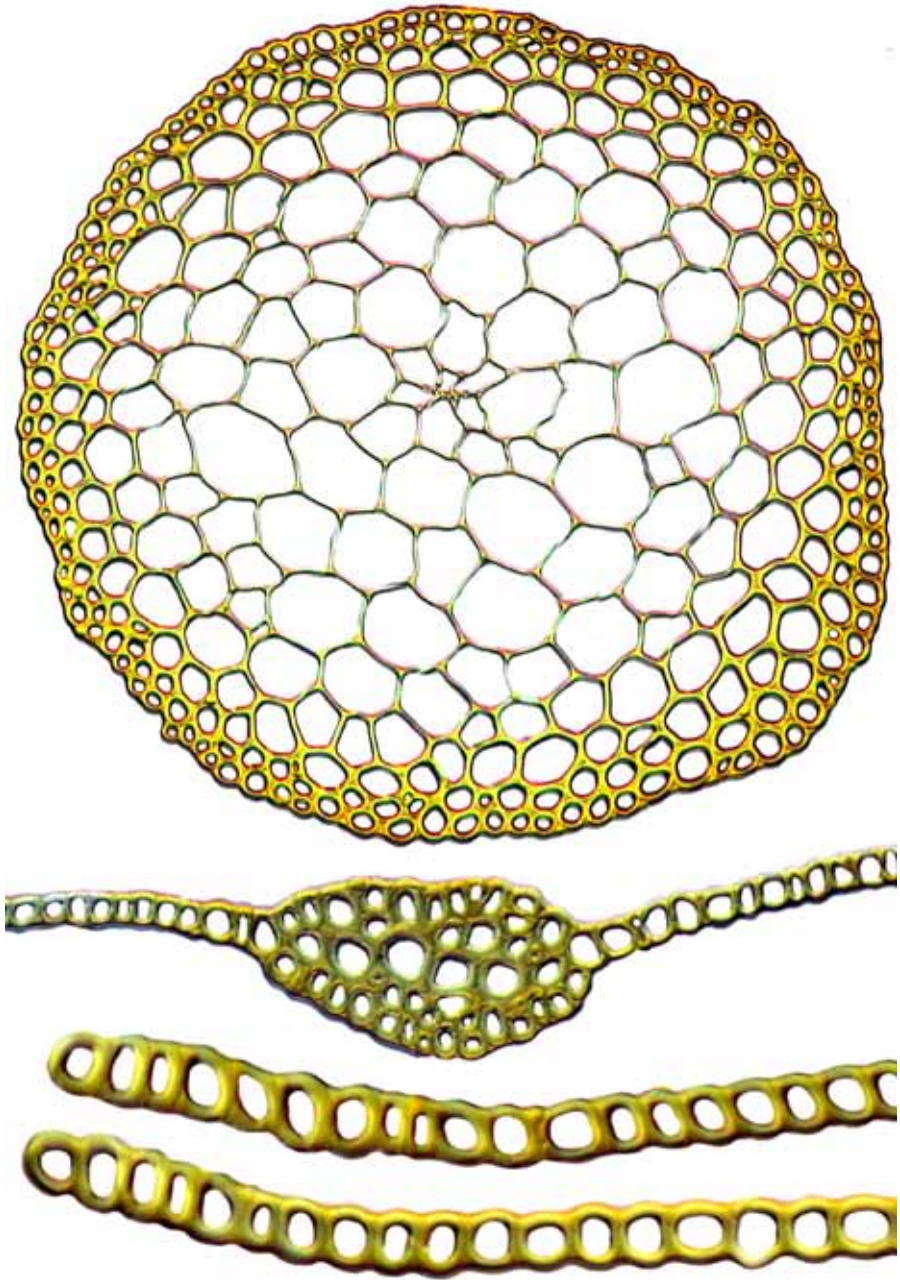
■ 2 mm (2), ■ 1 mm, ■ 0.5 mm (2)



leaf apices (2), leaf margin near apex, and costa at midleaf

■ 10 μm , ■ 10 μm , ■ 10 μm , ■ 10 μm

continued next page



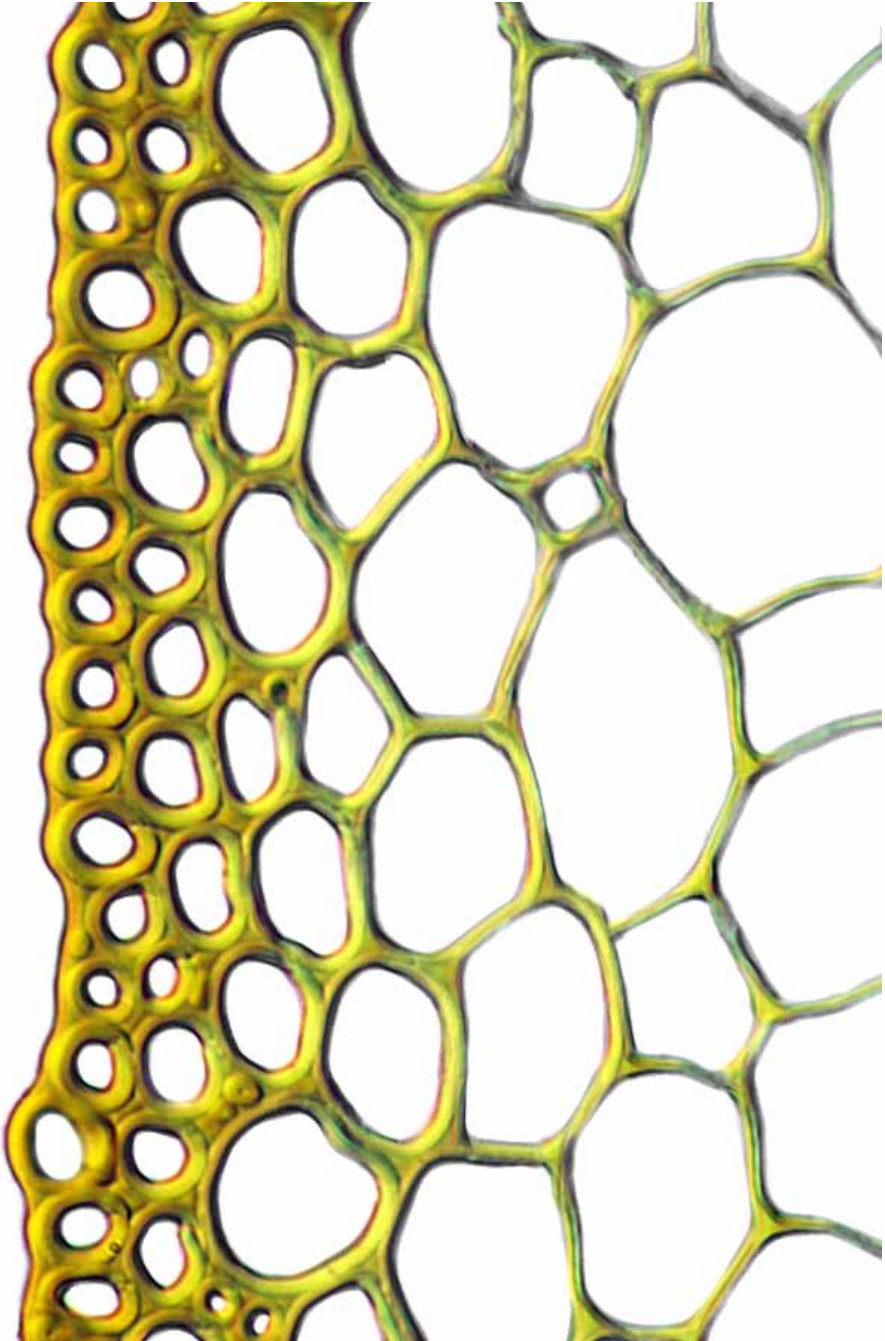
Amblystegium varium stem, costa, and leaf margin (2) cross-sections

50 μm (top),

50 μm (middle),

10 μm (bottom two)

continued next page

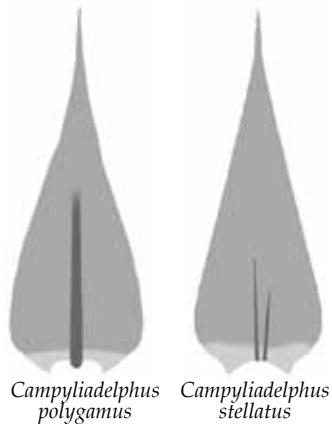


Amblystegium varium stem cross-section (detail)
10 μm

Key* to the New Zealand species of *Campyliadelphus* (2)

- 1 Costa single, ending about midleaf..... ● ***Campyliadelphus polygamus***
 1: Costa none or short and double..... ● ***Campyliadelphus stellatus***

* based on Crum, HA; Anderson, LE (1981): *Mosses of Eastern North America*. Columbia University Press, New York, 945.



Campyliadelphus polygamus (Bruch & Schimp.) Kanda

form: loosely tufted, irregularly branched, radiculose, procumbent stems, 15–45 mm tall, lacking paraphyllia, leaves glossy, golden

habitat: peat or soil in marshes and stream margins, ± aquatic, to 1600 m

leaf: size: 1.8–2.3 × 0.6–0.8 mm; branch leaves 1.2–1.4 × 0.3–0.4 mm

shape: stem leaves lanceolate, unistratose, little altered when dry

tip: tapered to a channelled, ± twisted acumen

base: cells enlarged at the angles and forming a distinct triangular group

costa: single, weak, reaching to about halfway up the lamina

border: not differentiated

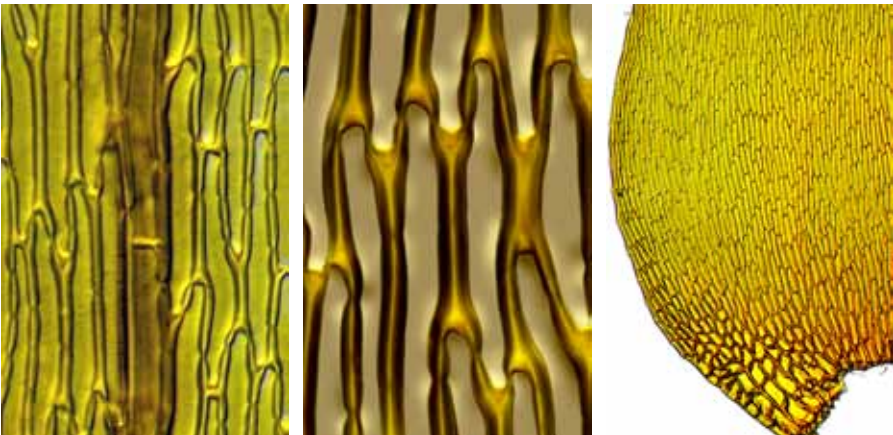
margin: entire to obscurely denticulate, plane

cells: 45–90 × 5–8 μm, narrowly linear, firm-walled, smooth, not porose

capsule: 2.5–3.0 mm, cylindrical, necked, curved, inclined to horizontal, exserted, brown, annulate; seta 20–30 mm, orange, flexuose; operculum conic; peristome hypnoid, endostome cilia 2, nodulose; spores 15–18 μm in diam., ± papillose

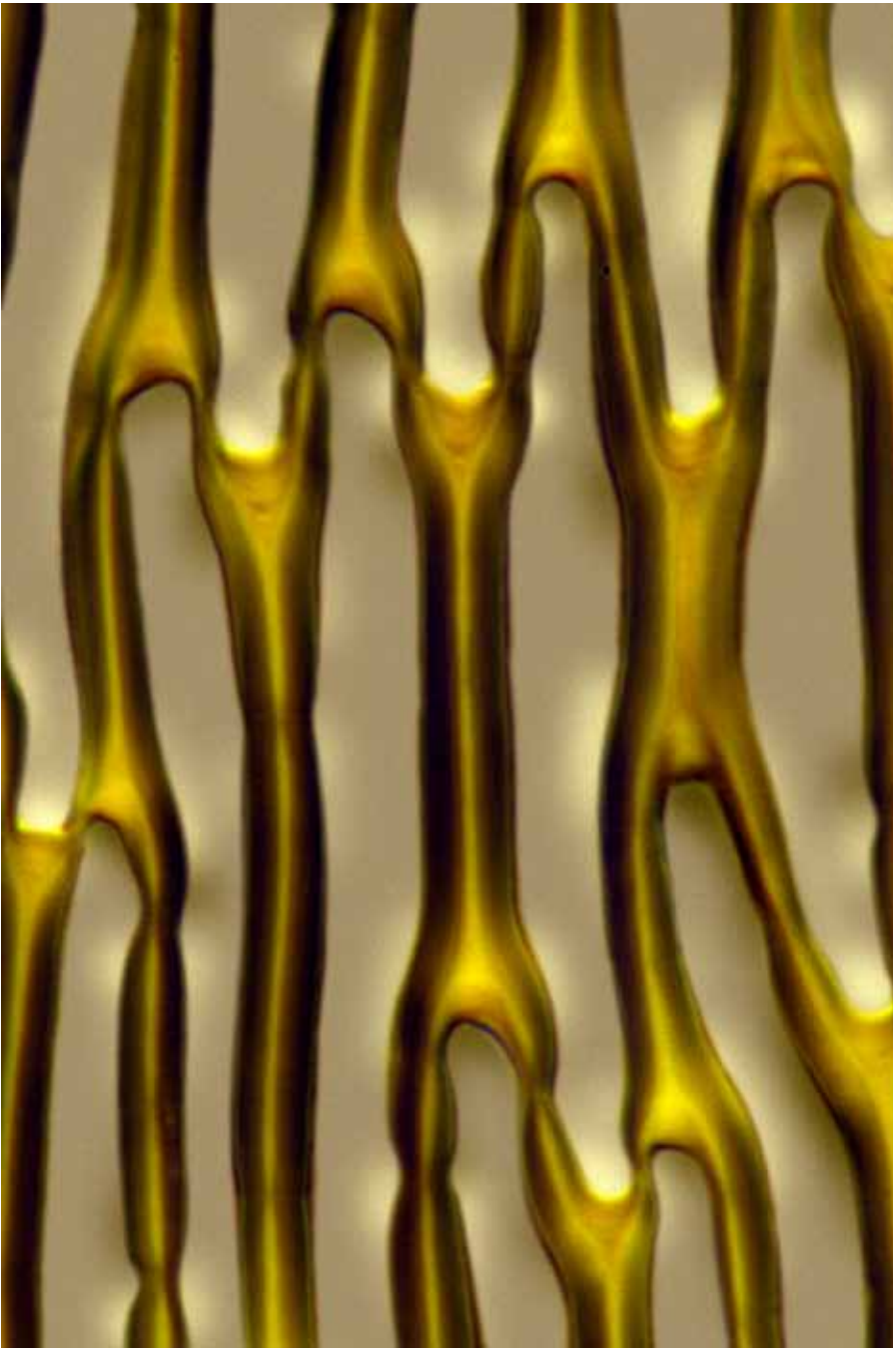


vegetative shoot (dry) (2), leaf outline, leaf apex, and margin midleaf
 1 mm, 1 mm, 0.1 mm, 10 μm, 10 μm



costa at midleaf, cells at midleaf, and leaf basal angle
 10 μm, 10 μm, 50 μm

continued next page



Campyliadelphus polygamus midleaf cells
10 μm

continued next page

Campyliadelphus stellatus (Hedw.) Kanda

form: tufted or matted, ± erect, branched stems, 100 mm tall, leaves green or golden-brown, glossy

habitat: wet soil or humus in high-altitude limey fens or seeps, to 1600 m

leaf: size: stem leaves 2.5–3.5 × 0.8–1.0 mm; branch leaves smaller

shape: lanceolate, tapering evenly to the apex, striolate when dry

tip: long, slender, channelled acumen, narrower in branch leaves

base: alar region ± auriculate, cells inflated, hyaline to pigmented

costa: absent, weak, or short and double

border: not differentiated

margin: entire above, serrulate below, plane

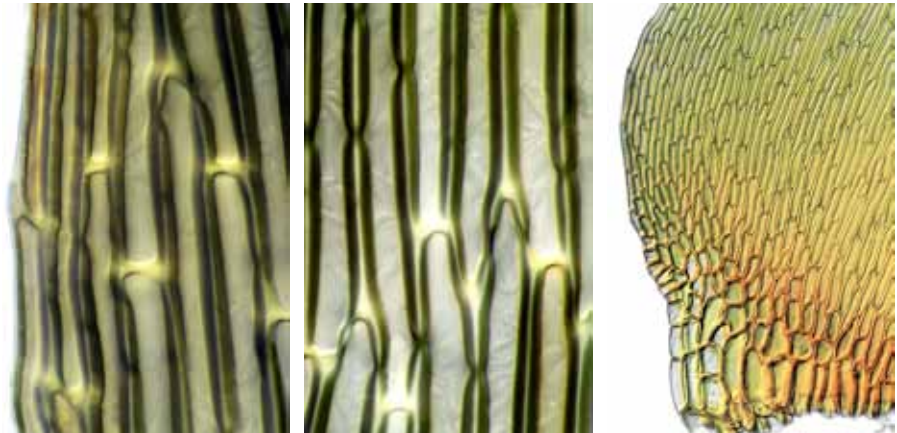
cells: 40–90 × 4–5 μm, vermicular, incrassate, porose, smooth

capsule: capsules not seen in New Zealand; 2–3 mm, cylindrical, curved, exserted, inclined to horizontal, strangulate when dry; seta 20–35 mm; operculum conic, apiculate; peristome double; spores 15–18 μm in diam., finely papillose



vegetative shoot (dry) (2), branch leaf outline, and leaf apex (2)

■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 50 μm, ■ 50 μm



margin at midleaf, cells at midleaf, and branch leaf basal angle

■ 10 μm, ■ 10 μm, ■ 50 μm

Cratoneuron filicinum (Hedw.) Spruce

form: interwoven mats of erect, pinnately branched (up to 45 mm), radiculose, and sparsely paraphylliate stems, 80(–120) mm tall, leaves green or golden

habitat: rock or soil in limey bogs, seepages, damp concrete, bricks, to 1500 m

leaf: size: stem leaves 1–1.2 × 0.6 mm; branch leaves 0.5–1.0 × 0.2 mm

shape: stem leaves wide-triangular, ± falcate-secund; branch leaves ovate-lanceolate

tip: gradually narrowed to a broad, plane subula

base: stem: auriculate, decurrent; branch: neither

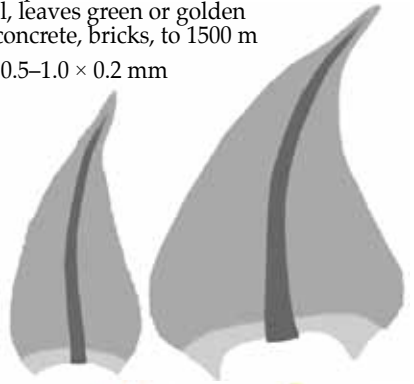
costa: percurrent or ending in the subula

border: not differentiated

margin: serrulate, plane to recurved at the base

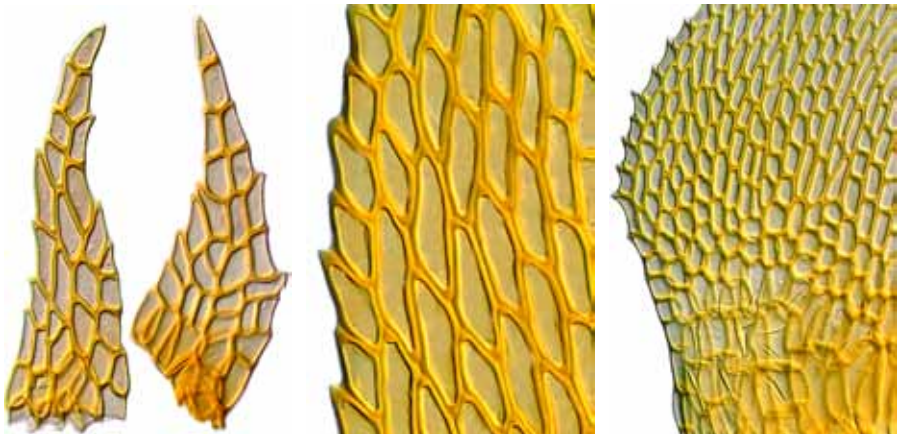
cells: 20–30 × 5–7 μm, oblong, firm-walled, smooth

capsule: no capsules in New Zealand; 2–2.5 mm, oblong to cylindric, strongly necked, inclined to horizontal, asymmetric, curved, strangulate when dry and empty; seta 25–35 mm



vegetative shoots (dry) (2), leaf outlines (2), and leaf apex

■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 0.1 mm, ■ 10 μm



toothed paraphyllia, margin midleaf, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 10 μm, ■ 50 μm

Cratoneuropsis relaxa (Broth.) Fleisch.

form: (typical) dense and large mats of paraphylliate, irregularly branched stems, 100–250 mm long, the leaves yellowish, not glossy

habitat: shaded wet soil, rock, or logs, submerged or emergent, to 1600 m

leaf: *size:* stem leaves 1.2–1.8 × 0.6–0.9 mm; branch leaves same or smaller
shape: cordate to lanceolate, ± constricted at midleaf, unchanged when dry

tip: acuminate, often oblique

base: basal cells shortly rectangular, not in distinct auricles or alar groups

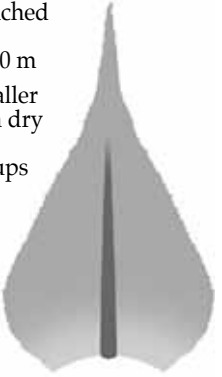
costa: evenly tapered, variably failing from midleaf to the acumen

border: weak or not differentiated

margin: entire to denticulate, plane to tubulose, recurved midleaf

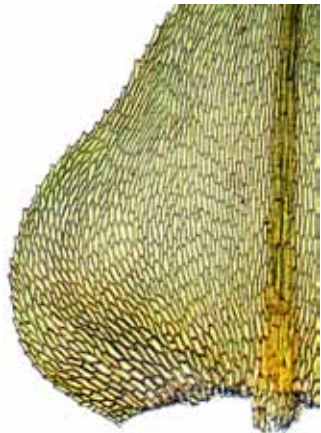
cells: 15–35 × 6–9 μm, linear-rhombic, firm-walled, smooth, not porose

capsule: 2–3 mm, cylindric-oblong, exserted, ± curved, horizontal, brown; seta 30–40 mm, red, flexuose; operculum conic, ± apiculate; exostome teeth yellow, fused at the base, endostome cilia 2–3; spores 12–16 μm in diam., smooth



vegetative shoots (dry) (2), leaf outline, and leaf apex (2)

5 mm, 1 mm, 0.5 mm, 50 μm, 50 μm



margin of upper leaf, cells at midleaf, and leaf basal angle

10 μm, 10 μm, 50 μm

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Cratoneuropsis relaxa vegetative shoots (moist)
1 mm, 1 mm

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Cratoneuropsis relaxa vegetative shoots (dry)

1 mm, 1 mm

Key* to the New Zealand species of *Drepanocladus* (2)

- 1 Alar cells in inflated decurrent auricles; the costa of a leaf pulled off the stem takes with it some of the stem's cortex; costa reaching only halfway up the lamina ● ***Drepanocladus aduncus***
- 1: Alar cells not in inflated decurrent auricles; the costa of a leaf pulled off the stem does not take with it any of the stem's cortex; costa reaching over two-thirds up the lamina..... ● ***Drepanocladus brachiatus***

* based on Hedenäs, L (1998): An overview of the *Drepanocladus sendtneri* complex. *Journal of Bryology* **20**, 83–102.



Drepanocladus aduncus (Hedw.) Warnst.

form: matted or loose wefts of erect, \pm pinnately branched stems, to 50 mm tall, leaves golden yellow, not glossy

habitat: soil in meadows or floating in bogs or fens

leaf: size: stem leaves $1.5\text{--}2.5 \times 0.5\text{--}0.8$ mm; branch leaves smaller

shape: ovate-lanceolate to oblong-lanceolate, usually falcate-secund

tip: short- to long-acuminate

base: narrowed to insertion, alar cells inflated, hyaline, in triangular auricles

costa: reaching about halfway up the lamina

border: not differentiated

margin: entire, plane to \pm inrolled

cells: $30\text{--}60 \times 3\text{--}4$ μm , vermicular, firm-walled, the ends rounded, not porose

capsule: not seen in New Zealand; 2.5–3 mm, oblong, exserted, arcuate, horizontal, reddish brown; seta 30–80 mm, reddish; operculum conic, apiculate; peristome hypnoid; spores 16–20 μm in diam.

note: cosmopolitan



fertile shoot (moist) (2), capsule, leaf outline, leaf apex, and leaf subapex

5 mm, 5 mm, 1 mm, 0.5 mm, 10 μm , 10 μm



margin at midleaf, cells at midleaf, and leaf basal angle

10 μm , 10 μm , 10 μm

continued next page

Drepanocladus brachiatus (Mitt.) Dixon

form: matted or loose wefts of erect, variously branched, \pm falcate-secund stems, 30–80 mm tall, leaves green, yellow-green, or golden

habitat: soil in limey, boggy sites, often submerged, to 1200 m

leaf: size: stem leaves $2.0\text{--}5.0 \times 0.8\text{--}1.1$ mm; branch leaves smaller

shape: ovate-lanceolate, strongly concave, \pm falcate-secund

tip: tapered to an acumen

base: alar cells \pm inflated, \pm rectangular, pigmented, not decurrent

costa: single, ending about 70% up the blade

border: not differentiated

margin: entire below, \pm denticulate above, plane to reflexed below

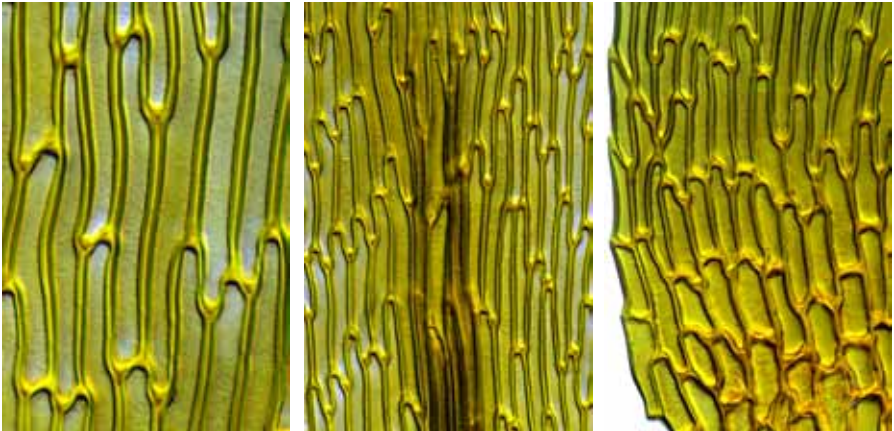
cells: $60\text{--}120 \times 4\text{--}6$ μm , linear, firm-walled, smooth

capsule: to 3.5 mm, cylindrical, curved throughout, inclined to horizontal, long-exserted, brown, not furrowed, constricted below the mouth when dry; seta 30–70 mm, red, smooth; operculum conic; peristome double, the exostome well-developed; spores 13–21 μm in diam.



vegetative shoot (dry) (2), leaf outline, leaf apex, and margin lower leaf

1 mm, 1 mm, 0.5 mm, 10 μm , 10 μm



cells at midleaf, costa terminus, and leaf basal angle

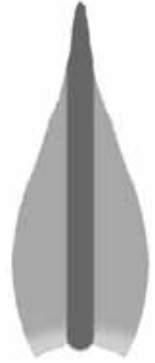
10 μm , 10 μm , 10 μm

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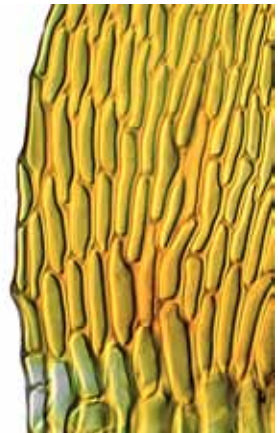
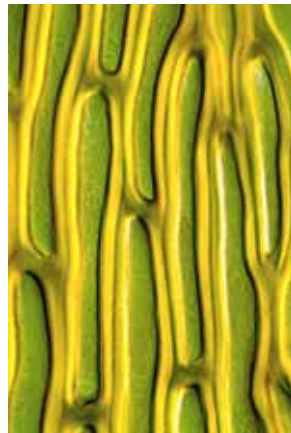


Drepanocladus brachiatus vegetative habit (dry)

■ 1 mm

Hypnobartlettia fontana Ochyra**form:** interwoven, wiry, branched, floating stems, to 60 μm long**habitat:** fast-flowing calcareous springs**leaf:** size: 1.6–2.0 \times 0.6–0.9 mm**shape:** lanceolate to ovate-lanceolate, bistratose except near the base**tip:** acuminate**base:** alar cells little differentiated**costa:** excurrent into a stout cuspidate point**border:** not differentiated**margin:** distantly serrulate to entire, plane**cells:** 40–100 \times 8–10 μm , linear-flexuose, thick-walled, prorulose**capsule:** capsules not known**note:** now thought to be an aquatic growth form of the highly variable *Cratoneuropsis relaxa*; restricted to Te Waikoropupū Springs near Nelson

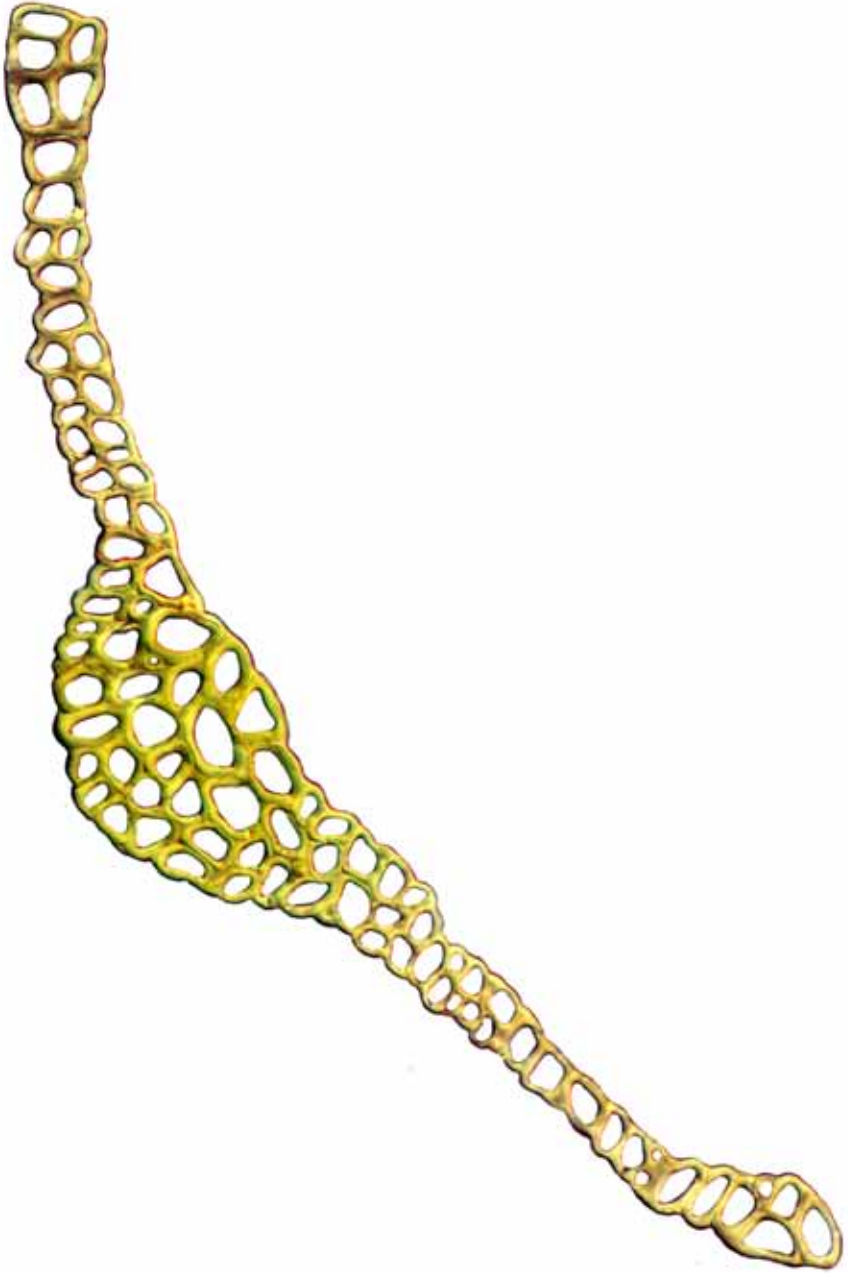
vegetative shoots (2), leaf outline, and leaf apex (2)

 1 mm, 1 mm, 0.5 mm, 100 μm , 10 μm


margin at midleaf, cells at midleaf, and leaf basal angle

 10 μm , 10 μm , 10 μm

continued next page



Hypnobartlettia fontana leaf cross-section showing bistratose lamina
10 μm

Leptodictyum riparium (Hedw.) Warnst.

form: creeping, subpinnately branched stems, to 100 mm long, ± flattened, lacking paraphyllia and rhizoids, leaves ± glossy, yellowish

habitat: wood, also on soil or rock in pools or swamps, to 600 m

leaf: size: stem and branch leaves similar, 2–4 × 0.8–1.6 mm

shape: ovate-lanceolate to oblong-lanceolate, highly variable, ± complanate

tip: acuminate

base: weakly decurrent, the basal cells rectangular, not arranged in auricles

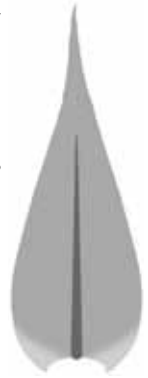
costa: narrow, reaching about 2/3 up the leaf blade

border: not differentiated

margin: entire, plane

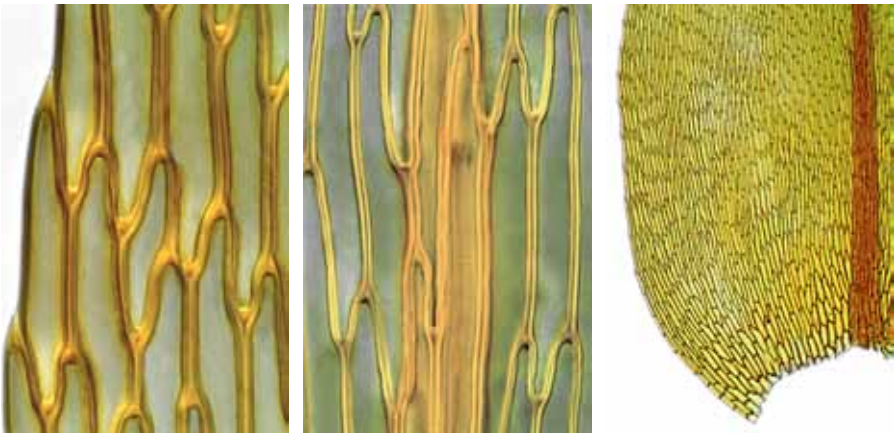
cells: 70–100 × 7–12 μm, linear-rhombic, firm-walled, smooth, not porose

capsule: to 2.5 mm, oblong-cylindric, mouth oblique when dry, strongly curved, inclined to horizontal, brown; seta 10–15 mm, red-orange; operculum low-conic, exostome teeth joined at base, hyaline-margined, striolate; endostome cilia 1–2; spores 10–18 μm in diam., green



vegetative shoots (moist and dry), leaf outline, leaf apex, and leaf subapex

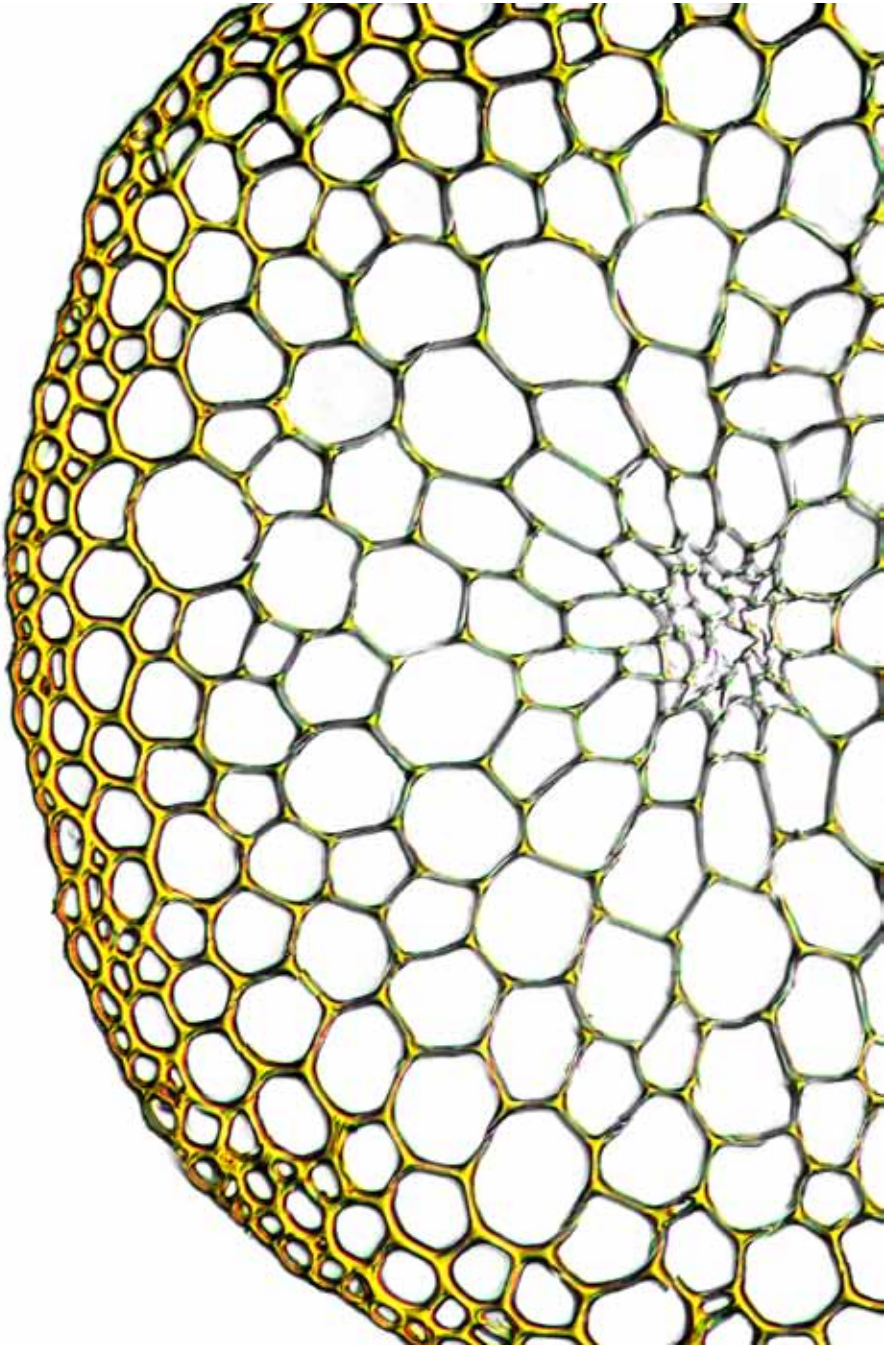
■ 1 mm, ■ 1 mm, ■ 0.25 mm, ■ 10 μm, ■ 10 μm



margin at midleaf, costa at midleaf, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 100 μm

continued next page



Leptodictyum riparium stem cross-section
10 μ m

Sanionia uncinata (Hedw.) Loeske

form: dense mats of creeping, variously branched stems, to 100 mm, the

leaves falcate-secund, pale straw colour to golden, glossy

habitat: bark, rotting logs, or damp soil in bogs and swamps, to 1000 m

leaf: size: stem leaves $2-4 \times 0.7-1.0$ mm; branch leaves smaller, less plicate

shape: ovate-lanceolate, falcate to circinate, plicate wet or dry, \pm decurrent

tip: narrowly acuminate

base: angle cells numerous, inflated, hyaline, porose, but not in auricles

costa: narrow, extending into the acumen, \pm obscured by plications

border: not differentiated

margin: entire to \pm serrulate above, plane

cells: $35-75 \times 4$ μm , linear, firm-walled, slightly sinuose, smooth

capsule: 1.5–2 mm, smooth, red, cylindrical, \pm arcuate, asymmetric, erect to

cernuous; seta 20–35 mm, slender, flexuose; calyptra cucullate, smooth;

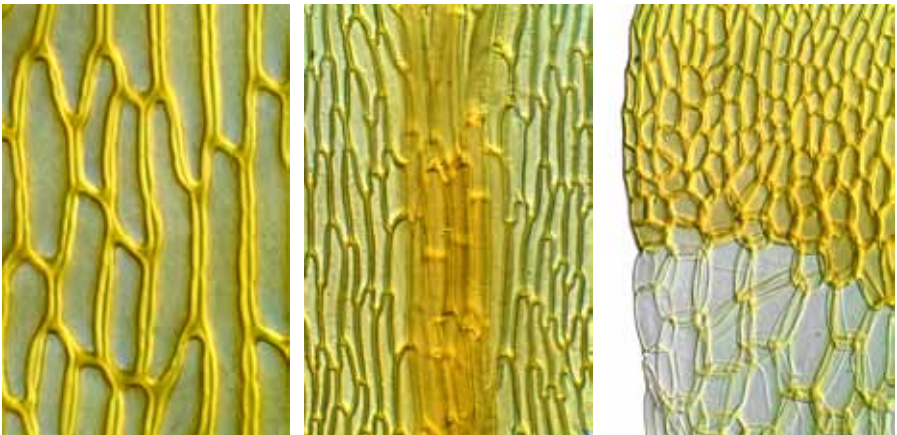
operculum conic, apiculate; peristome double; exostome teeth cross-

striolate below, papillose above; spores 14–20 μm in diam.



vegetative shoot (dry) (2), leaf outline, leaf apex, and margin midleaf

■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 10 μm , ■ 10 μm



cells at midleaf, costa at midleaf, and leaf basal angle

■ 10 μm , ■ 10 μm , ■ 10 μm

Scorpidium cossonii (Schimp.) Hedenäs

form: interwoven mats of creeping, irregularly branched stems, 25–50 mm tall, leaves falcate-secund, golden, reddish or blackish

habitat: waterlogged soil or submerged, to 1600 m

leaf: size: 2–3 × 0.4 mm

shape: all leaves ovate to oblong-ovate, concave

tip: acute to obtuse, often minutely apiculate

base: a few outer angle cells inflated, hyaline, in weak auricles

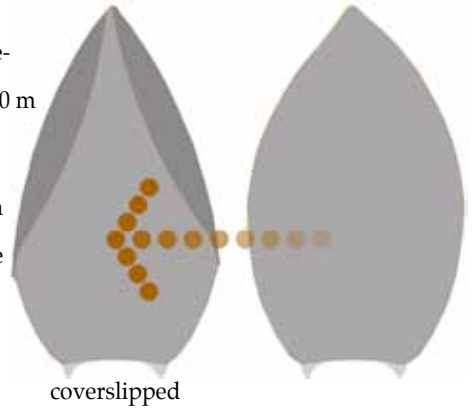
costa: absent, or to midleaf, or short and double

border: not differentiated

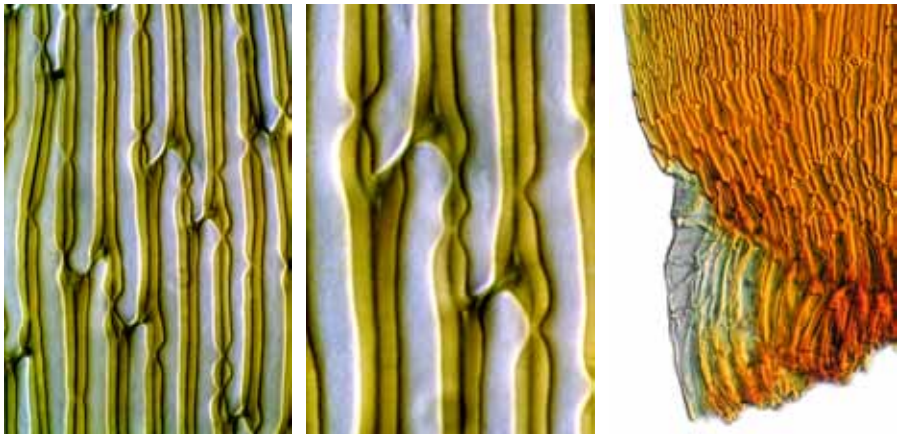
margin: entire, ± incurved above

cells: 50–90 × 3–4 μm, linear, incrassate, porose below, lumina rounded at the ends, smooth

capsule: not seen in NZ



vegetative shoots (dry) (2), shoot apex (moist), leaf outline, and leaf apex
 5 mm, 1 mm, 1 mm, 0.5 mm, 50 μm



cells at midleaf (2), and leaf basal angle
 10 μm, 10 μm, 50 μm

Calliergon richardsonii (Mitt.) Warnst.

form: large mats of ascending, branched stems, to 100 mm long, pseudoparaphyllia foliose, leaves yellowish, glossy
habitat: boggy soil or humus, often submerged, to 1100 m

leaf: size: 2.5–3.5 × 1.4–1.9 mm; branch leaves narrower

shape: broadly ovate, deeply concave

tip: rounded-obtuse, ± cucullate

base: alar cells abruptly enlarged, inflated, hyaline, ± auriculate, and decurrent

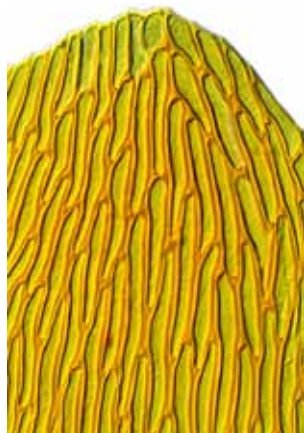
costa: reaching to three-quarters up the blade, forked or spurred

border: not differentiated

margin: entire, plane or incurved

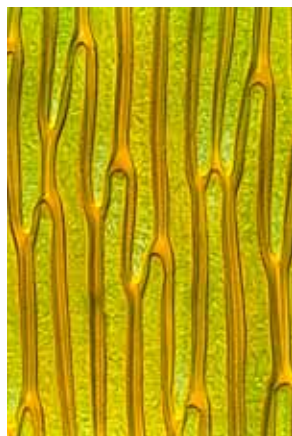
cells: 60–75 × 9 μm, linear-rhombic, firm-walled, smooth

capsule: not seen in New Zealand; 2.5–3 mm, oblong-cylindric, long-exserted, horizontal, curved, neck tapered; seta 45–60 mm; peristome hypnoid; spores 15–22 μm in diam., papillose



vegetative shoot (dry), leaf outline, and leaf apex

1 mm, 0.1 mm, 50 μm



margin of upper leaf, margin at midleaf, and cells at midleaf

10 μm, 10 μm, 10 μm

Straminergon stramineum (Brid.) Hedenäs

form: wefts or mats of \pm unbranched stems, 20–55 mm, leaves glossy

habitat: soil in wet meadows and boggy sites, to 1800 m

leaf: *size:* stem leaves $0.8\text{--}1.8 \times 0.5$ mm; branch leaves similar

shape: stem leaves broadly ovate, concave, not plicate; stem leaves same

tip: obtuse to rounded, minutely apiculate

base: \pm decurrent; alar cells inflated, hyaline, thin-walled, in auricles

costa: weak, reaching $2/3$ up the lamina

border: not differentiated

margin: entire, plane

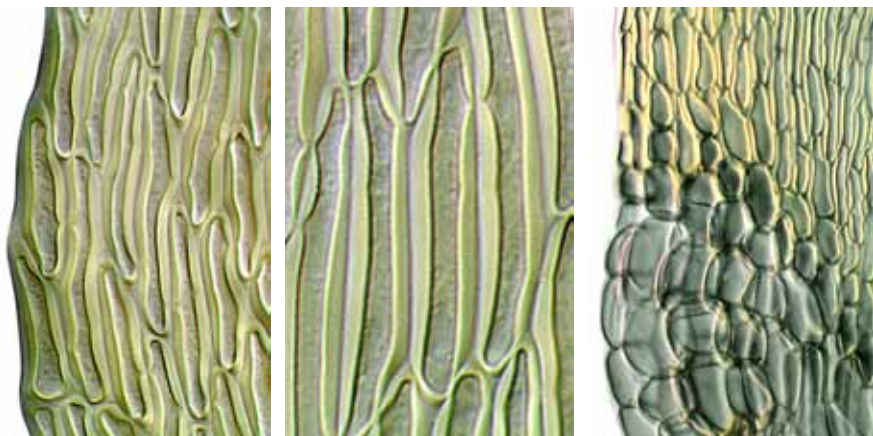
cells: $20\text{--}50 \times 6\text{--}8$ μm , oblong to linear, thick-walled, smooth

capsule: not seen in NZ; 2.5–3 mm; oblong-cylindric, long-exserted, curved, inclined to cernuous; exannulate; seta 30–60 mm; operculum conic, bluntly apiculate; calyptra cucullate, smooth, naked; exostome teeth yellowish, dentate, endostome cilia 2–3, nodose; spores $13\text{--}23$ μm in diam., finely papillose



vegetative shoots (dry) (3), leaf outline, and leaf apex

■ 1 mm (left two), ■ 1 mm, ■ 0.1 mm, ■ 10 μm



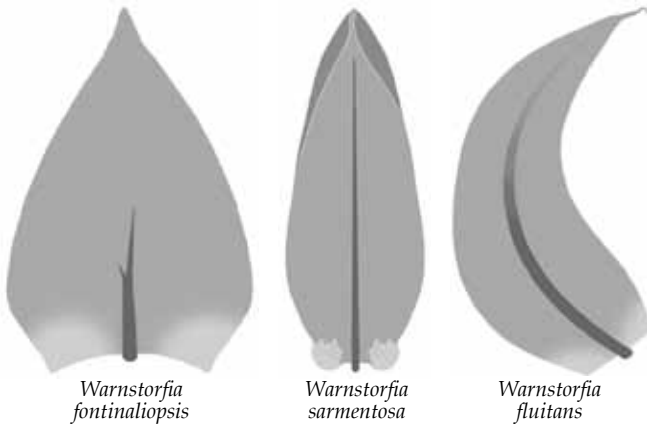
margin at midleaf, cells at midleaf, and leaf basal angle

■ 10 μm , ■ 10 μm , ■ 10 μm

Key* to the New Zealand species of Warnstorfia (3)

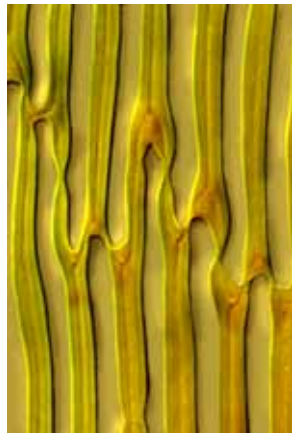
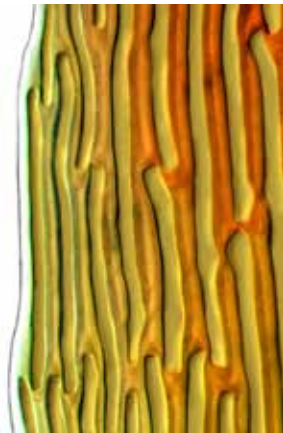
- 1 Leaves 0.9–1.2 mm, ovate to ovate-lanceolate ● **Warnstorfia fontinaliopsis**
 1: Leaves > 1.2 mm, lanceolate to narrowly lanceolate.....2
- 2(1:) Stem-tip leaves falcate-secund, tip gradually narrowed to a long, flexuose point;
 stem leaves striolate when dry ● **Warnstorfia fluitans**
 2: Stem-tip leaves not falcate-secund, tip rounded and cucullate; stem leaves not striolate
 when dry ● **Warnstorfia sarmentosa**

* based partly on Crum, HA; Anderson, LE (1981): *Mosses of Eastern North America*. Columbia University Press, New York. 917.



Warnstorfia fluitans (Hedw.) Loeske**form:** matted, variously branched stems, 40–120 mm, leaves golden**habitat:** acidic meadows, bogs, tarns, ditches, ± submerged, to 1600 m**leaf:** *size:* 1.0–4.5 × 0.4–0.8 mm*shape:* narrowly lanceolate, concave, falcate-secund to ± circinate*tip:* gradually tapered to a long flexuose acumen*base:* basal cells inflated, hyaline, thin-walled, weakly auriculate*costa:* reaching to above midleaf*border:* not differentiated*margin:* denticulate or serrulate above, plane*cells:* 70–120 × 5–7 μm, linear-flexuose, firm-walled, prorate, smooth**capsule:** 2–3 mm, oblong, exserted, curved, inclined to horizontal; seta 40–70 mm; operculum short-conic; peristome hypnoid; spores 17–27 μm in diam.**note:** species of *Warnstorfia* have small clear cells (nematogons) near the leaf apex (one is arrowed in the acumen close-up below)

vegetative shoots (2), leaf outline, flexuose acumen with nematogon, and capsule
 ■ 5 mm, ■ 1 mm, ■ 0.5 mm, ■ 10 μm, ■ 1 mm



margin at midleaf, cells at midleaf, and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 10 μm

continued next page

Warnstorfia fontinaliopsis (Müll.Hal.) Ochyra

form: loosely matted, pinnately branched stems, 20–80 mm long
habitat: soil or rarely rock, in boggy sites, sometimes submerged

leaf: size: 0.9–1.2 mm

shape: ovate to ovate-lanceolate

tip: acute to acuminate, blunt or rounded at the apex

base: cells of basal angle \pm inflated, sometimes in auricles

costa: single, often forked above, reaching to at least midleaf

border: not differentiated

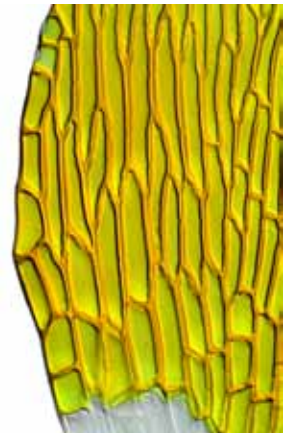
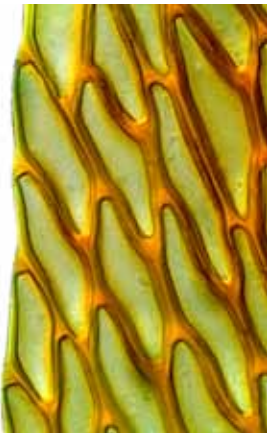
margin: entire, plane

cells: 30–60 \times 8–10 μm , at the extreme apex 15–20 μm and \pm quadrate, linear to fusiform below, firm-walled, smooth

capsule: 2–3 mm, oblong-cylindric, inclined to horizontal, curved, necked, asymmetric, brown, contracted below the mouth when dry; seta 45–60 mm, orange, flexuose, smooth; operculum bluntly conic; annulus none; calyptra cucullate



vegetative habit (dry), vegetative shoot (dry), leaf outline, and leaf apex
 ■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm



margin at midleaf, cells at midleaf, and leaf basal angle
 ■ 10 μm , ■ 10 μm , ■ 10 μm

Warnstorfia sarmentosa (Wahlenb.) Hedenäs

form: matted, irregularly branched stems, 40–150 mm, often submerged;
leaves purple-red to yellow-brown, glossy

habitat: rock or soil in rocky acidic or calcareous alpine seepages or tarns

leaf: size: 1.3–3.5 × 0.5–0.8 mm

shape: oblong-ovate, cucullate

tip: stem leaves rounded-obtuse, cucullate; branch leaves apiculate

base: alar cells in auricles, 20–40 × 16–20 μm, hyaline, inflated, decurrent

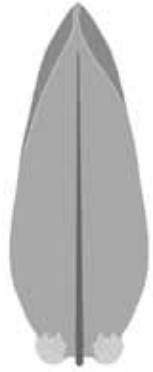
costa: single, reaching to nearly the tip of the lamina

border: not differentiated

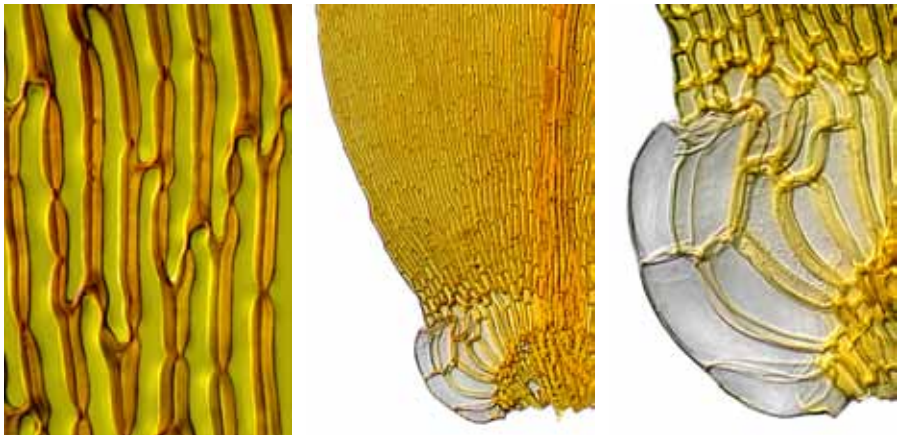
margin: entire, plane

cells: 40–75 × 3–6 μm, long-linear, flexuose, thick-walled, porose, smooth

capsule: not seen in NZ; 2.5 mm; oblong-cylindric, long-exserted,
curved, inclined, stomatose in the neck, annulus none; seta 25–35 mm,
red; operculum conic, apiculate; peristome hypnoid, endostome cilia
1–3; spores 16–20 μm in diam., finely papillose



vegetative shoots (2), leaf outline, and margin midleaf
 1 mm, 1 mm, 0.25 mm, 10 μm



cells at midleaf, leaf basal angle, and auricular alar cells
 10 μm, 25 μm, 10 μm

continued next page



Warnstorfia sarmentosa vegetative habit (dry)

1 mm

Lindbergia maritima Lewinsky

form: thinly matted, creeping, irregularly branched stems, 5–8 mm,
leaves yellowish, clusters of brood branchlets in leaf axils

habitat: rock on the Waitakere Ranges coast

leaf: size: 0.4–0.6 × 0.2–0.3 mm

shape: broadly ovate

tip: acute to obtuse

base: base not decurrent; alar cells not differentiated

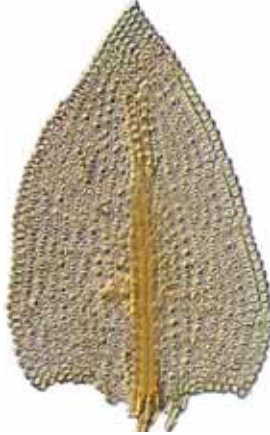
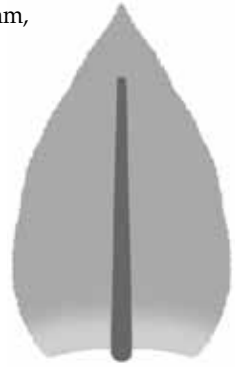
costa: strong, ending below the apex

border: not differentiated

margin: ± crenulate toward the apex, plane

cells: 7–12 μm, quadrate to hexagonal, firm-walled, mammillose

capsule: capsules not known



vegetative shoot (dry), leaf outline, and leaf apex
 ■ 0.1 mm, ■ 0.1 mm, ■ 10 μm



margin at midleaf, costa at midleaf, and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 50 μm

Pseudoleskea imbricata (Hook.f. & Wilson) Broth.

form: primary stems matted, wiry, to 40 mm long, secondary stems curved, terete, julaceous, often parallel, simple or branched, not paraphylliate

habitat: wet limestone, in or near streams, lowland to montane

leaf: size: 0.5–0.8 × 0.3–0.4 mm

shape: broadly ovate, plicate

tip: acute to obtuse

base: weakly decurrent; basal margin cells subquadrate to oval

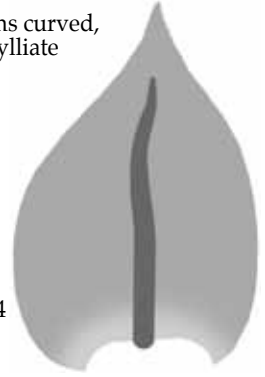
costa: failing below the apex

border: not differentiated

margin: ± crenulate toward the apex, plane to ± recurved below

cells: 12–18 × 3–5 μm, oval to ± hexagonal, firm-walled, smooth

capsule: 2 mm, short-cylindric, exserted, erect, ± curved; seta 8–14 mm, flexuose, red; calyptra cucullate, naked; operculum conic; exostome teeth hyaline-bordered, cross-striolate; endostome equalling exostome teeth, cracked, cilia 1; spores 14–18 μm in diam.

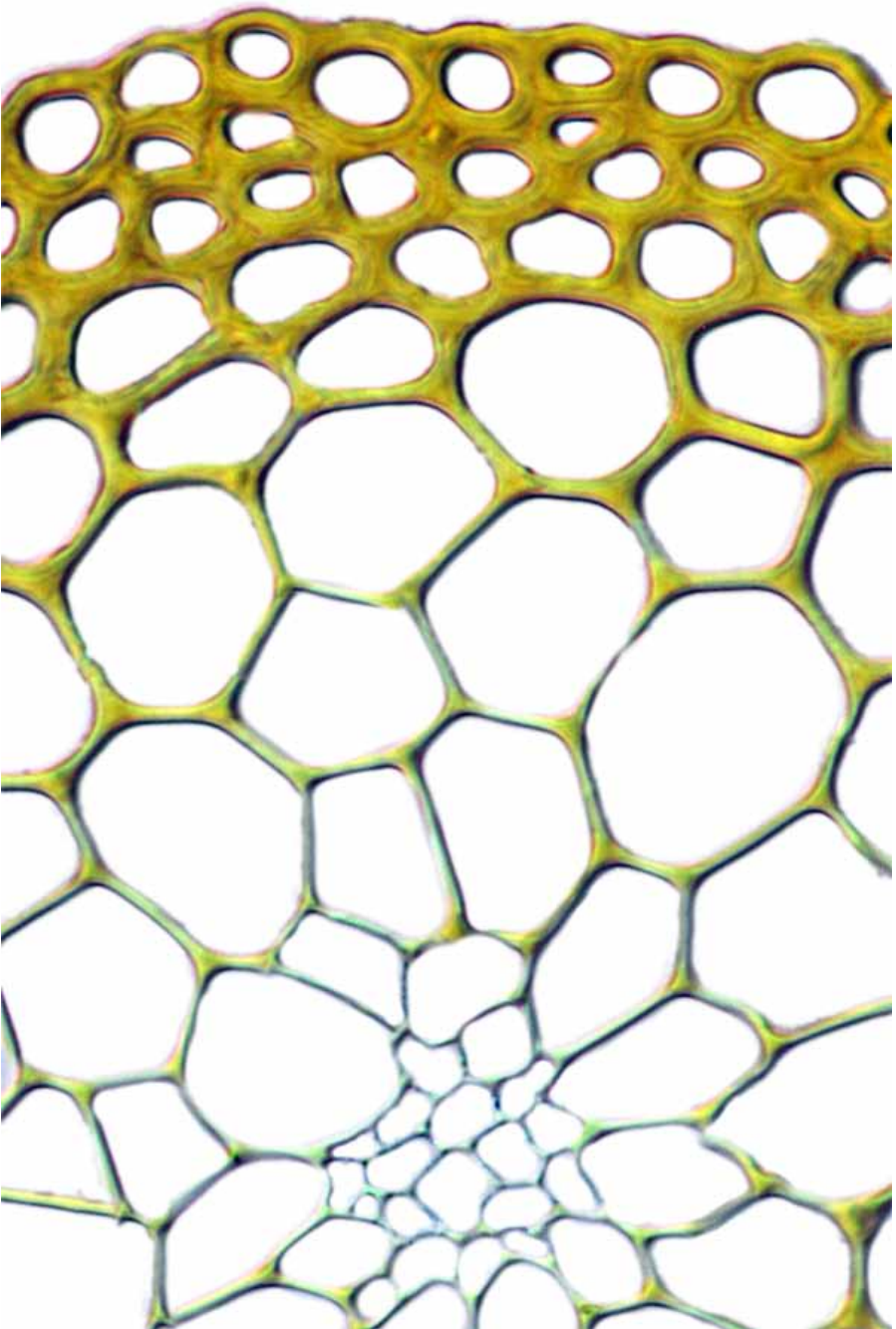


vegetative habit (dry), leaf outline, and leaf apex
 1 mm, 0.25 mm, 50 μm



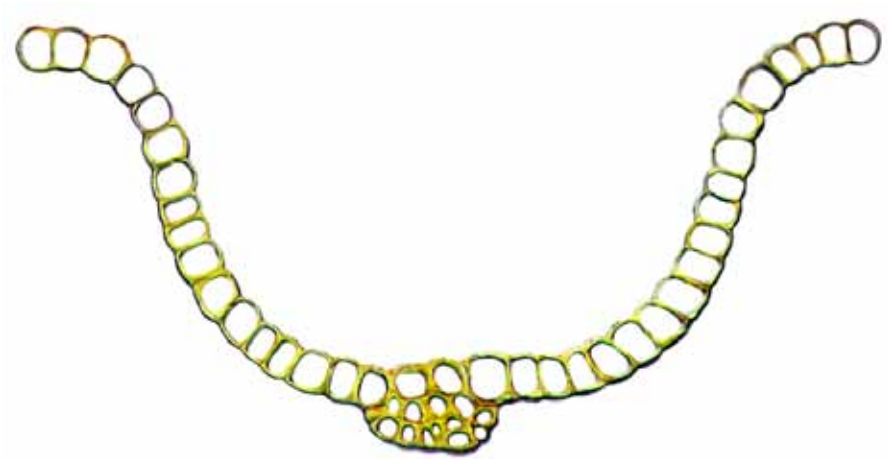
margin at midleaf, costa at midleaf, and leaf basal angle
 10 μm, 10 μm, 50 μm

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Pseudoleskea imbricata seta cross-section
10 μm

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Pseudoleskea imbricata leaf cross-section
50 μm

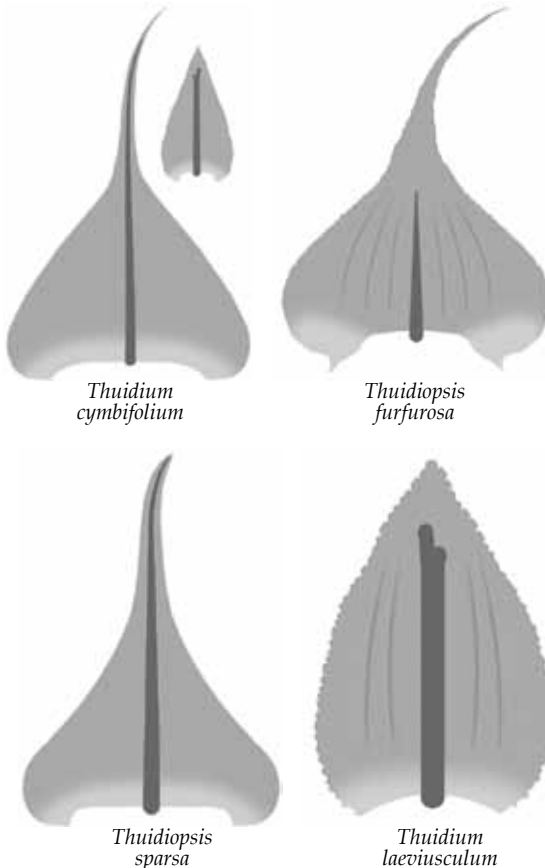


Pseudoleskea imbricata leaf margin cross-section
10 μm

Key* to the New Zealand species of Thuidium and Thuidiopsis (4)

- 1 Stem leaf apex a filiform acumen ending in a single row of cells..... ● **Thuidium cymbifolium**
 2
 1: Stem leaf apex not ending in a single row of cells 2
- 2(1:) Stem leaf costa cristate on the back..... ● **Thuidium laeviusculum**
 2: Stem leaf costa not cristate on the back 3
- 3(2:) Leaf cells mostly 1–4-papillose..... ● **Thuidiopsis sparsa**
 3: Leaf cells mostly 1-papillose..... ● **Thuidiopsis furfurosa**

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 415, plus Streimann, H (2002): *The Mosses of Norfolk Island. Flora of Australia Supplementary Series 14*, 158.



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Thuidiopsis furfurosa (Hook.f. & Wilson) M.Fleisch.

form: matted, creeping, bipinnately branched, paraphylliate stems, to 100 mm long, leaves dull, yellowish

habitat: sunny to shady soil, bark, or rock, sea level to montane

leaf: size: stem leaves 1.5–2 mm; branch leaves 0.8–1 mm

shape: ovate-cordate to triangular-ovate, ± plicate, ± decurrent

tip: finely acuminate

base: decurrent; basal cells ± rectangular

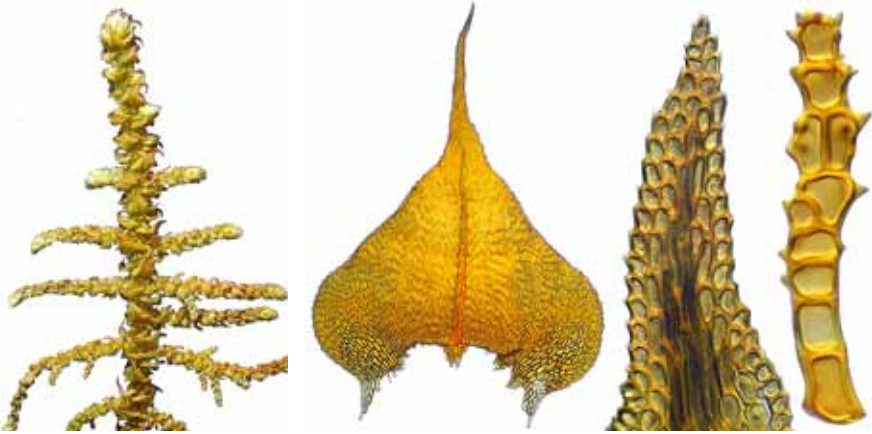
costa: failing below the acumen

border: not differentiated

margin: denticulate or crenulate above, plane to ± recurved

cells: 10 μm, isodiametric, firm-walled, unipapillose

capsule: 2–2.5 mm, oblong-cylindric, long-exserted, ± curved, cernuous, pale brown; seta 20–30 mm, flexuose, red; operculum obliquely long-rostrate; calyptra cucullate, naked, smooth; peristome double; spores 10–12 μm, smooth



vegetative shoot, leaf outline, leaf apex, and paraphyllum

5 mm, 0.25 mm, 50 μm, 10 μm



margin in upper leaf, costa at midleaf, and leaf basal angle

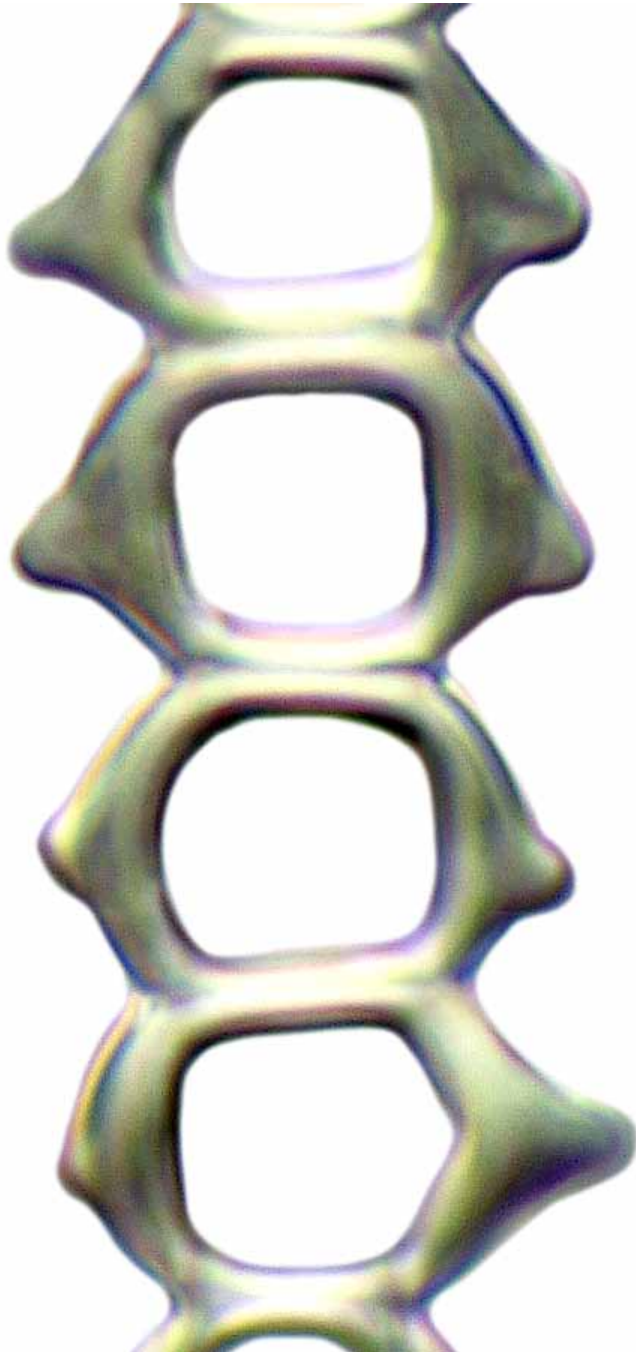
10 μm, 10 μm, 50 μm

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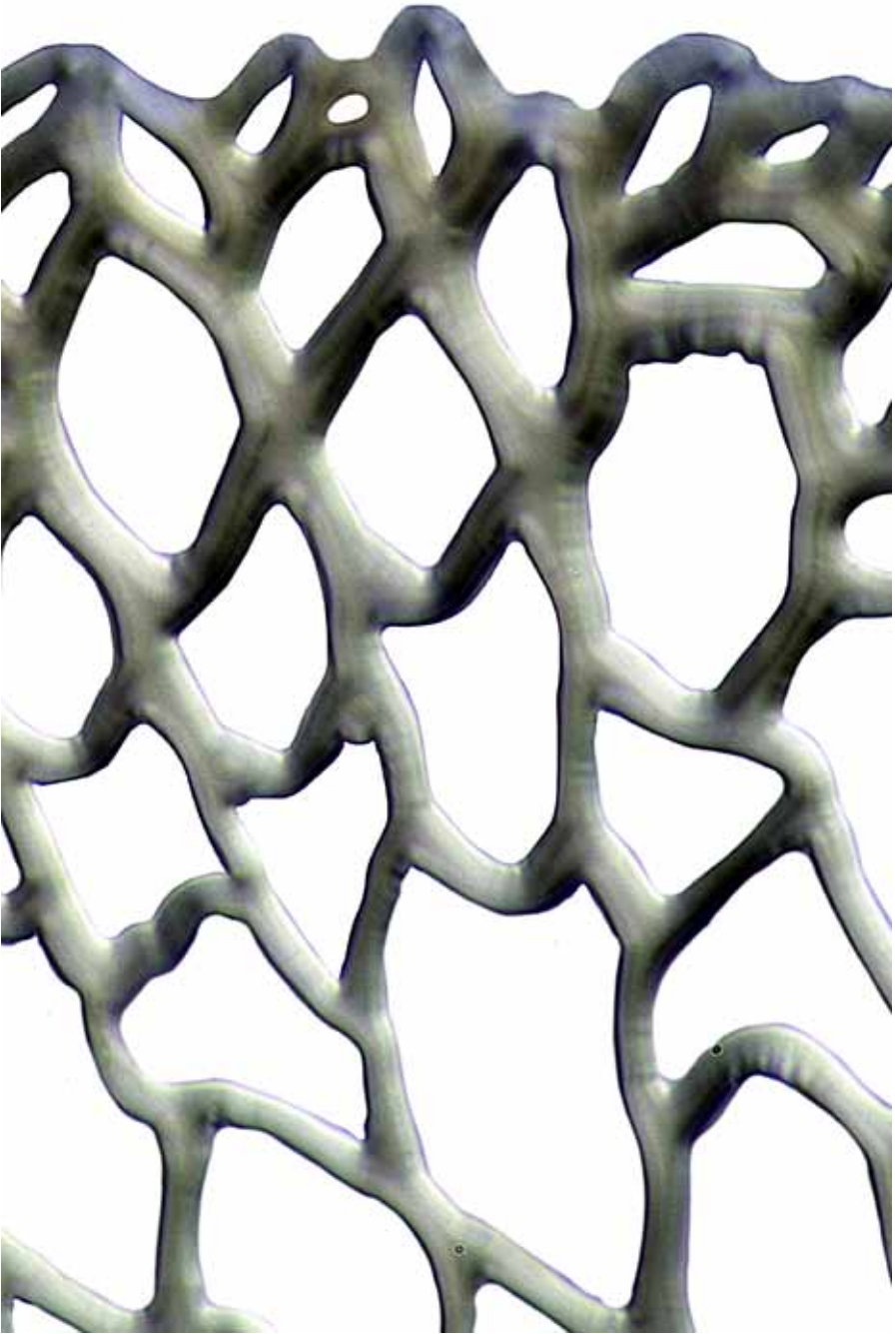
Thuidiopsis furfurosa vegetative shoot (dry)
1 mm

continued next page



Thuidiopsis furfurosa leaf cross-section showing strongly unipapillose cells
10 μm

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Thuidiopsis furfurosa stem cross-section
10 μ m

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Thuidiopsis sparsa (Hook.f. & Wilson) Broth.

form: matted, pinnately branched, paraphylliate stems, to 60 mm long,
leaves yellow to pale green, branches not paraphylliate

habitat: rock, damp forest

leaf: *size:* branch leaves $0.5\text{--}0.7 \times 0.3\text{--}0.4$ mm; stem leaves 1×0.6 mm

shape: branch leaves \pm ovate; stem leaves cordate-ovate to deltoid-ovate

tip: branch leaves acute; stem leaves acuminate

base: basal juxtacostal cells longer than the other laminal cells

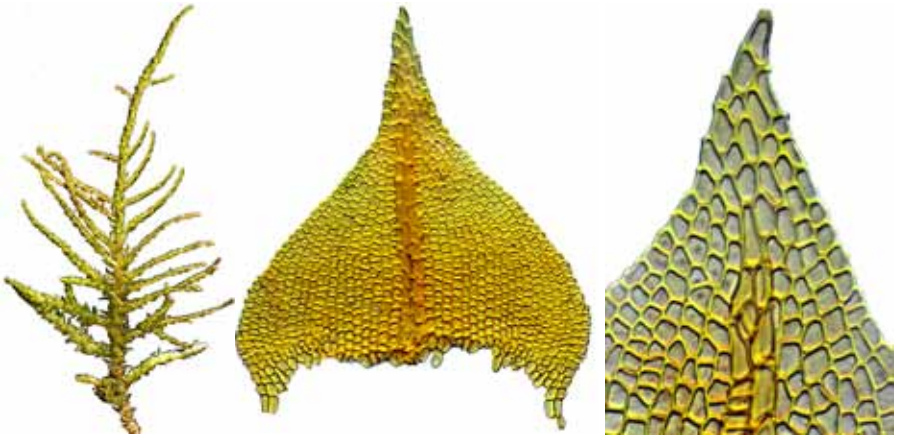
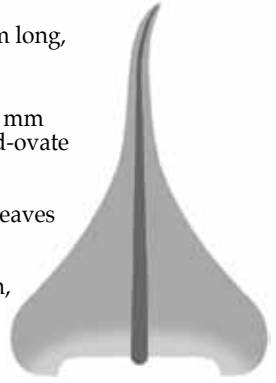
costa: failing below the apex, prominent on abaxial side of stem leaves

border: not differentiated

margin: entire to serrulate, plane

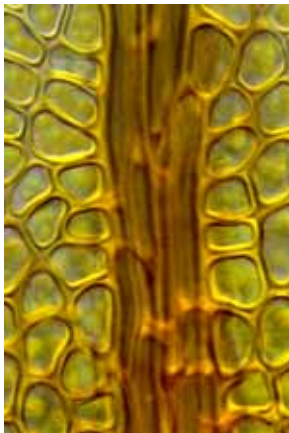
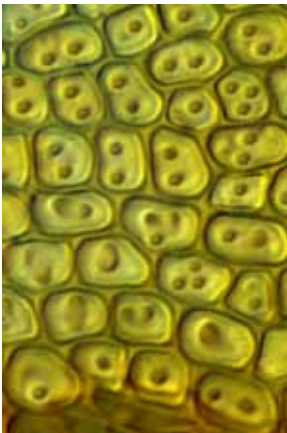
cells: midleaf cells $6\text{--}10\ \mu\text{m}$, \pm isodiametric; tip cells to $20 \times 10\ \mu\text{m}$,
firm-walled, mostly 2–4-papillose

capsule: to 2.5 mm, oblong-cylindric, exserted, inclined to pendent, red-brown; seta to 20 mm, reddish, smooth; calyptra cucullate, hairy; operculum long-rostrate; spores $8\text{--}16\ \mu\text{m}$ in diam.



vegetative shoot (dry), stem leaf outline, and stem leaf apex

1 mm, 50 μm , 50 μm



papillose cells at midleaf, costa at midleaf, and leaf basal angle

10 μm , 10 μm , 50 μm

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Thuidium cymbifolium (Dozy & Molk.) Dozy & Molk.

form: matted, bi- or tripinnately branched, arched stems, to 150 mm long
habitat: soil, rotting logs, or rock in forest and grassland or on roadsides

leaf: *size:* branch: to 0.2, stem: to 1.6 mm

shape: branch: ovate, stem: \pm triangular

tip: branch: acute, with truncate terminal cell, stem: filiform (3–7 cells)

base: not differentiated

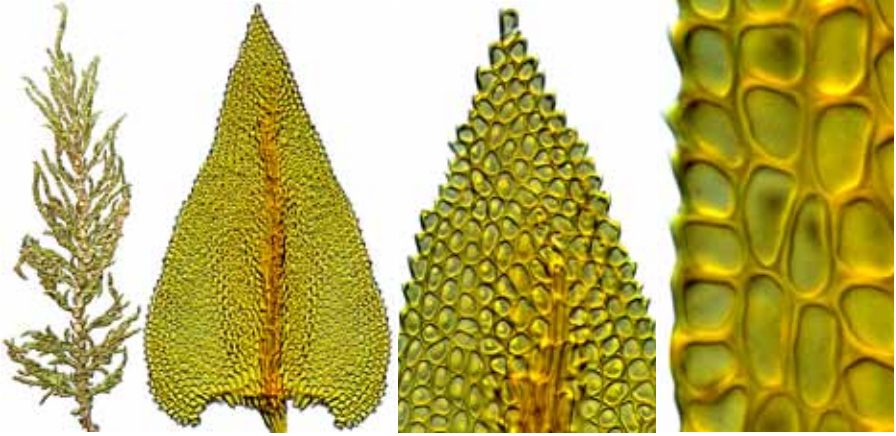
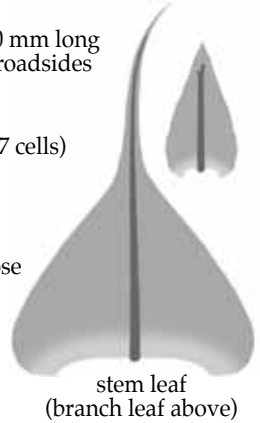
costa: reaching 2/3 up the blade, spinose on the back above

border: not differentiated

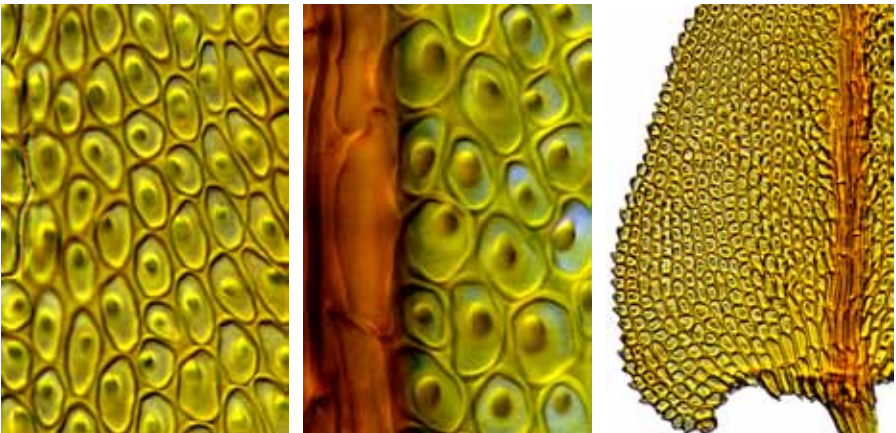
margin: serrulate throughout, plane

cells: 6–10 μm , isodiametric to elongate, firm-walled, unipapillose or strongly mammillose

capsule: to 6 mm, ellipsoid to cylindric, inclined to horizontal, exserted, brown; seta to 40 mm, reddish, smooth, peristome double, endostome segments narrowly perforate, cilia nodulose, in groups of 2–4; spores 9–12 μm in diam.



vegetative shoot (dry), branch leaf outline, branch leaf apex, and branch leaf margin
 1 mm, 0.1 mm, 50 μm , 10 μm



branch leaf cells, branch leaf costa, and branch leaf basal angle
 10 μm , 10 μm , 50 μm

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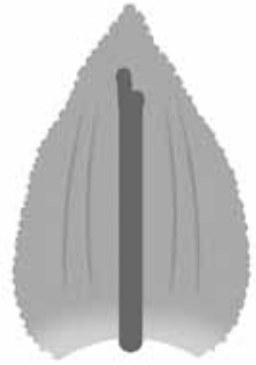
Thuidium cymbifolium branch leaf costa
10 μm

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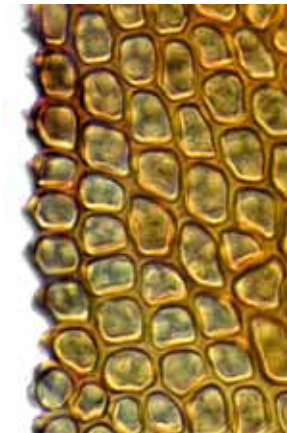


Thuidium cymbifolium paraphyllium and filiform apex of stem leaf
10 μm , 50 μm , 10 μm

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Thuidium laeviusculum (Mitt.) A. Jaeger**form:** matted, creeping, paraphylliate stems, to 150 mm long**habitat:** damp rotting logs, humus, or rock in shaded forest**leaf:** *size:* stem leaves 1 mm; branch leaves 0.3 mm*shape:* ovate to cordate-ovate or wide-triangular*tip:* acute to obtuse*base:* basal cells longer than the blade cells*costa:* failing below the apex, crested on the back*border:* not differentiated*margin:* finely crenulate, plane*cells:* 7–8 μm , isodiametric, firm-walled, pluripapillose**capsule:** 3–4 mm; cylindric, arcuate, long-exserted, horizontal to cernuous, brown; seta 20–35 mm, stout, red; operculum obliquely long-rostrate, red; calyptra cucullate, naked, smooth; exostome teeth joined at the base, endostome cilia 2–3, nodulose; spores 10–12 μm in diam., smooth

habit, branch leaf outline, and branch leaf apex showing crested costa

5 mm, 50 μm , 10 μm 

margin at midleaf, costa at midleaf (abaxial surface), and stem paraphyllia

10 μm , 10 μm , 10 μm

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Thuidium laeviusculum vegetative shoot

1 mm

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Thuidium laeviusculum vegetative shoot detail showing costae
50 μm

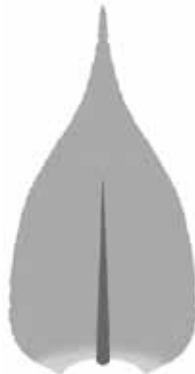
Key* to the New Zealand species of Brachytheciastrum and Brachythecium (10)

- 1 Leaves strongly falcate ● **Brachytheciastrum paradoxum**
 1: Leaves straight or only weakly falcate.....2
- 2(1:) Leaf apex piliform3
 2: Leaf apex not piliform7
- 3(2) Stem leaves < 1.5 mm long..... ● **Brachytheciastrum velutinum**
 3: Stem leaves > 1.5 mm long4
- 4(3:) Stem leaves 1.5–2.5 mm long, not or only slightly decurrent; capsules 0.6–1.5 mm long; spores 11–20 μm in diam.....5
 4: Stem leaves 2.8–3.1 mm long, decurrent; capsules 2.6 mm long; spores 18–22 μm in diam..... ● **Brachythecium fontanum**
- 5(4) Capsules < 1.5 mm long; spores 11–16 μm in diam.....
 ● **Brachythecium albicans**
 5: Capsules 1.3–2.5 mm long; spores 15–20 μm in diam.....6
- 6(5:) Leaves < 2.8 mm long, \pm triangular **Brachythecium subpilosum**
 6: Leaves > 2.8 mm long, ovate-lanceolate **Brachythecium allisonii**
- 7(2:) Leaves plicate.....8
 7: Leaves not or only weakly plicate9
- 8(7) Branch leaves slightly falcate; seta lightly papillose.....
 ● **Brachythecium campestre**
 8: Branch leaves straight; seta smooth ● **Brachythecium salebrosum**
- 9(7:) Seta papillose in only the upper half..... ● **Brachythecium plumosum**
 9: Seta papillose throughout..... ● **Brachythecium rutabulum**

* based partly on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*. RSNZ Bulletin 5, 436.



*Brachythecium
salebrosum*



*Brachythecium
rutabulum*



*Brachythecium
fontanum*



*Brachythecium
albicans*



*Brachythecium
subpilosum*



*Brachythecium
plumosum*



*Brachytheciastrum
velutinum*



*Brachythecium
allisonii*



*Brachythecium
campestre*



*Brachytheciastrum
paradoxum*

Brachytheciastrum paradoxum (Hook.f. &Wilson) Ignatov & Huttunen

form: tufted, creeping, radiculose, pinnately branched stems, 25–40 mm long, tips hooked, leaves falcate-secund, golden, glossy

habitat: moist soil, wet rock or damp logs in boggy sites

leaf: size: 1–1.5 mm

shape: lanceolate, striate, ± circinate

tip: long-acuminate

base: alar cells subquadrate, ± nodulose, decurrent

costa: reaching above midleaf

border: not differentiated

margin: denticulate, plane

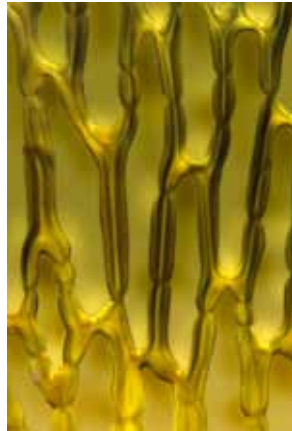
cells: 60–90 × 5–6 μm, linear, firm-walled, ± porose, smooth

capsule: 2 mm, oblong, exserted, inclined to horizontal, brown; seta 10–15 mm, reddish, papillose throughout; operculum conic, obtuse; calyptra cucullate, naked, smooth; annulus of 2 cell rows; peristome double, cilia in 2s or 3s; spores 12–16 μm in diam.



vegetative shoots (dry) (2), leaf outline, and leaf apex

■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm



margin at midleaf, cells near leaf base, and margin near leaf base

■ 10 μm, ■ 10 μm, ■ 10 μm

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Brachytheciastrum paradoxum vegetative shoot (dry)
1 mm

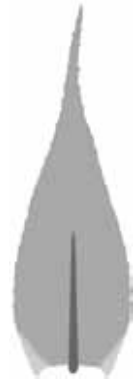
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Brachytheciastrum velutinum (Hedw.) Ignatov & Huttunen**form:** procumbent, ± pinnately branched, radiculose stems, to 30 mm long**habitat:** bark of tree trunks, stumps, rock, and walls in shady sites**leaf: size:** stem: 1.5 × 0.4 mm; branch: narrower**shape:** stem: lanceolate-triangular; branch: lanceolate**tip:** gradually acuminate**base:** angle cells quadrate to oblong**costa:** faint, failing about midleaf**border:** not differentiated**margin:** denticulate, plane to narrowly recurved**cells:** 50–80 × 5–8 μm, narrowly linear, firm-walled, smooth**capsule:** 1.4–1.7 mm, ellipsoid, asymmetric, exserted, inclined, reddish

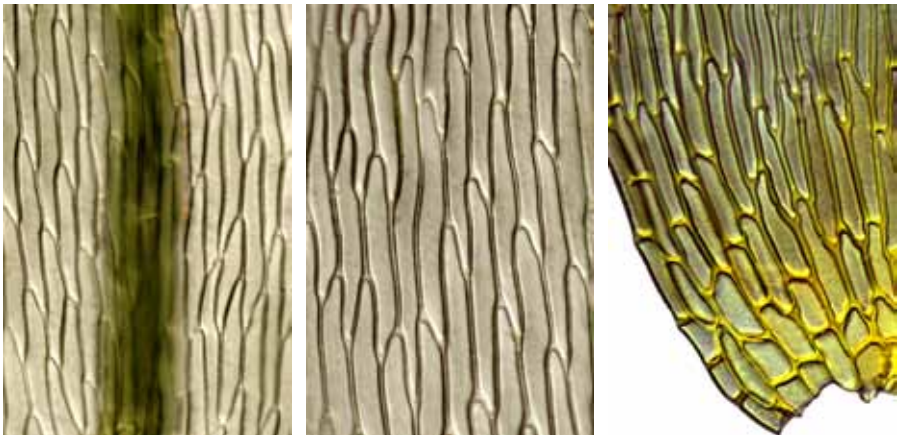
brown, ± constricted below the mouth when dry, annulus large, detachable;

seta 15 mm, flexuose, red, papillose; operculum high-conic, long-rostrate;

peristome double, the exostome teeth yellow, the endostome 2/5 height of teeth, cilia 2; spores 13–16 μm in diam.

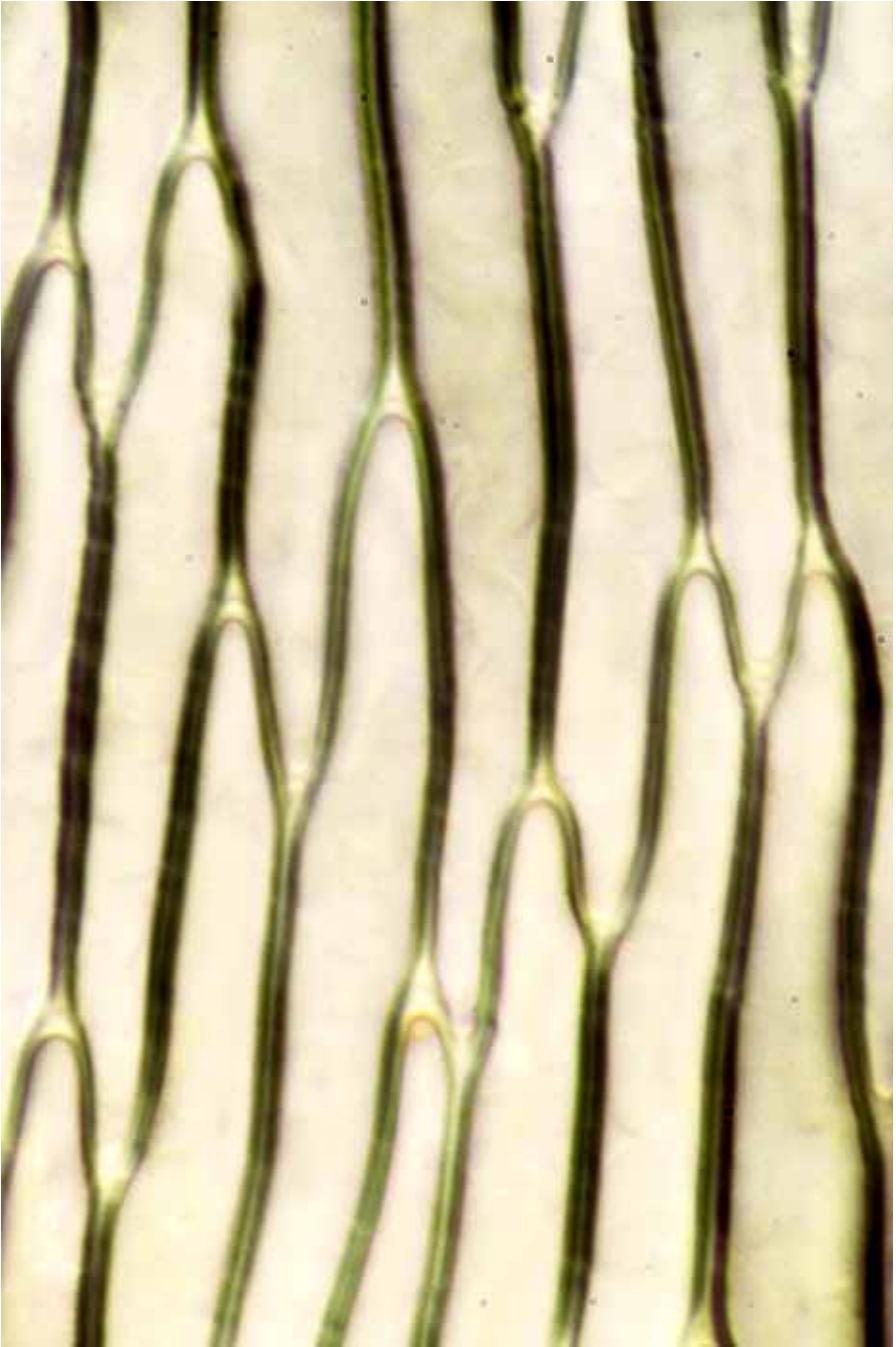


vegetative shoot (dry) (2), branch leaf outline, leaf apex, and margin midleaf
 1 mm, 1 mm, 0.5 mm, 10 μm, 10 μm



costa at midleaf, cells at midleaf, and leaf basal angle
 10 μm, 10 μm, 10 μm

continued next page



Brachytheciastrum velutinum cells at midleaf
10 μ m

continued next page

Brachythecium albicans (Hedwig) Bruch & W.P.Schimper

form: matted, creeping, branched stems, to 40 mm long, leaves pale, glossy
habitat: damp to dry soil, rock, or bases of trees in shady sites

leaf: size: 2.2–3.0 × 0.7–1.2 mm

shape: ovate-lanceolate, plicate; stem leaves decurrent, branch leaves not

tip: narrowly acuminate, sometimes filiform

base: alar cells numerous, quadrate to short-oblong

costa: reaching 2/3 up the blade

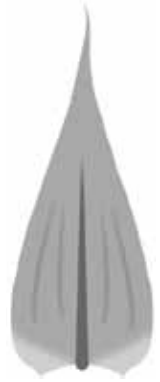
border: not differentiated

margin: entire to minutely serrulate toward the tip, narrowly recurved

cells: 50–80 × 6–9 μm, linear to rhombic, firm-walled, smooth

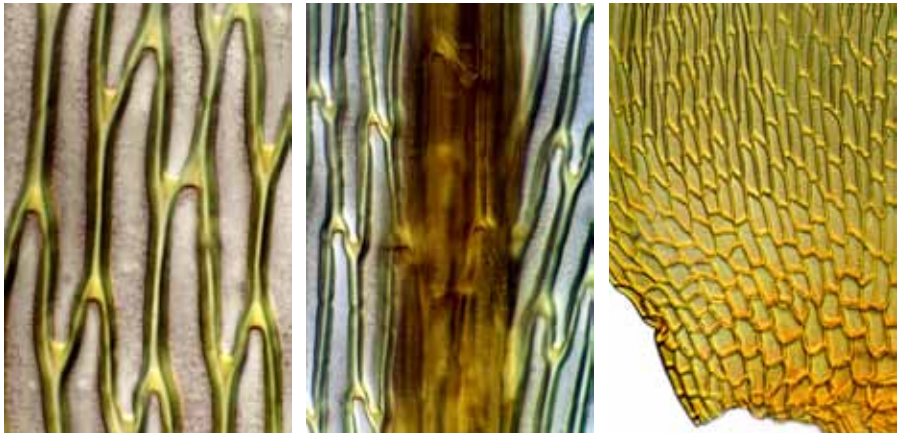
capsule: 1–1.5 mm, oblong, asymmetric, exerted, inclined to horizontal;
 seta 15–22 mm, reddish brown, smooth; operculum conic, acute; peri-
 stome double; spores 11–16 μm in diam., papillose

note: differs from *Brachythecium salebrosum* in having acuminate and more strongly plicate leaves with entire margins and smaller alar cells



vegetative shoots (2), leaf outline, leaf apex, and margin midleaf

■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm, ■ 10 μm



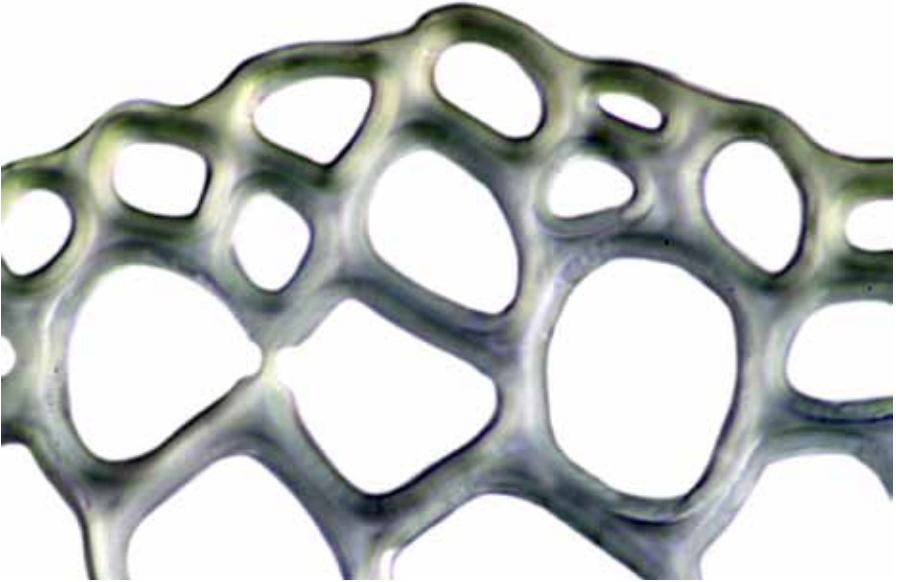
cells at midleaf, costa at midleaf, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 50 μm

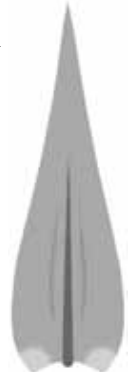
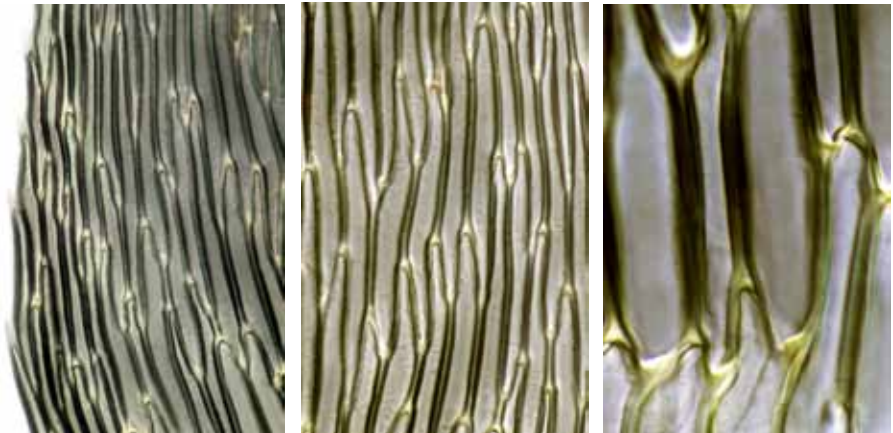
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Brachythecium albicans costa cross-section
10 μm



Brachythecium albicans stem cross-section (fragment)
10 μm

Brachythecium campestre (Müll.Hal.) Bruch & Schimp.**form:** mats of branched golden to green shoots 30–60 mm long, ± stoloniform**habitat:** on soil, rock, tree bases, or fallen logs, in shaded forest or meadows**leaf: size:** stem leaves 1.5–3 × 0.6–1.2 mm; branch leaves 1.5–2 × 0.6–1 mm**shape:** stem leaves ovate-lanceolate, acuminate, plicate, ± falcate; branch leaves lanceolate, acuminate, weakly plicate**tip:** ending in a single linear cell**base:** alar cells few, shorter and wider than other lamina cells**costa:** narrow, to 3/4 the leaf length**border:** not differentiated**margin:** entire to serrulate, narrowly revolute**cells:** 7–9 μm wide, linear, ± sinuose, thin-walled, smooth**capsule:** to 2 mm long, ovoid to cylindrical, asymmetric, ± curved, red-brown, inclined to horizontal; seta 10–20 mm, papillose; operculum short-apiculate; spores 12–16 μm in diam., brownish, minutely papillose**note:** adventivebranch
leafvegetative shoot (dry), papillose seta, branch leaf outline, apex (2), and upper margin
 1 mm, 10 μm, 1 mm, 50 μm, 10 μm, 10 μmbranch leaf lower margin, lamina cells, and cells near base of leaf
 10 mm, 10 μm, 10 μm

continued next page



Berachythecium campestre margin near base of branch leaf
10 mm

Brachythecium fontanum Fife

form: matted, branched stems, to 200 mm long, leaves yellow-green

habitat: soil in montane to subalpine springs and seeps, 700–1450 m

leaf: *size:* stem leaves 2.5–3.2 × 1.3–1.7 mm; branch leaves smaller

shape: ovate-oblong

tip: abruptly tapered to a piliferous acumen

base: basal cells porose, shorter and wider than other lamina cells

costa: reaching to 70% of the blade

border: not differentiated

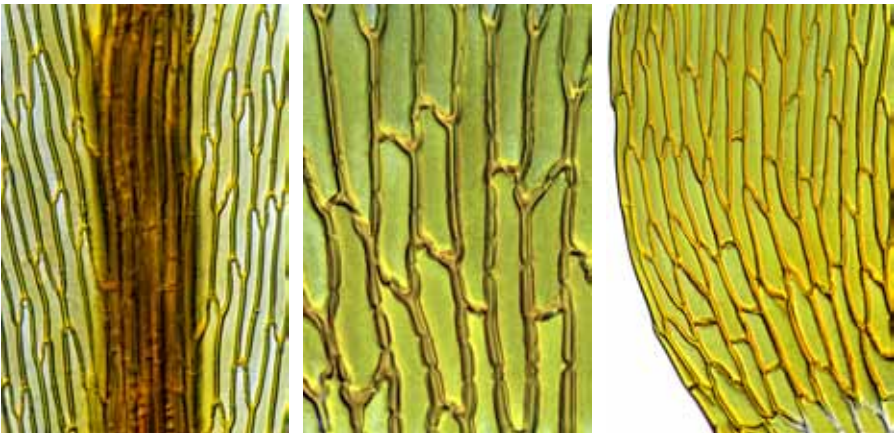
margin: entire below, ± denticulate above, plane to inrolled below

cells: 80–120 × 7–8 μm, linear, firm-walled, smooth

capsule: 2.6 mm, oblong-cylindric, exserted, horizontal, curved, brown; seta 15–25 mm; calyptra cucullate, smooth; operculum short-conic; exostome teeth yellowish brown, cross-striolate, endostome segments perforate; cilia paired, nodose; spores 18–22 μm in diam., green, ± smooth



vegetative shoots (dry) (2), leaf outline, acumen apex, and upper leaf margin
 5 mm, 1 mm, 0.5 mm, 10 μm, 50 μm



costa in lower leaf, porose basal leaf cells, and leaf basal angle
 50 μm, 10 μm, 50 μm

continued next page

Brachythecium plumosum (Hedw.) Bruch & Schimp.

form: matted, pinnately branched stems, to 40 mm tall, leaves dark green to yellow-green

habitat: tree trunk bases, rotting logs, stumps, soil, or rock in moist forest

leaf: size: stem: 1.0–1.2 mm; branch: 0.6–0.9 mm

shape: stem: ± deltoïd; branch: lanceolate, rounded to the insertion, decurrent

tip: gradually acuminate

base: alar cells short-rectangular to subquadrate

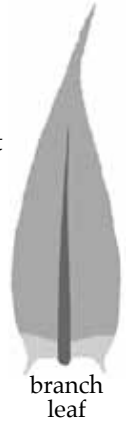
costa: ending below the acumen

border: not differentiated

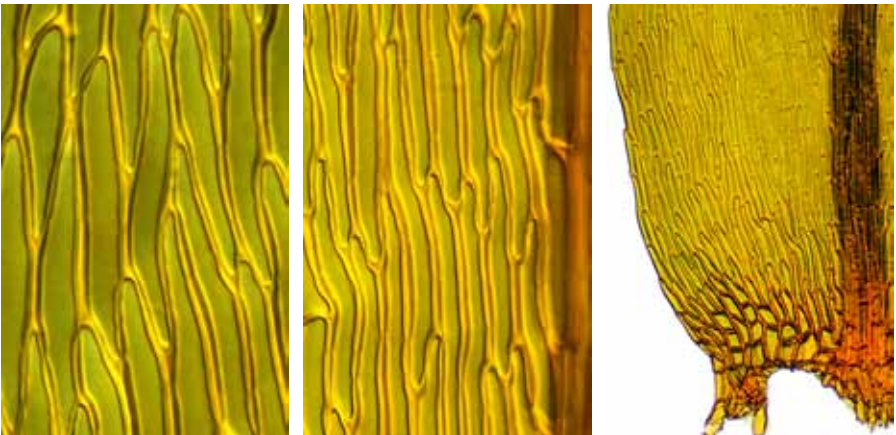
margin: serrate above, serrulate below, plane

cells: 50–90 × 10 μm, rhombic to linear, firm-walled, smooth

capsule: 1.5–1.8 mm, shortly ovoid, asymmetric, exserted, ± horizontal, brown; seta 7–13 mm, orange to dark red, rough; annulus two-rowed; operculum conic, mammillate to apiculate; peristome double, endostome with 2–3 cilia; spores 11–16 μm in diam., finely papillose



vegetative branch shoots (dry) (2), branch leaf outline, leaf apex, and margin midleaf
 1 mm, 1 mm, 0.1 mm, 10 μm, 10 μm



cells at midleaf, juxtacostal cells in lower leaf, and leaf basal angle
 10 μm, 10 μm, 50 μm

continued next page

Brachythecium rutabulum (Hedw.) Bruch & Schimp.

form: tufted, creeping, branched, ascending stems, to 120 mm long;

leaves dark to bright green or yellow-green, glossy

habitat: soil in lawns or grass, rarely on bark, in damp, shady forest

leaf: size: 2.5–3.5 × 1.2–1.8 mm

shape: cordate-ovate, concave, ± decurrent, weakly plicate when dry

tip: acuminate

base: decurrent, not forming distinct auricles

costa: thin, narrow, reaching above midleaf

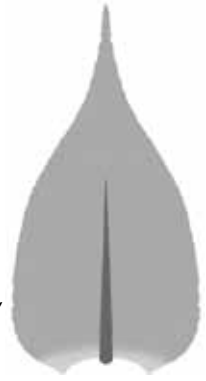
border: not differentiated

margin: denticulate, mostly plane but slightly reflexed toward the base

cells: 55–100 × 6–10 μm, linear-rhombic, firm-walled, smooth

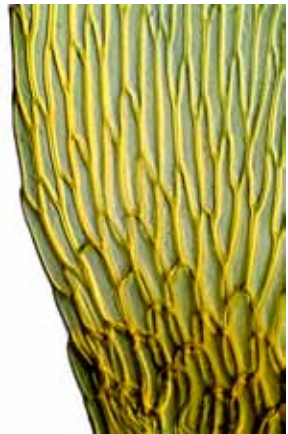
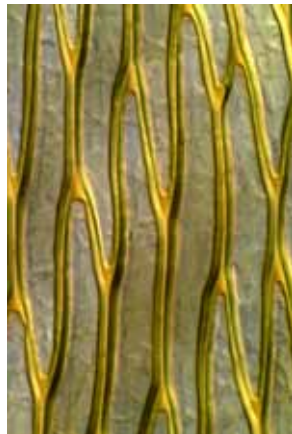
capsule: 2.5–3 mm, oblong, asymmetric, ± curved, exserted, horizontal, dark brown; seta 25–30 mm, strongly papillose throughout; operculum conic; peristome double; spores 16–24 μm in diam.

note: possibly introduced



vegetative shoots (dry) (2), leaf outline, and leaf apex (2)

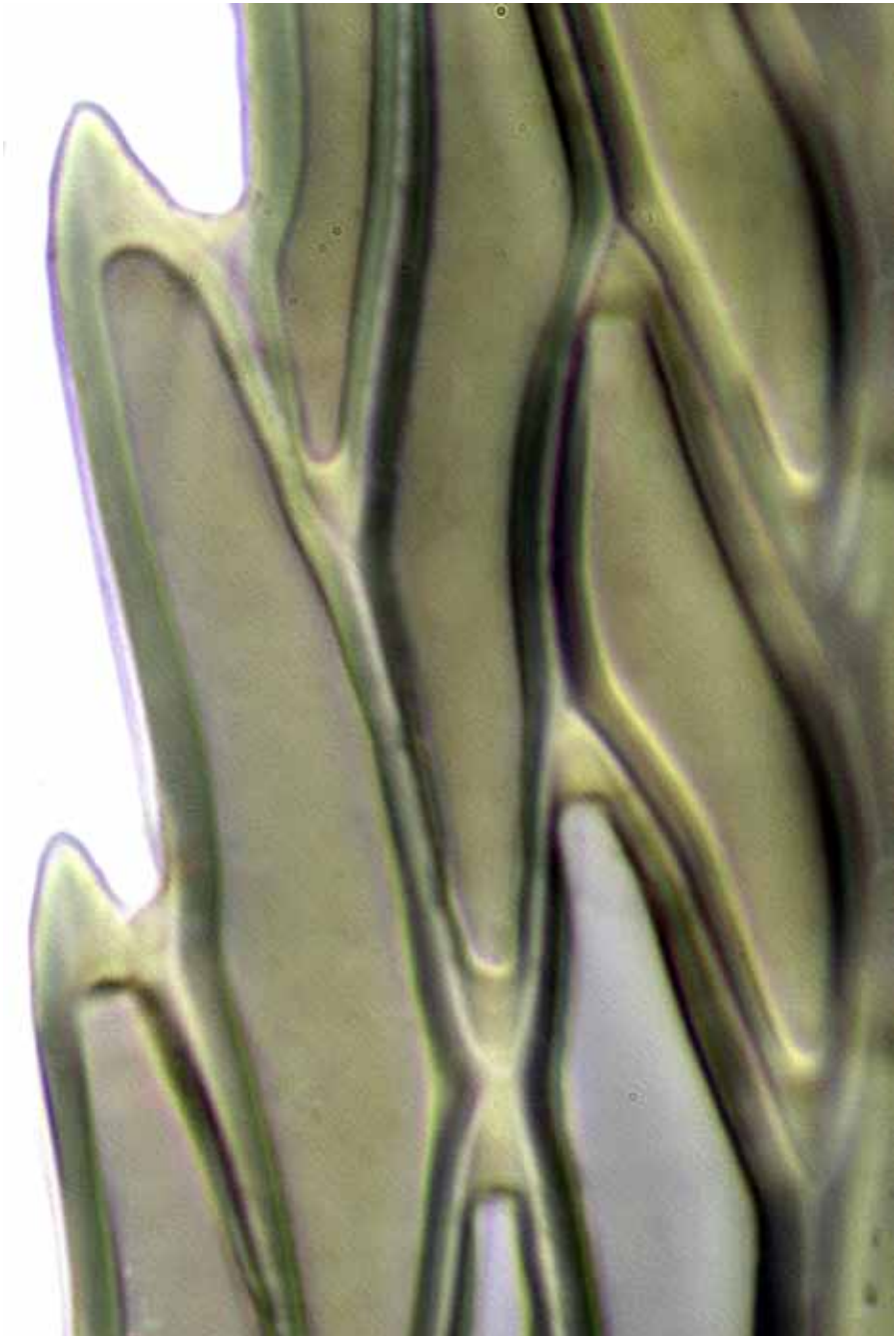
■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm, ■ 10 μm



margin at midleaf, cells at midleaf, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 10 μm

continued next page



Brachythecium rutabulum leaf margin
10 μm

continued next page

Brachythecium salebrosum (F.Weber & D.Mohr) Bruch & Schimp.

form: matted, creeping, \pm pinnately branched stems, 100–150 mm tall, leaves glossy, yellowish green

habitat: damp or wet soil, rotten logs, rock, or tree bases in shady sites

leaf: *size:* stem leaves $2.0\text{--}2.5 \times 1.0\text{--}1.3$ mm; branch leaves smaller

shape: stem leaves lanceolate to ovate-lanceolate, plicate, \pm decurrent

tip: acuminate, sometimes twisted

base: alar cells subquadrate, not thick-walled

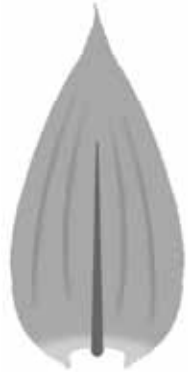
costa: reaching about $2/3$ the leaf length

border: not differentiated

margin: entire, mostly plane but irregularly recurved below

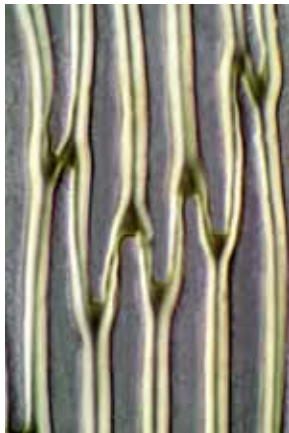
cells: $50\text{--}100 \times 6\text{--}10$ μm , linear, firm-walled, \pm porose, smooth

capsule: 2–2.5 mm, oblong-cylindric, asymmetric, exserted, inclined to horizontal, blackish; seta 10–20 mm, smooth; operculum apiculate; peristome double, endostome cilia 2, nodulose; spores 15–20 μm in diam., finely punctate



vegetative shoots (dry) (2), leaf outline, and leaf apex

■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 10 μm



margin at midleaf, cells at midleaf, and leaf basal angle

■ 10 μm , ■ 10 μm , ■ 50 μm

continued next page



Brachythecium salebrosum peristome tooth
50 μm

Eriodon cylindritheca (Dixon) Dixon & Sainsbury

form: slender, tufted, creeping, ± pinnately branched stems, to 60 mm long, flattened, leaves pale green, glossy

habitat: bark of shrubs or small trees in damp forest or subalpine scrub

leaf: size: 1.5–5 × 0.5–1.5 mm

shape: ovate-lanceolate

tip: acuminate

base: alar cells differentiated in only the extreme basal angles

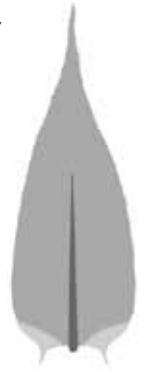
costa: variably reaching from midleaf to well up the acumen

border: not differentiated

margin: minutely and distantly serrulate throughout, plane

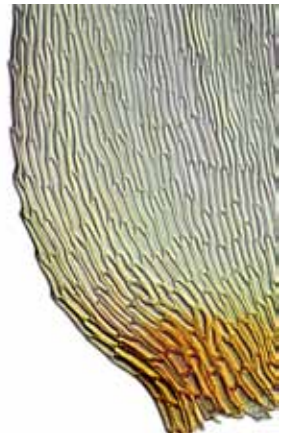
cells: 60–80 × 4–6 μm, linear, firm-walled, smooth

capsule: 1.5–2.5 mm, narrowly cylindrical, long-exserted, suberect, neck tapered, mouth reddish; seta 15–25 mm, thin, smooth; operculum long-rostrate; peristome double, endostome cilia absent; spores 14–20 μm in diam., smooth



vegetative habit (moist) and shoot (dry), leaf outline, and leaf apex (2)

■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 10 μm, ■ 10 μm



margin at midleaf, costa at midleaf, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 10 μm

Key* to the New Zealand species of *Eurhynchium* (4)

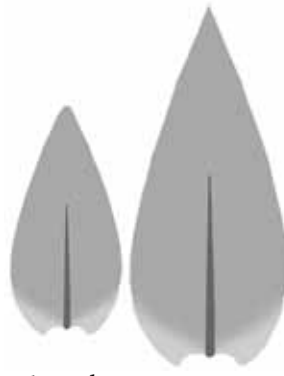
- 1 Leaves dimorphic in shape and/or size2
 1: Leaves not dimorphic3
- 2(1) Stems with vertical lamella-like ridges; branch leaf apex narrowly acute.....
 ● ***Eurhynchium praelongum***
- 2: Stems smooth; branch leaves broadly acute to obtuse ... ● ***Eurhynchium pulchellum***
- 3(1:) Branch leaves elliptic, acute ● ***Eurhynchium speciosum***
 3: Branch leaves ovate-cordate, abruptly long-acuminate..... ● ***Eurhynchium asperipes***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 447, and Crum, HA; Anderson, LE (1981): *Mosses of Eastern North America*. Columbia University Press, New York, 1014.



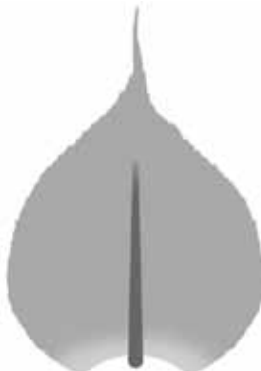
branch stem

*Eurhynchium
praelongum*

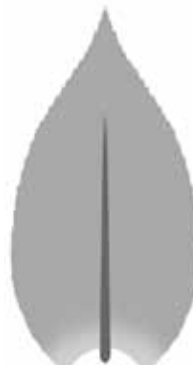


branch stem

*Eurhynchium
pulchellum*



*Eurhynchium
asperipes*



*Eurhynchium
speciosum*

continued next page

Eurhynchium asperipes (Mitt.) Dixon

form: tufted or matted, creeping, radiculose, branched stems, 30–100 mm tall, leaves glossy, green or yellow-green

habitat: soil, logs, roots, or rock in forest

leaf: size: 1–1.7 × 0.7–1.0 mm

shape: cordate-ovate

tip: abruptly acuminate

base: undifferentiated

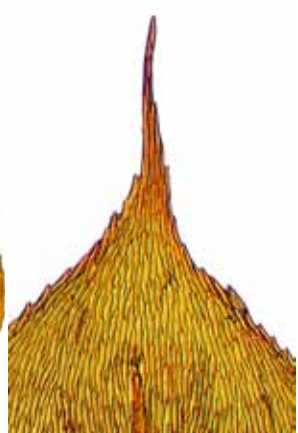
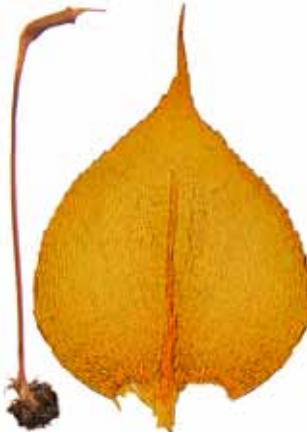
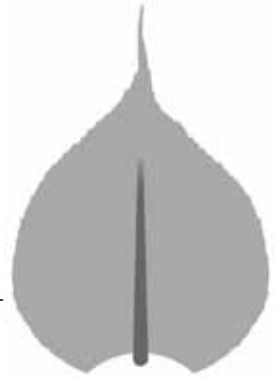
costa: reaching above midleaf

border: not differentiated

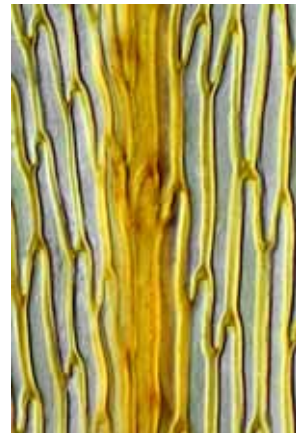
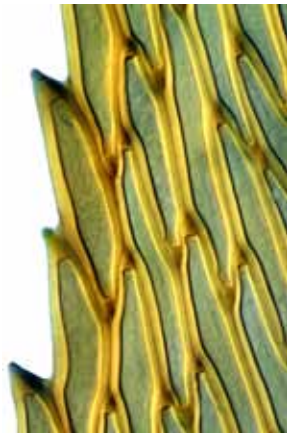
margin: serrulate, plane

cells: 50–100 × 8–10 μm , linear-rhombic to linear-fusiform, firm-to thick-walled, smooth

capsule: 1.5–2 mm, oblong-cylindric, \pm gibbous, exserted, cernuous; seta 10–20 mm; operculum rostrate; peristome double; spores 8–12 μm in diam.

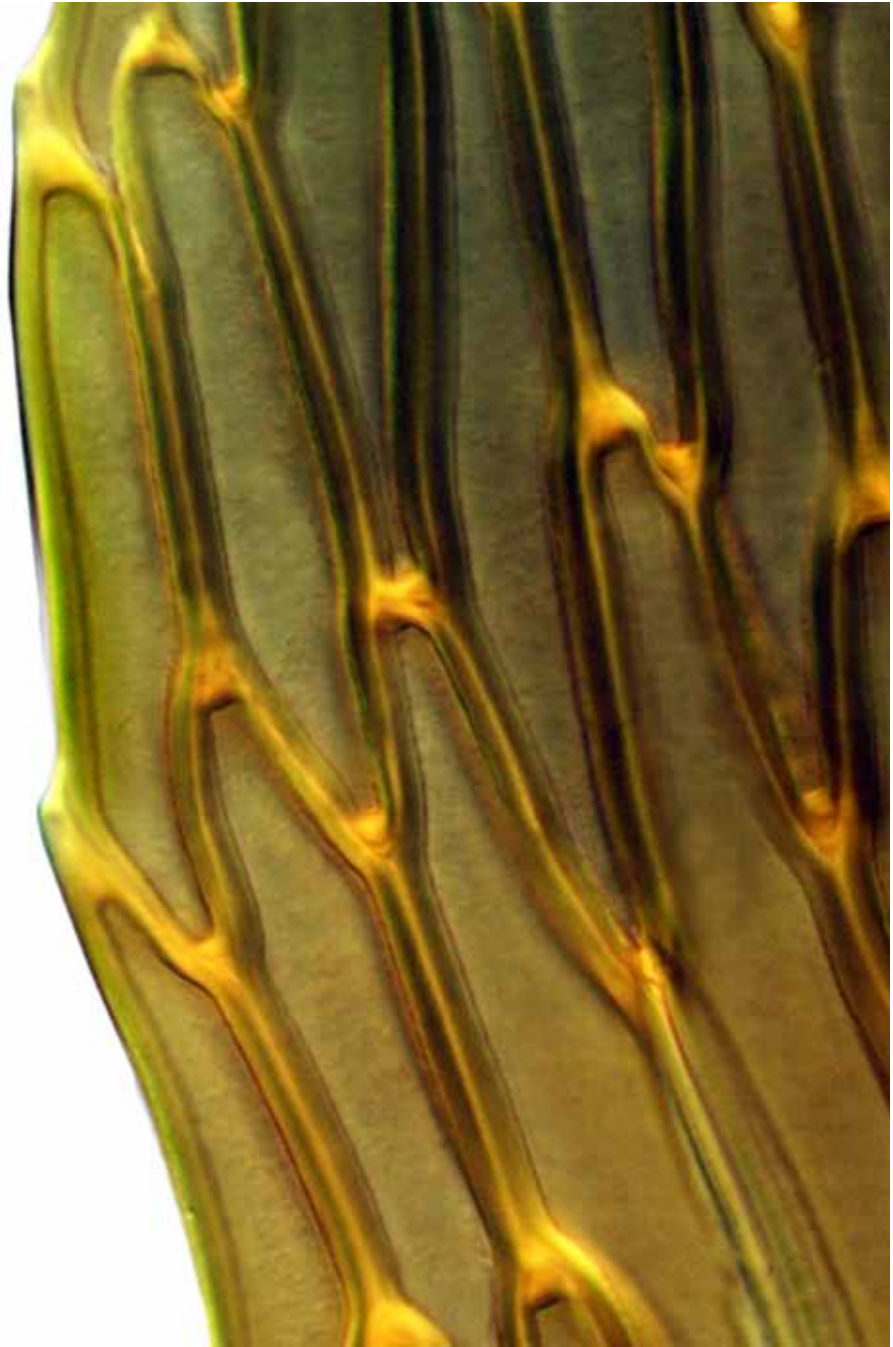


vegetative shoots, capsule (dry), leaf outline, and leaf apex
 1 mm, 1 mm, 0.5 mm, 50 μm



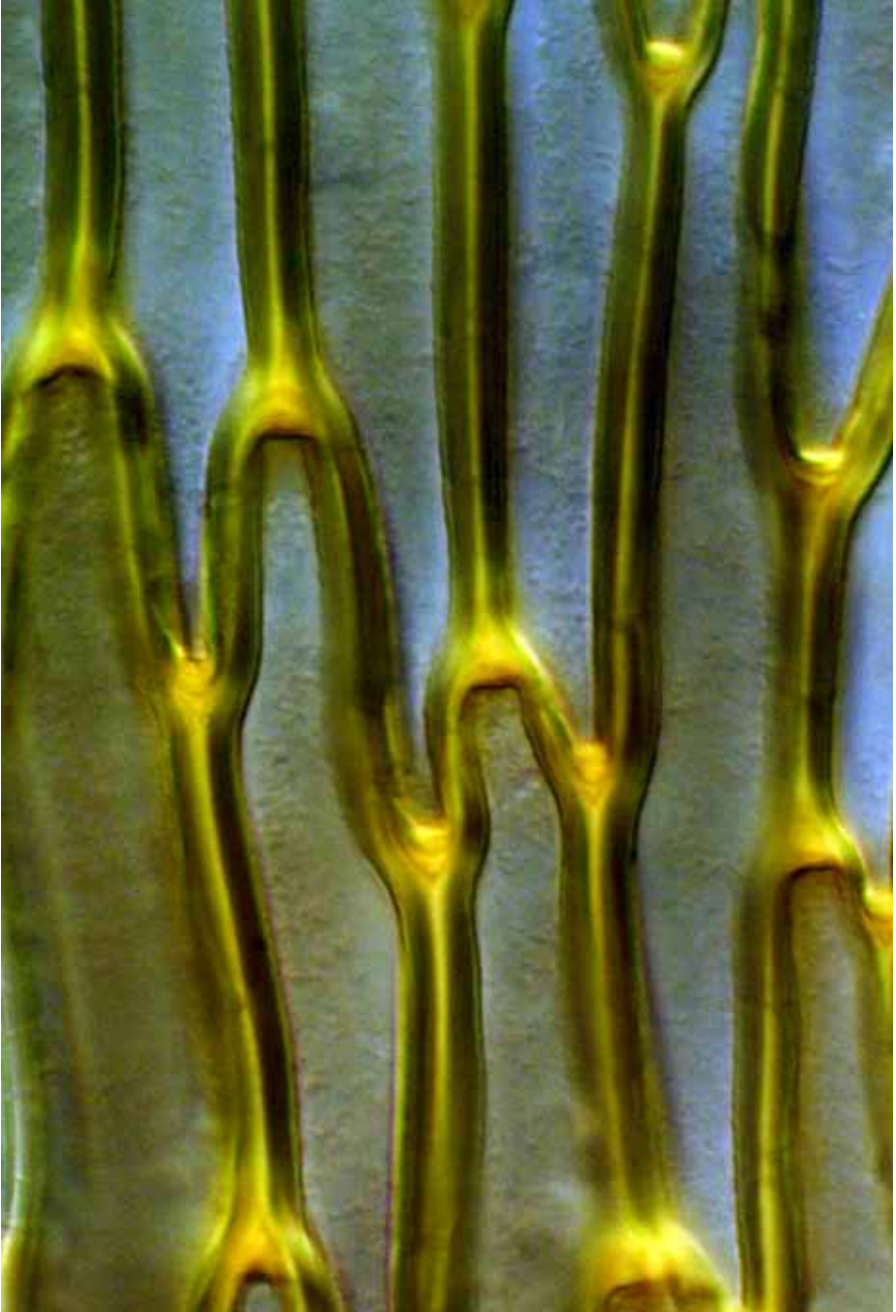
margin at midleaf, costa at midleaf, and leaf basal angle
 10 μm , 10 μm , 50 μm

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Eurhynchium asperipes margin lower leaf
10 μm

continued next page



Eurhynchium asperipes cells midleaf
10 μm

continued next page

Eurhynchium praelongum (Hedw.) Hook.

form: matted, bi- to tripinnately branched stems, to 80 mm long, leaves dull, yellowish

habitat: moist soil or rock near streams and seeps

leaf: size: stem: 1.0–1.4 × 1.0 mm; branch: smaller

shape: stem leaves triangular-cordate and decurrent;

branch leaves lanceolate, not decurrent

tip: short- to long-acuminate

base: basal cells wider and laxer than the blade cells

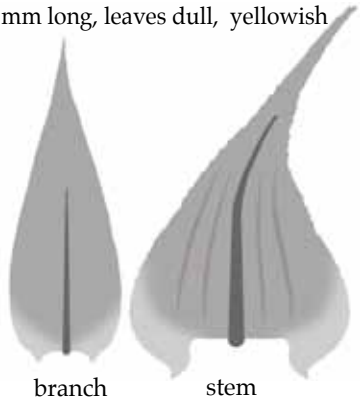
costa: ending above midleaf as a minute abaxial spine

border: not differentiated

margin: sharply denticulate, plane

cells: 30–60 × 6–10 μm, linear, firm-walled, smooth

capsule: 1.5 mm, ovate to cylindric, brown; seta 15 mm; operculum finely long-rostrate; peristome double; spores 12–16 μm in diam., smooth

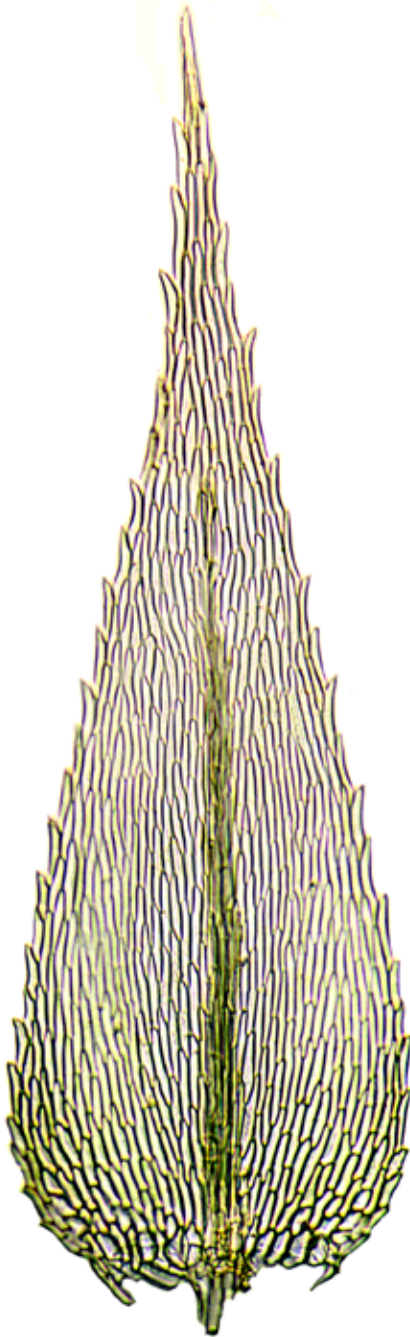


vegetative shoot (2), capsule (dry), branch and stem leaf outlines, and stem leaf apex
 5 mm, 1 mm, 1 mm, 0.25 mm, 0.25 mm, 10 μm



margin at midleaf, costa terminus, margin of lower leaf, and lamellar stem ridge xs
 10 μm, 10 μm, 10 μm, 10 μm

continued next page



Eurhynchium praelongum branch leaf whole-mount
100 μm

Eurhynchium pulchellum (Hedw.) Jenn.

form: matted procumbent stems, ± pinnately branched, yellow-green
habitat: soil, soil on rock, rotting logs, and root bark in moist forest

leaf: *size:* stem leaves 1–2.5 mm; branch leaves 0.6–1.5 mm

shape: stem: ± cordate-triangular; branch: ovate-lanceolate, concave

tip: stem: acute to acuminate; branch: mostly obtuse

base: alar cells quadrate, rectangular, or irregular, thick-walled

costa: reaching to 7/8 up the lamina, abaxial terminus spinose

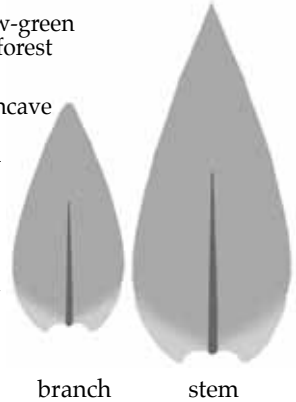
border: not differentiated

margin: serrulate, plane above, ± recurved below

cells: 30–70 × 4–7 μm, ± linear, firm- to thick-walled, smooth

capsule: 1.3–2.5 mm, oblong-cylindric, inclined to horizontal,
 long-exserted, brown; seta 7–20 mm, smooth; operculum
 long-beaked; peristome double

note: male plants minute, on leaves or stems of females

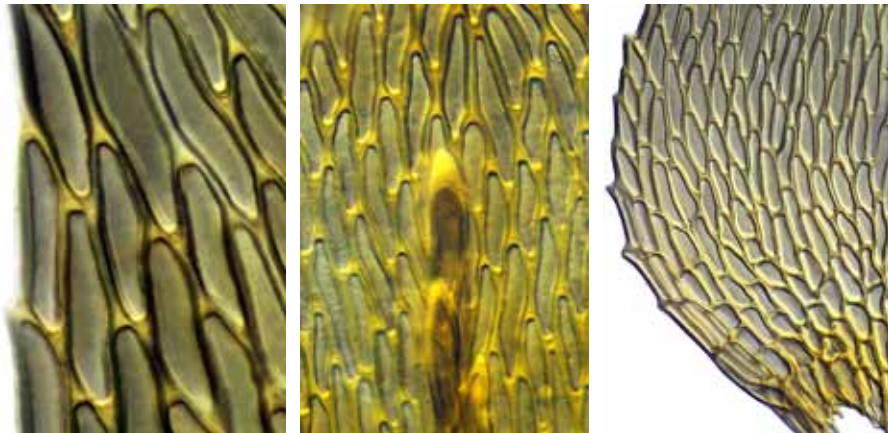


branch

stem



vegetative shoot (dry), mature capsule (dry), branch leaf outline, and branch leaf apex
 5 mm, 1 mm, 0.1 mm, 10 μm



branch leaf margin at midleaf, branch leaf costa terminus, and branch leaf basal angle
 10 μm, 10 μm, 50 μm

continued next page

Eurhynchium speciosum (Brid.) Jur.

form: patchy, irregularly branched stems, the branches 10–20 mm, leaves dull, sordid green

habitat: soil and bark of tree bases in wet sites

leaf: *size:* stem leaves 1.5–1.7 × 0.8 mm; branch leaves shorter, wider

shape: stem leaves ovate; branch leaves elliptic

tip: stem leaves acute to acuminate; branch leaves acute or apiculate

base: angle cells rectangular, decurrent

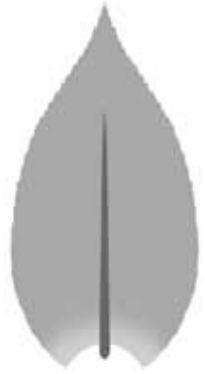
costa: to 4/5 up the lamina, ending in a sharp abaxial spicule

border: not differentiated

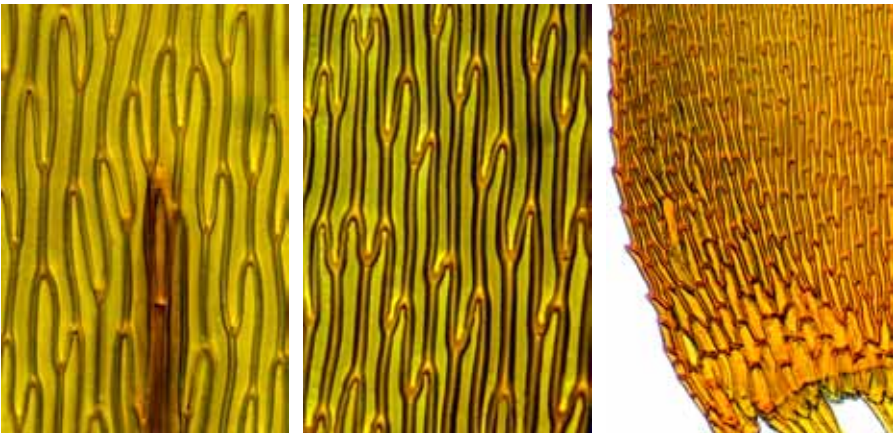
margin: sharply denticulate, plane

cells: 40–90 × 6–9 μm, narrowly linear, ± flexuose, firm-walled, smooth

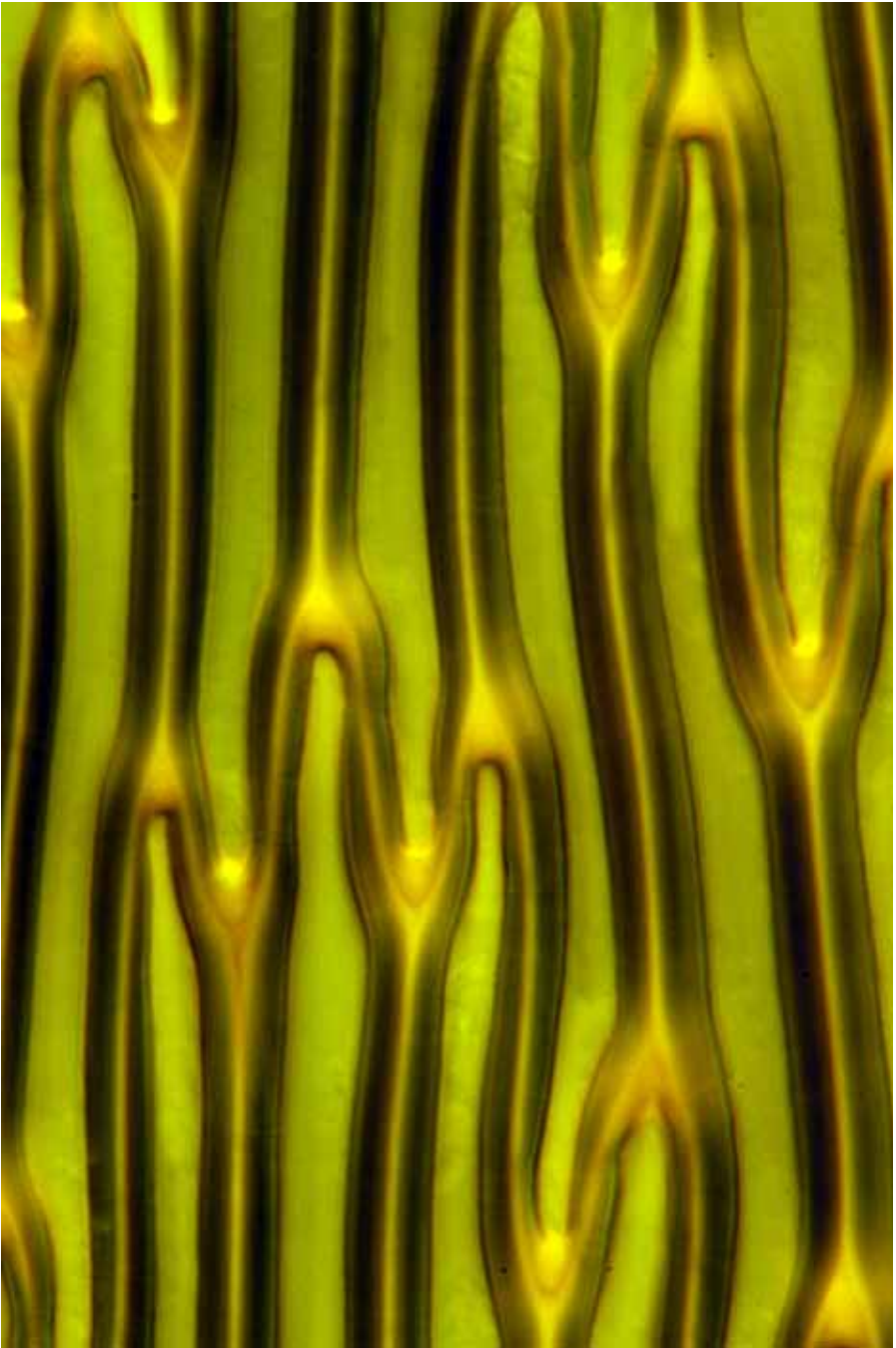
capsule: to 2 mm, ellipsoid, ± asymmetric, exserted, horizontal, brown; seta to 20 mm, red, slender, flexuose; operculum finely long-rostrate; exostome teeth yellow-brown, cross-striolate; endostome pale yellow, cilia 2–3, nodulose; spores 12–16 μm in diam., smooth



vegetative branch (dry), capsule (dry), branch leaf outline, apex, and margin upper leaf
 1 mm, 1 mm, 0.1 mm, 10 μm, 10 μm



abaxial costa spicule, cells at midleaf, and leaf basal angle
 10 μm, 10 μm, 50 μm



Eurhynchium speciosum cells midleaf
10 μ m

Palamocladium leskeoides (Hook.) E.Britt.

form: matted or tufted, sparsely branched stems, to 50 mm long, creeping at first, later erect, leaves golden, glossy

habitat: soil, bark, rotting logs, or rock, roadbanks and moist forest

leaf: size: stem 1.5–3 × 0.5–1.1 mm; branch 0.8–2.4 × 0.3–0.9 mm

shape: triangular-lanceolate, plicate

tip: acuminate

base: ± decurrent; alar cells numerous, ± quadrate, pigmented

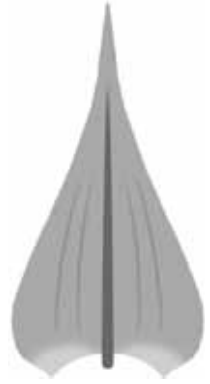
costa: reaching to three-quarters up the blade

border: not differentiated

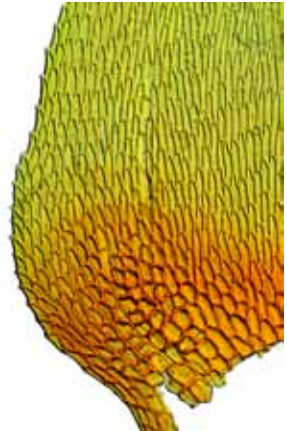
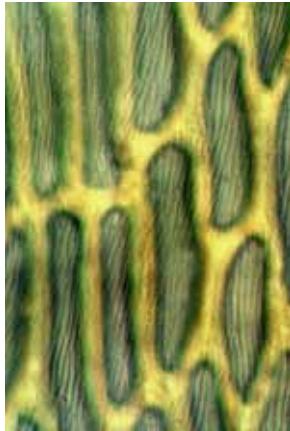
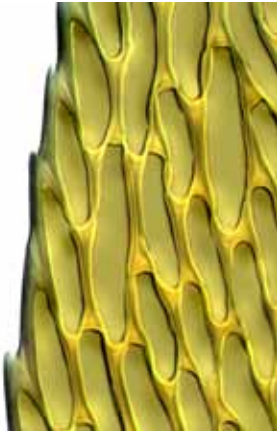
margin: serrulate to coarsely toothed above, plane

cells: 30–55 × 3–5 μm, linear-vermicular, thick-walled, striolate

capsule: 2–3 mm, ovoid-cylindric, exserted, erect, stomatose at the base, annulus two-layered, cells inflated; seta 12–22 mm; peristome double, endostome cilia none; spores 9–20 μm in diam., finely papillose



vegetative shoot (dry), leaf outline, leaf apex, and leaf subapex
 1 mm, 0.5 mm, 10 μm, 10 μm



margin at midleaf, surface striolations, and leaf basal angle
 10 μm, 5 μm, 50 μm

Platyhypnidium austrinum (Hook.f. & Wilson) M.Fleisch.

form: primary stems tufted, creeping, leafless, ± filiform, to 80 mm long,
secondary stems stout, simple, foliose-pseudoparaphylliate, leaves dull

habitat: wet rock, often submerged in streams

leaf: size: 2 × 1 mm

shape: ovate to ovate-cordate

tip: short-acuminate

base: basal cells thinner-walled than the blade cells, not auricled

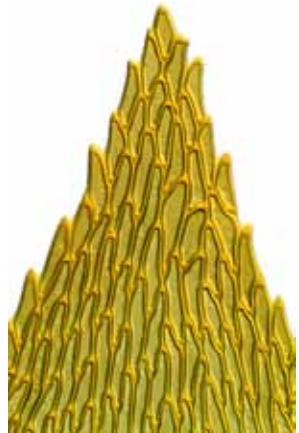
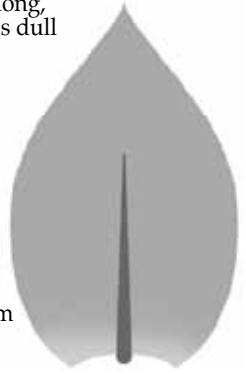
costa: faint, reaching above midleaf, sometimes ending in spicule

border: not differentiated

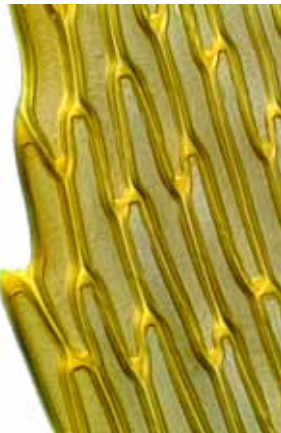
margin: entire to serrulate, plane

cells: 50–90 × 6–7 μm, linear-rhombic, firm-walled, smooth

capsule: 2 mm, ovoid, asymmetric, curved, exserted, inclined to nearly erect; seta 20–30 mm, slender, reddish, papillose; operculum obliquely long-rostrate; exostome teeth cross-striolate, endostome cilia 2; spores 15–20 μm in diam., smooth to papillose



vegetative shoot, leaf outline, and leaf apex
 5 mm, 0.5 mm, 10 μm



leaf apex detail, margin at midleaf, and costa at midleaf
 10 μm, 10 μm, 10 μm

Pseudoscleropodium purum (Hedw.) M.Fleisch.

form: matted, pinnately branched stems, 50–150 mm long, leaves pale green to yellowish brown, glossy

habitat: exposed soil or rock in lawns and pasture or along tracks

leaf: size: 1–1.2 × 0.6–0.7 mm

shape: widely cordate, concave, ± plicate

tip: rounded to obtuse, abruptly apiculate

base: alar region of ± rectangular, incrassate, porose cells

costa: thin, reaching 2/3 up leaf blade

border: not differentiated

margin: finely denticulate throughout, plane

cells: 50–100 × 4–8 μm, vermicular, firm-walled, smooth

capsule: not seen in NZ; 1.5 mm, cylindric, curved, asymmetric, exserted, inclined to pendent; seta 9–13 mm, smooth, red; operculum conic short-rostrate; endostome cilia 2–3.

notes: probably introduced from Europe



vegetative habit (2), leaf outline, and leaf cross-section

■ 10 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm



leaf apex, margin at midleaf, and leaf basal angle

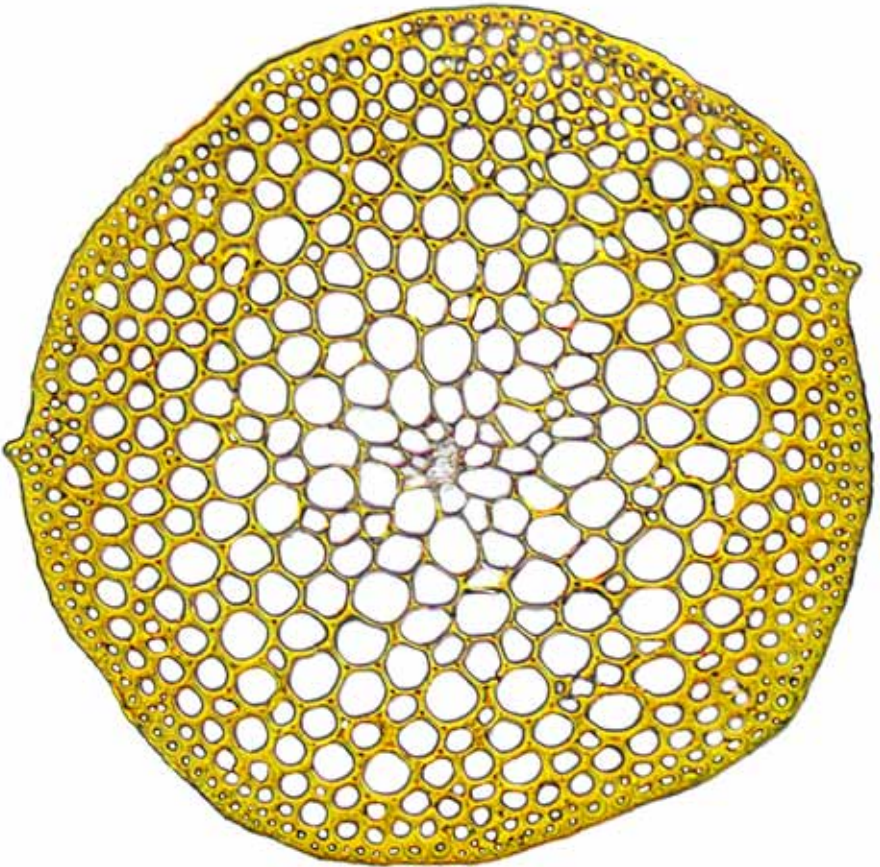
■ 10 μm, ■ 10 μm, ■ 10 μm

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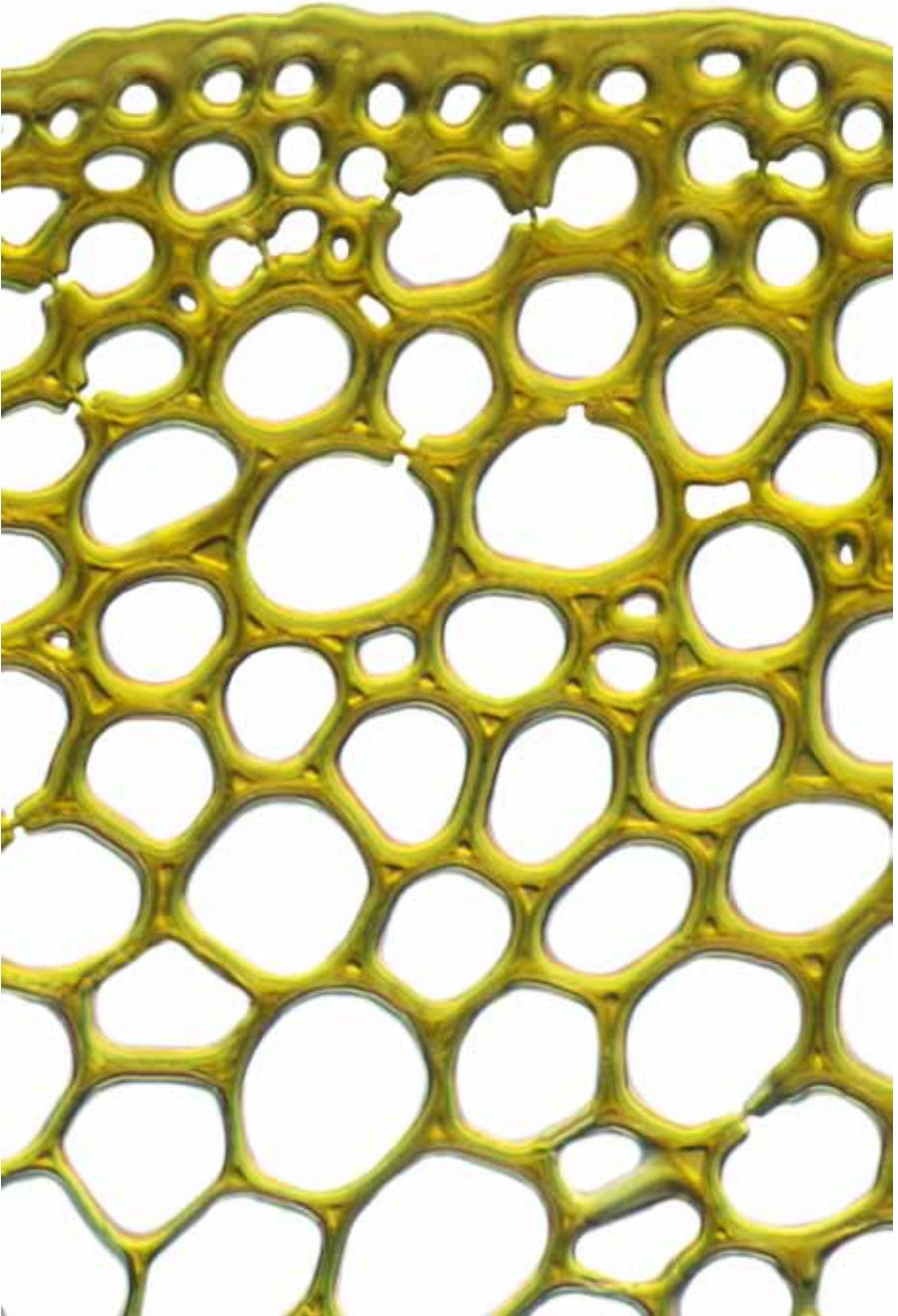
Pseudoscleropodium purum vegetative habit
10 mm

continued next page



Pseudoscleropodium purum stem cross-section
10 μm

continued next page

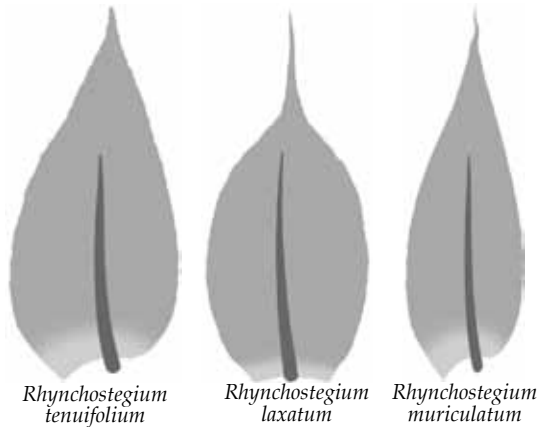


Pseudoscleropodium purum stem cross-section (detail)
10 μ m

Key* to the New Zealand species of *Rhynchostegium* (3)

- 1 Seta smooth..... 2
 1: Seta rough..... ● ***Rhynchostegium muriculatum***
- 2(1:) Leaf cells 50–80 μm long, chlorophyllous; apex piliferous.....
 ● ***Rhynchostegium laxatum***
- 2: Leaf cells 80–140 μm long, pellucid; apex acute ● ***Rhynchostegium tenuifolium***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 436, 442.



Rhynchostegium laxatum (Mitt.) Paris

form: tufted, slender, ± pinnately branched, radiculose stems, to 30 mm long, leaves yellow-green to yellow-brown, not glossy

habitat: soil, humus, rotting logs, or rock

leaf: size: stem leaves 1–1.4 × 0.5–0.9 mm; branch leaves smaller

shape: ovate, slightly asymmetric

tip: usually piliferous, the tip sometimes twisted

base: basal cells subrectangular, firm-walled, not in auricles

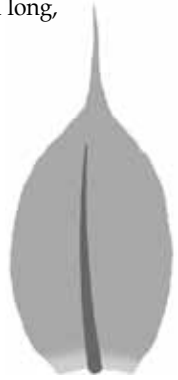
costa: slender, reaching well above midleaf

border: not differentiated

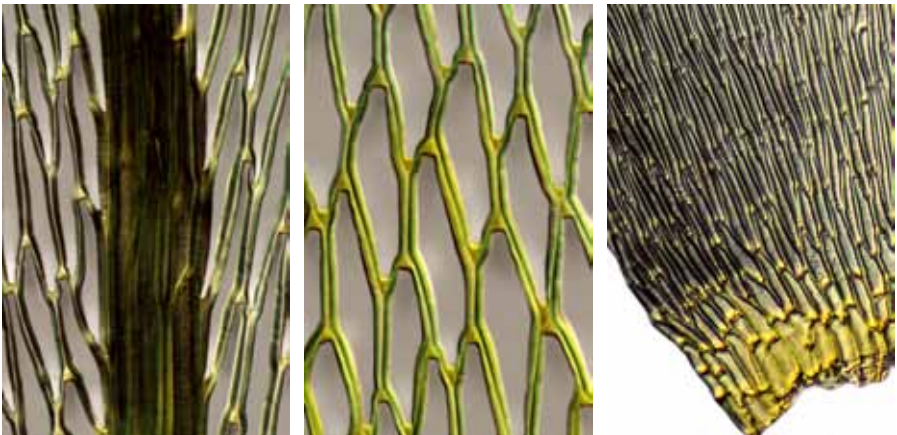
margin: ± denticulate, plane

cells: 50–80 × 7–10 μm, fusiform, firm-walled, smooth

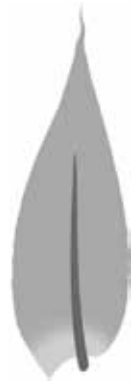
capsule: 1.5–2 mm, reddish; ovoid to cylindric, ± curved, exserted, horizontal to cernuous, dark brown; seta 7–10 mm, slender, flexuose; operculum rostrate; exostome teeth striolate below, papillose above; endostome cilia 1–3, nodulose; spores 12–14 μm in diam.



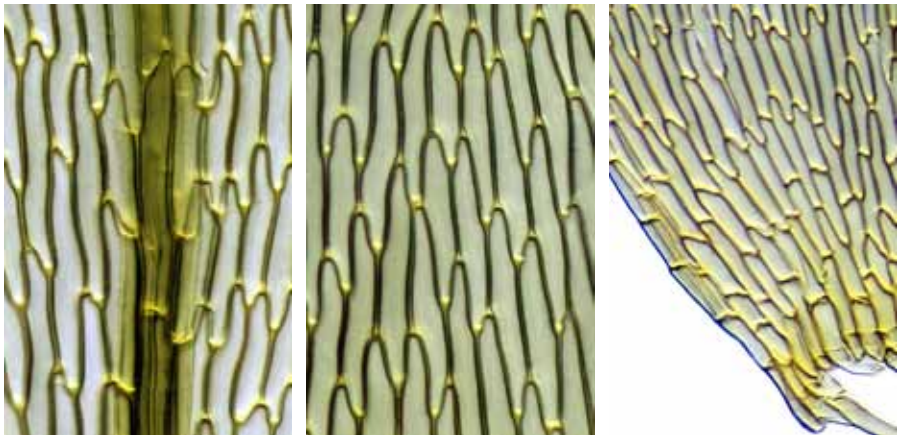
vegetative shoot (dry) (2), leaf outline, leaf apex, apex hair-point, and margin midleaf
 1 mm, 1 mm, 0.1 mm, 50 μm, 10 μm, 10 μm



costa at midleaf, cells of upper leaf, and leaf basal angle
 10 μm, 10 μm, 50 μm

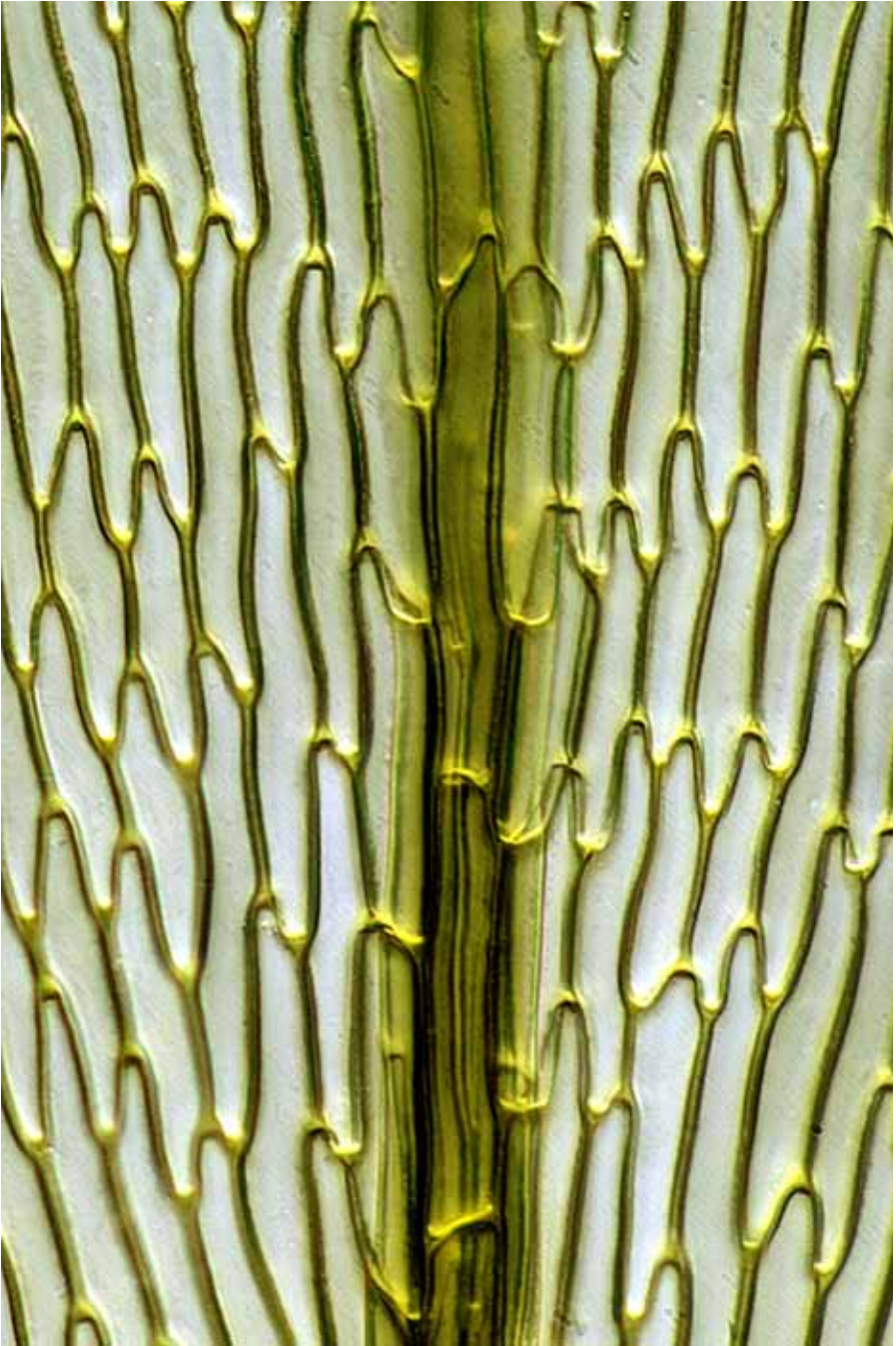
Rhynchostegium muriculatum (Hook.f. & Wilson) Reichardt**form:** dense tufts or mats of creeping, ± pinnate, glossy, radiculose stems**habitat:** on bark of trunks and roots, or on rotting logs**leaf:** size: 1–1.5 × 0.4–0.7 mm**shape:** ovate-lanceolate, asymmetric toward the base**tip:** acuminate to ± piliferous**base:** alar cells none; basal cells wider and shorter than other lamina cells**costa:** weak, narrow, reaching to two-thirds up lamina**border:** not differentiated**margin:** ± denticulate, plane**cells:** 40–80 × 6–8 μm, linear-rhombic, firm-walled, smooth**capsule:** 1–2 mm, oblong, curved, horizontal to cernuous, long-exserted, brown; seta 6–12 mm, densely papillose; ± strangulate when dry; operculum beak long, curved; peristome double**note:** differs from *Rhynchostegium laxatum* in its densely papillose seta

vegetative shoots (dry), mature capsule (dry), leaf outline, leaf apex, and margin midleaf
 1 mm (2), 1 mm, 0.1 mm, 50 μm, 50 μm, 10 μm



costa at midleaf, cells at midleaf, and leaf basal angle
 10 μm, 10 μm, 50 μm

continued next page



Rhynchoszegium muriculatum costa midleaf
10 μm

continued next page



Rhynchoszegium muriculatum cells midleaf
10 μm

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Rhynchostegium tenuifolium (Hedw.) Reichenbach

form: straggling or tufted, radiculose, branched stems, to 80 mm long,

leaves pale to dark green or yellow-green, ± glossy

habitat: soil, humus, rotting logs, or rock

leaf: size: stem leaves $1.5-5 \times 0.5-1.4$ mm; branch leaves smaller

shape: ovate-cordate, concave, slightly asymmetric

tip: acuminate to ± piliferous, the tip often twisted

base: basal cells subrectangular, thin-walled, not in auricles

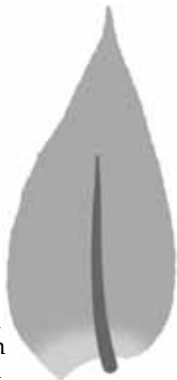
costa: slender, reaching above midleaf

border: not differentiated

margin: ± serrulate, plane

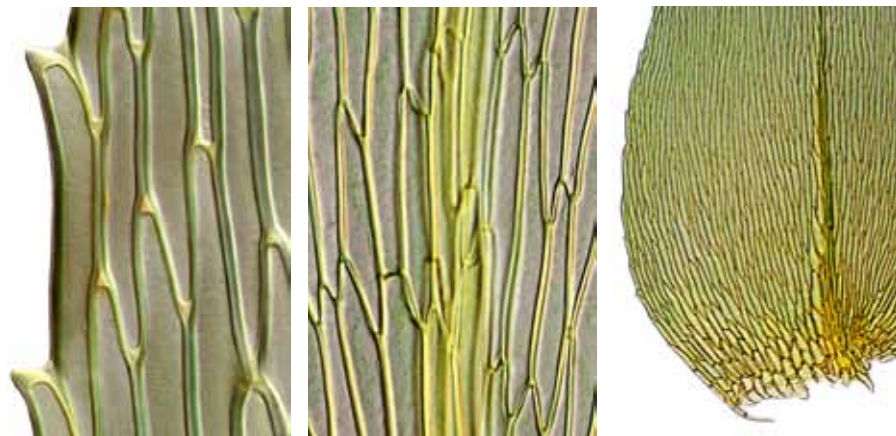
cells: $80-140 \times 7-10$ μm, linear-fusiform, firm-walled, smooth

capsule: 2–2.5 mm, slender, flexuose, reddish; ovoid to cylindrical, ± curved, exserted, horizontal to cernuous, dark brown; seta 10–15 mm; operculum rostrate; exostome teeth striolate below, papillose above; endostome cilia 1–3, nodulose; spores $12-14$ μm in diam.



vegetative shoot (2), mature capsule (dry), leaf outline, and leaf apex

■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 10 μm



margin at midleaf, costa at midleaf, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 50 μm

Scleropodium touretii (Brid.) Koch

form: matted, curved, irregularly branched stems, to 80 mm long,
leaves green, olive-green, or yellowish

habitat: soil or rock in shady disturbed sites (gardens, quarries)

leaf: size: 1.2–1.5 × 0.8–1.0 mm

shape: triangular-ovate, ovate, or ovate-cordate, concave

tip: abruptly narrowed to an acuminate or obtuse apex

base: alar cells long-rectangular in a distinct triangular group

costa: reaching 3/4 up the leaf blade, often ending in a spine

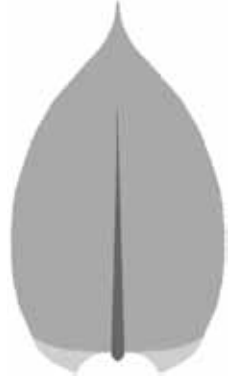
border: not differentiated

margin: minutely denticulate

cells: 40–100 × 4–6.5 μm, vermicular, firm-walled, smooth

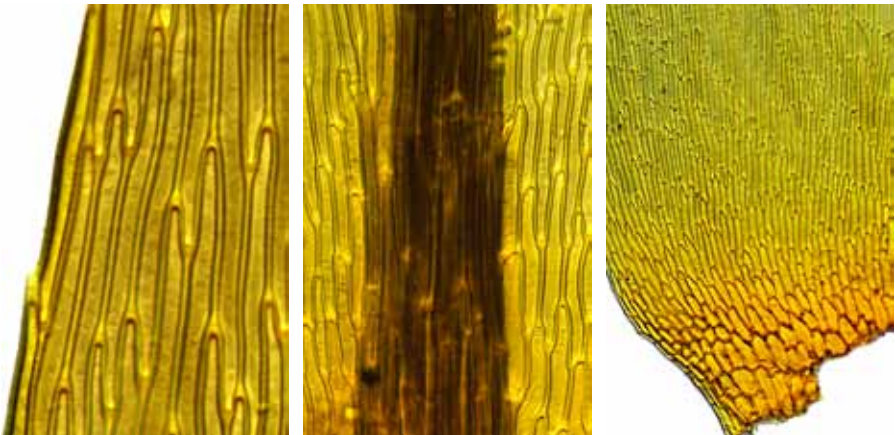
capsule: capsules not yet found in New Zealand

notes: endemic; differs from *Pseudoscleropodium purum* in having a larger alar group, stems and branches that curve strongly when dry, and a leaf apex that's not reflexed



shoots (dry) (2), leaf outline, and leaf apex

■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm



margin at midleaf, costa near leaf base, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 50 μm

Scorpiurium cucullatum (Mitt.) Hedenäs

form: tufted, creeping, ± pinnately branched, rhizomatous stems with pale green leaves

habitat: bark, often near water in silty, occasionally inundated sites

leaf: size: 0.8–1.0 × 0.3–0.4 mm

shape: ovate to ovate-lanceolate, concave, strongly inrolled when dry

tip: acuminate to broadly acute, ± cucullate

base: 3–4 rows of oblate to ± quadrate cells extending far up the margin

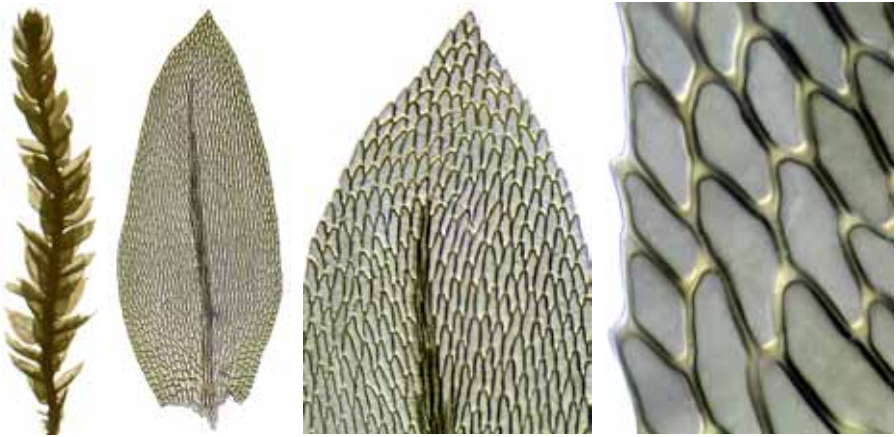
costa: reaching about 2/3 up the leaf blade, ± spinose at the tip

border: not differentiated

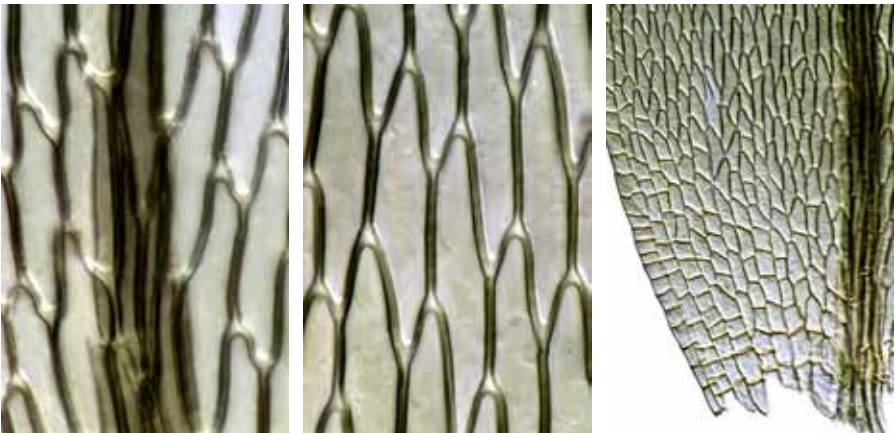
margin: minutely denticulate, plane

cells: 25–80 × 6–9 μm, linear-rhombic, firm-walled, smooth

capsule: 1.2 mm, short-cylindric, curved, inclined; seta 5–11 mm, mammillose, purple; operculum beak long, oblique; peristome double; endostome cilia vestigial or absent; spores 13–18 μm in diam.

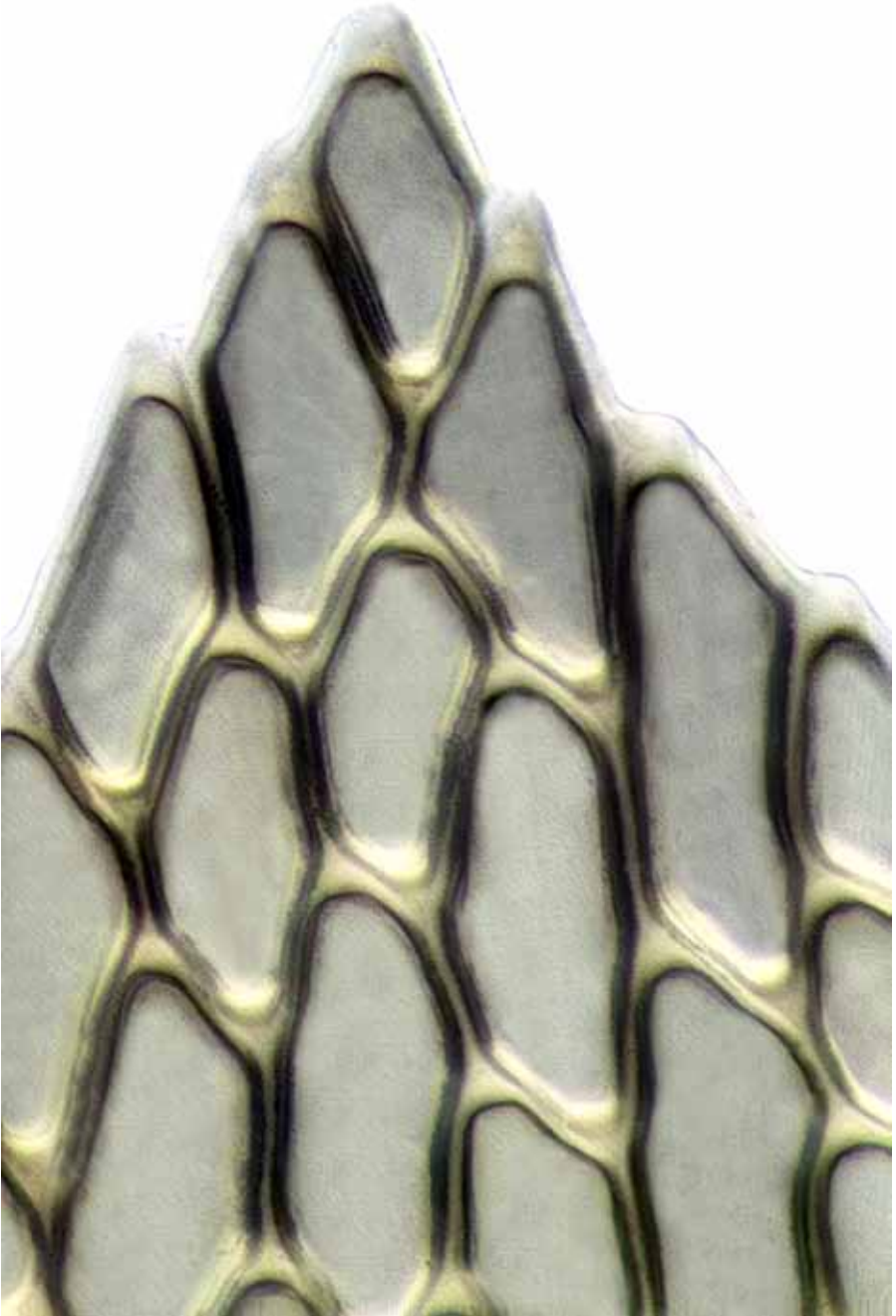


vegetative shoot (moist), leaf outline, leaf apex, and margin midleaf
 1 mm, 0.1 mm, 50 μm, 10 μm



costa at midleaf, cells at midleaf, and leaf basal angle
 10 μm, 10 μm, 50 μm

continued next page



Scorpiurium cucullatum leaf apex
10 μm

Meteoriopsis reclinata (Müll.Hal.) M.Fleisch. ex Broth.

form: primary stems creeping, branched; secondary stems pendent, to 200 mm long, leaves yellow-green to yellow-brown, ± glossy

habitat: tree trunk and branch bark, rarely rock and logs, in humid forest

leaf: size: 2–2.5 mm

shape: ovate to ovate-oblong, ± clasping at the base

tip: tapering to a long, ± canaliculate acumen

base: alar cells weakly delimited

costa: reaching to about midleaf

border: not differentiated

margin: serrulate, plane

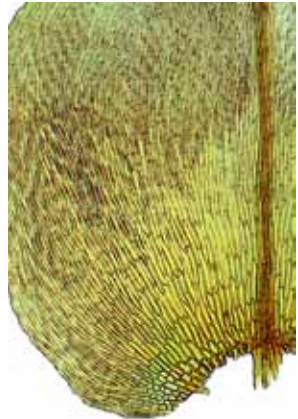
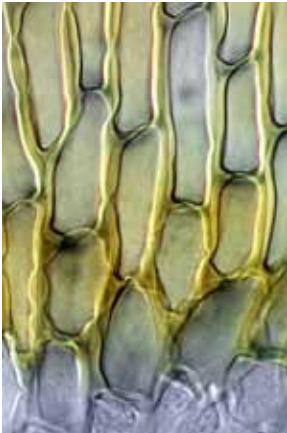
cells: 40–50 × 10 μm, linear-rhombic, firm-walled, unipapillose

capsule: 1.5–2 mm, oblong-ovoid, symmetric, erect, emergent, brown, dark with age; seta 1–2 mm; calyptra mitrate, pilose; operculum conic-rostrate; exostome teeth cross-striolate, endostome reduced; spores 20–30 μm in diam., scabrate



vegetative shoots (dry) (2), leaf outline, leaf apex, and margin midleaf

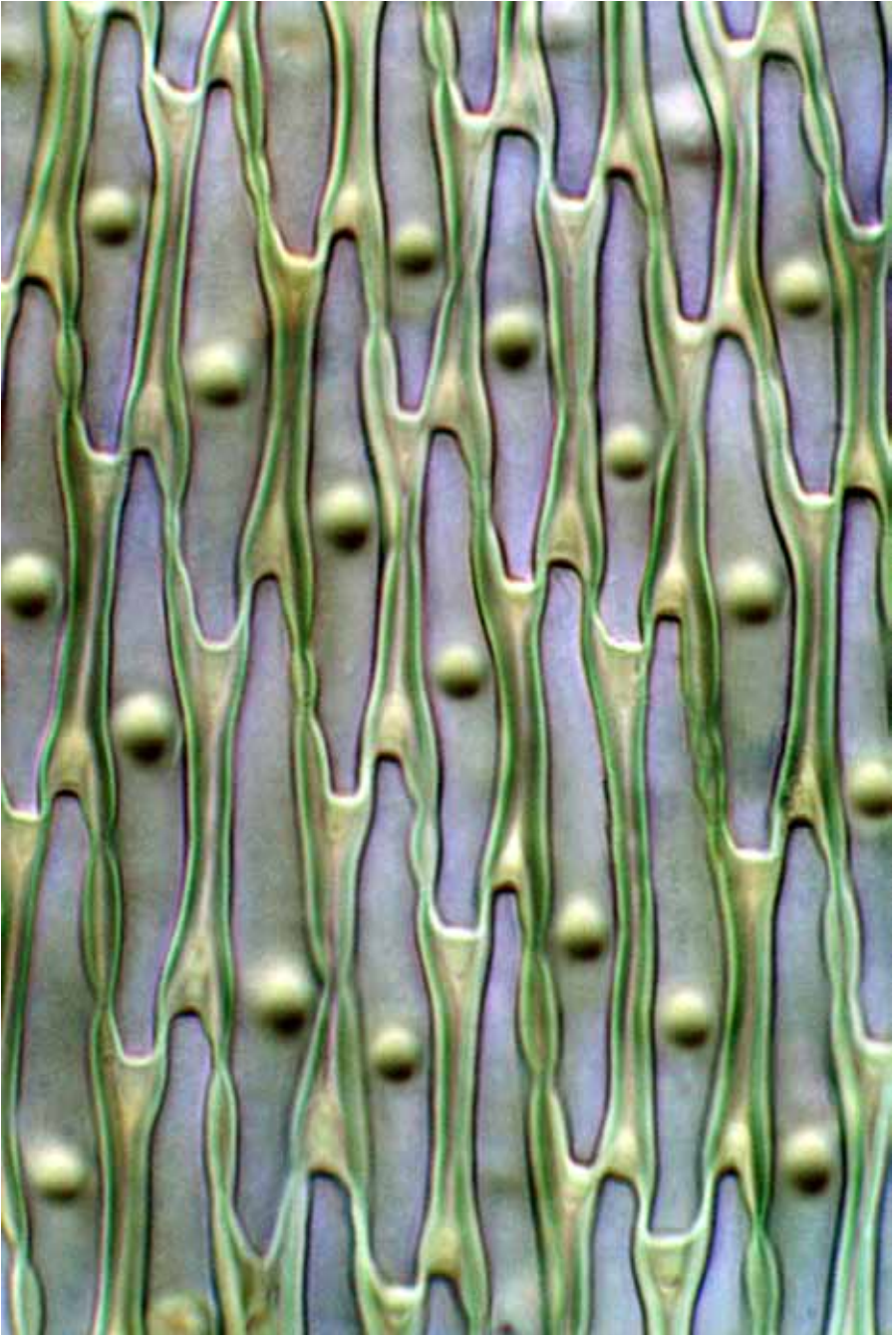
■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm, ■ 10 μm



alar cells, costa at midleaf, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 50 μm

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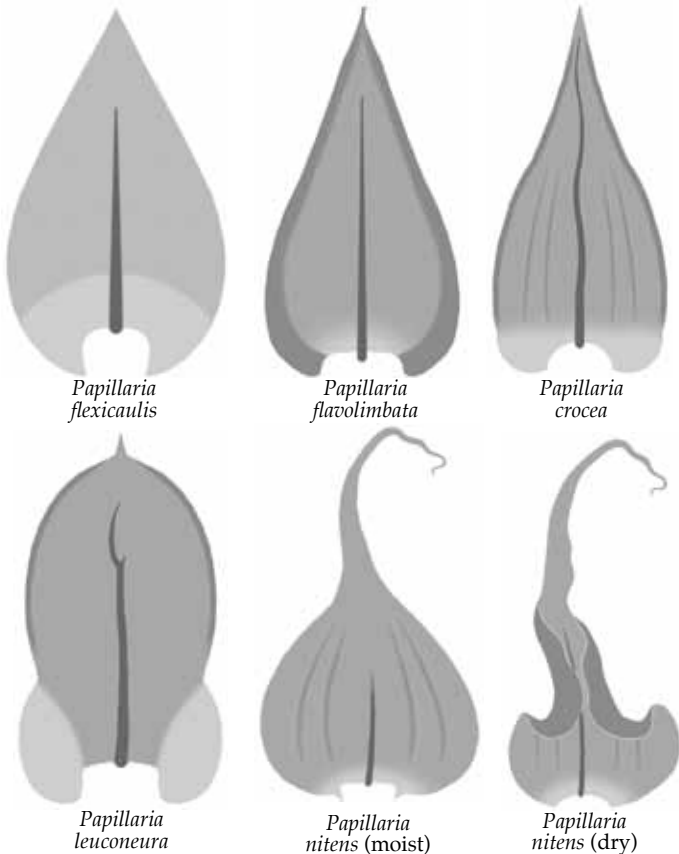


Meteoropsis reclinata cells midleaf
— 10 μm

Key* to the New Zealand species of *Papillaria* (5)

- 1 Leaves not or only weakly bordered; plants soft 2
 1: Leaves bordered at least in part; plants rigid.....3
- 2 (1) Upper lamina cells sparsely papillose; leaf apex long-acuminate, the tip often filiform; cells in the auricle \pm parallel to the margin..... ● **Papillaria nitens**
 2: Upper lamina cells densely papillose; leaf apex acute, never filiform; cells in the auricle meeting the margin \pm at a right angle ● **Papillaria flexicaulis**
- 3 (1:) Margin recurved; auricle with a broad border of long narrow cells..... ● **Papillaria flavolimbata**
 3: Margin straight; auricle without a broad border of long narrow cells.....4
- 4 (3:) Leaves smoothly curved when dry; costa straight or if flexuose then forked ... ● **Papillaria leuconeura**
 4: Leaves undulate and long-grooved when dry; costa \pm flexuose, never forked ● **Papillaria crocea**

* based on Streimann, H (1991): Taxonomic studies on Australian Meteoriaceae (Musci) 3: *Papillaria nitens* (Hook.f. & Wilson) Sainsb. *Journal of the Hattori Botanical Laboratory* 70, 220, plus Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bulletin 5, 354.



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Papillaria crocea (Hampe) A.Jaeger

form: primary stems trailing, to 200 mm long; secondary stems to 100 mm long, leaves imbricate, dull, yellowish green

habitat: bark, rotting logs, tree roots, or rock in forest or other moist sites

leaf: size: branch leaves 1–1.5 mm; stem leaves slightly longer

shape: cordate to broadly lanceolate

tip: acute or rarely acuminate

base: strongly auriculate, juxtacostal cells rectangular, smooth

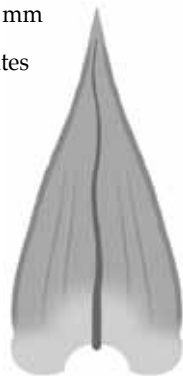
costa: reaching nearly to the apex

border: 1–2 rows of \pm smooth, quadrate cells

margin: irregularly denticulate-prurulose, undulate

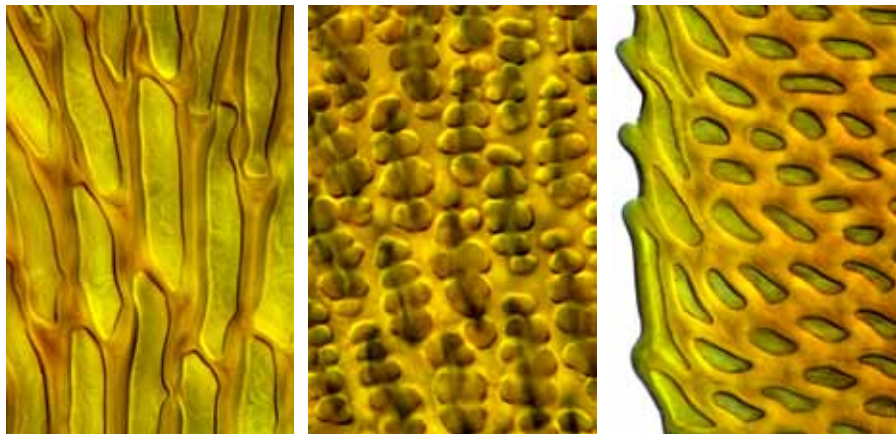
cells: 9–13 \times 2–6 μm , upper cells oval to rhombic, thick-walled, multipapillose

capsule: rare; 1.3–1.6 mm, ovoid, symmetric, exserted, erect, brown; seta 4–5 mm; peristome double, endostome cilia lacking or only rudimentary



vegetative shoots (4), leaf outline, and leaf apex

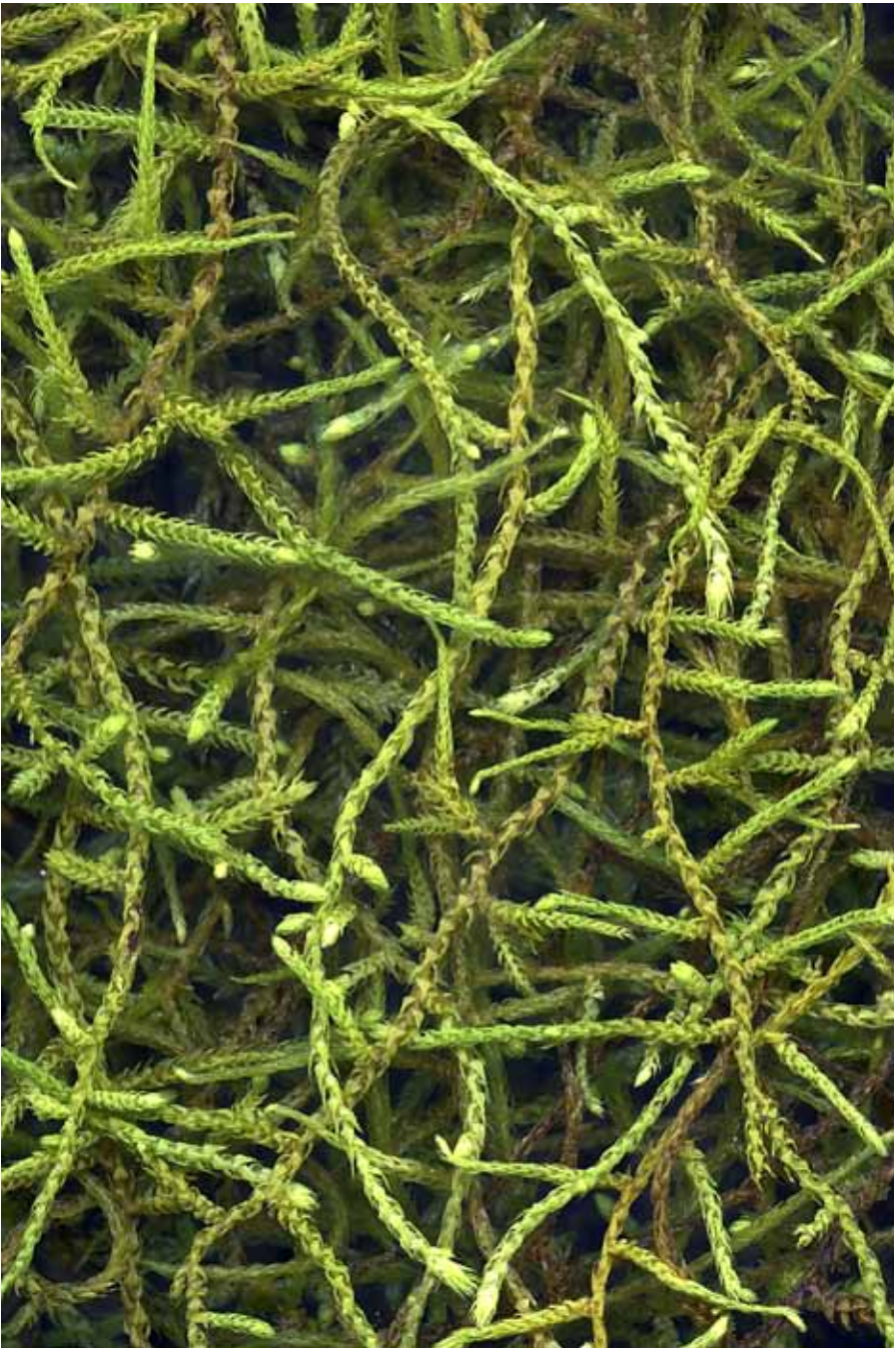
10 mm, 5 mm, 1 mm, 1 mm, 0.1 mm, 10 μm



basal juxtacostal cells, leaf papillae, and auricle margin

10 μm , 10 μm , 10 μm

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Papillaria crocea habit
10 mm

continued next page

Papillaria flavolimbata (Müll.Hal. & Hampe) A.Jaeger

form: primary stems creeping, flexuose, branched, to 300 mm long; secondary

stems \pm pinnately branched, a few filiform, to 100 mm long, leaves dull

habitat: bark of tree trunks and canopy branches in moist forest, often in pendent festoons, rarely also on rock

leaf: size: 2–2.5 \times 1.2–1.5 mm

shape: lanceolate from a broadly auricled base, not plicate

tip: acuminate, ending in a flexuose, papillose, forked point

base: outer base: many rows of border cells; inner base: rows of cells diverging at an angle from the costa

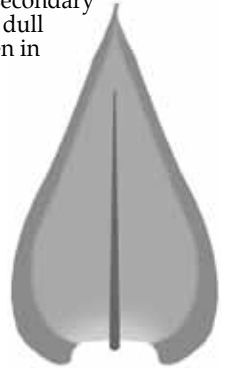
costa: prominent at the back, vanishing below the apex

border: several to many rows of pale, elongate, incrassate cells

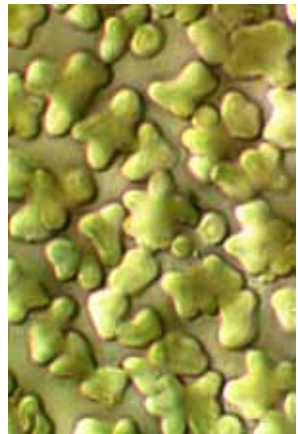
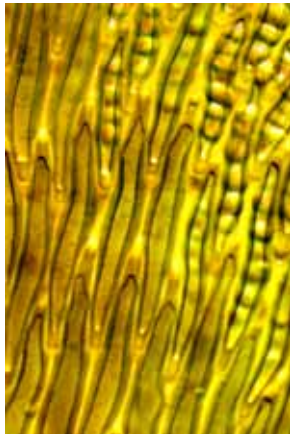
margin: serrulate below, plane to \pm recurved below, \pm undulate

cells: 12–20 \times 4–5 μm , narrow-rhombic, firm-walled, papillose

capsule: not found in New Zealand



vegetative shoots (4), margin cross-section, leaf outline, and papillose forked leaf apex
 ■ 10 mm, ■ 5 mm, ■ 1 mm, ■ 1 mm, ■ 5 μm , ■ 0.1 mm, ■ 10 μm

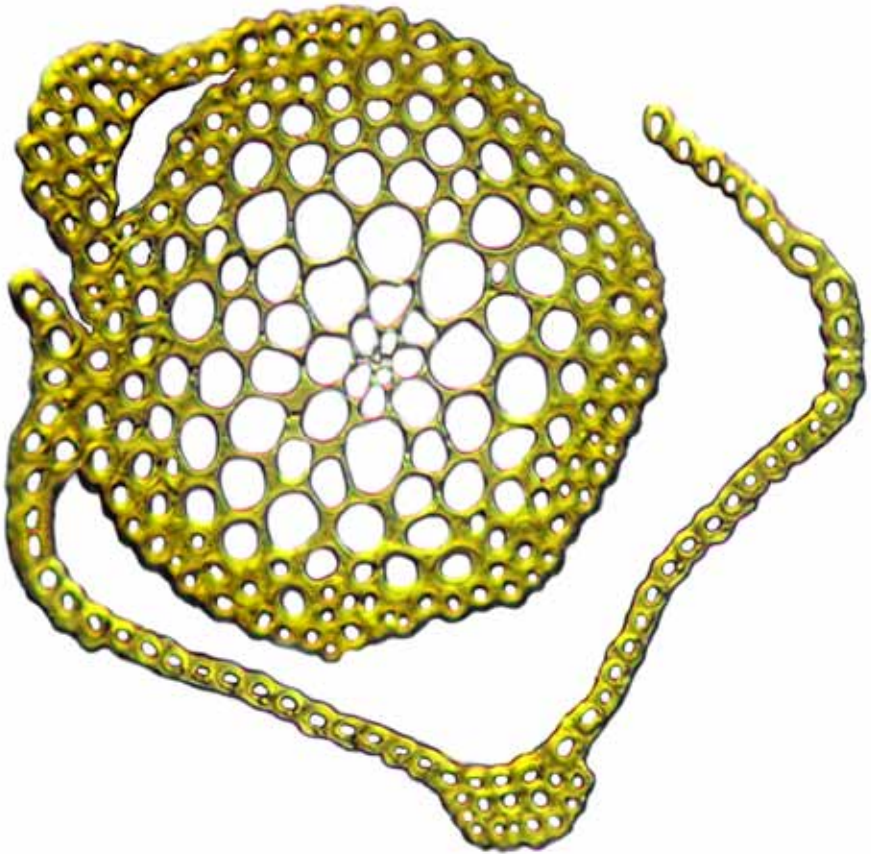


border of lower leaf, cells of inner leaf base, and leaf papillae
 ■ 10 μm , ■ 10 μm , ■ 10 μm



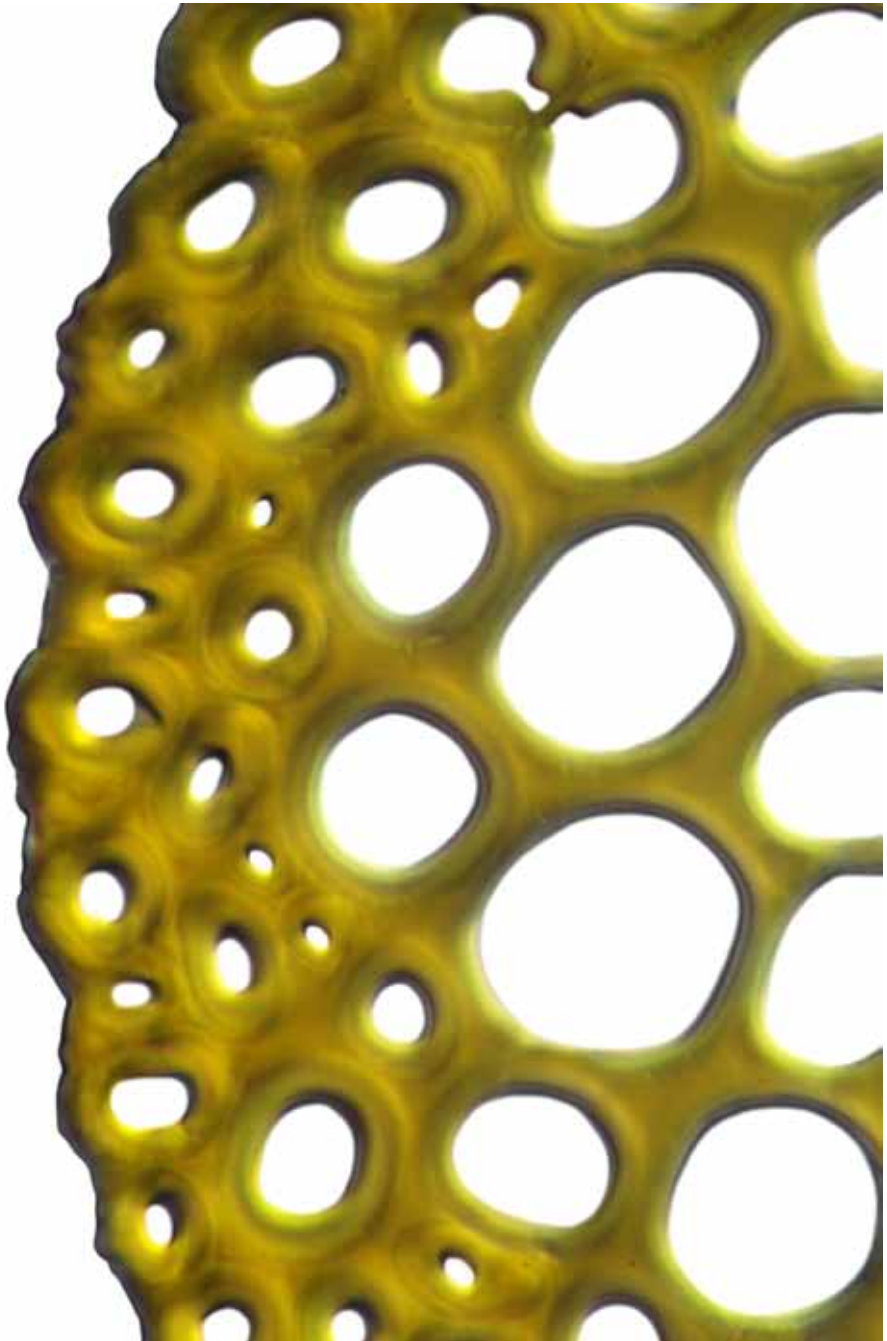
Papillaria flavolimbata vegetative pendent shoot tip
1 mm

continued next page



Papillaria flavolimbata stem and leaf cross-section
10 μm

continued next page



Papillaria flavolimbata stem cross-section (portion)
10 μm

continued next page

Papillaria flexicaulis (Wilson) A.Jaeger

form: primary stems pinnate; secondary stems long-pendent, to 300 mm, flexuose, pinnate branches to 10 mm, leaves dark to yellow-green

habitat: shrub or tree bark or rarely limestone in damp forest

leaf: size: 0.8–2.0 mm

shape: triangular-ovate, concave, not plicate

tip: acute

base: cells in the auricle meeting the margin \pm at a right angle

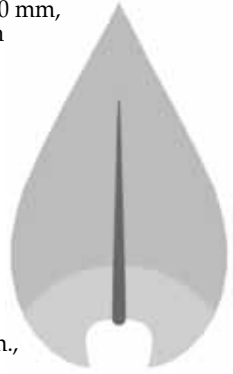
costa: reaching 3/4 up lamina, straight, not forked

border: not or only weakly differentiated

margin: \pm crenulate from papillae or projecting cells, plane

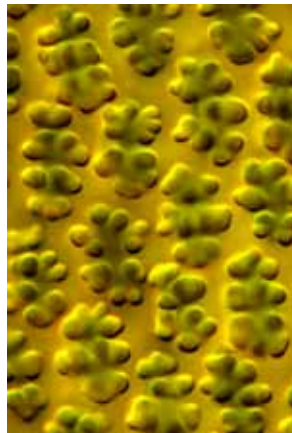
cells: 8–15 \times 3–5 μm , rhombic to oval, incrassate, papillose

capsule: to 1.2 mm, ovoid, exserted, erect, brown; seta 3–9 mm, smooth; operculum obliquely subulate; calyptra hairy; exostome teeth 16, endostome segments perforate; spores 16–20 μm in diam., brownish green, \pm papillose



habit (moist), leaf outline, and leaf apex (2)

10 mm, 0.1 mm, 10 μm , 5 μm



margin at midleaf, leaf papillae, and margin of lower leaf

5 μm , 5 μm , 5 μm

continued next page



Papillaria flexicaulis exostome teeth (lanceolate) and endostome processes (linear)
50 μm

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Papillaria leuconeura (Müll.Hal.) A.Jaeger

form: primary stems to 20 mm long; secondary stems foliate, terete, pinnately branched, to 300 mm long, leaves yellowish, julaceous
habitat: tree bark in damp forest and in urban areas, also in bogs and on rock, from sea level to 1200 m

leaf: size: 1–2 mm

shape: ovate-oblong to panduriform, the base cordate to auriculate

tip: ± cucullate with a short recurved mucro or cusp

base: auricle cells ± parallel to the border

costa: pale, reaching 3/4 up lamina, ± forked and flexuose above

border: a few rows of elongate cells

margin: entire above, denticulate in the auricles, plane

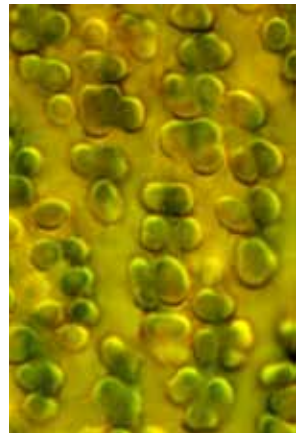
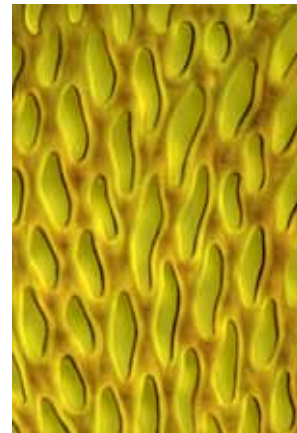
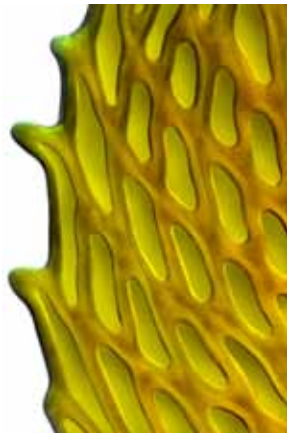
cells: 10–20 × 3–8 μm, elliptic to rhombic, incassate, low-papillose

capsule: 1.5–3.5 mm, ovoid, exserted, erect, brown; seta 2–6 mm; operculum short-rostrate; peristome double; spores 13–24 μm in diam.



habit (moist), vegetative shoots (dry) (3), and leaf outline (coverslipped)

■ 5 mm, ■ 5 mm (2), ■ 1 mm, ■ 0.1 mm



margin of lower leaf, cells at midleaf, and leaf papillae

■ 10 μm, ■ 10 μm, ■ 10 μm

Papillaria nitens (Hook.f. & Wilson) Sainsbury

form: primary stems creeping or pendent, to 120 mm long; secondary stems pendent, to 200 mm long, leaves yellow-green, \pm glossy

habitat: bark in moist forest

leaf: size: stem leaf 1.5–2.0 mm; branch leaf smaller

shape: lanceolate from an ovate to broadly triangular base

tip: acuminate, in the upper leaves ending in a filiform hair-point

base: auriculate, the auricle cells nearly parallel with the margin

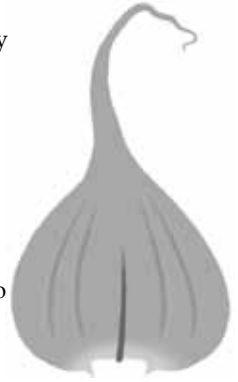
costa: reaching about halfway up the blade

border: not differentiated

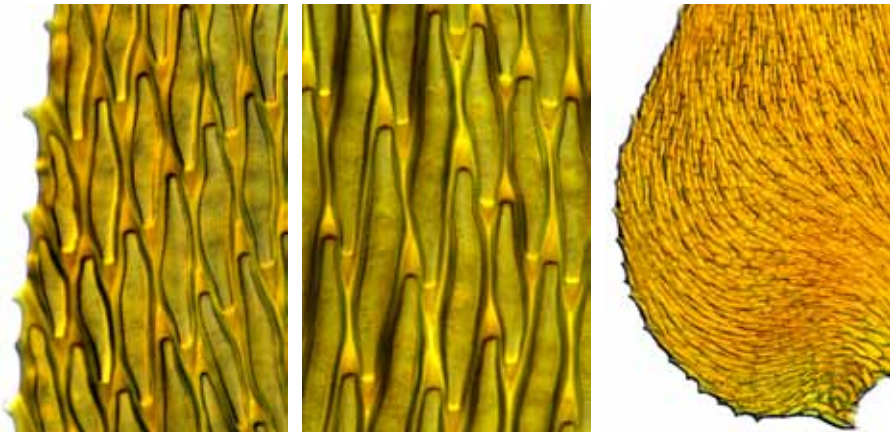
margin: denticulate throughout but more strongly below, plane

cells: $25\text{--}60 \times 4\text{--}5 \mu\text{m}$, linear-rhombic, firm- to thick-walled, smooth to sparsely papillose

capsule: 1.5 mm, ovoid-oblong, exserted, erect, symmetric, pale brown; seta 4 mm; calyptra mitriform, hairy; endostome hyaline; spores smooth, $20 \mu\text{m}$ in diam.



vegetative shoot (dry), stem and branch leaf outlines, branch leaf apex (2) and subapex
 5 mm, 1 mm, 0.1 mm (2), 10 μm , 10 μm , 5 μm



margin at midleaf, cells at midleaf, and auricle in leaf basal angle
 10 μm , 10 μm , 50 μm

continued next page



Papillaria nitens cells midleaf
10 μm

Fabronia australis Hook.

form: tufts of creeping, branched stems, 5–15 mm, leaves pale, ± glossy

habitat: soil, bark, rock, or concrete, dry habitats, urban to montane, to 800 m

leaf: size: 0.4–0.8 × 0.2–0.3 mm

shape: ovate to ovate-lanceolate

tip: tapering to an acumen or hair-point

base: quadrate cells 12–14 μm arranged obliquely up the margin

costa: reaching about midleaf

border: not differentiated

margin: variable, from entire to sharply serrate (unicellular), plane

cells: 25–50 × 5–9 μm, rhombic, thin-walled, smooth

capsule: 0.6–0.8 mm, ovoid or cylindric with a tapered neck, exserted, erect, red-brown; seta 3–6 mm, yellow, twisted when dry; calyptra narrowly cucullate, smooth; operculum conic, apiculate; peristome exostome only, teeth triangular, brown, papillose; walls of exothecial cells wavy; spores 13–26 μm in diam., papillose, green



habit, vegetative shoot (moist), mature capsule (2) (dry), leaf outline, and leaf apex

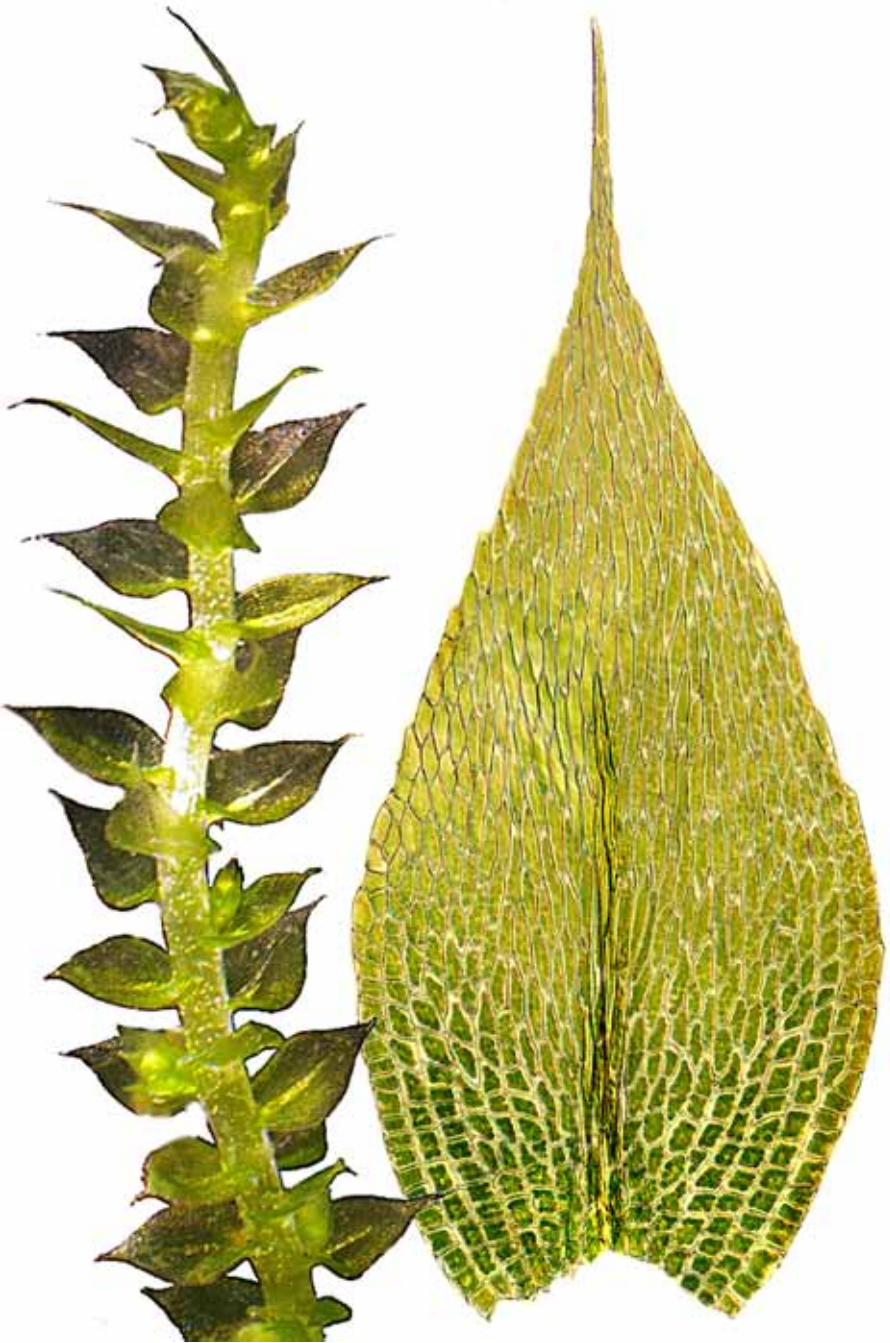
1 mm, 1 mm, 1 mm, 1 mm, 0.1 mm, 50 μm



margin at midleaf plus costa terminus, leaf basal angle, and margin near leaf base

50 μm, 10 μm, 10 μm

continued next page



Fabronia australis vegetative shoot and leaf outline
1 mm, 10 μ m

continued next page



Fabronia australis fertile shoots showing calyptrae

1 mm

Ischyrodon lepturus (Taylor) Schelpe

form: loose mats of creeping, rhizomatous, variously branched stems, to 50 mm long, the branches erect, 10–20 mm, flexuose-curved, leafy, glossy

habitat: coastal rock in damp sheltered sites

leaf: *size:* stem: 1.2–2.0 × 0.5–0.8 mm; branch: 0.8–1.4 × 0.4–0.5 mm

shape: ovate-lanceolate, concave, narrowed at the base

tip: gradually narrowing to an acuminate tip

base: alar region concave, cells subquadrate, 10–12 μm in diam.

costa: reaching beyond midleaf, broad base overgrown by alar cells

border: not differentiated

margin: entire to weakly crenulate, plane to reflexed toward base

cells: 45–90 × 6–7 μm, long-rhombic, firm-walled, smooth

capsule: no capsules in NZ; 1.5 mm, lateral, broadly oval, exerted, erect, brown; seta 6–7 mm, thick, reddish; operculum conic, bluntly rostrate; calyptra cucullate, naked, smooth; exostome teeth paired, endostome reduced; spores 14–18 μm in diam., green, verrucose

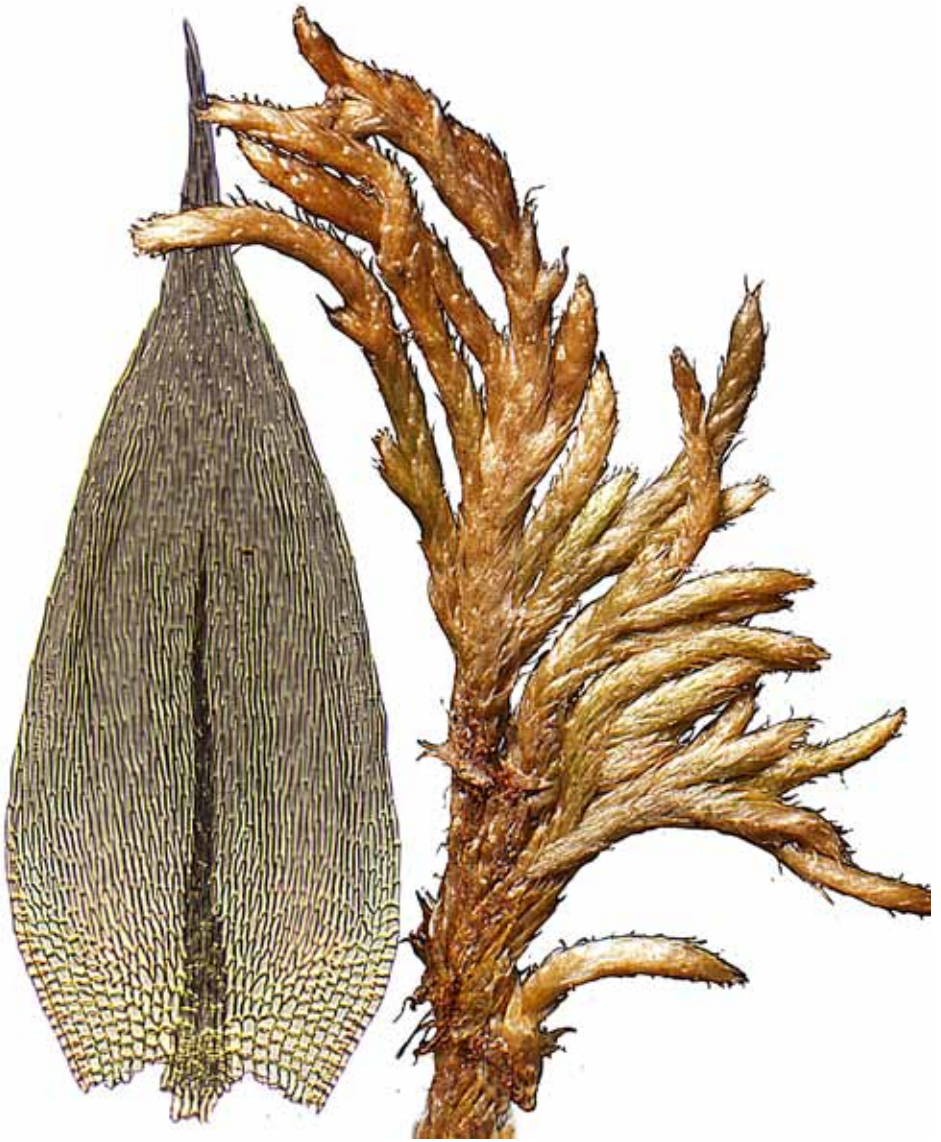


vegetative shoot and branch tip (dry) (2), leaf outline, leaf apex, and margin midleaf
 1 mm, 0.1 mm, 0.5 mm, 50 μm, 10 μm



leaf subapex, costa at midleaf, and leaf basal angle (alar cells overgrow adaxial costa base)
 10 μm, 50 μm, 50 μm

continued next page



Ischyrodon lepturus leaf outline and vegetative shoot (dry)
0.1 mm, 1 mm



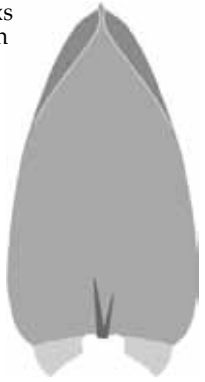
Ischyrodon lepturus alar cells overgrowing the adaxial surface of the base of the costa
50 μ m

Calliergonella cuspidata (Hedw.) Loeske

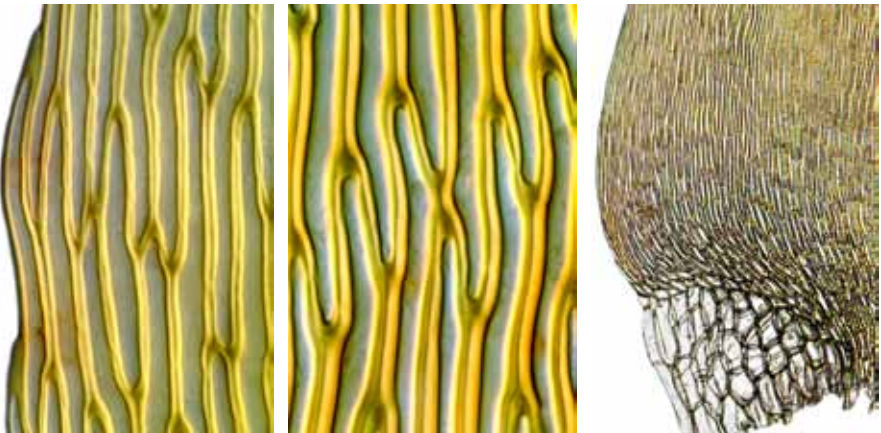
form: loosely tufted, ± pinnately branched stems, 70–100 mm long, in xs with a well-developed hyaloderm; leaves glossy, pale green to golden
habitat: damp soil in marshy or boggy disturbed sites (ditches, verges)

leaf: *size:* stem leaves 2.0–2.5 × 0.9–1.2 mm; branch leaves smaller
shape: broadly ovate from a wide sheathing base
tip: obtuse to rounded, concave-cucullate, often with a short apiculus
base: angle cells large, hyaline, thin-walled, in decurrent auricles
costa: absent or faint, short, and double
border: not differentiated
margin: entire, ± inrolled toward apex, otherwise plane
cells: 60–100 × 5–6 μm, linear-vermicular, firm to incrassate, smooth

capsule: 3 mm, subcylindric, exserted, ± horizontal; seta 50–75 mm, reddish, smooth; annulus triseriate; operculum minutely apiculate; exostome teeth yellow; endostome cilia in threes; spores 18–21 μm in diam., yellowish, rough



vegetative shoot, cuspidate branch apex, leaf outline, and leaf apex
 ■ 5 mm, ■ 1 mm, ■ 0.5 mm, ■ 50 μm



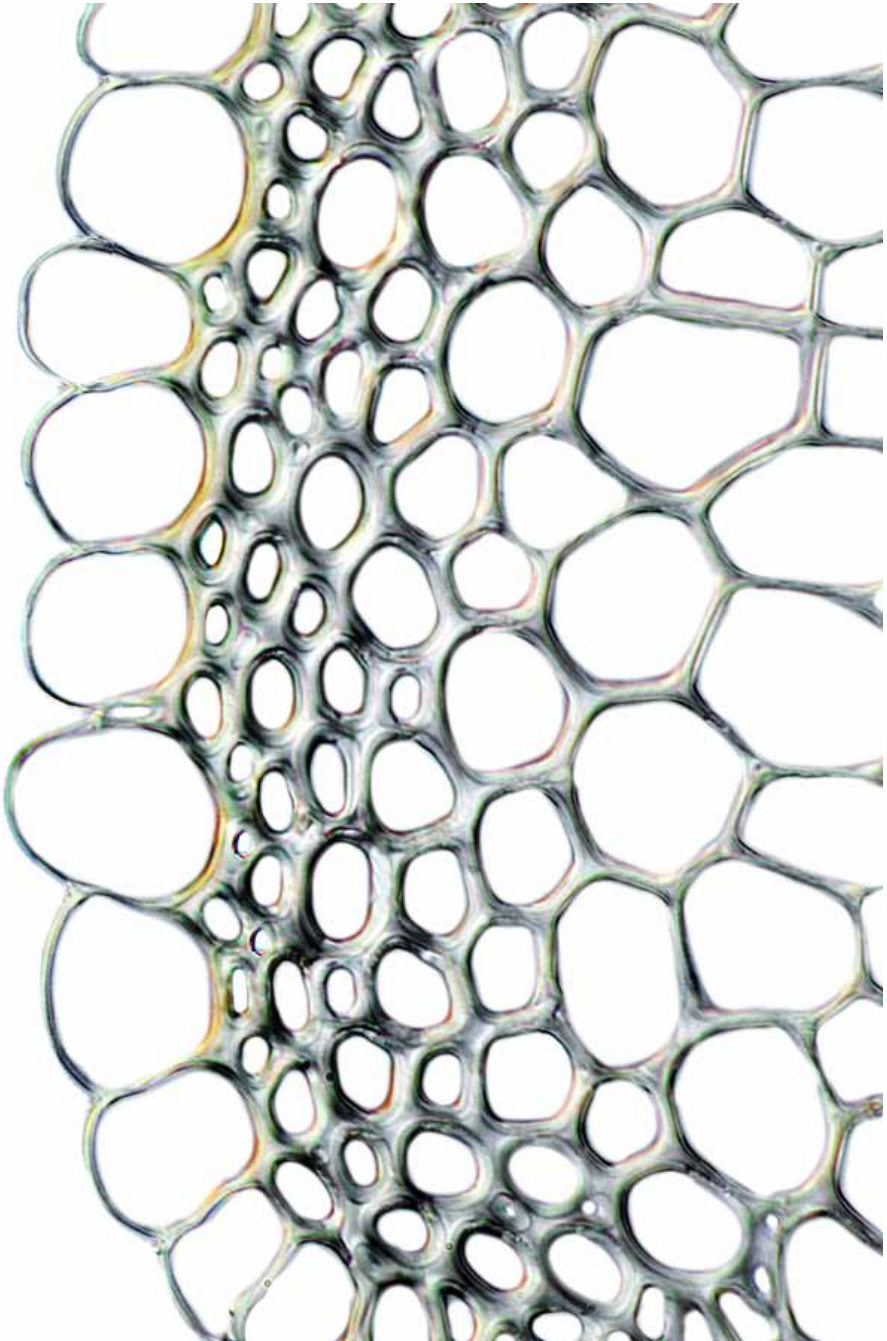
margin at midleaf, cells at midleaf, and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 50 μm

continued next page



Calliergonella cuspidata vegetative shoots
1 mm

continued next page



Calliergonella cuspidata stem cross-section showing hyaloderm
10 μm

Ctenidium pubescens (Hook.f. & Wilson) Broth.

form: densely tufted, creeping, pinnately branched stems, 20–80 mm long, pseudoparaphylliate, leaves soft, yellow-green, glossy

habitat: soil, bark, tree bases, and rock in moist montane forests

leaf: size: stem leaves 1–1.4 mm; branch leaves narrower

shape: triangular-cordate, ± curved

tip: long-acuminate

base: decurrent, basal cells rectangular to rounded, not auriculate

costa: faint, double

border: not differentiated

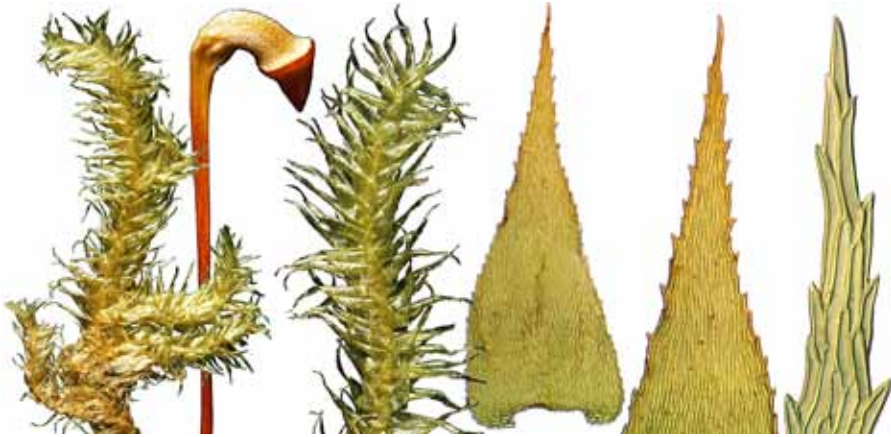
margin: sharply dentate or denticulate, plane

cells: 45–70 × 6–8 μm, linear to rhombic, firm-walled, smooth

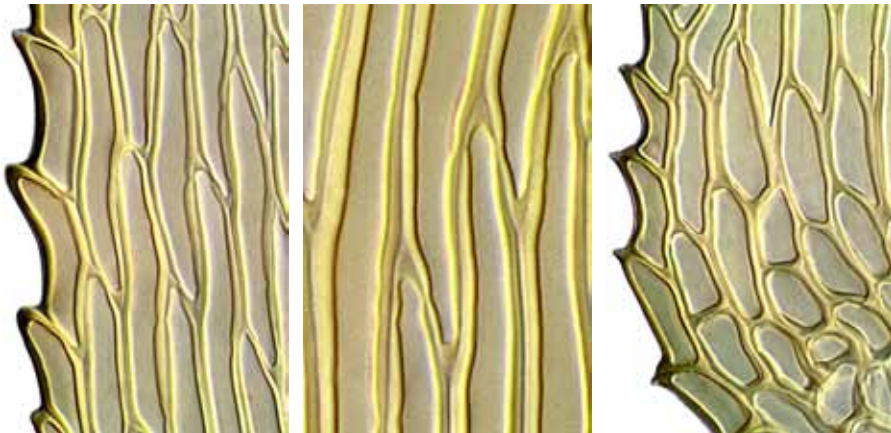
capsule: 1.5 mm, ovoid, curved, exserted, inclined to pendent, brown; seta 10–15 mm, brownish, smooth; operculum long-conic; calyptra hairy; exostome teeth cross-striolate, endostome segments keeled and perforate, cilia 1–2; spores weakly papillose



branch leaf



vegetative shoots (dry) (2), immature capsule, branch leaf outline, branch leaf apex (2)
 1 mm, 1 mm, 1 mm, 0.5 mm, 50 μm, 10 μm



margin at midleaf, cells at midleaf, and leaf basal angle
 10 μm, 10 μm, 10 μm

Ectropothecium sandwichense (Hook. & Arnott) Mitt.

form: primary stems matted, radiculose, creeping; secondary stems \pm pinnately branched, to 50 mm long, complanate, pseudoparaphylliate, leaves glossy
habitat: soil, humus, or rotting logs, wet lowland to high-montane, 2800 m

leaf: size: 1–1.5 mm

shape: ovate-lanceolate, \pm falcate-secund, \pm decurrent

tip: short- to long-acuminate

base: basal cells smaller than the other blade cells, \pm porose

costa: absent or short and double

border: not differentiated

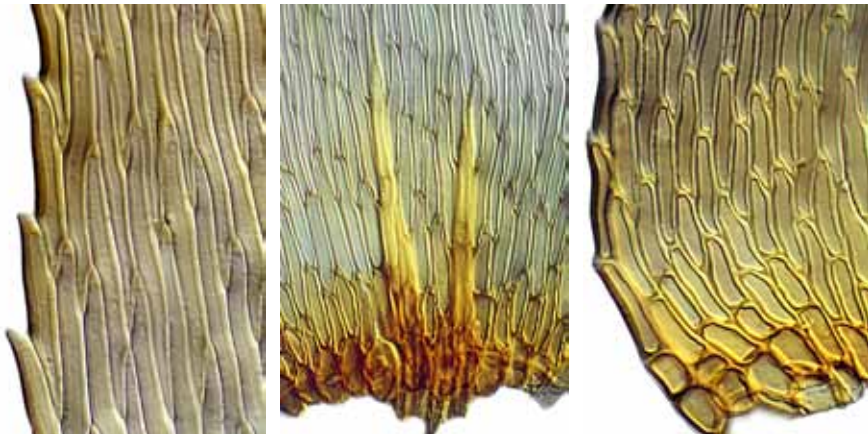
margin: serrulate, plane to reflexed

cells: 50–90 \times 8–10 μ m, linear, firm-walled, prorulose

capsule: 1 mm, ovoid-cylindric, exserted, inclined to pendent, stragulate when empty; seta 12–20 mm, red below, pale above; calyptra \pm hairy; operculum apiculate; exostome teeth cross-striate, endostome cilia 1–2; spores papillose



vegetative shoots (dry) (2), leaf outline, leaf apex, and leaf subapex
 1 mm, 1 mm, 0.1 mm, 10 μ m, 10 μ m

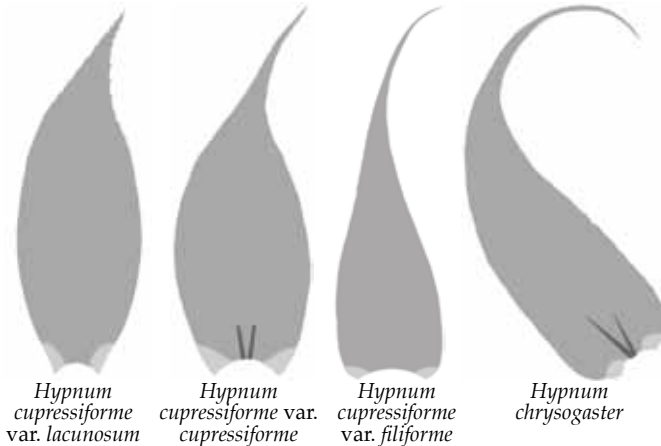


margin at midleaf, short and double costa, and leaf basal angle
 10 μ m, 10 μ m, 10 μ m

Key* to the New Zealand species and varieties of *Hypnum* (4)

- 1 Alar cells few; central strand absent..... ● *Hypnum chrysogaster*
 1: Alar cells many; central strand present 2
- 2(1:) Leaves > 2 mm long 3
 2: Leaves < 1.5 mm long..... ● *Hypnum cupressiforme* var. *filiforme*
- 3(2) Leaves gradually tapering to apex. ● *Hypnum cupressiforme* var. *cupressiforme*
 3: Leaves abruptly narrowed to apex..... ● *Hypnum cupressiforme* var. *lacunosum*

* based on Smith, AJE; Smith, R (1978): *The Moss Flora of Britain and Ireland*. Cambridge University Press, Cambridge. 646.



Hypnum chrysogaster Müll.Hal.

form: matted, regularly pinnately branched stems, to 50 mm long, golden
habitat: rotting wood or bark in damp to high-rainfall forest

leaf: size: 1–1.5 × 0.3–0.5 mm

shape: ovate-lanceolate, strongly falcate

tip: narrowed to a long acumen

base: alar cells inflated, angle cells orange or yellow

costa: absent or short and double

border: not differentiated

margin: faintly denticulate above, plane to ± recurved below

cells: 60–90 × 4–7 μm, linear, firm-walled, smooth

capsule: 1–1.5 mm, cylindrical, exserted, horizontal to pendent, red-brown;
 seta 6–18 mm; calyptra cucullate, naked, smooth; operculum apiculate;
 exostome teeth striolate, endostome perforate, cilia 1–3, nodulose; spores
 13–20 μm in diam., papillose

note: *Hypnum cupressiforme* has a rostrate operculum and stronger alar cells



vegetative habit, pinnate branches, capsules (mature, young), peristome, and leaf outline
 — 5 mm, — 1 mm, — 1 mm (2), — 0.1 mm



margin at midleaf, cells at midleaf, and leaf basal angle
 — 10 μm, — 10 μm, — 50 μm

continued next page



Hypnum chrysogaster vegetative frond
1 mm

continued next page

Hypnum cupressiforme Hedw. var. **cupressiforme**

form: tufted or matted, procumbent, ± pinnately branched stems, 60–120 mm long, central strand present, pseudoparaphylliate, leaves golden, glossy

habitat: soil, bark, rotten logs, or rock, in diverse sites, lowland to high-montane

leaf: size: 2–3 × 0.8–1.0 mm

shape: variable, ovate-lanceolate, ± falcate-secund, concave

tip: ± abruptly acuminate

base: far-angle cells inflated, hyaline; near-angle cells ± quadrate in 10 rows

costa: absent to thin and rudimentary or short and double

border: not differentiated

margin: entire or minutely denticulate above, plane

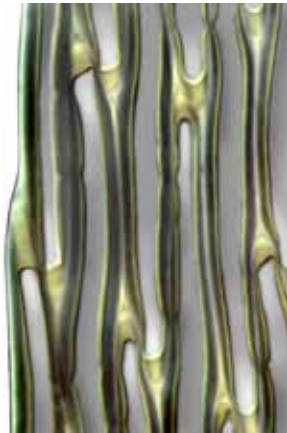
cells: 50–80 × 5–8 μm, linear-rhombic, firm-walled, smooth

capsule: 2 mm, oblong-cylindric, curved, exserted, suberect, brown; seta 20–30 mm, reddish; calyptra cucullate, naked, smooth; operculum erect-rostrate; endostome cilia 1–2, nodulose; spores 14–24 μm in diam., smooth



habit (moist), vegetative shoots (dry) (2), leaf outline, and leaf apex

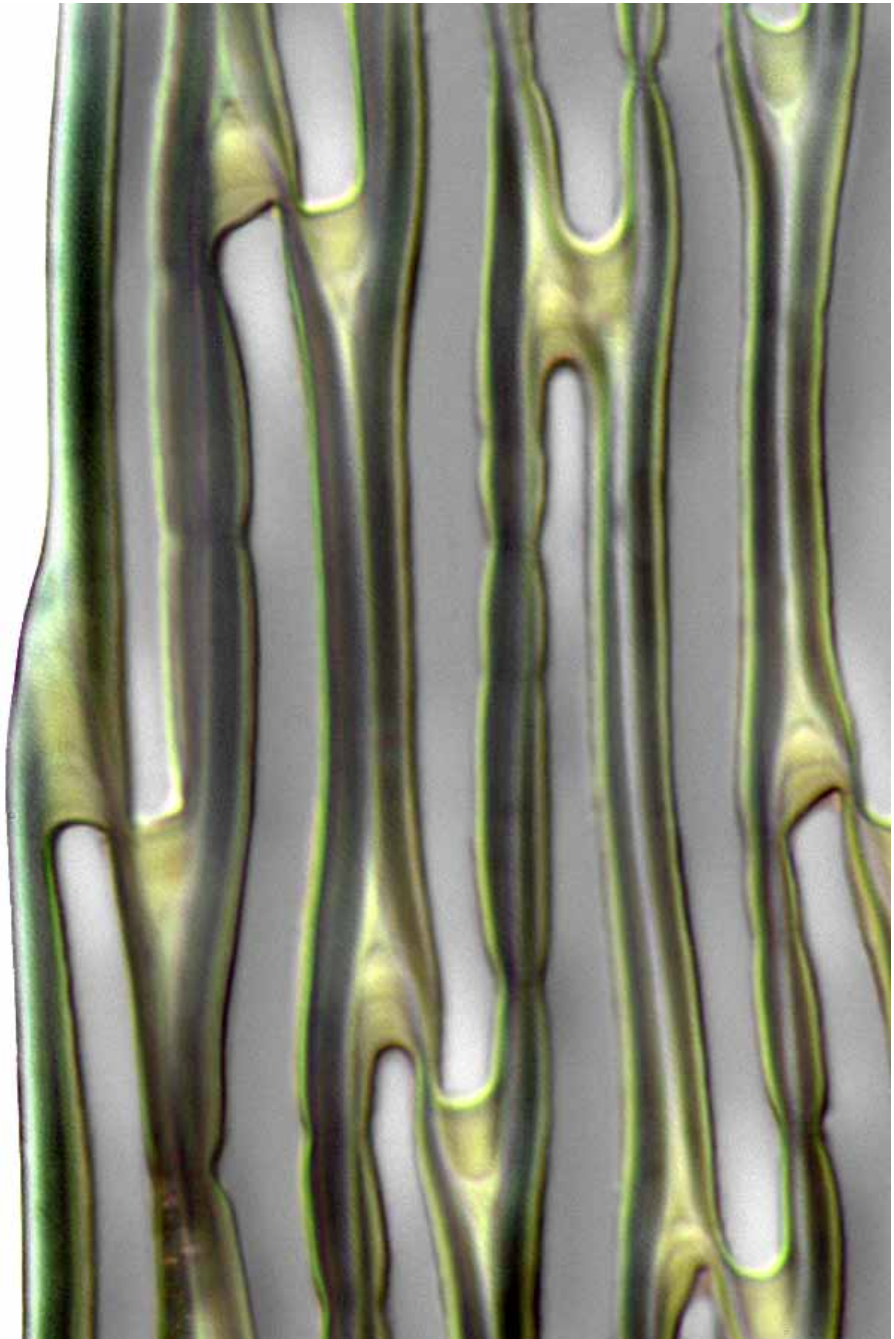
■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 50 μm



margin at midleaf, leaf basal angle, and capsules

■ 10 μm, ■ 50 μm, ■ 0.5 mm

continued next page



Hypnum cupressiforme var. *cupressiforme* margin midleaf
10 μ m

continued next page

Hypnum cupressiforme var. **filiforme** Brid.

form: matted, pendent to procumbent, filiform stems, to 100 mm long, leaves light green to pale yellowish green or bronze

habitat: bark of trunks and twigs, or rotting logs, (rarely rock), in damp forest

leaf: size: to 1.5 mm

shape: narrowly lanceolate, falcate-secund

tip: tapering to a long channelled acumen

base: distinct group of pigmented, irregularly shaped cells in basal angles

costa: none or short and double

border: not differentiated

margin: entire to faintly denticulate, plane

cells: 30–60 × 5–7 μm, linear, firm-walled, smooth

capsule: 2 mm, oblong-ellipsoid, slightly curved, long-exserted, inclined to horizontal; seta 20–30 mm; calyptra cucullate, naked, smooth; operculum short-rostrate; endostome cilia 1–2, nodulose; spores 14–24 μm in diam., smooth



vegetative shoots (dry) (3), leaf outline, and leaf apex

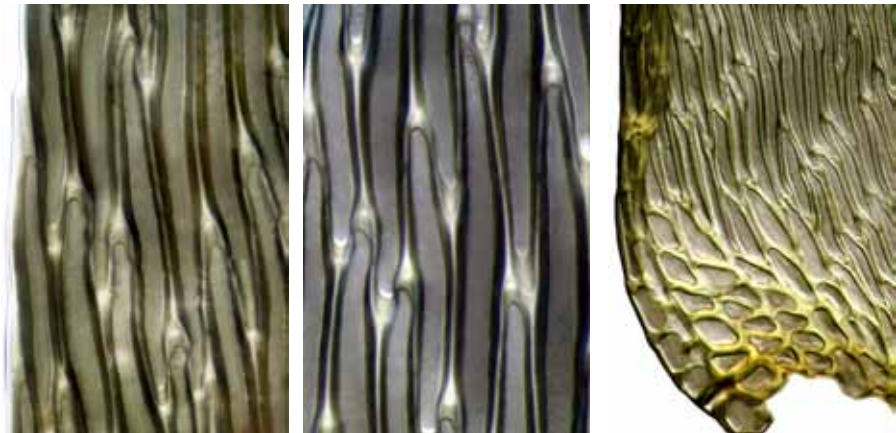
■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm



leaf subapex, margin at midleaf, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 10 μm

continued next page

Hypnum cupressiforme var. **lacunosum** Brid.**form:** matted, creeping stems, dull green to glossy yellow-green or bronze**habitat:** calcareous soil or rock, rarely rotting logs, open forest to grassland**leaf:** *size:* to 3 mm*shape:* ovate to ovate-oblong, ± abruptly narrowed to the apex, concave*tip:* acuminate*base:* alar cells ± quadrate, thick-walled, not porose, orange-pigmented*costa:* weak or absent*border:* not differentiated*margin:* entire below, denticulate above, plane above, recurved below*cells:* 50–80 × 5–8 μm, linear, thick-walled, smooth**capsule:** 2 mm, cylindric, ± curved, inclined to horizontal, exserted, brown; seta 30–40 mm; calyptra cucullate, naked, smooth; operculum conic-rostrate; peristome double; exostome teeth papillose above; endostome segments broad, keeled, narrowly perforate; cilia 1–3vegetative shoots (dry) (2), leaf outline, leaf apex, and leaf subapex
 ■ 5 mm, ■ 1 mm, ■ 0.5 mm, ■ 10 μm, ■ 10 μmmargin midleaf, cells midleaf, and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 50 μm

Isopterygiopsis pulchella (Hedw.) Z.Iwats.

form: matted, creeping, irregularly branched stems, to 15 mm long, the branches ascending, leaves glossy, appearing to be flattened into two rows

habitat: damp soil, humus, rock, or bark of trees in deep shade

leaf: size: 0.7–1.2 × 0.2–0.4 mm

shape: narrowly lanceolate, ± curved and homomallous

tip: acuminate

base: a few subquadrate angle cells

costa: absent or short and double

border: not differentiated

margin: entire, plane

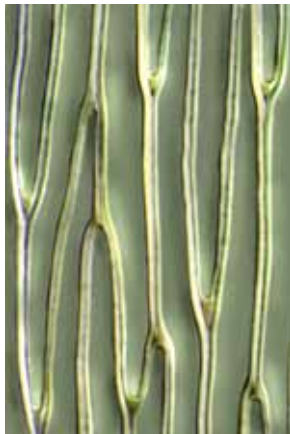
cells: 60–120 × 5–8 μm, linear-flexuose, firm-walled, smooth

capsule: 1–1.6 mm, oblong-cylindric, ± asymmetric, exserted, suberect to horizontal; seta 8–16 mm, orange or red; annulus biseriate; calyptra cucullate, naked, smooth; operculum obliquely rostrate; peristome hypnoid, cilia 1; spores 9–13 μm in diam., minutely roughened



vegetative habit, branchlet (dry), mature capsule, leaf outline, and leaf apex

1 mm, 1 mm, 1 mm, 0.1 mm, 10 μm



margin at midleaf, cells at midleaf, and leaf basal angle

10 μm, 10 μm, 10 μm

Orthothecium strictum Lor.

form: tufted, ± erect, unbranched stems, 10–60 mm tall, leaves orange-pink, glossy

habitat: moist to wet tundra, humus, soil, or rock ledges and crevices

leaf: *size:* about 1 mm

shape: ovate-lanceolate to narrowly lanceolate, slightly plicate

tip: short, flexuose, subhyaline acumen

base: proximal basal cells short, brownish yellow

costa: none, single and weak, or short and double

border: not differentiated

margin: serrulate above, partially recurved

cells: 48–64 × 8 μm, oblong-linear, thick-walled, porose, smooth

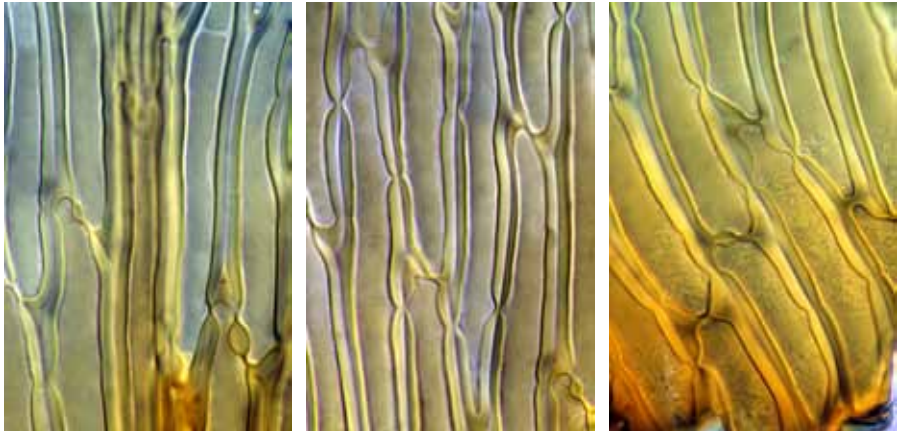
capsule: not seen in New Zealand

note: asexual reproduction by clusters of claviform, multicellular propagula in leaf axils (rare)



vegetative habit and shoots (dry) (3), leaf outline, and leaf apex (2)

1 mm, 1 mm, 1 mm, 0.1 mm, 50 μm, 10 μm



costa near leaf base, porose midleaf cells, and porose cells near leaf base

10 μm, 10 μm, 10 μm

Key to the New Zealand species of *Pseudotaxiphyllum* (2)

- 1 Leaves < 2 mm long, distant on the stem; costa usually strong but sometimes short and double ● ***Pseudotaxiphyllum distichaceum***
- 1: Leaves > 2 mm, crowded on the stem; costa absent ● ***Pseudotaxiphyllum falcifolium***



*Pseudotaxiphyllum
distichaceum*



*Pseudotaxiphyllum
falcifolium*

Pseudotaxiphyllum distichaceum (Mitt.) Z.Iwats.

form: loose, glossy, yellow-green mats of creeping, \pm branched, flattened stems, up to 20 mm \times 1–3.5 mm; gemmae sometimes in leaf axils

habitat: soil, humus, or soil over rock in shady montane forest

leaf: 1–1.8 0.3–0.6 mm, distant on the stem; stem and branch leaves similar in size and shape

shape: ovate to oblong-lanceolate, asymmetric, folded on one side

tip: acuminate

base: alar cells variable, 0–3, quadrate to short-rectangular

costa: single or unevenly forked, reaching 1/3 the lamina length

border: not differentiated

margin: \pm entire below, serrate to serrulate above, plane, \pm reflexed below

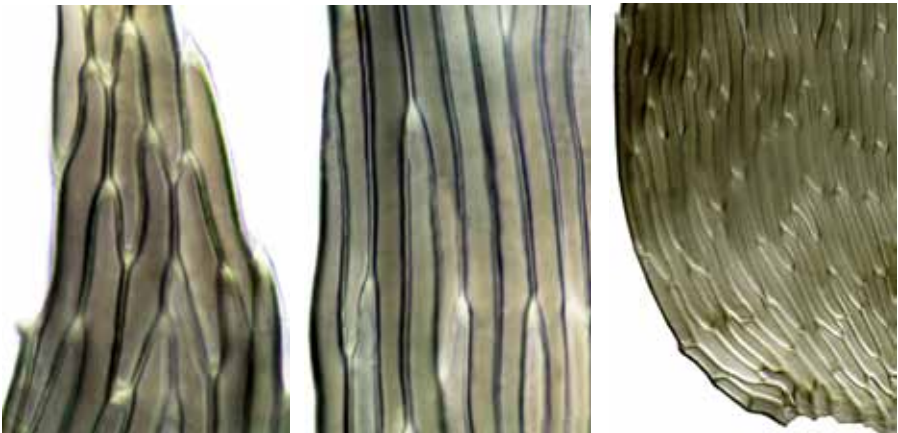
cells: 60–120 \times 4–7 μ m, linear-fusiform, firm-walled, smooth

capsule: sporophytes unknown



vegetative shoots (wet) (2), leaf outline, and leaf apex (2)

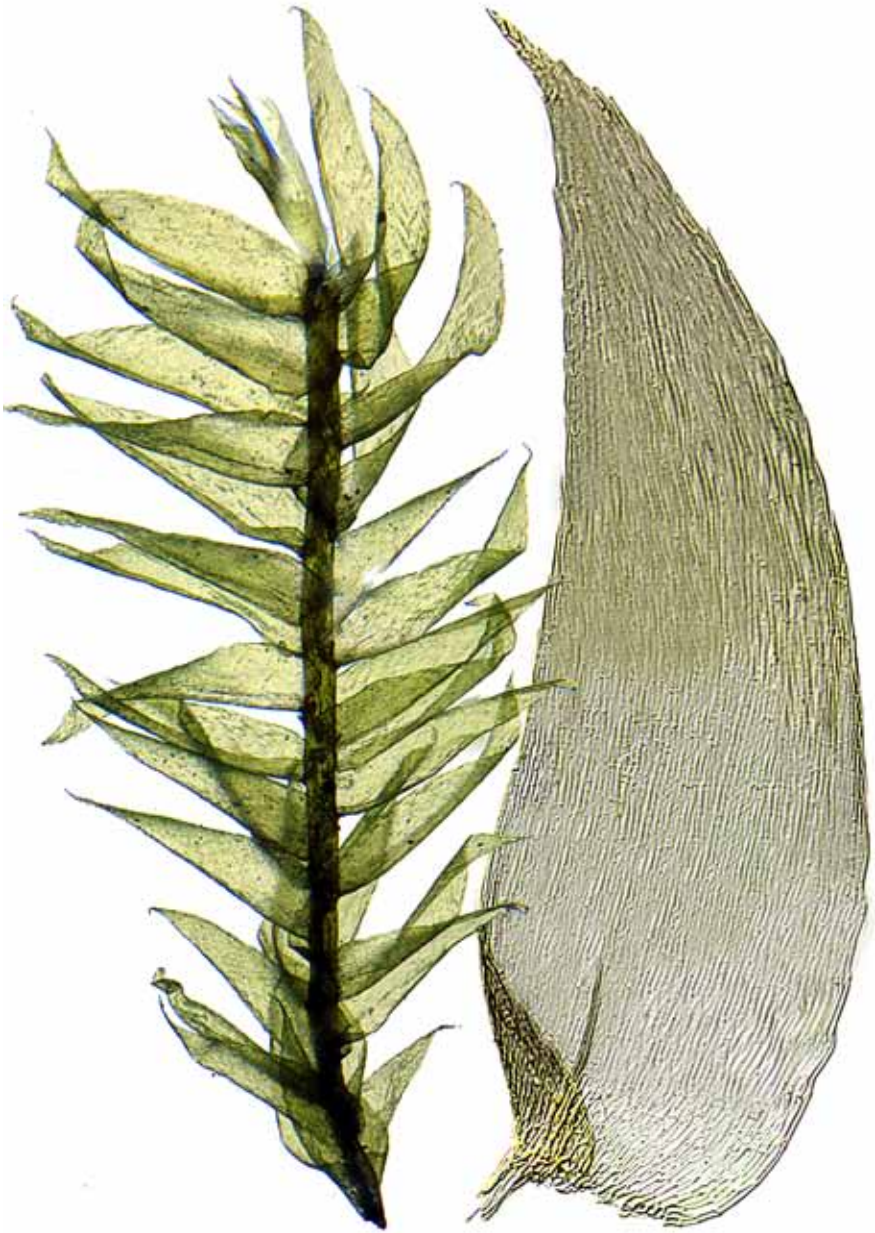
5 mm, 1 mm, 0.1 mm, 10 μ m, 10 μ m



subapex, midleaf margin and lamina cells, and leaf basal angle

10 μ m, 10 μ m, 10 μ m

continued next page



Pseudotaxiphyllum distichaceum vegetative shoot (moist) and leaf whole-mount
1 mm, 50 μ m

Pseudotaxiphyllum falcifolium (Hook.f. & Wilson) S.He

form: primary stem matted, creeping, branched; secondary stem 20–70 mm long, pinnately branched, leaves crowded, flattened, glossy
habitat: moist soil, humus, or soil over rock in shaded lowland to montane forest

leaf: size: > 2 mm

shape: ovate to oblong-lanceolate, asymmetric, ± falcate

tip: broadly acute

base: two rows of cells near the insertion oval or short-oblong

costa: none

border: not differentiated

margin: ± serrulate above, entire below, inflexed on one side below

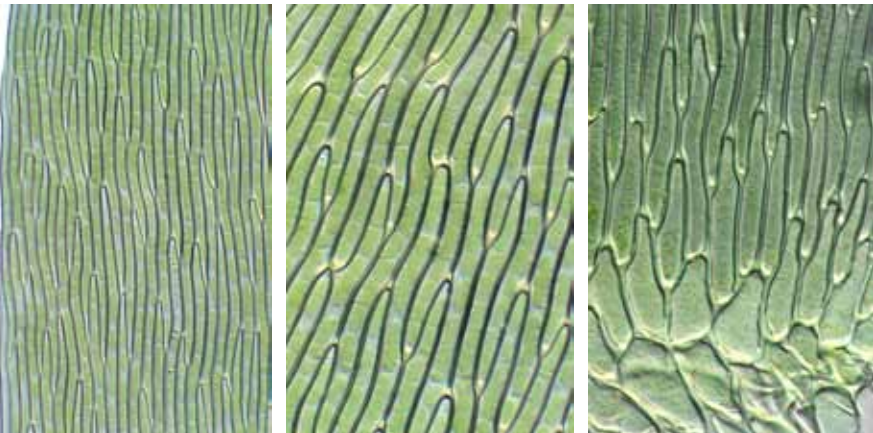
cells: 80–100 × 4–5 μm, linear-vermicular, firm-walled, smooth

capsule: 1.3–2 mm, ovoid, exserted, inclined to horizontal, dark brown, annulate; seta 10–20 mm, reddish brown, smooth; operculum short-rostrate; peristome double; spores 12–15 μm in diam., yellow



vegetative shoots (dry) (2), capsule, leaf outline, and leaf apex

1 mm, 1 mm, 1 mm, 0.1 mm, 10 μm



margin at midleaf, cells at midleaf, and leaf base cells

50 μm, 10 μm, 10 μm



Pseudotaxiphyllum falcifolium vegetative shoot and capsule
1 mm (foreground), 1 mm (background)

Vesicularia inflectens (Brid.) Müll.Hal.

form: stems creeping, irregularly short-branched, to 15 mm tall, leaves pale to dark green or yellowish brown, glossy

habitat: soil, rotting logs, bark, and rock, moist shaded sites, to 2000 m

leaf: size: 1.6–1.8 × 0.8–0.9 mm

shape: ovate, ± asymmetric

tip: acute

base: alar cells not differentiated

costa: none or short and double

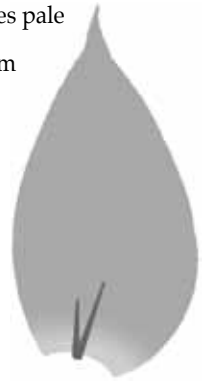
border: not differentiated

margin: entire below to ± crenulate above, plane

cells: 60–90 × 15–18 μm, rhombic, thin-walled, smooth

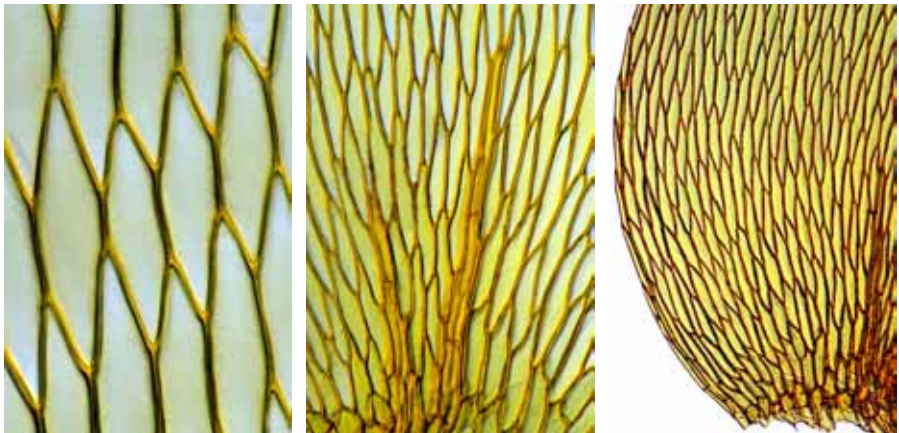
capsule: 1 mm, oblong-cylindric, exserted, horizontal, brown; seta 9–15 mm; operculum obliquely short-rostrate; peristome double, endostome cilia 1–3; spores 12–17 μm in diam.

note: currently known from only Raoul Island



vegetative shoot (dry), leaf outline, leaf apex, and margin midleaf

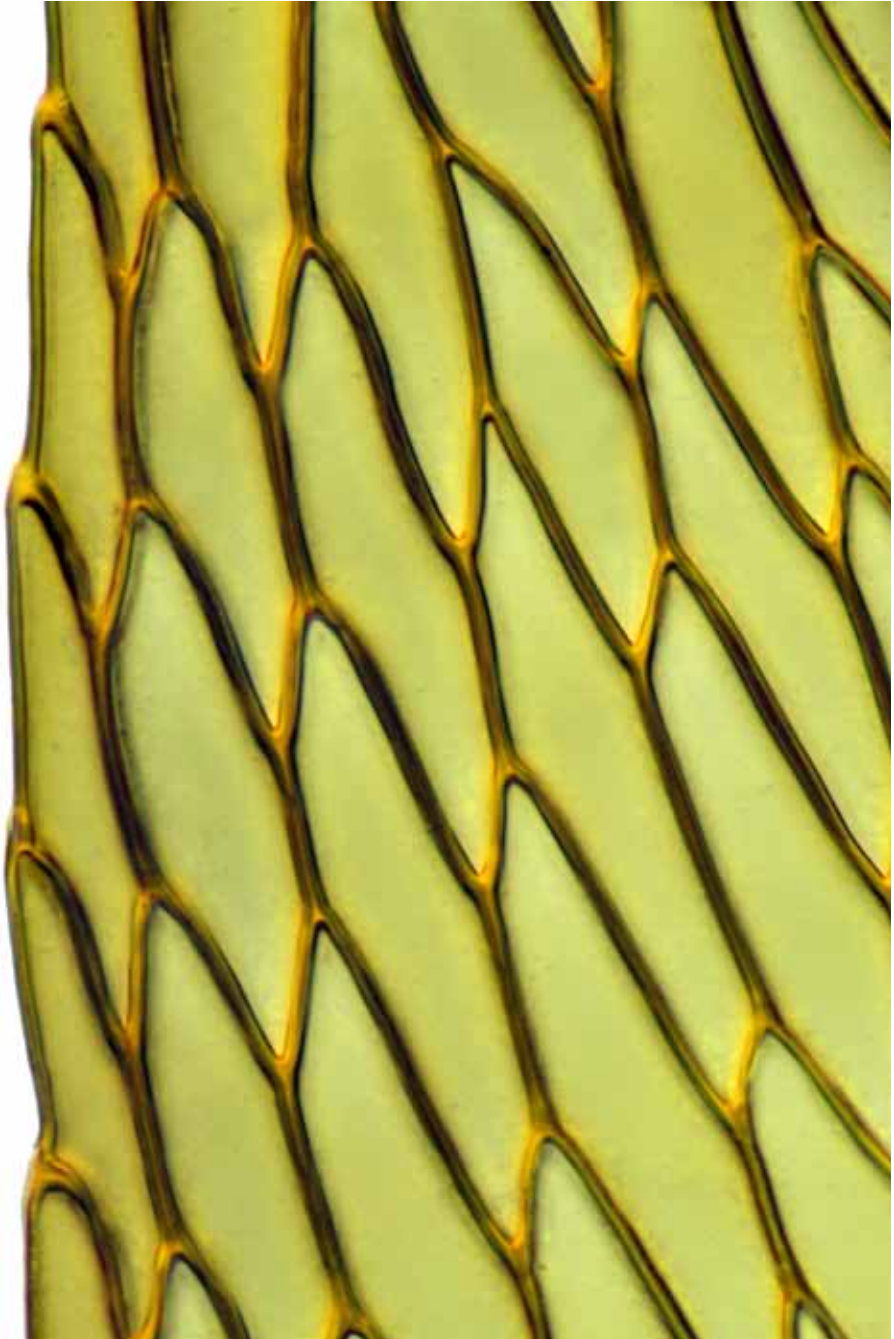
■ 1 mm, ■ 0.1 mm, ■ 10 μm, ■ 10 μm



cells at midleaf, double costa near leaf base, and leaf basal angle

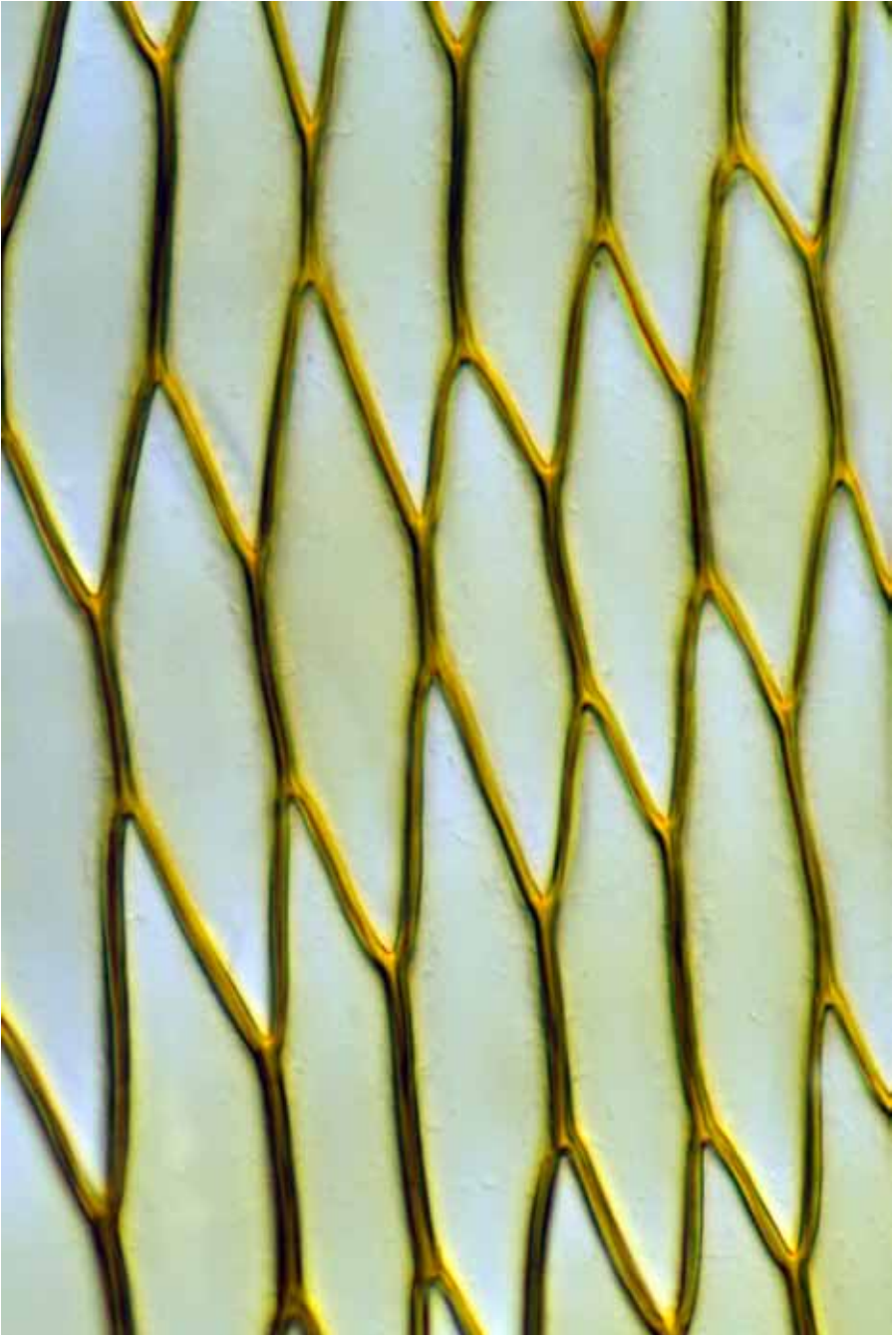
■ 10 μm, ■ 50 μm, ■ 50 μm

continued next page



Vesicularia inflectens margin midleaf
10 μm

continued next page



Vesicularia inflectens cells midleaf
10 μm

Catagonium nitens (Brid.) Card. subsp. **nitens**

form: tufted, prostrate, branched stems, to 20 mm long, leaves soft, delicate, pale yellow to yellow-green, glossy

habitat: soil and dry earthen banks, or rock, lowland to montane

leaf: size: 1.0–1.5 × 0.3–0.5 mm

shape: oblong, concave, conduplicate, shoots distichous

tip: reflexed mucro

base: basal cells shorter and wider than the blade cells; no distinct alar region

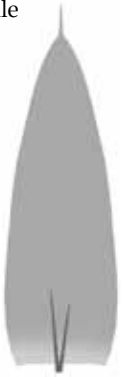
costa: absent or faint and double

border: not differentiated

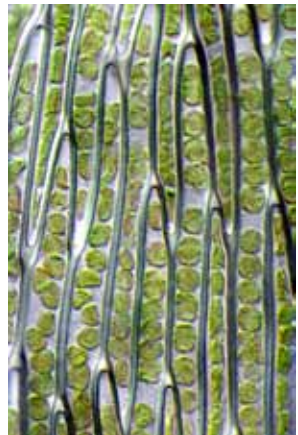
margin: entire, plane

cells: 60–100 × 3–4 μm, linear-vermicular, firm-walled, smooth

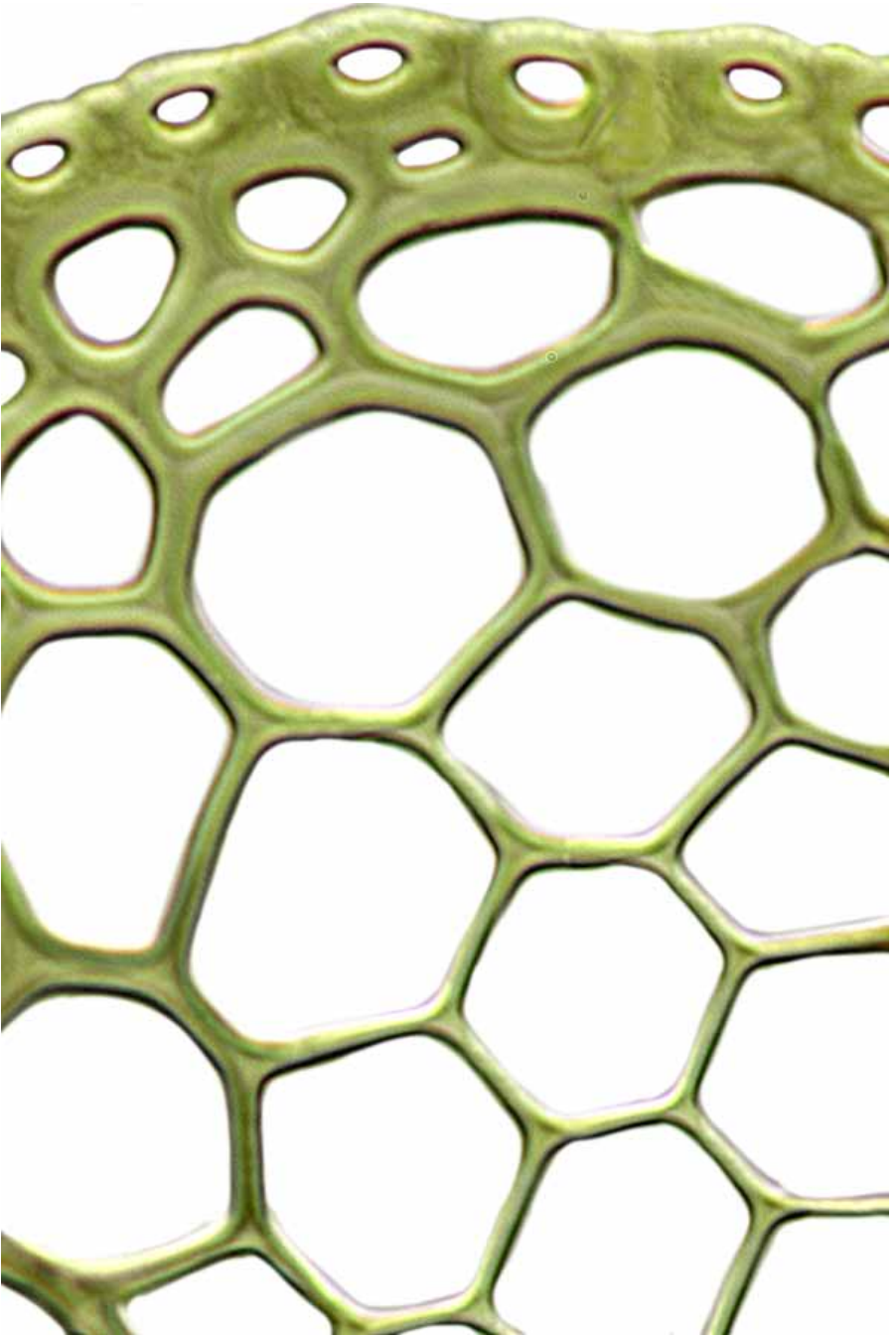
capsule: 2–2.5 mm; oblong, inclined to erect, ± curved, apophysate; seta 12–20 mm; calyptra cucullate, smooth; operculum conico-rostrate; exostome teeth joined at the base; endostome cilia 2, nodulose; spores 12–16 μm in diam., smooth



vegetative habit, cleared shoot, leaf outlines (2), and leaf apex
 1 mm, 1 mm, 0.25 mm (2), 10 μm



mucronate leaf tips, margin at midleaf, and cells at midleaf
 0.25 mm, 10 μm, 10 μm

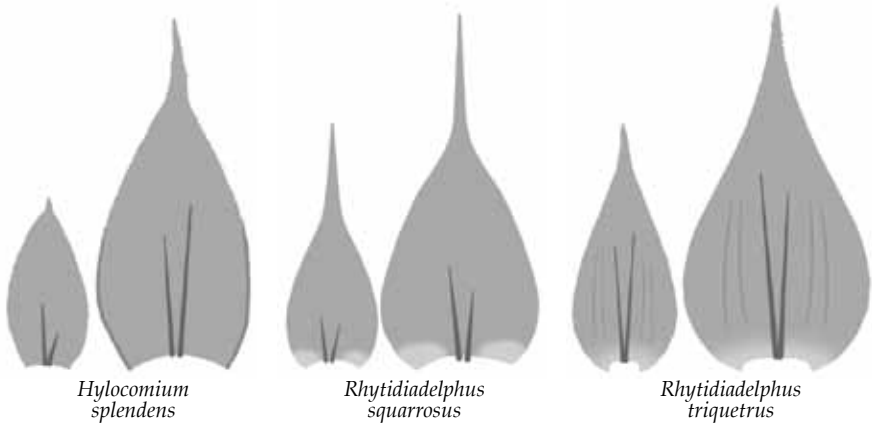


Catagonium nitens stem cross-section showing stiffening collar
10 μ m

Key* to the New Zealand species of *Hylocomium* (1) and *Rhytidiadelphus* (2)

- 1 Stems and branches densely covered with paraphyllia; branch leaf apex rounded or broadly acute ● ***Hylocomium splendens***
 1: Paraphyllia absent; branch leaf apex narrowly acute 2
- 2 Leaf plicate, gradually narrowed to a broad flat acumen; costa reaching 2/3 up the leaf blade ● ***Rhytidiadelphus triquetrus***
 2: Leaf not plicate, abruptly narrowed to a slender channelled acumen; costa reaching 1/3 up the leaf blade ● ***Rhytidiadelphus squarrosus***

* based on Crum, HA; Anderson, LE (1981): *Mosses of Eastern North America*. Columbia University Press, New York, 1211.



Hylocomium splendens (Hedw.) Bruch & Schimp.

form: loose mats of wiry, 2–3-pinnately branched stems, to 120 mm, in stepped fronds, densely covered with branched filamentous paraphyllia; leaves dull, olive-green to golden, stem leaves erect and overlapping

habitat: soil, humus, or logs in bogs and streambeds, to 1900 m

leaf: size: stem 1.5–1.8 × 8–1.1 mm; branch 0.8–1.0 × 0.5–0.7 mm

shape: stem leaves ± ovate, concave, ± plicate; branch leaves elliptic

tip: stem leaves abruptly narrowed to a short channelled acumen;

branch leaves abruptly narrowed to a bluntly acute apex

base: basal cells little differentiated

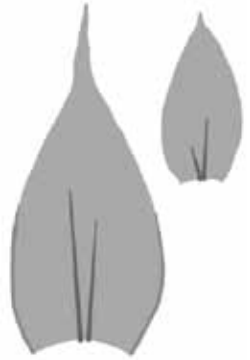
costa: double, reaching halfway up the blade

border: not differentiated

margin: serrulate above, recurved below, ± inflexed near acumen

cells: 40–50 × 5–7 μm, linear, ± sinuose, incrassate, prorate, ± porose

capsule: capsules not known in New Zealand



vegetative habit (dry), leaf outlines (2), and branch leaf apex
 ■ 5 mm, ■ 0.5 mm (2), ■ 10 μm



margin at midleaf, costa near leaf base and branched paraphyllium
 ■ 5 μm, ■ 10 μm, ■ 50 μm

continued next page

Rhytidiadelphus squarrosus (Hedw.) Warnst.

form: matted, reddish, decumbent, branched stems, to 150 mm tall; leaves papery, translucent, glossy, yellowish

habitat: soil or gravel in damp, grassy, or disturbed sites, to 600 m

leaf: size: 2.5–3.5 × 1.2–1.6 mm; branch leaves smaller

shape: ovate-lanceolate sheathing base, papery, concave, not plicate

tip: narrowing to a long, squarrose-recurved, channelled acumen

base: alar cells oblong, weakly porose, ± enlarged, pigmented

costa: double, reaching 1/4 up the leaf blade

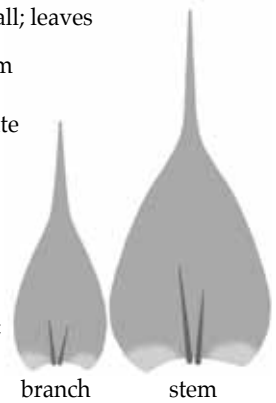
border: not differentiated

margin: serrulate toward the apex, plane

cells: 40–70 × 6–9 μm, elliptic-linear, firm-walled, prorate, porose

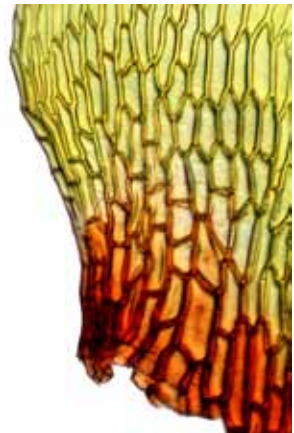
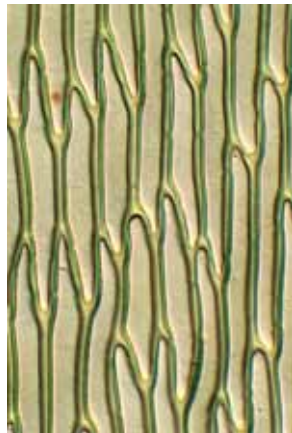
capsule: males only in New Zealand; 1.8–2.5 mm, ovoid, exerted, horizontal, asymmetric with a short apophysis; seta 17–33 mm; peristome hypnoid, cilia in 3s; spores 11–17 μm in diam.

note: adventive, spread along roads by verge-mowing



habit (moist), vegetative shoots (dry) (2), and leaf outlines (2)

5 mm, 5 mm, 1 mm, 0.5 mm (2)



margin at midleaf, cells at midleaf, and leaf basal angle

10 μm, 10 μm, 10 μm

continued next page

Rhytidiadelphus triquetrus (Hedw.) Warnst.

form: loose wefts of rigid, irregularly branched stems, to 100 mm, leaves

papery, yellowish, translucent, glossy; a weedy adventive being eradicated

habitat: soil, sand, humus, or rotting logs on grassy banks or in forest clearings

leaf: *size:* stem leaves $4\text{--}5 \times 2$ mm; branch leaves $1.5\text{--}3 \times 1.5$ mm

shape: ovate-lanceolate, \pm plicate, \pm rugose, papery, clasping

tip: acute to acuminate

base: \pm decurrent, alar cells weakly differentiated, porose

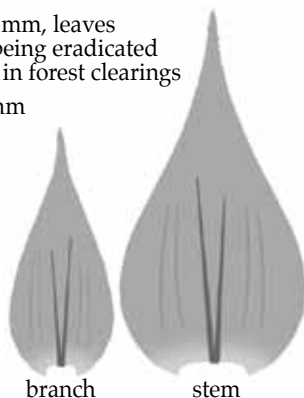
costa: double, nearly parallel, reaching two-thirds up blade

border: not differentiated

margin: densely serrate above, serrulate below, plane

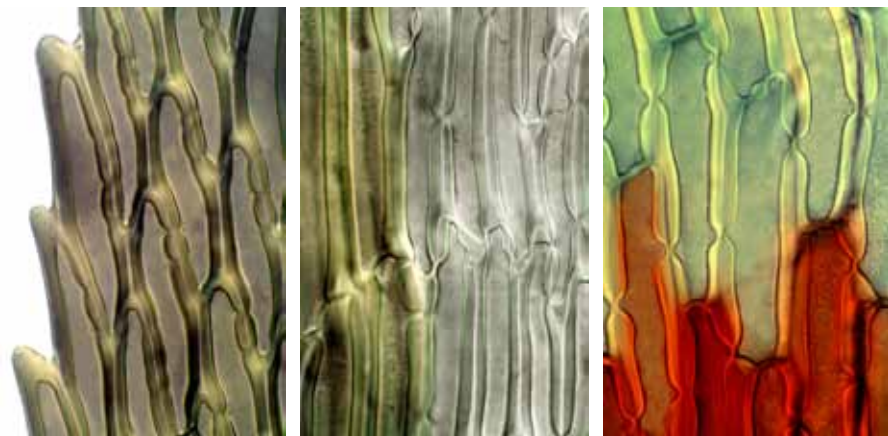
cells: $38\text{--}50 \times 5\text{--}7$ μm , linear, firm-walled, \pm prorate, \pm porose

capsule: no capsules in New Zealand; 1.5–3 mm; obloid, asymmetric, gibbous, exserted, horizontal, hypophysis short; seta 15–45 mm; operculum sharply conic; peristome hyponoid, endostome cilia 1–3; spores 14–21 μm in diam.



vegetative shoots (2) (dry), leaf outlines, and leaf apex

5 mm, 1 mm, 1 mm (2), 10 μm



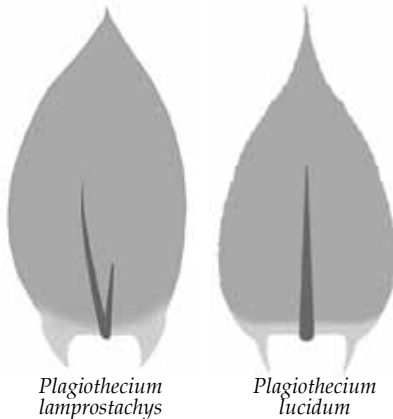
margin at midleaf, costa at midleaf, and cells at leaf base

10 μm , 10 μm , 5 μm

Key* to the New Zealand species of *Plagiothecium* (2)

- 1 Median cells 9–18 μm wide; decurrencies broad, auriculate; flagelliferous branches usually present ● ***Plagiothecium lamprostachys***
 1: Median cells 5–9 μm wide; decurrencies narrow, triangular; flagelliferous branches lacking ● ***Plagiothecium lucidum***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 154.



Plagiothecium lamprostachys (Hampe) A.Jaeger

form: tufted, prostrate, branched, 20–40 mm long, complanate, leaves glossy, soft, bright green or yellow-green

habitat: soil, tree trunk bases, rotting logs, or rock, lowland to montane

leaf: size: 1.8–2 × 0.9–1.0 mm

shape: broadly ovate to oblong-ovate, complanate, decurrent; lateral leaves ± asymmetric; dorsal and ventral leaves symmetric

tip: acute or short-acuminate to obtuse and apiculate

base: decurrent angle cells subrectangular, hyaline

costa: double, unevenly forked, reaching 1/3 up leaf blade

border: not differentiated

margin: entire to faintly toothed toward the apex, ± recurved below

cells: 80–180 × 5–12 μm, elongate-linear, firm-walled, smooth

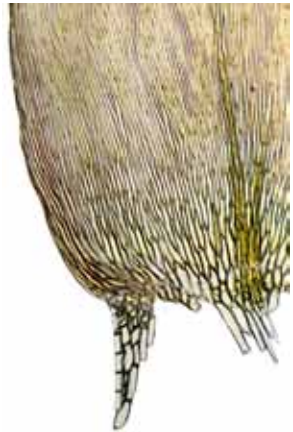
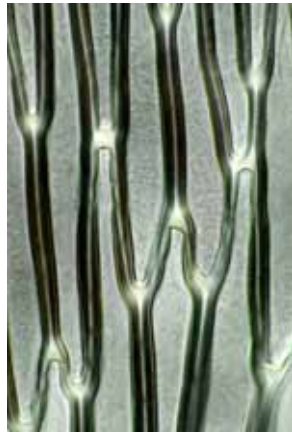
capsule: 1.5–2 mm, cylindric, necked, ± curved, exserted, suberect to cernuous, brown, striate; seta 20–25 mm, slender, red; operculum conic; peristome hyponoid, cilia 1–2; spores 9–14 μm in diam.



lateral leaf



vegetative habit, shoot (dry) (2), leaf outline, mature capsule (dry), and leaf apex
 1 mm (2), 0.5 mm, 1 mm, 10 μm



margin at midleaf, cells at midleaf, and leaf basal angle with decurrency
 10 μm, 10 μm, 50 μm

Plagiothecium lucidum (Hook.f. & Wilson) Paris

form: matted, ascending, \pm unbranched stems, 20–80 mm tall, complanate, leaves \pm glossy, sordid pale green

habitat: soil, humus, bark, rotting logs, or rock

leaf: size: 1–2.5 mm

shape: ovate to ovate-lanceolate, \pm complanate, slightly asymmetric

tip: acuminate

base: narrowly decurrent; basal cells shorter than the other blade cells

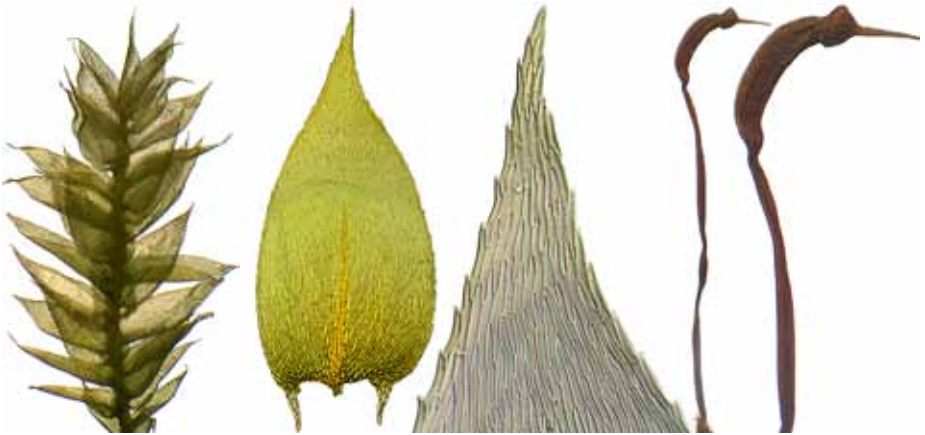
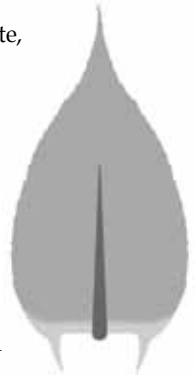
costa: reaching about two-thirds up the blade

border: not differentiated

margin: serrulate above, plane

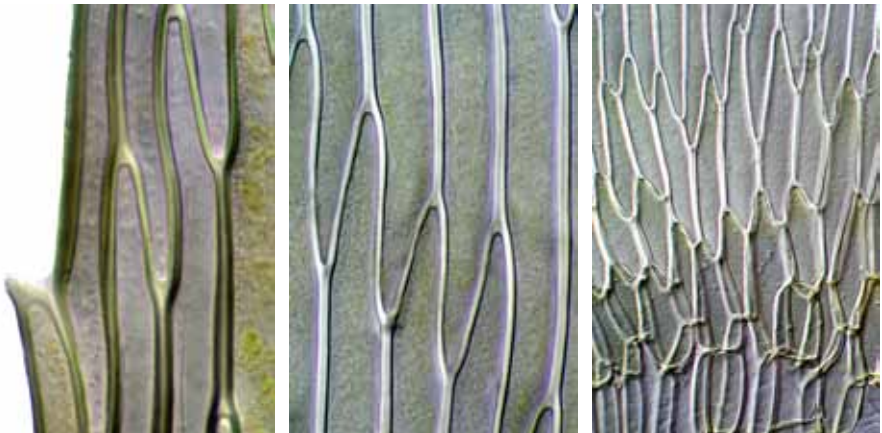
cells: 50–90 \times 5–9 μm , vermicular, firm-walled, smooth

capsule: 1.5–2.5 mm, oblong-cylindric, exserted, suberect to horizontal, short-necked; seta 10–25 mm, red, twisted distally, smooth; operculum high-conic; exostome teeth cross-striolate below, endostome segments perforate, cilia 1–2, nodulose; spores 9–14 μm in diam., papillose



vegetative shoot (dry), leaf outline, leaf apex, and mature capsules

■ 0.5 mm, ■ 0.1 mm, ■ 50 μm , ■ 1 mm, ■ 1 mm



margin at midleaf, cells at midleaf, and lower leaf cells

■ 10 μm , ■ 10 μm , ■ 10 μm

Entodon plicatus Müll.Hal.

form: mats of prostrate, radiculose, pinnately branched stems, complanate, with cuspidate tips, 40–80 mm tall, leaves yellow-green to golden, glossy
habitat: exposed roots, calcareous rock in damp montane forests, to 1100 m

leaf: size: 1.8–2.2 × 0.9 mm

shape: oblong-ovate to oblong-lanceolate, concave, ± auriculate

tip: acute or acuminate

base: alar cells hyaline, inflated, thin-walled, not porose

costa: none or short and double

border: not differentiated

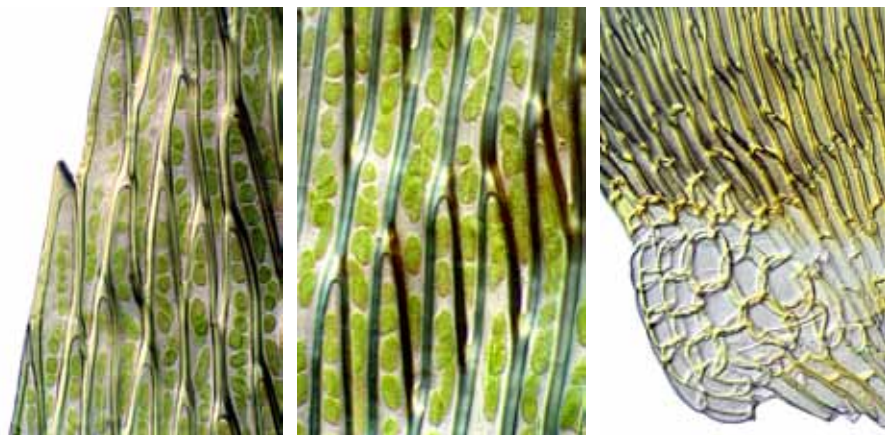
margin: entire below, ± serrulate above, plane

cells: 80–120 × 5–6 μm, narrowly linear, flexuose, firm-walled, smooth

capsule: 3.5 × 0.7–0.9 mm, narrowly cylindric, lateral, ± curved, exserted, erect, pale brown; stomata superficial; seta 10–15 mm; operculum short-rostrate, oblique; exostome double; teeth vertically striolate, endostome segments perforate, keeled, cilia none; spores 15–18 μm in diam., green



vegetative shoots (dry) (2), leaf outlines (2), and leaf apex
 2 mm (2), 0.5 mm (2), 10 μm



margin at midleaf, cells at midleaf, and leaf basal angle
 10 μm, 10 μm, 10 μm

Key* to *Austrohondaella* and *Isopterygium* in New Zealand

- 1 Leaf strongly curved; seta 10–15 mm long; capsule suberect..... ● ***Austrohondaella limata***
 1: Leaf not strongly curved; seta < 9 mm long; capsule horizontal to pendent..... ● ***Isopterygium minutirameum***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 457.



Austrohondaella limata (Hook.f. & Wilson) Z.Iwats., H.P.Ramsay & Fife
formerly *Isopterygium limatum*

form: creeping, ± pinnately branched, ± radiculose stems, 10–20 mm long, leaves yellow or golden green, glossy

habitat: damp to dry rock, less often bark, from sea level to 1600 m

leaf: size: 1.2–1.5 × 0.5–0.6 mm

shape: triangular-lanceolate, falcate-secund, concave, asymmetric

tip: acumen narrowed to a piliform point

base: basal cells shorter and wider than the blade cells, ± porose

costa: none

border: not differentiated

margin: entire, plane

cells: 75–100 × 6–8 μm, linear-vermicular, firm-walled, smooth

capsule: 2 mm, subcylindric, exserted, erect, reddish brown; seta 10–15 mm, dark red, smooth; operculum bluntly conic; peristome hypnoid, endostome cilia 1–2, nodose; spores spherical, 10–18 μm in diam.



vegetative shoots (dry) (2), leaf outline, leaf subapex, and leaf apex
 1 mm, 0.5 mm, 0.1 mm, 10 μm (2)



margin at midleaf, cells at midleaf, and leaf basal angle
 10 μm, 10 μm, 10 μm



Austrohondaella limata mature capsules and an exostome tooth

1 mm (2),

0.1 mm,

50 μ m

Isopterygium minutirameum (Müll.Hal.) A.Jaeger

form: creeping stems, ± pinnately branched, forming dense green mats
habitat: soil, bark, rotting logs, or rarely rock in forests and plantations

leaf: size: 1.2 × 0.3 mm

shape: branch leaves lanceolate to ovate-lanceolate; stem leaves broader

tip: long-acuminate

base: alar cells irregularly quadrate

costa: absent or faint

border: not differentiated

margin: entire or nearly so, plane

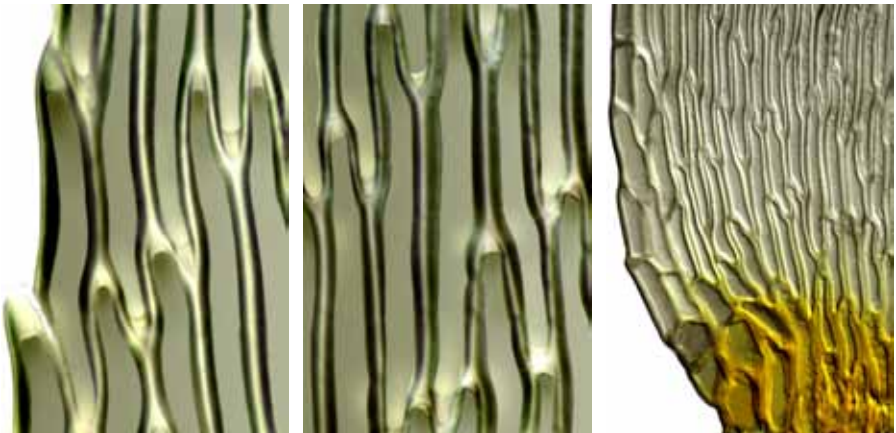
cells: midleaf cells to 90 × 9 μm, linear to vermicular, firm-walled, smooth

capsule: to 1 mm, narrowly ovoid, horizontal to pendent, exerted, brownish;
 seta to 9 mm, smooth; constricted below the mouth when dry; calyptra
 cucullate, naked; operculum conic; peristome hypnoid



vegetative shoot (dry) (2), leaf outline, and leaf apex (2)

1 mm, 1 mm, 0.5 mm, 50 μm, 10 μm



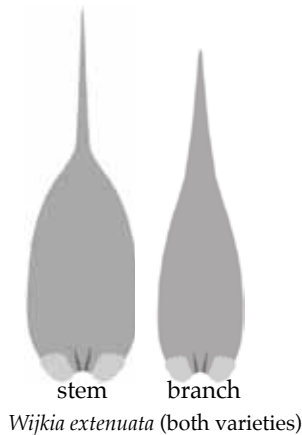
margin at midleaf, cells at midleaf, and leaf basal angle

10 μm, 10 μm, 50 μm

Key* to the New Zealand varieties of *Wijkia extenuata* (2)

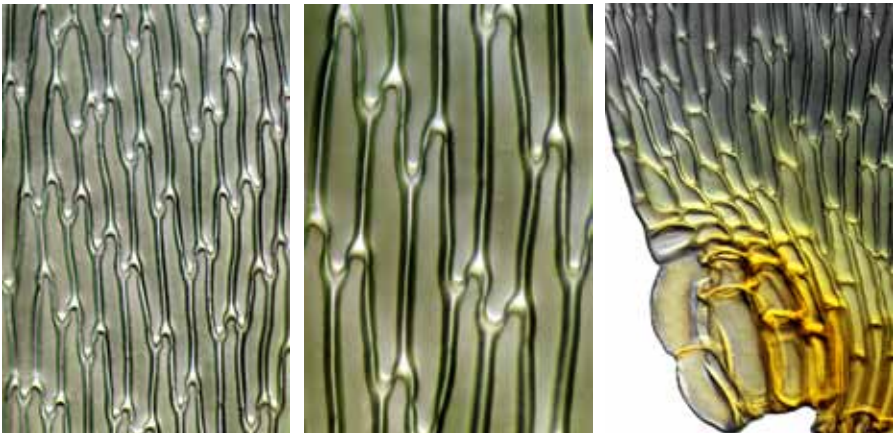
- 1 Flagelliferous-microphyllous branchlets numerous near branch tips; branch leaves 0.7–1.0 mm long, sharply serrulate near the apex..... ● ***Wijkia extenuata* var. *caudata***
- 1: No flagelliferous branchlets near tips; branch leaves 1.1–1.4 mm long, entire or crenulate near the apex..... ● ***Wijkia extenuata* var. *extenuata***

* based on Fife, AJ (2012): New taxa of *Sematophyllum* and *Wijkia* (Musci: Sematophyllaceae), with a key to New Zealand Sematophyllaceae. *New Zealand Journal of Botany* 50, 435–447.

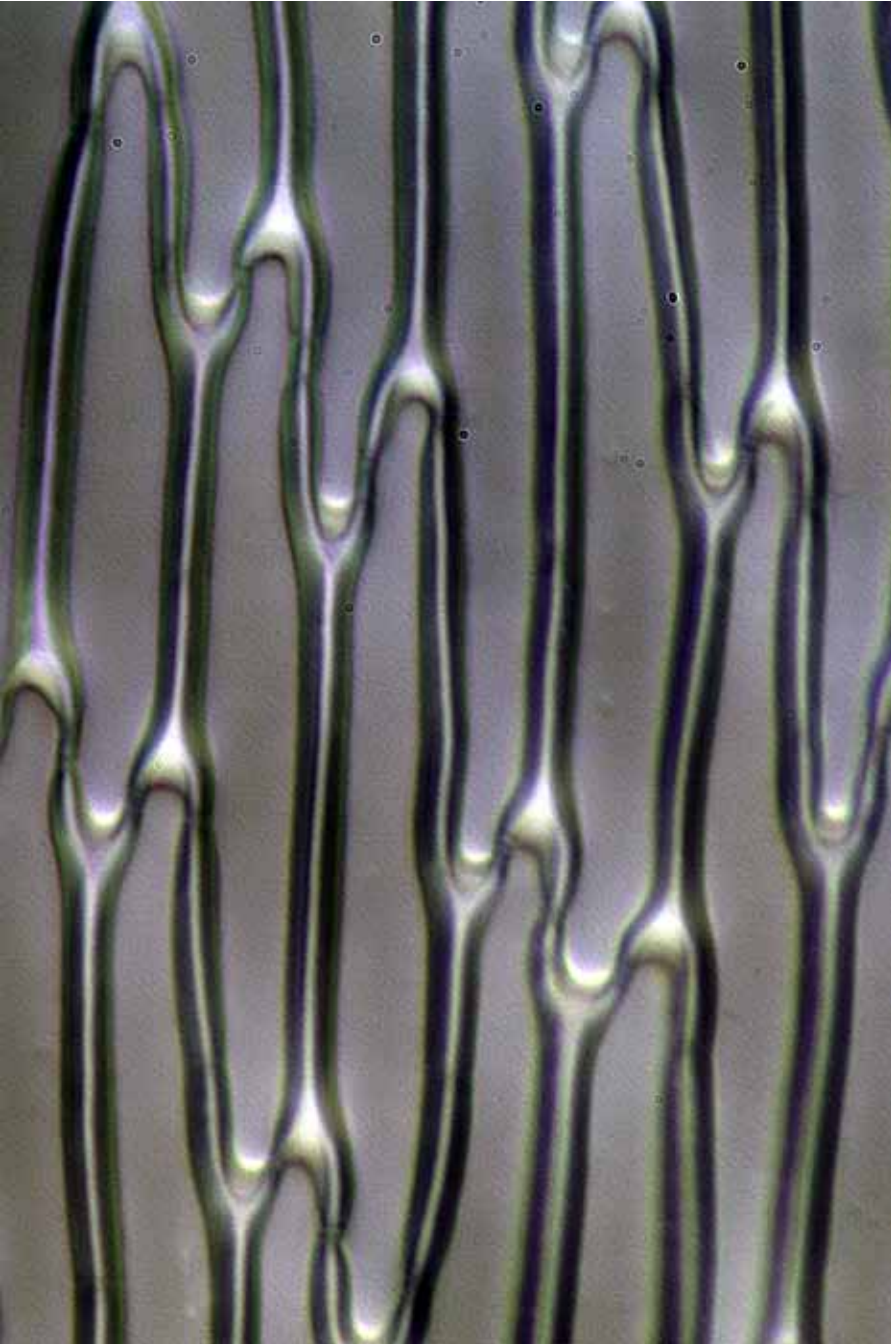


Wijkia extenuata var. **caudata** Fife**form:** mats of glossy, branched, yellowish, radiculose stems, to 40 mm**habitat:** bark, fallen logs, and rarely rock, in forest and scrub, to 520 m**leaf: size:** stem leaves 1.2–1.4 × 0.4–0.5 mm; branch leaves 0.7–1.0 × 0.2–0.4 mm**shape:** broadly ovate to ovate-lanceolate**tip:** tapered to an acumen**base:** alar cells hyaline, thin-walled, inflated**costa:** none or short and double**border:** not differentiated**margin:** entire below, sharply serrulate above, plane**cells:** 30–60 × 4–6 μm, linear to linear-rhombic, firm-walled, smooth, not porose**capsule:** 2 mm, oblong, horizontal, gibbous, short-necked; seta 15–40 mm, flexuose, smooth, dark red; peristome double**note:** var. *caudata* differs from var. *extenuata* in having many microphyllous branches, only weak pinnate branching, similar stem and branch leaves, entire branch leaf margins, and eporose lamina cells

vegetative shoot (dry), branch leaf outline, branch leaf apex, and margin midleaf
 1 mm, 0.5 mm, 10 μm, 10 μm



cells at midleaf (2), and leaf basal angle
 10 μm, 10 μm, 10 μm



Wikia extenuata var. *caudata* cells at midleaf
10 μ m

continued next page

Wijkia extenuata (Brid.) H.A.Crum var. **extenuata**

form: mats of 1–2-pinnately branched, ± radiculose stems, to 120 mm,
leaves green, yellowish, or grey, glossy, lacking flagelliform branchlets

habitat: bark, tree ferns, rotting logs, soil, and rock, in forests to 1400 m

leaf: size: stem: 1.1–1.4 × 0.3–0.4 mm; branch: 0.9–1.2 × 0.9–0.1 mm

shape: stem leaves oblong-ovate; branch leaves lanceolate

tip: stem leaves abruptly piliferous; branch leaves gradually tapered

base: alar cells hyaline, thin-walled, inflated, $40 \times 15 \mu\text{m}$

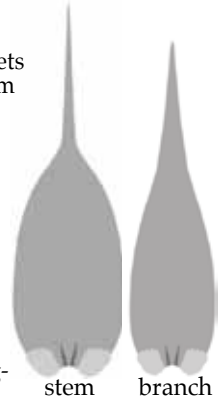
costa: absent or short and double

border: not differentiated

margin: entire below, crenulate near the apex, plane

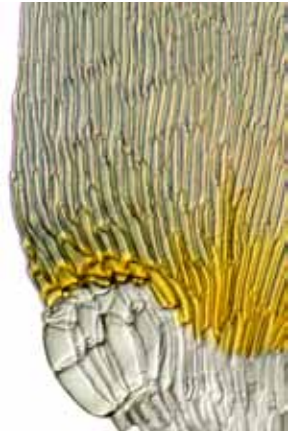
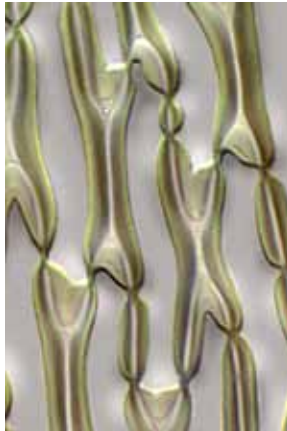
cells: $30\text{--}60 \times 4\text{--}6 \mu\text{m}$, linear to linear-rhombic, firm-walled, smooth
to seriatly papillose

capsule: 2 mm, oblong, long-exserted, horizontal, gibbous, short-necked; seta 15–40 mm, flexuose, smooth, dark red; operculum long-conic, red; peristome hypnoid; spores $12\text{--}16 \mu\text{m}$ in diam.



vegetative habit, mature capsule, leaf outline, and peristome (top and side views)

1 mm, 1 mm, 0.1 mm, 0.1 mm, 0.1 mm



branch leaf subapex, branch leaf cells, and alar cells in leaf basal angle

5 μm , 5 μm , 50 μm

continued next page



Wikia extenuata var. *extenuata* habit
5 mm

continued next page

Rhaphidorrhynchium amoenum (Hedw.) M.Fleisch.

form: mats of creeping, branched stems, 10–35 mm long, leaves glossy, yellow-green to yellow-brown

habitat: rotting logs and stumps, exposed roots and twigs, to 1200 m

leaf: size: 1.3–1.7 × 0.2–0.3 mm

shape: ovate-lanceolate from an oblong base, falcate or circinate

tip: narrowed to a long, curved acumen

base: alar cells inflated, hyaline, thin-walled

costa: none or short and double

border: not differentiated

margin: faintly denticulate above, plane to ± recurved above

cells: 60–90 × 3–5 μm, linear-vermicular, firm-walled, smooth

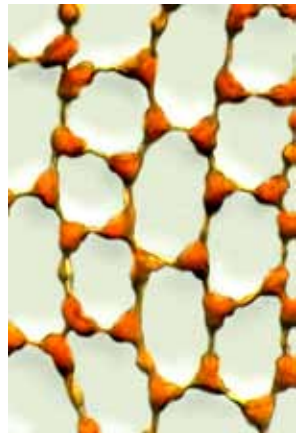
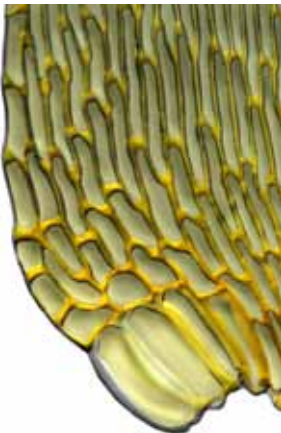
capsule: 1–1.5 mm, cylindric, elliptic or ovoid, exserted, horizontal to pendent, orange; seta 8–20 mm, smooth, red; operculum long-rostrate; peristome hypnoid, exothecium cells strongly trigonous; spores 12–18 μm in diam., papillose, green



costa can be absent



vegetative habit, shoot (dry), immature and mature capsules, leaf outline, and leaf apex
 ■ 1 mm, ■ 1 mm, ■ 0.5 mm (2), ■ 0.1 mm, ■ 10 μm



margin at midleaf, leaf basal angle, and trigonous capsule wall cells
 ■ 10 μm, ■ 10 μm, ■ 20 μm

continued next page



Rhipidorrhynchium amoenum habit
1 mm

Key* to the New Zealand species of *Sematophyllum* (6) and *Warburgiella* (1)

- 1 Inflated alar cells in a single row *and* leaves strongly falcate-secund ● ***Warburgiella leucocyta***
- 1: Inflated alar cells in more than one row *or* leaves straight or nearly so *or* both 2
- 2(1): Leaf tips of the ultimate branches pointing up away from the substratum 3
- 2: Leaf tips of the ultimate branches not pointing up away from the substratum 4
- 3(2) Cells in extreme basal angle opaque; plant restricted to coastal sites ● ***Sematophyllum homomallum***
- 3: Cells in extreme basal angle not opaque; plant not restricted to coastal sites ● ***Sematophyllum subhumile* var. *contiguum***
- 4(2): Leaf apex tapering to a long, filiform acumen 5
- 4: Leaf apex not tapering to a long, filiform acumen 6
- 5(4) Midleaf cells 75–115 × 4 μm, not porose; distal leaf margin serrate-spinose ● ***Sematophyllum fiordensis***
- 5: Midleaf cells 60–75 × 4 μm, porose; distal leaf margin denticulate ● ***Sematophyllum kirkii***
- 6(4): Leaves highly glossy; branches flattened, cuspidate; leaves elliptic, gradually tapered to an acute apex ● ***Sematophyllum jolliffii***
- 6: Leaves usually dull; branches not flattened or cuspidate; leaves ovate, abruptly tapered to an acuminate apex ● ***Sematophyllum uncinatum***

* based on Scott, GAM; Stone, IG; Rosser, C (1976): *The Mosses of Southern Australia*. Academic Press, London. 441, and Buck, WR; Tan, BC (1989): The Asiatic genera of Sematophyllaceae associated with *Trichosteleum*. *Acta Bryolichenologica Asiatica* **1**, 5–19, and Fife, AJ (2012): New taxa of *Sematophyllum* and *Wijkia* (Musci: Sematophyllaceae), with a key to New Zealand Sematophyllaceae. *New Zealand Journal of Botany* **50**, 435–447.



*Sematophyllum
homomallum*



*Sematophyllum
jolliffii*



*Sematophyllum
uncinatum*



*Sematophyllum
subhumile* var.
contiguum



*Warburgiella
leucocyta*



*Sematophyllum
kirkii*



*Sematophyllum
fiordensis*

Sematophyllum fiordensis Fife

form: dense mats of branched, shiny, golden, ± pendent stems 15–20 mm long, with smooth rhizoids in the leaf axils

habitat: streamside rocks and wet rock faces in forest, sea level to 600 m

leaf: size: 3.5–4.5 × 0.3–0.4 mm

shape: falcate-secund, narrowly lanceolate, little altered when dry

tip: acuminate, long-filiform

base: alar groups strong, 12–15 inflated cells, unistratose, the largest to 40 × 20 μm, thin-walled, and hyaline, and the smallest firm-walled and red or brown-pigmented

costa: not differentiated

border: not differentiated

margin: entire below, serrate to spinose near the apex, plane

cells: 80–110 × 4 μm, linear, thick-walled (but the transverse walls thin), ± porose below, smooth to weakly prorate

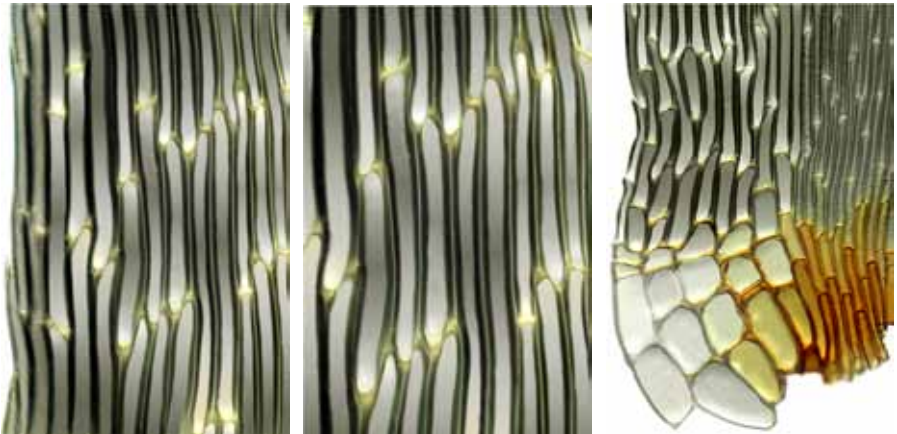
capsule: sporophytes unknown

note: a rare New Zealand endemic



vegetative shoot (dry), leaf outline, apex (2), and subapex

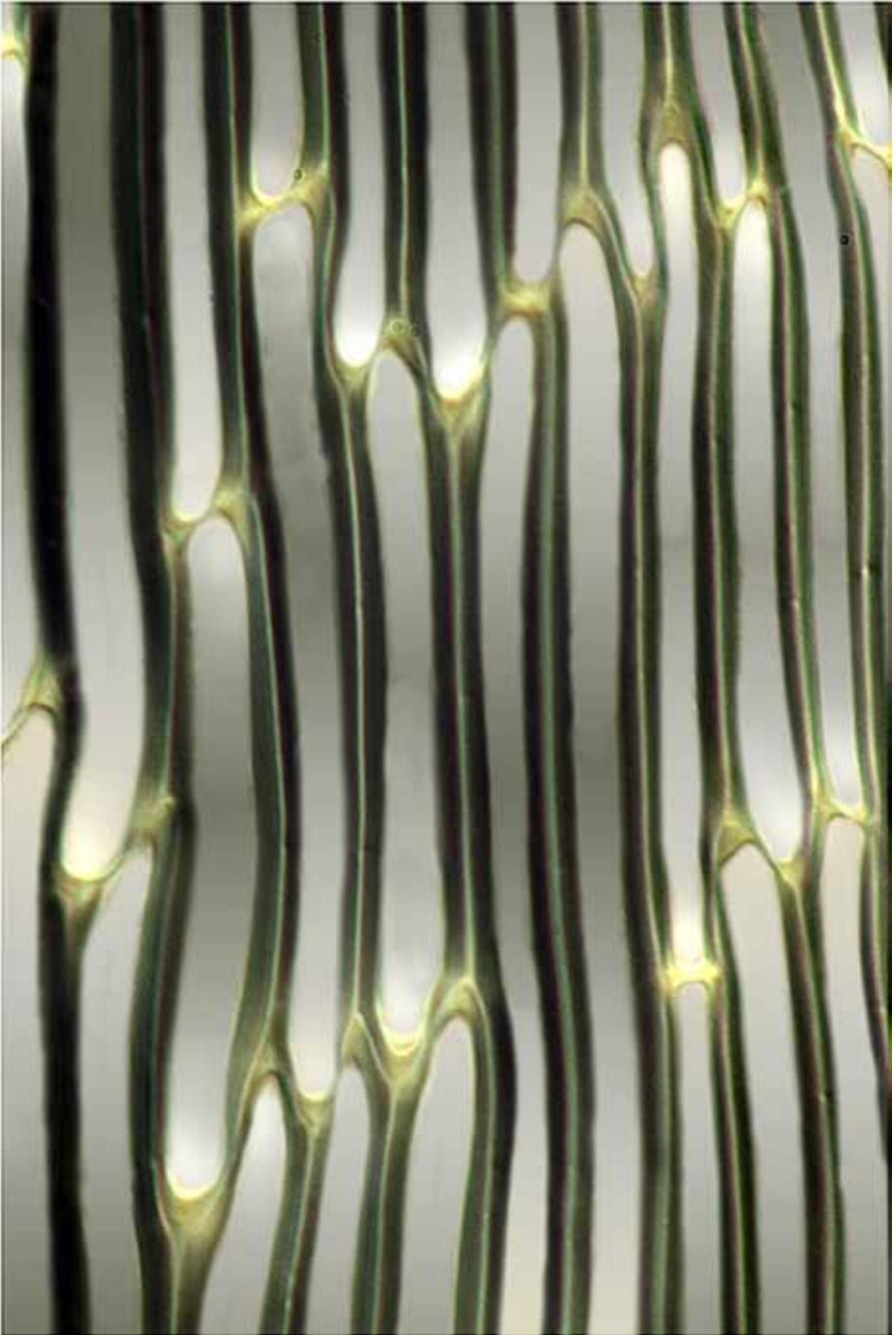
1 mm, 1 mm, 10 μm, 10 μm, 10 μm



margin, lamina cells, and leaf basal angle

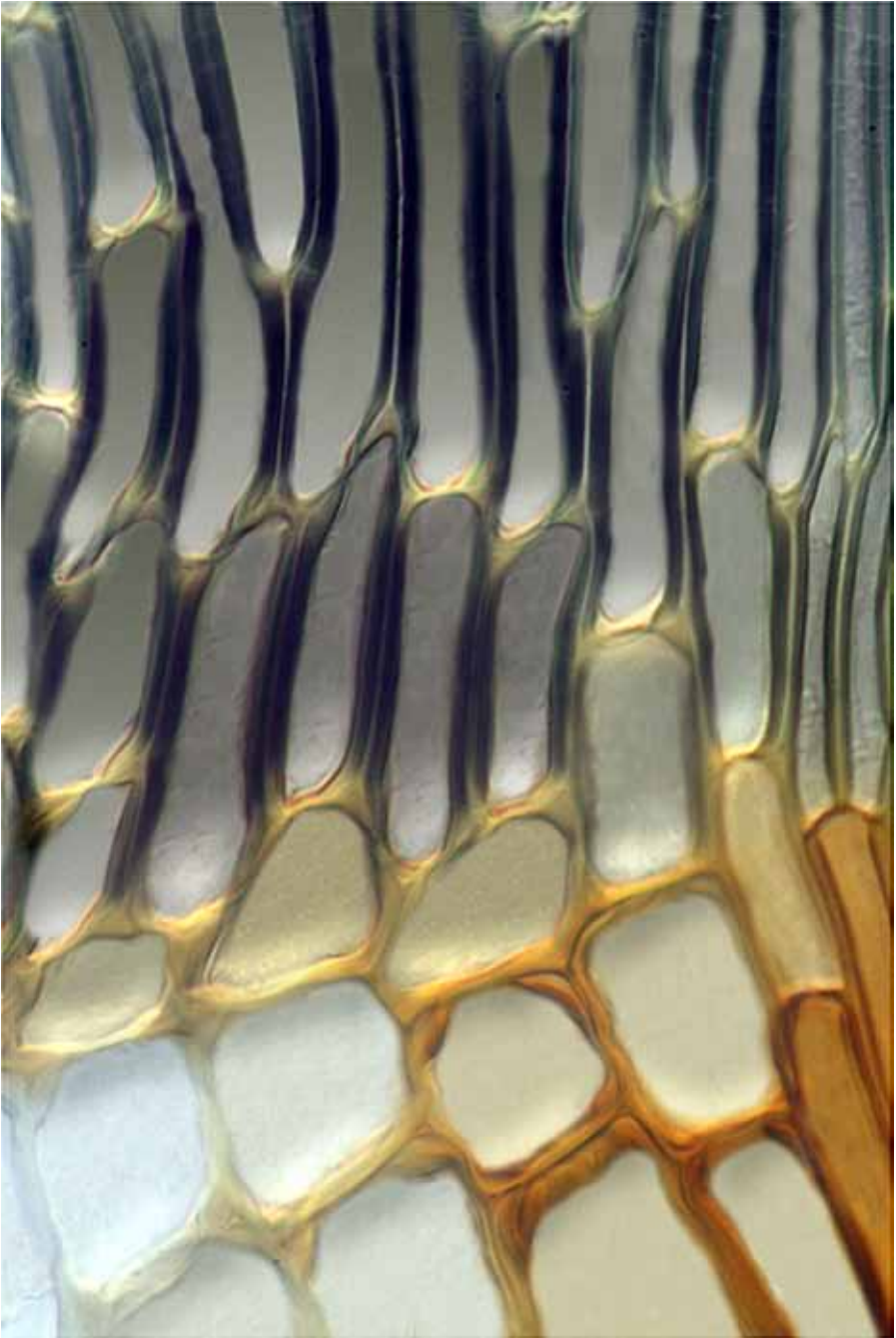
10 μm, 10 μm, 50 μm

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Sematophyllum fiordensis lamina cells
10 μm

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Sematophyllum fiordensis cells near base of leaf
10 μm

Sematophyllum homomallum (Hampe) Broth.

form: densely matted, creeping, irregularly branched, radiculose stems, to 30 mm long, leaves yellow-green to bronze or dark red, glossy

habitat: dry coastal rock, rarely tree trunk bases, damp forest to coastal dunes

leaf: size: 1.5–2 × 0.5–0.7 mm

shape: ovate to oblong, concave, strongly secund

tip: bluntly acuminate, tapering to a short point

base: alar cells orange, incrassate, quadrate above, longer below

costa: absent or short and double

border: not differentiated

margin: entire, plane or widely recurved

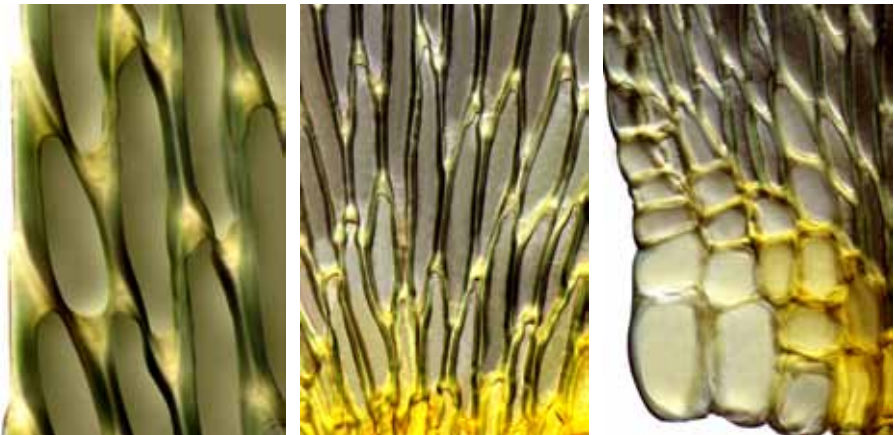
cells: 40–80 × 5 μm, linear to vermicular, incrassate, ± porose, smooth

capsule: 1.5–2 mm, ovate to oblong, exserted, erect, neck shortly tapered; seta 10 mm; operculum finely long-rostrate; exostome teeth cross-striolate, hyaline-bordered, endostome segments equalling exostome teeth, cilia 0–1



vegetative shoots (dry) (2), leaf outline, and leaf apex (2)

1 mm (2), 0.5 mm, 50 μm, 10 μm



margin at midleaf, cells at leaf base, and leaf basal angle

10 μm, 10 μm, 10 μm

continued next page



Sematophyllum homomallum leaf apex
10 μm

continued next page

Sematophyllum jolliffii (Hook.f. & Wilson) Dixon

form: densely matted, ± pinnately branched stems, cuspidate, ± hooked,
leaves metallic-glossy, sordid yellow-green, ± secund but not falcate
habitat: wet rock or rarely soil in swamps or occasionally submerged
sites close to watercourses

leaf: size: 1.5–1.8 × 0.8 mm

shape: ovate-lanceolate

tip: widely acuminate

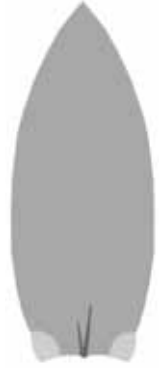
base: angle cells large, inflated, hyaline or yellowish

costa: short and double

border: not differentiated

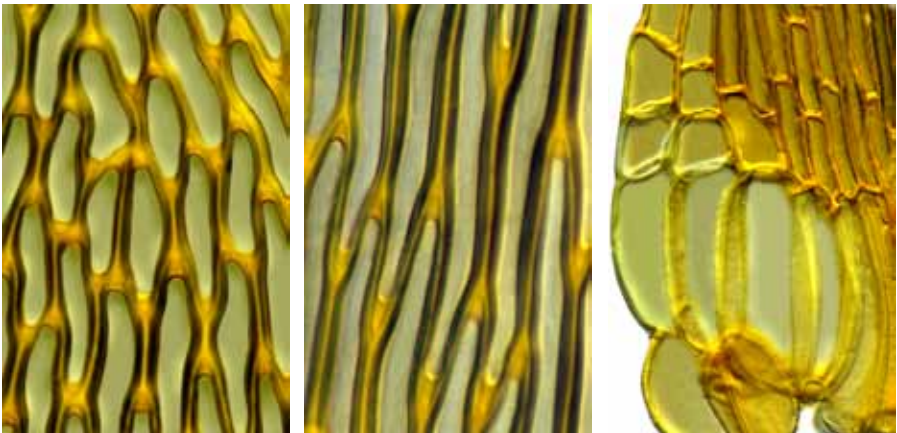
margin: entire to slightly denticulate, plane to inflexed on one side below
cells: 40–80 × 4–5 μm, linear-rhombic, firm-walled, smooth to prorse

capsule: about 1 mm, ovoid, exserted, cernuous to horizontal, brown;
seta 10–15 mm, roughened above; operculum long-rostrate; peristome
hypnoid



vegetative branch (dry), leaf outline, apex, and margin midleaf

1 mm, 0.1 mm, 50 μm, 10 μm



cells in upper leaf, cells at midleaf, and inflated alar cells

10 μm, 10 μm, 10 μm

continued next page



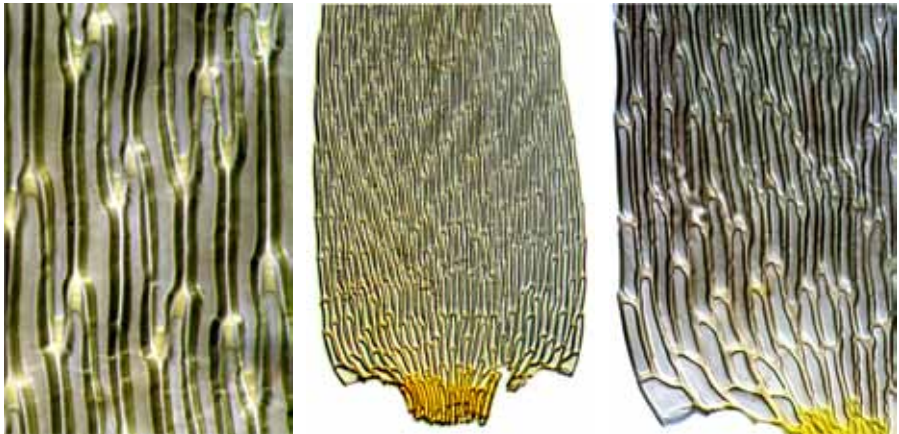
Sematophyllum jolliffii margin midleaf
10 μ m

continued next page

Sematophyllum kirkii (Müll.Hal. ex Beckett) Paris**form:** pendent yellow-green, branched stems, 10–30 mm, with sparse rhizoids**habitat:** rotting logs, exposed roots, or rock in native or exotic forests, to 500 m**leaf:** size: 1.0–3.0 × 0.3–0.6 mm*shape:* narrowly lanceolate, curved, ± homomalous, little altered when dry*tip:* slenderly acuminate*base:* alar cells 2–3, hyaline, inflated, thin-walled, to 45 × 15 μm*costa:* not differentiated*border:* not differentiated*margin:* sharply denticulate above, plane*cells:* 60–75 × 4 μm, linear, thick-walled, ± porose, smooth**capsule:** 1–2 mm, oblong-cylindric, short-necked, stragulate when dry, red-brown when mature, inclined to horizontal; seta 6–8 mm, reddish; calyptra cucullate and naked; operculum slender-beaked; peristome double, pale; exostome teeth 16; endostome segments perforate, as tall as the exostome teeth; cilia 0–2; spores green

vegetative shoot (moist), leaf outline, leaf apex (3), subapex, and margin at midleaf

1 mm, 0.5 mm, 50 μm, 10 μm, 5 μm, 10 μm, 5 μm



lamina cells, leaf base, and leaf basal angle

5 μm, 50 μm, 10 μm

Sematophyllum subhumile var. **contiguum** (Mitt.) B.C.Tan, W.B.Schofield & H.P.Ramsay

form: tufts or mats of creeping, ± pinnately branched, light green stems

habitat: rock and rotting logs

leaf: size: 1–1.5 mm × 0.3–0.4 mm

shape: ovate-lanceolate to lanceolate, concave

tip: acuminate

base: 2–4 inflated, hyaline alar cells; supra-alar cells subquadrate, ± yellow

costa: short or none

border: not differentiated

margin: entire to minutely denticulate, plane

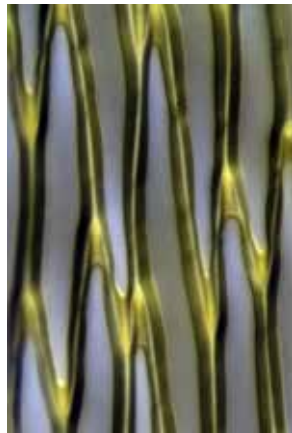
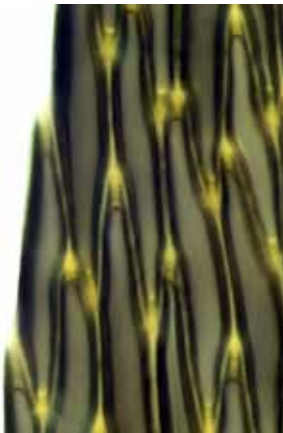
cells: 60–90 × 6–9 μm, narrowly linear-rhombic, thick-walled, smooth

capsule: 1–1.3 mm, elliptic to oblong, short-necked, inclined to horizontal, exserted, brown; seta 5–10 mm, reddish, smooth; operculum long-beaked; peristome double



vegetative shoot (dry), mature capsule, leaf outline, and leaf apex and subapex

1 mm, 1 mm, 0.5 mm, 0.1 mm, 10 μm, 10 μm



margin at midleaf, cells at midleaf, and leaf basal angle

10 μm, 10 μm, 10 μm

continued next page



Sematophyllum subhumile var. *contiguum* vegetative shoot (dry) and leaf outline
1 mm, 0.1 mm

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Sematophyllum uncinatum I.G.Stone & G.A.M.Scott

form: matted, ± pinnately branched stems, to 50 mm long, falcate, hooked at the ends, leaves reddish bronze, glossy

habitat: wet rock in montane springs and bogs, semi-squatic

leaf: size: 1.5–2.7 mm

shape: ovate-lanceolate, concave, slightly falcate

tip: widely acuminate, acute at the tip

base: alar cells large, inflated, thin-walled

costa: none

border: not differentiated

margin: entire to obscurely denticulate, plane to narrowly recurved

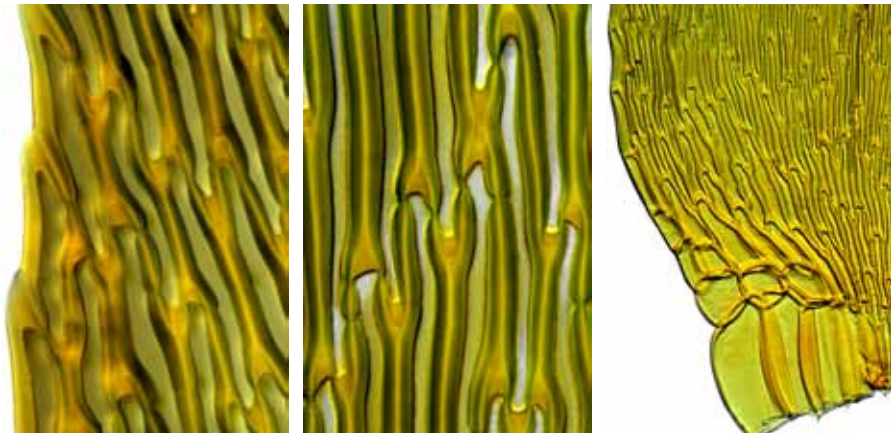
cells: 70–90 × 8–10 μm, linear, incrassate, ± porose, smooth

capsule: 1.5–2 mm, oblong, exserted, horizontal to pendent, brown; seta to 20 mm, red, smooth; operculum obliquely long-rostrate; calyptra cucullate, smooth, naked; peristome hypnoid; spores 15–20 μm in diam., smooth



vegetative shoot (dry) (2), leaf outline, and leaf apex (2)

5 mm, 1 mm, 0.1 mm, 50 μm, 10 μm



margin at midleaf, cells at midleaf, and leaf basal angle

10 μm, 10 μm, 50 μm

continued next page



Sematophyllum uncinatum cells midleaf
10 μ m

continued next page

Warburgiella leucocyta (Müll.Hal.) B.C.Tan, W.B.Schofield & H.P.Ramsay

form: matted, creeping, pinnately branched stems, to 40 mm long, leaves pale green to yellow-brown, glossy or not

habitat: bark, rotting logs, and humus in damp shady forest and rainforest

leaf: size: 1.0–1.5 × 0.3–0.4 mm

shape: ovate-lanceolate, tapering to a ± piliform apex, ± falcate-secund

tip: long-acuminate

base: 2–4 angle cells inflated, thin-walled, and hyaline, uniseriate; a few supra-alar cells subquadrate, firm-walled; central basal cells ± porose

costa: absent or short and double

border: not differentiated

margin: entire or faintly denticulate, plane

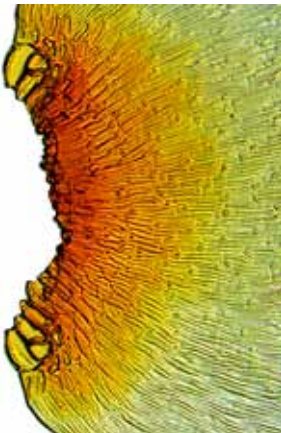
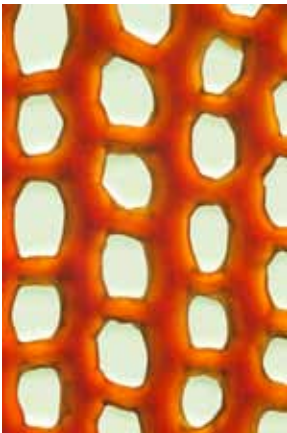
cells: 60–90 × 4–7 μm, narrowly linear, firm-walled, smooth

capsule: 1.3–1.5 mm, oblong to elliptic, exserted, horizontal to pendent, brown; seta 10–15 mm, red, papillose above; operculum long-subulate; peristome hypnoid; spores 12–24 μm in diam.



fertile shoot (dry), leaf outline, leaf apex (2), and margin midleaf

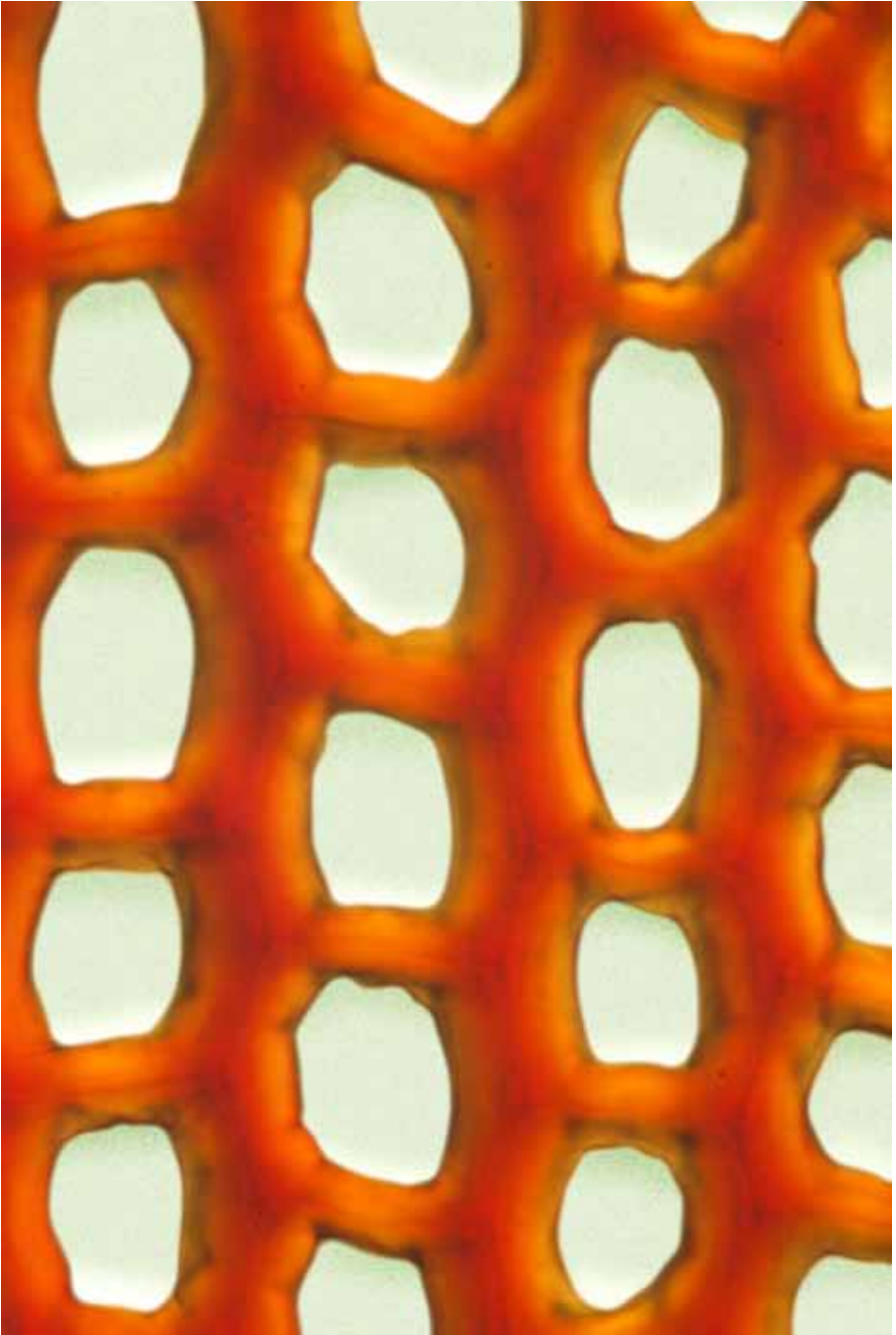
■ 1 mm, ■ 0.1 mm, ■ 10 μm, ■ 10 μm, ■ 10 μm



capsule wall cells, leaf base, and uniseriate inflated alar dells

■ 10 μm, ■ 50 μm, ■ 10 μm

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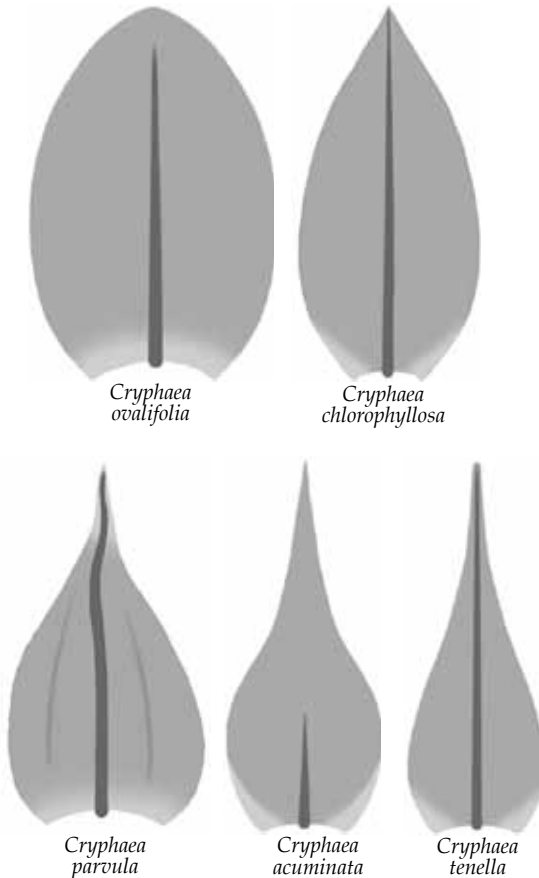


Warburgiella leucocyta capsule wall cells
10 μm

Key* to the New Zealand species of *Cryphaea* (5)

- 1 Leaf apex obtuse..... ● *Cryphaea ovalifolia*
 1: Leaf apex acute, acuminate, or setaceous..... 2
- 2(1:) Costa of stem leaves < 70% of blade length..... ● *Cryphaea acuminata*
 2: Costa of stem leaves excurrent or > 80% of blade length..... 3
- 3(2:) Costa excurrent in a hyaline arista..... ● *Cryphaea parvula*
 3: Costa subpercurrent to percurrent, not hyaline..... 4
- 4(3:) Upper lamina cells of stem leaves narrowly rhombic.. ● *Cryphaea chlorophyllosa*
 4: Upper lamina cells of stem leaves oval..... ● *Cryphaea tenella*

* based on Pengcheng Rao (2001): Monographic studies on *Cryphaea* (Bryopsida) *Bryobrothera* 7, 27.



continued next page

Cryphaea acuminata Hook.f. & Wilson

form: primary stems creeping; secondary stems erect, branched, curved
habitat: bark of tree trunks and branches in mesic forest

leaf: size: 0.8–1.1 mm

shape: ovate

tip: long-acuminate

base: basal cells oval to oblong; alar cells poorly developed

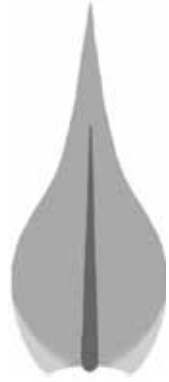
costa: failing above midleaf

border: not differentiated

margin: entire, plane above, recurved below

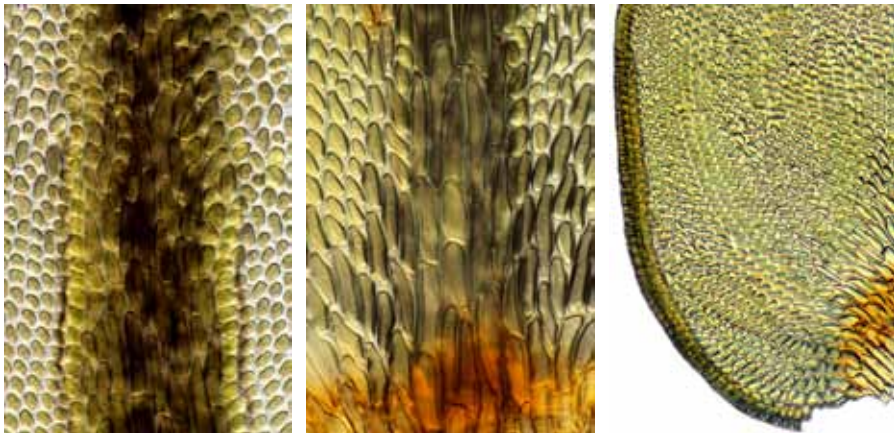
cells: 8–12 μm and isodiametric above; 20–30 \times 8–12 μm and oval below, firm-walled, smooth

capsule: 1.5–2 mm, \pm cylindric, erect, immersed, on short branches, brown; seta 0.2 mm; operculum conic-rostrate; peristome double, exostome teeth 16, papillose; calyptra cucullate, endostome segments 16, filiform; cilia absent



fertile shoot (dry), leaf outline, leaf apex (2), and margin midleaf

1 mm, 0.1 mm, 0.1 mm, 50 μm , 50 μm



costa at midleaf, costa at leaf base, and leaf basal angle

50 μm , 50 μm , 100 μm

continued next page

Cryphaea chlorophyllosa Müll.Hal.

form: primary stems creeping; secondary stems pinnately branched, 40–120 mm long, leaves light or yellow-green, dull to glossy

habitat: bark of twigs and small branches along forest margins

leaf: size: 1.3–1.8 × 0.5–0.8 mm

shape: ovate

tip: bluntly acute

base: cells at the basal angles subquadrate or rhombic

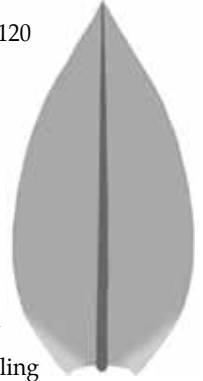
costa: slender, failing below the apex

border: not differentiated

margin: entire below, serrulate above, plane above, ± reflexed below

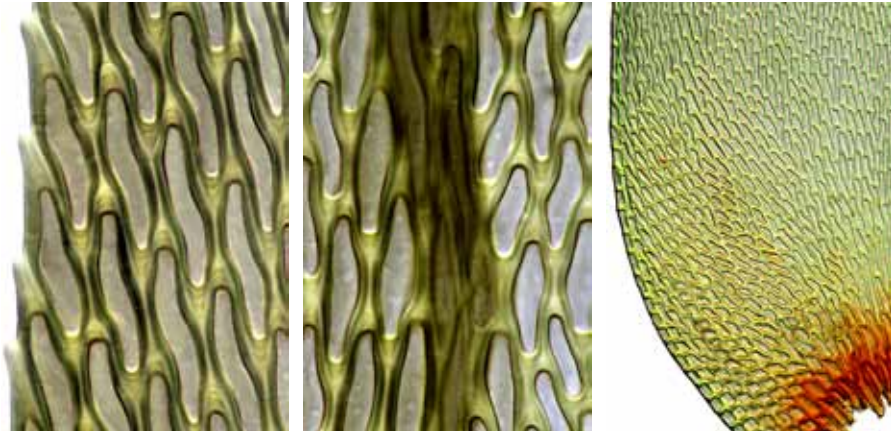
cells: 10–15 × 5 μm, oval to rounded-rhombic, thick-walled, smooth

capsule: 1.3–1.6 mm, oblong, erect, immersed, brown, red-mouthed; seta < 2 mm; calyptra cucullate, lacinate below; operculum acutely conic; exostome teeth pale, inserted below the rim, endostome filiform, equalling the teeth in length, cilia none



fertile shoots (dry) (3), leaf outline, and leaf apex

■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm



margin at midleaf, costa in upper leaf, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 50 μm

continued next page

Cryphaea ovalifolia (Müll.Hal.) A.Jaeger

form: primary stems creeping, secondary stems pinnately branched, 50–120 mm long, leaves light to yellow-green, dull or glossy

habitat: bark of twigs and small branches in scrub or forest

leaf: size: 1.3–1.8 × 0.6–0.8 mm

shape: widely lanceolate to ovate

tip: obtuse to subacute

base: angle cells subquadrate to rhombic, juxtacostal cells ± linear

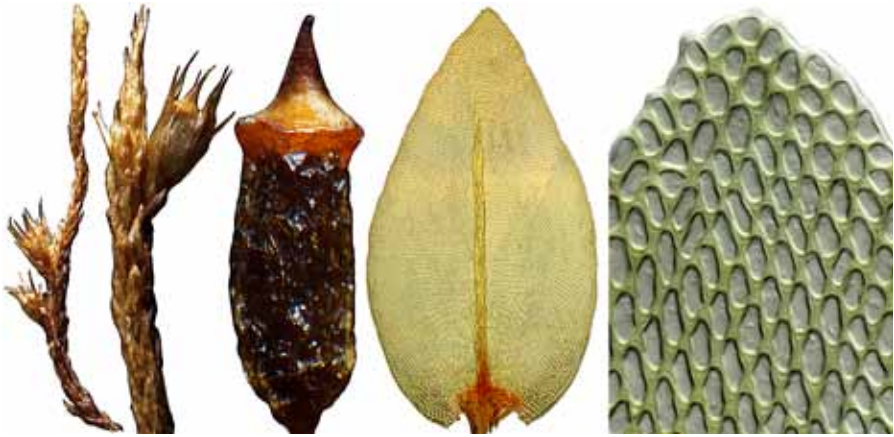
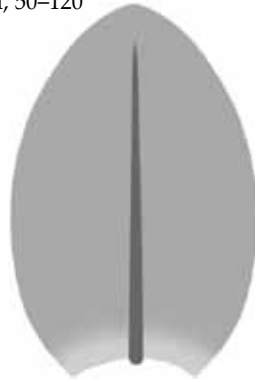
costa: failing well below the leaf apex

border: not differentiated

margin: entire below, irregularly denticulate near the apex, plane

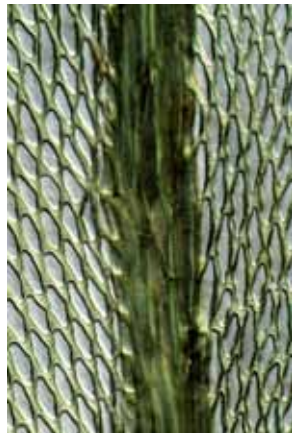
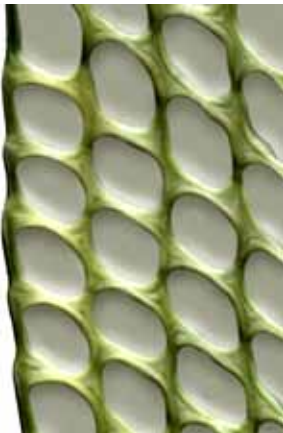
cells: 12–15 μm, oval to rounded rhombic, thick-walled, smooth

capsule: 1.3–1.6 mm, oblong, erect, immersed, brown, mouth red, thickened; seta < 2 mm; calyptra cucullate, laciniate; exostome teeth pale, endostome segments filiform, equalling the exostome teeth, cilia absent



fertile shoots (dry) (2), capsule (dry), leaf outline, and leaf apex

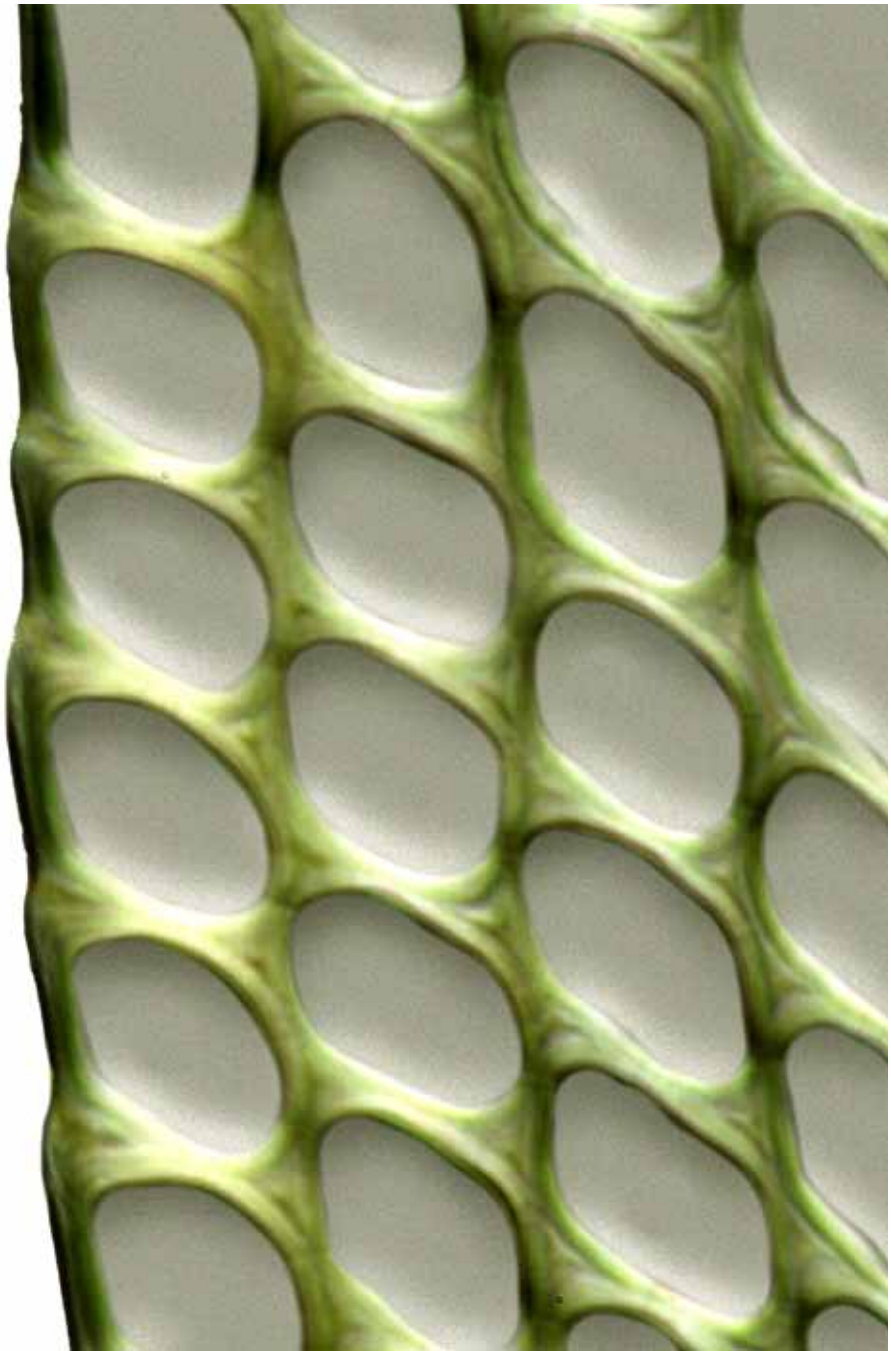
■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 0.1 mm, ■ 10 μm



margin at midleaf, costa at midleaf, and cells near leaf base

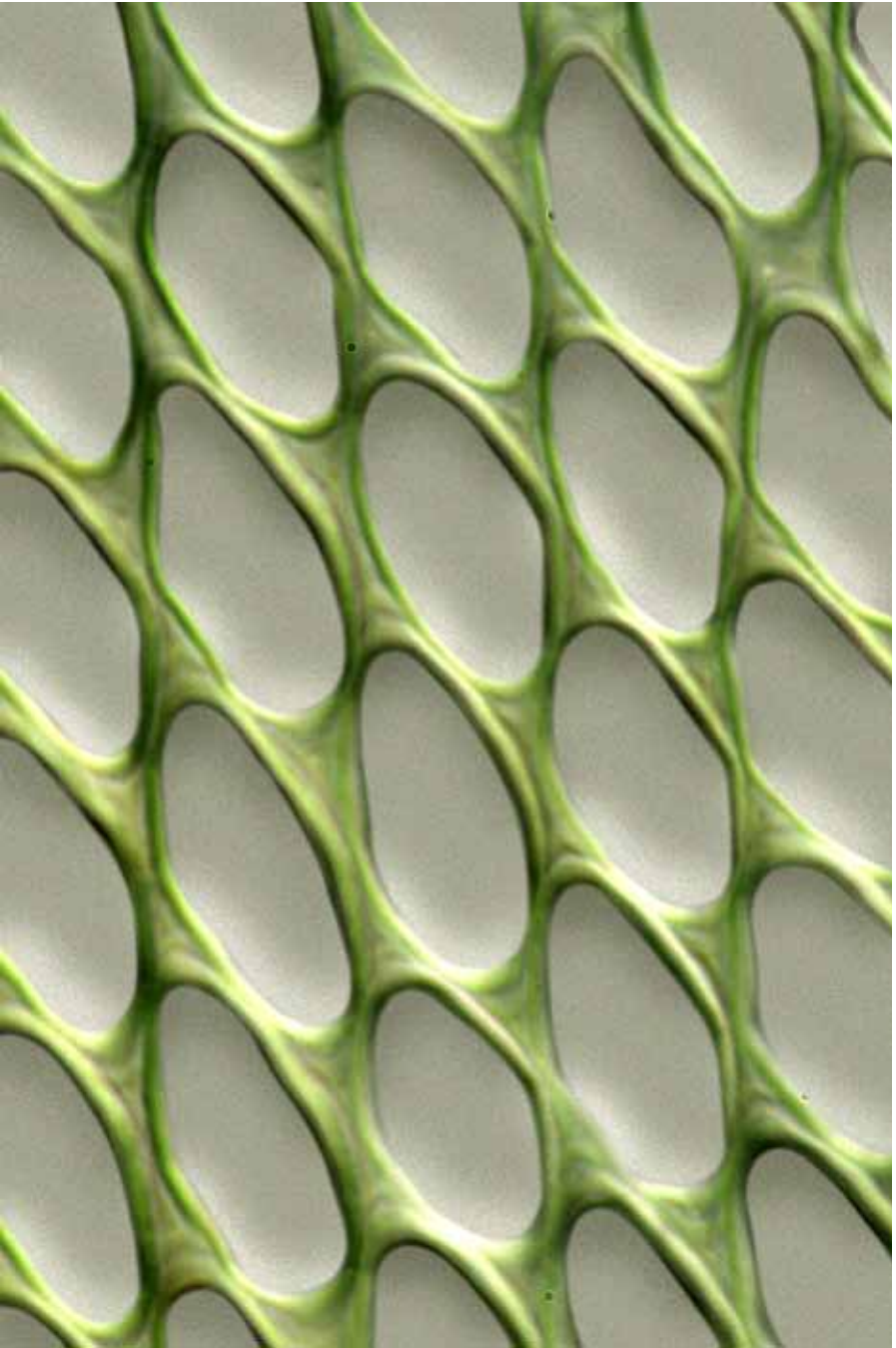
■ 10 μm, ■ 50 μm, ■ 50 μm

continued next page



Cryphaea ovalifolia margin midleaf
10 μ m

continued next page



Cryphaea ovalifolia cells midleaf
10 μm

continued next page

Cryphaea parvula Mitt.

form: tufted, creeping, curved, branched, pendent stems, 30–50 mm long, leaves yellowish to dark green

habitat: bark of tree trunks and branches in moist forest

leaf: size: 1–1.5 × 0.5–0.8 mm

shape: ovate

tip: acuminate

base: alar cells round to subquadrate, 10–14 μm diam., smooth

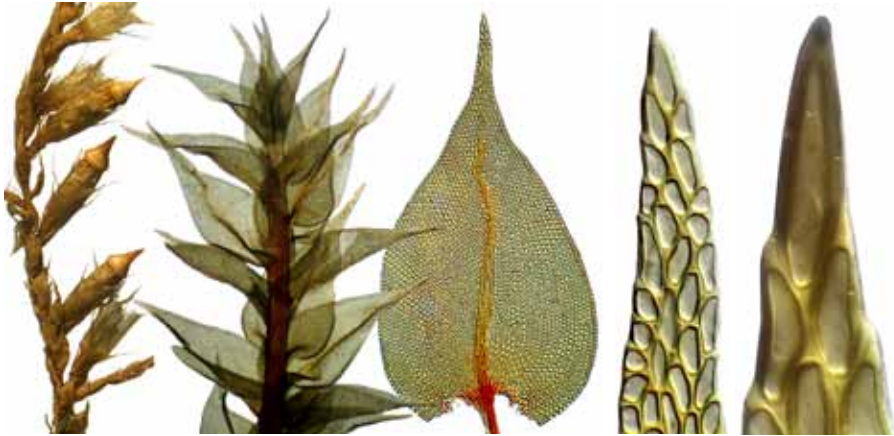
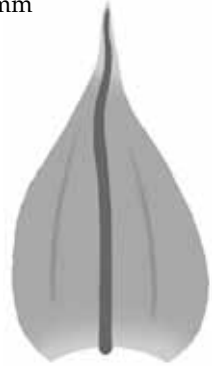
costa: ending below the acumem, ± sinuose above

border: not differentiated

margin: entire, plane

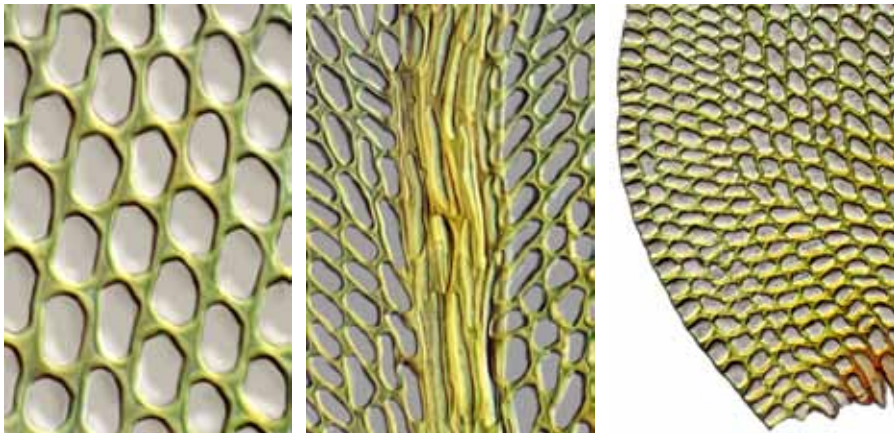
cells: 8–14 μm, oval, firm-walled, smooth

capsule: 1.5–2 mm, obloid, straight, immersed, brown; seta 0.2 mm; annulus 1–2-seriate; operculum rostrate, smooth; calyptra mitriform, prorate above; peristome double, pale; spores 18–20 μm in diam., papillose



fertile shoot, shoot apex (cleared), leaf outline, and leaf apex (2)

1 mm, 1 mm, 0.1 mm, 10 μm, 10 μm



cells at midleaf, costa at midleaf, and leaf basal angle

10 μm, 50 μm, 50 μm

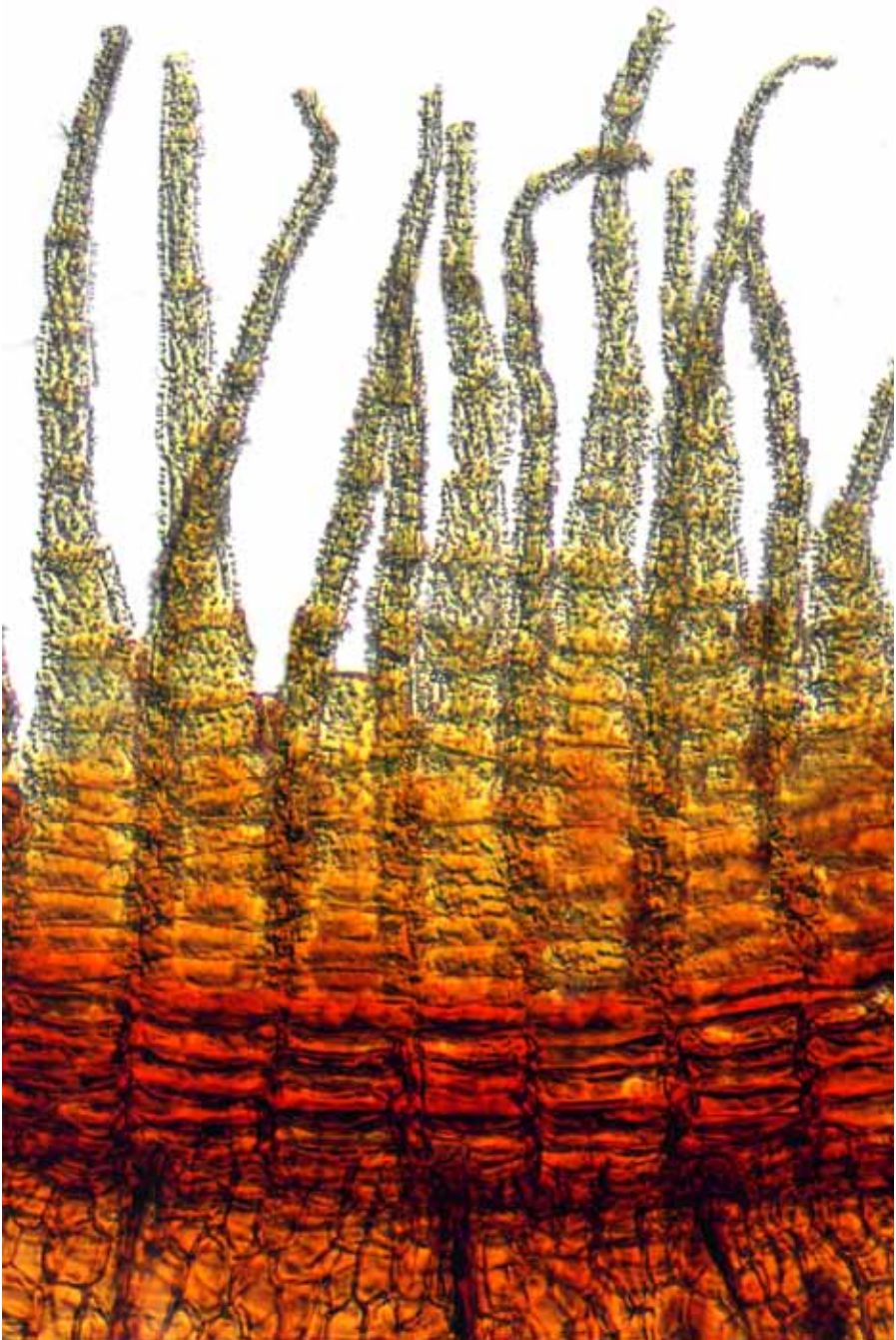
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Cryphaea parvula capsules

1 mm

continued next page



Cryphaea parvula peristome
50 μ m

continued next page

Cryphaea tenella Hornsch. ex C.Muell.

form: primary stems creeping; secondary stems irregularly branched, 20–50 mm long, stiff, pseudoparaphylliate

habitat: bark of trunks and twigs of shrubs and trees in mesic forest

leaf: size: 1–3 × 1.5 mm

shape: ovate-lanceolate, concave

tip: long-acuminate to ± piliferous

base: basal cells nearly isodiametric, forming a ± distinct group

costa: vanishing in the acumen

border: not differentiated

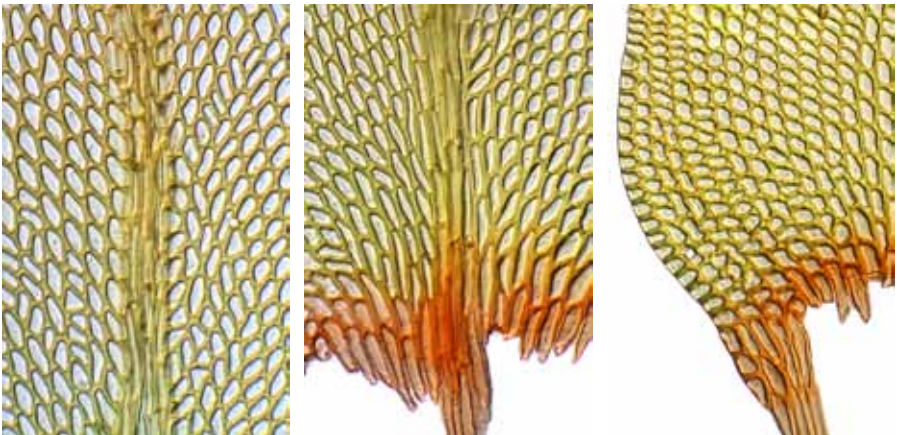
margin: entire, narrowly recurved below

cells: 8–14 μm, oval or rounded-rhombic, incrassate, smooth

capsule: 1–1.5 mm, oblong-oval, lateral, erect, immersed, light brown, mouth reddish; seta 0.2–0.3 mm; operculum high-conic; calyptra campanulate, red-brown, lobed; exostome teeth and endostome segments equal; spores 24–28 μm in diam.



immature capsules, exostome tooth, endostome segment, leaf outline, apex, and margin
 0.5 mm, 100 μm (2), 0.5 mm, 10 μm, 10 μm



costa at midleaf, costa at leaf base, and leaf basal angle
 50 μm, 50 μm, 50 μm

continued next page



Cryphaea tenella fertile shoot (moist)

1 mm

Cyrtodon dilatatus (Hook.f. & Wilson) Paris & Schimp.

form: primary stem creeping; secondary stem tomentose, 40–80 mm long, pinnately branched, complanate, secund, leaves brownish green, glossy

habitat: rock or bark in or near streams, occasionally submerged

leaf: size: 1.5 × 0.8 mm

shape: ovate, slightly concave

tip: acute, blunt at the tip

base: cells at the basal margin subquadrate, longer near the costa

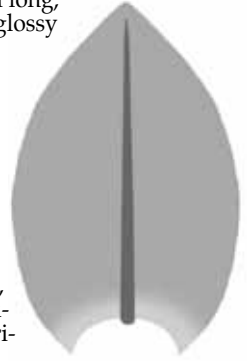
costa: failing below the apex

border: not differentiated

margin: faintly serrulate, plane

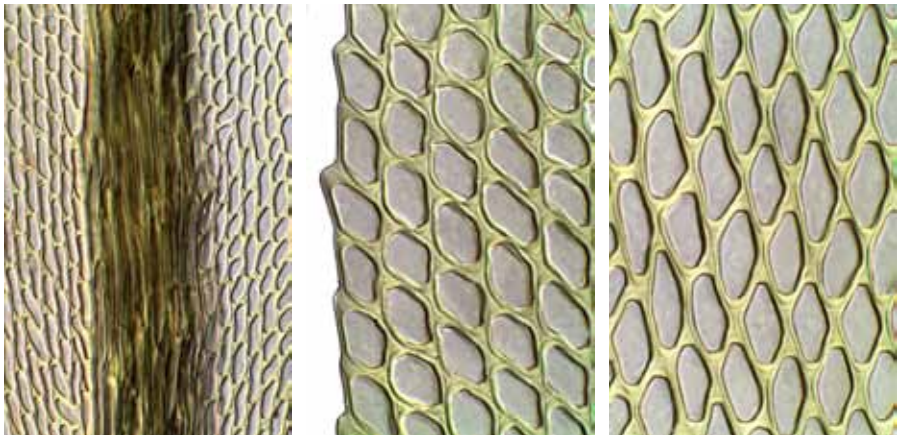
cells: 10–20 × 6–8 μm, oval, thick-walled, smooth

capsule: 1–1.5 mm, oblong, on short side-branches, erect, immersed, grooved and wide-mouthed when mature; seta very short; operculum conic, acute; calyptra cucullate, laciniate, papillose above; peristome double, cilia none



fertile shoots (dry) (2), leaf outline, and leaf apex

1 mm, 1 mm, 0.5 mm, 50 μm



costa at midleaf, margin at midleaf, and cells at midleaf

50 μm, 10 μm, 10 μm

continued next page



Cyrtodon dilatatus fertile shoots, immersed grooved capsules (dry)
1 mm, 1 mm

Dendrocryphaea tasmanica (Mitt.) Broth.

form: primary stems creeping; secondary stems \pm unbranched, 50–80 mm long, naked below, leaves dull, green or yellow-green

habitat: wet rock in fast-flowing streams, often submerged, rheophytic

leaf: size: 1.5–2.5 \times 0.9–1.5 mm

shape: ovate-orbicular

tip: acute

base: basal cells subquadrate, in small auricles

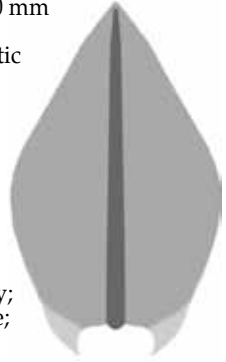
costa: reaching the apex or just below

border: not differentiated

margin: minutely crenulate, plane

cells: 12–15 μ m, oval to rhombic, \pm incrassate, smooth

capsule: 1.5 mm, oval-oblong, erect, immersed, \pm furrowed when dry; seta short; operculum conico-rostellate; calyptra cucullate, laciniate; peristome double, pale, cilia none; spores 12–16 μ m in diam.



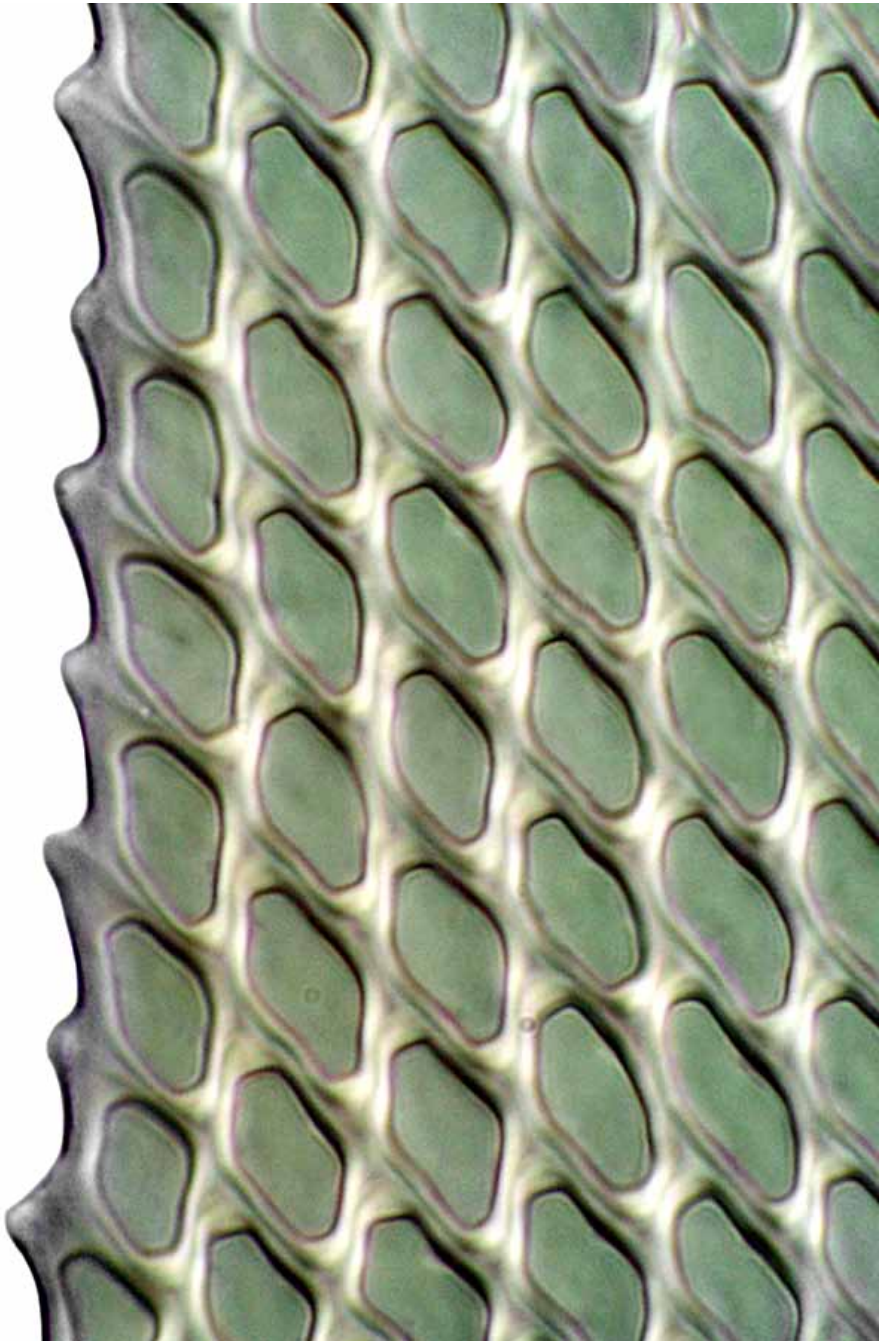
fertile shoot (2), leaf outline, and margin midleaf

1 mm, 1 mm, 0.5 mm, 10 μ m



cells at midleaf, leaf basal angle, and peristome tooth surface

10 μ m, 50 μ m, 10 μ m



Dendrocryphaea tasmanica margin midleaf
10 μm

Cryptogonium phyllogonioides (Sull.) Isov.

form: primary stems creeping; secondary stems strongly distichous, leaves dark green, glossy

habitat: bark or rock in shaded moist forest

leaf: size: 2–2.5 mm

shape: oblong-rhombic

tip: acute, ± recurved, especially in leaves near the shoot apex

base: basal cells shorter than other lamina cells; alar cells not differentiated

costa: none

border: not differentiated

margin: entire or nearly so, plane

cells: 50–90 × 4–7 μm, linear, firm-walled, smooth

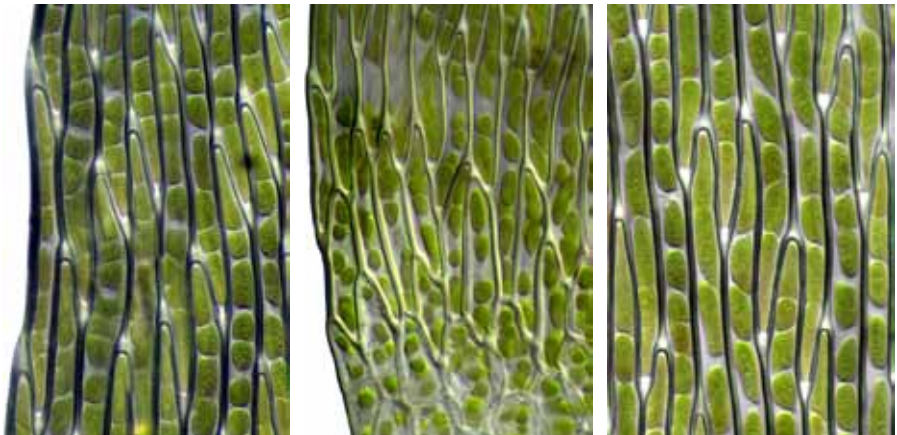
capsule: capsules not seen in New Zealand

note: known from only Raoul Island



vegetative shoots (dry) (4), leaf outline, and leaf apex

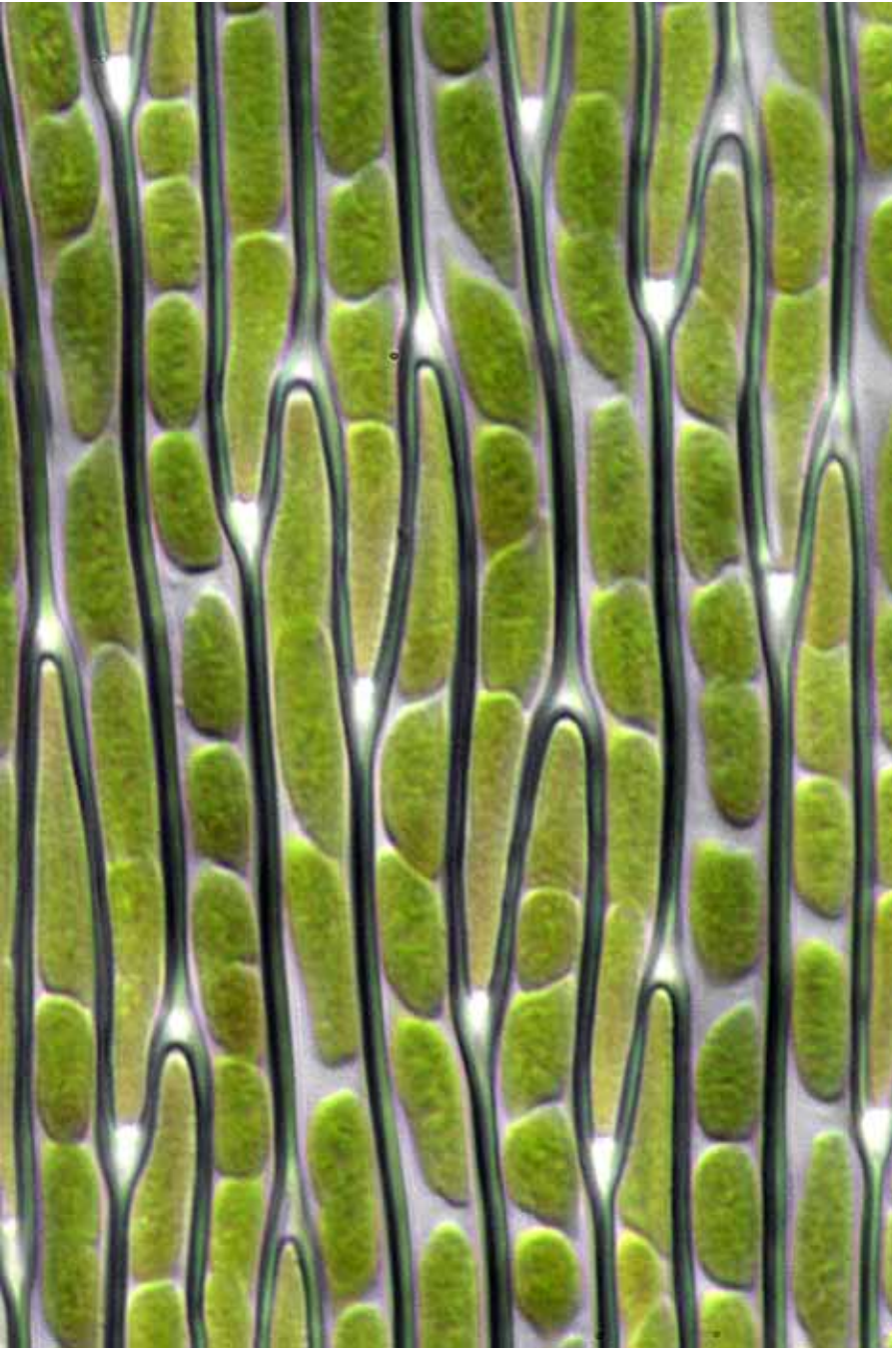
5 mm (2), 1 mm, 1 mm, 0.1 mm, 10 μm



margin at midleaf, near leaf basal angle, and cells at midleaf

10 μm, 10 μm, 10 μm

continued next page



Cryptogonium phyllogonioides cells midleaf
10 μm

Symphysodontella cylindracea (Mont.) Fleisch.

form: creeping, rhizomatous, leafless primary stem; secondary stems pale green, glossy, ± frondose

habitat: soil or bark

leaf: *size:* branch leaves 0.8–1.5 × 0.2–0.4 mm; stem leaves to 2.8 × 0.8 mm

shape: ovate-lanceolate, concave, abruptly acuminate

tip: acute

base: basal cells rectangular to quadrate, strongly porose

costa: absent or faint or short and double, the forks unequal

border: not differentiated

margin: entire to serrulate, plane

cells: branch leaf cells 30–60 × 5 μm; stem leaf cells to 100 × 8 μm, linear to vermicular, firm- to thick-walled, smooth

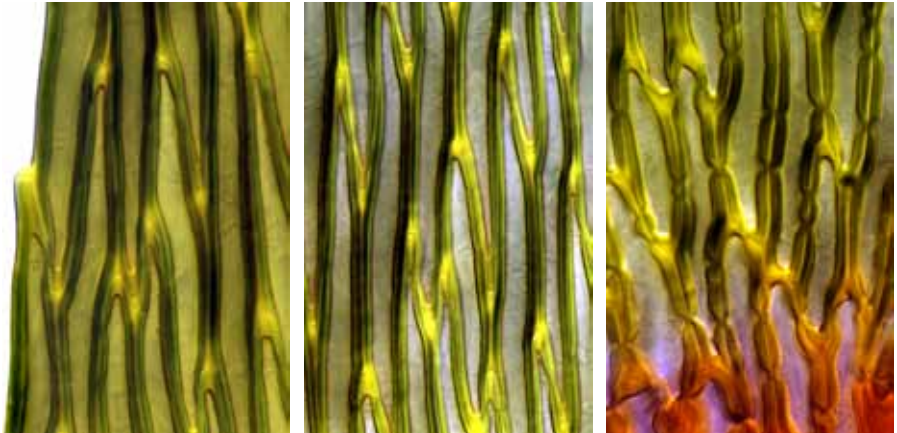
capsule: to 3 mm long, cylindric, erect, immersed; seta short; calyptra small, cucullate, naked; teeth 0.3 mm; endostome rudimentary

notes: known from only Raoul Island; capsules not seen in New Zealand



vegetative shoot (dry) (3), leaf outline, and leaf apex

5 mm, 5 mm, 1 mm, 0.5 mm, 10 μm



margin at midleaf, cells at midleaf, and cells at leaf base

10 μm, 10 μm, 10 μm

Orthorrhynchium elegans (Hook.f. & Wilson) Reich.

form: mats of creeping primary stems; secondary stems 20–40 mm long, distichous, closely pinnately branched, leaves dark green, glossy

habitat: bark or rarely rock in shady, damp forest

leaf: *size:* branch leaves to 1.1×0.4 mm; stem leaves similar

shape: oblong-rhombic, conduplicate, \pm falcate, the insertion narrow

tip: obtuse to rounded and truncate, overlapping in a \pm straight edge

base: alar cells not differentiated

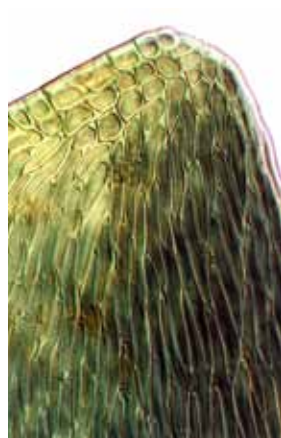
costa: none

border: not differentiated

margin: entire, plane

cells: $40\text{--}70 \times 4\text{--}6$ μm , subvermicular, firm-walled, smooth; uppermost apical cells rectangular in a distinct group (cucullus)

capsule: 6–1.1 mm, turbinate, erect, immersed, brown, wide-mouthed dry, columella exerted; seta 2–4 mm, reddish, straight, smooth; calyptra mitrate, hairy, covering capsule; peristome exostome only; spores 24–30 μm in diam.



vegetative habit and shoot, leaf outline, and leaf apex showing cucullus

■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm



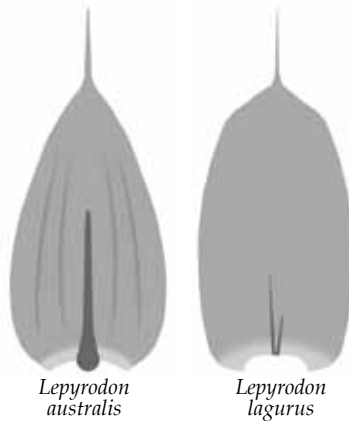
margin at midleaf, cells at midleaf, and margin near leaf base

■ 10 μm , ■ 10 μm , ■ 10 μm

Key* to the New Zealand species of Lepyrodon (2)

- 1 Leaves deeply plicate, to 2.5 mm long; midleaf cells 4–5 mm wide; peristome single, endostome only..... ● **Lepyrodon australis**
- 1: Leaves rugose but not plicate, to 4 mm long; midleaf cells 6–9 μm wide; peristome double..... ● **Lepyrodon lagurus**

* based on Allen, BH (1999): A revision of the moss genus *Lepyrodon* (Leucodontales, Lepyrodontaceae). *Bryobrothera* 5, 27.



Lepyrodon australis Broth.

form: mats of creeping, tomentose stems, 5–20(–50) mm tall,
leaves pale to bright or yellow-green, glossy

habitat: bark, rock, or logs in dryish upland forest, to 1600 m

leaf: size: 1.5–2.5 × 0.7–1.2 mm

shape: ovate-lanceolate, plicate, concave

tip: narrowly acuminate, ending in a hair-point

base: alar cells quadrate, dark, in small auricles

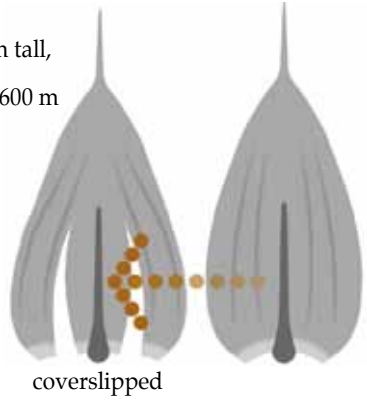
costa: reaching about midleaf

border: not differentiated

margin: serrulate above, plane

cells: 30–50 × 4–5 μm above, 40–80 × 4–5 μm below,
linear, incrassate, ± porose, smooth

capsule: 2–3.5 mm, cylindric, exserted, erect, brown;
seta 9–14 mm; calyptra naked, cucullate; operculum
obliquely rostrate; endostome only; spores 13–24 μm

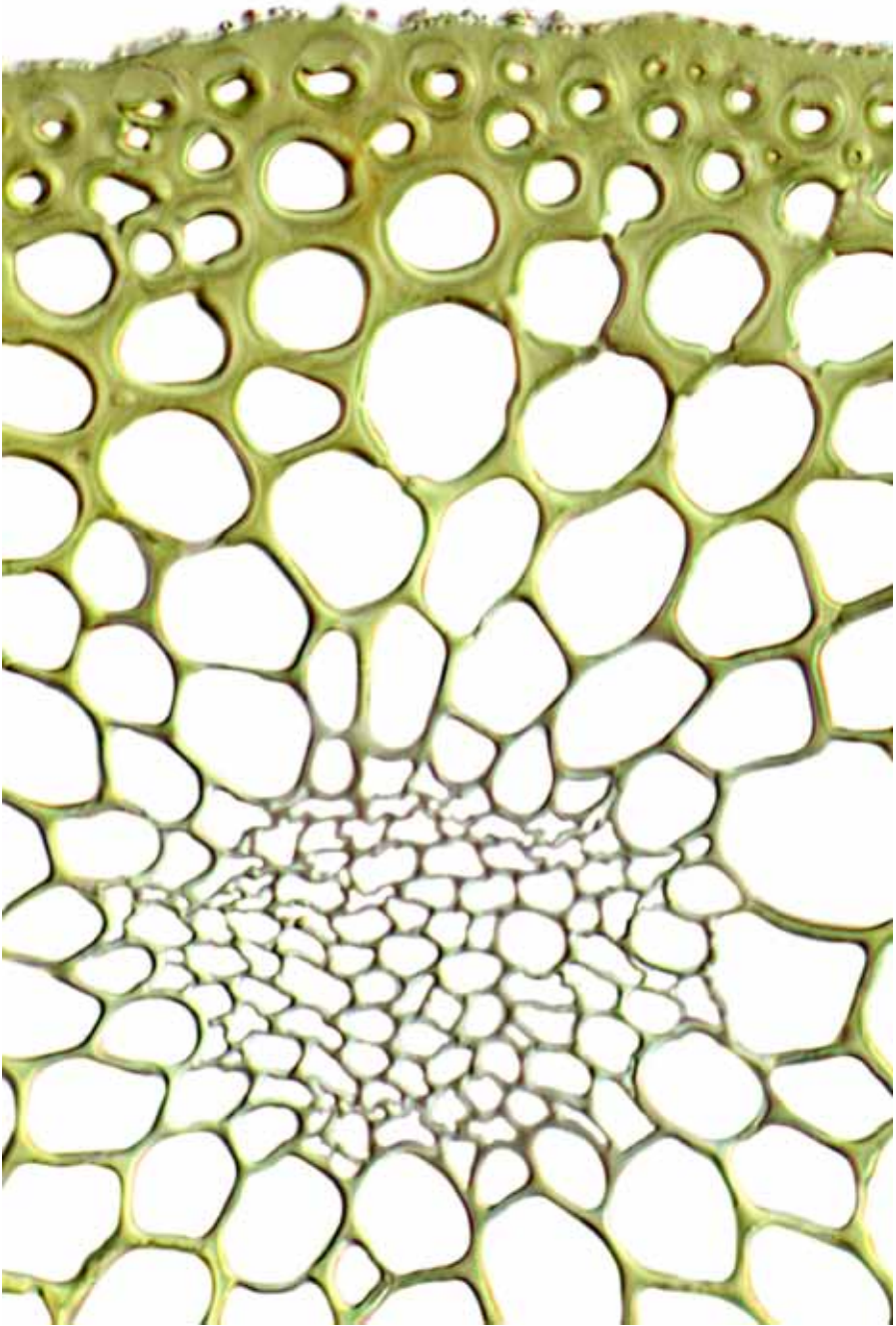


fertile and vegetative shoots, flagellate propagule, capsules, leaf outline, hair-point (2)
■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 1 mm (2), ■ 0.1 mm, ■ 5 μm, ■ 5 μm



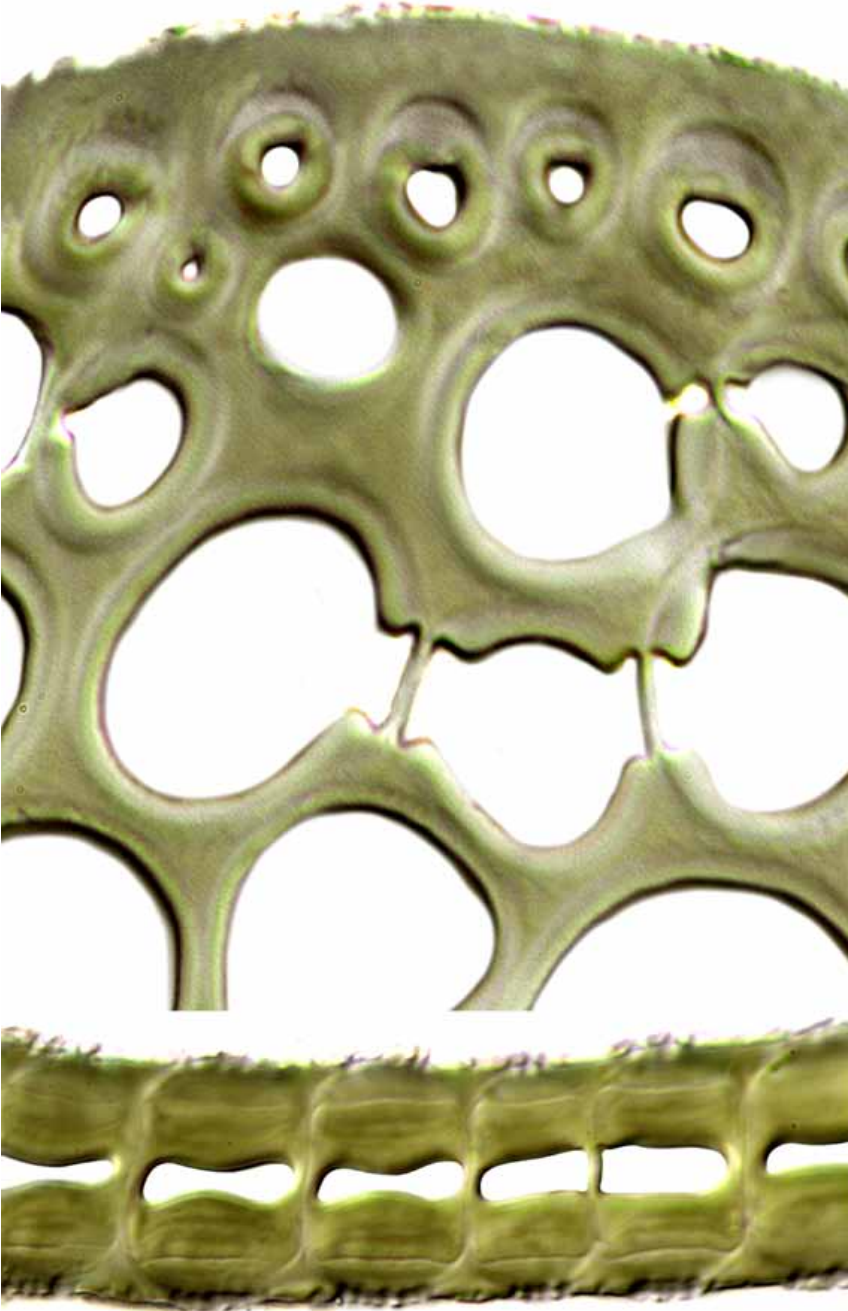
margin of upper leaf, cells at midleaf, and leaf basal angle
■ 10 μm, ■ 10 μm, ■ 50 μm

continued next page



Lepyrodon australis stem cross-section showing thick-walled cells of outermost stiffening collar, porose cells of cortex, and thin-walled cells of well-developed central strand
10 μ m

continued next page



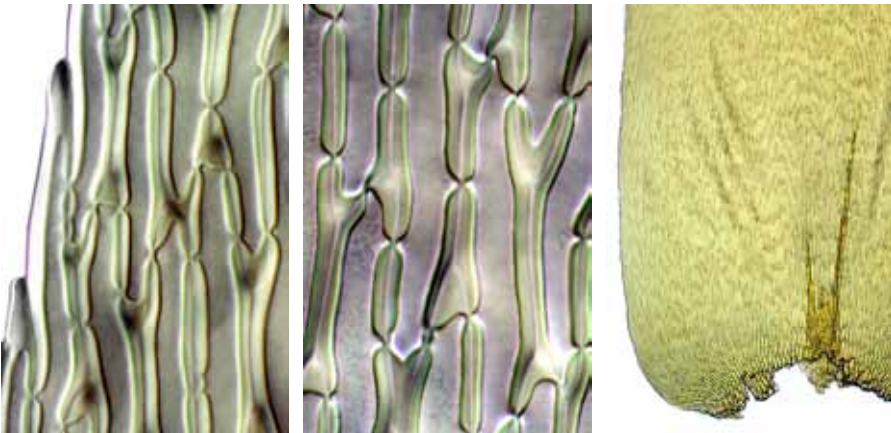
Lepyrodon australis (above) stem cross-section showing porose cells of cortex (detail), and (below) leaf cross-section showing thick-walled cells

10 μm (above),

10 μm (below)

Lepydodon lagurus (Hook.) Mitt.**form:** mats of tomentose, branched stems, 10–50 mm, leaves pale green, glossy**habitat:** bark, rotting logs, or rock in damp montane forest, herbfields, and tussock**leaf:** size: 1.5–4 × 0.9–1.4 mm (minus acumen)*shape:* oblong to broadly ovate, concave, symmetric, rugose above, not plicate*tip:* narrowed to a short or long capillary hair-point*base:* alar cells not differentiated*costa:* broad below, short and double or single and reaching to midleaf*border:* not differentiated*margin:* weakly serrulate above, plane*cells:* 50–90 × 6–9 μm, linear-vermicular, ± porose, thick-walled, smooth**capsule:** 1.5–2.8 mm, cylindric, long-exserted, erect, brown; seta 13–23 mm; calyptra cucullate, naked to sparsely erect-hairy; operculum obliquely rostrate; peristome mostly endostome, segments 16, perforate, 400 μm tall, hyaline, papillose, cilia absent or rudimentary; spores spherical, 12–17 μm in diam., papillose

vegetative shoots (dry), capsules with calyptrae, leaf outline, leaf apex, and leaf subapex
 ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 1 mm, ■ 0.5 mm, ■ 5 μm, ■ 5 μm

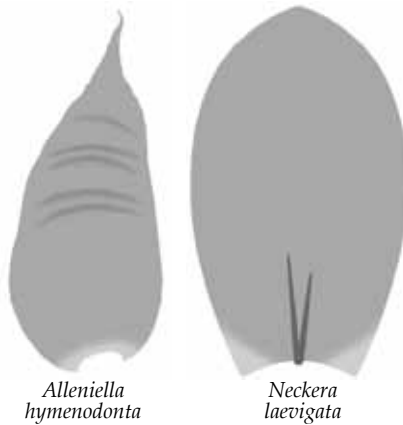


margin at midleaf, cells at midleaf, and leaf basal angle
 ■ 10 μm, ■ 10 μm, ■ 100 μm

Key* to the New Zealand species of *Alleniella* and *Neckera* (2)

- 1 Leaf blade strongly undulate; apex acuminate..... ● ***Alleniella hymenodonta***
1: Leaf blade ± rugose but not undulate; apex rounded or obtuse.. ● ***Neckera laevigata***

* based on Ji, M-C; Enroth, J (2008): *Neckera hymenodonta* (Neckeraceae, Bryopsida) reinstated, with an emended description. *Annales Botanici Fennici* 45, 277–280.



Alleniella hymenodonta (Müll.Hal.) S.Ohlsson, Enroth & D.Quandt
formerly *Neckera hymenodonta* Müll.Hal.

form: primary stem stoloniferous, secondary stem pinnately branched, to 150 mm
long, complanate, paraphylliate, leaves olive-green to bronze, glossy

habitat: bark in damp forest, lowland to montane

leaf: size: 2–2.5 × 0.8–1.0 mm

shape: oblong-lanceolate to oblong-ovate, strongly undulate

tip: acute to acuminate

base: small alar groups of subquadrate cells

costa: absent, faint, or short and double

border: not differentiated

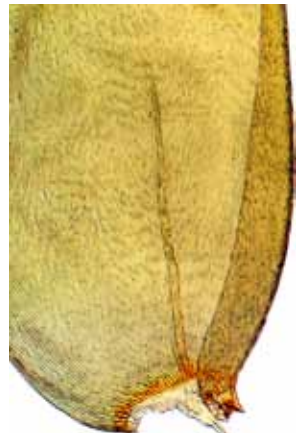
margin: serrulate at the apex, sinuose-serrulate below, plane

cells: 40–50 × 3–4.5 μm, oblong-linear, flexuose, incrassate, smooth

capsule: 1.5 mm, oblong-ovoid, erect, immersed to slightly exerted,
brown; seta 1 mm; calyptra cucullate, glossy; operculum conic-rostrate;
endostome rudimentary



fertile shoot (dry), mature capsule, peristome, paraphyllium, leaf outline, and leaf apex
 ■ 1 mm, ■ 0.5 mm, ■ 0.1 mm, ■ 50 μm, ■ 0.1 mm, ■ 0.1 mm



margin of upper leaf, cells at midleaf, and leaf base
 ■ 10 μm, ■ 10 μm, ■ 0.25 mm

continued next page

Neckera laevigata Hook.f. & Wilson

form: primary stems creeping, secondary stems branched, trailing, to 60 mm long, flattened, leaves green to yellow-green, dull to \pm glossy

habitat: bark in shaded forest, lowland to montane

leaf: size: 1.3–2 mm

shape: widely oval to oblong, rugose but not transversely undulate

tip: widely obtuse to rounded, sometimes slightly apiculate

base: angle cells subquadrate, thick-walled

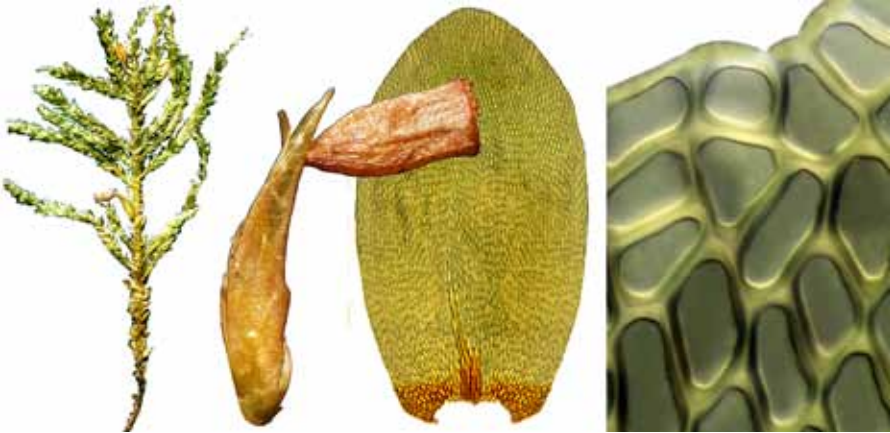
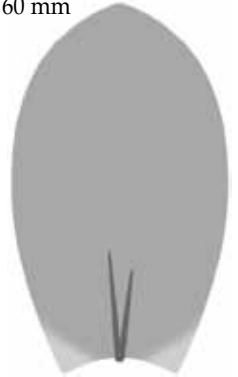
costa: absent, single to halfway up the lamina, or short and double

border: not differentiated

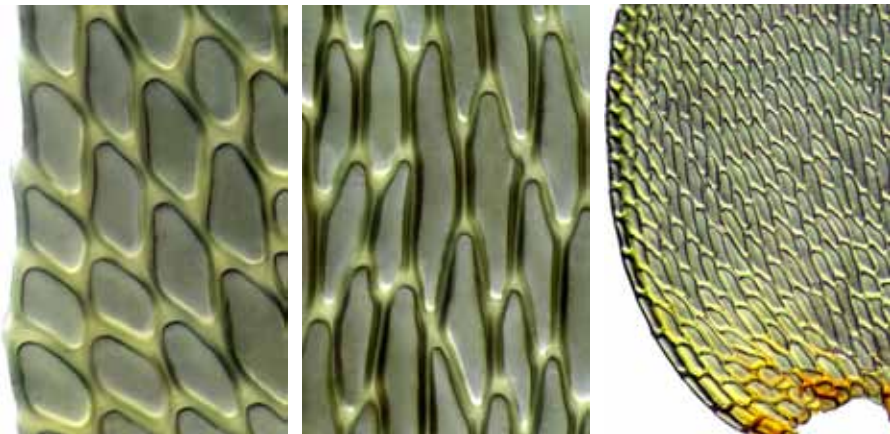
margin: entire below, \pm denticulate near apex; inflexed 1–2 sides

cells: 25–50 μ m \times 8 μ m, rhombic (oval near tip), firm-walled, smooth

capsule: 1–1.5 mm, oblong, necked, exserted, erect to inclined, red-brown; seta 1.5 mm; calyptra cucullate, naked, smooth; operculum conico-rostrate; exostome teeth pale, subulate, endostome reduced; spores 24–28 μ m in diam., papillose

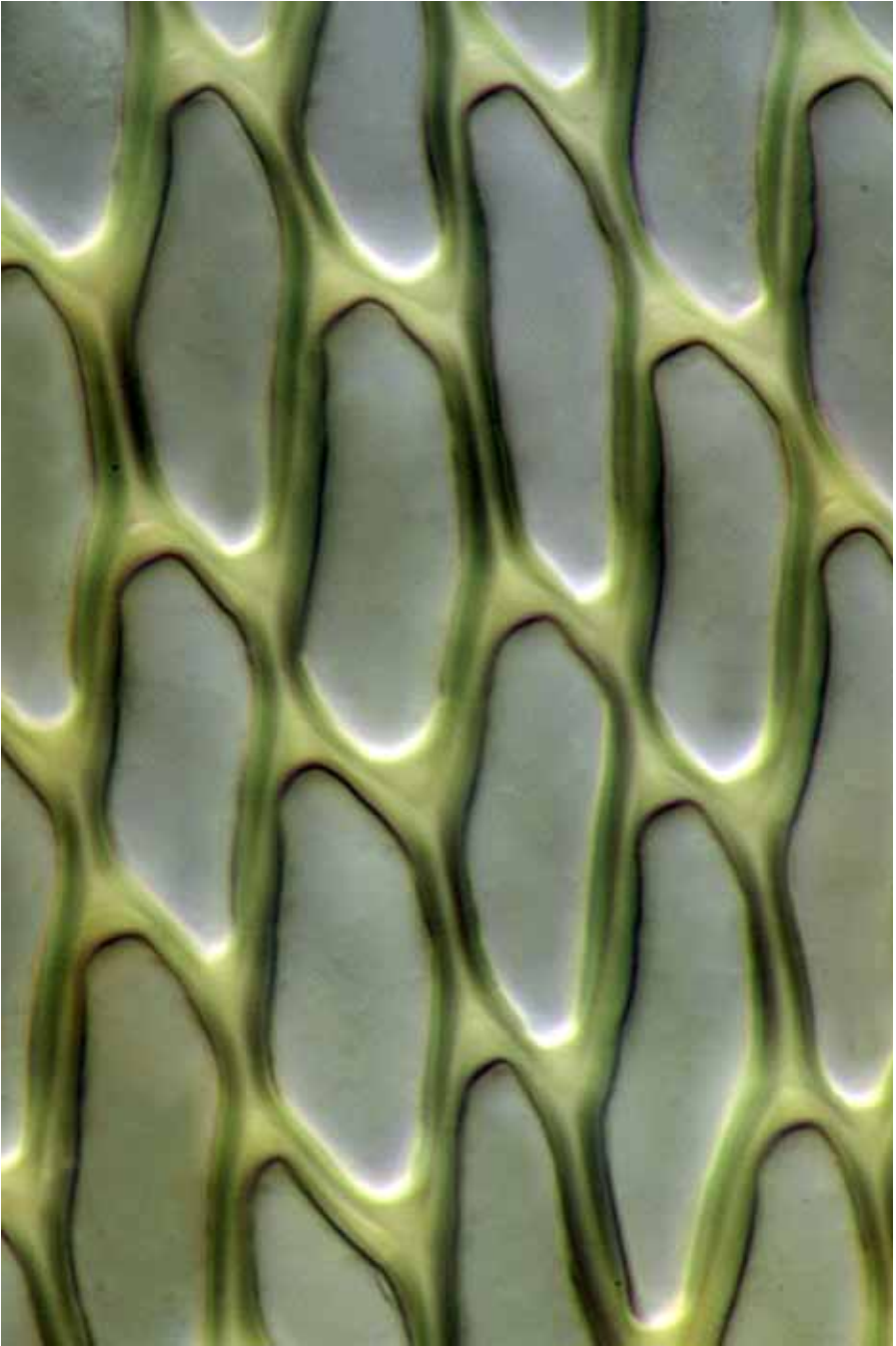


fertile shoot (dry), perichaetial branch and capsule, leaf outline, and margin near apex
 5 mm, 1 mm, 0.1 mm, 10 μ m



margin of upper leaf, cells at midleaf, and leaf basal angle
 10 μ m, 10 μ m, 50 μ m

continued next page



Neckera laevigata cells upper leaf
10 μm

Neckeropsis lepineana (Mont.) Fleisch.

form: primary stem creeping; secondary stem branched, to 300 mm long, pendent, complanate, leaves yellowish green, glossy, undulate

habitat: trunk or twig bark, or less often soil, in damp montane forest

leaf: size: 1.5–3.5 mm long

shape: lingulate, asymmetric, strongly undulate, complanate

tip: rounded, truncate

base: clasping and decurrent on the distal side

costa: absent or unequally short and double, rarely triple

border: not differentiated

margin: faintly serrulate, inflexed on one side

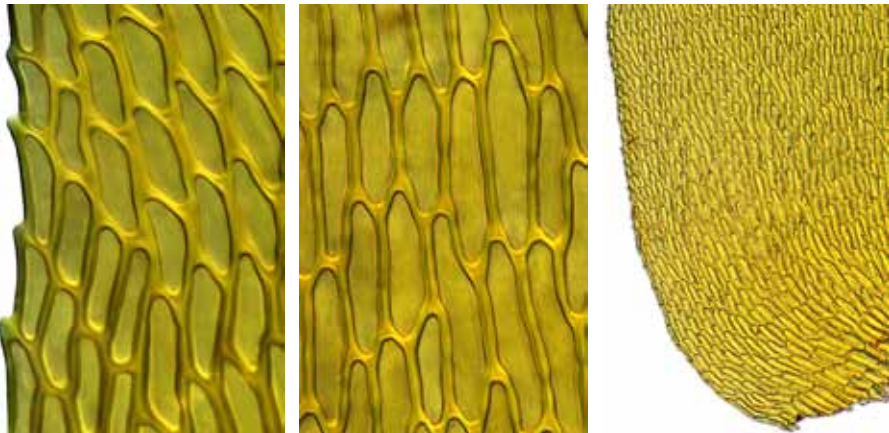
cells: 6–15 × 5–15 μm, rhombic, firm-walled, smooth

capsule: 2 mm, ellipsoid, lateral, erect, immersed, brown; seta 0.5 mm; calyptra cucullate, ± hairy; operculum obliquely short-rostrate; exostome teeth papillose, endostome segments yellow, perforate; spores 20–30 μm in diam., brown



vegetative shoots (dry) (3), leaf outline, and leaf apex

5 mm, 5 mm, 1 mm, 1 mm, 10 μm



margin at midleaf, cells at midleaf, and leaf basal angle

10 μm, 10 μm, 100 μm

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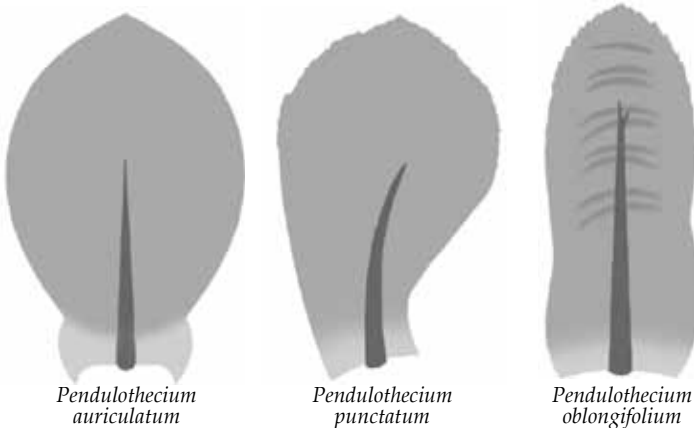


Neckeropsis lepineana margin midleaf
10 μm

Key* to the New Zealand species of *Pendulothecium* (3)

- 1 Leaves distinctly undulate; branch leaf costa reaching > 80% up blade..... ● ***Pendulothecium oblongifolium***
- 1: Leaves not or only weakly undulate; branch leaf costa reaching only 50% up blade ...2
- 2(1:) Secondary stem leaves to 1.8 mm long; base auricled; margin entire to denticulate above; apical cells to 25 μm long ● ***Pendulothecium auriculatum***
- 2: Secondary stem leaves to 1.1 mm long; base not or only indistinctly auricled; margin strongly and irregularly dentate above; apical cells mostly 10–12 μm long ● ***Pendulothecium punctatum***

* based on Enroth, J; He, S (1991): Notes on the Neckeraceae (Musci) 8: *Pendulothecium*, a new genus from New Zealand and Norfolk Island. *New Zealand Journal of Botany* 29, 10.



Pendulothecium auriculatum (Hook.f. & Wilson) Enroth & He

form: primary stem creeping; secondary stem frondose, \pm bipinnately branched, brittle, leaves brownish or yellow-green, \pm glossy

habitat: soil, rotting wood, or rock in wet (> 1250 mm/year) forest

leaf: *size:* branch leaves to 1.8 mm; stem leaves slightly longer

shape: stem leaves spatulate; branch leaves obovate-orbicular from a narrow base, with 1–2 lunate undulations, auriculate

tip: round or \pm mucronate

base: \pm auricled; juxtacostal cells to $40 \times 5\text{--}6 \mu\text{m}$, porose

costa: reaching about halfway up the lamina

border: marginal cells shorter than the inner laminal cells

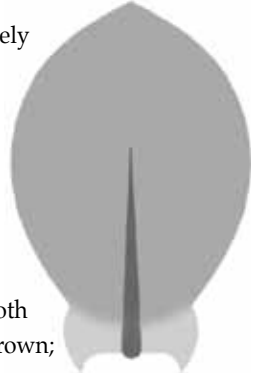
margin: irregularly denticulate above, entire below, plane

cells: $12\text{--}25 \times 5\text{--}6 \mu\text{m}$, oval to rhombic, thick-walled, \pm porose, smooth

capsule: to 1.5 mm; ellipsoid, lateral, exserted, cernuous, orange-brown;

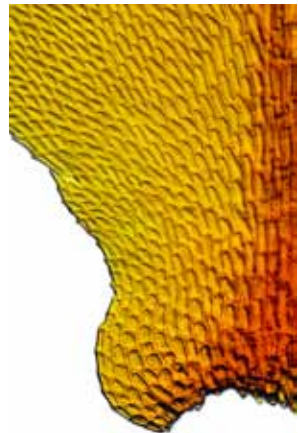
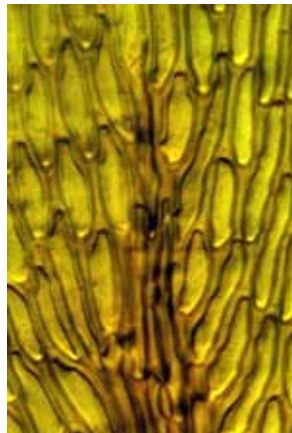
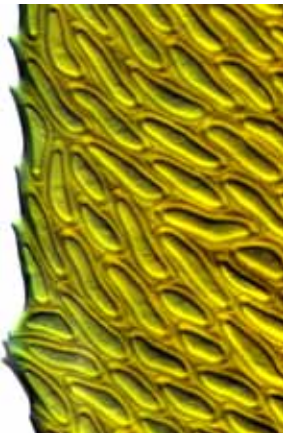
seta about 12 mm; operculum conic-rostrate; calyptra cucullate;

peristome hypnoid; spores yellow



frondose vegetative shoot (dry), branch leaf outline, and branch leaf apex

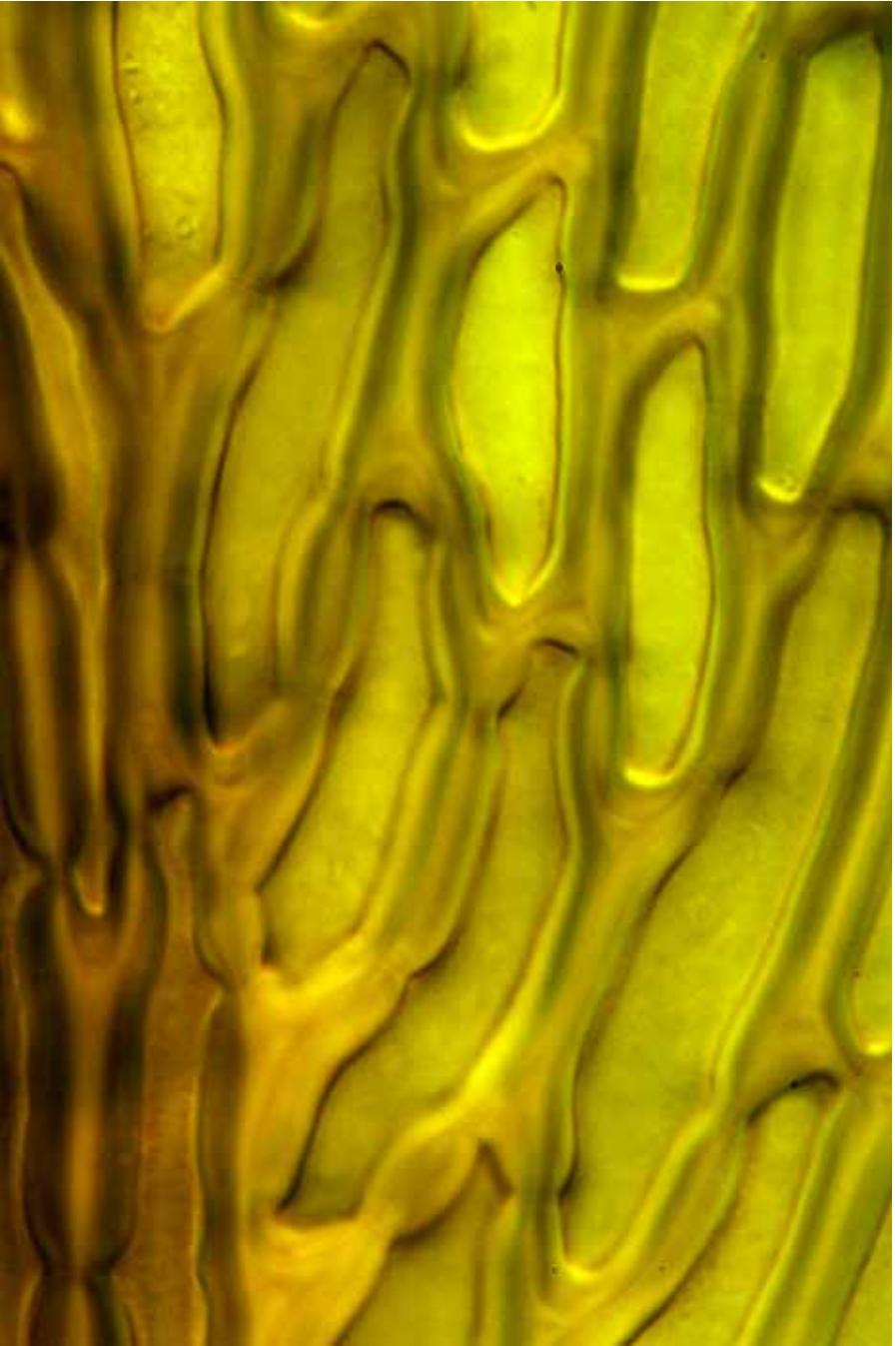
5 mm, 0.1 mm, 10 μm



margin at midleaf, costa terminus, and auricle in leaf basal angle

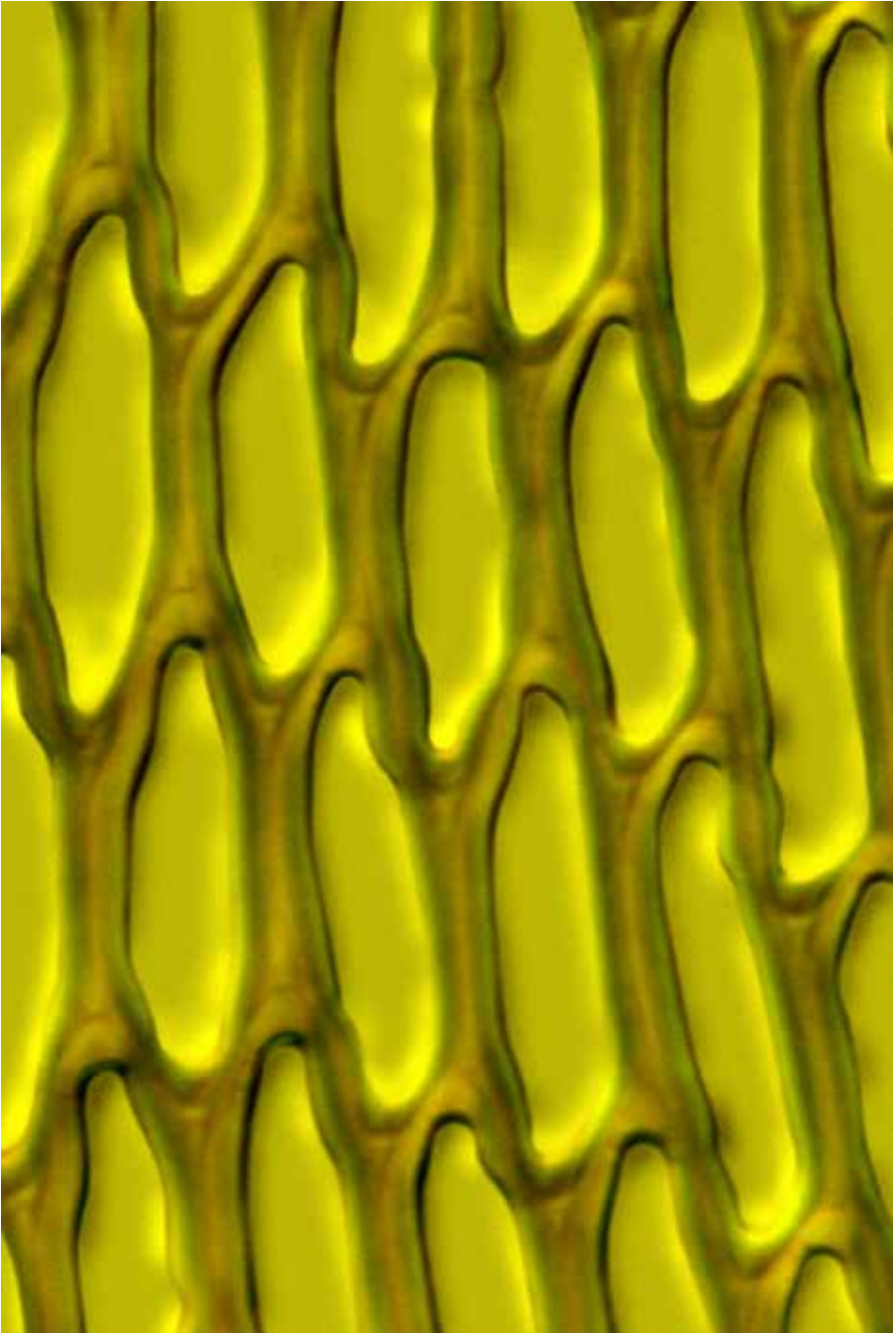
10 μm , 10 μm , 50 μm

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Pendulothecium auriculatum juxtacostal cells in lower leaf
10 μm

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Pendulothecium auriculatum midleaf cells
10 μm

continued next page

Pendulothecium oblongifolium (Hook.f. & Wilson) Enroth & S.He

form: primary stem creeping; secondary stem bipinnately branched, frondose, with flagelliform, microphyllous branches, leaves dull, sordid green

habitat: soil, bark, rotting wood, or rock in damp, shady forest

leaf: size: to 1.5 mm; subsidiary frond leaves to 0.8 mm

shape: oblong to lingulate or spatulate from a broad base, undulate

tip: broadly acute to obtuse, ± mucronate

base: sometimes auricled, basal cells ± rectangular, to $30 \times 5-6 \mu\text{m}$

costa: strong, single, reaching 70% or more up the lamina

border: not differentiated

margin: entire below, irregularly toothed above, plane

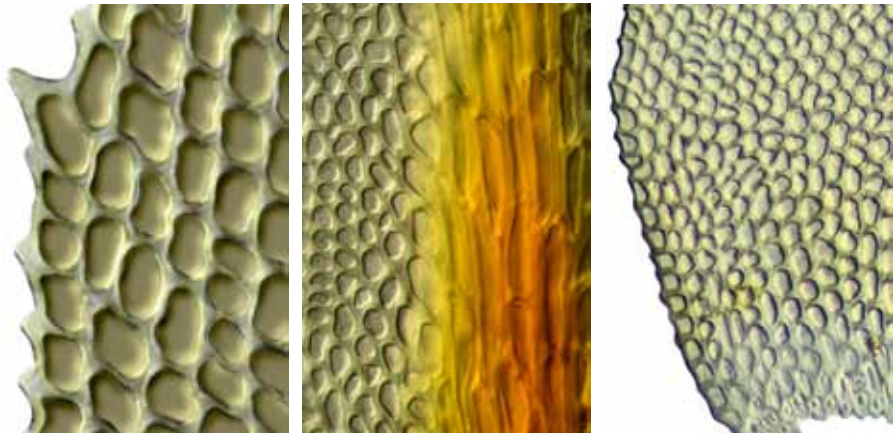
cells: $10-12 \times 6-8 \mu\text{m}$, isodiametric to oblong, thick-walled, ± papillose

capsule: to 1 mm, oblong, lateral, exserted, horizontal or pendent, light brown; seta 7-9 mm, slender, reddish; annulate; calyptra cucullate; operculum curved long-rostrate; peristome hypnoid; spores $16-20 \mu\text{m}$ in diam., yellowish, smooth



vegetative and subsidiary fronds, leaf outlines (2), and leaf apex

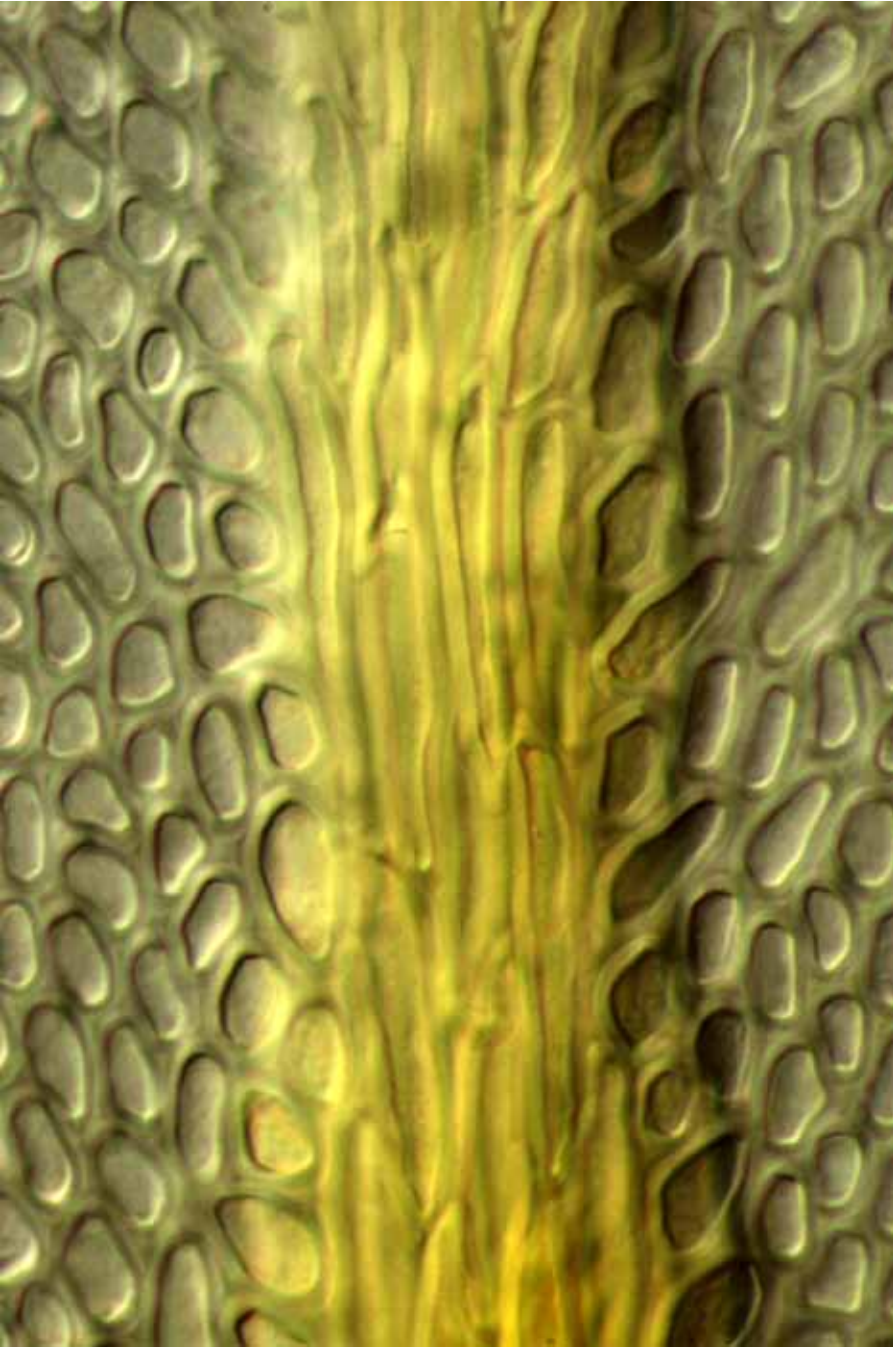
■ 1 mm, ■ 0.1 mm (2), ■ $10 \mu\text{m}$



margin at midleaf, costa near leaf base, and leaf basal angle

■ $10 \mu\text{m}$, ■ $50 \mu\text{m}$, ■ $50 \mu\text{m}$

continued next page



Pendulothecium oblongifolium costa midleaf
10 μ m

continued next page

Pendulothecium punctatum (Hook.f. & Wils.) Enroth & S.He

form: primary stem creeping; secondary stem \pm unbranched, frondose, leaves yellowish or brownish, dull, dark green to sordid green

habitat: shaded bark, rock, or soil in damp to wet forest

leaf: size: to 1.8 mm

shape: obovate-orbicular

tip: obtuse to rounded, \pm mucronate

base: basal cells $40 \times 5-7 \mu\text{m}$

costa: wide at the base, reaching above midleaf, \pm bifurcate

border: not differentiated

margin: irregularly dentate above, plane

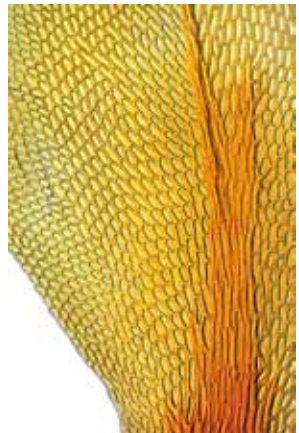
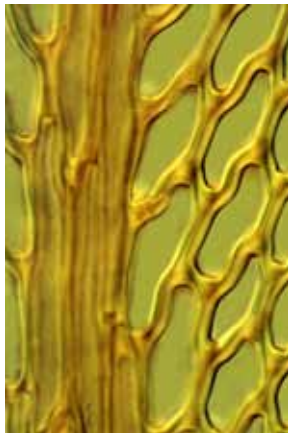
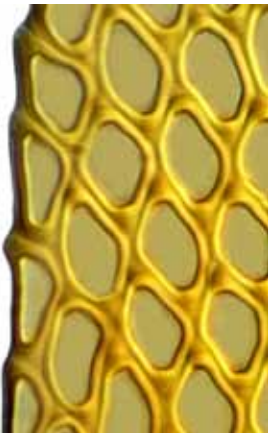
cells: $10-20 \times 5-6 \mu\text{m}$, quadrate to hexagonal, firm-walled, smooth

capsule: 1.3 mm; oblong to ellipsoid, exserted, cernuous to pendent, light brown; seta 13-15 mm, reddish, not twisted; calyptra cucullate; operculum curved conic-rostrate; peristome hypnoid; spores $16-20 \mu\text{m}$ in diam., yellowish, smooth



vegetative habit, shoot, leaf outline, and leaf apex

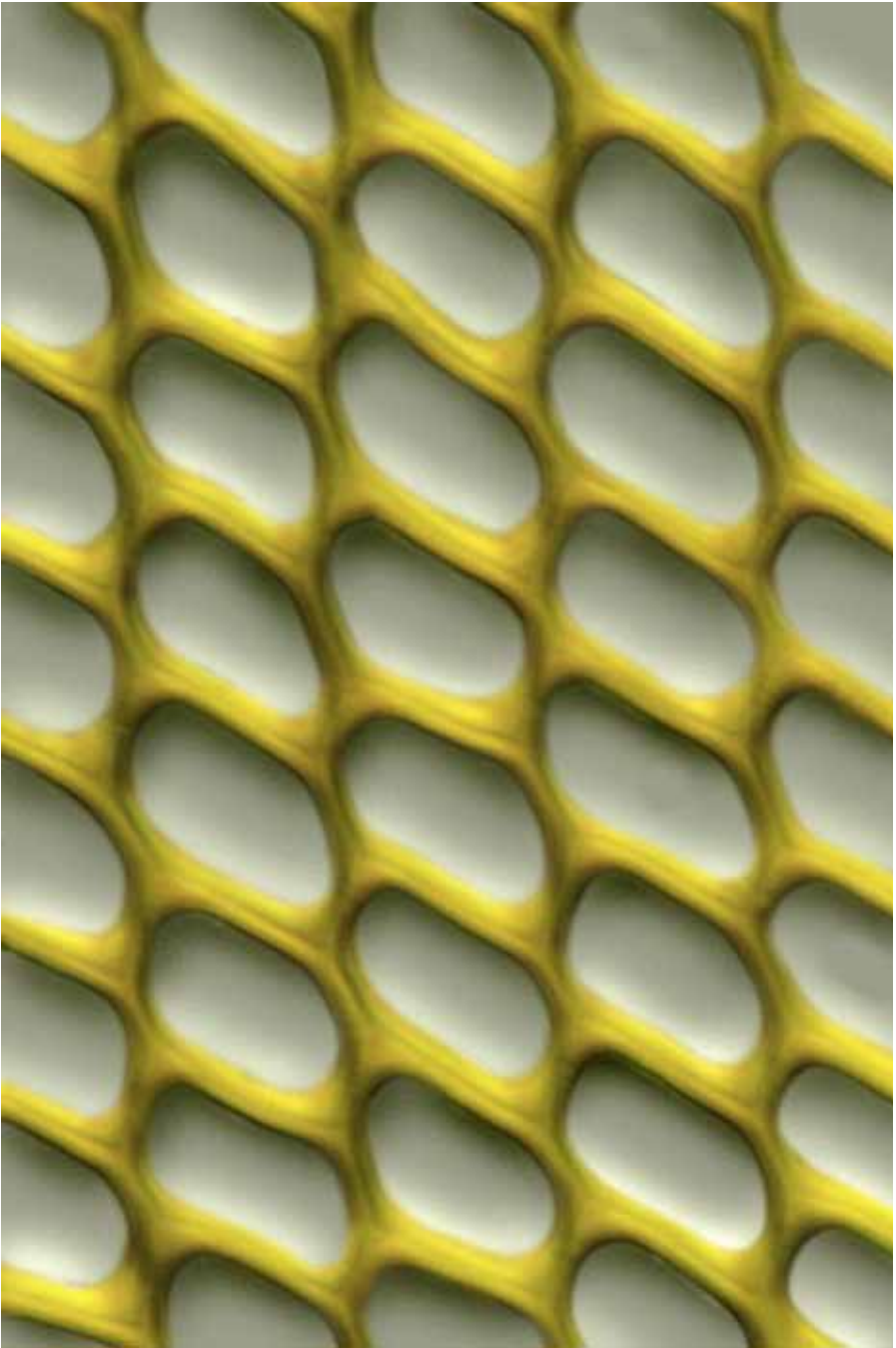
■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm



margin at midleaf, costa at midleaf, and just above leaf basal angle

■ 10 μm , ■ 10 μm , ■ 50 μm

continued next page

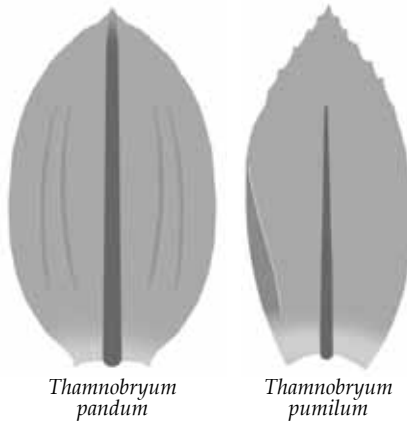


Pendulothecium punctatum cells midleaf
10 μm

Key* to the New Zealand species of *Thamnobryum* (2)

- 1 Leaves 1–2 mm long, ± plicate; costa failing just below the apex ● ***Thamnobryum pandum***
 1: Leaves < 1 mm long, not plicate; costa ending far below the apex ● ***Thamnobryum pumilum***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 371.



Thamnobryum pandum (Hook.f. & Wilson) I.G.Stone & G.A.M.Scott

form: primary stem creeping, secondary stem wiry, arcuate, flexuose, frondose, to 100 mm long, leaves green to nearly black

habitat: soil (rarely bark) or rock, ± submerged in streams in damp forest

leaf: size: 1–2 mm

shape: oval to broadly oblong, concave below

tip: broadly acute

base: basal cells little differentiated

costa: stout, narrow above, failing below the apex

border: not differentiated

margin: irregularly coarsely serrulate, inflexed on one side

cells: 12–20 × 6–10 μm, 4–6-sided, firm-walled, smooth

capsule: 2–2.5 mm, broadly ovoid, symmetrical, exserted, inclined, brown; seta 10–20 mm, red, flexuose, smooth; calyptra cucullate, naked, smooth; operculum obliquely conic-rostrate; exostome teeth yellow, hyaline-bordered; endostome cilia 2–4; spores 10–12 μm in diam.



vegetative branch (2), leaf outline, and leaf apex

1 mm, 1 mm, 0.5 mm, 50 μm



margin at midleaf, cells at midleaf, and margin near leaf base

10 μm, 10 μm, 10 μm

continued next page

Thamnobryum pumilum (Hook.f. & Wilson) I.G.Stone & G.A.M.Scott

form: primary stem creeping; secondary stem complanate, stoloniferous, to 100 mm long, bipinnately branched, leaves dull green

habitat: rock in streams

leaf: size: 0.8×0.4 mm

shape: elliptic-spathulate to oblong-spathulate, \pm asymmetric, concave

tip: acute to shortly acuminate

base: basal cells longer than the blade cells

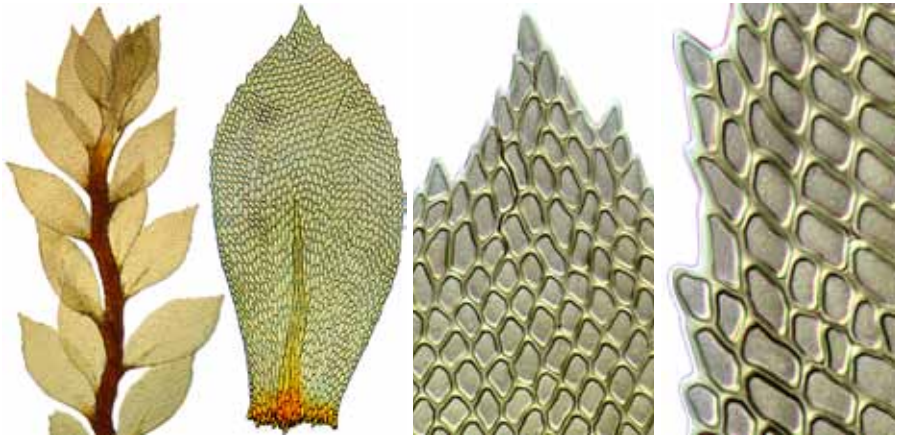
costa: stout below, failing far below the apex

border: not differentiated

margin: serrulate in upper half, plane to incurved on one side below

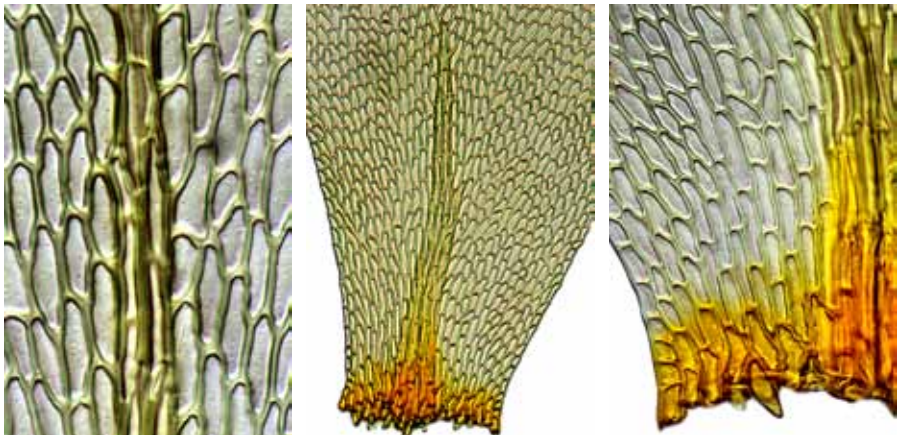
cells: $12-16 \times 6-8 \mu\text{m}$, irregularly 4-6-sided, firm-walled, smooth

capsule: 1.3-2 mm, ovoid, \pm asymmetric, gibbous, exserted, inclined, brown; seta 7-10 mm, curved, red; operculum erect conic-rostrate, calyptra cucullate, naked, smooth; exostome teeth cross-striolate, endostome cilia 2-4; spores 8-12 μm in diam., green, smooth



shoot (cleared), leaf outline, leaf apex and margin midleaf

0.5 mm, 0.1 mm, 10 μm , 10 μm

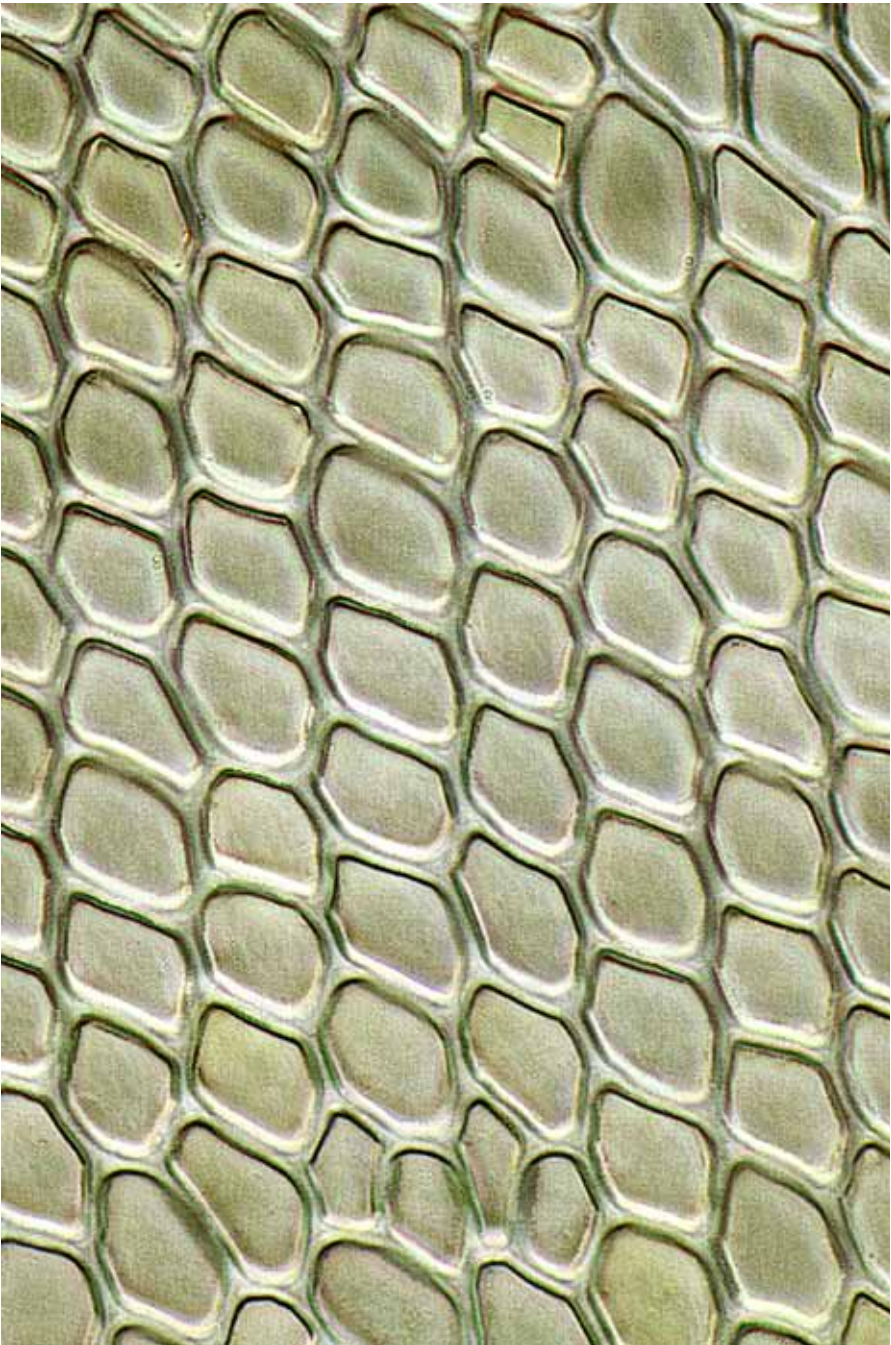


costa at midleaf, leaf base, and leaf basal angle

10 μm , 50 μm , 10 μm



Thamnobryum pumilum costa terminus
10 μm

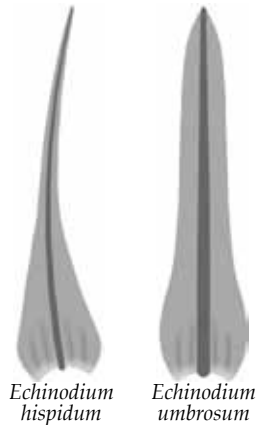


Thamnobryum pumilum lamina cells
10 μ m

Key* to the New Zealand species of Echinodium (2)

- 1 Plants robust; leaves 2.5–4 mm long, ovate-lanceolate; cells 8–15 μm ● **Echinodium hispidum**
 1: Plants slender; leaves 1–2.5 mm long, ligulate or lingulate from a wider base; cells 6–8 μm ● **Echinodium umbrosum**

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 371.



Echinodium hispidum (Hook.f. & Wilson) Reichardt

form: primary stem wiry, creeping, ± leafless; secondary stem pinnately branched, rough, 40–100 mm long, leaves dull, dark green to yellow-green

habitat: soil, root bark, or rock, sometimes aquatic, in damp to wet forest

leaf: size: 3.5–5 × 0.9–1.3 mm

shape: subulate from a triangular base, ± plicate at the base

tip: long-acute

base: basal cells longer than the blade cells

costa: long-excurrent in a rigid arista

border: not differentiated

margin: entire, plane or recurved below on one side, variably bistratose above

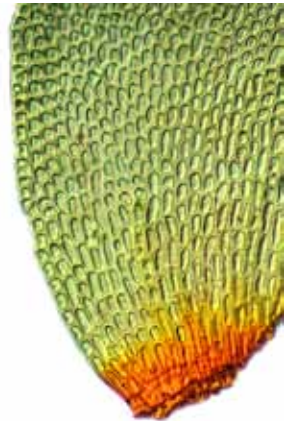
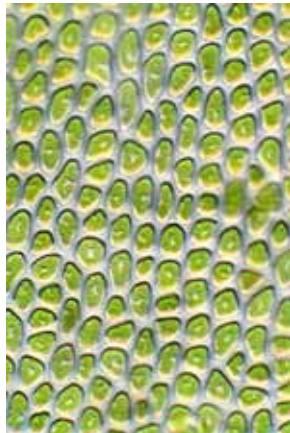
cells: 4–12 μm, quadrate to fusiform, incrassate, smooth

capsule: 1.5–2.0 mm, ± curved, reddish brown; oval, long-exserted, inclined to horizontal, dark brown; seta 10–25 mm; calyptra cucullate, smooth; operculum obliquely long-rostrate; exostome teeth orange, striate, endostome cilia 2; spores 12–14 μm in diam., papillose



shoots (moist on right) (3), mature capsule (2), leaf outline, and leaf apex

5 mm, 1 mm (2), 1 mm, 1 mm, 0.5 mm, 10 μm



leaf margin, cells at midleaf, and leaf basal angle

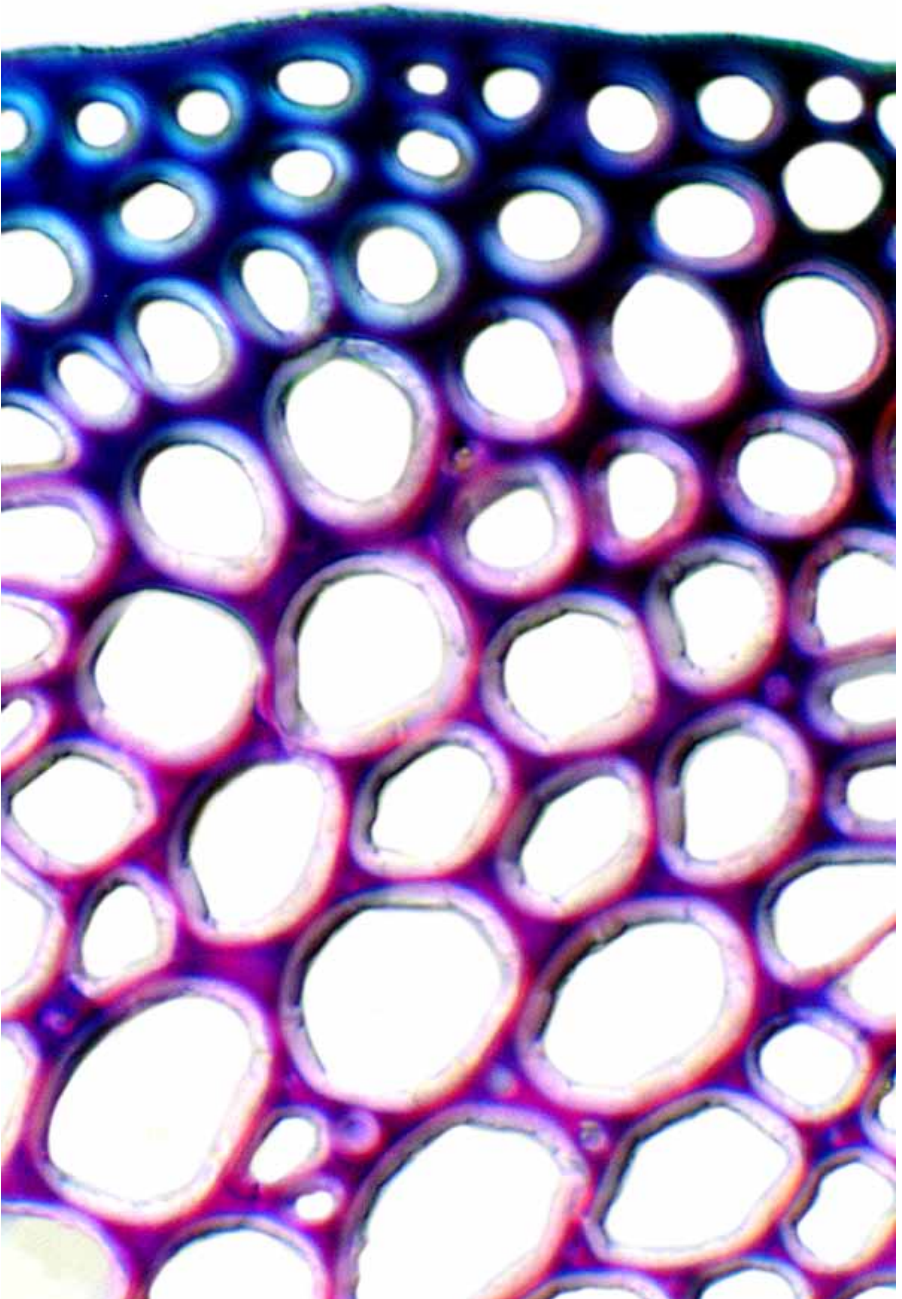
10 μm, 10 μm, 50 μm

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Echinodium hispidum vegetative shoot
5 mm

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Echinodium hispidum stem cross-section showing outermost stiffening collar
10 μm

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Echinodium hispidum leaf cross-section showing prominent costa
50 μm (above), 10 μm (below)

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Echinodium umbrosum (Mitt.) A. Jaeger

form: primary stem creeping; secondary stem to 30 mm long, pseudoparaphylliate, leaves dark green to blackish, dull or glossy

habitat: soil and rock in damp shady forest

leaf: size: 2–3 × 0.3–0.5 mm

shape: lanceolate from a narrowly ovate base, ± plicate below

tip: acute, ± curved

base: basal margin cells longer than other lamina cells, 12–22 μm

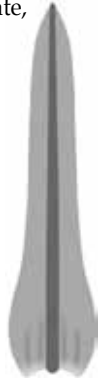
costa: stout and wide, percurrent to shortly excurrent

border: not differentiated

margin: denticulate to serrate above, plane

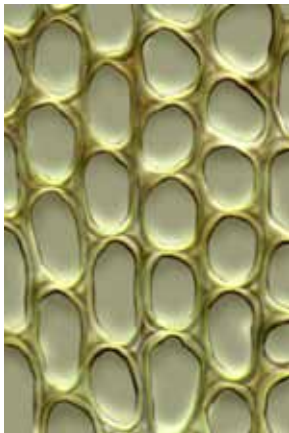
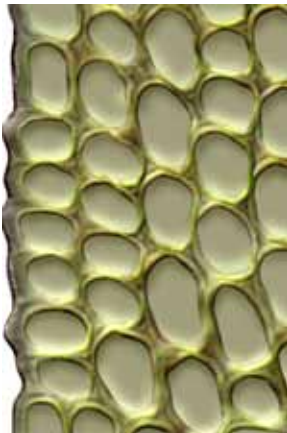
cells: 6–10 μm, rounded-quadrate to oblong, thick-walled, ± prorulose

capsule: 1.2 mm; subglobose, exserted, inclined, reddish-orange; operculum long-rostrate; annulus uniseriate; seta 12–20 mm, dark reddish orange; calyptra cucullate, smooth; exostome teeth 550 × 100 μm, endostome segments shorter, cilia 2; spores 12–14 μm in diam., papillose



vegetative habit, leaf outline, and leaf apex (2)

1 mm, 0.5 mm, 100 μm, 50 μm



margin at midleaf, cells at midleaf, and just above leaf basal angle

10 μm, 10 μm, 50 μm

continued next page



Echinodium umbrosum vegetative habit

1 mm

Leptodon smithii (Hedw.) F.Weber & D.Mohr

form: primary stems creeping, brittle; secondary stems to 30 mm long, ± pinnately branched, strongly incurled when dry, paraphylliate, leaves 8-ranked, lateral leaves spreading, dorsal and ventral leaves appressed

habitat: bark or limestone rock in dryish forest, sea level to 1360 m

leaf: size: stem leaves $0.5\text{--}0.7 \times 0.3\text{--}0.5$ mm; branch leaves smaller

shape: orbicular-ovate to elliptic, ± asymmetric, weakly plicate

tip: obtuse to rounded

base: cells in mid-base slightly longer than the blade cells

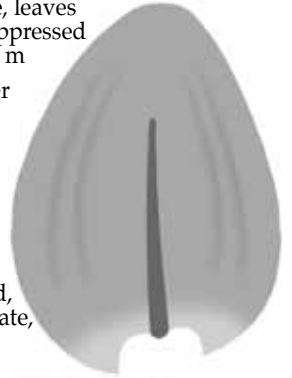
costa: wide below, reaching $3/4$ up lamina, ± spurred

border: not differentiated

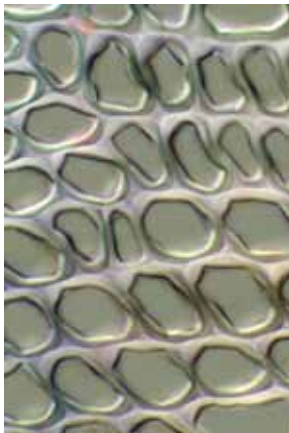
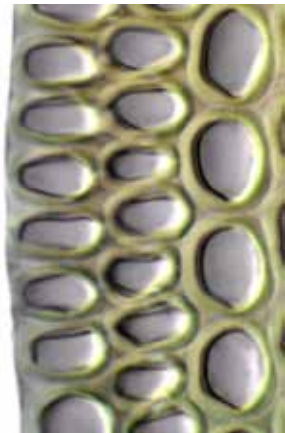
margin: entire, inrolled on one side below

cells: $9\text{--}15 \times 5\text{--}7$ μm , ± oval, thick-walled, smooth to ± papillose

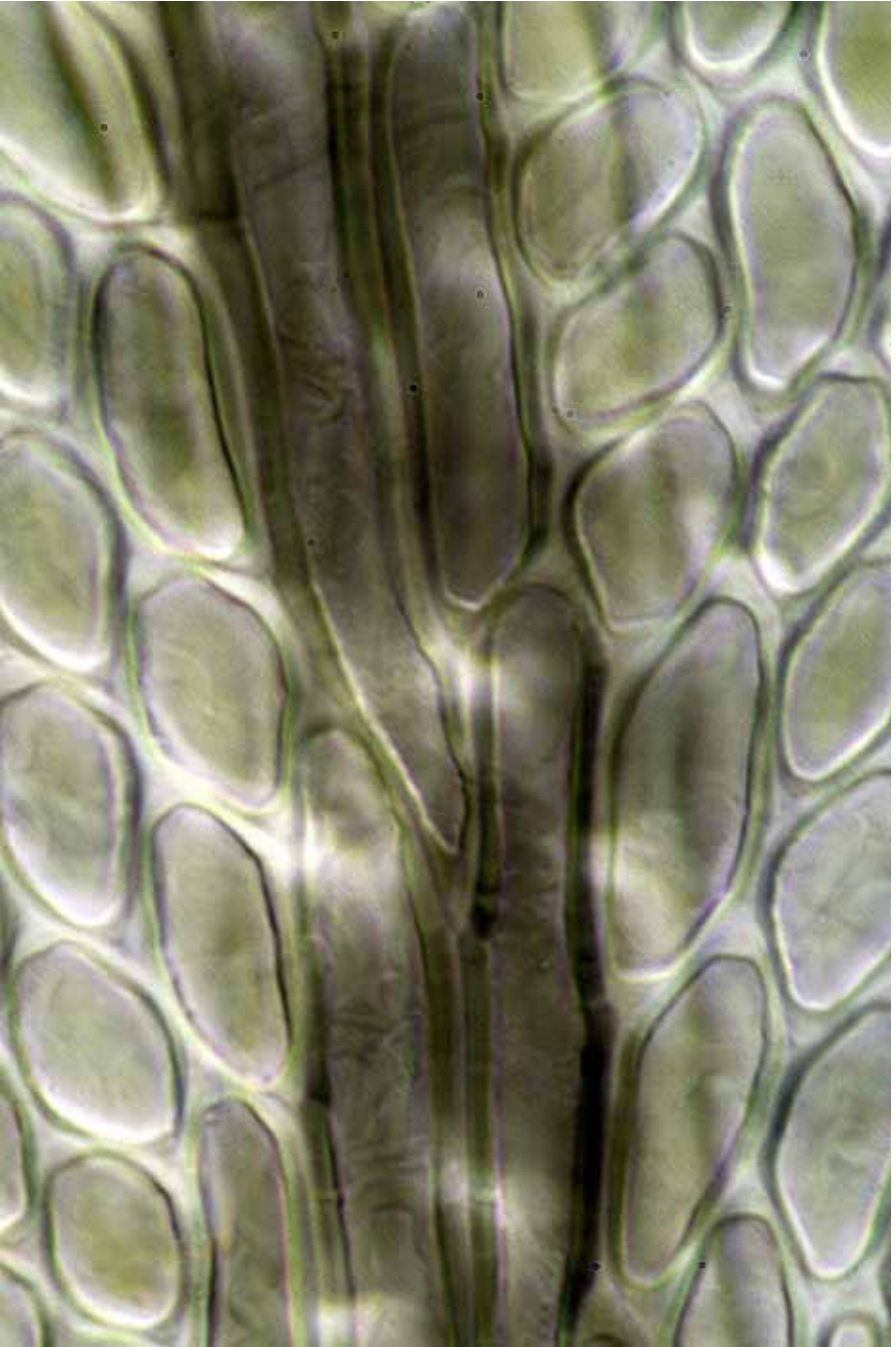
capsule: 2 mm, ellipsoid, symmetrical, exserted, erect or inclined, orange; seta to 3 mm, lateral, curved, dark red; calyptra cucullate, erect-hairy; operculum acuminate; endostome reduced



vegetative shoot apex (moist), shoot (dry), leaf outline, and leaf apex
 5 mm, 5 mm, 0.25 mm, 50 μm



margin at midleaf, cells at midleaf, and leaf basal angle
 10 μm , 10 μm , 50 μm



Leptodon smithii costa midleaf
10 μ m

Acrocladium chlamydophyllum (Hook.f. & Wilson) Müll.Hal. & Broth.

form: tufted, procumbent, branched stems, 30–60 mm long,
leaves yellow or yellow-green, glossy

habitat: soil or rotting wood, rarely rock, ± aquatic

leaf: *size:* 1.3–1.5 × 1.4–1.6 mm (wider than long)

shape: elliptic, concave, decurrent at the base

tip: rounded or obtuse

base: alar cells large, thin-walled, and hyaline

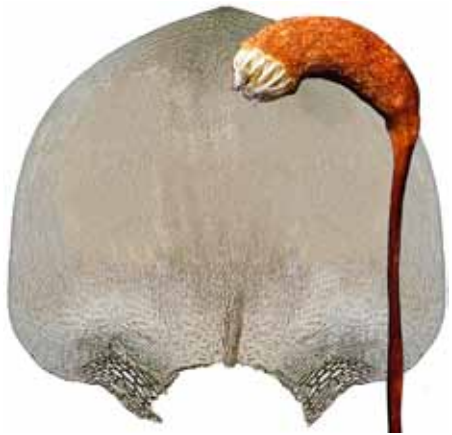
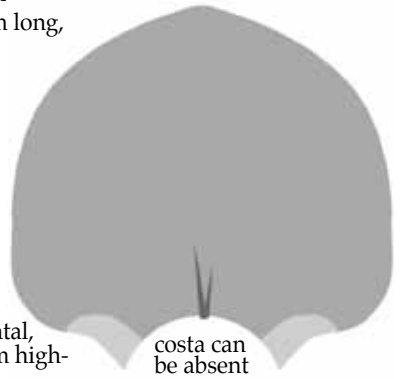
costa: absent, single and faint, or short and double

border: not differentiated

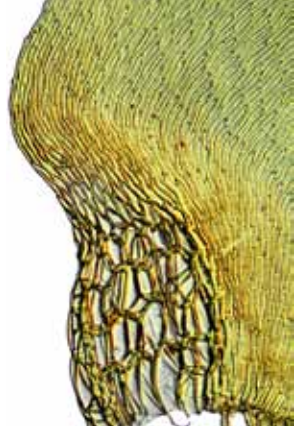
margin: entire, plane

cells: 50–80 × 4–6 μm, linear-vermicular, incrassate,
smooth; cells near the leaf base porose

capsule: 1.5–2 mm; oblong, curved, exserted, horizontal,
pale brown; seta 20–40 mm, slender, red; operculum high-
conic, calyptra cucullate; peristome hypnoid



vegetative habit, shoot apex, leaf outline, and mature capsule
 1 mm, 1 mm, 0.1 mm, 1 mm



rounded leaf apex, non-porose midleaf cells, and alar cells in leaf basal angle
 5 μm, 5 μm, 50 μm



Acrocladium chlamydophyllum vegetative shoot (dry)
5 mm (whole shoot),

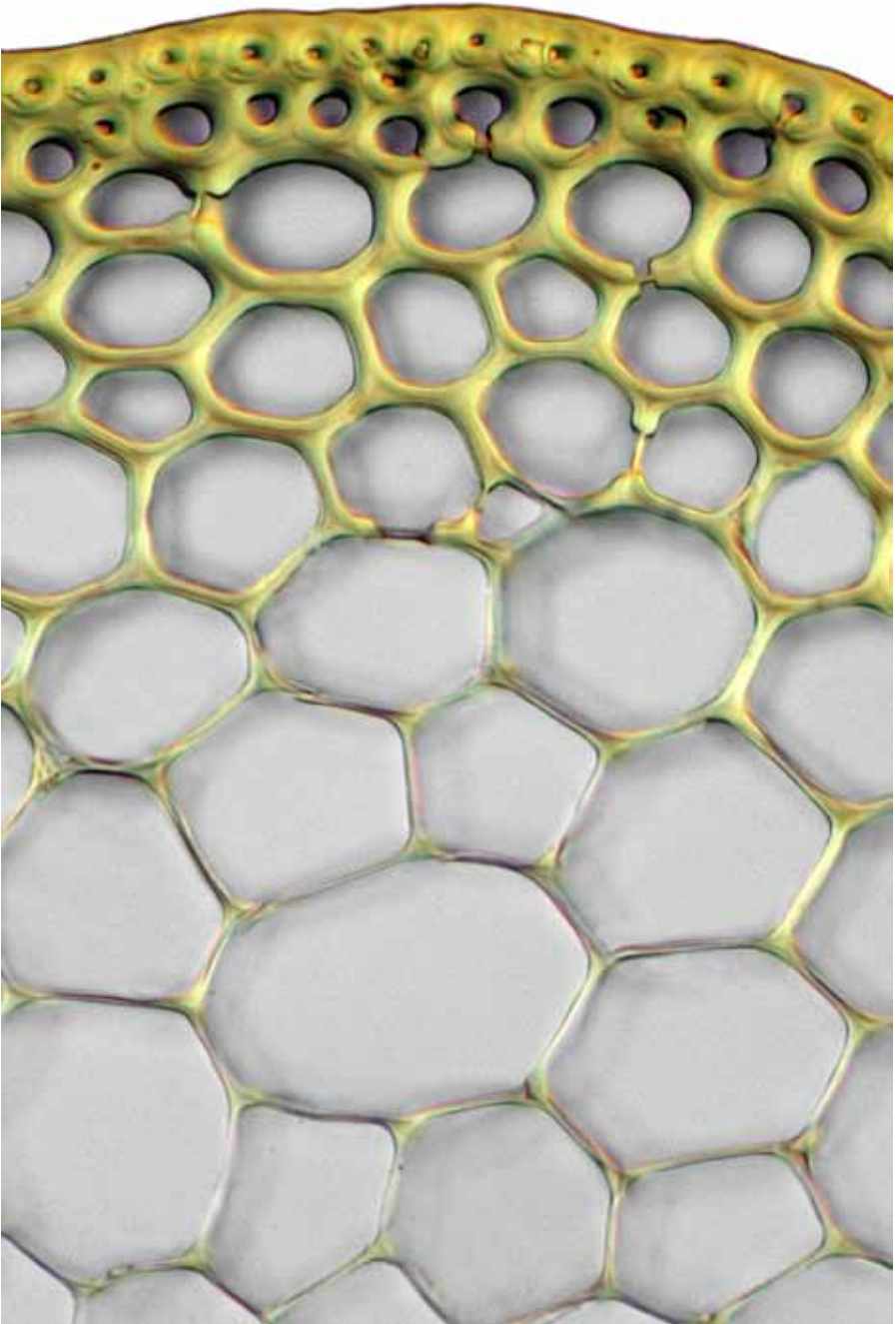
1 mm (detail on left)

continued next page



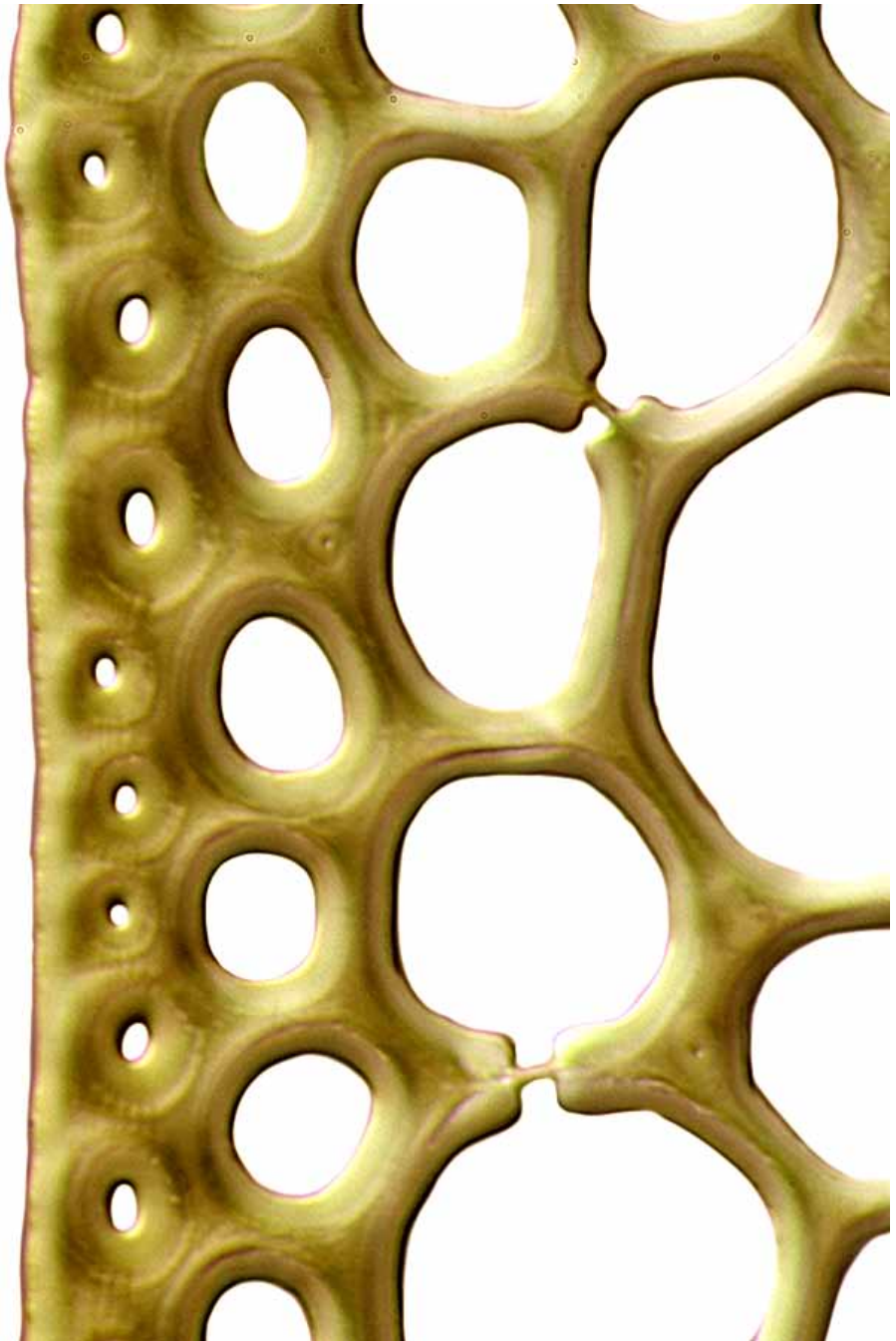
Acrocladium chlamydophyllum mature capsule (dry)
0.5 mm

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Acrocladium chlamydophyllum stem cross-section
10 μ m

continued next page



Acrocladium chlamydophyllum stem cross-section
10 μ m

continued next page



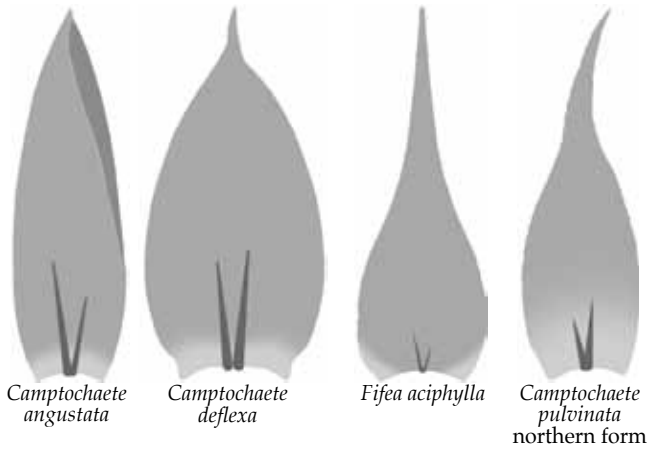
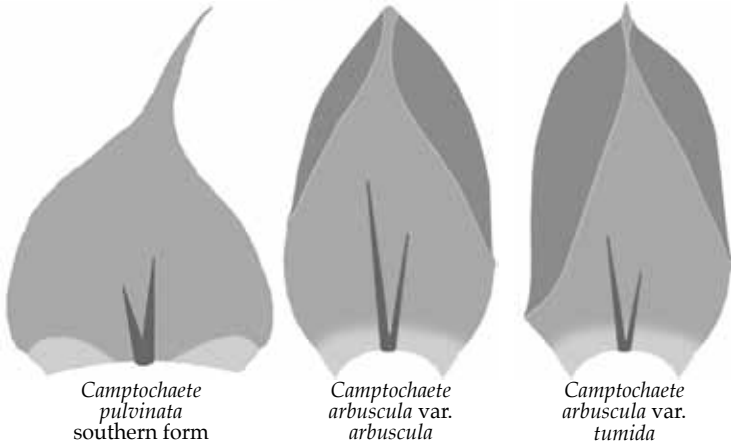
Acrocladium chlamydophyllum leaf cross-sections (on left, margin near leaf base)

5 μ m

Key* to the New Zealand species and varieties of *Camptochaete* (5) and *Fifea* (1)

- 1 Leaves of branches and the frond axis falcate-secund..... ● ***Camptochaete pulvinata***
 1: Leaves of branches and the frond axis not falcate-secund.....2
- 2(1:) Apex of leaves of the branches and frond axis ending in a long-aciculate acumen
 6–10 cells long; terminal cell > 75 μm long ● ***Fifea aciphylla***
 2: Apex of leaves of the branches and frond axis obtuse, broadly acute, or acuminate,
 lacking an aciculate acumen, 1–2 cells at the most; terminal cell < 50 μm long.....3
- 3(2:) Branch leaves narrowly ovate-lanceolate, serrulate..... ● ***Camptochaete angustata***
 3: Branch leaves broadly ovate to oblong, entire or nearly so.....4
- 4(3:) Leaves not markedly altered when dry; cells in apex 4–7. ● ***Camptochaete deflexa***
 4: Leaves collapsed and wrinkled when dry; cells in apex < 25
- 5(4:) Branches and frond axes mostly complanate, untidy in appearance, the leaves not
 in neat spirals; leaves obtuse to acuminate ● ***Camptochaete arbuscula* var. *arbuscula***
 5: Branches and frond axes inflated and loosely julaceous, the leaves arranged in neat
 catenulate spirals; leaves abruptly mucronate ● ***Camptochaete arbuscula* var. *tumida***

* based on Tangney, RS (1997): A generic revision of the genus *Camptochaete* Reichdt.,
 Lembophyllaceae (Musci). *Journal of the Hattori Botanical Laboratory* **81**, 79.



Camptochaete angustata (Mitt.) Reichardt

form: primary stem stoloniform; secondary stem branched, dendroid, 30–60 mm long, leaves dark green to brownish or yellowish green

habitat: tree bark, rotting logs, exposed roots, and rock in forest, 0–600 m

leaf: *size:* axis leaves 1.8–2.2 × 0.6–0.9 mm; branch leaves 0.9–1.5 × 0.2–0.4 mm

shape: axis leaves narrowly ovate-oblong; branch leaves narrowly elliptic

tip: acute

base: alar cells ± quadrate, in a triangular group

costa: long and double, reaching about midleaf, but sometimes absent

border: not differentiated

margin: ± entire below, irregularly denticulate above, plane

cells: 40–70 × 5–8 μm, linear, firm- to thick-walled, smooth

capsule: 1.5–2.0 mm, oblong-cylindric, exserted to horizontal, reddish brown; seta 6–8 mm, reddish brown; operulum conic or apiculate; exostome teeth striate below, baculate above (covered in rods that are longer than wide), endostome cilia nodose, baculate; spores 15–18 μm in diam.

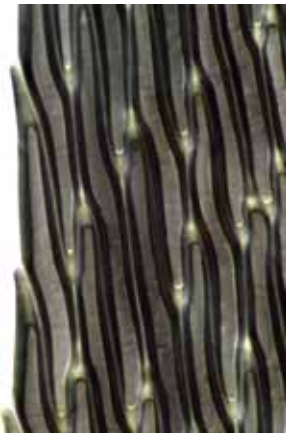


costa can be absent



portion of vegetative frond and shoot (dry), leaf outline, and leaf apex

5 mm, 1 mm, 0.1 mm, 10 μm



margin at midleaf, cells at midleaf, and leaf basal angle

10 μm, 10 μm, 10 μm

continued next page

Camptochaete arbuscula (Sm.) Reichdt. var. **arbuscula**

form: primary stem stoloniform; secondary stem dendroid, branched, 40–60(–110) mm long, leaves pale green to yellow-green, glossy

habitat: logs, tree bark, or rarely soil in damp forest

leaf: size: stem leaves $1.5\text{--}2.5 \times 0.8\text{--}1.4$ mm; branch leaves smaller

shape: ovate, concave

tip: acute

base: basal cells wider and longer than blade cells

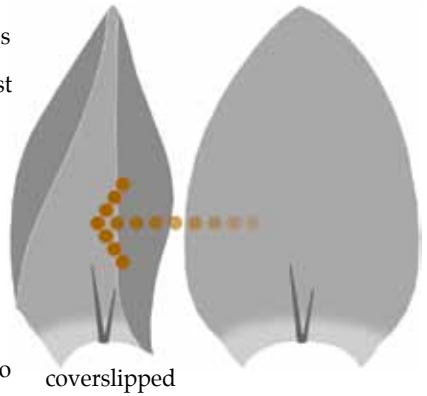
costa: faint, short and double

border: not differentiated

margin: entire below, \pm denticulate above, plane

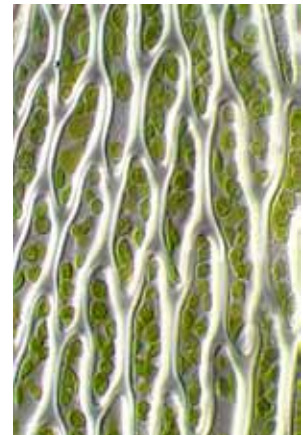
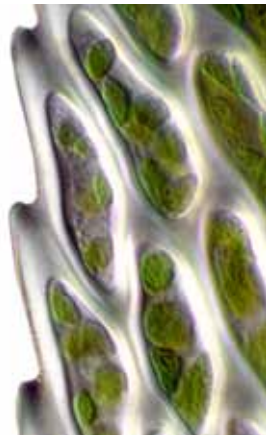
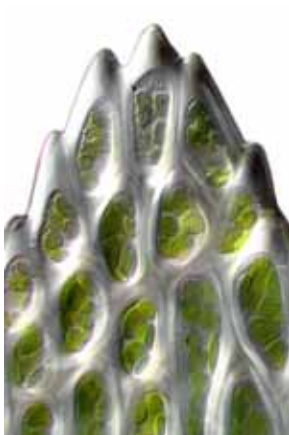
cells: $20\text{--}25 \times 5\text{--}7$ μm , rhombic, \pm sigmoid, firm-walled, smooth

capsule: 1.5–2.5 mm, exserted, oval-oblong, erect to cernuous, brown; seta 3–10 mm, lateral



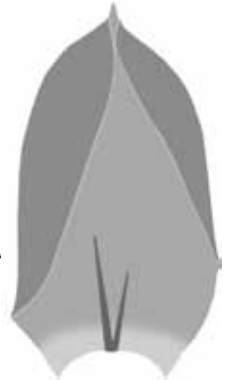
vegetative habit, fertile shoot, leaf outline, and immature capsule

50 mm, 5 mm, 0.5 mm, 0.5 mm

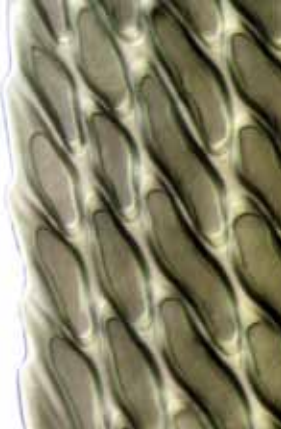


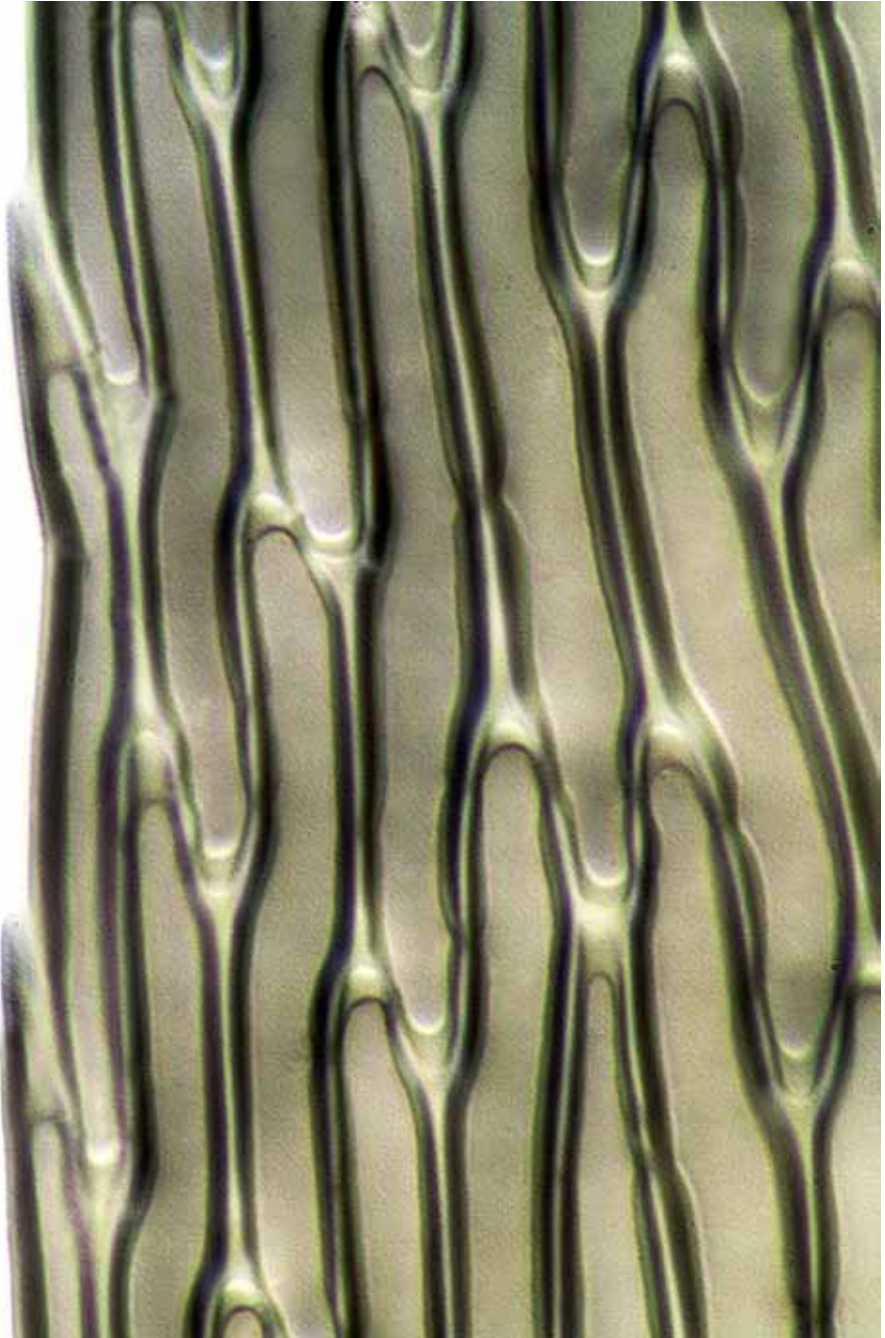
leaf apex, margin at midleaf, and cells midleaf

10 μm , 10 μm , 10 μm

Camptochaete arbuscula var. **tumida** Tangney**form:** matted, creeping, ± pinnately branched, ± julaceous stems**habitat:** soil or bark of exposed tree roots, in forest to 900 m**leaf:** size: 2.0–1.3 mm*shape:* widely ovate to oblong, deeply concave*tip:* rounded to obtuse, cucullate with a short mucro*base:* alar cells in a distinct group, shorter than other laminal cells*costa:* faint, short and double*border:* not differentiated*margin:* entire below, weakly denticulate above, plane*cells:* 15–50 × 4–9 μm, linear-rhombic, ± sigmoid, firm- to thick-walled, smooth**capsule:** to 2.2 mm, oblong-cylindric, horizontal, exerted, reddish brown; seta 8–13 mm; calyptra cucullate; peristome double

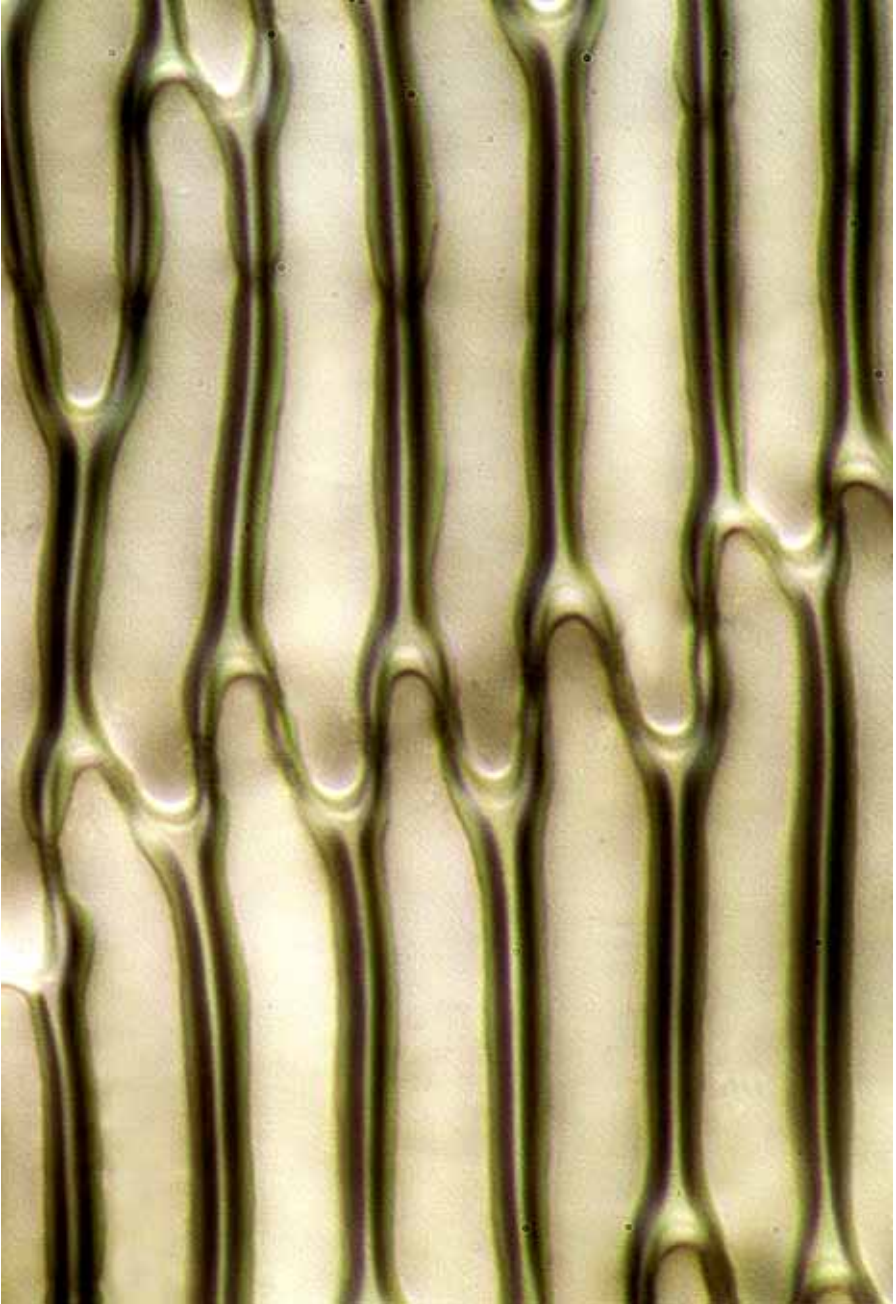
coverslipped

vegetative shoot (dry), capsule (dry), shoot tips (dry), and leaf outline (coverslipped)
 5 mm, 1 mm, 1 mm, 0.5 mmmucronate leaf apex, margin of upper leaf, and leaf basal angle
 50 μm, 10 μm, 50 μm



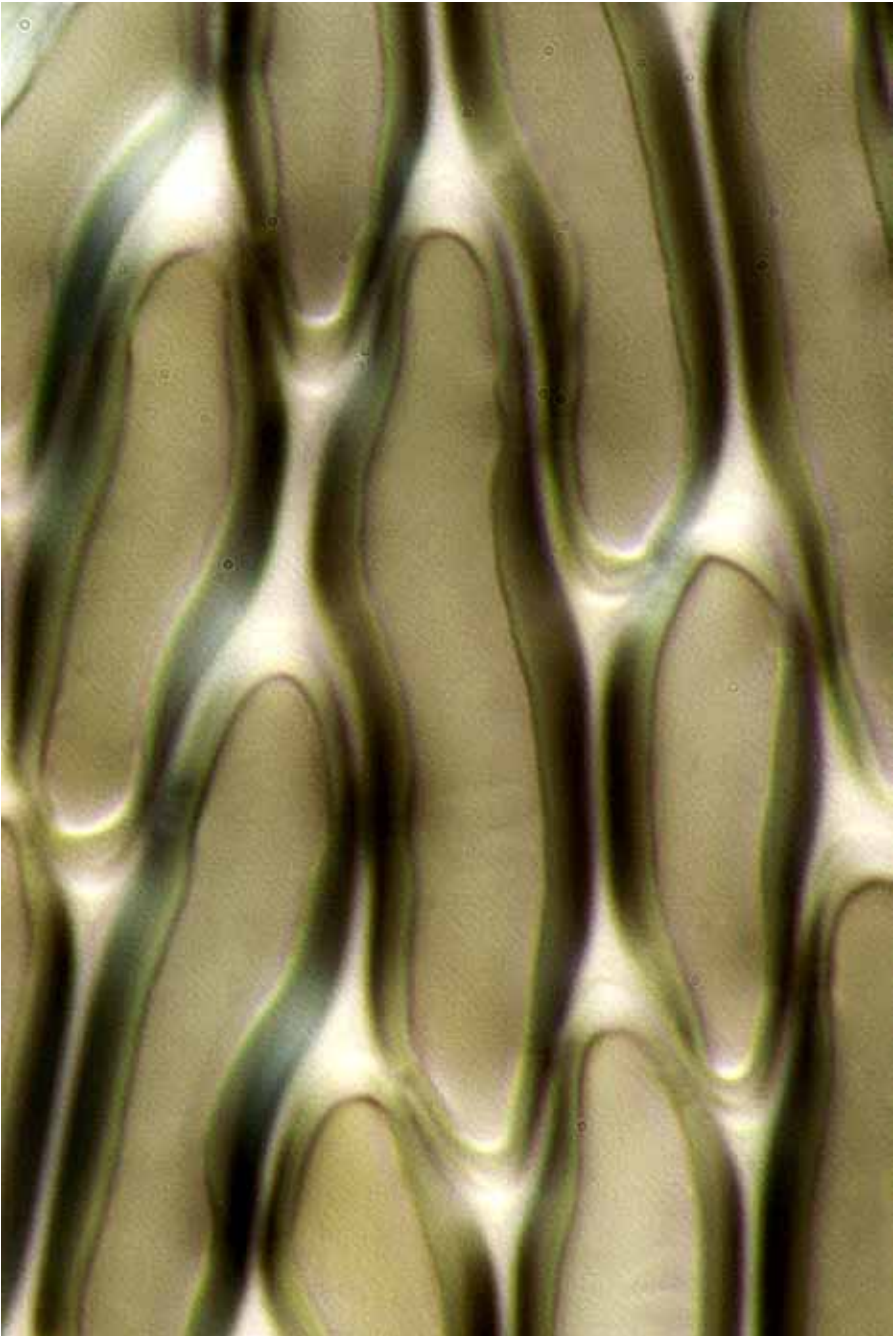
Camptochaete arbuscula var. *tumida* margin midleaf
10 μ m

continued next page



Camptochaete arbuscula var. *tumida* cells of lower leaf
10 μ m

continued next page



Camptochaete arbuscula var. *tumida* cells of upper leaf
10 μ m

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Camptochaete deflexa (Wilson) A. Jaeger

form: primary stem stoloniform; secondary stem dendroid, 40–80(–100) mm long, branched, leaves dark green or olive-green

habitat: rock and exposed roots in damp lowland forest, sea level to 1100 m

leaf: size: 1.5–2.5 × 1.2–1.8 mm

shape: widely ovate, concave

tip: shortly apiculate

base: basal cells thinner-walled than the other blade cells

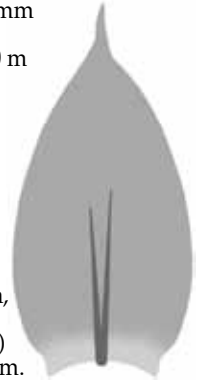
costa: long and double

border: not differentiated

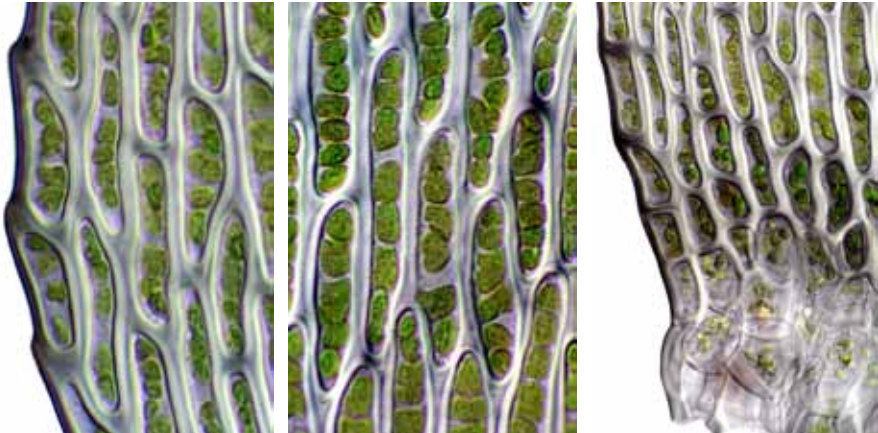
margin: entire below, irregularly denticulate above, plane

cells: 20–25 × 5–7 μm, linear-rhombic, firm-walled, smooth

capsule: 1.5–2.5 mm, oval-oblong, exserted, erect to cernuous, red-brown, seta 3–10 mm, lateral; operculum blunt or apiculate; exostome teeth, cross-striate below, baculate (covered in rods that are longer than wide) above, endostome cilia 2–3, nodulose, baculate; spores 13–15 μm in diam.



dendroid vegetative shoot (moist), branchlet, capsule, leaf outline, and leaf apex
 10 mm, 1 mm, 1 mm, 0.5 mm, 10 μm



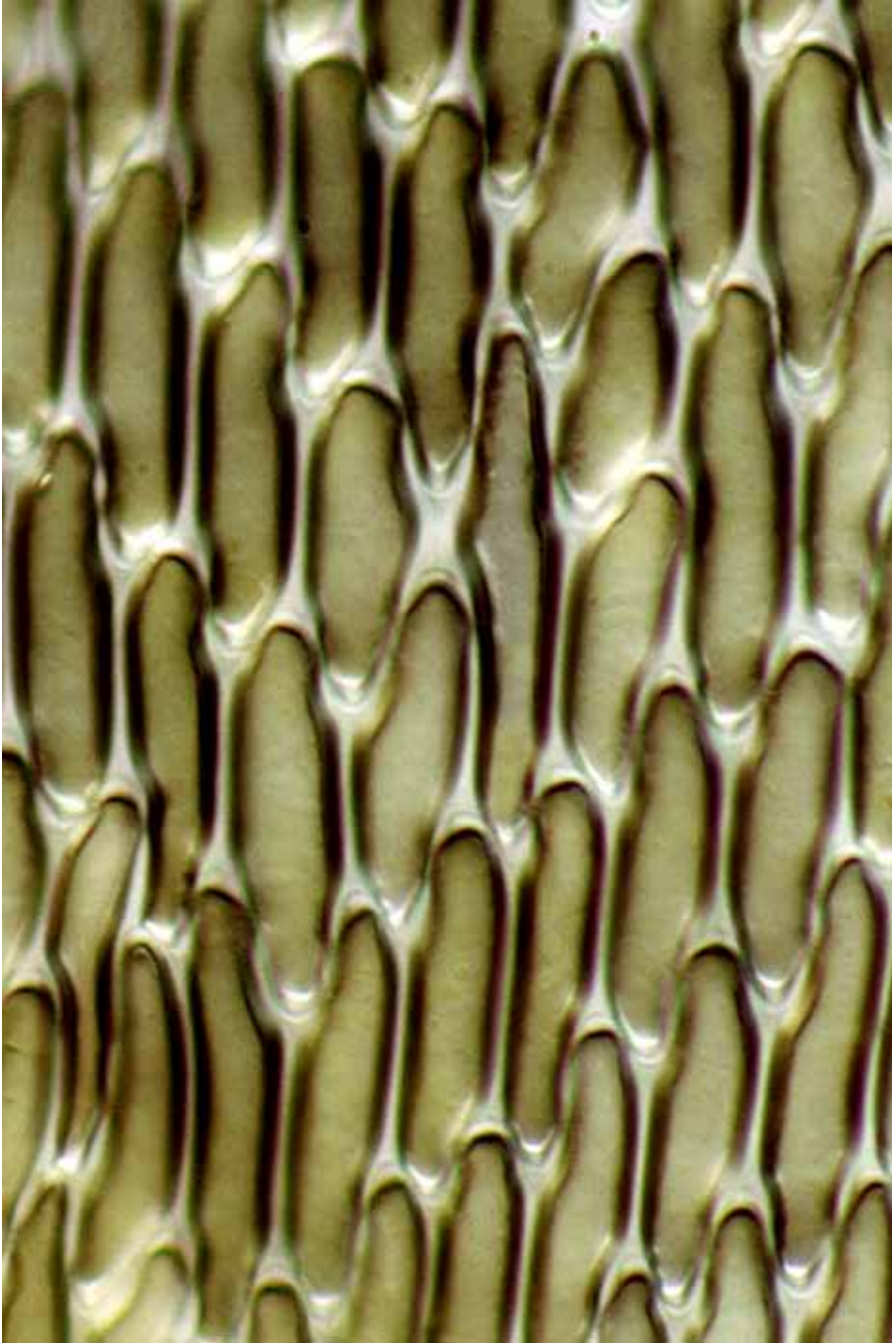
margin of lower leaf, cells at midleaf, and leaf basal angle
 10 μm, 10 μm, 10 μm

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Camptochaete deflexa leaf apex
10 μ m

continued next page



Camptochaete deflexa midleaf cells
10 μ m

Camptochaete pulvinata (Hook.f. & Wilson) A.Jaeger

form: primary stem creeping; secondary stem complanate, pinnately branched, dendroid; leaves pale green to olive-green

habitat: soil, bark of tree bases, or rock in forest, sea level to 930 m

leaf: size: 1.0–1.7 × 0.6–1.5 mm

shape: lanceolate to widely ovate, strongly concave, falcate-secund tip: abruptly narrowed to an acute apex

base: basal cells ± rectangular, ± porose; alar region 7–12 × 7–11 μm

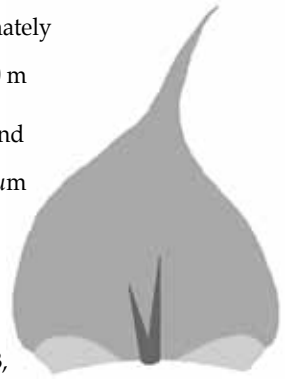
costa: absent or weak, short and double

border: not differentiated

margin: entire to denticulate, plane to incurved

cells: 40–80 × 5 μm, ± rhombic, thick-walled, smooth

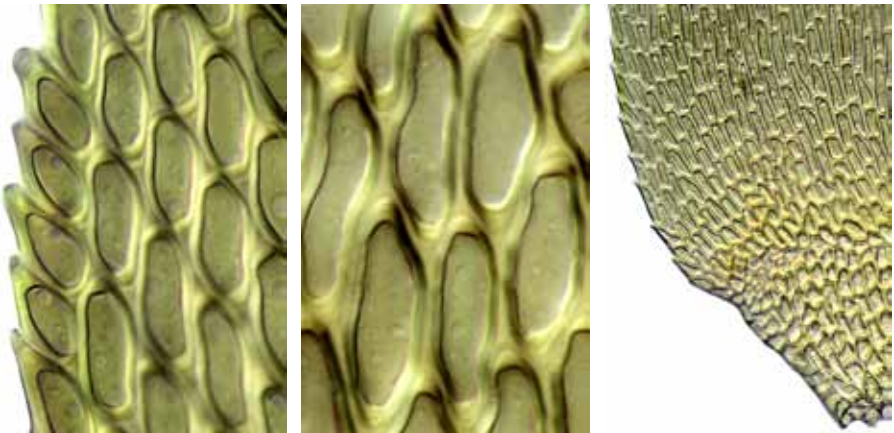
capsule: 1–2 mm, cylindric, lateral, exserted, inclined to horizontal; seta 8–10 mm, reddish brown to purple; brown; operculum ± apiculate; peristome double, endostome cilia 2–3, finely bullate; spores 10–12 μm in diam.



southern form



vegetative shoot (dry), leaf outlines (northern and southern forms), and leaf apex
 1 mm, 0.5 mm (2), 10 μm



margin at midleaf, cells at midleaf, and leaf basal angle
 10 μm, 10 μm, 50 μm

Fifea aciphylla (Dixon & Sainsbury) H.A.Crum

form: primary stem creeping, secondary stem pinnately branched, the branches curved, flexuose, to 10 mm long, leaves green to golden

habitat: soil in damp shady forest

leaf: size: 0.8–1.0 mm

shape: ovate-lanceolate base contracting to a long acumen, concave

tip: long-acuminate, the terminal cell 50–75 μm long

base: basal cells shorter than the other lamina cells

costa: none or short and double

border: not differentiated

margin: entire to faintly serrulate, plane

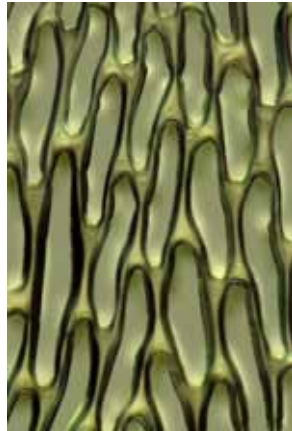
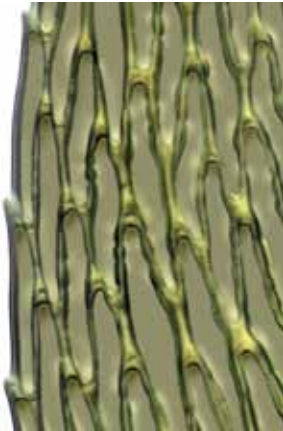
cells: 25–40 \times 8–10 μm , rounded-rhombic, firm-walled, smooth

capsule: 1.5 mm, ovoid, asymmetric, exserted, erect to cernuous, brown to castaneous; seta 10 mm, red, slender; annulate; operculum high-conic, bluntly apiculate; exostome teeth joined basally, cross-striolate, endostome cilia nodulose; spores 12–16 μm in diam., smooth



vegetative frond and shoot (dry) (2), leaf outline, and leaf apex (2)

■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 50 μm , ■ 50 μm



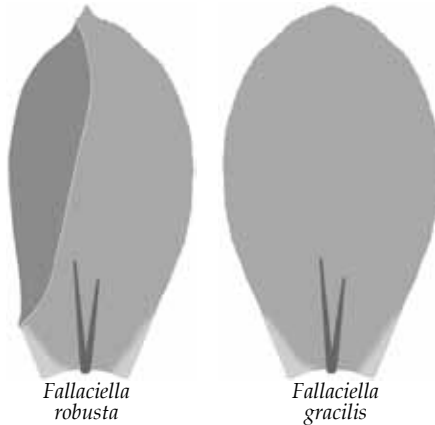
margin at midleaf, cells at midleaf, and leaf basal angle

■ 10 μm , ■ 10 μm , ■ 10 μm

Key* to the New Zealand species of *Fallaciella* (2)

- 1 Plant glossy; leaves collapsed-wrinkled when dry; upper margin concave when moist; apex sharply apiculate and recurved; distal cell prorae not papillose..... ● ***Fallaciella robusta***
- 1: Plant dull; leaves little altered when dry; upper margin plane when moist; apex broadly acute, not apiculate, not recurved; distal cell prorae typically papillose..... ● ***Fallaciella gracilis***

* based on Tangney, RS; Fife, AJ (2003): A review of the genus *Fallaciella* (Bryopsida: Lembophyllaceae), including a new species from South Island, New Zealand. *Journal of Bryology* 25, 121–128.



Fallaciella gracilis (Hook.f. & Wilson) H.A.Crum

form: primary stem creeping, filiform, radiculose, secondary stem 15–40 mm long, procumbent, irregularly branched, leaves dull, yellow-green

habitat: damp or wet rock near streams, rarely on bark

leaf: size: 0.6–1.0 × 0.4–0.6 mm

shape: obovate-oblong to ovate-oblong

tip: obtuse to rounded

base: basal cells quadrate, forming a distinct region

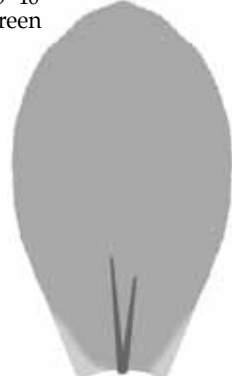
costa: absent or faint and double

border: not differentiated

margin: serrulate toward the apex, plane

cells: 20–40 × 5–7 μm, rhombic, ± sigmoid, incrassate, smooth

capsule: 1.3–2 mm, ovoid-oblong, asymmetric, exserted, inclined to cernuous, red-brown; seta 15–20 mm, arcuate at the tip; annulate; operculum short conico-rostrate; exostome teeth cross-striolate, endostome cilia 2–3, baculate; spores 15–18 μm in diam.



vegetative shoots (moist) (2), mature capsule, leaf outline, and leaf apex

1 mm, 1 mm, 1 mm, 0.1 mm, 10 μm



margin of upper leaf, cells at midleaf, and leaf basal angle

10 μm, 10 μm, 10 μm

Fallaciella robusta Tangney & Fife

form: primary stem creeping, matted, secondary stems \pm bipinnately branched, \pm stipitate, leaves yellow-green to brownish, glossy

habitat: rock in damp shaded forest

leaf: *size:* stem leaves 1.5×1 mm; branch leaves smaller

shape: broadly ovate, deeply concave, collapsed-wrinkled when dry

tip: stem leaves acute to broadly acute; branch leaves apiculate

base: alar cells quadrate, thick-walled, extending up the margin

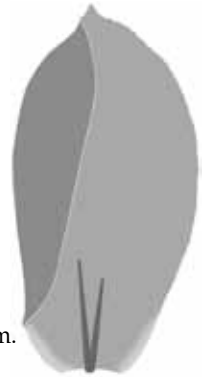
costa: short and double

border: not differentiated

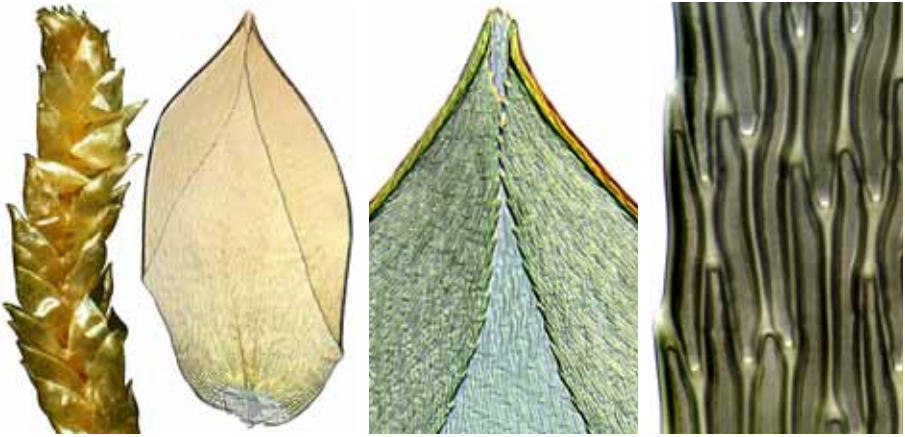
margin: bluntly serrulate, plane below, cucullate at the tip

cells: $25\text{--}34 \times 5\text{--}7$ μm , rhombic to linear, firm-walled, smooth

capsule: 1.6 mm, ovoid-oblong, exserted, cernuous, red-brown; seta 15 mm, weakly sinistrorse; peristome hypnoid; spores $12\text{--}15$ μm in diam.

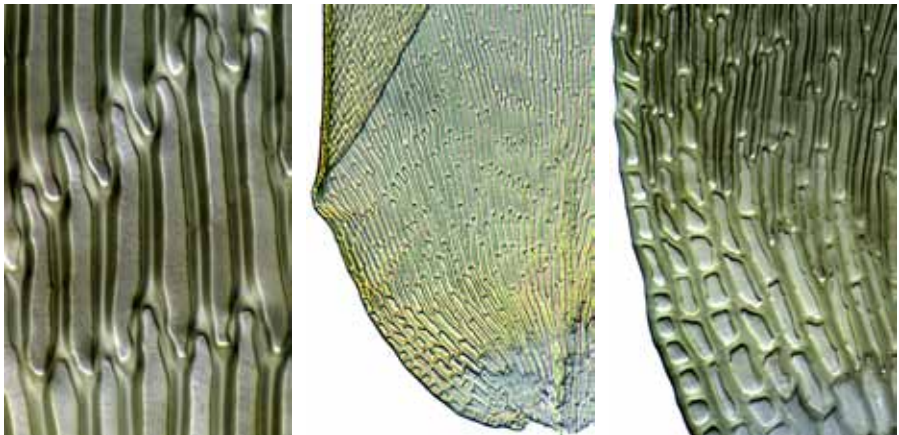


coverslipped



vegetative branch (dry), leaf outline (coverslipped), leaf apex, and margin lower leaf

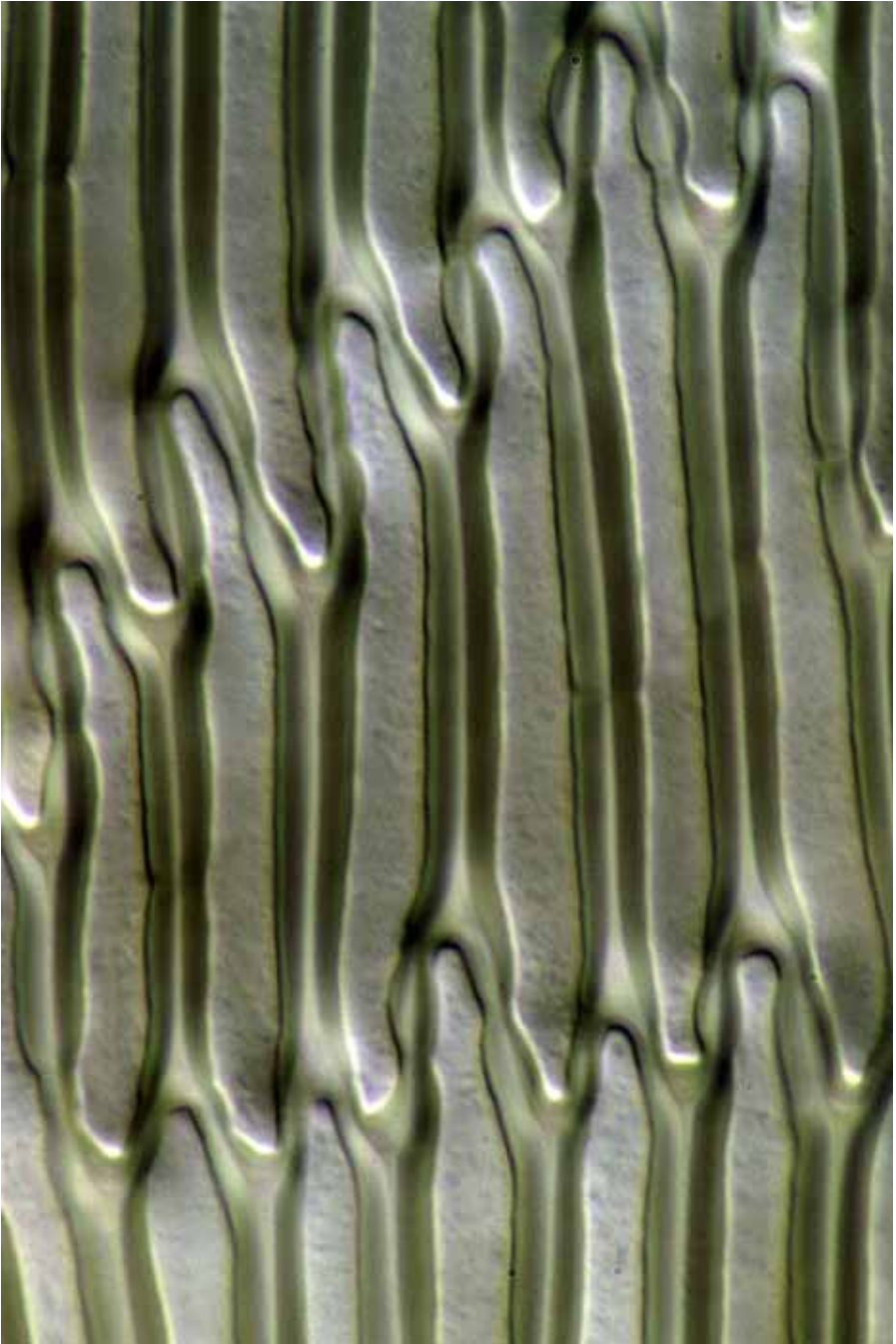
1 mm, 0.1 mm, 50 μm , 10 μm



cells at midleaf, and leaf basal angle (2)

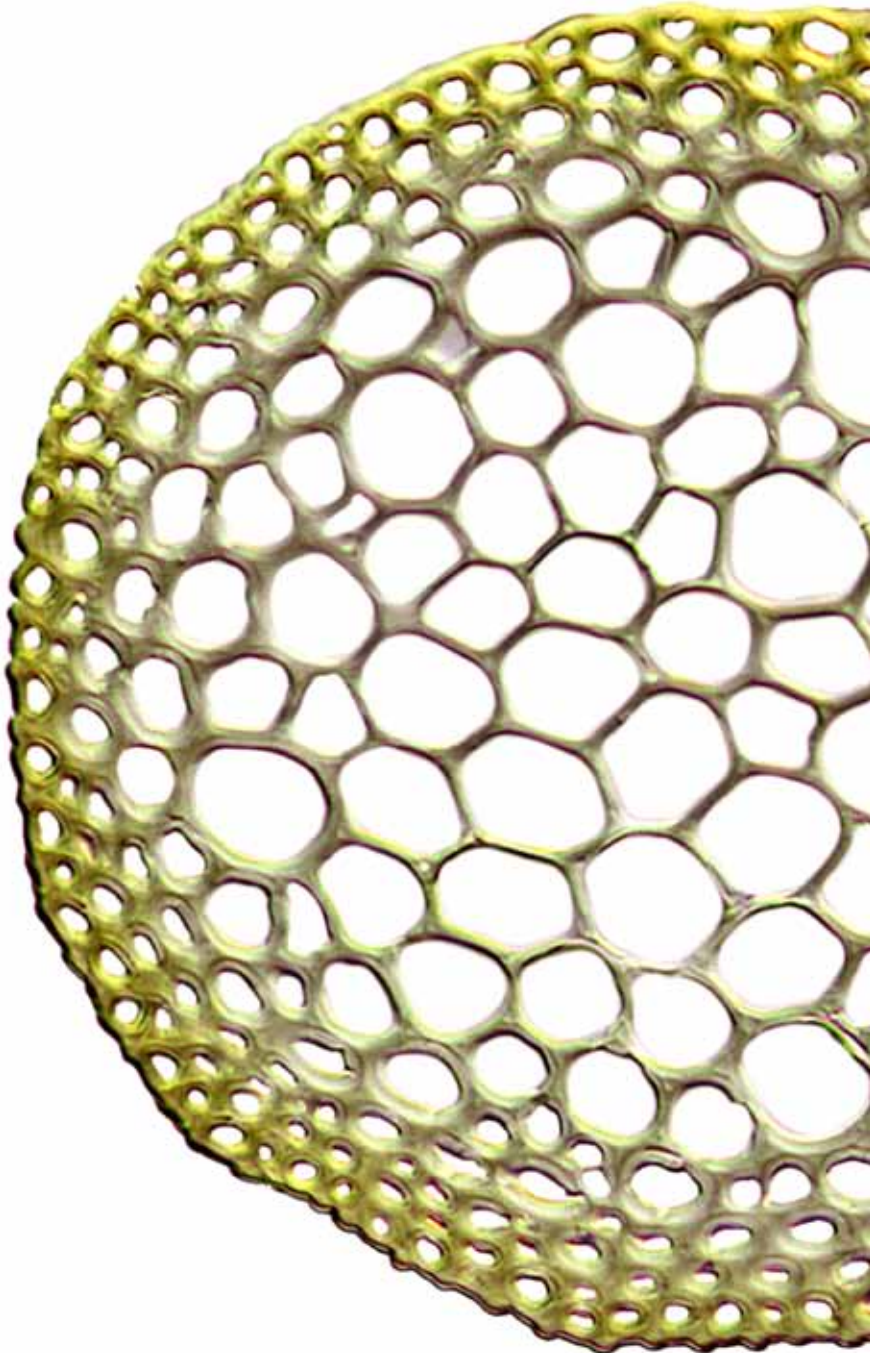
10 μm , 50 μm , 50 μm

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Fallaciella robusta cells midleaf
10 μm

continued next page

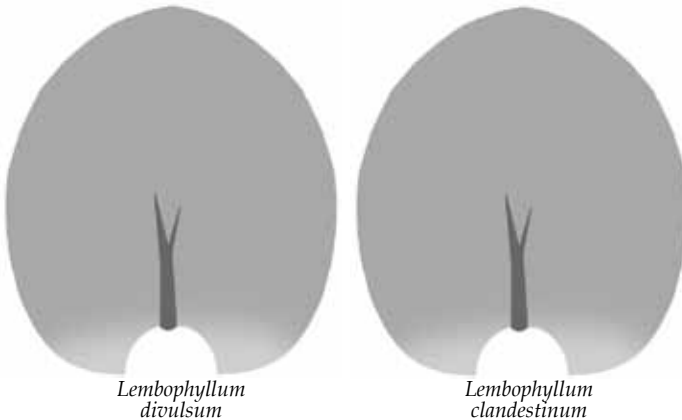


Fallaciella robusta stem cross-section showing lack of a distinct central strand
10 μm

Key* to the New Zealand species of *Lembophyllum* (2)

- 1 Upper leaf cells 9–16 μm long, subrhombic or hexagonal, firm-walled ● ***Lembophyllum divulgum***
- 1: Upper leaf cells 13–25 μm long, narrowly elliptic, incrassate ● ***Lembophyllum clandestinum***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 383–384.



Lembophyllum clandestinum (Hook.f. & Wilson) Lindb.

form: primary stem creeping, radiculose; secondary stem flexuose, procumbent, ± pinnately branched, to 100 mm long, strongly julaceous, leaves yellow-green to yellow-brown, glossy

habitat: bark, soil, or rock

leaf: size: 0.8–1.3 × 0.7–1.2 mm

shape: suborbicular, cochleariform, unaltered when dry

tip: rounded to obtuse

base: angle cells small, incrassate, often forming auricles

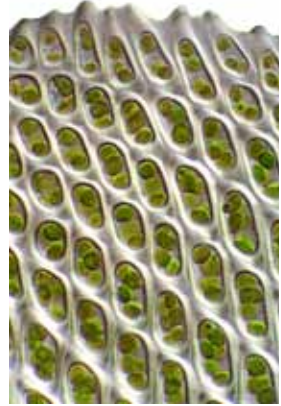
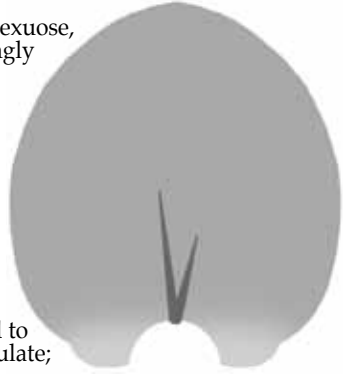
costa: absent, single and faint, or short and double

border: not differentiated

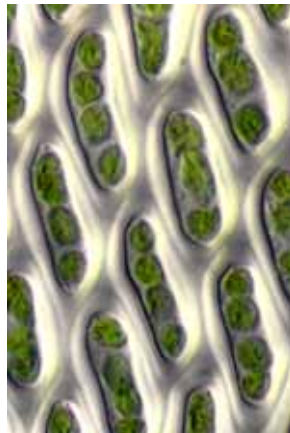
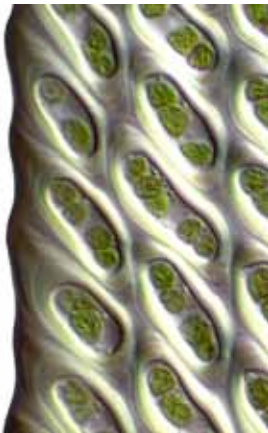
margin: entire below, minutely crenulate above, plane

cells: upper 13–25 μm long, oval-elliptic, incrassate, smooth

capsule: 1.5–2 mm; oblong-ovoid, lateral, exserted, inclined to horizontal; seta 13–25 mm, red, flexuose; operculum apiculate; peristome hypnoid; spores 12–16 μm in diam.



vegetative habit, fertile shoot, mature capsule, leaf outline (partial), and leaf apex
 5 mm, 1 mm, 1 mm, 0.5 mm, 10 μm



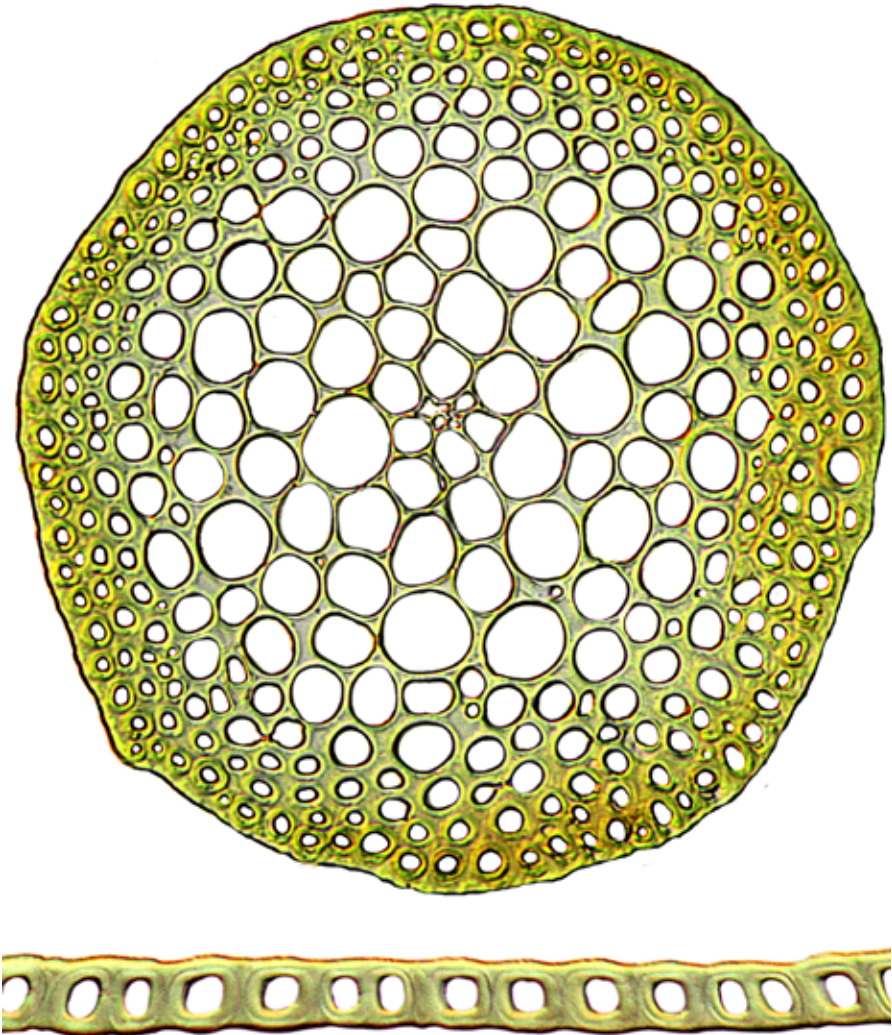
margin at midleaf, cells at midleaf, and leaf basal angle
 10 μm, 10 μm, 10 μm

continued next page



Lembophyllum clandestinum habit
5 mm

continued next page



Lembophyllum clandestinum stem and leaf cross-sections
10 μm (above), 10 μm (below)

continued next page

Lembophyllum divulgum (Hook.f. & Wilson) Lindb.

form: primary stem creeping, radiculose; secondary stem to 40 mm long, erect, julaceous, subpinnately branched, leaves pale green

habitat: bark or rock in damp forest, lowland to montane

leaf: size: 0.8–1.3 × 0.7–1.2 mm

shape: suborbicular, cochleariform, little altered when dry

tip: rounded to obtuse

base: angle cells small, ± subquadrate, often coloured

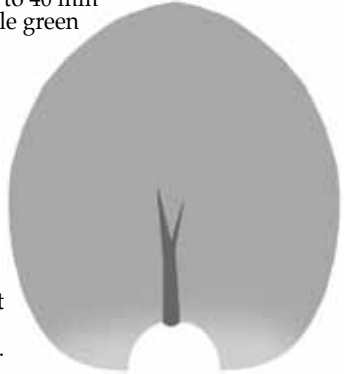
costa: absent, single and faint, or rarely double

border: not differentiated

margin: entire below, ± serrulate toward the apex, plane

cells: upper cells 9–16 μm long, rhombic, firm-walled, smooth; lower cells elongate, porose

capsule: 1.5–2.0 mm; oblong-ovoid, lateral, exserted, erect to horizontal; seta 12–25 mm, red, flexuose; operculum apiculate; peristome hypnoid; spores 12–16 μm in diam.



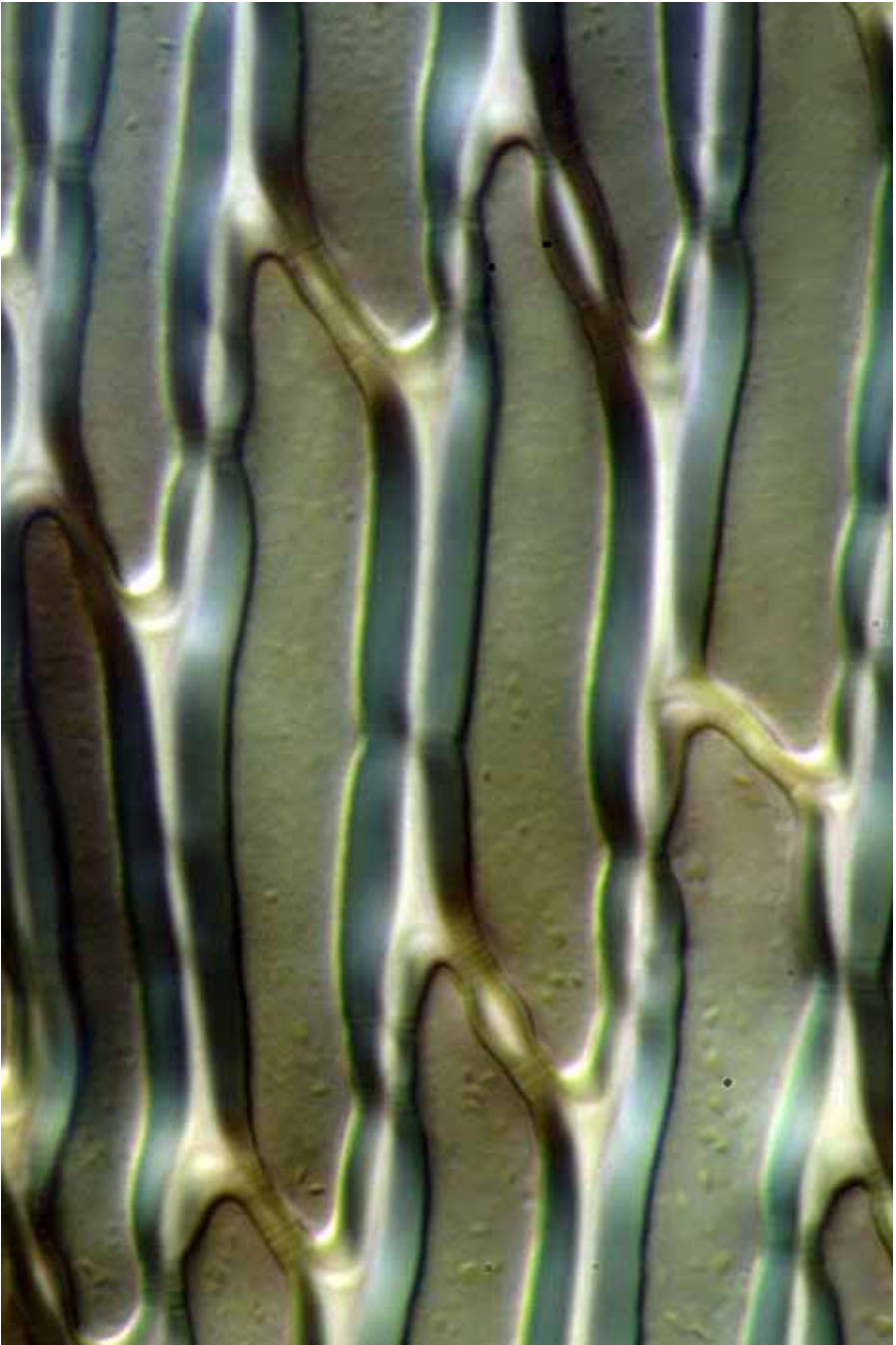
vegetative shoots (dry) (2), leaf outline (partial), and leaf apex

■ 1 mm, ■ 1 mm, ■ 0.1 mm, ■ 10 μm



margin at midleaf, cells near leaf base, and leaf basal angle

■ 10 μm, ■ 10 μm, ■ 10 μm



Lembophyllum divulgum cells near leaf base
10 μm

continued next page

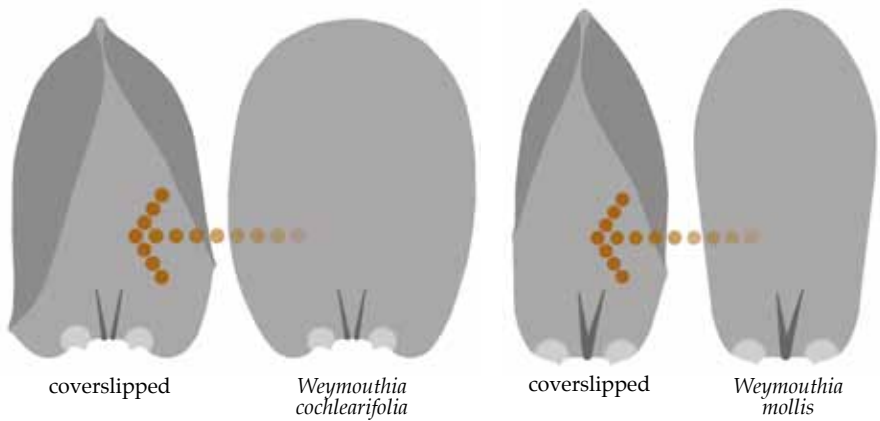


Lembophyllum divulgum mature capsule and peristome
1 mm

Key* to the New Zealand species of *Weymouthia* (2)

- 1 Leaves 2–3 mm long, suborbicular; lamina cell walls porose..... ● ***Weymouthia cochlearifolia***
- 1: Leaves 1–2 mm long, oblong-spathulate; lamina cell walls not porose..... ● ***Weymouthia mollis***

* based on Sainsbury, GOK (1955): *A Handbook of the New Zealand Mosses*, RSNZ Bull. 5, 352.



Weymouthia cochlearifolia (Schwägr.) Dixon

form: primary stem pendent; secondary flexuose, yellowish, glossy, branched

habitat: branch bark, damp, shady forest

leaf: size: 2–3 × 1.5–2.4 mm

shape: suborbicular, deeply concave

tip: rounded, cucullate

base: angle cells incrassate, in auricles

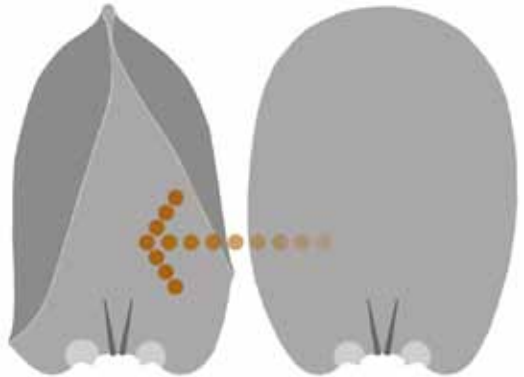
costa: absent or short and double

border: not differentiated

margin: entire, plane

cells: 40–70 × 6–7 μm, linear to fusiform, thick-walled, porose, smooth

capsule: 1.5–2.5 mm, oval, asymmetric, long-exserted, suberect, red-brown; seta 5–20 mm; calyptra ± hairy; operculum conic; peristome hypnoid

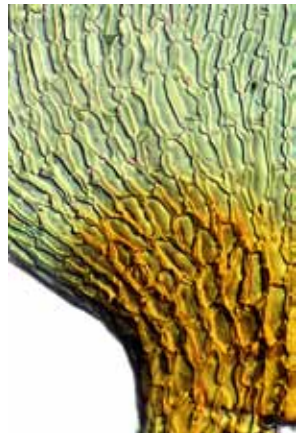
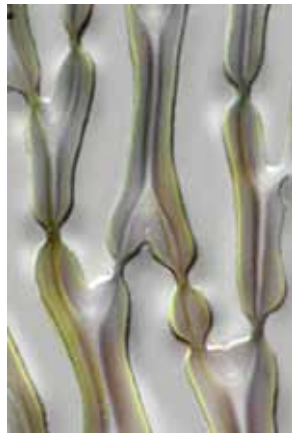


coverslipped



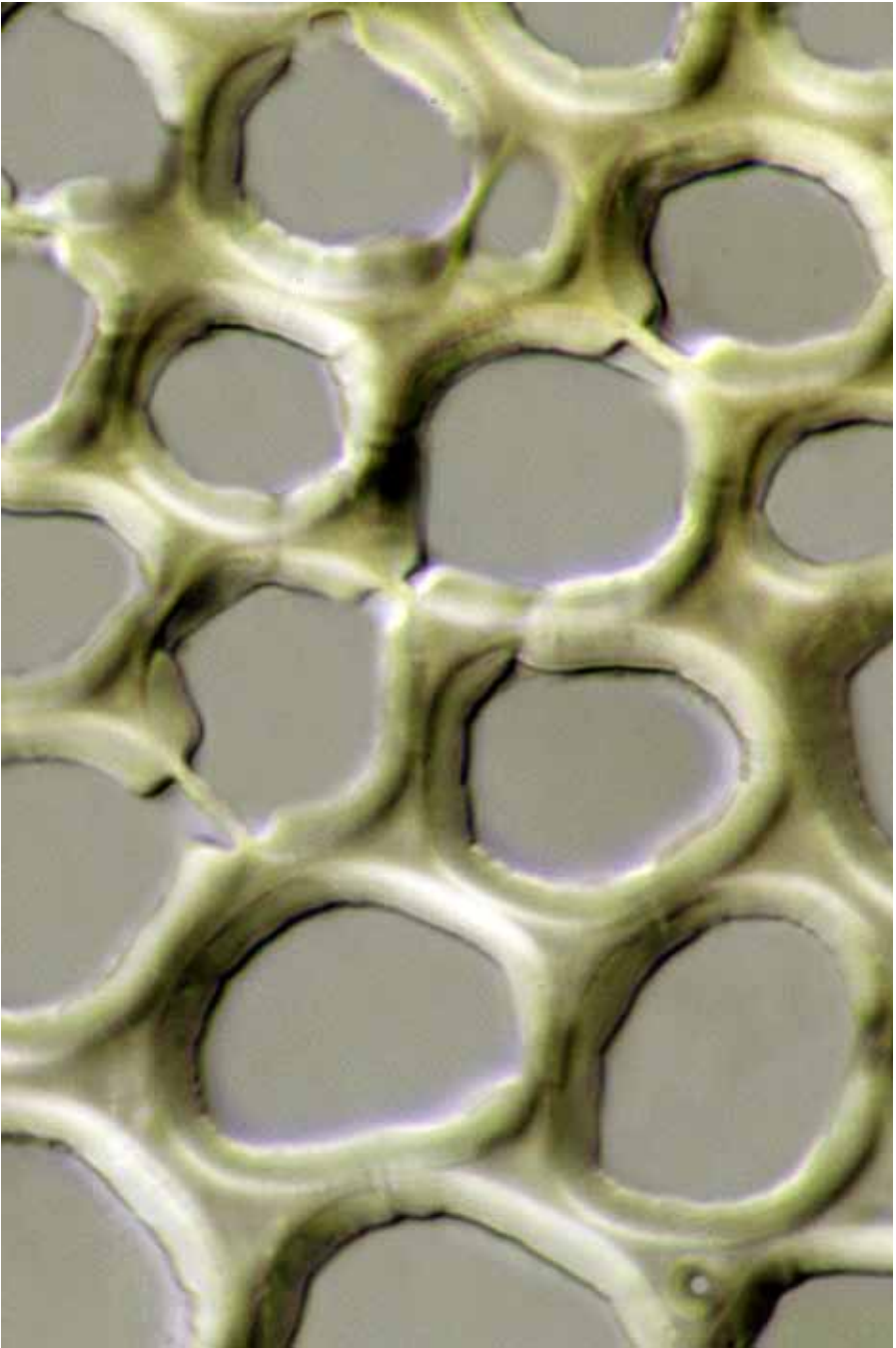
vegetative habit, fertile shoot, capsule with peristome, and leaf outline (coverslipped)

5 mm, 5 mm, 1 mm, 1 mm



margin at midleaf, cells at midleaf, and leaf basal angle

10 μm, 10 μm, 10 μm



Weymouthia cochlearifolia stem cross-section
10 μ m

Weymouthia mollis (Hedw.) Broth.

form: primary stem pendent; secondary stem flexuose, branched, to 250 mm long, leaves pale green, glossy
habitat: bark of twigs in damp forest and rainforest

leaf: size: 1–2 × 0.5–1.0 mm

shape: oblong-spathulate

tip: obtuse to rounded, ± cucullate

base: angle cells incrassate, dark, short, in auricles

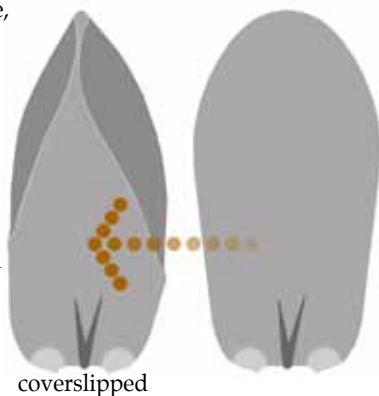
costa: absent or short and double

border: not differentiated

margin: entire, plane but folds when coverslipped

cells: 40–70 × 4–5 μm, vermicular, firm-walled, smooth

capsule: 1–1.5 mm, ovoid, lateral, exerted, erect on the seta, brown; seta 4–5 mm, arcuate at the tip; calyptra hairy; operculum curved conico-rostrate; peristome hypnoid, cilia none



coverslipped



vegetative shoot (2), young capsule with calyptra, leaf outline, and leaf apex

1 mm, 1 mm, 1 mm, 0.5 mm, 10 μm



margin at midleaf, leaf basal angle, and mature capsule with peristome

10 μm, 50 μm, 1 mm

Haplohymenium pseudotriste (Müll.Hal.) Broth.

form: matted, creeping stems, thin, wiry, ± radiculose, olive- to yellow-green, ± pinnately branched, the branches julaceous and obtuse at their tips

habitat: smooth bark or rarely shady limestone, to 300 m

leaf: size: stem leaves to 0.5 mm; branch leaves 0.4–0.6 mm long

shape: stem leaves ovate-lanceolate; branch leaves lingulate, ovate below

tip: stem leaves acute; branch leaves rounded to acute to ± apiculate

base: alar cells not differentiated

costa: reaching 2/3 up the blade, rarely short and double

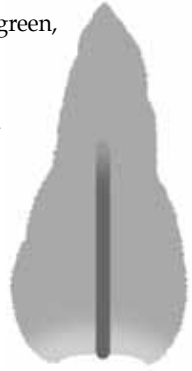
border: not differentiated

margin: crenulate, plane

cells: 6–8 μm , isodiametric, firm-walled, bulging, pluripapillose

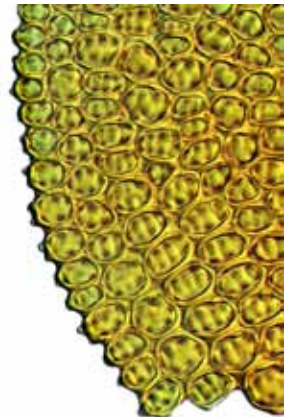
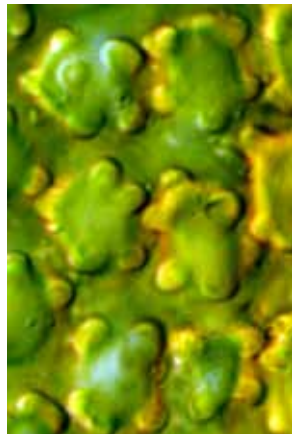
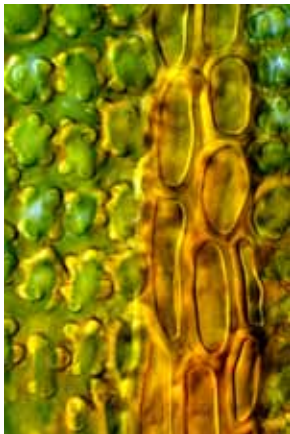
capsule: capsules not known in New Zealand

notes: *Eropodium glaucum* has no costa; *Lindbergia maritima* has axillary brood bodies; *Pseudoleskea imbricata* grows mostly on rock; species of *Thuidium* and *Thuidiopsis* have papillose paraphyllia.



vegetative shoots (dry) (2), leaf outline, and leaf apex

1 mm, 1 mm, 0.1 mm, 10 μm



costa at midleaf, leaf surface papillae, and leaf basal angle

10 μm , 10 μm , 10 μm

Glossary (for illustrations, see Malcolm, B; Malcolm, N (2006): *Mosses and Other Bryophytes, an Illustrated Glossary*, second edition. Micro-Optics Press, Nelson)

abaxial — facing away from a stem or axis, hence a leaf's "underside", "outer", "back", or "lower" surface (*the opposite of adaxial*, facing toward a stem or axis, hence a leaf's "upperside" or "inner" surface).

abrupt — changing suddenly over a short distance.

acrocarpous (noun **acrocarpy**) — producing sporophytes at the tips of main stems (*compare with pleurocarpous*, producing sporophytes laterally, and **cladocarpous**, producing sporophytes at the tips of branches). Most acrocarpous mosses are erect, tufted, and sparingly branched, whereas most pleurocarpous mosses are prostrate, matted, and highly branched.

acumen (plural **acumina**, adjective **acuminate**) — a long, narrow, tapering point with slightly concave margins.

acute — tapering with nearly straight margins to a point with an angle less than 90° (*compare with obtuse*, blunt, with the sides making an angle of more than 90°).

adaxial — facing toward a stem or axis, hence a leaf's "upperside" or "inner" surface (*the opposite of abaxial*, facing away from a stem or axis, hence a leaf's "underside", "outer", "back", or "lower" surface).

alar cells — specialized cells at both basal corners of a moss leaf that differ from the other leaf cells in their size, shape, colour, or wall thickness and ornamentation.

angle cells (or **angular cells**) — ± specialized cells in the basal angles of a leaf.

annulus (plural **annuli**, adjective **annular**) — a band of specialized cells at the junction of the lid (operculum) and the mouth of a moss capsule. During dehiscence (opening) of the capsule, the annulus peels off or breaks up, allowing the lid to fall off and the spores to escape.

apex (plural **apices**, adjective **apical**) — the tip or unattached end of a stem, leaf, or other structure.

apiculate — ending in a short, abrupt point (an apiculus) that's longer than a mucro but shorter and less stout than a cusp.

apiculus (plural **apiculi**, adjective **apiculate**) — a short abrupt point at a tip or apex.

apophysis (plural **apophyses**) — a distinctly swollen and often stomatous sterile base of a capsule where it joins the seta (*synonym hypophysis*).

aquatic — growing or living in water.

archegonium (plural **archegonia**) — a moss' female reproductive organ. It's like a flask with a long neck and a swollen base (venter), and contains an egg (ovum).

arcuate — curved or bent like an archery bow or the arc of a circle.

arista (plural **aristae**, adjective **aristate**) — a hard, straight awn or bristle at the tip of a leaf, usually a projection of the costa beyond the tip of the blade.

aristate — ending in a bristle-point or awn (arista).

asexual reproduction — reproduction without the fusion of sex cells (gametes, eggs and sperm).

asymmetric (or **asymmetrical**) — lacking symmetry of form, but more precisely, said of anything that can't be cut into two mirror halves along *any* plane through its axis.

attenuate — tapering to a point.

auricle — an ear-like lobe of specialized cells near the margin of a leaf base.

autoicous — producing both male and female sex organs (antheridia and archegonia) on the same plant but in separate inflorescences (*compare with dioicous*, producing male and female sex organs (antheridia and archegonia) on separate plants).

awn — a bristle at the tip of a leaf, usually hyaline and formed by a **costa** projecting beyond the end of the leaf blade.

axil — the angle between a stem and the upper (facing) surface of a leaf, branch, or some other structure growing out of that stem.

axillary hyaline nodule — in *Fissidens*, a protuberant cluster of enlarged cells in a leaf axil, best seen after the leaf has been removed.

baculate — covered with rods (bacula) that are longer than wide.

basal angles — the groups of cells in the two outermost corners of a leaf base.

basal membrane — a delicate cylindrical or tubular membrane at the base of the inner peristome (endostome) of the capsule of many mosses. It gives rise to segments that often alternate with cilia.

- bi-** — a prefix meaning *two*, as in *bistratose* (made up of two layers of cells) (*compare with uni-*, a prefix meaning *one*, **tri-**, a prefix meaning *three*, **pluri-**, a prefix meaning *several or a few*, and **multi-**, a prefix meaning *many*).
- bifurcated** — forked into roughly equal halves.
- bistratose** — two cell layers thick.
- blade** — the thin and usually flat main portion of a leaf.
- border** — cells along a leaf margin that differ from the other leaf cells in their shape, size, colour, or wall thickening.
- brood bodies** — structures that function as vegetative propagules, such as gemmae, bulbils, underground tubers, or reduced branches (surculi) and leaves.
- calyptra** (plural **calyptrae**) — a membranous or hairy cap that forms from the wall of the archegonium (the female reproductive organ) and protects the embryonic sporophyte (the spore-producing generation of a moss life cycle). It's formed from tissues around the base of the archegonium (after the fertilization of the egg), and is ripped off as the seta elongates.
- campanulate** — bell-shaped, like an upside-down cup with a flaring mouth.
- canaliculate** — grooved or channelled lengthwise like a canal, gutter, or channel (*synonym channelled*).
- cancellinae** (singular **cancellina**, adjective **cancellinate**) — the large, sharply defined, empty, porose, and usually transparent cells in the leaf base of mosses mostly in the family Calymperaceae (*Calymperes* and *Syrrophodon*).
- carinate** — shaped like the keel of a boat.
- cauline** — part of, resembling, shaped like, or belonging to the stem.
- central strand** — a thin column or cylinder of elongate cells at the centre of the stem of some mosses.
- cernuous** — nodding or drooping at about 45°.
- channelled** — with a longitudinal groove formed by upturned margins or a sunken **costa** (*synonym canaliculate*).
- chlorocysts** — (1) in a *Sphagnum* leaf, long and narrow cells containing chlorophyll and forming a network surrounding much larger hyaline cells (hyalocysts), (2) in the leaves of the Leucobryaceae mosses (*Leucobryum*, for example), small green cells enclosed by layers of hyaline cells or intermixed with them.
- chlorophyllous** — containing chlorophyll and therefore appearing green.
- ciliate** — having fine hairs (cilia) along a margin or on a surface.
- cilium** (plural **cilia**, adjective **ciliate**) — a delicate hair-like structure.
- circinate** — coiled into a near-circle, with the tip or apex innermost.
- cladocarpous** (noun **cladocarp**) — producing sporophytes at the tips of branches (*compare with acrocarpous*, producing sporophytes at the tips of main stems, and **pleurocarpous**, producing sporophytes laterally).
- clavate** — club-shaped, lengthened and thickened toward the tip.
- cleared** — said of cells that have been stripped of their contents for better viewing under a microscope, usually by being soaked for several hours in either lactic acid or potassium hydroxide (KOH).
- cleistocarpous** — (of capsules) lacking a lid (operculum) or valves, and thus opening not along a line of built-in weakness but instead by the decay or rupture of the wall (*compare with stegocarpous*, opening with a lid or valves).
- cochleariform** — shaped like a spoon, hence deeply concave (*compare with spatulate*, shaped like a spatula, flat rather than concave).
- collenchymatous** — having cell walls that are thicker at the corners than the sides.
- coma** (plural **comae**, adjective **comal** or **comate**) — a cluster of branches at the tip of a *Sphagnum* moss, or in other mosses a tuft of crowded leaves at the stem apex.
- commissural pores** — in species of *Sphagnum* mosses, pores arranged along the margins of the hyaline leaf cells (hyalocysts).
- commissure** — in *Sphagnum* leaves, the margins of hyaline cells (hyalocysts) where they adjoin green cells (chlorocysts).
- complanate** — flattened into one plane.
- concave** — curving inwards or dished like a shallow soup bowl (*compare with convex*, curving outwards).
- concolorous** (with) — coloured the same as...

- conduplicate**— folded lengthwise so sharply that the two sides are nearly parallel.
- conic** (or **conico-**) — shaped like a cone.
- contorted** — (1) irregularly bent, twisted, or curved, (2) overlapping like shingles.
- convex** — curving or bulging outwards (*compare with* **concave**, curving inwards).
- cordate** — heart-shaped and attached by the notch rather than the tip.
- costa** (plural **costae**, adjective **costate**) — the thickened midrib or nerve of a leaf.
- crenate** — scalloped along the edge with coarse rounded teeth (*compare with* **crenulate**, scalloped along the edge with tiny rounded teeth, usually bulging cells).
- crenulate** — scalloped along the edge with tiny rounded teeth, usually bulging cells (*compare with* **crenate**, scalloped along the edge with coarse rounded teeth).
- crested** — a mane-like growth of cilia or other projections on a seta or costa.
- crisped** (or **crispate**) — strongly curled, twisted, or wavy like crisp bacon.
- C-shaped** — appearing crescent-shaped when viewed from above with an ordinary light microscope.
- cucullate** — resembling or shaped like a hood (for example, a cucullate leaf is concave at its tip, with the two sides of the leaf curving inwards).
- cuspid** — a stout and rigid tooth-like point.
- cuspidate** — ending abruptly in a stout and rigid tooth-like cusp or point.
- cuticle** (adjective **cuticular**) — a coating on the outermost wall of cells that are in direct contact with the environment, secreted onto the surface of the epidermis.
- cygneous** — curved downwards at the top like the neck of a swan.
- cymbiform** — shaped like a shallow boat.
- deciduous** — falling off, not persistent, or lost at maturity.
- decurrency** (adjective **decurent**) — any part of a structure that extends below the insertion or point of origin of that structure on a stem or costa.
- dehiscent** — rupturing or splitting open.
- dendroid** — resembling a tree in form.
- dentate** — having coarse or multicellular teeth along the margin (*compare with* **denticulate**, having fine teeth along the margin).
- denticulate** — having fine teeth along the margin (*compare with* **dentate**, having coarse or multicellular teeth along the margin).
- differentiated** — (1) specialized in morphology and physiology, (2) differing from nearby cells in size, shape, and/or colour.
- dimorphic** — having two distinctly different forms.
- dioicous** — producing male and female sex organs on separate plants (*compare with* **autoicous**, producing male and female sex organs on the same plant but in different inflorescences).
- distant** — widely spaced, as in leaves along a stem or teeth along a margin.
- distichous** — arranged in two rows or ranks on the opposite sides of a stem.
- dorsal** — the upper surface of a prostrate stem or the outer surface of a peristome tooth (*compare with* **ventral**, the lower surface of a prostrate stem or the inner surface of a peristome tooth).
- dorsal leaves** — one or more rows of leaves on the upperside of a prostrate stem (*compare with* **ventral leaves**, one or more rows of modified leaves on the underside of a prostrate stem).
- ecostate** — lacking a costa.
- elliptic** — shaped like an ellipse, with a wide middle and rounded ends.
- elongate** — markedly lengthened.
- emarginate** — notched or indented at the apex.
- emergent** — partly exposed, as in a capsule protruding only partly beyond the tips of the surrounding leaves and bracts.
- endostome** — in many mosses, the inner peristome, usually arising from the basal membrane and consisting of segments alternating with one or more cilia (*compare with* **exostome**, the outer peristome, the outer ring of teeth of a double peristome).
- entire** — said of a margin that's smooth, lacking any teeth, cilia, or indentations.
- ephemeral** — completing the entire life cycle within only a few months (*compare with* **perennial**, (1) living indefinitely, (2) taking at least three years to mature).
- epiphyte** (adjective **epiphytic**) — growing on a plant (or bark).
- equitant** — sheathing a stem tightly.

- erect** — said of anything that's pointing in the same direction as what it's attached to, for example a seta and its capsule or a leaf and its stem.
- excurrent** — (of costae) extending beyond the apex (*compare with* **failing**, not reaching the apex, **percurrent**, extending to the apex but not beyond, and **subpercurrent**, not quite reaching the apex).
- exostome** — the outer row or rows of the peristome, consisting of teeth that often are forked toward the top (*compare with* **endostome**, the inner peristome, consisting of segments and cilia).
- exothecium** (plural **exothecia**, adjective **exothecial**) — the outermost layer of cells in a capsule.
- exserted** — fully exposed (*compare with* **immersed**, fully hidden, and **emergent**, partly exposed).
- failing** — not reaching the apex (*compare with* **excurrent**, extending beyond the apex, **percurrent**, extending to the apex but not beyond, and **subpercurrent**, not quite reaching the apex).
- faint** — indistinct, poorly or weakly developed.
- falcate** — resembling a sickle blade, with edges curved and parallel.
- falcate-secund** — having leaves both curved and turned toward one side of the stem.
- fascicle** — a bundle or cluster of branches, leaves, propagules, or other structures.
- fibrillose** (*the opposite of* **efibrillose**) — ornamented with fine spiral or annular fibre-like wall thickenings.
- filament** (adjective **filamentous**) — a row of cells attached end-to-end, long and sometimes branched.
- filiform** — filamentous, thread-like, long and slender.
- firm-walled** — said of walls taking up between a tenth and a quarter of the cell width (*compare with* **thin-walled**, the walls taking up less than a tenth of the cell width, and **thick-walled**, the walls taking up a quarter or more of the cell width).
- flaccid** — soft, flabby, or limp (*compare with* **turgid**, plump, swollen, or inflated).
- flexuose** — zig-zag, wavy, bent, or twisted.
- foliate** — leafy.
- frond** (adjective **frondose**) — a highly branched shoot system that's flattened and resembles a fan, umbrella, or fern leaf.
- furrowed** — grooved lengthwise.
- fusiform** — narrow and tapered at both ends like a weaver's shuttle.
- gametophyte** — the multicellular gamete- (sex cell) producing generation of a moss or other embryophyte (*compare with* **sporophyte**, the spore-producing generation of a moss or other embryophyte).
- gemma** (plural **gemmae**, adjective **gemmae**) — a propagule produced asexually and usually consisting of a few to many cells. Gemmae can be formed on stems, rhizoids, leaves, leaf axils, or on specialized gemmiferous (gemmae-bearing) structures.
- gibbous** — bulging or swollen on one side toward the top.
- glaucous** — having a whitish or greyish bloom like the surface of a ripe plum.
- globose** — spherical or nearly so.
- gregarious** — growing close together but not densely, as in mats or tufts.
- guide cells** — a layer of large, thin-walled cells stretching across a moss leaf costa.
- gymnostomous** — lacking a capsule lid (peristome).
- hair-point** — a hair-like and often hyaline leaf tip, formed either by a costa projecting well beyond the end of the leaf blade, or by a gradual tapering of the blade tip.
- hexagonal** — having six nearly equal sides.
- homomallous** — all pointing in one direction.
- hyaline** — transparent or nearly so, lacking chlorophyll or other pigments.
- hyalocyst** — in the leaves of *Sphagnum* species, a colourless water-storage cell.
- hyalodermis** (or **hyaloderm**) — in the stems of many mosses, but especially species of *Sphagnum*, an outer layer composed of large, empty, colourless cells.
- hydrated** — wetted.
- hydric** — very wet (*compare with* **mesic**, intermediate between very wet and very dry, and **xeric**, very dry).
- hypophysis** (plural **hypophyses**) — a distinctly swollen and often stomatous sterile base of a capsule where it joins the seta (*synonym* **apophysis**).

- imbricate** — overlapping like shingles.
- immersed** — (of capsules) overtopped by surrounding leaves or bracts.
- inclined** — angled 20°–60° from the vertical (or from the seta in the case of a capsule, and then described as “inclined on the seta”).
- incurved** — curved upwards and inwards.
- inflated** — swollen like a full bladder.
- inflorescence** — a cluster of sex organs plus any leaves or bracts surrounding them.
- innovation** (adjective **innovative**) — (1) any new branch, (2) a lateral branch that forms at the base of a terminal inflorescence.
- inrolled** — rolled inwards.
- insertion** — the line or point of attachment of a leaf or branch to a stem.
- interrupted** — said of any disturbance to an arrangement that’s usually continuous or symmetric.
- intramarginal border** — a leaf border of one or more rows of specialized cells lying a short distance in from the leaf edge.
- involute** — rolled inwards at the edges (*the opposite of revolute*, rolled downwards and under at the edges).
- irregular** — not regular, as in the shape of leaf cells or the spacing of marginal teeth.
- isodiametric** — about as wide as long.
- julaceous** — resembling a catkin, with crowded leaves appressed against the stem and overlapping each other.
- juxtacostal** — located near or next to the costa.
- keeled** — sharply folded in the middle like the keel of a boat.
- lamellae** (singular **lamella**) — ribs or flaps running lengthwise down the leaves of some mosses (notably *Polytrichum* and the other hair-caps).
- lamina** (plural **laminae**, adjective **laminal**) — the flat blade of a leaf (usually one cell thick), not including the costa (midrib or nerve) if present.
- lanceolate** — lance-shaped, 3–6 times longer than wide, widest below the middle, and with slightly convex sides tapering gradually toward the apex.
- lateral** — at the side or at 90° to the stem (*compare with terminal*, at the tip or unattached end of a leaf, stem, or other structure).
- lateral leaves** — in mosses that have two kinds of leaves arranged in rows, the *larger* leaves (usually in two opposing rows along the sides of the stem).
- ligulate** — strap-shaped (*compare with lingulate*, tongue-shaped and therefore wider).
- linear** — long and narrow with nearly parallel edges.
- lingulate** — tongue-shaped (*compare with ligulate*, strap-shaped and therefore somewhat narrower).
- littoral** — of the sea.
- lumen** (plural **lumina**) — the cavity of a cell inside the cell walls.
- mammillose** — bluntly bulging in the middle (*compare with papillose*, ornamented with one or more solid protuberances).
- margin** (adjective **marginal**) — the edge of a structure such as a leaf.
- mesic** — moist, intermediate between very wet and very dry (*compare with hydric*, very wet, and *xeric*, very dry).
- midleaf** — the part of a leaf that’s roughly halfway between the base and the tip.
- midrib** — a vein in the centre of a leaf (*synonyms costa* and *nerve*).
- mitrate** (or **mitriform**) — shaped like a bishop’s cap (mitre), conic with an entire or regularly lobed base (*compare with cucullate*, conic and split down one side).
- muco** (plural **mucrones**, adjective **mucronate**) — a short and abrupt point.
- mucronate** — ending abruptly in a short point (muco) (*compare with apiculate*, ending in a point somewhat longer than a muco, and **cuspidate**, ending in an even longer point that’s also stouter).
- multi-** — a prefix meaning *many*, as in *multipapillose*, having many papillae per cell) or *multistratose* (made up of many cell layers) (*compare with uni-*, a prefix meaning *one*, *bi-*, a prefix meaning *two*, and *tri-*, a prefix meaning *three*).
- multicellular** — made up of many cells.
- naked** — smooth, lacking hairs, cilia, rhizoids, or other projections.
- neck** (adjective **necked**) — the sterile portion of a capsule (the portion that doesn’t produce spores) between the base of the spore chamber (urn) and the top of the seta.

- nerve** — the midrib of a leaf (*synonym costa*).
- ob-** — a prefix meaning *upside down or the reverse of*.
- obconic** — shaped like an upside-down cone.
- oblique** — slanted.
- oblong** — nearly rectangular in outline.
- obovate** — shaped like an egg but upside down.
- obtuse** — blunt, with the sides making an angle of more than 90° (*compare with acute*, tapering with nearly straight margins to a point with an angle less than 90°).
- operculum** (plural **opercula**, adjective **operculate**) — the lid of a moss capsule.
- orbicular** — circular in outline or nearly so.
- oval** — in outline shaped like a short ellipse.
- ovate** — egg-shaped in outline.
- ovoid** — (adjective) egg-shaped (three-dimensional); (noun) an egg-shaped solid.
- palmate** — arranged like fingers on the palm of a hand.
- panduriform** — violin-shaped.
- papilla** (plural **papillae**) — a minute solid protuberance on a cell surface, variously wart-like, spinose, forked, branched, or C-shaped.
- papillose** — roughened or ornamented with one or more papillae per cell (*compare with mamillose*, bluntly bulging in the middle).
- paraphyllia** (singular **paraphyllum**) — tiny filaments, scales, or leaf-like structures scattered on the stems of some mosses (*compare with pseudoparaphyllia*, which are clustered around the bases of branches or branch buds).
- paraphyses** (singular **paraphysis**) — sterile, septate, usually uniseriate hairs, some club-shaped or coloured, intermixed with the sex organs in most mosses.
- pellucid** — transparent or translucent.
- pendent** — drooping or hanging down.
- pentastichous** — arranged in five vertical rows evenly spaced around a stem.
- percurrent** — extending to the apex but not beyond (*compare with subpercurrent*, not quite reaching the apex, **excurrent**, extending beyond the apex, and **failing**, not reaching the apex).
- perennial** — (1) living for an indefinite number of years, (2) taking at least three years to mature (*compare with ephemeral*, completing the entire life cycle within only a few months).
- perichaetium** (plural **perichaetia**, adjective **perichaetial**) — the female sex organs plus the cluster of modified leaves surrounding them (*compare with perigonium*, the male sex organs plus the cluster of modified leaves surrounding them).
- perigonium** (plural **perigonia**, adjective **perigonial**) — the male sex organs plus the cluster of modified leaves surrounding them (*compare with perichaetium*, the female sex organs plus the cluster of modified leaves surrounding them).
- peristome** (adjective **peristomate**) — a single or double circle of teeth at the mouth of a capsule. A single peristome consists of only teeth, whereas in a double peristome, the outer peristome (the exostome) consists of teeth, and the inner peristome (the endostome) consists of segments, sometimes alternating with cilia and often arising from a basal membrane.
- persistent** — remaining attached or active.
- piliferous** — having hair-points.
- piliform** — hair-like.
- pinnate** — arranged like the barbs on a feather.
- pit** (adjective **pitted**) — a recessed or thinned area in a plant cell wall, usually opposite a similar pit in the wall of an adjacent cell.
- plane** — flat, lying in one plane, two-dimensional.
- pleurocarpous** (noun **pleurocarpy**) — producing sporophytes laterally (*compare with acrocarpous*, producing sporophytes at the tips of main stems, and **cladocarpous**, producing sporophytes at the tips of branches). Most pleurocarpous mosses are prostrate, matted, and highly branched, whereas most acrocarpous mosses are erect, tufted, and sparingly branched.
- plica** (plural **plicae**) — a lengthwise pleat or ridge.
- plicate** — pleated, folded, or furrowed lengthwise (*compare with undulate*, somewhat wavy in one direction, **rugose**, strongly wavy, folded, or wrinkled crosswise, **sul-**

- cate**, strongly grooved, furrowed, or folded lengthwise, and **striate**, marked with lines or ridges lengthwise).
- pluristratose** — several-layered.
- porose** — having cell wall pits, usually opposite similar pits in adjacent cell walls.
- propagulum** (or **propagule**) (plural **propagula** or **propagules**) — a reduced branch, bud, leaf, or other structure that reproduces a plant vegetatively.
- prorate** (or **prorose**) — (of a surface) coarsely roughened by the protruding tips of cells that strongly overlap at their ends.
- prorulate** (or **prorulose**) — (of a surface) minutely roughened by the protruding tips of cells that slightly overlap at their ends.
- prosenchymatous** — composed of tissue made up of long tapering parallel cells overlapping at their tips rather than butt-joined end-to-end.
- prostrate** — lying flat.
- protonema** (plural **protonemata**, adjective **protonemal**) — the first stage of growth (usually filamentous) of a germinating spore or other propagule.
- pseudoparaphyllia** (singular **pseudoparaphyllum**) — tiny filaments, scales, or leaf-like structures clustered around the bases of branches or branch buds (*compare with paraphyllia*, tiny filaments, scales, or leaf-like structures scattered on the stems of some mosses).
- pseudopodium** (plural **pseudopodia**) — in species of the moss genera *Andreaea* and *Sphagnum*, a tall, leafless stalk topped by a capsule (it looks like a seta, but isn't a true seta because it grows from the leafy egg-and-sperm-shedding plant in the moss life cycle rather than the spore-shedding plant that the capsule grows from).
- pyriform** — pear-shaped.
- quadrate** — square-sided or nearly so.
- radial** — arranged symmetrically in three or more rows around a stem.
- rank** — a row of similar structures such as leaves on a stem or teeth in a peristome.
- recurved** — curved backwards, downwards, or under.
- reflexed** — bent or curved abruptly downwards and inwards.
- resorption** (adjective **resorbed**) — the lysing, digestion, or erosion of parts of the cell walls in *Sphagnum* leaves, leaving irregular gaps in the surfaces of the hyaline cells (hyalocysts) or on the margins of the leaves.
- revoluble** — rolling away or falling off as a ring.
- revolute** — rolled backwards or downwards and under at the edges (*the opposite of involute*, rolled inwards at the edges).
- rhizoid** — a slender filament on stems and sometimes leaves.
- rhizome** (adjective **rhizomate**) — a slender, horizontal, underground stem.
- rhombic** — having an outline resembling a diamond or rhombus.
- rostrate** — long-beaked.
- rounded** — shaped like part of a circle.
- rudimentary** — poorly developed or vestigial.
- rugose** — strongly wavy, folded, or wrinkled crosswise (*compare with plicate*, pleated, folded, or furrowed lengthwise, **undulate**, somewhat wavy in one direction, **sulcate**, strongly grooved, furrowed, or folded lengthwise, and **striate**, marked with lines or ridges lengthwise).
- rugulose** — minutely or somewhat rugose.
- sainsburia-type peristome** — the peristome teeth are deeply split in most *Fissidens* species, but they're not in New Zealand's *Fissidens taylorii* var. *sainsburyanus*. That variant is so unusual that it's been named the *sainsburia*-type peristome.
- secund** — strongly turned or bent toward one side.
- segment** — a single, tooth-like division of the inner peristome (endostome).
- serrate** — regularly toothed like a saw blade, with the teeth pointing toward the tip.
- serrulate** — minutely regularly toothed, with each tooth part of a single cell.
- seta** (plural **setae**) — the stalk of a capsule.
- setaceous** — bristle-like.
- sheathing** — surrounding or closely clasping a stem or seta.
- side-nerve** — a branchlet of a costa.
- sigmoid** — S-shaped.
- simple** — not forked or branched.

- sinuose** — having a wavy or uneven wall or margin.
- sinus** — in *Andreaea* leaves, a U-shaped indentation along the leaf margin.
- smooth** — lacking any surface irregularities such as papillae, spines, or striae.
- spathulate** — in the shape of a spatula, narrow below and broad and flat above (*compare with cochleariform*, shaped like a spoon and therefore deeply concave).
- spherical** — shaped like a sphere or nearly so.
- spinose** — having sharp teeth or spines.
- sporophyte** — the spore-producing generation of a moss or other embryophyte (*compare with gametophyte*, the multicellular gamete- (sex cell) producing generation of a moss or other embryophyte).
- spreading** — making an angle of more than 45° with the stem.
- squarrose** — making an angle of 90° with the stem.
- stegocarpous** — (of capsules) opening with a lid (operculum) or valves (*compare with cleistocarpous*, lacking a lid or valves and thus opening not along a line of built-in weakness but instead by the decay or rupture of the wall).
- stellate** — star-shaped.
- stereids** — stiffener cells that support the leaves and stems of some mosses. They're long, slender, and thick-walled (fibre-like), are alive at maturity in some species, and occur in bundles in the costa and borders of leaves or in the central strand and toward the outside of stems.
- stipe** (adjective **stipitate**) — the erect, unbranched trunk-like stem of mosses that look like miniature fern fronds.
- stoma** (plural **stomata**, adjective **stomatous**) — a tiny pore for gas exchange, usually surrounded by two guard cells that control its opening, and in mosses usually found in only the neck of capsules.
- stria** (plural **striae**, adjective **striate**) — a line or ridge running lengthwise.
- striola** (plural **striolae**, adjective **striolate**) — a delicate or fine line or ridge running lengthwise.
- strumose** — swollen goiter-like on one side.
- sub-** — a prefix meaning *nearly, almost, below, or somewhat*.
- subapex** — the portion of a leaf just below the apex.
- subpercurrent** — not quite reaching the tip (*compare with excurrent*, extending beyond the apex, **failing**, not reaching the apex, and **percurrent**, extending to the apex but not beyond).
- subquadrate** — not quite square-sided.
- substratum** (plural **substrata**) — whatever surface an organism is growing on, such as soil, plant debris, bark, living leaves, or rock.
- subula** (plural **subulae**, adjective **subulate**) — a long and slender needle- or awl-like point.
- subulate** — shaped like an awl, tapering to a fine point from a broad base.
- sulcate** — strongly grooved, furrowed, or folded lengthwise (*compare with plicate*, pleated, folded, or furrowed lengthwise, **rugose**, strongly wavy, folded, or wrinkled crosswise, **undulate**, somewhat wavy in one direction, and **striate**, marked with lines or ridges lengthwise).
- superficial** — on the surface.
- super-** — a prefix meaning *placed above or higher than or of higher quality or size*.
- supra-** — a prefix meaning *just above, beyond, or greater than*.
- surculus** (plural **surculi**) — a reduced branch or leaf that functions as a vegetative propagule.
- symmetric** (or **symmetrical**) — said of anything that can be cut into two mirror halves along an unlimited number of planes.
- systylious** — said of a capsule that opens without shedding its lid (which remains attached to the tip of the columella, a core of sterile tissue at the capsule's centre).
- teniola** (plural **teniolae**) — an intramarginal border of hyaline (colourless) cells.
- terete** — circular or nearly so in cross-section.
- terminal** — located at the tip or unattached end of a structure (*compare with lateral*, at the side or at 90° to the stem).
- terrestrial** — growing on soil.
- thick-walled** — said of walls taking up a quarter or more of the cell width (*compare*

- with **thin-walled**, the walls taking up less than a tenth of the cell width, and **firm-walled**, the walls taking up between a tenth and a quarter of the cell width).
- thin-walled** — said of walls taking up less than a tenth of the cell width (*compare with firm-walled*, the walls taking up between a tenth and a quarter of the cell width, and **thick-walled**, the walls taking up a quarter or more of the cell width).
- tomentum** (plural **tomenta**, adjective **tomentose**) — a felted and woolly covering of rhizoids.
- toothed** — armed with teeth or other sharp projections.
- tri-** — a prefix meaning *three* (*compare with uni-*, a prefix meaning *one*, **bi-**, a prefix meaning *two*, **pluri-**, a prefix meaning *several or a few*, and **multi-**, a prefix meaning *many*).
- triangular** — shaped like a triangle.
- trigonous** — said of a cell having triangle- or heart-shaped wall thickenings in the corners where it abuts two adjacent cells.
- truncate** — cut off closely and squarely at the apex.
- tuber** — a gemma-like but non-green brood body (asexual propagule) that's borne on rhizoids, usually underground.
- turbinate** — shaped like a child's top, an upside-down pear, or an inverted cone.
- turf** (plural **turves** or **turfs**) — a growth form of large patches of short or tall, erect and crowded shoots.
- turgid** — plump, swollen, or inflated (*compare with flaccid*, soft, flabby, or limp).
- umbellate** — arranged in a cluster of branches all arising from one point on a stem.
- underleaves** — leaves (usually arranged in a row) that are smaller than the other leaves on the stem, and usually shaped differently as well.
- undifferentiated** — said of cells that are *not* distinctly different in size, shape, and/or colour from nearby cells, for example in the alar region of a leaf base (*the opposite of differentiated*).
- undulate** — somewhat wavy in one direction (*compare with plicate* — pleated, folded, or furrowed lengthwise, **rugose**, strongly wavy, folded, or wrinkled crosswise, **sulcate**, strongly grooved, furrowed, or folded lengthwise, and **striate**, marked with lines or ridges lengthwise).
- uni-** — a prefix meaning *one*, as in *unipapillose* (having only a single papilla per cell) or *unistratose* (made up of a single layer of cells) (*compare with bi-*, a prefix meaning *two*, **tri-**, a prefix meaning *three*, **pluri-**, a prefix meaning *several or a few*, and **multi-**, a prefix meaning *many*).
- urceolate** — urn-shaped, narrowed somewhat below the mouth and again strongly at the base.
- urn** — the spore-bearing part of a capsule.
- vaginant lamina** — the slotted portion of the forward edge of a *Fissidens* leaf.
- valves** (adjective **valvate**) — in *Andreaea*, the segments that the opening capsule wall splits into along built-in lines of weakness.
- ventral** — the lower surface of a prostrate stem or the inner surface of a peristome tooth (*compare with dorsal*, the upper surface of a prostrate stem or the outer surface of a peristome tooth).
- ventral leaves** — one or more rows of modified leaves on the underside of a prostrate stem (*compare with dorsal leaves*, one or more rows of leaves on the upperside of a prostrate stem).
- vermicular** — long, narrow, and wavy like a worm.
- verrucose** — coarsely warty or roughened on the surface, as in the ornamentation of a spore (*compare with verruculose*, delicately or irregularly roughened or warty on the surface).
- verruculose** — delicately or irregularly roughened or warty on the surface (*compare with verrucose*, coarsely warty or roughened on the surface).
- vestigial** — reduced to only a non-functioning trace or remnant.
- wide-spreading** — making an angle of almost 90° with the stem.
- xeric** — very dry (*compare with hydric*, very wet, and **mesic**, intermediate between very wet and very dry).

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