KEYS FOR THE IDENTIFICATION OF THE MOSSES OF THE PACIFIC NORTHWEST

Reprinted from

Moss Flora of the Pacific Northwest

ELVA LAWTON

University of Washington, Seattle

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Nichinan, Miyazaki, Japan

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As defined in the present work, the Pacific Northwest includes Washington, Oregon, Idaho, western Montana, Wyoming, and the Canadian Provinces of British Columbia and Alberta through the Rocky Mountains and north to about the fifty-second parallel. A total of 598 species and varieties of mosses are known from these states and provinces, but the keys include a few additional taxa for which there are unverified reports. Vegetative characters have been used whenever possible in the key dichotomies because many collections are sterile or have immature capsules.

Summary of General Keys 1–5

Always begin with Key 1. A genus or a species may appear more than once. The first five keys lead to Keys 6–118, or to genera, species, or rarely to families. The keys to genera and species, numbers 6–118, are arranged by families according to the system given by Brotherus in Engler and Prantl.

Illustrations for terms in the glossary are given in the Moss Flora of the Pacific Northwest.

The index includes all genera given in the keys and all family names. Species names are included for those occurring in keys 1–5. For other species names refer to the appropriate genera.

Grateful acknowledgement is made to the National Science Foundation for research grants to the University of Washington (G 19332 and GB 3046) in support of this study.

GENERAL KEYS (1–5)

The general keys consist of five numbered parts. In Keys 1–5 page numbers refer to pages in the Moss Flora of the Pacific Northwest which contains the descriptions and illustrations.

Key 1. Introductory Key

1. Plants gray-green or whitish, scarcely appearing green when dry; leaves with small green cells surrounded by large hyaline cells; capsule elevated on a pseudopodium, opening by an operculum..... .....Sphagnidae (not treated here)
1. Plants without this combination of characters.....2
2. Capsule with an operculum and a peristome of 4 teeth .....Tetraphidaceae, Key 8 (p. 27)
2. Capsule eperistomate, or the peristome of more than 4 teeth, or the plants sterile.....3
3. Capsules never erect and radially symmetric; leaves not evident or not conspicuous (larger and evident in *Diphyscium*) 4
3. Capsules otherwise, or plants sterile; leafy gametophyte evident and often conspicuous.....5
4. Capsule horizontal to cernuous, about 1 mm long; seta smooth.....*Discelium nudum* (p. 150)
4. Capsule ± obliquely egg-shaped, somewhat ventricose, 3–7 mm long; seta rough or smooth..... .....Buxbaumiaceae, Key 9 (p. 28)
5. Leaves distichous (in 2 rows on the stem), or strongly complanate.....6
5. Leaves neither distichous nor complanate.....11
6. Leaves distichous; plants mostly small 7
6. Leaves complanate but not distichous 10
7. Leaves ecostate; plants small and fern-like, in caves and dark places in the woods..... .....*Schistostega pennata* (p. 162)
7. Leaves costate; plants not fern-like.....8
8. Leaves subulate; seta long .....*Distichium*, Key 19 (p. 50)
8. Leaves not subulate, or the perichaetial bracts subulate and the seta short.....9
9. Leaves apparently split on inner edge and clasping the stem .....*Fissidens*, Key 17 (p. 44)
9. Leaves folded lengthwise and clasping the stem; rare .....*Bryoxiphium norvegicum* (p. 43)
10. Acrocarpous (sporophyte terminal); leaves bordered.....Mniaceae, Key 66 (p. 189)
10. Pleurocarpous (sporophytes lateral, on special short branches); plants creeping; leaves not bordered...14
11. Calyptra hairy, covering most of the capsule.....12
11. Calyptra not hairy or not found, often small and falling early, or the plants sterile.....13
12. Calyptra plicate; seta short; plants on trees or rocks.....Orthotrichaceae, Key 74 (p. 215)
12. Calyptra not plicate; seta long; plants usually on soil, sometimes on rocks or rotten wood..... .....Polytrichaceae, Key 11 (p. 30)
13. Plants pleurocarpous (sporophytes lateral, on special short branches).....14
13. Plants acrocarpous (sporophyte terminal).....16
14. Leaves ecostate, or the costa short, double, or both .....Key 4 (p. 18)
14. Costa otherwise 15
15. Costa strong, 3/4 or more the length of the leaf, often with 1–2 supplementary costae on each side of the main costa.....*Antitrichia*, Key 83 (p. 240)
15. Costa single and to the middle of the leaf at least in stem leaves, supplementary costae wanting...Key 5 (p. 21)
16. Leaves ecostate, ovate or ovate-lanceolate.....17
16. Leaves costate, ovate to linear, sometimes the rib occupying all the upper part of the leaf.....20
17. Plants very small, on soil, often with persistent protonema.....*Micromitrium tenerum* (p. 150)
17. Plants otherwise, on rock 18
18. Leaves with hyaline points.....Hedwigiaceae, Key 80 (p. 236)
18. Leaves without hyaline points 19
19. Capsule opening by 4 slits, the slits not reaching the apex .....*Andreaea rupestris* (p. 26)
19. Capsule with an operculum and a peristome of 4 teeth .....Tetraphidaceae, Key 8 (p. 27)
20. Leaves with lamellae or filaments on the ventral (upper) surface, rarely on both surfaces.....21
20. Leaves without outgrowths on the leaf surfaces, or rarely with lamellae on the dorsal costa only.....23

21. Leaves with filaments on the ventral surface; capsule peristomate.....Pottioideae, Key 35 (p. 84)
21. Leaves with lamellae.....22
22. Leaves small, to 1.5 mm long, usually shorter, piliferous; capsule eperistomate.....*Pterygoneurum*, Key 44 (p. 103)
22. Leaves larger, 2.5–14 mm long; capsule peristomate except *Lyellia*.....Polytrichaceae, Key 11 (p. 30)
23. Plants bearing special asexual reproductive bodies.....24
23. Plants without evident asexual reproductive bodies (bulbils sometimes borne on the rhizoids).....43
24. Asexual reproductive bodies borne on special pseudopodia; leaf cells papillose.....*Aulacomnium*, Key 67 (p. 201)
24. Asexual reproductive bodies not borne on pseudopodia.....25
25. Asexual reproduction by flagellate branches, or by clusters of small leaves borne on the tips of leafy stems.....26
25. Asexual reproduction otherwise.....29
26. Leaves oblong to spatulate.....*Tortula*, Key 46 (p. 106)
26. Leaves ovate-lanceolate to lanceolate.....27
27. Plants small, silvery to whitish green, common.....*Bryum argenteum* (p. 165)
27. Plants otherwise.....28
28. Costa with guide cells and stereid bands evident in cross section, the ventral layer of cells scarcely differentiated.....*Dicranum flagellare* (p. 74)
28. Costa with a ventral layer of large hyaline cells, the guide cells and stereid bands less clearly differentiated.....*Campylopus*, Key 25 (p. 62)
29. Leaf cells papillose, mammillose, or with cuticular thickenings.....30
29. Leaf cells smooth.....36
30. Gemmae borne on the leaf tips.....31
30. Gemmae borne on the leaf blades or in the leaf axils.....32
31. Gemmae ± spherical, multicellular; leaf cells with cuticular thickenings resembling papillae in cross section.....*Grimmia hartmanii* var. *anomala* (p. 128)
31. Gemmae oblong-cylindric, septate; leaf cells papillose.....*Ulota phyllantha* (p. 229)
32. Leaves with one papilla per cell.....33
32. Leaves with more than one papilla per cell.....34
33. Leaves entire; plants on trees.....*Orthotrichum*, Key 76 (p. 217)
33. Leaves usually serrate at the tips; plants on wet soil or soil over rock.....*Dichodontium pellucidum* (p. 65)
34. Leaves 1–2 mm long, contorted when dry, acuminate, apex often subulate; margins plane, entire; plants on trees or rocks.....*Zygodon vulgaris* (p. 230)
34. Leaves larger, or apex otherwise, or both.....35
35. Gemmae filamentous, borne on stems and leaf bases; plants on soil or rock.....*Encalypta*, Key 47 (p. 115)
35. Gemmae ± spherical, borne on leaf blades; plants on trees, rarely on rock.....*Tortula latifolia* (p. 110)
36. Leaves ± contorted when dry, the apices broad and rounded.....37
36. Leaves acute or acuminate.....38
37. Leaves ± fleshy, obovate, 2–3×1.5–2 mm; basal leaf cells with long cilia on the margins.....*Oedipodium griffithianum* (p. 157)
37. Leaves not fleshy, ovate to obovate or suborbicular, 1.5–2×0.8–1.5 mm, without cilia.....*Bryum cyclophyllum* p. 169)
38. Gemmae borne in cup-shaped receptacles formed by the upper leaves.....Tetraphidaceae, Key 8 (p. 27)
38. Gemmae not borne in cup-shaped receptacles.....39
39. Upper leaf cells long, 3:1 or longer; gemmae in the leaf axils, or sometimes on the rhizoids; plants on soil.....Key 3, no. 59 (p. 18)
39. Upper leaf cells short, rounded to quadrate.....40
40. Leaves strongly crisped and contorted when dry.....41
40. Leaves not or only slightly crisped and contorted.....42
41. Plants always on rock; leaves 0.75–2 mm long, rarely longer, usually with hyaline points on some of the upper leaves.....*Grimmia torquata* (p. 132)
41. Plants usually on wood; leaves 2–3 mm long, hyaline points never present.....*Dicranoweisia cirrata* (p. 71)
42. Leaves with hyaline points, leaf margins bistratose; plants on rock.....*Grimmia trichophylla* (p. 132)
42. Leaves without hyaline points, leaf margins unistratose; plants on soil, soil over rock, or rarely on wood.....*Ceratodon purpureus* (p. 49)

Plants without evident asexual reproduction

43. Plants dark green to blackish, or sometimes reddish brown, commonly on rock; leaf cells usually thick-walled, the basal cell walls sometimes sinuose or nodulose....44
43. Plants otherwise, if blackish, on soil....51
44. Leaves large, to 5 mm long or longer, broad and rounded at apex; capsules immersed to emergent; plants black or nearly so except at the growing tips, ± aquatic....*Scouleria*, Key 51 (p. 149)
44. Plants otherwise; capsules immersed or exserted....45
45. Calyptra plicate and often hairy, if naked the capsule ribbed; peristome often double; capsule immersed, or exserted on a short seta; plants on trees or rock....Orthotrichaceae, Key 74 (p. 215)
45. Calyptra not plicate except *Ptychomitrium* and *Grimmia* subg. *Coscinodon*, never hairy; peristome single or wanting....46
46. Leaves rigid and brittle when dry (except *Andreaea nivalis*); seta wanting, capsule opening by 4 slits, the slits not reaching the apex; peristome wanting; small plants on rock, usually alpine or subalpine....*Andreaea*, Key 7 (p. 25)
46. Leaves otherwise; capsule with operculum, peristome usually present....47
47. Basal leaf cells, sometimes all cells, with thick sinuose or nodulose walls; peristome teeth 16, each cleft to the base or nearly so....*Rhacomitrium*, Key 50 (p. 141)
47. Plants otherwise....48
48. Leaves large, 4–6 mm long, sharply toothed above, the cells smooth; calyptra plicate, campanulate-mitrate; seta long; peristome teeth 16, each cleft to the base or nearly so....*Ptychomitrium gardneri* (p. 140)
48. Plants otherwise....49
49. Leaves broad at apex, the cells papillose; peristome teeth long, twisted; seta long; plants usually on soil or rock, rarely on trees....*Tortula*, Key 46 (p. 106)
49. Leaves not broad at apex, the cells rarely papillose; peristome usually well-developed, never long and twisted, rarely rudimentary or wanting; plants on rock, mostly noncalcareous....50
50. Leaves crisped when dry, muticous, 1–3 mm long; autoicous; capsule long, seta usually curved, operculum about as long as the urn....*Campylostelium saxicola* (p. 119)
50. Leaves not usually crisped, if crisped, at least the upper leaves piliferous....*Grimmia*, Key 49 (p. 120)
51. Leaves broadly lingulate to spatulate, bordered by thick-walled, enlarged cells, the border cells sometimes orange in color and sometimes in 2 layers, the extreme marginal row of cells not enlarged; rare....*Scopelophila latifolia* (p. 104)
51. Leaves otherwise....52
52. Stems covered with dense tomentum; leaves strongly serrate above, cells smooth, or weakly papillose; capsules subglobose to short-cylindric, erect, not conspicuously furrowed when dry; plants on rock....*Anacolia menziesii* (p. 206)
52. Stems without tomentum, or the tomentum inconspicuous; capsules otherwise....53
53. Plants with capsules....54
53. Plants either sterile or with capsules....96
54. Capsule without operculum, opening irregularly; plants on soil....55
54. Capsule with operculum....59
55. Capsule 2–4 mm long, seta long; arctic-alpine....*Voitia nivalis* (p. 161)
55. Capsule smaller, immersed; not arctic-alpine....56
56. Capsule ± globose, not apiculate....[*Acaulon*, reported from the Pacific Northwest]
56. Capsule otherwise....57
57. Costa ending before leaf apex, thin; cells of lamina 13–17 μ wide....*Pseudephemerum nitidum* (p. 83)
57. Costa excurrent....58
58. Leaves subulate, the cells smooth....*Pleuridium subulatum* (p. 55)
58. Leaves ovate to lanceolate, the cells smooth or ± papillose....*Phascum cuspidatum* (p. 100)
59. Small plants on rock; leaves ovate-lanceolate to subulate, margins plane; leaf cells never papillose; capsule exserted, erect, or somewhat inclined by the curved seta....60
59. Plants otherwise....62
60. Leaves 1–2 mm long, sometimes bistratose near apex; capsule ribbed above the middle when dry, urn ovoid, 0.4–0.6 mm long; peristome wanting; seta 1–2 mm long, arcuate when moist; rare, at high altitudes....*Grimmia olympica* (p. 130)
60. Without this combination of characters....61

61. Leaves crisped when dry, 1–4 mm long, the cells small, thick-walled; margins bistratose; seta usually curved; capsule smooth; peristome of 16 teeth; operculum rostrate.....*Campylostelium saxicola* (p. 119)
61. Leaves not crisped, less than 2 mm long except *Blindia*; margins not bistratose; capsule often with a short neck, the urn smooth or ribbed; peristome wanting, or of 16 teeth, sometimes rudimentary.....Seligeriaceae, Key 21 (p. 56)
62. Capsules eperistomate.....63
62. Capsules peristomate, or old capsules sometimes without peristomes.....73
63. Leaf cells papillose, mammillose, or with thickened cuticular ridges, in cross section the ridges resembling papillae 64
63. Leaf cells smooth.....72
64. Calyptra large and conspicuous, covering the capsule; leaves usually more than 3 mm long.....*Encalypta*, Key 47 (p. 115)
64. Calyptra smaller, or not evident; leaves smaller.....65
65. Capsules ribbed when dry.....Orthotrichaceae, Key 74 (p. 215)
65. Capsules not ribbed.....66
66. Leaf margins involute; peristome variable, well-developed, rudimentary, or wanting.....*Weissia controversa* (p. 114)
66. Leaf margins plane to revolute.....67
67. Leaves lanceolate from the ovate base, ± decurrent, margins slightly to strongly recurved; plants on rock or soil near streams .....*Barbula rubiginosa* (p. 92)
67. Leaves otherwise.....68
68. Leaf margins distinctly recurved on one or both sides.....69
68. Leaf margins usually plane, sometimes slightly recurved in *Pottia truncata*.....70
69. Costa ending before the apex; columella attached to the operculum; plants usually on limestone.....*Gymnostomum recurvirostre* (p. 99)
69. Costa percurrent or shortly excurrent; columella free .....*Didymodon columbianus* (p. 96)
70. Costa excurrent, or the leaves bordered, or both.....*Pottia*, Key 43 (p. 100)
70. Costa not excurrent.....71
71. Basal leaf cells hyaline, rectangular; seta 2–5 mm long; sex organs not axillary; plants on moist limestone .....*Gymnostomum aeruginosum* (p. 99)
71. Basal leaf cells not hyaline; seta 6–12 mm long; sex organs and seta axillary; plants in dense cushions on noncalcareous rock .....*Anoectangium aestivum* (p. 87)
72. Capsule ventricose, immersed on a short arcuate seta; plants on rock.....*Grimmia anodon* (p. 125)
72. Capsule not ventricose, not immersed except *Physcomitrium immersum*.....Key 3, no. 28 (p. 17)

Capsule with operculum, most species peristomate

73. Calyptra large and conspicuous, covering the capsule or nearly so, commonly campanulate, often plicate...74
73. Calyptra smaller, often not evident on mature capsules.....77
74. Leaf cells papillose.....75
74. Leaf cells smooth.....76
75. Calyptra neither plicate nor hairy, extending to the base of the capsule; seta long; leaves sometimes piliferous; plants on soil or rock.....*Encalypta*, Key 47 (p. 115)
75. Calyptra plicate, often hairy, usually not extending to the base of the capsule; seta shorter; capsule immersed to shortly exserted; leaves not piliferous; plants on trees or rock.....Orthotrichaceae, Key 74 (p. 215)
76. Leaves with long white awns; capsule not ribbed.....*Grimmia* subg. *Coscinodon*, Key 49 (p. 120)
76. Leaves without awns; capsule ribbed.....*Orthotrichum*, Key 76 (p. 217)
77. Capsule smooth, inclined to pendent, the neck about as long as the rest of the capsule; leaves subulate, the cells not papillose .....Key 3, no. 22 (p. 16)
77. Plants otherwise 78
78. Capsule strumose (with a goiter-like swelling at the base).....79
78. Capsule not strumose.....85
79. Costa lacking guide cells and stereid bands; alar cells ± differentiated, sometimes inflated; autoicous.....*Arctoa*, Key 24 (p. 59)
79. Costa with guide cells and stereid bands, the stereids usually well-developed.....80
80. Alar cells plainly inflated, usually brown; dioicous .....*Dicranum*, Key 30 (p. 72)
80. Alar cells not inflated, or if slightly inflated not brown.....81

81. Leaf cells papillose or mammillose....82
81. Leaf cells smooth....83
82. Leaf margins plane; leaves oblong-lanceolate to lingulate....*Dichodontium olympicum* (p. 65)
82. Leaf margins recurved at least in the middle of the leaf....*Cynodontium*, Key 26 (p. 63)
83. Capsule long, about 3:1, plainly ribbed when dry; operculum conic; peristome teeth 16, bifid nearly to the base; common....*Ceratodon purpureus* (p. 49)
83. Capsule usually shorter, often broader, smooth, or somewhat ribbed when dry; operculum rostrate; peristome teeth 16, bifid about halfway....84
84. Capsule smooth, or somewhat wrinkled; autoicous; leaves crisped and contorted when dry....*Oncophorus*, Key 31 (p. 81)
84. Capsule ± ribbed when dry; dioicous; leaves not crisped and contorted when dry....*Dicranella*, Key 28 (p. 66)
85. Capsule strongly ribbed when dry....86
85. Capsule not strongly ribbed when dry....89
86. Capsule plainly zygomorphic; peristome teeth and cells of the operculum spiral; annulus well-developed, deciduous; leaves obovate to oblong-ovate; leaf cells large, smooth, and clear....*Funaria hygrometrica* (p. 153)
86. Plants otherwise....87
87. Capsule always straight and erect; calyptra large, plicate, often hairy; leaf cells commonly papillose, the papillae on the lumen....Orthotrichaceae, Key 74 (p. 215)
87. Without this combination of characters....88
88. Capsule short and broad, zygomorphic, or if erect and radially symmetric, the leaves lanceolate to subulate, or sometimes subulate from the sheathing base; leaf cells rarely smooth, commonly papillose, the papillae often on the cell ends....Bartramiaceae, Key 70 (p. 206)
88. Capsule 3:1 or longer, or if short, the operculum rostrate....96

Capsules not strongly ribbed

89. Capsule erect, or rarely horizontal; neck usually plainly differentiated, either long or short, sometimes longer than the rest of the capsule; leaf cells smooth....90
89. Capsule not erect, or if erect, the neck not clearly differentiated....96
90. Alar cells inflated, brown; capsule short, ovoid to pyriform, the neck short; plants on rock....*Blindia acuta* (p. 56)
90. Alar cells not inflated; plants not usually on rock....91
91. Leaves subulate from the sheathing base; capsule reddish brown; operculum rostrate; peristome single....*Trematodon boasii* (p. 84)
91. Plants otherwise....92
92. Leaves linear-lanceolate to setaceous; plants on charred or decaying wood, usually in the redwood region....*Orthodontium gracile* (p. 178)
92. Leaves broader....93
93. Leaf margins recurved; cells with thick pitted walls; costa broad, 1/3 the width of the leaf base or wider....*Pohlia cardotii* (p. 182)
93. Leaves otherwise....94
94. Leaf margins ± recurved, entire; walls of leaf cells thin, not pitted; capsule erect to horizontal; outer peristome wanting; endostome of 16 linear segments; plants on rock....*Mielichhoferia macrocarpa* (p. 177)
94. Without this combination of characters; plants not on rock....95
95. Leaves ovate to ovate-lanceolate, the margins plane or nearly so; median leaf cells 9–15 μ wide, the walls not pitted; neck usually shorter than the rest of the capsule; peristome double, the endostome rudimentary; in alpine regions, usually near melting snow....*Pohlia erecta* (p. 184)
95. Plants otherwise....Key 3, no. 47 (p. 18)
96. Basal leaf cells, sometimes all cells, with thick sinuose or nodulose walls; cells smooth, or if papillose, with several papillae per cell; leaves sometimes with conspicuous, strongly papillose hyaline points....*Rhacomitrium*, Key 50 (p. 141)
96. Leaves otherwise....97
97. Leaf cells papillose, mammillose, or with thickened cuticular ridges, in cross section the ridges resembling papillae....Key 2 (p. 13)

97. Leaf cells smooth .....Key 3 (p. 15)

Key 2. Acrocarpous Mosses, the Leaf Cells Papillose, Mammillose, or with Cuticular Ridges

1. Leaves strongly squarrose-recurved, decurrent, the cells mammillose; capsule arcuate, smooth, the neck long; plants in bogs.....*Paludella squarrosa* (p. 204)
1. Without this combination of characters.....2
   2. Vegetative leaves lingulate, rounded to cucullate at apex, bistratose, the cells of both layers with many small papillae; costa ending before the apex; margins plane; perichaetial bracts ovate-lanceolate, costa excurrent; capsule immersed, ventricose, obliquely ovoid-conic.....*Diphyscium foliosum* (p. 30)
   2. Plants otherwise.....3
3. Leaves linear-lanceolate, muticous, lamina bistratose, the ventral layer of cells strongly mammillose, the dorsal layer smooth; capsule erect, cylindric; seta long.....*Timmiella crassinervis* (p. 104)
3. Leaves otherwise, the lamina not bistratose, or if so, the cells otherwise*.....4
   4. Leaves strongly toothed, stiff, linear-lanceolate or oblong-lanceolate from the sheathing base, the sheath hyaline, yellow, or orange; peristome double, the basal membrane of endostome broad, with 64 long, papillose cilia.....*Timmia*, Key 73 (p. 213)
   4. Plants otherwise 5
5. Leaves oblong, lingulate, or spatulate, always broad in the upper part, or ± acuminate in *Encalypta alpina* 6
5. Leaves ovate, ovate-lanceolate, lanceolate, or sometimes oblong-lanceolate, always plainly narrower in the upper part.....12
   6. Plants arctic-alpine, yellow-green; leaves entire, apex broad and rounded, often ± cucullate; costa ending just before the apex; leaf cells with a single papilla on each surface; cell walls thick and sinuose .....*Aulacomnium turgidum* (p. 202)
   6. Without this combination of characters.....7
7. Plants on soil; leaves 1–2.8 mm long, never bordered, sometimes apiculate, never with long awns; seta long; peristome with a short basal membrane, the teeth long and twisted.....*Barbula*, Key 39 (p. 88)
7. Without this combination of characters.....8
   8. Plants on trees or rocks near streams; leaves never apiculate, usually toothed at apex; costa ending before apex; margins strongly recurved; capsule immersed, ribbed when dry, nearly covered by the large plicate calyptra.....*Orthotrichum rivulare* (p. 226)
   8. Plants otherwise, on soil or soil over rock, rarely on trees; capsule never immersed.....9
9. Leaf margins plane or incurved, sometimes ± recurved in part of the leaf; calyptra large, covering the capsule, never plicate.....*Encalypta*, Key 47 (p. 115)
9. Leaf margins usually plainly recurved at least at the base, often recurved from base to apex, rarely only in the middle; calyptra cucullate.....10
   10. Peristome teeth long, distinctly twisted, basal membrane long or short.....*Tortula*, Key 46 (p. 106)
   10. Peristome teeth when present not long and twisted, sometimes short and slightly twisted.....11
11. Peristome wanting, or if present, each tooth irregularly divided or perforate; leaves usually imbricate... .....*Pottia*, Key 43 (p. 100)
11. Peristome teeth usually divided to form 2–3 prongs, straight or slightly twisted, sometimes rudimentary; leaves usually somewhat twisted and contorted when dry .....*Desmatodon*, Key 40 (p. 94)
   12. Leaf cells papillose or mammillose, one papilla on each surface on or near the middle of the cell, the papillae often high, sometimes a few cells with forked papillae.....13
   12. Papillae otherwise, either not clearly in the middle of the cell, or more than one per cell, or formed at the cell ends.....16
13. Leaves ovate-lanceolate to lingulate, apex acute to obtuse, margins plane, or recurved at base; leaf cells papillose-mammillose, the papillae simple or rarely forked, usually large; cell walls not sinuose; capsule exserted, smooth, peristome single .....*Dichodontium*, Key 27 (p. 65)
13. Leaves otherwise; capsule smooth or ribbed.....14
   14. Calyptra large, plicate, often hairy; capsule erect and straight, smooth or ribbed, immersed, or on a

* Leaves with the lamina bistratose in part are found in the following genera, but identification depends primarily on other characters: *Bartramia*, *Ditrichum zonatum*, *Grimmia*, *Orthotrichum hallii*, *Tortula bistratosa*.

short seta; gemmae, if present, borne on the leaves; plants on trees or rock..... ..... *Orthotrichum*, Key 76 (p. 217)
14. Calyptra otherwise; capsule ribbed.....15
15. Capsule elongate, 2–3:1; seta long; upper leaf cells short, the papillae large..... *Aulacomnium*, Key 67 (p. 201)
15. Capsule short, nearly as broad as long; seta long or short; leaf cells usually clearly longer than broad, the papillae large or small.....Bartramiaceae, Key 70 (p. 206)
16. Alar cells inflated, often brown .....Key 1, no. 79 (p. 12)
16. Alar cells not inflated.....17
17. Hyaline cells of leaf base extending up the margins forming a "V"..... *Tortella*, Key 45 (p. 105)
17. Hyaline cells, if present, not extending higher on the margins than at the costa.....18
18. Leaf apex with teeth on the margins and on the adjacent cells of the lamina; cells with cuticular thickenings..... *Plagiopus oederi* (p. 212)
18. Leaves otherwise 19
19. One papilla at or near the upper end of the cell, or a papilla at each end, or rarely the papilla in the middle of the cell.....20
19. Two to many papillae per cell, or the cells with cuticular ridges.....22
20. Small plants on soil; leaves ± squarrose and contorted, or stiff and erect; capsule ± cylindric; peristome of 16 teeth, each divided nearly to the base .....*Ditrichum*, Key 20 (p. 51)
20. Plants otherwise 21
21. Leaves with margins plane or incurved, alar cells differentiated, sometimes inflated; capsule smooth, or if ribbed, distinctly longer than broad; operculum rostrate; peristome teeth 16, each divided about halfway .....*Arctoa*, Key 24 (p. 59)
21. Leaves with margins recurved, or if plane, the alar cells not clearly differentiated; capsule short and broad, zygomorphic, often ribbed when dry; operculum not rostrate except in *Conostomum*; peristome otherwise .....Bartramiaceae, Key 70 (p. 206)
22. Leaves bordered by yellowish, thick-walled cells.....*Pottia*, Key 43 (p. 100)
22. Leaves not bordered.....23
23. Plants small, usually on soil; leaf margins recurved, rarely plane, never involute; costa excurrent.....24
23. Plants otherwise 27
24. Median leaf cells small, 6–12 μ wide, ± quadrate; capsule exserted, with operculum and peristome .....*Barbula*, Key 39 (p. 88)
24. Median leaf cells larger.....25
25. Capsule immersed, without operculum; leaf margins recurved.....*Phascum cuspidatum* (p. 100)
25. Capsule exserted, operculum present.....26
26. Leaf margins recurved or plane; peristome wanting, or of 16 teeth, the teeth entire, or bifid at the tips.....*Pottia*, Key 43 (p. 100)
26. Leaf margins recurved; the 16 peristome teeth bifid to below the middle, straight, or slightly twisted .....*Desmatodon leucostoma* (p. 95)
27. Leaf margins plane or incurved.....28
27. Leaf margins recurved.....38
28. Leaf cells with thickened cuticular ridges; leaf margins often bistratose; peristome present; plants usually on rock, rarely on logs .....*Dicranoweisia*, Key 29 (p. 71)
28. Leaf cells papillose.....29
29. Leaves with subulate tips ending in 1–2 elongate cells; clavate gemmae common; plants on bark or rock .....*Zygodon vulgaris* (p. 230)
29. Plants otherwise 30
30. Plants usually on trees.....*Orthotrichum*, Key 76 (p. 217)
30. Plants on rock or soil.....31
31. Plants on bare soil; leaf margins strongly involute; peristome variable, well-developed, rudimentary, or wanting..... *Weissia controversa* (p. 114)
31. Plants otherwise 32
32. Leaves serrulate above the base on the margins of the upper hyaline cells; peristome of 16 teeth... .....*Eucladium verticillatum* (p. 98)
32. Leaves entire, or sometimes crenulate by projecting papillae, irregularly notched in *Trichostomum*...33
33. Plants small, on rock, usually limestone; leaves 0.6–1.8 mm long; costa with guide cells and stereid bands; seta 3–4 mm long; urn less than 1 mm long; peristome wanting .....*Gymnostomum aeruginosum* (p. 99)

33. Plants otherwise 34
34. Leaves oblong-lanceolate to ± lingulate, never long-acuminate; perichaetial bracts convolute; peristome long and twisted; plants commonly fruiting; on soil or soil over rock...*Barbula*, Key 39 (p. 88)
34. Plants otherwise 35
35. Leaf margins bistratose; leaves to 2 mm long ..... *Trichostomopsis australasiae* (p. 113)
35. Leaf margins unistratose 36
36. Leaves 2–6 mm long; costa glossy and prominent on the back of the leaf ..... *Trichostomum tenuirostre* (p. 114)
36. Leaves smaller; costa otherwise 37
37. Upper leaf cells ± rounded, the papillae on the cross walls and over the lumen; costa with 2–4 large median guide cells; autoicous; capsule ribbed when dry; seta short, about 1.5 mm long ..... *Amphidium lapponicum* (p. 216)
37. Upper leaf cells ± quadrate, the papillae over the lumen; costa with a stereid band, without guide cells; capsule not ribbed; seta 6–12 mm long ..... *Anoectangium aestivum* (p. 87)

Leaves with recurved margins

38. Cross walls of leaf cells sometimes thickened and bulging dorsally and ventrally, in cross section resembling papillae ..... *Dicranoweisia cirrata* (p. 71)
38. Leaf cells distinctly papillose 39
39. Plants on rock, dark green to nearly black, or sometimes reddish brown; leaf margins of more than one layer of cells, the upper lamina sometimes bistratose; calyptra never large and plicate ..... *Grimmia*, Key 49 (p. 120)
39. Plants otherwise 40
40. Plants green, in soft dense tufts on rock; leaves crisped when dry, linear-lanceolate; margins recurved at the middle or below, plane above; capsule ribbed, immersed, or on a short seta; peristome wanting; calyptra cucullate, smooth ..... *Amphidium*, Key 75 (p. 215)
40. Without this combination of characters 41
41. Capsule immersed, or on a short seta; calyptra plicate, large, often hairy; stems erect, or often creeping and the branches erect; plants on trees or rock, never on soil ..... Orthotrichaceae, Key 74 (p. 215)
41. Capsule not immersed, seta long; calyptra small and cucullate 42
42. Plants small, usually on limestone; leaves lanceolate, 0.8–1.8 mm long; peristome wanting; operculum attached to the columella ..... *Gymnostomum recurvirostre* (p. 99)
42. Plants otherwise; operculum free 43
43. Plants often encrusted with lime; leaves entire, lanceolate to lingulate, apex acute to rounded; leaf base strongly decurrent, the decurrent part 2–5 cells wide at leaf base and 5–10 cells long; dioicous ..... *Didymodon tophaceus* (p. 98)
43. Plants otherwise; leaves not decurrent or less strongly so 44
44. Plants yellow-green above, reddish brown below; costa usually excurrent as a pellucid mucro; leaf apex often denticulate; peristome of 16 straight teeth; annulus deciduous; autoicous ..... *Didymodon recurvirostris* (p. 97)
44. Without this combination of characters 45
45. Capsule ribbed when dry, strumose, or the leaf margins bistratose, or both ..... *Cynodontium*, Key 26 (p. 63)
45. Capsule never ribbed when dry, not strumose; leaf margins usually unistratose 46
46. Peristome long and twisted (wanting in *B. rubiginosa*) ..... *Barbula*, Key 39 (p. 88)
46. Peristome not long and twisted, short, straight or slightly twisted, the teeth divided or perforate, sometimes rudimentary or wanting ..... *Didymodon*, Key 41 (p. 96)

Key 3. Acrocarpous Mosses with Smooth Leaf Cells

1. Costa broad, 1/3 to 1/2 the width of the leaf base, usually ending before the rounded, obtuse apex; leaf margins entire, revolute; outer peristome shorter than the endostome ..... *Meesia uliginosa* (p. 204)
1. Plants otherwise 2
2. Leaves long-lingulate, oblong, or spatulate; leaf cells sometimes papillose; peristome single, or rarely wanting 3
2. Plants otherwise 6
3. Peristome long and twisted 4
3. Peristome short or wanting; leaves apiculate or piliferous 5

4. Costa with one stereid band; leaves sometimes with a border of differentiated cells..... ..... *Tortula*, Key 46 (p. 106)
4. Costa with two stereid bands; leaves not bordered ..... *Barbula unguiculata* (p. 92)
5. Leaves imbricate to spreading when dry, or only slightly contorted; cell walls strongly thickened on the dorsal side in the upper part of the leaf, or peristome wanting..... *Pottia*, Key 43 (p. 100)
5. Leaves usually somewhat contorted or twisted when dry; cells otherwise; peristome present..... ..... *Desmatodon*, Key 40 (p. 94)
6. Peristome of 4 teeth; if sterile, gemmae commonly present, borne in cup-shaped receptacles formed by the upper leaves; leaves ovate to lanceolate, the upper cells isodiametric..... ..... Tetraphidaceae, Key 8 (p. 27)
6. Plants otherwise 7
7. Plants plainly dendroid..... *Leucolepis menziesii* (p. 191)
7. Plants never dendroid.....8
8. Leaves ovate-lanceolate, linear-lanceolate, or linear, the margins plane or incurved; alar cells differentiated, usually plainly inflated, often brown.....9
8. Leaves otherwise 14
9. Costa often ribbed or lamellose on the back, 1/3 to 2/3 the width of the leaf base, the ventral layer of cells larger than the cells within ..... *Campylopus*, Key 25 (p. 62)
9. Leaves otherwise 10
10. Costa 1/3 or more the width of the leaf base, without guide cells and without stereid bands..... ..... *Paraleucobryum*, Key 32 (p. 82)
10. Costa narrower, or with guide cells and stereid bands.....11
11. Costa with guide cells and 1–2 stereid bands, or the leaf tips commonly broken off.....12
11. Costa without guide cells, the leaf tips not broken.....13
12. Costa usually more than 1/3 the width of the leaf base, plainly excurrent; leaf tips not broken; peristome teeth 16, each divided to the base or nearly so ..... *Dicranodontium denudatum* (p. 70)
12. Costa narrower, to about 1/3 the width of the leaf base, often less, not excurrent, or less conspicuously so; peristome teeth 16, each divided about halfway; leaf tips broken off in only a few species..... ..... *Dicranum*, Key 30 (p. 72)
13. Alar cells plainly inflated, brown; capsule erect, radially symmetric, smooth, pyriform; peristome teeth entire or perforate, sometimes split at the tips ..... *Blindia acuta* (p. 56)
13. Alar cells differentiated, sometimes inflated but not conspicuously so; capsule inclined and curved, or if erect, plainly ribbed; peristome teeth 16, each divided about halfway ..... *Arctoa*, Key 24 (p. 59)
14. Capsule immersed, without an operculum ..... Key 1, no. 56 (p. 11)
14. Capsule exserted, with an operculum.....15
15. Leaves glaucous.....16
15. Leaves not glaucous 17
16. Leaves appressed, keeled; leaf cells sometimes papillose by projecting cell ends; capsule short, curved, ribbed when dry..... *Conostomum tetragonum* (p. 209)
16. Leaves neither appressed nor keeled; cells never papillose; capsule oblong-cylindric, straight .... *Saelania glaucescens* (p. 55)
17. Plants small, the leaves usually imbricate, ovate, ovate-lanceolate, or lanceolate, margins recurved, costa usually excurrent; cells smooth, or sometimes papillose, median and upper cells small, quadrate to rounded, 6–12 μ in diameter; seta long, capsule cylindric, peristomate, rarely fruiting..... *Barbula*, Key 39 (p. 88)
17. Without this combination of characters.....18
18. Leaves, at least upper and perichaetial, lanceolate-subulate, setaceous, or sometimes subulate from the ovate base, always with a subulate apex.....19
18. Leaf apex not subulate.....28
19. Plants commonly sterile; leaf base whitish and glossy; costa broad, more than 1/3 the width of the leaf base, with a ventral row of large cells and a row of median guide cells, sometimes with stereid cells, often with lamellose cells on the dorsal surface; plants on cliffs ..... *Campylopus fragilis* (p. 62)
19. Plants otherwise.....21
20. Plants small, on rock ..... Key 1, no. 59 (p. 11)
20. Plants otherwise, larger, or on soil.....21
21. Capsule with a neck nearly as long as the rest of the capsule, sometimes longer.....22
21. Capsule without a neck, or the neck not clearly set off.....24

22. Capsule inclined to pendent, brown, glossy, not strumose; peristome double; upper leaves to 6 mm long, costa long-excurrent; plants common.....*Leptobryum pyriforme* (p. 177)
22. Capsule erect to inclined; plants rare.....23
23. Leaves to 5 mm long, rarely to 7 mm, costa usually ending before the apex; peristome double; plants on rotten or charred wood, usually in the redwood region.....*Orthodontium gracile* (p. 178)
23. Leaves smaller, 1–4 mm long; peristome single; plants on soil .....*Trematodon*, Key 33 (p. 83)
24. Capsule horizontal to pendent, dark reddish brown, small, to 1 mm long, subglobose, zygomorphic, smooth, mouth small; operculum conic-apiculate; peristome of 16 short, irregular, papillose teeth .....*Catascopium nigritum* (p. 205)
24. Plants otherwise, the peristome teeth well-developed.....25
25. Peristome teeth bifid to the base or nearly so .....*Ditrichum*, Key 20 (p. 51)
25. Peristome teeth bifid about halfway.....26
26. Costa without stereid bands; alar cells usually differentiated, sometimes ± inflated; autoicous..... .....*Arctoa*, Key 24 (p. 59)
26. Costa with stereid bands; alar cells not differentiated.....27
27. Autoicous; leaves 2–5 mm long, lanceolate-subulate from the broad base; capsule zygomorphic, strumose, not ribbed.....*Oncophorus wahlenbergii* (p. 82)
27. Dioicous, or rarely autoicous; capsule not strumose, or if so, ribbed when dry, or the leaves smaller..... .....*Dicranella*, Key 28 (p. 66)

Leaves neither setaceous nor subulate

28. Leaf margins plane or incurved, sometimes ± recurved in *Pottia* and *Meesia*.....29
28. Leaf margins recurved.....50
29. Leaves strongly squarrose.....30
29. Leaves not strongly squarrose.....32
30. Leaves not decurrent .....*Dicranella schreberiana* (p. 69)
30. Leaves decurrent 31
31. Leaves entire except the crenulate apex, obtuse to ± acute .....*Dicranella palustris* (p. 68)
31. Leaves serrate to the base or nearly so, acute .....*Meesia triquetra* (p. 204)
32. Leaves bordered by elongate cells, the border commonly of more than one row of cells (border weak in *Mnium blyttii*).....33
32. Leaves without a definite border, sometimes the marginal row of cells somewhat longer and narrower 38
33. Leaves long-decurrent, the decurrent part 0.5–2 mm long; margins entire.....*Bryum weigelii* (p. 176)
33. Leaves not long-decurrent, or if so, the margins toothed.....34
34. Capsule erect, globose to pyriform, with an operculum, eperistomate; small plants on soil..... .....*Physcomitrium*, Key 55 (p. 154)
34. Capsule horizontal to pendent, never erect; peristome double.....35
35. Capsule zygomorphic, with a long tapering neck.....36
35. Capsule radially symmetric, without a neck, or the neck short.....37
36. Leaf border bistratose; median leaf cells 60–85 × 20–30 μ, the walls thin except in the border cells .....*Bryum uliginosum* (p. 175)
36. Leaf border unistratose, weak.....*Amblyodon dealbatus* (p. 203)
37. Leaf margins entire, the border unistratose, often darker in color; leaves acuminate, cell walls thin, median cells 160 × 30 μ; urn 1–1.5 mm long; plants small, in the lowlands west of the Cascade Mountains..... .....*Epipterygium tozeri* (p. 176)
37. Leaf margins otherwise, or the median leaf cells with thick pitted walls, or the plants arctic-alpine; capsule usually larger.....Mniaceae, Key 66 (p. 189)
38. Leaves entire, ovate to obovate-spatulate, the apex rounded; basal leaf cells with long cilia on the margins.....*Oedipodium griffithianum* (p. 157)
38. Leaves otherwise.....39
39. Small glossy plants with elongate julaceous stems; leaves imbricate, ± ovate, concave, entire or nearly so; upper leaf cells long and narrow.....*Pohlia filiformis* (p. 185)
39. Plants otherwise.....40
40. Capsule not erect; peristome double.....41
40. Capsule erect.....45

41. Capsule zygomorphic....42
41. Capsule not zygomorphic, or only slightly so in a few species of *Bryum*....44
42. Peristome teeth and cells of the operculum spiral; outer teeth not shorter than the inner; operculum conic, blunt; leaf cells large and thin-walled....*Funaria*, Key 54 (p. 152)
42. Peristome teeth and cells of the operculum not spiral; outer peristome teeth usually shorter than the endostome; plants not common....43
43. Leaves small, to 1 mm long, or if larger, the costa excurrent; margins entire; perichaetial bracts to about 2 mm long; operculum acute; plants not in bogs....*Plagiobryum*, Key 63 (p. 178)
43. Leaves larger, 2–6 mm long; costa never excurrent; margins entire or serrate; plants in bogs.... ....Meesiaceae, Key 68 (p. 202)
44. Leaves oblong or oblong-ovate, median cells long, 4–6:1, margins entire; or leaves ovate, the upper ones sometimes ovate-lanceolate, median cells short, less than 4:1, margins entire, or slightly serrulate at apex....*Bryum*, Key 62 (p. 163)
44. Leaves ovate-lanceolate, or the upper leaves linear-lanceolate; median cells more than 4:1; margins often serrulate at apex....*Pohlia*, Key 64 (p. 179)
45. Plants on rock....*Grimmia*, Key 49 (p. 120)
45. Plants not on rock; infrequent to rare....46
46. Plants ± julaceous; leaves imbricate, stiff and erect when dry, ovate to ovate-lanceolate, apex ± obtuse; peristome teeth 16, each tooth usually divided about halfway....*Aongstroemia longipes* (p. 59)
46. Without this combination of characters....47
47. Capsule with a neck as long as the rest of the capsule or longer; peristome single, rarely wanting; plants on dung or decaying animal matter, rarely on soil or rotten wood; not common....Splachnaceae, Key 57 (p. 157)
47. Capsule with the neck shorter or sometimes indistinct; plants on soil....48
48. Operculum convex to conic, the cells in spiral or oblique rows; capsule peristomate, the teeth sometimes rudimentary; rare....*Entosthodon*, Key 53 (p. 151)
48. Operculum conic-apiculate to rostrate, the cells not in spiral rows....49
49. Operculum rostrate, sometimes attached to the columella; peristome wanting or present; calyptra cucullate ....*Pottia*, Key 43 (p. 100)
49. Operculum conic-apiculate, free from the columella; peristome wanting; calyptra mitrate ....*Physcomitrium*, Key 55 (p. 154)

Leaves with recurved margins

50. Cells in the upper part of the leaf isodiametric to short-rectangular, the walls ± thickened; peristome single, or sometimes double in *Orthotrichum*....51
50. Cells in the upper part of the leaf 2:1 or longer, if shorter, the walls thin and the cells very large; capsule with a long or short differentiated neck....57
51. Plants usually dark green to blackish, on rock; capsule immersed to exserted, ovoid to ellipsoid, rarely short-cylindric....*Grimmia*, Key 49 (p. 120)
51. Plants otherwise....52
52. Capsule strongly ribbed when old, inclined to horizontal; peristome teeth 16, each divided nearly to the base, somewhat united at nodes; plants common in various habitats, often on bare soil.... ....*Ceratodon purpureus* (p. 49)
52. Capsule smooth, or the teeth otherwise....53
53. Leaves crisped and contorted when dry....54
53. Leaves not crisped and contorted when dry....56
54. Peristome teeth 16, entire, or sometimes divided at the tips; capsule smooth, straight and erect or nearly so; plants on wood, rarely on rock, common....*Dicranoweisia cirrata* (p. 71)
54. Peristome teeth 16, each divided nearly halfway; plants on soil or rock, rarely on decaying wood....55
55. Leaves lanceolate to lanceolate-subulate from the ovate or obovate base, the cells never papillose; capsule arcuate, not ribbed....*Oncophorus virens* (p. 81)
55. Leaf base not clearly differentiated; cells smooth or papillose; capsule erect to inclined or ± curved, longitudinally ribbed when dry....*Cynodontium*, Key 26 (p. 63)
56. Capsule ribbed when dry, seta to 3 mm long; leaves smooth, or slightly papillose; costa not excurrent; plants on rock....*Orthotrichum*, Key 76 (p. 217)
56. Capsule not ribbed, seta about 10 mm long; costa excurrent....*Barbula*, Key 39 (p. 88)
57. Leaf cells large and thin-walled, the median cells 25 μ wide or wider; capsule erect and radially symmetric...58

57. Leaf cells narrower (except *Bryum sandbergii*); peristome double, or in *Mielichhoferia*, the exostome wanting 59
58. Neck as long as the rest of the capsule or longer; peristome single..... *Tayloria*, Key 59 (p. 159)
58. Neck shorter than the rest of the capsule; peristome wanting..... *Physcomitrium*, Key 55 (p. 154)
59. Leaf cells elongate, 4:1 or longer; leaves never bordered..... 60
59. Leaf cells usually shorter and broader, less than 4:1, or longer in a few species; leaves of some species bordered by elongate cells; cilia of endostome often appendiculate..... *Bryum*, Key 62 (p. 163)
60. Leaves ovate to ovate-lanceolate, margins recurved, entire; capsule erect to inclined, radially symmetric; outer peristome wanting; plants on rock ..... *Mielichhoferia macrocarpa* (p. 177)
60. Plants otherwise..... 61
61. Leaves entire, or the costa excurrent; capsule zygomorphic; rare, arctic-alpine... *Plagiobryum*, Key 63 (p. 178)
61. Leaves often serrulate at apex, costa never excurrent; capsule usually radially symmetric, sometimes ± zygomorphic; cilia rarely appendiculate..... *Pohlia*, Key 64 (p. 179)

Key 4. Pleurocarpous Mosses, the Leaves Ecostate, or the Costa Short, Double, or Both

1. Plants large, usually regularly pinnate, each year's growth arising from about the middle of the stem of the preceding year; stem leaves usually 2–3 mm long..... *Hylocomium splendens* (p. 332)
1. Plants otherwise..... 2
2. Plants small, often glaucous green; leaves 0.3–0.6 mm long, broadly ovate to ± orbicular, concave; leaf cells short, often papillose, the papillae usually formed by projecting cell ends; paraphyllia wanting..... *Myurella*, Key 87 (p. 248)
2. Plants otherwise..... 3
3. Plants reproducing asexually by branch-like propagula borne in the leaf axils... *Isopterygium elegans* (p. 315)
3. Propagula wanting, or not branch-like..... 4
4. Leaf cells papillose..... 5
4. Leaf cells not papillose..... 11
5. Upper and perichaetial leaves, or all leaves ending in hyaline points; plants always on rock..... Hedwigiaceae, Key 80 (p. 236)
5. Leaves without hyaline points..... 6
6. Papillae formed by projecting cell ends..... 7
6. Papillae not formed by projecting cell ends..... 10
7. Branches strongly julaceous..... 8
7. Branches not or less strongly julaceous..... 9
8. Leaves to 1.6 mm long, sharply serrate at apex; paraphyllia wanting... *Pterogonium gracile* (p. 240)
8. Leaves smaller, to 1 mm long, often shorter, entire, or serrulate at apex; paraphyllia and asexual reproductive bodies often present..... *Pterigynandrum filiforme* (p. 259)
9. Leaves plicate; paraphyllia wanting..... *Rhytidiadelphus triquetrus* (p. 330)
9. Branch leaves not plicate; stems with branched paraphyllia..... *Hylocomium splendens* (p. 332)
10. Leaves entire or the tips of branch leaves serrulate; cells smooth, or ± papillose on the dorsal surface, the papillae small; plants often flagelliform; small pseudoparaphyllia often present; rarely fruiting ..... *Pseudoleskeella tectorum* (p. 258)
10. Leaves commonly serrate or serrulate; cells distinctly papillose, one or more papillae per cell; paraphyllia commonly present; capsule horizontal to cernuous..... *Heterocladium*, Key 94 (p. 262)
11. Leaves plicate..... 12
11. Leaves not plicate, or if somewhat plicate, the alar cells differentiated, or the leaves complanate, or both... 16
12. Stems with abundant paraphyllia..... 13
12. Stems without paraphyllia..... 15
13. Leaves transversely undulate, falcate-secund at the ends of branches; plants branching irregularly..... *Rhytidiopsis robusta* (p. 331)
13. Leaves not transversely undulate..... 14
14. Leaves strongly falcate-secund; plants regularly pinnate, the branches complanate..... *Ptilium crista-castrensis* (p. 327)
14. Leaves not falcate-secund; plants branching irregularly to ± regularly pinnate, not clearly complanate..... *Hylocomium*, Key 118 (p. 332)

15. Leaf margins recurved; leaves imbricate, straight and erect, never falcate; plants glossy, usually golden green ..... *Orthothecium chryseum* (p. 313)
15. Leaf margins plane; leaves not straight and erect, usually falcate-secund; common ..... *Rhytidiadelphus loreus* (p. 329)
16. Leaves complanate and undulate 17
16. Leaves not undulate, or rarely slightly so, sometimes complanate 20
17. Main stems with abundant paraphyllia, the leaves costate; small leaves of flagelliform branches ecostate, or the costa short ..... *Neckera menziesii* (p. 243)
17. Stems without paraphyllia 18
18. Leaves spinose-dentate at apex; plants usually on trees, rarely on rock ..... *Neckera douglasii* (p. 243)
18. Leaves entire or serrate, never spinose-dentate 19
19. Plants large, leaves 2–5 × 1–2 mm, entire, or serrate to serrulate at apex; on rotten logs or soil ..... *Plagiothecium undulatum* (p. 320)
19. Plants smaller, leaves 1.5–3 × 0.5–1 mm, serrate or serrulate to about the middle of the leaf; on trees or rock ..... *Neckera pennata* (p. 244)
20. Stems with branched paraphyllia; costa single and strong, or short and double ..... *Alsia californica* (p. 238)
20. Stems without paraphyllia, or the paraphyllia less conspicuous; costa sometimes single in *Calliergon turgescens* 21
21. Paraphyllia or pseudoparaphyllia often present 22
21. Paraphyllia and pseudoparaphyllia wanting, or if present, small and inconspicuous 24
22. Leaves squarrose ..... *Heterocladium procurrens* (p. 263)
22. Leaves not squarrose 23
23. Leaves obovate or ovate-oblong; cells often papillose by projecting cell ends; asexual reproductive bodies sometimes present ..... *Pterigynandrum filiforme* (p. 259)
23. Plants otherwise ..... Hypnaceae, Key 114 (p. 320)
24. Plants soft, light green to whitish green; leaves broadly oval, complanate, entire; alar cells not differentiated ..... *Hookeria*, Key 86 (p. 246)
24. Plants otherwise 25
25. Plants aquatic 26
25. Plants not aquatic, but often in wet places 29
26. Leaves falcate, 2–4 × 1.4–1.8 mm, the walls of the basal cells strongly pitted ..... *Scorpidium scorpioides* (p. 287)
26. Leaves otherwise 27
27. Plants often floating, usually attached at base, 10 cm long or longer, sometimes to 50 cm; leaves ecostate, often keeled, if not keeled, lanceolate to ovate-lanceolate; stem leaves more than 3 mm long ..... *Fontinalis*, Key 79 (p. 232)
27. Without this combination of characters 28
28. Plants floating, not attached; leaves ecostate, oblong-ovate, 2–3 mm long; cell walls not pitted; median cells 60–95 × 12–16 μ ..... *Calliergonella conardii* (p. 272)
28. Plants not floating, usually on rocks in or near water, or on wet soil; costa usually short and double, sometimes longer and forked, rarely wanting ..... *Hygrohypnum*, Key 103 (p. 282)
29. Leaves broadly ovate, oblong-ovate, elliptic, or suborbicular, never narrowly acuminate 30
29. Leaves ovate-lanceolate, lanceolate, or linear, always plainly acuminate 33
30. Plants on wet rocks or wet soil ..... *Hygrohypnum*, Key 103 (p. 282)
30. Plants on soil, sometimes in bogs 31
31. Leaves often apiculate; alar cells quadrate to short-rectangular; plants in cold bogs in calcareous regions ..... *Calliergon turgescens* (p. 272)
31. Leaves rarely apiculate, apex usually obtuse to rounded 32
32. Alar cells hyaline, inflated; leaves entire; median cells 60–90 × 4–6 μ; stems green or reddish brown ..... *Calliergonella cuspidata* (p. 273)
32. Alar cells differentiated, ± quadrate, or somewhat enlarged but not clearly inflated, often colored; leaves entire, or serrulate at apex; median cells 50–80 × 6–8 μ; stems red ..... *Pleurozium schreberi* (p. 286)
33. Leaves squarrose to wide-spreading, or erect-spreading 34
33. Leaves not squarrose and not usually wide-spreading 36
34. Leaves always squarrose, not decurrent, usually more than 2 mm long, to 4 mm long .....

.....*Rhytidiadelphus squarrosus* (p. 330)

34. Leaves smaller, or decurrent, or both.....35

35. Leaves squarrose, often ± complanate, serrate to serrulate at least in upper part; stem leaves or all leaves plainly decurrent; alar cells not inflated; paraphyllia often present.....*Heterocladium procurrens* (p. 263)

35. Leaves squarrose to erect-spreading, never complanate, the margins entire to serrulate; paraphyllia wanting, pseudoparaphyllia sometimes present.....*Campylium*, Key 100 (p. 273)

36. Leaves small, 0.4–0.85×0.18–0.35 mm, coarsely serrate; basal cells quadrate in several rows extending from the margins to the costa; costa often to the middle of the leaf.....*Fabronia*, Key 88 (p. 249)

36. Plants otherwise.....37

37. Stem leaves with costa to the middle of the leaf or longer; branch leaves with costa often ending before midleaf.....Key 5 (p. 21)

37. Leaves ecostate, or the costa short, double, or both.....38

38. Alar cells quadrate to rectangular, few, 2–3 on the margins; plants small, leaves ovate-lanceolate, gradually acuminate, to 0.45 mm long, often shorter; margins plane, often minutely serrulate at base, rarely at apex; asexual reproductive bodies sometimes borne in the leaf axils.....*Platydictya jungermannioides* (p. 286)

38. Plants without this combination of characters.....39

39. Alar cells quadrate to transversely elongate in several rows; plants small, yellow-green to brownish when old; stem leaves abruptly acuminate, to 1.2 mm long; branch leaves gradually or abruptly acuminate, 0.3–0.6 mm long; leaves entire, or young branch leaves minutely serrulate at apex; median leaf cells short, or to 30 μ long in well-developed stem leaves; plants rarely fruiting.....*Pseudoleskeella tectorum* (p. 258)

39. Leaves larger, or alar and median cells otherwise.....40

40. Leaves concave, abruptly piliferous.....*Plagiothecium piliferum* (p. 318)

40. Leaves not abruptly piliferous.....41

41. Leaves distinctly decurrent, the decurrent part long.....42

41. Leaves not decurrent, or sometimes slightly decurrent.....43

42. Leaves never complanate, ± obtuse; walls of basal leaf cells not pitted; median leaf cells 45–95×4–6 μ.....*Hygrohypnum ochraceum* (p. 284)

42. Leaves often complanate, never obtuse; walls of basal leaf cells pitted; median leaf cells usually wider .....*Plagiothecium*, Key 113 (p. 317)

43. Leaves to 1.2 mm long, often shorter, serrulate at apex; alar cells few, inflated, often a row of enlarged cells extending nearly to the costa; operculum rostrate.....*Brotherella roellii* (p. 321)

43. Without this combination of characters.....44

44. Leaves with alar cells plainly inflated forming distinct regions.....45

44. Alar cells not inflated, sometimes quadrate, or rarely a few cells inflated.....47

45. Cortical stem cells large and hyaline, evident in sections of young stems and branches.....46

45. Cortical stem cells not large and hyaline.....*Heterophyllium haldanianum* (p. 321)

46. Walls of basal leaf cells not pitted; leaf apex ± obtuse.....*Hygrohypnum ochraceum* (p. 284)

46. Walls of basal leaf cells usually pitted; leaf apex narrow to filiform, or ± obtuse in *H. lindbergii* .....*Hypnum*, Key 115 (p. 322)

47. Leaves imbricate, entire or nearly so, usually straight; walls of basal cells often pitted; alar cells not differentiated; capsule erect and straight or nearly so.....*Orthothecium*, Key 110 (p. 313)

47. Plants otherwise.....48

48. Branches ± julaceous; leaves never falcate, the cells thick-walled; median cells long and narrow, 30–50×5–7 μ; alar cells strongly differentiated, quadrate to irregular, extending halfway to the costa, and 20 or more differentiated cells on the basal margins.....*Tripterocladium leucocladulum* (p. 328)

48. Leaves otherwise.....49

49. Alar cells not differentiated, or 1–3 quadrate to rectangular cells on the basal margins; leaves sometimes ± secund, never circinate.....*Isopterygium*, Key 112 (p. 314)

49. Alar cells plainly differentiated, 3 to many quadrate cells on the basal margins, or the leaves plainly falcate to circinate, or both.....50

50. Capsule arcuate, the peristome perfect; leaves often falcate to circinate; walls of the basal leaf cells often pitted; plants yellow-green to brownish green.....*Hypnum*, Key 115 (p. 322)

50. Capsule straight and erect, the peristome without cilia, or the cilia rudimentary; leaves never circinate, sometimes ± falcate; walls of the basal leaf cells not pitted; plants green to yellow-green, on trees.....*Pylaisia polyantha* (p. 328)

Key 5. Pleurocarpous Mosses with Unicostate Leaves, the Costa to the Middle of the Leaf or Longer

1. Plants dark green to blackish, sometimes reddish brown, usually on rock; leaf cells commonly thick-walled; acrocarpous, but capsules often lateral by subfloral innovations ..... Key 1, no. 44 (p. 10)
1. Without this combination of characters 2
2. Leaves complanate and undulate (the complanate and undulate characters not always evident in leaves of flagelliform branches); paraphyllia numerous ..... *Neckera menziesii* (p. 243)
2. Plants otherwise 3
3. Plants usually large, light green, dendroid; erect stems pinnately or bipinnately branched; median leaf cells long, more than 5:1; alar cells inflated, hyaline, decurrent; rare ..... *Pleuroziopsis ruthenica* (p. 236)
3. Plants otherwise 4
4. Leaf cells papillose 5
4. Leaf cells smooth 14
5. Plants large, dendroid; main stems creeping, secondary stems stiff, ± erect; stems with branched paraphyllia; leaf cells thick-walled, papillose on the dorsal surface, the papillae high, sharp ..... *Dendroalsia abietina* (p. 238)
5. Plants otherwise 6
6. Plants regularly pinnate, bipinnate, or tripinnate; stems with branched paraphyllia ..... Thuidiaceae, Key 92 (p. 260)
6. Plants not regularly pinnate, or if pinnate, the stems without paraphyllia 7
7. Alar cells inflated; costa strong, broad at base, sometimes percurrent or excurrent; stems with paraphyllia ..... *Cratoneuron williamsii* (p. 276)
7. Alar cells not inflated 8
8. Leaves rugose, plicate, often secund ..... *Rhytidium rugosum* (p. 331)
8. Leaves neither rugose nor secund 9
9. Leaves with plane margins, piliferous except *C. whippleanum*, the costa pellucid; leaf cells short, with one or more papillae over the lumen; paraphyllia wanting or small; seta rough, operculum rostrate ..... *Claopodium*, Key 93 (p. 260)
9. Plants otherwise 10
10. Leaf margins recurved at least at base, leaves usually plicate 11
10. Leaf margins plane, serrate; leaves not plicate; alar cells quadrate; stems without paraphyllia 45
11. Leaves strongly plicate; plants ± glossy, yellow-green to brownish when old; paraphyllia and pseudoparaphyllia wanting; papillae small, formed by projecting cell ends ..... *Homalothecium*, Key 107 (p. 303)
11. Leaves less strongly plicate; plants green to yellow-green 12
12. Stems without paraphyllia; leaves often piliferous; leaf cells papillose, the papillae on the lumen at upper ends, the walls pitted ..... *Lescuraea baileyi* (p. 252)
12. Stems with simple or branched paraphyllia 13
13. Autoicous; leaves entire, the cells short, each with a single papilla over the lumen on both dorsal and ventral surfaces; peristome teeth incurved when dry ..... *Leskea polycarpa* (p. 257)
13. Dioicous; leaves often serrulate, the cells short or long; papillae either formed by projecting cell ends or over the lumen, central or at the upper ends; peristome teeth not incurved when dry ..... *Lescuraea*, Key 90 (p. 251)
14. Paraphyllia or pseudoparaphyllia present, at least on the stems 15
14. Stems without paraphyllia, sometimes with pseudoparaphyllia 21
15. Costa variable, either short and double, or single and to the middle of the leaf 16
15. Costa always single, usually well-developed 17
16. Leaves strongly plicate; upper leaves or all leaves strongly serrate ..... *Hylocomium*, Key 118 (p. 332)
16. Leaves less strongly plicate, sometimes plane or nearly so, entire, or slightly serrulate at apex ..... *Alsia californica* (p. 238)
17. Alar cells of branch leaves or of all leaves inflated ..... *Cratoneuron*, Key 101 (p. 275)
17. Alar cells not inflated 18
18. Leaves complanate ..... *Porothamnium bigelovii* (p. 245)
18. Leaves not complanate 19
19. Paraphyllia large, numerous, branched; plants usually dendroid; leaf margins not recurved ..... *Climacium dendroides* (p. 235)
19. Paraphyllia smaller, sometimes few 20

20. Plants sometimes ± dendroid; leaves coarsely toothed at apex...*Thamnobryum neckeroides* (p. 245)
20. Plants never dendroid; leaves entire, or serrulate at apex.....*Lescuraea*, Key 90 (p. 251)
21. Leaves squarrose, entire or nearly so.....*Campylium*, Key 100 (p. 273)
21. Leaves not squarrose, or if so, strongly toothed.....22
22. Leaves complanate.....23
22. Leaves not complanate.....28
23. Leaves dimorphous.....*Hypopterygium fauriei* (p. 248)
23. Leaves not dimorphous.....24
24. Median leaf cells short, less than 5:1.....25
24. Median leaf cells long, usually more than 5:1.....27
25. Alar cells differentiated, quadrate and thick-walled.....*Bestia vancouveriensis* (p. 241)
25. Alar cells not clearly differentiated.....26
26. Leaf apex minutely serrulate; plants small, the leaves 1–1.6 mm long...*Homalia trichomanioides* (p. 242)
26. Leaf apex sharply and coarsely serrate; plants larger, the leaves to 3 mm long.....
.....*Porothamnium bigelovii* (p. 245)
27. Seta rough at least in part; operculum conic; leaves decurrent, branch leaves never obtuse.....
.....*Brachythecium*, Key 105 (p. 288)
27. Seta smooth; operculum rostrate; leaves not decurrent, or if so, the branch leaves obtuse.....
.....*Eurhynchium*, Key 106 (p. 298)
28. Leaves bordered with a thickened band of submarginal cells; plants very rare.....
.....*Sciaromium tricostatum* (p. 287)
28. Leaves otherwise.....29
29. Plants very small, the leaves less than 1 mm long, subulate-acuminate, coarsely serrate to ciliate-dentate; median leaf cells less than 5:1; quadrate alar and basal cells numerous; costa to the middle of the leaf or sometimes shorter.....*Fabronia*, Key 88 (p. 249)
29. Plants otherwise, the leaves larger, or if small, not coarsely serrate, or the apex otherwise.....30
30. Costa variable, short and double, or single and to the middle of the leaf or longer; leaf margins plane or incurved, never recurved.....*Hygrohypnum*, Key 103 (p. 282)
30. Costa single, to the middle of the leaf or longer; if supporting costae present, the leaf margins strongly recurved.....31
31. Plants aquatic.....32
31. Plants not aquatic, sometimes in wet places (*Calliergon* and *Drepanocladus* sometimes aquatic).....35
32. Plants yellow-green to brown; leaves falcate to circinate; costa percurrent to long-excurrent; alar cells scarcely differentiated, never inflated.....*Dichelyma falcatum* (p. 231)
32. Leaves neither falcate nor circinate, rarely slightly secund; costa percurrent, or ending before the apex, or if excurrent, the plants green.....33
33. Leaves ovate-lanceolate to lanceolate, gradually long-acuminate.....*Amblystegium*, Key 97 (p. 266)
33. Leaves ovate to suborbicular, never long-acuminate.....34
34. Alar cells inflated; branches julaceous; seta rough.....*Scleropodium obtusifolium* (p. 311)
34. Alar cells scarcely inflated; branches not julaceous; seta smooth...*Eurhynchium riparioides* (p. 302)
35. Leaves entire, apex obtuse to rounded, rarely apiculate, if apiculate, the plants red or purple, or the costa weak; leaves variable in shape, cordate-ovate, ovate-oblong, oblong, or lingulate.....
.....*Calliergon*, Key 98 (p. 269)
35. Leaves otherwise.....36
36. Alar cells inflated, forming a definite group.....37
36. Alar cells not inflated, or not forming a definite group of inflated cells.....40
37. Leaves long-acuminate; costa strong, usually percurrent; paraphyllia often present at least on the stems
.....*Cratoneuron*, Key 101 (p. 275)
37. Without this combination of characters.....38
38. Stem leaves concave, often abruptly short-acuminate, sometimes plicate; branch leaves never falcate, the acumen often longer; plants green or yellow-green, never red or purple.....
.....*Brachythecium*, Key 105 (p. 288)
38. Leaves not noticeably concave, always long-acuminate.....39
39. Leaves often falcate, sometimes plicate, entire or serrulate.....*Drepanocladus*, Key 102 (p. 277)
39. Leaves neither falcate nor plicate, entire, with or without a few inflated alar cells; leaf apex channeled.....
.....*Amblystegium*, Key 97 (p. 266)

40. Median leaf cells short, usually less than 5:1 41
40. Median leaf cells long, to 20:1, usually more than 5:1 47
41. Basal cells or alar cells plainly differentiated, either quadrate or rounded-quadrate to elliptic 42
41. Basal and alar cells not differentiated, or if differentiated, few and not forming a well-defined group 46
42. Alar cells thin-walled ..... *Brachythecium*, Key 105 (p. 288)
42. Alar cells thick-walled, or all cells thick-walled 43
43. Leaf margins usually recurved to above the middle; costa strong, ending before the apex, sometimes with short supplementary costae; costa without teeth on the back at apex; all leaf cells thick-walled ..... *Antitrichia*, Key 83 (p. 240)
43. Leaf margins not recurved, or the recurved part not extending above midleaf 44
44. Leaves entire, or minutely serrulate at apex ..... *Pseudoleskeella nervosa* (p. 257)
44. Leaves distinctly toothed 45
45. Branches julaceous, or the leaf cells more than 5:1, or both ..... *Isothecium*, Key 108 (p. 307)
45. Branches not julaceous ..... *Bestia vancouveriensis* (p. 241)
46. Leaves coarsely toothed at apex ..... *Thamnobryum neckeroides* (p. 245)
46. Leaves entire or minutely serrulate ..... *Amblystegium*, Key 97 (p. 266)
47. Branch leaves strongly serrate to the leaf base or nearly so; costa strong, ending before apex, with one or more spines at the end; operculum rostrate; stem and branch leaves usually differentiated;
(a) stem leaves distinctly decurrent, squarrose, abruptly narrowed to the apex, often plicate; branch leaves acute, the apical cells 2:1 or longer; seta rough; plants usually regularly pinnate ..... *Eurhynchium*, Key 106 (p. 298)
or (b) stem leaves only slightly decurrent, not or scarcely squarrose; branch leaves ± obtuse, at least some of the apical cells less than 2:1; seta smooth ..... *Eurhynchium*, Key 106 (p. 298)
47. Without this combination of characters 48
48. Leaves falcate 49
48. Leaves not falcate 50
49. Plants yellow-green, golden green, brown, or reddish; leaves entire, or the outer layer of stem cells larger than the cells within; plants in wet places ..... *Drepanocladus*, Key 102 (p. 277)
49. Plants light to dark green; leaves usually plicate; branch leaves not entire ..... *Brachythecium*, Key 105 (p. 288)
50. Leaves plicate 51
50. Leaves not plicate 52
51. Leaves deeply plicate, margins recurved; leaf cells linear nearly to the leaf base, about 5–8 μ wide at the base (to 10 μ in *H. megaptilum*); alar cells clearly differentiated forming a well-defined group (except in *H. nitens*), quadrate to oval, irregular, or somewhat elongate, the walls often thick; plants usually glossy, often yellow-green ..... *Homalothecium*, Key 107 (p. 303)
51. Leaves less deeply plicate; leaf cells shorter and wider toward leaf base, usually about 10 μ wide; alar cells thin-walled, if differentiated; plants less glossy, usually light green to dark green ..... *Brachythecium*, Key 105 (p. 288)
52. Alar cells differentiated forming a well-defined group of dense, ± thick-walled cells; leaves coarsely serrate above; seta smooth; branches often stoloniferous ..... *Isothecium*, Key 108 (p. 307)
52. Without this combination of characters 53
53. Costa long, percurrent or nearly so, sometimes excurrent 54
53. Costa shorter, ending well before the apex 56
54. Leaves entire, or sinuolate at the apex; plants often ± aquatic ..... *Amblystegium*, Key 97 (p. 266)
54. Leaves never entire 55
55. Plants often in deep cushions or mats in wet places, often in calcareous regions; leaf margins serrulate, the teeth at the leaf base often formed by two adjacent marginal cells; filamentous asexual reproductive bodies sometimes present ..... *Rhynchostegiella compacta* (p. 309)
55. Plants otherwise; branch leaves usually sharply serrate at apex and often nearly to the base; costa often ending in a spine; leaves decurrent ..... *Brachythecium*, Key 105 (p. 288)
56. Leaves relatively long and narrow, 3:1 or longer, never strongly imbricate, entire, or sometimes minutely serrulate; costa never ending in a spine; seta smooth 57
56. Leaves otherwise, the branch leaves distinctly serrate, or the leaves strongly concave, often both concave and serrate 58
57. Leaves usually squarrose, sometimes wide-spreading or erect-spreading, entire, or serrulate only at base; alar cells quadrate to rectangular ..... *Campylium chrysophyllum* (p. 274)

57. Leaves wide-spreading to erect-spreading, never squarrose, entire, or minutely serrate at apex; alar cells undifferentiated, or sometimes slightly inflated.....*Amblystegium*, Key 97 (p. 266)
    58. Branches commonly julaceous; leaves usually deeply concave, never strongly decurrent, entire, or serrulate at apex; dioicous.....59
    58. Without this combination of characters.....61
59. Leaves deeply concave, abruptly narrowed to filiform points, the points 0.4–0.8 mm long..... .....*Cirriphyllum cirrosum* (p. 298)
59. Leaves otherwise, without points, or the points shorter, or the leaves not deeply concave.....60
    60. Stems branching ± regularly, the branches in one plane; seta smooth..... .....*Pseudoscleropodium purum* (p. 309)
    60. Stems branching irregularly; seta usually rough.....*Scleropodium*, Key 109 (p. 310)
61. Operculum rostrate; seta smooth or nearly so; dioicous; leaves neither falcate nor decurrent, small, stem leaves 1–1.6 mm long, branch leaves to about 1 mm long; leaf margins plane; alar cells ± differentiated, short and irregular.....*Eurhynchium brittoniae* (p. 299)
61. Operculum not rostrate; seta rough or smooth; autoicous or dioicous; leaves larger, or decurrent, or the margins recurved at least at base, or the alar cells clearly quadrate.....*Brachythecium*, Key 105 (p. 288)

Key 6. SUB-CLASSES

1. Plants whitish or gray-green; leaves composed of two distinct kinds of cells, small green cells and large hyaline cells, usually with fibrils and pores; capsule elevated on a pseudopodium, opening by an operculum..... .....I. SPHAGNIDAE (not treated here)
1. Plants not usually whitish, the leaf cells without fibrils and not usually dimorphous 2
   2. Capsule opening by vertical slits; seta wanting, the capsule borne on a pseudopodium..... .....II. ANDREAEIDAE
   2. Capsule opening by an operculum or sometimes cleistocarpous; seta usually present and long..... .....III. BRYIDAE

Key 7. *Andreaea*

1. Leaves ecostate.....*A. rupestris*
1. Leaves costate..... 2
   2. Plants not brittle; perichaetial bracts similar to the vegetative leaves; upper leaf margins usually distinctly serrate and papillose.....*A. nivalis*
   2. Plants brittle when dry; perichaetial bracts larger and more convolute than the vegetative leaves; upper leaf margins usually neither serrate nor papillose..... 3
3. Midrib weak at base, the entire leaf base composed of one layer of cells; basal leaf cells elongate; spores 10–17 μ.....*A. blyttii*
3. Midrib at leaf base of several layers of cells; basal leaf cells except near midrib short, rounded, or transversely elongate; spores 30–42 μ.....*A. rothii*

Key 8. TETRAPHIDACEAE

1. Plants almost stemless; calyptra covering the capsule..... 2
1. Plants with erect leafy stems; calyptra shorter, to about the middle of the capsule..... 3
   2. Vegetative leaves frondiform, of 2–3 layers of cells.....*Tetrodontium brownianum*
   2. Vegetative leaves not frondiform, ovate to ovate-lanceolate, borne on flagelliform branches..... .....*Tetrodontium repandum*
3. Seta geniculate and papillose above the bend.....*Tetraphis geniculata*
3. Seta not geniculate, smooth; asexual reproduction by gemmae common.....*Tetraphis pellucida*

Key 9. BUXBAUMIACEAE

1. Seta rough, as long as or longer than the capsule; leaves microscopic, usually disappearing early...*Buxbaumia*
1. Seta very short, smooth, capsule immersed in the perichaetial bracts; leaves larger, persistent...*Diphyscium*

Key 10. *Buxbaumia*

1. Capsule reddish brown, ± glossy; cuticle usually rolling back from the mouth at dehiscence.....*B. aphylla*
1. Capsule yellow-green becoming yellow-brown, not glossy..... 2
   2. Cuticle splitting longitudinally, the edges recurved when moist, incurved when dry.....*B. viridis*
   2. Cuticle rolling back from the mouth.....*B. piperi*

Key 11. POLYTRICHACEAE

1. Lamellae of the ventral leaf surface fewer than 20; calyptra not hairy..... 2
1. Lamellae of the ventral leaf surface more than 20; calyptra hairy..... 4
   2. Lamina of leaf bistratose or the margins sometimes unistratose; cilia borne on the upper part of the leaf sheath; peristome wanting; rare.....*Bartramiopsis lescurii*
   2. Lamina unistratose or the margins sometimes thicker; cilia wanting; capsule peristomate..... 3
3. Leaves bordered by long narrow cells; lamellae on the ventral leaf surface only.....*Atrichum*
3. Leaves not bordered; lamellae often present on both leaf surfaces.....*Oligotrichum*
   4. Marginal cells of the lamellae with longitudinal cuticular ridges evident in surface view, in section resembling small papillae; capsule ventricose, 2 of the longitudinal ridges often closer together; calyptra

with a few hairs.....*Polytrichadelphus lyallii*

4. Marginal cells of the lamellae without cuticular ridges, either smooth or distinctly papillose; calyptra very hairy..... 5

5. Mature capsule terete, or with indistinct ridges; leaves toothed to the middle or below; marginal cells of lamellae papillose, or if smooth, the leaves thin and strongly crisped when dry.....*Pogonatum*

5. Mature capsule with 4–6 longitudinal ridges; leaves entire or toothed, never thin and crisped when dry; marginal cells of lamellae never papillose.....*Polytrichum*

Key 12. *Atrichum*

1. Dioicous; lamellae 2–13 cells high; median leaf cells often more than 30 μ in longest dimension, the walls thin, not or only slightly collenchymatous; calyptra smooth, or with papillae or teeth at the tip..... 2

1. Polyoicous or monoicous (at least some plants autoicous or paroicous); median leaf cells seldom over 30 μ in longest dimension, the walls often thick and strongly collenchymatous; lamellae low, 2–4(7) cells high in section; calyptra hispid at tip..... 3

2. Leaves broad, often more than 1.5 mm wide, sometimes to 2 mm, apex broadly acute to obtuse; dorsal surface of lamina usually distinctly toothed with several rows of teeth; urn often more than 3 mm long .....*A. selwynii*

2. Leaves narrow, seldom to 1.5 mm wide; apex acute or rarely somewhat obtuse; dorsal surface of lamina without teeth or with a few indistinct teeth; urn not more than 3 mm long.....*A. tenellum*

3. Plants autoicous (some plants with only male or female organs), or rarely paroicous with the archegonia central and surrounded by antheridia; capsule horizontal, strongly arcuate.....*A. undulatum* var. *undulatum*

3. Plants paroicous, or synoicous with the antheridia central and surrounded by archegonia; capsule inclined and subarcuate, or sometimes straight and erect.....*A. undulatum* var. *gracilisetum*

Key 13. *Oligotrichum*

1. Leaves lanceolate from a sheathing base; ventral lamellae wavy or undulate; lamina cells 6–15 μ in diameter, the walls thick..... 2

1. Leaves broader, ovate, ovate-lanceolate, or oblong, with an acute apex, the base not sheathing; lamellae straight and entire or nearly so; lamina cells 10–25 μ in diameter, the walls not thickened, or the walls of the marginal cells somewhat thickened.....*O. parallelum*

2. Lamellae of the dorsal surface few and small; arctic-alpine.....*O. hercynicum*

2. Dorsal costa and lamina with conspicuous lamellae; from the lowlands to about 1500 m...*O. aligerum*

Key 14. *Pogonatum*

1. Leaves plainly crisped and contorted when dry, the margins bistratose and the lamina cells with thin walls; marginal cells of lamellae smooth; exothecial cells papillose or mammillose with high, sharp projections .....*P. contortum*

1. Leaves not or only slightly contorted when dry; cells of lamina with thick walls; marginal cells of lamellae papillose 2

2. In section the marginal cells of the lamellae not longer than broad; capsule without stomata, the exothecial cells papillose or mammillose; peristome teeth 32..... 3

2. In section the marginal cells of the lamellae longer than broad; capsule with stomata, the exothecial cells smooth; peristome teeth about 40–55.....*P. alpinum*

3. Marginal cells of the lamellae round in section.....*P. urnigerum*

3. Marginal cells of the lamellae flat-topped in section, the cavity $\pm$ quadrate to transversely elongate..... .....*P. dentatum*

Key 15. *Polytrichum*

1. Marginal cells of the lamellae grooved, appearing notched in section.....*P. commune*

1. Marginal cells of the lamellae not notched..... 2

2. Leaves distinctly serrate..... 3

2. Leaves entire except costa, if excurrent, sometimes toothed; leaf margins usually incurved..... 4

3. Cells of the lamina 15–25 μ in diameter.....*P. longisetum*

3. Cells of the lamina 10–12 (15) μ in diameter.....*P. formosum*

4. Leaves blunt and ± cucullate at the apex; capsule usually with 6 longitudinal ridges...*P. sexangulare*
4. Leaves with the costa excurrent; capsule with 4 longitudinal ridges..... 5
5. Excurrent costa forming a white awn, usually long.....*P. piliferum*
5. Excurrent costa short and reddish..... 6
6. Stems with rhizoids only at base; leaves 5–9 mm long, with (30) 35–50 lamellae; capsule oblong, the urn 3–6 mm long.....*P. juniperinum*
6. Stems with whitish rhizoids extending up among the leaves; leaves 3–5 mm long, with 25–30 (35) lamellae; capsule short, the urn 2–3 mm long.....*P. strictum*

Key 16. FISSIDENTACEAE

1. Leaves with a very narrow dorsal lamina or lamella; perichaetial bracts with costa long-excurrent; peristome wanting; plants rarely fruiting.....*Bryoxiphium*
1. Leaves with well-developed dorsal and ventral laminae or lamellae; costa of perichaetial bracts ending before the apex to shortly excurrent; peristome well-developed.....*Fissidens*

Key 17. *Fissidens*

1. Leaves bordered by a band of narrow, elongate cells, the border sometimes inconspicuous and only on the vaginant laminae of upper leaves..... 2
1. Leaves not bordered by narrow, elongate cells..... 4
2. Leaf border often inconspicuous and only on the vaginant laminae of upper leaves.....*F. obtusifolius*
2. Leaf border conspicuous, present on all laminae..... 3
3. Plants large, 1–2.5 cm long, often on submerged rocks in streams; dorsal and ventral laminae often streaked with bistratose regions; seta short, 1–3 mm long.....*F. ventricosus*
3. Plants small, usually less than 1 cm long, not or rarely on submerged rocks; dorsal and ventral laminae unistratose; seta 3–8 mm long.....*F. bryoides*
4. Leaves rigid, the lamina of several layers of cells, unistratose regions present only on the margins of the vaginant lamina; plants on wet calcareous rock or soil.....*F. grandifrons*
4. Leaves not rigid, the lamina unistratose; plants aquatic or terrestrial, usually non-calcareous..... 5
5. Plants aquatic, floating or submerged; leaves distant or imbricate at the apex; vaginant lamina 1/4–1/3 the length of the dorsal lamina.....*F. fontanus*
5. Plants terrestrial; leaves close and imbricate; vaginant lamina 1/2–2/3 the length of the dorsal lamina... 6
6. Leaves coarsely and irregularly serrate; plants large, often over 2 cm long.....*F. adianthoides*
6. Leaves entire or finely and evenly serrate; plants small, usually less than 2 cm long..... 7
7. Costa commonly percurrent or excurrent, rarely ending below the acute to apiculate apex; median leaf cells above the vaginant lamina 8–12 μ; perichaetial buds and sporophytes near the base of the stem..... .....*F. taxifolius*
7. Costa always ending several cells below the apex; perichaetial buds and sporophytes terminal..... 8
8. Leaf apex obtuse to broadly acute; upper leaves often with a border of elongate cells on the vaginant lamina; leaves entire or very minutely crenulate at the apex.....*F. obtusifolius*
8. Leaf apex acute or apiculate, never rounded; vaginant lamina never bordered by elongate cells..... 9
9. Median cells above the vaginant lamina 14–18 μ, thick-walled and mammillose.....*F. osmundoides*
9. Median cells above the vaginant lamina 14–28 μ, thin-walled, never mammillose.....*F. pauperculus*

Key 18. DITRICHACEAE

1. Leaves distichous (in 2 rows on the stem).....*Distichium*
1. Leaves not distichous..... 2
2. Leaves glaucous green.....*Saelania glaucescens*
2. Leaves not glaucous..... 3
3. Leaves usually ovate-lanceolate, never subulate, the margins usually recurved, toothed, and unistratose; capsule with 8 longitudinal ribs.....*Ceratodon purpureus*
3. Leaves otherwise, often subulate..... 4
4. Cleistocarpous; leaves subulate, the margins plane to incurved.....*Pleuridium subulatum*
4. Capsule with operculum and peristome; leaf margins plane, incurved, or recurved.....*Ditrichum*

Key 19. *Distichium*

1. Leaves plainly distichous; capsule straight and erect or nearly so; spores 17–20 μ.....*D. capillaceum*
1. Leaves less conspicuously distichous; capsule inclined, somewhat zygomorphic; spores 30–40 μ.....*D. inclinatum*

Key 20. *Ditrichum*

1. Upper leaves squarrose, the awn rough throughout; seta yellow to red.....*D. cylindricum*
1. Leaves not squarrose..... 2
   2. Leaf margins recurved and bistratose at least above; dioicous; spores smooth..... 3
   2. Leaf margins plane or incurved..... 4
3. Leaves somewhat crisped when dry; seta red; urn 1.25–2.5 mm long; operculum 0.6–0.8 mm long; peristome teeth to 0.6 mm long, spinose-papillose, not nodose or only slightly so at base.....*D. ambiguum*
3. Leaves not crisped; seta brown; urn 0.8–1.6 mm long; operculum 0.5–0.6 mm long; peristome teeth 0.2–0.4 mm long, papillose or obliquely striate, often united at the nodes at the base.....*D. pusillum*
   4. Stems often long, 2–15 cm, usually matted with rhizoids, in dense tomentose sods in calcareous habitats; median leaf cells short; plants often sterile.....*D. flexicaule*
   4. Plants otherwise..... 5
5. Lamina of the leaf bistratose in the upper part..... 6
5. Lamina unistratose except sometimes on the margins..... 7
   6. Leaf cells smooth.....*D. zonatum* var. *zonatum*
   6. Leaf cells of the lamina and the costa papillose to about the middle.....*D. zonatum* var. *scabrifolium*
7. Dioicous; seta dark; upper and median leaf cells long.....*D. heteromallum*
7. Autoicous; seta yellow..... 8
   8. Spores rough, 20–29 μ; antheridial buds below the perichaetium; leaf margins unistratose; upper leaf cells long; costa filling the awn near the apex or nearly so.....*D. schimperi*
   8. Spores smooth, 8–10 μ; antheridial buds on short basal branches; leaf margins bistratose above; upper leaf cells short; lamina evident to apex.....*D. montanum*

Key 21. Seligeriaceae

1. Very small plants with stems 1–3 mm high; leaves less than 2 mm long, the alar cells never inflated..... 2
1. Plants larger, the stems 1–10 cm high; leaves 2–3 mm long, the alar cells plainly inflated.....*Blindia acuta*
   2. Capsule longitudinally ribbed when dry; peristome teeth papillose, short and blunt.....*Brachydontium trichodes*
   2. Capsule not ribbed; peristome teeth smooth or the peristome wanting.....*Seligeria*

Key 22. *Seligeria*

1. Leaves entire, the costa excurrent.....*S. recurvata*
1. Leaves entire or often serrulate; costa ending before the apex or percurrent..... 2
   2. Leaf margins entire, or serrulate at the apex; seta arcuate; peristome present.....*S. campylopoda*
   2. Leaf margins serrulate at the base; seta straight; peristome wanting.....*S. donniana*

Key 23. Dicranaceae

1. Plants very small with stems to 1 or 2 mm high; leaves with plane margins and costa ending before the apex; cells smooth, with thin walls, the alar cells not differentiated; capsule immersed, cleistocarpous.....*Pseudephemerum nitidum*
1. Plants larger or leaves otherwise or both; capsule with an operculum..... 2
   2. Small julaceous plants; leaves ± obtuse, the alar cells not inflated; capsule straight and erect.....*Aongstoemia longipes*
   2. Plants otherwise..... 3
3. Leaves oblong-lanceolate to lingulate; leaf apex obtuse or the leaves distinctly serrate or both; leaf cells papillose-mammillose with a large simple or rarely forked papilla on each surface, rarely nearly smooth.....*Dichodontium*
3. Leaf cells smooth or if papillose, the papillae otherwise, or the leaves of a different shape..... 4

4. Costa broad, 1/3 to 2/3 the width of the leaf base, often ribbed on the back, in cross section with the ventral layer of cells larger than the cells within.....*Campylopus*
4. Costa narrower or if broad, the ventral cells otherwise..... 5
5. Leaves crisped and contorted when dry, the costa with guide cells and stereid bands; autoicous..... 6
5. Leaves not crisped when dry, or if so, either dioicous or without guide cells and stereid bands..... 8
6. Leaves lanceolate to lanceolate-subulate from an ovate or obovate base, the cells never papillose; capsule strumose.....*Oncophorus*
6. Leaf base not clearly differentiated..... 7
7. Capsule erect and straight or nearly so, not ribbed and never strumose.....*Dicranoweisia*
7. Capsule erect to inclined and somewhat curved, longitudinally ribbed when dry; sometimes strumose..... *Cynodontium*
8. Capsule with a neck as long or longer than the rest of the capsule.....*Trematodon*
8. Capsule otherwise 9
9. Autoicous; costa ± terete, without guide cells and stereid bands; leaf margins plane to incurved.....*Arctoa*
9. Dioicous or sometimes pseudomonoicous; leaves otherwise.....10
10. Alar cells never inflated; costa with guide cells and 1 or 2 stereid bands at least in the lower part of the leaf ..... *Dicranella*
10. Alar cells inflated, hyaline or often brown.....11
11. Costa ± terete, to 1/3 the width of the leaf base but often narrower, with guide cells and stereid bands, or the leaf tips commonly broken.....*Dicranum*
11. Costa broad and flat, 1/3 to 9/10 the width of the leaf base, usually more than 1/3; leaf margins never recurved 12
12. Costa with guide cells and stereid bands.....*Dicranodontium*
12. Costa without guide cells and stereid bands.....*Paraleucobryum*

Key 24. *Arctoa*

1. Capsule erect and radially symmetric or nearly so, not strumose; peristome teeth wide-spreading when dry .....*A. fulvella*
1. Capsule inclined and somewhat zygomorphic when dry, usually strumose..... 2
2. Exothecial cells of the capsule short, the walls ± thickened; leaves commonly falcate-secund; annulus adherent.....*A. falcata*
2. Exothecial cells long, the walls thin; leaves sometimes falcate, often crisped; annulus well-developed and deciduous 3
3. Perigonium close to the perichaetium; capsule usually plainly ribbed when dry; alar cells inflated, brown, usually clearly set off by small quadrate cells above.....*A. starkei*
3. Perigonium well below the perichaetium or on a separate branch; capsule not plainly ribbed when dry, sometimes wrinkled; alar cells less clearly differentiated, sometimes brown, grading into the upper cells.....*A. blyttii*

Key 25. *Campylopus*

1. Alar leaf cells not differentiated; basal leaf cells thin-walled and hyaline, not abruptly set off from the cells above.....*C. fragilis*
1. Alar cells abruptly inflated, usually red or brown..... 2
2. Leaves usually with long, hyaline apices to 1 mm long or longer.....*C. atrovirens*
2. Leaves without hyaline apices, or rarely a few leaves with very short ones.....*C. flexuosus*

Key 26. *Cynodontium*

1. Leaf cells not papillose or only faintly so; capsule not strumose..... 2
1. Leaf cells plainly papillose..... 3
2. Leaf margins bistratose; perigonial bracts obtuse.....*C. tenellum*
2. Leaf margins unistratose; perigonial bracts acute.....*C. jenneri*
3. Capsule strumose, curved and zygomorphic..... 4
3. Capsule not strumose, erect and radially symmetric or nearly so..... 5
4. Leaves 3–4 mm long, apex acute; margins bistratose; annulus clearly differentiated.....*C. strumiferum*
4. Leaves 1–2.25 mm long, apex acute or ± obtuse; margins unistratose; annulus wanting...*C. strumulosum*

5. Leaf cells usually not papillose, sometimes faintly so; perichaetial bracts obtuse; peristome teeth divided about halfway.....*C. tenellum*
5. Leaf cells strongly papillose; perigonial bracts ± acute; peristome teeth not divided, often perforate.....*C. schisti*

Key 27. *Dichodontium*

1. Leaf margins plane; capsule strumose.....*D. olympicum*
1. Leaf margins recurved below; capsule not strumose.....*D. pellucidum*

Key 28. *Dicranella*

1. Leaves squarrose from an enlarged, usually sheathing base..... 2
1. Leaves not squarrose, either falcate or erect and flexuose to ± crisped..... 5
   2. Leaves with broad, obtuse apices.....*D. palustris*
   2. Leaves subulate or acute..... 3
3. Capsule erect and straight or nearly so, ribbed when dry; annulus broad and deciduous; leaf margins and lamina bistratose in the upper part.....*D. crispa*
3. Capsule inclined to horizontal, ± zygomorphic..... 4
   4. Capsule somewhat ribbed when dry, slightly strumose; leaf apex entire or nearly so...*D. grevilleana*
   4. Capsule smooth, not strumose; leaf apex serrulate.....*D. schreberiana*
5. Capsule strumose.....*D. cerviculata*
5. Capsule not strumose..... 6
   6. Capsule erect and straight or nearly so..... 7
   6. Capsule otherwise, inclined to horizontal and ± zygomorphic..... 8
7. Capsule smooth to somewhat wrinkled when dry.....*D. rufescens*
7. Capsule ribbed when dry.....*D. crispa*
   8. Capsule plainly ribbed when dry; leaf margins plane or incurved..... 9
   8. Capsule smooth or slightly wrinkled; leaf margins recurved in part, bistratose above.....10
9. Mouth of capsule oblique when dry; annulus poorly developed; seta yellow when young, dark when old; costa to 1/3 the width of leaf base.....*D. heteromalla*
9. Mouth of capsule not oblique; annulus of 2 rows of cells, deciduous; seta red; costa to 1/5 the width of leaf base.....*D. subulata*
   10. Upper leaves to 2 mm long, margins bistratose near apex; upper leaf cells 2:1 or longer.....*D. varia*
   10. Upper leaves 3–5 mm long, margins and sometimes the lamina bistratose near apex; upper leaf cells short at least on the margins, isodiametric or 1.5:1, rarely longer.....*D. pacifica*

Key 29. *Dicranoweisia*

1. Leaf margins recurved; the walls between the cells sometimes bulging dorsally and ventrally; alar cells not inflated; peristome teeth smooth below, papillose above.....*D. cirrata*
1. Leaf margins not recurved; cells with longitudinal cuticular thickenings on the surface, resembling papillae in cross section; alar cells sometimes inflated..... 2
   2. Alar cells plainly inflated, brown, forming a well-differentiated group.....*D. crispula* var. *crispula*
   2. Alar cells not inflated or not forming a definite group, sometimes a few cells inflated..... 3
3. Peristome teeth striate below, papillose above; awn of perichaetial bract shorter than the base.....*D. crispula* var. *contermina*
3. Peristome teeth papillose throughout; awn of perichaetial bract often longer than the base.....*D. crispula* var. *roellii*

Key 30. *Dicranum*

1. Leaves straight, the points mostly broken..... 2
1. Leaves falcate, crisped, or sometimes straight, the points not or rarely broken..... 3
   2. Costa lacking stereid bands, with 1 or rarely 2 layers of cells ventral to the guide cells; capsule straight and erect; common.....*D. tauricum*
   2. Costa sometimes with weak stereid bands, with 2 or sometimes 3 layers of cells ventral to the guide cells; capsule arcuate; rare.....*D. fragilifolium*

3. Leaf cells in the upper 1/3 of the leaf with few or no pits, short, usually less than 2:1 (sometimes longer in *D. acutifolium*) 4
3. Leaf cells in the upper 1/3 of the leaf with many pits, longer, usually more than 2:1 (sometimes shorter and with few pits in forms of *D. scoparium*) 14
4. Plants with flagelliform branches in the upper leaf axils; capsule straight and erect ..... *D. flagellare*
4. Plants without flagelliform branches 5
5. Plants small, the stems 0.5–2 cm high; leaves 2–4 mm long, crisped when dry, not secund; leaf cells papillose from apex to about the middle of leaf; capsule erect and straight or nearly so ..... *D. montanum*
5. Plants larger, the stems commonly more than 2 cm high; leaves usually larger; capsule inclined to horizontal, arcuate 6
6. Leaves often undulate or rugose especially near apex; walls between the cells bulging dorsally and ventrally 7
6. Leaves not undulate or rugose 9
7. Costa usually percurrent; leaf apex narrowly acute 8
7. Costa ending below the apex to percurrent; leaf apex obtusely acute; seta solitary ..... *D. undulatum*
8. Leaf cells smooth or weakly papillose; seta usually solitary ..... *D. acutifolium*
8. Leaf cells commonly spinulose or strongly papillose; setae often aggregate (see discussion under *D. undulatum*) ..... *D. drummondii*
9. Leaves small, usually less than 5×0.5 mm ..... *D. elongatum*
9. Leaves larger, usually 5–10×0.5–1 mm 10
10. Leaves keeled in the upper part; stereid bands extending well into the upper 1/3 of the leaf, often nearly to the apex 11
10. Leaves tubular in the upper part 12
11. Leaf apex narrow, costa excurrent; upper leaf margins commonly with bistratose regions; cells usually distinctly papillose near apex; capsule usually ± strumose ..... *D. fuscescens*
11. Leaf apex broader, costa percurrent or ending before the apex; upper leaf margins commonly unistratose, sometimes bistratose in spots; leaf cells smooth or weakly papillose; capsule not strumose ..... *D. acutifolium*
12. Leaf cells strongly papillose in upper half of leaf; costa without stereids in upper 1/4–1/3 of leaf, the cells on dorsal and ventral surfaces not or scarcely differentiated; capsule plainly arcuate and striate, sometimes strumose ..... *D. pallidisetum*
12. Leaf cells smooth or weakly papillose in upper half of leaf; costa with stereid bands in upper part of leaf as well as below, the cells on dorsal and ventral surfaces commonly differentiated; capsule nearly straight, smooth or weakly striate, never strumose 13
13. Costa at leaf base 1/6–1/10 the width of leaf; lower leaf cells with very thick walls, strongly pitted, the upper cells variable in shape, often with some pits ..... *D. spadiceum*
13. Costa wider at leaf base; lower leaf cells with thin walls, with or without pits, the upper cells not pitted ..... *D. muehlenbeckii*
14. Costa with a double row of guide cells, without dorsal ridges or lamellae; leaves 10–15 mm long; setae often aggregate ..... *D. majus*
14. Costa with one row of guide cells; leaves often less than 10 mm long 15
15. Leaves conspicuously undulate; setae usually aggregate ..... *D. polysetum*
15. Leaves not or only slightly undulate; setae solitary or rarely 2–3 per perichaetium 16
16. Leaves without lamellae 17
16. Leaves with 2–4 lamellae on the back of the costa, the lamellae rarely small or wanting 18
17. Costa excurrent; cells of upper part of leaf variable, often short, or some cells long, the walls with or without pits; capsule ± curved ..... *D. spadiceum*
17. Costa ending before apex; cells of the upper part of the leaf usually long, the walls pitted; capsule straight and erect, ribbed when dry ..... *D. rhabdocarpum*
18. Inner perichaetial bracts gradually acuminate ..... *D. howellii*
18. Inner perichaetial bracts abruptly acuminate ..... *D. scoparium*

Key 31. *Oncophorus*

1. Leaves gradually narrowed from the ovate or oblong base, the margins plainly recurved ..... *O. virens*
1. Leaves abruptly narrowed from the obovate base, the margins plane or incurved ..... *O. wahlenbergii*

Key 32. *Paraleucobryum*

1. Leaf margins entire or with a few teeth at the apex; costa smooth.....*P. enerve*
1. Leaf margins plainly denticulate; costa with ridges of projecting cells on the dorsal surface...*P. longifolium*

Key 33. *Trematodon*

1. Leaves 2–4 mm long; each peristome tooth divided nearly to the base.....*T. ambiguus*
1. Leaves 0.8–2 mm long; peristome teeth not divided.....*T. boasii*

Key 34. POTTIACEAE – Subfamilies

1. Perigonia and perichaetia axillary.....Pleuroweisioideae - *Anoectangium aestivum*
1. Perigonia and perichaetia terminal..... 2
   2. Leaves usually broad in outline, ovate, oblong, ligulate, or lingulate; costa usually with one stereid band, never two, rarely the stereid band wanting.....Pottioideae
   2. Leaves usually ± lanceolate, tapering to the apex; costa usually with two stereid bands sometimes one, rarely without stereids.....Trichostomoideae

Key 35. POTTIOIDEAE

1. Capsule cleistocarpous, apiculate; leaves ovate to ovate-lanceolate, the costa excurrent...*Phascum cuspidatum*
1. Capsule with an operculum..... 2
   2. Leaves broadly lingulate to spatulate, bordered, the border submarginal, composed of thick-walled, enlarged cells, sometimes orange in color.....*Scopelophila latifolia*
   2. Leaves otherwise..... 3
3. Leaves with lamellae or filaments on the ventral surface..... 4
3. Leaves without lamellae or filaments..... 6
   4. Leaves with lamellae..... *Pterygoneurum*
   4. Leaves with filaments..... 5
5. Leaf margins ± recurved.....*Crossidium*
5. Leaf margins incurved.....*Aloina*
   6. Leaves ovate-lanceolate to linear, to 1.7 mm long.....*Trichostomopsis australasiae*
   6. Leaves otherwise..... 7
7. Leaves imbricate to spreading, not or scarcely twisted or contorted when dry.....*Pottia*
7. Leaves crisped and contorted when dry..... 8
   8. Peristome teeth long and twisted, from a long or short basal membrane.....*Tortula*
   8. Peristome teeth often short, rarely twisted, sometimes rudimentary or wanting, the basal membrane short ..... *Desmatodon*

Key 36. TRICHOSTOMOIDEAE

1. Leaves linear-lanceolate, without awns, the lamina bistratose with the ventral layer of cells strongly mammillose, the dorsal layer smooth.....*Timmiella crassinervis*
1. Leaves otherwise..... 2
   2. Hyaline cells of the leaf base extending up the margins to form a "V".....*Tortella*
   2. Hyaline cells, if present, not extending up the margins farther than at the costa..... 3
3. Leaf margins strongly involute.....*Weissia controversa*
3. Leaf margins plane or revolute..... 4
   4. Leaf margins plane, toothed above the base at the upper margins of the hyaline basal cells..... .....*Eucladium verticillatum*
   4. Leaf margins plane or recurved, entire or if toothed, the teeth at the apex..... 5
5. Peristome long and twisted, rarely wanting; cells of the operculum in spiral rows; leaf margins usually recurved ..... *Barbula*
5. Peristome teeth never long and twisted; cells of the operculum not in spiral rows..... 6
   6. Leaves 2–6 mm long, the margins plane.....*Trichostomum tenuirostre*
   6. Leaves smaller or the margins recurved or both..... 7
7. Peristome wanting; leaf margins plane and the operculum free from the columella, or the leaf margins recurved

and the operculum attached to the columella ..... *Gymnostomum*
7. Peristome usually present, sometimes rudimentary or wanting; operculum never attached to the columella; leaf margins recurved ..... *Didymodon*

Key 37. POTTIACEAE

1. Leaves with lamellae or filaments on the ventral surface 2
1. Leaves without outgrowths on the surface 4
2. Leaves with lamellae ..... *Pterygoneurum*
2. Leaves with filaments 3
3. Leaf margins ± recurved; cells of the lamina and of the filaments papillose ..... *Crossidium aberrans*
3. Leaf margins incurved; cells smooth ..... *Aloina*
4. Leaves broadly lingulate to spatulate, bordered, the border submarginal, composed of thick-walled, enlarged cells, sometimes orange in color, sometimes bistratose in part ..... *Scopelophila latifolia*
4. Leaves otherwise 5
5. Leaves linear-lanceolate, without awns, the lamina bistratose with the ventral layer of cells strongly mammillose and the dorsal layer smooth ..... *Timmiella crassinervis*
5. Leaves otherwise, the lamina not bistratose, or if so, the cells otherwise 6
6. Hyaline cells of the leaf base extending up the margins to form a "V" ..... *Tortella*
6. Hyaline cells, if present, not extending up the margins farther than at the costa 7
7. Leaves strongly crisped, usually linear-lanceolate, the margins involute; costa usually excurrent as a short point ..... *Weissia controversa*
7. Leaves otherwise 8
8. Small plants usually in calcareous regions, often encrusted with lime; leaves to 1.8 mm long but often shorter, never with a long awn 9
8. Without this combination of characters 11
9. Leaf margins plane, toothed above the base at the upper margins of the hyaline basal cells ..... *Eucladium verticillatum*
9. Leaf margins plane or recurved, entire 10
10. Leaves decurrent; capsule with a peristome of 16 straight teeth ..... *Didymodon tophaceus*
10. Leaves not decurrent; capsule eperistomate ..... *Gymnostomum*
11. Leaves ovate to ovate-lanceolate, the costa excurrent; capsule apiculate, without an operculum; small plants on soil ..... *Phascum cuspidatum*
11. Capsule with operculum 12
12. Leaves ovate-lanceolate to linear, the apex always narrow; costa ending before the apex to excurrent 13
12. Leaves never linear-lanceolate, with at least one of the following characters: leaf apex broad; leaves apiculate or awned; leaves with a border of differentiated cells 17
13. Leaf margins bistratose near the apex and the lamina often bistratose in spots; cross section of costa near middle with a dorsal stereid band, the dorsal layer of cells differentiated, the ventral cells large, usually in 3 layers ..... *Trichostomopsis australasiae*
13. Leaf margins unistratose, or if bistratose, the costa otherwise 14
14. Leaf margins recurved throughout or in part 15
14. Leaf margins plane 16
15. Cells of the operculum in straight or nearly straight rows and the peristome teeth, if present, never spiral ..... *Didymodon*
15. Cells of the operculum in spiral rows and the peristome teeth, if present, long and twisted ..... *Barbula*
16. Costa without guide cells, with one stereid band ..... *Anoectangium aestivum*
16. Costa with 3–4 guide cells and 2 stereid bands ..... *Trichostomum tenuirostre*
17. Costa with 2 stereid bands, or the perichaetial bracts sheathing; leaves not bordered ..... *Barbula*
17. Costa with one stereid band; perichaetial bracts not sheathing, or if so, the leaves bordered 18
18. Leaves imbricate to spreading, not or only slightly twisted or contorted when dry, not bordered except *Pottia heimii* ..... *Pottia*
18. Leaves contorted to crisped or twisted when dry, often strongly so 19
19. Peristome teeth long and twisted, from a long or short basal membrane ..... *Tortula*
19. Peristome teeth from a short basal membrane, often short, straight or rarely somewhat twisted, sometimes rudimentary or wanting ..... *Desmatodon*

Key 38. *Aloina*

1. Leaves piliferous; costa without stereid cells ..... *A. pilifera*
1. Leaves muticous; costa with stereid cells 2
   2. Synoicous; costa with 1–2 layers of stereid cells and usually only one layer of large thin-walled cells ventral to the stereids ..... *A. brevirostris*
   2. Dioicous; costa with 2–3 layers of stereid cells and usually 2 layers of large thin-walled cells ventral to the stereids ..... *A. rigida*

Key 39. *Barbula*

1. Leaf margins revolute from just above the base to the apex 2
1. Leaf margins often revolute or recurved to above the middle but not to the apex 3
   2. Costa excurrent ..... *B. platyneura*
   2. Costa percurrent, or ending just before the apex ..... *B. brachyphylla*
3. Leaves oblong-lanceolate or lingulate, never long-acuminate, apex ± obtuse 4
3. Leaves ovate-lanceolate to lanceolate, acuminate, apex acute 6
   4. Perichaetial bracts convolute; seta yellow, twisted to the left; upper leaf cells papillose, often densely so 5
   4. Perichaetial bracts not convolute; seta red or brown; upper leaf cells smooth or weakly papillose ..... *B. unguiculata*
5. Inner perichaetial bracts blunt, truncate or obtusely acute ..... *B. convoluta*
5. Inner perichaetial bracts acute or acuminate, often abruptly narrowed to an acute apex ..... *B. eustegia*
   6. Alpine plants with reddish brown, multicellular gemmae borne on the rhizoids; capsules unknown ..... *B. ferruginascens*
   6. Plants otherwise 7
7. Costa plainly excurrent at least in the upper leaves; leaf cells smooth or with small papillae 8
7. Costa not excurrent or rarely slightly so in the upper leaves; leaf cells usually papillose 10
   8. Costa enlarged above, the excurrent part deciduous ..... *B. johansenii*
   8. Costa not enlarged above, the excurrent part never deciduous 9
9. Excurrent costa short, 1/8–1/6 the length of the leaf, sometimes longer in perichaetial bracts; upper leaf cells rounded to irregular, 6–10 μ in diameter ..... *B. acuta*
9. Excurrent costa longer, 1/5–1/4 the length of the leaf in the upper leaves; leaf cells ± quadrate, 7–12 μ in diameter ..... *B. icmadophila*
   10. Cells of the ventral surface of the costa near the middle of the leaf elongate, narrowly linear; leaves wide-spreading to squarrose-recurved when wet 11
   10. Cells of the ventral surface of the costa quadrate, similar to the cells of the lamina 12
11. Central strand of stem very strong; costa distinctly wider at the leaf base with 5–7 guide cells and with 3–4 guide cells near the middle of the leaf; leaves wide-spreading to somewhat recurved when wet ... *B. fallax*
11. Central strand smaller; costa not wider at the base, in cross section the cells ± homogeneous or the guide cells and stereid bands somewhat differentiated; leaves strongly recurved to squarrose when wet ... *B. reflexa*
   12. Capsule eperistomate or rarely with a very rudimentary peristome; basal cells of vegetative leaves quadrate or only slightly elongate ..... *B. rubiginosa*
   12. Capsule with a long twisted peristome; basal cells of vegetative leaves elongate, 2–2.5:1 13
13. Leaf margins recurved to above the middle of the leaf ..... *B. vinealis* var. *vinealis*
13. Leaf margins recurved only at the base ..... *B. vinealis* var. *flaccida*

Key 40. *Desmatodon*

1. Leaves bordered at least in the lower part, not awned; capsule horizontal to pendent 2
1. Leaves not bordered; capsule erect and straight or nearly so 3
   2. Leaf cells smooth to lightly papillose; capsule inclined to horizontal; peristome not twisted ..... *D. cernuus*
   2. Leaf cells distinctly papillose; capsule inclined to pendent; peristome somewhat twisted ..... *D. laureri*
3. Leaves, at least the upper ones, awned 4
3. Leaves not awned 6
   4. Leaf cells smooth; margins plane except at base ..... *D. systylius*
   4. Leaf cells papillose; margins recurved 5

5. Leaves oblong to spatulate, the upper cells 15–21 μ wide.....*D. latifolius* var. *latifolius*
5. Leaves gradually tapering from the middle or below, ± acute; upper cells 11–16 μ wide.....*D. leucostoma*
   6. Upper leaf cells 8–13 μ wide; spores 8–15 μ, smooth.....*D. obtusifolius*
   6. Upper leaf cells 15–21 μ wide; spores 18–24 μ, papillose.....*D. latifolius* var. *muticus*

Key 41. *Didymodon*

1. Leaf margins and sometimes the lamina bistratose at apex.....*D. rigidulus*
1. Leaf margins and lamina unistratose..... 2
   2. Leaves linear-lanceolate, acute, often denticulate at apex, usually apiculate; autoicous; annulus deciduous .....*D. recurvirostris*
   2. Leaves ovate-lanceolate to ± lingulate, acute or obtuse, entire; dioicous; annulus wanting..... 3
3. Leaves plainly decurrent, obtuse to rounded or rarely acute.....*D. tophaceus*
3. Leaves scarcely decurrent, acute.....*D. columbianus*

Key 42. *Gymnostomum*

1. Leaf margins plane; operculum free from the columella.....*G. aeruginosum*
1. Leaf margins recurved on one or both sides at the middle and below; operculum attached to the columella .....*G. recurvirostre*

Key 43. *Pottia*

1. Plants bulbiform; walls of upper leaf cells strongly thickened on the dorsal side; capsule peristomate..... 2
1. Plants not bulbiform; cells otherwise; capsule with or without peristome..... 3
   2. Leaves muticous, the costa ending before the apex.....*P. latifolia* var. *latifolia*
   2. Costa excurrent, forming an awn.....*P. latifolia* var. *pilifera*
3. Capsule peristomate; columella not attached to the operculum; leaf margins usually recurved from the base nearly to the apex.....*P. lanceolata*
3. Capsule eperistomate; columella usually attached to the operculum..... 4
   4. Capsule ovoid to obovoid, wider at the mouth when deoperculate; seta usually twisted to the right; leaf margins plane to ± recurved.....*P. truncata*
   4. Capsule ovoid to cylindric, not wider at the mouth; seta twisted to the left or rarely to the right at the base; leaf margins plane or incurved..... 5
5. Upper leaf cells papillose except the border of 2–5 rows of smooth, yellowish cells.....*P. heimii*
5. Leaves not bordered, the cells smooth.....*P. nevadensis*

Key 44. *Pterygoneurum*

1. Capsule emergent to exserted; calyptra cucullate.....*P. ovatum*
1. Capsule immersed to emergent; calyptra mitrate.....*P. subsessile*

Key 45. *Tortella*

1. Leaves scarcely crisped, fragile, the tips often broken; rarely fruiting.....*T. fragilis*
1. Leaves crisped and contorted when dry, not fragile; commonly fruiting..... 2
   2. Autoicous; upper and median leaf cells 4–9 μ in diameter; rare in western North America...*T. humilis*
   2. Dioicous; upper and median leaf cells usually larger, 8–13 μ in diameter..... 3
3. Leaves linear-lanceolate, tapering gradually to the narrow apex.....*T. tortuosa*
3. Leaves ± oblong-lanceolate, narrowed somewhat abruptly in the upper part to the acute or obtuse apex .....*T. inclinata*

Key 46. *Tortula*

1. Plants bearing propagula, usually growing on trees..... 2
1. Plants without propagula or the propagula inconspicuous..... 3
   2. Leaves with costa excurrent as a long awn.....*T. laevipila* var. *meridionalis*
   2. Leaves muticous.....*T. latifolia*

3. Costa ending before the apex, percurrent, or excurrent as a spine, never as a long awn 4
3. Costa excurrent as an awn, usually long 11
4. Leaves bordered by differentiated cells 5
4. Leaves not bordered by differentiated cells 8
5. Border often bistratose, the border cells usually all elongate; autoicous ..... *T. subulata*
5. Border unistratose, the cells not elongate 6
6. Perichaetial bracts sheathing; upper leaf cells smooth or inconspicuously papillose, 12–22 μ, rarely to 26 μ in diameter; dioicous ..... *T. amplexa*
6. Perichaetial bracts not sheathing, similar to the vegetative leaves 7
7. Leaf cells smooth or with low papillae; leaf border weak; autoicous or synoicous ..... *T. mucronifolia*
7. Leaf cells densely papillose; leaves plainly bordered; dioicous ..... *T. bolanderi*
8. Leaf margins revolute throughout, the leaf cells densely papillose; autoicous ..... *T. inermis*
8. Leaf margins not revolute throughout 9
9. Upper leaf cells 15–28 μ in diameter, smooth or with low, inconspicuous papillae; autoicous or synoicous ..... *T. mucronifolia*
9. Upper leaf cells 10–19 μ in diameter, densely papillose; dioicous or capsules unknown 10
10. Costa ending before the apex to percurrent; leaves rarely apiculate; basal leaf cells scarcely differentiated at the margins; propagula common ..... *T. latifolia*
10. Costa usually excurrent as a short mucro or as an awn; marginal cells of the leaf base distinctly smaller than the median basal cells; propagula wanting ..... *T. bartramii*
11. Synoicous; leaf margins recurved except at the apex; upper cells 12–16 μ; awn usually rough ..... *T. princeps*
11. Without this combination of characters; dioicous, autoicous, or capsules unknown 12
12. Lamina of leaf bistratose at least in upper part ..... *T. bistratosa*
12. Lamina unistratose 13
13. Leaf margins revolute from base to apex; awn smooth or nearly so 14
13. Leaves otherwise 15
14. Leaves often with a border of differentiated cells; autoicous; basal tube of peristome not extending beyond the mouth of the capsule ..... *T. muralis*
14. Leaves not bordered; dioicous; peristome with a well-developed basal tube ..... *T. brevipes*
15. Leaf margins plainly recurved from base to apex or nearly so; awn rough, hyaline or reddish at base 16
15. Leaf margins plane at least in the upper part, sometimes plane throughout; awn smooth or rough 18
16. Leaf apex gradually narrowed to an acute hyaline point; cells about 10 μ in diameter ... *T. ruraliformis*
16. Leaf apex obtuse to emarginate, the costa abruptly excurrent; cells 12–18 μ 17
17. Upper leaf cells strongly papillose with branched antleroid papillae ..... *T. papillosissima*
17. Upper leaf cells with several papillae per cell, the papillae often branched but never antleroid ... *T. ruralis*
18. Leaf margins ± revolute in the middle of the leaf, plane above; marginal leaf cells usually with thicker walls; autoicous; growing on trees ..... *T. laevipila* var. *laevipila*
18. Without this combination of characters 19
19. Leaf margins recurved from the base to about the middle; awn long, reddish, rough or nearly smooth; dioicous, often fruiting ..... *T. norvegica*
19. Leaf margins plane or slightly recurved in the lower part; awn short or to 0.35 mm long, sometimes longer, often wanting except on upper leaves; capsules unknown ..... *T. bartramii*

Key 47. ***Encalypta***

1. Leaves muticous, the basal cells plainly papillose; autoicous, capsule smooth or wrinkled, never ribbed; peristome single or double; calyptra fringed ..... *E. affinis*
1. Plants without this combination of characters 2
2. Dioicous, sterile in America; leaves muticous, the costa percurrent or ending before the apex; filamentous asexual reproductive bodies common; central strand of stem wanting or small ..... *E. streptocarpa*
2. Autoicous and commonly fruiting 3
3. Leaves oblong-lanceolate, broadest at the middle, tapering gradually to the piliferous apex; margins plane; peristome wanting; calyptra fringed ..... *E. alpina*
3. Leaves otherwise, oblong-lingulate to spatulate, the apex usually broad, muticous or piliferous 4
4. Calyptra fringed; leaf margins plane to incurved, or often some leaves with the margins recurved at the middle or below 5

4. Calyptra not fringed; leaf margins very rarely recurved..... 6
5. Fringe of the calyptra bordered above by small cells; capsule smooth or wrinkled, never ribbed; peristome single; asexual reproductive bodies wanting.....*E. ciliata*
5. Fringe of the calyptra not bordered by small cells; capsule ribbed, the ribs usually spiral; peristome double; filamentous asexual bodies common, at least on sterile plants.....*E. procera*
6. Leaves muticous or apiculate, rarely piliferous; peristome wanting or rudimentary..... .....*E. vulgaris* var. *vulgaris*
6. Upper leaves commonly piliferous, sometimes all the leaves with awns; peristome present, single, usually well-developed, sometimes with a preperistome.....*E. vulgaris* var. *rhabdocarpa*

Key 48. GRIMMIACEAE

1. Plants growing in or beside streams, black or nearly so except the growing tips; leaves to 5 mm long, apex broad and rounded; capsule immersed to emergent, ± spherical.....*Scouleria*
1. Plants without this combination of characters..... 2
2. Leaves lanceolate to linear-lanceolate, muticous, crisped and contorted when dry, the basal cells never sinuose; calyptra mitrate..... 3
2. Leaves rarely crisped when dry, if crisped, the plants with one or more of the following characters: (a) leaves piliferous, (b) leaf cells plainly sinuose, (c) asexual reproductive bodies present..... 4
3. Plants small, the stems about 1 mm high; leaves 1–4 mm long, entire; seta arcuate.....*Campylostelium saxicola*
3. Plants larger, the stems 2–4 cm high; leaves 4–6 mm long, coarsely toothed in the upper part; seta straight .....*Ptychomitrium gardneri*
4. Peristome teeth divided nearly to the base into 2–3 filiform branches; basal leaf cells or all leaf cells sinuose or nodulose; dioicous; capsule exserted on a straight seta (± arcuate in *R. patens*).....*Rhacomitrium*
4. Peristome teeth entire, cribrose, or cleft above the middle, rarely the capsule eperistomate; basal leaf cells not or less conspicuously sinuose, if strongly sinuose, the plants with 1 or more of the following characters: (a) autoicous, (b) seta short and capsule immersed to emergent, (c) seta arcuate, (d) leaves crisped when dry.....*Grimmia*

Key 49. *Grimmia*

1. Maritime plants; leaves muticous, bistratose or thicker to below the middle; costa with guide cells and stereid bands; capsule immersed .....*G. maritima*
1. Plants otherwise 2
2. Leaves crisped and contorted when dry..... 3
2. Leaves not crisped and contorted when dry..... 6
3. Leaves only slightly crisped and contorted, usually with well-developed hair-points; commonly fruiting ..... *G. trichophylla*
3. Leaves strongly crisped and contorted, without hair-points or the hair-points short; commonly sterile..... 4
4. Basal leaf cells strongly incrassate and ± sinuose; gemmae common.....*G. torquata* var. *torquata*
4. Basal leaf cells less incrassate, not or only slightly sinuose, sometimes with rather thin walls..... 5
5. Basal leaf cells quadrate to short-rectangular; arctic-alpine; gemmae wanting or rare..... ..... *G. torquata* var. *flettii*
5. Basal leaf cells long and narrow, hyaline to yellow; gemmae wanting.....*G. incurva*
6. Leaves muticous..... 7
6. Leaves commonly piliferous, at least the upper and perichaetial leaves with hair-points.....18

Leaves muticous

7. Capsule immersed, wide-mouthed and funnel-shaped when old; leaves variable in shape but at least the lower long and narrow, not keeled or the tips of some leaves keeled; lamina unistratose; margins plane to incurved, sometimes slightly recurved at the base .....*G. agassizii*
7. Plants otherwise 8
8. Leaves not keeled, the margins plane to incurved..... 9
8. Leaves keeled at least in the upper part; margins various; capsule immersed (except *G. alpestris* var. *holzingeri*) 12
9. Leaves 1.5–2×0.5–0.9 mm, usually widest at the middle or above, unistratose throughout; cells with thin walls; capsule exserted on a straight seta, peristomate.....*G. mollis*

9. Without this combination of characters; cells with thick walls at least in the upper part of the leaf.....10
10. Small alpine plants with leaves 1.2–2 mm long; capsule exserted on an arcuate seta; peristome wanting .....*G. olympica*
10. Plants larger; capsule immersed, peristomate; leaf margins bistratose or thicker to about the middle of the leaf; lamina unistratose or bistratose in part; capsule ovoid to short-cylindric.....11
11. Lamina unistratose or bistratose at the extreme apex; costa terete at the base, of 4–6 layers of cells..... .....*G. occidentalis*
11. Lamina mostly bistratose or thicker in the upper part, with bistratose strips extending to the leaf base adjacent to the costa; costa broad and flat at the base, of 6–9 layers of cells.....*G. cinclidodontea*
12. Vegetative leaves 1.2–2.8 mm long, the margins recurved, bistratose above; capsule wide-mouthed and tapering to the base; spores large, 14–22 μ in diameter.....13
12. Vegetative leaves smaller, to 1.3 mm but often less than 1 mm; capsule ovoid to short-cylindric; spores smaller, 6–15 μ.....15
13. Leaves denticulate at the apex; stems often long.....*G. alpicola* var. *rivularis*
13. Leaves entire; stems usually shorter.....14
14. Vegetative leaves ovate-lanceolate, 1.2–2.8×0.4–0.6 mm.....*G. alpicola* var. *alpicola*
14. Vegetative leaves ovate, 1.2–2.5×0.7–1 mm.....*G. alpicola* var. *latifolia*
15. Leaf margins plane or incurved; leaves with several rows of marginal cells at the base with the cross walls thicker than the longitudinal ones; lamina bistratose in the upper part; usually sterile..... .....*G. alpestris* var. *holzingeri*
15. Leaf margins recurved (sometimes plane in *G. atricha*); basal marginal cells otherwise; leaves unistratose or the margins bistratose.....16
16. Leaf margins bistratose to about the middle; peristome teeth usually yellowish red, cribrose, plainly papillose.....*G. apocarpa* var. *conferta*
16. Leaf margins unistratose or bistratose only at the apex or in spots; peristome teeth not cribrose, entire or nearly so, smooth or with small papillae.....17
17. Leaf margins plane or sometimes slightly recurved; median and upper leaf cells 4–7 μ in diameter; spores 6–8 μ.....*G. atricha*
17. Leaf margins revolute; median and upper leaf cells 7–10 μ in diameter; spores 9–15 μ.....*G. dupretii*

Leaves commonly piliferous

18. Small plants, the leaves with hair-points to 3.4 mm long on the upper and perichaetial leaves, much longer than the body of the leaf; dioicous; capsule exserted on an arcuate seta.....*G. brittoniae*
18. Leaves with shorter hair-points.....19
19. Leaves not keeled, the margins plane to incurved.....20
19. Leaves keeled at least in the upper part of the vegetative leaves.....23
20. Leaves with lamina always unistratose; autoicous; capsule immersed: peristome teeth cribrose; calyptra mitrate, plicate, covering the capsule.....*G. wrightii*
20. Leaves with lamina of more than one layer of cells at least in upper part; dioicous; calyptra not plicate, smaller 21
21. Vegetative leaves 1.5–2.8 mm long exclusive of the hair-points; basal leaf cells long, 4–8:1; median leaf cells with sinuose walls.....*G. ovalis* (*G. commutata*)
21. Vegetative leaves smaller, 1–1.8 mm long exclusive of the hair-points; basal leaf cells short, to 2:1; walls of leaf cells not sinuose.....22
22. Capsule emergent, seta to 2.6 mm long; costa broad and flat; hair-points decurrent.....*G. laevigata*
22. Capsule immersed, seta less than 1 mm long; costa ± terete at least in the upper part of the leaf; hair-points not decurrent.....*G. heterophylla*
23. Capsule ventricose, immersed on a short arcuate seta; autoicous; leaf margins plane to erect or incurved, rarely slightly recurved in part.....24
23. Capsule never ventricose, immersed or exserted.....25
24. Capsule eperistomate; leaf margins and sometimes the upper lamina partly bistratose.....*G. anodon*
24. Capsule with a peristome; lamina and margins always unistratose.....*G. plagiopodia*
25. Small plants with immersed capsules; dioicous; hair-points spinulose; lamina of leaf unistratose below, streaked with bistratose areas above the middle, often entirely bistratose near apex; margins often unistratose, plane above, recurved below.....*G. tenera*
25. Without this combination of characters.....26

26. Leaf margins plane to incurved, never recurved....27
26. Leaf margins recurved on one or both sides....31

Leaf margins plane to incurved

27. Basal cells of vegetative leaves long and narrow, 2–6:1, the walls thin, the cells ± uniform from costa to margins or the marginal cells sometimes hyaline; autoicous; rare....*G. donniana* var. *triformis*
27. Without this combination of characters....28
28. Basal cells of vegetative leaves short, 1–2:1, with several rows of marginal cells with the cross walls thicker than the longitudinal ones; dioicous....29
28. Basal leaf cells otherwise, the cross walls of the marginal cells not thicker than the longitudinal ones...30
29. Vegetative leaves 0.5–1.75 (2) mm long exclusive of the hair-points; operculum conic; plants of higher altitudes....*G. alpestris* var. *alpestris*
29. Vegetative leaves 1–2.8 mm long exclusive of the hair-points; operculum rostrate; plants of lower elevations ....*G. montana*
30. Basal cells of vegetative leaves short or often somewhat elongate near the costa, not or only slightly sinuose; leaf margins always plane; autoicous; capsule immersed....*G. apocarpa* var. *ambigua*
30. Basal cells of vegetative leaves 3: 1 or longer and the walls ± sinuose in several rows on either side of the costa, becoming shorter and less sinuose toward the margins; leaf margins plane or recurved on one side; dioicous; capsule exserted....*G. elongata*

Leaf margins recurved on one or both sides

31. Leaves commonly bearing clusters of gemmae at the tips; leaf cells with thickened cuticular ridges resembling papillae in cross section....*G. hartmanii* var. *anomala*
31. Plants otherwise....32
32. Leaves strongly keeled above, ± plicate below; lamina of 2–3 layers of cells in the upper part; leaf margins of 2–5, usually of 3–4 layers of cells; upper leaf cells usually papillose or mammillose..... ....*G. elatior*
32. Without this combination of characters....33
33. Capsule immersed; autoicous....34
33. Capsule exserted; autoicous or dioicous....38

Capsule immersed

34. Stems long, ± prostrate; back of the costa and often the cells of the lamina papillose near the leaf apex....*G. apocarpa* var. *stricta*
34. Stems shorter; cells smooth....35
35. Peristome wanting or rudimentary....*G. flaccida*
35. Peristome well-developed....36
36. Leaves muticous, or sometimes the perichaetial bracts with a few hyaline cells; peristome teeth smooth or with very small papillae....*G. dupretii*
36. Upper leaves and perichaetial bracts piliferous; peristome teeth distinctly papillose....37
37. Vegetative leaves 1.2–2 mm long; perichaetial bracts to 3 or 4 mm long; peristome teeth usually dark red, entire to ± cribrose....*G. apocarpa* var. *apocarpa*
37. Vegetative leaves 0.5–1.3 mm long; perichaetial bracts 1.5–2.2 mm long; peristome teeth yellowish red and usually strongly cribrose....*G. apocarpa* var. *conferta*

Capsule exserted

38. Autoicous....39
38. Dioicous....40
39. Leaves ± oblong-lanceolate, the walls of the basal cells not sinuose; hair-points denticulate; seta arcuate ....*G. pulvinata*
39. Leaves ovate-lanceolate, the walls of the basal cells thick and ± sinuose; hair-points smooth or nearly so; seta straight....*G. affinis*
40. Calyptra large, covering the capsule to the middle or below, plicate, campanulate-mitrate; leaf cells often thick-walled but scarcely sinuose; plants commonly fruiting....*G. calyptrata*
40. Calyptra otherwise, smaller; walls of the leaf cells usually sinuose at the leaf base....41
41. Leaves 2–3.3 mm long exclusive of the hair-points; margins plainly recurved on one or both sides; seta arcuate;

capsule usually distinctly ribbed when dry; operculum rostrate.....*G. trichophylla*

41. Leaves 1.5–2 mm long exclusive of the hair-points; margins plane, or sometimes recurved on one side; seta straight; capsule not ribbed; operculum conic; rare.....*G. elongata*

Key 50. *Rhacomitrium*

1. Leaves with lamellae or wings on the dorsal surface of the costa; seta twisted counterclockwise...*R. patens*
1. Leaves without lamellae or wings..... 2
   2. Leaves ± oblong, muticous, the apex broad, rounded, usually denticulate; cells papillose; seta twisted clockwise.....*R. aciculare*
   2. Leaves ovate-lanceolate to lanceolate, usually acuminate..... 3
3. Leaf cells strongly papillose with high papillae; seta twisted counterclockwise..... 4
3. Leaf cells smooth or if papillose the papillae low..... 5
   4. Leaves with papillose hair points; plants usually with many short, lateral branches..... .....*R. canescens* var. *ericoides*
   4. Leaves muticous.....*R. canescens* var. *epilosum*
5. Leaves with the hyaline points rough with conspicuous papillae; cells of lamina not papillose; seta twisted counterclockwise.....*R. lanuginosum*
5. Leaves muticous or piliferous; hair-points often toothed but not papillose; seta twisted clockwise (arcuate in *Grimmia elatior*)..... 6
   6. Leaf margins always unistratose..... 7
   6. Leaf margins bistratose or thicker, at least near the apex.....10
7. Leaf cells not papillose sometimes the cross walls thickened and bulging dorsally and ventrally..... .....*R. heterostichum* var. *heterostichum*
7. Leaf cells usually distinctly papillose, the papillae large or small but never high and sharp..... 8
   8. Leaves piliferous or some leaves muticous; seta 8–20 mm long; urn 2–3.5 mm long, usually about 3 mm; peristome teeth 1–1.7 mm long.....*R. varium*
   8. Leaves always muticous; urn and teeth shorter..... 9
9. Upper leaf cells long, usually 3: 1 or longer, the papillae large, in section evident as rounded thickenings on the cross walls and the walls depressed over the cavities.....*R. fasciculare*
9. Upper leaf cells shorter, often isodiametric, the papillae smaller, in section not evident as rounded thickenings .....*R. aquaticum*
   10. Upper leaf cells usually papillose; leaf margins of 2–5, usually of 3–4 layers of cells; leaves strongly keeled in the upper part; seta arcuate .....(*Grimmia elatior*)
   10. Cells not papillose; leaves otherwise; seta twisted clockwise.....11
11. Plants often large, the leaves usually 3–3.6 mm long, the hair-points 0.3–0.6 mm long with teeth on the dorsal surface and on the margins; upper leaf cells with sinuose walls, the cross walls not bulging dorsally and ventrally; urn 2–3.4 mm long, rarely less than 2 mm; from the lowlands to about 1700 m..... .....*R. heterostichum* var. *occidentale*
11. Plants smaller, the leaves to 3 mm long, often shorter, muticous or piliferous; upper leaf cells sinuose or smooth, usually with the cross walls bulging dorsally and ventrally; urn less than 2 mm long; alpine and subalpine.....*R. sudeticum*

Key 51. *Scouleria*

1. Leaf margins unistratose or bistratose in spots; capsule with a peristome.....*S. aquatica*
1. Leaf margins of 3–5 layers of cells except at base and apex; peristome wanting.....*S. marginata*

Key 52. Funariaceae

1. Capsule arcuate; peristome double.....*Funaria*
1. Capsule erect and radially symmetric..... 2
   2. Calyptra mitrate; peristome wanting; cells of the operculum in straight rows.....*Physcomitrium*
   2. Calyptra cucullate; peristome often rudimentary, sometimes wanting, if present, single or double; cells of the operculum usually in spiral rows.....*Entosthodon*

Key 53. *Entosthodon*

1. Exothecial cells short; leaves commonly serrate.....*E. fascicularis*
1. Exothecial cells elongate, 2–5: 1; leaves entire..... 2
   2. Leaves 0.8–1.5 mm long; peristome double and well-developed; spores 15–18 μ.....*E. californicus*
   2. Leaves large, 1.5–2.5 mm long; peristome wanting or rudimentary; spores 25–35 μ...*E. rubiginosus*

Key 54. *Funaria*

1. Leaves acute; annulus present and deciduous; capsule deeply striate when dry; common...*F. hygrometrica*
1. Leaves acuminate; annulus wanting; urn of capsule smooth, the neck wrinkled when dry; rare..... 2
   2. Costa excurrent.....*F. americana*
   2. Costa ending before the apex.....*F. muhlenbergii*

Key 55. *Physcomitrium*

1. Capsule immersed, the seta always shorter than the capsule.....*P. immersum*
1. Capsule emergent to long-exserted..... 2
   2. Dry capsule flaring at the mouth and contracted below..... 3
   2. Dry capsule not wider at mouth than below..... 4
3. Annulus of 2–3 rows of large deciduous cells; spores 20–30 μ in diameter.....*P. hookeri*
3. Annulus of 1–2 rows of small adherent cells; spores 31–55 μ in diameter but commonly 37–44 μ...*P. kellermanii*
   4. Leaves without a border of differentiated cells.....*P. pygmaeum*
   4. Leaves with a border of 1–4 rows of elongate cells..... 5
5. Leaf border of 2–4 rows of cells, usually yellowish when old.....*P. megalocarpum* var. *megalocarpum*
5. Leaf border less conspicuous, of 1–2, rarely of 3 rows of cells, not yellowish...*P. megalocarpum* var. *californicum*

Key 56. SPLACHNACEAE—Genera

1. Capsule cleistocarpous, without hypophysis.....*Voitia*
1. Capsule with operculum and hypophysis..... 2
   2. Peristome wanting; leaves ovate to obovate-spatulate, the apex broad and rounded; basal leaf cells with long cilia on the margins.....*Oedipodium*
   2. Peristome present; leaves without cilia..... 3
3. Calyptra constricted at the base; hypophysis of the same color as the urn and not wider, sometimes narrower; the dry peristome teeth erect or reflexed, single, in pairs, or divided to form 32 filaments.....*Tayloria*
3. Calyptra not constricted at the base; hypophysis usually wider than the urn at least when moist; dry peristome teeth reflexed in pairs..... 4
   4. Hypophysis when fresh and moist only slightly wider than the urn, not conspicuously colored; columella not exserted.....*Tetraplodon*
   4. Hypophysis distinctly wider than the urn fresh or dry, usually conspicuously colored; columella exserted ..... *Splachnum*

Key 57. Species of SPLACHNACEAE (based principally on leaf characters)

1. Leaves lingulate, apex rounded to obtuse; calyptra constricted at the base; peristome teeth erect when dry... 2
1. Leaves not lingulate; peristome wanting or the teeth reflexed when dry..... 4
   2. Leaves entire or with blunt teeth; preperistome usually present; spores 18–35 μ in diameter..... .....*Tayloria lingulata*
   2. Leaves always entire; preperistome never present; spores 30–47 μ in diameter..... 3
3. Columella included; hypophysis about as long as the urn.....*Tayloria froelichiana*
3. Columella exserted; hypophysis usually longer than the urn.....[*Tayloria hornschuiana*]
   4. Leaves lanceolate or oblanceolate, 2.5–3: 1, apex subulate..... 5
   4. Leaves otherwise, never subulate, sometimes apiculate..... 8
5. Leaves always entire..... 6
5. Upper leaves always toothed, lower leaves sometimes entire..... 7
   6. Leaves ovate-lanceolate; capsule cleistocarpous.....*Voitia nivalis*
   6. Leaves oblanceolate to ovate-lanceolate, the upper leaves or all leaves widest above the middle; capsule

with operculum and peristome.....*Tetraplodon mnioides*
7. Leaves lanceolate, not or only slightly narrowed at the base.....*Tetraplodon angustatus*
7. Leaves oblanceolate, clearly narrowed at the base.....*Splachnum ampullaceum*
8. Leaves always entire, apex rounded or bluntly acute to obtuse..... 9
8. Leaves toothed (some leaves of *S. sphaericum* entire); leaf apex otherwise.....10
9. Leaves ovate to obovate-lanceolate, apex broad and rounded, never acuminate; basal leaf cells with long cilia on the margins.....*Oedipodium griffithianum*
9. Leaves ovate to obovate, acuminate, apex blunt and rounded or with an obtuse point; leaves without cilia .....*Splachnum vasculosum*
10. Leaves broadly ovate or obovate, often abruptly acuminate or apiculate, toothed or some leaves entire.....*Splachnum sphaericum*
10. Leaves relatively narrower, ovate-lanceolate to elongate-obovate, always toothed.....11
11. Peristome teeth not divided, recurved, either separate or in pairs; operculum hemispheric...*Tayloria serrata*
11. Peristome teeth divided to form 32 narrow segments, reflexed and ± contorted when dry.....12
12. Leaves with a short acumen.....[*Tayloria splachnoides*]
12. Leaves long-acuminate.....*Tayloria acuminata*

Key 58. *Splachnum*

1. Leaves ± oblanceolate, with sharp teeth to the middle or below.....*S. ampullaceum*
1. Leaves ovate to obovate, entire or with small teeth at the apex..... 2
2. Leaves toothed in the upper part or sometimes entire, acuminate, often abruptly narrowed to form an apiculus; hypophysis only slightly wider than the urn when moist.....*S. sphaericum*
2. Leaves always entire, apex blunt and rounded or with an obtuse point; hypophysis much broader than the urn when moist.....*S. vasculosum*

Key 59. *Tayloria*

1. Leaves ± lingulate, obtuse to rounded, entire or with blunt teeth..... 2
1. Leaves obovate to oblanceolate, acute or acuminate, serrate..... 4
2. Leaves entire or with blunt teeth; peristome usually with a small preperistome; spores 18–35 μ..... .....*T. lingulata*
2. Leaves always entire; preperistome never present; spores 30–47 μ..... 3
3. Columella included; hypophysis about as long as the urn.....*T. froelichiana*
3. Columella exserted; hypophysis longer than the urn.....[*T. hornschuiana*]
4. Peristome teeth not divided, recurved and either separate or in pairs.....*T. serrata*
4. Peristome teeth divided to form 32 narrow segments, reflexed and somewhat contorted when dry... 5
5. Leaves with a short acumen.....[*T. splachnoides*]
5. Leaves long-acuminate.....*T. acuminata*

Key 60. *Tetraplodon*

1. Leaves narrowly lanceolate, usually toothed, the teeth sometimes of 2 cells; seta short.....*T. angustatus*
1. Leaves ovate-lanceolate to oblanceolate, entire; seta usually long.....*T. mnioides*

Key 61. BRYACEAE

1. Leaves linear-setaceous..... 2
1. Leaves not linear-setaceous, broader..... 3
2. Capsule horizontal to pendent, brown, glossy; peristome perfect; common.....*Leptobryum pyriforme*
2. Capsule erect to inclined, yellow-brown, not glossy; endostome with a narrow basal membrane and cilia wanting; rare.....*Orthodontium gracile*
3. Leaves bordered by elongate, often reddish cells; leaves of sterile stems ± dimorphous, smaller in the dorsal row and the larger leaves ± distichous; leaf cells long.....*Epipterygium tozeri*
3. Leaves otherwise..... 4
4. Outer peristome teeth shorter than the inner; capsule cernuous, neck long; leaves not bordered, entire or nearly so; in rock crevices; not common.....*Plagiobryum*
4. Without this combination of characters..... 5

5. Capsule erect to inclined or horizontal; outer peristome wanting; leaves ovate to ovate-lanceolate, entire; on rock; rare.....*Mielichhoferia macrocarpa*
5. Without this combination of characters; outer peristome well-developed..... 6
   6. Median leaf cells 5: 1 or longer, if shorter, the capsule erect and straight; leaves never bordered; costa ending before the apex to percurrent, never excurrent.....*Pohlia*
   6. Median leaf cells 4: 1 or often shorter, if longer, with at least one of the following characters: (a) leaves broadly ovate, oblong, or oblong-ovate; (b) apex obtuse to rounded; (c) costa excurrent; (d) leaf margins bordered by longer cells; (e) cilia of endostome plainly appendiculate.....*Bryum*

Key 62. *Bryum*

1. Plants small, silvery to whitish green; common.....*B. argenteum*
1. Plants not silvery..... 2
   2. Plants large; leaf cells thin-walled and large, to 150×50 μ.....*B. sandbergii*
   2. Plants usually smaller and leaf cells always smaller..... 3
3. Leaves conspicuously decurrent, ovate to ovate-lanceolate, acute or acuminate, without a border or the border indistinct; costa percurrent or ending before the apex.....*B. weigelii*
3. Leaves not conspicuously decurrent, or if so with a well-marked border..... 4
   4. Leaves obovate to broadly ovate, acute, serrate to serrulate; upper leaves or all leaves with the costa excurrent as a short recurved point; leaf cells with thick and pitted walls.....*B. canariense*
   4. Leaves not obovate or if obovate the cell walls not pitted or the costa otherwise..... 5
5. Leaves obtuse to rounded at the apex, entire, without a definite border; costa usually ending before the apex, rarely percurrent..... 6
5. Leaves otherwise..... 8
   6. Plants red to reddish brown or green with a reddish tinge; leaves 2–2.5×0.7–1 mm; median leaf cells 35–70×8–12 μ.....*B. miniatum*
   6. Plants green to brownish; leaves smaller; median leaf cells 35–70×15–25 μ; rare..... 7
7. Leaves ± contorted when dry, ovate, obovate, suborbicular, or oblong-ovate; filamentous propagula often borne on the stems; dioicous.....*B. cyclophyllum*
7. Leaves imbricate when dry, ovate to oblong-ovate; propagula wanting; autoicous.....*B. marratii*
   8. Small plants with imbricate ovate leaves, acute to ± obtuse; leaves to about 0.8 mm long or the perichaetial bracts longer; margins plane and entire, without a distinct border; capsule reddish brown, short and thick; cilia appendiculate.....*B. blindii*
   8. Without this combination of characters..... 9
9. Leaves 1.5–2.5 mm long, variable in shape but never long-acuminate; apex acute to ± obtuse; margins entire, not bordered; median leaf cells 40–80×12–20 μ.....10
9. Leaves otherwise.....11
   10. Plants green to yellow-green; margins recurved below, usually plane above, or recurved to apex in perichaetial bracts; gemmae often borne in leaf axils; calciphile.....*B. gemmiparum*
   10. Plants brownish green to brownish; margins commonly recurved to the middle of the leaf or higher; gemmae wanting.....*B. muehlenbeckii*
11. Small plants often bearing gemmae; leaves usually with short cells, without a definite border; capsule to about 2.5 mm long, often red.....12
11. Plants larger, without gemmae or gemmae rare.....15
   12. Gemmae axillary, never on the rhizoids; neck of capsule rounded and short, abruptly passing into the seta.....*B. bicolor*
   12. Gemmae borne on the rhizoids; neck of capsule tapering to the seta.....13
13. Rhizoids violet; gemmae usually reddish, small, 60–110 μ in diameter but usually less than 100 μ.....*B. violaceum*
13. Rhizoids yellow or brown; gemmae larger, 120–260 μ.....14
   14. Rhizoids usually yellow; gemmae yellow, 120–220 μ.....*B. tenuisetum*
   14. Rhizoids brown; gemmae red, 190–260 μ.....*B. micro-erythrocarpum*
15. Median leaf cells long, 6–7: 1, 50–80×8–13 μ.....16
15. Median leaf cells shorter, 2–3: 1, rarely to 4: 1.....17
   16. Stems short, to about 1 cm, often less; plants green or brown below; leaves ovate-lanceolate, long-acuminate; costa excurrent at least in upper leaves.....*B. caespiticium*

16. Stems 2–5 cm long; plants green to reddish; leaves lanceolate or oblong-lanceolate, ± obtuse or acute to acuminate; costa percurrent to shortly excurrent.....*B. alpinum*
17. Cilia rudimentary and the lamellae of the peristome teeth joined to the endostome; spores large, 20–33 μ; usually synoicous; leaves ovate-lanceolate, costa excurrent and margins recurved.....*B. angustirete*
17. Peristome otherwise; spores large or small.....18
18. Leaves with a distinct border, bistratose in part.....19
18. Leaves with a unistratose border.....21
19. Synoicous; neck usually shorter than the rest of the capsule; spores 25–32 μ in diameter; arctic-alpine.....*B. arcticum*
19. Dioicous or autoicous; neck about as long as the rest of the capsule.....20
20. Dioicous; spores 13–20 μ; cilia appendiculate.....*B. pallens*
20. Autoicous; spores 23–30 μ; cilia rudimentary.....*B. uliginosum*
21. Leaves obovate, usually widest above the middle, twisted and contorted when dry; costa variable, ending before the apex, percurrent, or excurrent; capsule usually inclined to horizontal, to about 5 mm long.....*B. capillare*
21. Plants otherwise, the leaves never obovate.....22
22. Costa percurrent to shortly excurrent; leaf cells with pitted walls.....23
22. Costa plainly excurrent at least in the upper leaves; walls of leaf cells not or scarcely pitted.....25
23. Capsule brown; leaves somewhat contorted when dry, decurrent; plants to 4 cm high, the stems matted with rhizoids.....24
23. Capsule usually red; leaves imbricate, not or little decurrent; dioicous...*B. pseudotriquetrum* var. *crassirameum*
24. Dioicous.....*B. pseudotriquetrum* var. *pseudotriquetrum*
24. Synoicous.....*B. pseudotriquetrum* var. *bimum*
25. Leaf border indistinct; dioicous; outer peristome teeth light yellow; cilia appendiculate.....*B. turbinatum*
25. Leaf border distinct; synoicous or autoicous; outer peristome teeth darker, at least below.....26
26. Spores large, 18–24 μ in diameter; cilia usually rudimentary, rarely long; arctic-alpine.....*B. stenotrichum*
26. Spores smaller, 13–17 μ in diameter; cilia well-developed, appendiculate.....27
27. Synoicous; leaves imbricate to slightly contorted when dry; plants not in dense cushions...*B. creberrimum*
27. Autoicous; leaves somewhat contorted when dry; plants in dense cushions.....*B. pallescens*

Key 63. *Plagiobryum*

1. Leaves usually reddish green, spreading to ± imbricate, the margins recurved; costa usually excurrent at least in the upper leaves.....*P. demissum*
1. Leaves light green to whitish, imbricate, the margins usually plane; costa percurrent or ending before the apex.....*P. zierii*

Key 64. *Pohlia*

1. Plants glossy, whitish green to yellow-green, the stems julaceous; leaves imbricate, 0.5–1.2 mm long, the apex ± obtuse.....*P. filiformis*
1. Without this combination of characters..... 2
2. Plants without gemmae..... 3
2. Plants commonly bearing gemmae; dioicous.....20
3. Leaves rounded to obtuse at apex; plants red or brown; capsule inclined to pendulous, usually red.....*Bryum miniatum*
3. Leaves acute or acuminate, or if obtuse, the plants green..... 4
4. Leaves distinctly decurrent, the costa ending before the apex in all leaves, and the median leaf cells commonly more than 15 μ wide..... 5
4. Leaves otherwise..... 7
5. Plants green above, reddish below; arctic-alpine, rare.....*P. ludwigii*
5. Plants not reddish; common..... 6
6. Plants yellow-green or brown below; stomata of the capsule wall phaneropore.....*P. drummondii*
6. Plants light green to whitish green; stomata cryptopore.....*P. wahlenbergii*
7. Leaves broadly ovate, obtuse to obtusely acute, sometimes ± cucullate, or the upper and perichaetial leaves ovate-lanceolate; median leaf cells 12–25 μ wide; paroicous; rare.....*P. obtusifolia*

7. Without this combination of characters..... 8
8. Leaves prominently toothed; perigonial and perichaetial bracts greatly enlarged, reaching 4 mm in length; dioicous; capsule short, urceolate; stomata cryptopore.....*P. longibracteata*
8. Without this combination of characters..... 9
9. Plants whitish green with a metallic lustre; leaf margins plane or nearly so; leaves large, the upper ones 3–5×1 mm; dioicous.....*P. cruda*
9. Plants otherwise.....10
10. Small alpine plants with erect capsules and the inner peristome rudimentary; leaves to about 1.5 mm long but often less than 1 mm; rare.....11
10. Plants otherwise.....12
11. Leaf margins plainly reflexed and the cell walls often pitted; costa very broad at base.....*P. cardotii*
11. Leaf margins plane or nearly so and the cell walls not pitted; costa not broad at the base.....*P. erecta*
12. Paroicous or rarely autoicous; capsule plainly longer than broad; exothecial cells elongate; stomata phaneropore 13
12. Dioicous; capsule short or long; exothecial cells short.....16
13. Plants reddish to purplish green; rare and sterile in America.....*P. schimperi*
13. Plants green to yellow-green.....14
14. Segments of endostome broad, open on the keel; cilia well-developed, long; neck commonly shorter than the rest of the capsule; wide spread and common.....*P. nutans*
14. Segments of endostome narrow, not usually open; cilia usually short, sometimes wanting; neck often as long as the rest of the capsule; alpine.....15
15. Leaves with recurved margins, median cells 40–85×6–9 μ, the walls somewhat thickened; neck usually as long as the rest of the capsule.....*P. elongata*
15. Leaf margins plane or only slightly recurved, the median leaf cells 95–140×8–11 μ, the walls thin; neck usually a little shorter than the rest of the capsule.....*P. longicolla*
16. Capsule very small, about as broad as long; stomata cryptopore (emergent in *P. atropurpurea*).....17
16. Capsule usually longer than broad; stomata always phaneropore; gemmae often present.....20
17. Plants 1–5 cm high, whitish green.....*P. wahlenbergii*
17. Plants smaller, 0.3–1.5 cm high, not whitish.....18
18. Leaves plainly decurrent; walls of exothecial cells with thickened corners.....*P. columbica*
18. Leaves not or only slightly decurrent; walls of exothecial cells not or only slightly thickened at the corners 19
19. Outer peristome teeth brown; stomata immersed or emergent; leaves not glossy.....*P. atropurpurea*
19. Outer peristome teeth yellow; stomata immersed; leaves glossy.....*P. vexans*
20. Gemmae usually present, yellow-green to yellow, solitary, or commonly 2 to many in the leaf axils...21
20. Gemmae less common, borne singly in the leaf axils.....24
21. Gemmae numerous in the leaf axils, elongate and twisted, with 1 or 2, rarely 3 leaf points; leaf margins plane, or often recurved in part; costa ending before the apex; plants glossy.....*P. proligera*
21. Gemmae 2–5 per leaf, rarely single; leaf margins plane; costa usually percurrent.....22
22. Plants glossy; gemmae stalked, 1–3 in the leaf axils, usually all along the stem, the gemmae ± spherical to obovoid, the leaf points incurved.....*P. bulbifera*
22. Plants not glossy; gemmae usually in the axils of the upper leaves, ovoid, cuneiform, or ± elongate and slightly twisted, the leaf points erect.....23
23. Gemmae ovoid to wedge-shaped.....*P. annotina* var. *annotina*
23. Gemmae somewhat elongate and twisted, usually with 3–4 leaf points.....*P. annotina* var. *decipiens*
24. Leaf margins usually ± reflexed; leaves often incurved when dry; gemmae usually reddish..... .....*P. drummondii* var. *drummondii*
24. Leaf margins usually plane; leaves straight when dry; gemmae yellow to brown or black..... .....*P. drummondii* var. *gracilis*

Key 65. MNIACEAE – Genera

1. Plants dendroid.....*Leucolepis*
1. Plants not dendroid..... 2
2. Leaves entire; outer peristome much shorter than the dome-shaped endostome.....*Cinclidium*
2. Leaves entire or toothed; peristome otherwise..... 3

3. Leaves always entire, apiculate, the border of 2–3 rows of cells, unistratose throughout.....*Cyrtomnium*
3. Leaves otherwise..... 4
   4. Leaves always entire, the border commonly bistratose or multistratose at least in part, rarely unistratose throughout .....*Rhizomnium*
   4. Leaves toothed or the lower leaves sometimes entire..... 5
5. Leaves bordered by more than 1 layer of cells and the teeth in pairs (border may be partly unistratose and the teeth single or double in *M. blyttii* and *M. arizonicum*).....*Mnium*
5. Leaf border always unistratose and the teeth always single.....*Plagiomnium*

Key 66. Species of Mniaceae

1. Plants dendroid, the branches in clusters on the upper part of the stem.....*Leucolepis menziesii*
1. Plants not dendroid..... 2
   2. Leaf cells very large, 100–150×35–50 μ; leaves ovate to obovate, distinctly serrate at least above, with a border of 2 rows of cells .....(*Bryum sandbergii*)
   2. Leaves otherwise..... 3
3. Leaves 4–9 mm long, ovate to oblong-lanceolate, rounded to the base, entire or with a few blunt teeth, the cells somewhat narrower at the margins but not forming a distinct border..... .....[*Pseudobryum cinclidioides*, reported from the Rocky Mountains]
3. Leaves otherwise, always bordered..... 4
   4. Leaves toothed or sometimes the lower leaves entire or nearly so..... 5
   4. Leaves always entire.....18
5. Leaves bordered by more than 1 layer of cells and the teeth in pairs (border may be partly unistratose and the teeth single or double in *M. blyttii* and *M. arizonicum*).....*Mnium*...6
5. Leaf borders always unistratose and the teeth always single.....*Plagiomnium*...11
   6. Leaf border and teeth somewhat variable, the border of 1–2 layers of cells and the teeth usually double 7
   6. Leaves, except the lower ones, usually plainly toothed to the middle or below, the teeth double, the border of 2 or more layers of cells..... 8
7. Median leaf cells 30–40×20–25 μ, the walls thick and pitted.....*M. arizonicum*
7. Leaf cells ± uniform throughout the leaf, 20–30 μ, rarely to 35 μ, the walls somewhat thickened but not pitted.....*M. blyttii*
   8. Leaf border with the inner cells stereid; cell walls not thickened at the corners; synoicous; outer peristome teeth dark-colored.....*M. spinulosum*
   8. Leaf border without stereid cells..... 9
9. Synoicous; costa never toothed on the back near apex; walls of leaf cells with thickened corners..... .....*M. marginatum*
9. Dioicous; outer peristome teeth yellow; costa usually toothed on the back near apex.....10
   10. Leaf cells 10–20, rarely to 25 μ, the walls not or little thickened at the corners...*M. orthorrhynchum*
   10. Leaf cells 20–40 μ, the walls plainly thickened at the corners.....*M. lycopodioides*
11. Leaves toothed to the base or nearly so, the teeth sharp.....12
11. Leaves toothed to about the middle or the teeth blunt.....15
   12. Leaves not or scarcely decurrent, the decurrent part rarely to 0.5 mm long; walls of leaf cells not pitted; capsule with a differentiated brown neck; synoicous; plants not stoloniferous.....*P. venustum*
   12. Leaves of fertile stems strongly decurrent, cells with pitted walls; capsule otherwise.....13
13. Synoicous; leaves of both fertile and sterile stems plainly decurrent; cells near costa 70–85 μ, distinctly smaller toward the border, about half as large, 30–40 μ long; capsules 1–3 per perichaetium.....*P. medium*
13. Dioicous 14
   14. Leaves of both fertile and sterile stems strongly decurrent; cells near costa 40–70, rarely to 80 μ, somewhat smaller toward the margins, 35–45 μ; capsules 1–9 per perichaetium, usually 3–6.....*P. insigne*
   14. Leaves of fertile stems long-decurrent, not or slightly decurrent on sterile stems; cells near costa 50–85 μ, about half as large at the border; capsules 1 or rarely 2–3 per perichaetium.....*P. ciliare*
15. Dioicous; leaf cells with pitted walls; leaves sometimes entire or nearly so.....*P. rugicum*
15. Synoicous or heteroicous; walls of leaf cells not pitted.....16
   16. Leaves slightly decurrent; teeth blunt, often extending nearly to the leaf base; operculum rostrate .....*P. rostratum*

16. Leaves plainly decurrent, toothed to about the middle, teeth usually sharp; operculum conic.....17
17. Walls of leaf cells thick, with definite corner thickenings.....*P. cuspidatum*
17. Walls of leaf cells thin or evenly thickened, without corner thickenings.....*P. drummondii*
18. Leaf border unistratose.....19
18. Leaf border of more than 1 layer of cells or sometimes unistratose at apex.....22
19. Leaves rounded at apex, never apiculate; costa ending well before apex.....*Rhizomnium andrewsianum*
19. Leaves otherwise.....20
20. Leaves 1.5–3 mm long, the costa usually ending just before the apex, median leaf cells near costa 35–55 μ.....*Cyrtomnium hymenophylloides*
20. Leaves without this combination of characters.....21
21. Leaves always entire, median cells near costa 70–110 μ; synoicous.....*Cinclidium stygium*
21. Leaves often toothed, the median cells near costa 50–70 μ; dioicous.....*Plagiomnium rugicum*
22. Leaves decurrent, $\pm$ ovate with acute points, entire or often toothed, sometimes with double teeth; leaf border of 1–2 layers of cells.....*Mnium blyttii*
22. Leaves otherwise, always entire.....*Rhizomnium*...23
23. Leaves elongate-ovate or elliptic, bordered all around by 4–6 rows of long narrow cells in 4–5 layers.....*R. glabrescens*
23. Leaves of a different shape or the border otherwise or both.....24
24. Leaf cells, except near the border, with the vertical walls strongly thickened dorsally and ventrally and the middle part thin .....*R. nudum*
24. Leaf cells otherwise.....25
25. Leaves 5–11 × 4–6 mm; dioicous; urn 3–4 mm long.....*R. perssonii*
25. Leaves smaller; urn 1.5–2 mm long.....26
26. Dioicous; leaves 0.8–3.8 × 1.3–3.2 mm.....*R. andrewsianum*
26. Synoicous; leaves 3–6 × 2.5–4 mm.....*R. pseudopunctatum*

Key 67. *Aulacomnium*

1. Basal leaf cells inflated, often brown..... 2
1. Basal leaf cells not inflated; gemmae fusiform, stalked, common.....*A. androgynum*
2. Leaves ovate, oblong-lanceolate or linear-lanceolate, usually serrulate at the apex, the apex often acute; walls of leaf cells not strongly sinuose; stems matted with a conspicuous tomentum of rhizoids.....*A. palustre*
2. Leaves elongate-obovate, entire, obtuse and often cucullate, the cell walls strongly sinuose; stem rhizoids covered by leaves.....*A. turgidum*

Key 68. Meesiaceae

1. Leaf cells mammillose; leaves strongly squarrose-recurved; peristome teeth as long as the endostome..... *Paludella*
1. Leaf cells smooth; leaves erect to spreading, or sometimes squarrose; peristome teeth much shorter than the endostome..... 2
2. Leaf cells large and thin-walled, 20–40 μ wide.....*Amblyodon*
2. Upper leaf cells small, 15 μ wide or less, the walls $\pm$ thickened.....*Meesia*

Key 69. *Meesia*

1. Leaves serrate, squarrose-recurved; dioicous.....*M. triquetra*
1. Leaves entire or nearly so..... 2
2. Leaves acute to $\pm$ obtuse, the margins plane or slightly recurved; costa less than 1/3 the width of the leaf at the base; synoicous.....*M. longiseta*
2. Leaves obtuse to rounded at the apex, the margins strongly recurved; costa 1/3 to 2/3 the width of the leaf at the base; autoicous.....*M. uliginosa*

Key 70. Bartramiaceae

1. Stems with conspicuous clusters of reddish brown rhizoids; capsule erect, smooth to somewhat wrinkled but never strongly ribbed when dry.....*Anacolia*

1. Stems without or with less conspicuous rhizoids 2
   2. Leaf cells not papillose but the upper cells with cuticular ridges resembling papillae in cross section ..... *Plagiopus oederi*
   2. Leaf cells otherwise, commonly papillose or mammillose 3
3. Leaves imbricate, stiff and erect, small, to 1.5 mm long; lamina and margins unistratose; operculum beaked ..... *Conostomum tetragonum*
3. Leaves without this combination of characters; operculum conic 4
   4. Leaves linear to linear-lanceolate or subulate from a differentiated sheathing base; upper lamina or margins often partly bistratose ..... *Bartramia*
   4. Leaves ovate, ovate-lanceolate or lanceolate, unistratose ..... *Philonotis*

Key 71. *Bartramia*

1. Leaves subulate, abruptly narrowed from the sheathing base; lamina bistratose or multistratose, the margins unistratose 2
1. Leaves lanceolate to linear, the base not clearly differentiated or somewhat sheathing in *B. halleriana* 3
   2. Capsule curved and zygomorphic at least when dry; marginal leaf cells not or little longer than the submarginal cells ..... *B. ithyphylla*
   2. Capsule erect and radially symmetric or nearly so; marginal leaf cells, especially the ones forming the teeth, distinctly longer than the submarginal cells ..... *B. subulata*
3. Leaves 2–3.5 mm long, strict, never crisped, the lamina partly bistratose; capsule erect and radially symmetric ..... *B. stricta*
3. Leaves larger, 4–9 mm long, the lamina mostly unistratose, the margins often bistratose 4
   4. Seta 6–18 mm long; capsule plainly zygomorphic when dry; leaf base not clearly set off ..... *B. pomiformis*
   4. Seta short, rarely to 5 mm long; capsule only slightly zygomorphic; leaf base ± differentiated and sheathing ..... *B. halleriana*

Key 72. *Philonotis*

1. Leaf cells papillose at the upper ends; leaf margins with single teeth ..... *P. capillaris*
1. Leaf cells papillose at the lower ends, sometimes at both ends, rarely in the middle; leaf margins often doubly serrate 2
   2. Leaves not plicate, the margins plane or nearly so ..... *P. caespitosa*
   2. Leaves plicate at least at the base; margins plainly recurved at least in part 3
3. Leaves twisted when dry, diverging from the stem at a wide angle, often in vertical rows 4
3. Leaves not twisted, sometimes falcate, not diverging at a wide angle 5
   4. Costa excurrent ..... *P. americana* var. *americana*
   4. Costa percurrent or shortly excurrent; leaves strongly twisted ..... *P. americana* var. *torquata*
5. Costa percurrent or shortly excurrent ..... *P. fontana* var. *fontana*
5. Costa long-excurrent ..... *P. fontana* var. *pumila*

Key 73. *Timmia*

1. Leaf sheath papillose on the dorsal side; dioicous ..... *T. norvegica*
1. Leaf sheath not papillose or rarely with a few papillae at the upper end 2
   2. Leaf sheath orange to brown; dioicous; cilia of endostome not appendiculate ..... *T. austriaca*
   2. Leaf sheath hyaline at least when young, sometimes yellow in older leaves; autoicous; cilia appendiculate 3
3. Leaf cells 9–18 μ in diameter, the walls thick ..... *T. megapolitana* var. *megapolitana*
3. Leaf cells 6–9 μ in diameter, rarely to 12 μ, the walls thin ..... *T. megapolitana* var. *bavarica*

Key 74. Orthotrichaceae

1. Leaves not crisped and contorted when dry ..... *Orthotrichum*
1. Leaves crisped and contorted when dry; capsule ribbed when dry 2
   2. Calyptra cucullate, never hairy; peristome wanting 3
   2. Calyptra campanulate, glabrous or hairy 4
3. Costa with central guide cells, or the leaves toothed; gemmae wanting; on rock ..... *Amphidium*

3. Costa without guide cells or the guide cells ventral; gemmae common; on trees or rocks.....*Zygodon*
   4. Calyptra smooth or with a few hairs; stomata immersed in the capsule wall; gemmae wanting.....*Orthotrichum consimile* and *Orthotrichum pulchellum*
   4. Calyptra hairy; stomata superficial; autoicous and usually fruiting, or if dioicous and sterile, usually with septate gemmae on the leaf tips.....*Ulota*

Key 75. *Amphidium*

1. Leaf margins plane or nearly so; upper leaf cells with large, conspicuous papillae; autoicous, commonly fruiting; perichaetial bracts plainly differentiated, sheathing, the cells smooth.....*A. lapponicum*
1. Leaf margins usually plainly recurved; papillae on upper leaf cells less conspicuous; dioicous, often sterile; perichaetial bracts not strongly differentiated, the cells papillose..... 2
   2. Leaves toothed near apex, the upper cells with small, round papillae, 8 or more per cell; capsule immersed, operculum conic-apiculate.....*A. californicum*
   2. Leaves entire or minutely serrulate, the upper cells with round or oval papillae, usually 6–8 per cell, rarely more; capsule exserted, operculum rostrate.....*A. mougeotii*

Key 76. *Orthotrichum*

1. Dioicous, on trees; capsule immersed or emergent, the stomata superficial..... 2
1. Autoicous..... 3
   2. Plants large, the leaves 2.5–9 mm long, commonly 4–6 mm, lanceolate, tapering to a narrow apex.....*O. lyellii*
   2. Plants small, the leaves 1–2.8 mm long, broadly ovate to oblong-ovate, usually obtuse...*O. obtusifolium*
3. Leaves crisped and contorted when dry; stomata immersed; on trees or very rarely on rock..... 7
3. Leaves not crisped when dry..... 4
   4. Stomata immersed; capsule ribbed when dry..... 5
   4. Stomata superficial; capsule smooth or ribbed.....15
5. Capsule plainly exserted, or if immersed, the peristome teeth red..... 6
5. Capsule immersed to emergent, never plainly exserted..... 8
   6. Leaves imbricate when dry; peristome teeth erect when dry, striate, often with a preperistome; on rock.....*O. anomalum*
   6. Leaves often ± contorted when dry; peristome teeth reflexed when dry, finely papillose; usually on trees..... 7
7. Peristome teeth orange-red.....*O. pulchellum*
7. Peristome teeth pale, almost colorless.....*O. consimile*
   8. Plants often large, 1–4 cm long, aquatic or semiaquatic, on trees or rock; leaves 2.5–4 mm long, variable, oblong-lingulate, or tapering from an ovate base to a ± obtuse apex; margins strongly recurved throughout, often denticulate at apex; peristome double; calyptra naked.....*O. rivulare*
   8. Plants without this combination of characters..... 9
9. Peristome teeth striate throughout, often with a preperistome; segments usually rudimentary.....10
9. Peristome teeth papillose throughout, or papillose below and striate above, without a preperistome; segments usually well-developed.....12
   10. Leaves bistratose in upper part, the margins often of 3 layers of cells.....*O. hallii*
   10. Leaves unistratose, or sometimes with bistratose streaks.....11
11. Vegetative leaves acute to ± obtuse; capsule usually with 16 ribs.....*O. cupulatum* var. *cupulatum*
11. Vegetative leaves broadly obtuse to rounded; capsule usually with 8 ribs...*O. cupulatum* var. *jamesianum*
   12. Capsule ± cylindric with a tapering neck, the stomata below the middle of the urn or in the neck; peristome teeth papillose, the segments 8; calyptra usually with a few smooth hairs; leaves usually obtuse, the cells with simple papillae.....[*O. tenellum*, reported from Alberta]
   12. Plants without this combination of characters.....13
13. Plants small, the stems less than 0.5 cm long; peristome teeth papillose, the papillae sometimes in lines above; stomata at about the middle of the capsule, the guard cells often partly exposed.....14
13. Plants larger, the stems often 1 cm or more long; peristome teeth papillose below and striate above, sometimes papillose throughout; stomata in the lower part of the spore sac region; the guard cells nearly covered.....*O. alpestre*
   14. Leaf cells plainly papillose, the papillae often forked; segments of endostome often 16.....*O. pallens*

14. Leaf cells with small simple papillae, sometimes smooth or nearly so; segments 8.....*O. pumilum*
15. Capsule immersed to emergent, the seta usually less than 2 mm long, or if exserted the peristome teeth revolute when dry.....16
15. Capsule plainly exserted, the seta 2–5 mm long.....21
16. Capsule immersed, entirely smooth; peristome teeth revolute when dry, densely papillose; endostome of 16 papillose segments nearly as long as the teeth, formed from 2 very irregular rows of cells; on trees.....*O. striatum*
16. Plants without this combination of characters.....17
17. Usually on trees; dry capsule strongly ribbed to the base and shrunken under the mouth, the peristome teeth reflexed and close to the wall; capsule immersed, the seta usually less than 1 mm long.....*O. affine*
17. Without this combination of characters.....18
18. Usually on trees; capsule emergent to exserted, the seta 1.5–2.8 mm long; peristome double, the teeth revolute with the tips close to the wall; endostome well-developed, the segments nearly as long as the teeth, formed from 2 rows of papillose cells.....*O. speciosum*
18. On rock, or rarely on trees; seta shorter; endostome usually with shorter segments, sometimes wanting 19
19. Plants often large, the stems 3–8 cm long; leaf apex acute to ± obtuse; seta usually less than 1 mm long; peristome teeth erect to spreading when dry, rarely ± revolute.....*O. rupestre*
19. Plants usually smaller; seta 1–3.5 mm long; peristome teeth reflexed when dry; rare.....20
20. Leaves 2–3.5 mm long, obtuse to broadly acute.....*O. microblephare*
20. Leaves 2–5 mm long, with slender points.....*O. praemorsum*
21. Leaf cells smooth or nearly so; peristome teeth smooth; capsule ribbed when dry.....*O. holzingeri*
21. Leaf cells papillose; peristome teeth papillose to striate.....22
22. Capsule ribbed when old at least in upper part; peristome teeth papillose, revolute when dry; seta 1.5–3.5 mm long.....23
22. Capsule smooth to somewhat wrinkled when dry, rarely slightly ribbed above when old; peristome teeth papillose to striate, erect to spreading; seta 2–5 mm long; usually on rock.....24
23. Capsule ± shrunken under the mouth when dry, the neck twisted and ribbed; endostome segments usually short, smooth or nearly so, sometimes wanting; seta 1.5–3.5 mm, rarely to 4 mm long; rare, commonly arctic-alpine, usually on rock.....*O. microblephare*
23. Capsule scarcely shrunken under the mouth when dry, the neck not strongly ribbed; segments nearly as long as the teeth, of 2 rows of papillose cells; seta 1.5–2.8 mm long; on trees or rock.....*O. speciosum*
24. Leaves obtuse to rounded.....*O. laevigatum* f. *laevigatum*
24. Leaves with slender points or sometimes ± abruptly acute.....*O. laevigatum* f. *macounii*

Key 77. *Ulota*

1. Dioicous; commonly with septate gemmae borne on the leaf tips; capsules rare.....*U. phyllantha*
1. Autoicous; gemmae wanting; capsules common..... 2
2. Plants on rock, arctic or alpine; leaf cells often with forked papillae.....*U. curvifolia*
2. Plants on trees, usually in the lowlands; papillae of leaf cells simple..... 3
3. Leaves filiform-acuminate and apiculate, often ending in a single row of 1–9 cells; stomata in the wall in the spore sac region; spores large, 30–60 μ.....*U. megalospora*
3. Leaves not apiculate; stomata in the neck; spores smaller, less than 30 μ.....*U. crispa* var. *alaskana*

Key 78. Fontinalaceae

1. Leaves costate.....*Dichelyma*
1. Leaves ecostate.....*Fontinalis*

Key 79. *Fontinalis*

1. Leaves never keeled, usually plane, sometimes ± concave..... 2
1. Leaves keeled at least on older parts of the stem; branch leaves keeled or concave to plane..... 3
2. Stem leaves lanceolate to ovate-lanceolate, 0.5–1.75 mm wide.....*F. hypnoides* var. *hypnoides*
2. Stem leaves broadly ovate-lanceolate, 1–2.5 mm wide.....*F. hypnoides* var. *duriaei*
3. Leaves closely imbricate at the ends of branches with the branch tips plainly 3-angled; perichaetial bracts

apiculate.....*F. neo-mexicana*
3. Leaves otherwise; perichaetial bracts obtuse, often lacerate.....4
4. Leaf keel curved above the basal curve.....5
4. Leaf keel straight above the basal curve, sometimes slightly curved at the leaf tip.....7
5. Stem leaves widest at the middle.....*F. antipyretica* var. *mollis*
5. Stem leaves widest below the middle.....6
6. Stem leaves 3–8×2–4.5 mm, 1.5–3: 1.....*F. antipyretica* var. *antipyretica*
6. Stem leaves 4–9×3–8 mm, 1–1.5: 1.....*F. antipyretica* var. *gigantea*
7. Leaf apices, especially of branch leaves, plane to somewhat concave.....*F. antipyretica* var. *patula*
7. Leaf apices, both stem and branch, predominantly keeled, rarely concave or canaliculate.....*F. antipyretica* var. *oregonensis*

Key 80. HEDWIGIACEAE

1. Capsule immersed, smooth, the perichaetial bracts with ciliate hairs on the margins; leaf cells with one or more simple or forked papillae on each surface.....*Hedwigia ciliata*
1. Capsule exserted, ribbed, the perichaetial bracts not ciliate; leaf cells with a simple papilla on each surface.....*Pseudobraunia californica*

Key 81. CRYPHAEACEAE

1. Leaf cells not papillose.....*Alsia californica*
1. Leaf cells with high sharp papillae.....*Dendroalsia abietina*

Key 82. LEUCODONTACEAE

1. Leaf cells not papillose.....*Antitrichia*
1. Leaf cells papillose by projecting cell ends.....*Pterogonium gracile*

Key 83. *Antitrichia*

1. Branches julaceous; leaves without supplementary costae or the supplementary costae weak; cell walls not pitted or the pits inconspicuous; capsule 3–5: 1.....*A. californica*
1. Branches not julaceous; leaves with supplementary costae often to 1/3 the length of the leaf; cells with strongly pitted walls; capsule 2–2.5: 1.....*A. curtipendula*

Key 84. NECKERACEAE

1. Plants not complanate; leaves coarsely toothed at the apex; costa strong, toothed on the back above.....*Thamnobryum neckeroides*
1. Without this combination of characters.....2
2. Small plants with leaves to 1 mm long but often shorter, sometimes ± complanate, never undulate; costa 3/4 the length of the leaf; alar cells quadrate, thick-walled.....*Bestia vancouveriensis*
2. Plants otherwise, larger, or the alar cells not clearly differentiated.....3
3. Leaves complanate and undulate (these characters often lacking in small leaves of flagellate branches); capsule immersed or on a short seta.....*Neckera*
3. Leaves complanate but never undulate; capsule exserted on a long seta.....4
4. Leaf apex minutely serrulate; leaves 1–1.6 mm long.....*Homalia trichomanioides*
4. Leaf apex sharply and coarsely serrate; leaves larger, to 3 mm long.....*Porothamnium bigelovii*

Key 85. *Neckera*

1. Stems with numerous paraphyllia; leaves costate to the middle or beyond (flagellate branches usually lacking paraphyllia; costa often short or wanting).....*N. menziesii*
1. Stems without paraphyllia, the leaves with costae wanting or short and double.....2
2. Dioicous; leaves long-acuminate, serrate with sharp, often recurved teeth at apex, serrate or serrulate to about the middle of the leaf.....*N. douglasii*
2. Autoicous; leaves ± abruptly rounded, apiculate, serrate to serrulate.....*N. pennata* var. *tenera*

Key 86. *Hookeria*

1. Leaves acute.....*H. acutifolia*
1. Leaves obtuse.....*H. lucens*

Key 87. *Myurella*

1. Leaves obtuse or sometimes with a very small apiculus.....*M. julacea*
1. Leaves gradually or sometimes ± abruptly narrowed to the distinct apiculus.....*M. tenerrima*

Key 88. *Fabronia*

1. Leaves dentate but not ciliate-dentate.....*F. ciliaris*
1. Leaves ciliate-dentate, the teeth often of more than 1 cell.....*F. pusilla*

Key 89. LESKEACEAE

1. Leaves ecostate or the costa short or double or both..... 2
1. Leaves costate, the costa single and to the middle of the leaf or longer..... 3
   2. Leaves ovate to obovate; cells often papillose by projecting cell ends; branches julaceous; paraphyllia and asexual reproductive bodies often present.....*Pterigynandrum filiforme*
   2. Leaves ovate to ovate-lanceolate, never obovate; cells smooth or with low papillae; branches not or scarcely julaceous; paraphyllia wanting or small; gemmae wanting.....*Pseudoleskeella tectorum*
3. Costa to about the middle of the leaf, broad; cells short, smooth or nearly so...[*Pseudoleskeella catenulata*]
3. Costa extending beyond the middle of the leaf 4
   4. Small plants without paraphyllia or pseudoparaphyllia; leaf cells never papillose..... .....*Pseudoleskeella nervosa*
   4. Plants with paraphyllia or papillose leaf cells or both..... 5
5. Autoicous; leaves entire, the cells short, isodiametric, with a single papilla on the lumen of each surface; peristome teeth incurved when dry.....*Leskea polycarpa*
5. Dioicous; leaves often serrulate, the cells short or long; papillae various, rarely few or wanting; peristome teeth not incurved when dry.....*Lescuraea*

Key 90. *Lescuraea*

1. Leaf cells with large papillae on the lumen, usually central.....*L. patens*
1. Leaf cells with small papillae at cell ends or papillae wanting..... 2
   2. Paraphyllia wanting; cells papillose; basal cells, except the alar, longer than the median...*L. baileyi*
   2. Paraphyllia abundant at least on stems..... 3
3. Cell walls of mature stem leaves plainly pitted.....*L. atricha*
3. Cells without pitted walls, or pits in basal cell walls only..... 4
   4. Leaves large, 1.7–2.3×0.7–1 mm; branches and rhizoids few or none..... 5
   4. Leaves smaller; branches and rhizoids common..... 6
5. Cells with thick walls; median cells 12–20 μ long, rarely a few to 30 μ.....*L. incurvata* var. *gigantea*
5. Cells with thin walls; median cells mostly 30 μ long or longer.....*L. radicosa* var. *denudata*
   6. Basal cells of stem leaves, except the alar, predominantly long with many cells more than 2: 1..... 7
   6. Basal cells of stem leaves predominantly short, isodiametric or 2: 1..... 8
7. Leaves abruptly acuminate with a narrow oblique acumen, the margins strongly revolute at base of acumen; capsule often inclined; endostome segments open on the keel.....*L. saviana*
7. Leaves otherwise, gradually narrowed to the apex, or sometimes the stem leaves abruptly acuminate; capsule always straight and erect; endostome segments narrow, not keeled.....*L. saxicola*
   8. Median cells of stem leaves short, mostly isodiametric, often angular; branch leaves strongly papillose, the papillae on both sides of the lamina of young leaves.....*L. incurvata* var. *tenuiretis*
   8. Median cells of stem leaves predominantly longer, 2: 1 or more..... 9
9. Alar cells of stem leaves in part quadrate and in part transversely elongate, the median cells mostly 12–20 μ long, if longer, the walls very thick and short cells intermingled.....*L. incurvata* var. *incurvata*
9. Alar cells of stem leaves quadrate, the median cells commonly longer than 20 μ, often 30 μ or more, if shorter, the walls not conspicuously thickened 10

10. Leaves gradually long-acuminate, the acumen more than half the length of the leaf; cells usually papillose, the papillae over the cell cavity at upper end; segments of endostome narrow, not keeled..... ..... *L. stenophylla*
10. Leaves with the acumen shorter; when present, papillae formed by projecting cell ends; endostome segments broad and keeled.....11
11. Leaves abruptly acuminate with a narrow oblique acumen, the margins strongly revolute at base of acumen; branch leaves strongly papillose..... *L. saviana*
11. Leaves without this combination of characters.....12
12. Leaves plainly acuminate; apical cells long, usually 30 μ or more..... *L. radicosa* var. *radicosa*
12. Leaves merely acute or with short acumen; apical cells short, less than 30 μ.....13
13. Branch leaves strongly concave; leaves a clear light green..... *L. radicosa* var. *pallida*
13. Branch leaves not strongly concave; leaves yellow-green to brownish..... *L. radicosa* var. *compacta*

Key 91. *Pseudoleskeella*

1. Leaves ecostate, or the costa short or double or both; cells smooth, or with low papillae..... *P. tectorum*
1. Leaves costate, the costa single and to the middle of the leaf or longer..... 2
2. Costa to about the middle of the leaf, broad; leaf cells short..... [*P. catenulata*]
2. Costa extending beyond the middle of the leaf; median cells 12–22 μ long or longer..... 3
3. Leaves entire..... *P. nervosa* var. *nervosa*
3. Leaves minutely serrulate at apex..... *P. nervosa* var. *sibirica*

Key 92. THUIDIACEAE

1. Leaves with costa short or double or both..... *Heterocladium*
1. Leaves with costa single, to the middle of the leaf or longer..... 2
2. Plants branching irregularly to ± regularly pinnate; paraphyllia wanting or few and small; midrib pellucid..... *Claopodium*
2. Plants regularly pinnate to tripinnate; stems with branched paraphyllia..... 3
3. Median leaf cells elongate, 3–5: 1; apical cells of the branch leaves and cells of the paraphyllia smooth; stems simply pinnate..... *Helodium*
3. Median leaf cells shorter, 1–3: 1; apical cells of branch leaves and cells of paraphyllia papillose..... *Thuidium*

Key 93. *Claopodium*

1. Leaves with hair-points..... 2
1. Leaves without hair-points..... *C. whippleanum*
2. Leaf cells with a single large papilla on each surface..... *C. crispifolium*
2. Leaf cells with 2 or more papillae on each surface..... *C. bolanderi*

Key 94. *Heterocladium*

1. Cells of stem leaves and stems smooth..... *H. procurrens*
1. Cells of stem leaves papillose..... 2
2. Cells of stems smooth; apical cells of ultimate branch leaves smooth or 1 papilla per cell... *H. dimorphum*
2. Cells of stems papillose; apical cells of ultimate branch leaves papillose, 2–5 papillae or rarely 1 per cell ..... *H. macounii*

Key 95. *Thuidium*

1. Stems simply pinnate, the branches terete and ± julaceous when dry; paraphyllia with the lateral papillae from middle of cells..... *T. abietinum*
1. Stems commonly bi-tripinnate, the branches not julaceous..... 2
2. Paraphyllia with the lateral papillae not at the cell ends; plants bipinnate to tripinnate... *T. philibertii*
2. Paraphyllia with the lateral papillae at the cell ends; plants usually bipinnate..... *T. recognitum*

Key 96. AMBLYSTEGIACEAE

1. Leaves costate, the costa single and to the middle of the leaf or longer 2
1. Leaves ecostate, or the costa short or double or both 7
   2. Leaves bordered by a thickened band of submarginal cells; rare ..... *Sciaromium tricostatum*
   2. Leaves not bordered 3
3. Leaves usually squarrose, 0.7–1.5 × 0.2–0.5 mm, entire, or serrulate only at the base; alar cells quadrate; costa to about the middle of the leaf ..... *Campylium chrysophyllum*
3. Leaves otherwise, never squarrose 4
   4. Leaves with alar cells plainly inflated, sharply differentiated from the cells above; costa strong, broad at base, ending just before the apex to excurrent; paraphyllia commonly abundant, rarely few or wanting; leaves usually serrate or serrulate; median cells 20–60 μ long, rarely to 85 μ ..... *Cratoneuron*
   4. Plants otherwise; paraphyllia wanting, pseudoparaphyllia sometimes present; alar cells not inflated, or if inflated, not sharply differentiated or the leaf cells longer 5
5. Leaves cordate-ovate, oblong-ovate, or ± oblong, never long-acuminate; apex obtuse or apiculate; margins entire ..... *Calliergon*
5. Leaves always plainly acuminate; margins entire or serrulate 6
   6. Leaves usually falcate or plicate or both; alar cells inflated or undifferentiated; dioicous or autoicous ..... *Drepanocladus*
   6. Leaves neither plicate nor distinctly falcate; alar cells undifferentiated, or if differentiated, a few cells quadrate, or rarely the cells inflated; in species with inflated alar cells, the leaves entire, or the median cells rather short, 30–60 μ long; autoicous ..... *Amblystegium*
7. Leaves very small, to 0.45 mm long, but often shorter, ovate-lanceolate, never squarrose, entire, or often serrulate at the base ..... *Platydictya jungermannioides*
7. Leaves large, or if small, either ± squarrose, or of a different shape 8
   8. Leaves 2–4 × 1.4–1.8 mm, falcate and ± asymmetric, somewhat rugose when dry; plants dark-colored ..... *Scorpidium scorpioides*
   8. Plants without this combination of characters 9
9. Leaves ovate to ovate-lanceolate, plainly acuminate, usually squarrose, sometimes wide-spreading ..... *Campylium*
9. Leaves otherwise, never tapering to a narrow apex 10
   10. Leaves small or large, less than 2: 1, or if longer commonly falcate; basal leaf cells rarely with pitted walls; usually on wet rocks or soil in or near streams ..... *Hygrohypnum*
   10. Leaves usually 2 mm long or longer, rarely less, commonly 2: 1 or longer, deeply concave, never falcate; walls of basal cells often pitted 11
11. Costa single or often divided above the base, sometimes reaching the middle of the leaf ..... *Calliergon turgescens*
11. Costa wanting or short and double, never to the middle of the leaf 12
   12. Stems red; alar cells differentiated, quadrate or somewhat enlarged but not clearly inflated ..... *Pleurozium schreberi*
   12. Stems green, brown, or reddish brown; alar cells inflated ..... *Calliergonella*

Key 97. *Amblystegium*

1. Costa of leaf strong, percurrent or excurrent; plants usually aquatic 2
1. Costa shorter; plants terrestrial, sometimes in wet places 3
   2. Costa thick and broad, to 1/3 the width of leaf base and of 5–8 layers of cells ..... *A. noterophilum*
   2. Costa narrower, of 4–5 layers of cells at the leaf base ..... *A. tenax*
3. Leaves small, to 1.2 mm long but often shorter, erect-spreading, never wide-spreading; costa to the middle of the leaf or sometimes longer, often shorter in branch leaves; alar cells few, quadrate to transversely elongate ..... *A. serpens*
3. Leaves larger, or wide-spreading, or both 4
   4. Alar cells plainly differentiated, usually inflated 5
   4. Alar cells not or scarcely differentiated 6
5. Leaves cordate-ovate, 1–1.6 mm long, rarely longer ..... *A. saxatile*
5. Leaves ovate-lanceolate to lanceolate, 2–2.5 mm long ..... *A. polygamum*
   6. Leaves small, usually 1 mm long or less, rarely more; alar cells rectangular; basal cells vertically elongate

and usually wider than the cells above.....*A. juratzkanum*
6. Leaves larger, or if small, the basal cells otherwise..... 7
7. Plants commonly aquatic; leaves entire, often attached to the stem obliquely; median leaf cells 8–15: 1.....*A. riparium*
7. Plants not usually aquatic but often in wet places; leaves entire to serrulate; leaf base attached to the stem transversely; median leaf cells less than 8: 1..... 8
8. Costa extending beyond the middle of the leaf.....*A. trichopodium* var. *trichopodium*
8. Costa weak, extending to about the middle of the leaf.....*A. trichopodium* var. *kochii*

Key 98. *Calliergon*

1. Plants usually tinged with red or purple; leaves often apiculate; alar cells abruptly enlarged, the walls hyaline or colored; basal cells thick-walled, often pitted.....*C. sarmentosum*
1. Plants without this combination of characters; leaves lacking red or purple coloration..... 2
2. Alar cells often yellow, gradually enlarged, the walls thick..... 3
2. Alar cells hyaline, often inflated, the walls thin..... 4
3. Leaves with obtuse apices; costa always single.....*C. trifarium*
3. Leaves obtuse or often shortly apiculate; costa often divided above the leaf base.....*C. turgescens*
4. Costa short, extending 1/2–3/4 the length of the leaf..... 5
4. Costa long, extending to within a few cells of the apex, sometimes percurrent..... 6
5. Leaves close and imbricate, 1–2 mm long; costa single; stems mostly simple, seldom over 1 mm wide.....*C. stramineum*
5. Leaves distant and spreading except at apex, 1.5–4.3 mm long; costa sometimes divided; stems often branched, mostly more than 1 mm wide.....*C. richardsonii*
6. Branches numerous, arranged ± pinnately; alar cells abruptly inflated to form auricles; stem leaves variable, sometimes nearly as broad as long.....*C. giganteum*
6. Branches few and irregular; alar cells inflated but not forming well-defined regions; stem leaves narrower, usually plainly longer than broad.....*C. cordifolium*

Key 99. *Calliergonella*

1. Plants aquatic, floating; leaves often minutely serrulate at apex; median cells 60–95 × 12–16 μ.....*C. conardii*
1. Plants usually in wet places, not floating; leaves entire; median cells 60–100 × 4–6 μ.....*C. cuspidata*

Key 100. *Campylium*

1. Costa single and strong, often to the middle of the leaf.....*C. chrysophyllum*
1. Costa weak, double, or wanting, rarely single, ending before the middle of the leaf..... 2
2. Plants large, leaves often 2 mm long or longer; alar cells abruptly inflated; pseudoparaphyllia wanting.....*C. stellatum*
2. Plants small, the leaves usually less than 1.5 mm long; alar cells not inflated; pseudoparaphyllia sometimes present..... 3
3. Plants yellow-brown or brownish green, in low dense mats, the leaves crowded with the bases imbricate; leaf margins usually recurved at base, entire or serrulate.....*C. halleri*
3. Plants green or yellow-green, rarely yellowish brown, in loose mats, the leaves distant with the bases rarely touching; leaf margins plane or rarely recurved, serrulate to serrate at the base.....*C. hispidulum* var. *sommerfeltii*

Key 101. *Cratoneuron*

1. Leaves plicate and falcate; paraphyllia usually numerous..... 2
1. Leaves not plicate, rarely falcate; paraphyllia less numerous, sometimes few or wanting.....*C. filicinum*
2. Leaf cells papillose at least near base of leaf.....*C. williamsii*
2. Leaf cells smooth..... 3
3. Plants branching regularly, pinnate and plumose; leaves cordate-triangular...*C. commutatum* var. *commutatum*
3. Plants branching irregularly; leaves ovate-lanceolate.....*C. commutatum* var. *falcatum*

Key 102. *Drepanocladus*

1. Outer layer of stem cells large and thin-walled 2
1. Outer layer of stem cells small and thick-walled 4
   2. Leaves not plicate, without auricles; walls of basal cells sometimes pitted; plants usually reddish... ..... *D. revolvens*
   2. Leaves plicate, with small decurrent auricles; plants green or yellow-green, never red or purple 3
3. Capsule curved and zygomorphic ..... *D. uncinatus* var. *uncinatus*
3. Capsule erect and straight ..... *D. uncinatus* var. *symmetricus*
   4. Leaves ± plicate, entire; cell walls not pitted, or only slightly so at leaf base; alar cells never inflated ..... *D. vernicosus*
   4. Leaves not plicate or rarely slightly so; cells of the alar region usually differentiated, often inflated, or if not differentiated, the basal cells with pitted walls 5
5. Leaves with undifferentiated alar cells; basal leaf cells with thick pitted walls, the pitted cells sometimes extending to the middle of the leaf; costa less than 50 μ wide, sometimes forking above ..... *D. brevifolius*
5. Leaves otherwise 6
   6. Alar cells thick-walled, usually yellow, sometimes inflated; plants usually deep yellow to golden; costa strong, 70–125 μ wide at base ..... *D. sendtneri*
   6. Alar cells hyaline and inflated, the walls thin 7
7. Leaves serrulate at apex or base or both; annulus wanting 8
7. Leaves entire 10
   8. Costa stout, usually extending well into the apex; decurrent auricles large, the cells inflated, usually elongate and extending to the costa 9
   8. Costa more slender and usually shorter; inflated alar cells less sharply differentiated, not extending to the costa and not forming very distinct auricles; plants green, yellow, or brown ..... *D. fluitans*
9. Plants often reddish to purple; leaves to 6 mm long, acute ..... *D. exannulatus* var. *exannulatus*
9. Plants never reddish or purple; leaves smaller, usually obtuse ..... *D. exannulatus* var. *tundrae*
   10. Costa excurrent; leaves falcate; alar cells few, not strongly inflated and often remaining on the stem ..... *D. capillifolius*
   10. Costa not excurrent; leaves falcate or straight; alar cells more numerous, clearly inflated and often extending to the costa; capsule with annulus ..... *D. aduncus*

Key 103. *Hygrohypnum*

1. Leaves small, rarely more than 1 mm long, usually less, ovate to rounded or suborbicular; margins entire... 2
1. Leaves larger, or ovate-lanceolate and tapering to the apex 4
   2. Costa commonly single and to the middle of the leaf at least in some leaves... *H. smithii* var. *smithii*
   2. Costa usually short and double 3
3. Leaves deeply concave, ± orbicular ..... *H. smithii* var. *goulardii*
3. Leaves less strongly concave, not orbicular ..... *H. norvegicum*
   4. Cortical cells of stem large, thin-walled, hyaline ..... *H. ochraceum*
   4. Cortical cells small, similar to the cells within 5
5. Dioicous; plants large, stems 3–12 cm long, leaves 1.4–3.4 mm long, commonly 2 mm long or longer..... ..... *H. bestii*
5. Autoicous; plants smaller, leaves rarely to 2 mm long 6
   6. Plants usually stiff and harsh; leaves wide-spreading and somewhat contorted when dry, broadly ovate to suborbicular, often nearly as broad as long, serrulate ..... *H. dilatatum*
   6. Without this combination of characters, leaves commonly longer than broad 7
7. Leaves entire, often falcate-secund, the margins usually incurved near apex; costa often single and strong in some leaves; annulus wanting ..... *H. luridum*
7. Leaves frequently serrulate at apex, never falcate; margins not or scarcely incurved at apex; costa commonly short and double, rarely one branch reaching the middle of the leaf ..... *H. molle*

Key 104. BRACHYTHECIACEAE

1. Small plants usually in deep cushions; leaves ovate-lanceolate to lanceolate, never plicate; costa percurrent; margins serrate, the teeth at leaf base often double and recurved ..... *Rhynchostegiella compacta*

1. Plants without this combination of characters..... 2
   2. Leaves deeply concave, abruptly narrowed to a filiform point 0.4–0.8 mm long...*Cirriphyllum cirrosum*
   2. Leaves without a filiform point or the point shorter, or the leaves not deeply concave..... 3
3. Leaves deeply plicate, linear cells extending nearly to the base, the basal cells narrow, 5–8 μ wide, rarely to 10 μ.....*Homalothecium*
3. Leaves not deeply plicate, or if so the basal cells otherwise..... 4
   4. Alar cells differentiated, dense, quadrate to rounded or transversely elongate, the walls thick; leaves coarsely serrate in the upper third; seta smooth.....*Isothecium*
   4. Alar cells otherwise, if quadrate the walls scarcely thickened..... 5
5. Operculum rostrate; branch leaves strongly serrate, the teeth extending to the base or nearly so...*Eurhynchium*
5. Operculum not rostrate..... 6
   6. Plants branching ± regularly, the branches in one plane; leaves concave, not plicate, ovate to ovate-oblong; seta smooth.....*Pseudoscleropodium purum*
   6. Plants not branching regularly, or if so, the leaves otherwise..... 7
7. Branches commonly julaceous; leaves neither falcate nor plicate, usually distinctly concave, to about 2 mm long; dioicous.....*Scleropodium*
7. Plants variable, the leaves straight or falcate, smooth or plicate; rarely julaceous, if julaceous either plicate or autoicous or both.....*Brachythecium*

Key 105. *Brachythecium*

1. Costa extending to the leaf apex or nearly so..... 2
1. Costa shorter, not extending to the leaf apex..... 4
   2. Seta rough above, smooth below; leaves only slightly decurrent.....*B. populeum*
   2. Seta rough throughout; leaves strongly decurrent..... 3
3. Stem leaves 0.8–1.2 mm long, the median cells 25–40(50)×7–8 μ.....*B. reflexum*
3. Stem leaves larger, 1.2–2 mm long, the median cells 45–80×7–10 μ.....*B. starkei* var. *pacificum*
   4. Stem leaves plainly plicate wet or dry, branch leaves usually plicate..... 5
   4. Leaves not or only slightly plicate.....13
5. Leaves strongly falcate..... 6
5. Leaves not or only slightly falcate..... 8
   6. Seta rough; autoicous; plants often regularly pinnate.....*B. leibergii*
   6. Seta smooth; plants branching irregularly..... 7
7. Dioicous; plants medium to large, the stem leaves 1.5–2 mm long; branch leaves without spines at end of costa .....*B. erythrorrhizon*
7. Autoicous; plants small, the stem leaves 1–1.8 mm long; branch leaves with one or more spines at end of costa 26
   8. Leaves with long slender apices, entire or nearly so; dioicous.....*B. albicans*
   8. Plants otherwise..... 9
9. Dioicous; seta rough; stem leaves usually ± deltoid-ovate, sometimes with auricles, usually a row of ± inflated cells across the base attaching the leaf to the stem.....10
9. Autoicous; seta rough or smooth; stem leaves usually ovate-lanceolate.....11
   10. Plants in wide loose mats, often stoloniferous.....*B. asperrimum*
   10. Plants in thick tufts, growing in wet places.....*B. frigidum*
11. Seta rough; leaves only slightly plicate.....*B. rutabulum*
11. Seta smooth; leaves strongly plicate.....12
   12. Branches julaceous, in tufts; plants in wet places, arctic-alpine.....*B. turgidum*
   12. Branches not julaceous and not in tufts; plants often on rotten wood, widespread.....*B. salebrosum*
13. Plants small, the stem leaves 0.6–1.2 mm long; leaves not concave, median cells short, 30–45×5–7 μ; dioicous, seta rough; rare.....*B. bolanderi*
13. Plants otherwise. 14
   14. Plants small, with concave imbricate leaves and julaceous branches; leaves ± abruptly acuminate, often somewhat secund; alar cells quadrate; autoicous; seta smooth or nearly so.....*B. collinum*
   14. Plants without this combination of characters..... 15
15. Dioicous; stem leaves strongly concave.....16
15. Autoicous, or rarely synoicous; leaves not or less strongly concave (plainly concave in *B. plumosum*).....20

16. Branches usually julaceous; seta rough, or rarely smooth.....*Scleropodium*
16. Branches not usually julaceous; seta rough throughout.....17
17. Alar cells plainly inflated, forming well-defined auricles.....18
17. Alar cells not inflated, or not forming definite auricles.....19
18. Stem leaves triangular-ovate, slenderly long-acuminate.....*B. nelsonii*
18. Stem leaves ± abruptly acute, or shortly acuminate.....*B. rivulare*
19. Stem leaves 2.3–3.6×1.2–2 mm, concave, scarcely plicate, often abruptly apiculate; margins recurved in the alar region.....*B. hylotapetum*
19. Stem leaves 1.8–3×0.6–1.5 mm, less strongly concave, usually ± plicate, never abruptly apiculate; margins not usually recurved.....*B. asperrimum*
20. Leaves strongly decurrent.....21
20. Leaves not decurrent or only moderately so.....23
21. Stem leaves ovate-lanceolate, gradually long-acuminate; seta smooth or slightly roughened.....*B. holzingeri*
21. Stem leaves cordate-triangular or broadly ovate-lanceolate from a ± cordate base, often abruptly acuminate 22
22. Stem leaves 1.4–2.2 mm long; seta rough throughout.....*B. starkei* var. *starkei*
22. Stem leaves larger, to 2.7 mm long; seta often smooth below, sometimes rough throughout..... .....*B. starkei* var. *explanatum*
23. Stem leaves 1.5–2.3×0.7–1 mm, usually deeply concave, closely imbricate; seta rough above, smooth below .....*B. plumosum*
23. Plants otherwise.....24
24. Plants large, stem leaves 2–3×1–1.8 mm; seta rough throughout.....*B. rutabulum*
24. Plants smaller, stem leaves 0.7–1.8×0.3–0.6 mm..... 25
25. Synoicous; capsule erect and straight or nearly so; cilia of endostome wanting or rudimentary; seta smooth or only weakly papillose.....*B. fendleri*
25. Autoicous; capsule ± horizontal, arcuate; cilia well-developed.....26
26. Seta rough throughout.....*B. velutinum* var. *velutinum*
26. Seta smooth, or slightly rough at base.....*B. velutinum* var. *venustum*

Key 106. *Eurhynchium*

1. Plants usually aquatic, on stones in or near streams; leaves widest at about the middle; cells at tips of branch leaves short; seta smooth; autoicous.....*E. riparioides*
1. Plants not aquatic; leaves widest below the middle..... 2
2. Branch leaves obtuse to ± acute, cells of the leaf tips short, some less than 2: 1; seta smooth..... 3
2. Branch leaves always acute, the cells of the tips 2: 1 or longer..... 4
3. Stem leaves 1–1.5 mm long; branch leaves to 1.2 mm long, often less than 1 mm..... .....*E. pulchellum* var. *pulchellum*
3. Stem leaves 1.5–2.5 mm long; branch leaves to 1.6 mm long, usually more than 1 mm..... .....*E. pulchellum* var. *barnesii*
4. Stem and branch leaves not clearly differentiated, ovate-lanceolate, not or only slightly decurrent; seta smooth or nearly so..... 5
4. Stem and branch leaves usually clearly differentiated; stem leaves, and often the branch leaves strongly decurrent; seta rough..... 6
5. Plants complanate-foliate; stem leaves to 2.6 mm long; autoicous; seta smooth.....*E. serrulatum*
5. Plants not complanate-foliate; stem leaves 1–1.6 mm long; dioicous; seta smooth or with a few papillae..... .....*E. brittoniae*
6. Plants branching irregularly.....*E. praelongum* var. *praelongum*
6. Plants regularly pinnate..... 7
7. Branch leaves 1–2×0.6–1.2 mm, usually more than 1 mm long; main stem simple or with few divisions... .....*E. oreganum*
7. Branch leaves 0.6–1.1×0.3–0.64 mm, usually less than 1 mm long; main stem commonly divided, the divisions often arching.....*E. praelongum* var. *stokesii*

Key 107. *Homalothecium*

1. Plants of bogs and marshes; stems usually ± erect, commonly with mats of rhizoids except near apex; alar cells of leaves not clearly differentiated; walls of basal cells thick and pitted; seta smooth.....*H. nitens*
1. Plants on trees, rocks, or soil, never in bogs; rhizoids less conspicuous; alar cells (except in *H. megaptilum*) always forming a clearly defined group; seta rough, at least below..... 2
   2. Leaves dentate at base and often at apex, the teeth sharp, usually recurved.....*H. nuttallii*
   2. Leaves entire at base or with a few inconspicuous teeth..... 3
3. Plants large and coarse, regularly pinnate, the branches in one plane, branches 1–3 cm long; alar and basal cells elongate, 25–35×8–10 μ, the walls thick and pitted.....*H. megaptilum*
3. Plants smaller, not regularly pinnate or if so, the branches not in one plane or less than 1 cm long; alar cells quadrate, rounded, or irregular, usually short, walls usually not pitted, the other basal cells often with pitted walls..... 4
   4. Alar cells clear, quadrate, stem leaves with 10 or more quadrate alar cells on the entire margin, the quadrate cells not extending higher within the margin; capsule curved and zygomorphic, operculum conic, cilia well-developed; plants regularly pinnate, branches about 5 mm long; on rock, or soil in rocky places .....*H. pinnatifidum*
   4. Alar cells not clear, quadrate to rounded or irregular, usually less than 10 cells on the entire or serrulate margin, about 5–6, the differentiated alar cells usually extending higher within the margin..... 5
5. Capsule erect and straight or nearly so, often enlarged at base; operculum rostrate, cilia none or rudimentary; usually on rock.....*H. nevadense*
5. Capsule not erect and straight when dry..... 6
   6. Four to six rows of basal leaf cells similar to alar cells, short, broad, about 17×8 μ, walls thick and pitted; branch leaves often papillose near apex; stem leaves 1.3–2 mm long; on sandy soil or rock..... .....*H. arenarium*
   6. Basal leaf cells not similar to alar cells; stem leaves often more than 2 mm long; on trees, rotten logs, rock, rarely on soil..... 7
7. Urn 2.4–2.8 mm long; operculum short-rostrate, 1–1.5 mm long; cilia ± rudimentary; branch leaves usually with narrow points; common on trees, sometimes on rock.....*H. fulgescens*
7. Urn 1.8–2.6 mm long; operculum conic, 0.5–0.75 mm long; cilia 2–3, well-developed, sometimes ± appendiculate; branch leaves always with broad points; usually on rock or soil over rock, rarely on trees or logs.... .....*H. aeneum*

Key 108. *Isothecium*

1. Quadrate alar cells numerous, extending at least 1/4 the way up the leaf margins; leaves widest near the middle; branches julaceous.....*I. cristatum*
1. Quadrate alar cells less numerous; leaves widest just above the base; branches rarely julaceous, often stoloniferous.....*I. stoloniferum*

Key 109. *Scleropodium*

1. Plants in or near streams, ± aquatic; leaf apex commonly obtuse to rounded, sometimes with a very short straight apiculus; alar cells inflated; costa without spines at the end; annulus wanting.....*S. obtusifolium*
1. Plants otherwise..... 2
   2. Plants usually ± robust; leaves relatively broad, on well-developed branches 1.2–2×0.7–1.2 mm, often smaller on attenuate branches; basal leaf cells ± rectangular in 1–2 rows, rarely 3 rows across the base; capsule horizontal and somewhat zygomorphic..... 3
   2. Plants smaller, the leaves narrower; well-developed branch leaves 0.8–1.8×0.3–0.8 mm, usually less than 0.7 mm wide; basal leaf cells quadrate to short-rectangular in 2–6 rows; capsule erect to somewhat inclined..... 4
3. Branches plainly julaceous, tumid or turgid; leaves deeply concave, commonly with apiculus recurved..... .....*S. touretii* var. *touretii*
3. Leaves and branches variable, the leaves erect-spreading and the branches not julaceous, or the leaves imbricate and the branches julaceous; apiculus rarely recurved.....*S. touretii* var. *colpophyllum*
   4. Seta rough throughout.....*S. cespitans* var. *cespitans*
   4. Seta smooth or nearly so.....*S. cespitans* var. *sublaeve*

Key 110. *Orthothecium*

1. Plants large; leaves deeply plicate, the margins recurved.....*O. chryseum*
1. Plants small; leaves not plicate, the margins plane..... 2
   2. Leaves ovate to ovate-lanceolate; endostome with cilia single, long or short.....*O. diminutivum*
   2. Leaves narrowly lanceolate; cilia wanting.....*O. intricatum*

Key 111. Plagiotheciaceae

1. Leaves strongly decurrent.....*Plagiothecium*
1. Leaves never strongly decurrent, either not decurrent, or only a few cells indistinctly decurrent...*Isopterygium*

Key 112. *Isopterygium*

1. Leaves entire or nearly so, the cell walls without pits; autoicous; urn of capsule smooth; asexual reproductive bodies sometimes present, cylindric to fusiform.....*I. pulchellum*
1. Plants without this combination of characters..... 2
   2. Asexual reproductive bodies common, branch-like; dioicous; urn of capsule often wrinkled, not striate; leaves serrulate to strongly serrate at apex, serrulate to entire below.....*I. elegans*
   2. Asexual reproductive bodies wanting; autoicous; urn of capsule usually striate, sometimes wrinkled or nearly smooth; leaves serrulate to strongly serrate above the middle, usually serrate or serrulate to the base..... 3
3. Leaves not appearing distichous or complanate, often secund at stem and branch apices; capsule often more than 2 mm long; plants of the Pacific Northwest.....*I. seligeri*
3. Leaves usually appearing distichous and complanate; capsule never more than 2 mm long; plants of eastern and central North America, rare in or west of the Rocky Mountains.....*I. turfaceum*

Key 113. *Plagiothecium*

1. Plants robust, whitish green; leaves plainly undulate, often 4 mm long or longer.....*P. undulatum*
1. Plants otherwise..... 2
   2. Leaves serrate above, often serrulate to the base; decurrent cells inflated.....*P. striatella*
   2. Leaves entire, or serrate to serrulate only at apex..... 3
3. Leaf apex abruptly contracted to a long filiform point.....*P. piliferum*
3. Leaf apex not abruptly contracted to a filiform point..... 4
   4. Decurrent part of leaf broad, rounded, often auriculate, the cells inflated, often ± spherical; autoicous .....*P. denticulatum*
   4. Decurrent part of leaf narrow, tapering, never auriculate, the cells rectangular, never inflated..... 5
5. Stems and branches usually julaceous; leaves symmetric, concave, the median cells often more than 10 μ wide; dioicous.....*P. roeseanum*
5. Stems and branches usually complanate; leaves often asymmetric, scarcely concave, the median cells 10 μ wide or less; autoicous.....*P. laetum*

Key 114. Hypnaceae

1. Plants regularly pinnate; stems with numerous paraphyllia; leaves deeply plicate.....*Ptilium crista-castrensis*
1. Plants otherwise..... 2
   2. Cortical cells of stem large and hyaline..... 3
   2. Cortical cells of stem small and thick-walled..... 4
3. Leaves small, to 1.2 mm long, often shorter, with a few large inflated alar cells, and often a row of inflated cells extending nearly to the costa; operculum rostrate; autoicous.....*Brotherella roellii*
3. Leaves large; alar cells inflated or not inflated; operculum conic to conic-apiculate; dioicous.....*Hypnum*
   4. Alar cells inflated; leaves neither falcate nor circinate, either straight or slightly secund..... .....*Heterophyllium haldanianum*
   4. Alar cells not inflated, or if inflated, the leaves circinate..... 5
5. Branches ± julaceous; leaves never falcate or secund; alar cells strongly differentiated, thick-walled, quadrate to irregular, or often transversely elongate, extending halfway to the costa...*Tripterocladium leucocladulum*
5. Branches not julaceous; leaves secund to circinate, rarely straight; alar cells sometimes quadrate, not trans-

versely elongate..... 6
6. Capsule usually curved and zygomorphic, the peristome perfect; leaves often falcate to circinate; walls of the basal cells often pitted.....*Hypnum*
6. Capsule erect and straight or nearly so, the peristome without cilia, or the cilia rudimentary; leaves never circinate, sometimes falcate; walls of basal leaf cells not pitted.....*Pylaisia polyantha*

Key 115. *Hypnum*

1. Cortical cells of stem hyaline, larger than the cells within..... 2
1. Cortical cells small, thick-walled, not larger than the cells within..... 8
2. Alar cells differentiated, usually plainly inflated; dioicous..... 3
2. Alar cells not inflated, often quadrate..... 6
3. Leaves usually falcate-secund, rarely nearly straight, acute to broadly acuminate..... 4
3. Leaves circinate, slenderly acuminate; capsule never ribbed when dry..... 5
4. Leaves rounded to the insertion, alar cells hyaline, ± rectangular, or slightly inflated; capsule not ribbed.....*H. pratense*
4. Leaves not rounded to the insertion, alar cells plainly inflated; capsule ribbed when dry...*H. lindbergii*
5. Leaves entire or nearly so, the apices filiform; plants green to yellow-green, usually branching irregularly .....*H. callichroum*
5. Leaves serrulate at apex, the apices narrow but not filiform; plants often brownish at least below, ± regularly pinnate .....*H. dieckii*
6. Leaves rarely more than 1 mm long, usually shorter; arctic-alpine, rare..... .....[*H. hamulosum*, reported from Canadian Rocky Mts.]
6. Leaves 1.5 mm long, or often longer..... 7
7. Leaves rounded to the insertion; alar cells plainly differentiated, hyaline, rectangular, or sometimes ± inflated .....*H. pratense*
7. Leaves not rounded to the insertion; differentiated alar cells few, quadrate.....*H. subimponens*
8. Leaf margins revolute to the middle or above, rarely plane or nearly so on one side.....*H. revolutum*
8. Leaf margins plane, or only slightly recurved at the base..... 9
9. Small plants with leaves to about 1 mm long, often shorter; autoicous.....10
9. Plants larger, the leaves more than 1 mm long; dioicous, or capsules unknown.....11
10. Plants in thin mats, stems often stoloniferous; leaves and perichaetial bracts entire or nearly so... .....*H. ravaudii* ssp. *fastigiatum*
10. Stems not stoloniferous; leaves and perichaetial bracts serrate; quadrate alar cells usually numerous .....*H. pallescens*
11. Leaves rounded to the insertion, serrate to serrulate at least at apex; alar region usually with 1–3 quadrate to rectangular cells on the margins, and 1–2 hyaline or colored, slightly inflated, decurrent cells below them .....*H. circinale*
11. Leaves otherwise.....12
12. Plants usually in tufts, the stems erect; alar cells quadrate to rectangular, 3–5 on the margins; basal and alar cells with thick pitted walls, walls of median cells often pitted.....*H. bambergeri*
12. Plants otherwise, the alar cells more numerous, or the cell walls not pitted, or the pits few.....13
13. Leaves ± auriculate at base, alar cells irregular to ± rhomboidal; plants usually regularly pinnate..... .....*H. procerrimum*
13. Leaves never auriculate, alar cells quadrate, numerous, 6–25 on the margins..... 14
14. Median leaf cells 45–75 × 5–7 μ, rarely shorter; alar cells 6–10, rarely to 15 in the marginal row; leaves usually gradually narrowed from base to apex.....*H. cupressiforme*
14. Median leaf cells 18–35 × 6–8 μ, rarely longer; alar cells 12–25 in the marginal row; leaves abruptly acuminate.....*H. vaucheri*

Key 116. RHYTIDIACEAE

1. Stems with numerous branched paraphyllia.....*Rhytidiopsis robusta*
1. Stems without paraphyllia..... 2
2. Leaves rugose, the cells papillose; costa single and strong.....*Rhytidium rugosum*
2. Leaves not rugose, sometimes plicate, the cells papillose or smooth; costa double, short or long, sometimes wanting.....*Rhytidiadelphus*

Key 117. *Rhytidiadelphus*

1. Leaf cells papillose by projecting cell ends; costa double and strong, often to the middle of the leaf..... *R. triquetrus*
1. Leaf cells smooth; costa wanting, or short and double..... 2
   2. Leaves plicate, falcate-secund..... *R. loreus*
   2. Leaves not plicate, plainly squarrose..... *R. squarrosus*

Key 118. *Hylocomium*

1. Costa single, usually to the middle of the leaf; cells not papillose..... *H. pyrenaicum*
1. Costa double, usually short; cells papillose by projecting cell ends; plants usually regularly bipinnate to tripinnate..... *H. splendens*

GLOSSARY

acaulescent, stemless or apparently so (Pl. 80, fig. 8; Pl. 82, fig. 15).

acrocarpous, having the sporophyte terminal on a stem or branch (Pl. 108, fig. 1).

acuminate, tapering gradually to a point, but with the sides somewhat concave (Pl. 148, fig. 2).

acute, with a sharp point, the sides of the point straight or nearly so, making an angle of less than 90° at the tip (Pl. 96, fig. 6; Pl. 135, fig. 2).

aggregate, clustered.

alar (or angular) *cells*, the cells at the basal angles of a leaf (Pl. 18, fig. 3; Pl. 174, fig. 11).

annulus, the ring of cells between the operculum and the mouth of the capsule (Pl. 80, fig. 6; Pl. 82, fig. 13).

antheridium, the male reproductive organ.

apiculate, ending in a short, abrupt point (leaf, Pl. 53, figs. 1–3; capsule, Pl. 17, fig. 12).

apophysis, see *hypophysis*.

appendiculate, of cilia, with short transverse bars (Pl. 94, fig. 13).

appressed, applied rather closely to the stem (Pl. 114, fig. 17).

archegonium, the female reproductive organ.

arcuate, curved or bent like a bow (Pl. 18, fig. 13; Pl. 151, fig. 20).

aristate, ending in a fine, bristle-shaped point.

articulate, jointed; in peristome teeth the joints indicated by the cross bars (Pl. 82, fig. 7).

asexual reproductive structures, see *brood bodies, bulbils, gemmae, propagula*.

asymmetric, without symmetry, with no plane or axis of symmetry (Pl. 136, fig. 2). See also *symmetric*.

attenuate, narrowed, tapered.

auricle, a small lobe at the basal angle of a leaf, sometimes used to refer to the group of alar cells (Pl. 162, fig. 7; Pl. 181, figs. 3, 7).

auriculate, with auricles.

autoicous, having the male and female sex organs on the same plant in separate clusters.

awn, a bristle-like appendage at the tip of a leaf (Pl. 56, fig. 3).

basal membrane, the undivided part of a single peristome, or the undivided part of the endostome of a double peristome (Pl. 50, fig. 14; Pl. 94, fig. 13).

bifarious, growing in two ranks (Pl. 14, fig. 13).

bistratose, consisting of two layers of cells (Pl. 45, fig. 27).

bordered, having a margin of cells distinct in color or otherwise differentiated from the rest of

the leaf (Pl. 13, figs. 14, 18; Pl. 44, figs. 2, 4, 5).

bracts, modified leaves surrounding the reproductive organs. See also *perigonium* and *perichaetium*.

brood body, deciduous vegetative reproductive structure.

bulbil, a small bulb-like body; an asexual reproductive structure, often borne in the leaf axil (Pl. 98, fig. 8).

caducous, falling off.

caespitose, growing in tufts.

calcareous, containing calcium carbonate.

calcicolous, growing on a substratum containing lime.

calyptra, the hood or cap of a moss, formed from the wall of the archegonium (Pl. 6, fig. 17; Pl. 8, fig. 16; Pl. 45, figs. 18, 23; Pl. 120, fig. 4).

campanulate, bell-shaped (Pl. 120, fig. 4).

canaliculate, channeled (Pl. 151, fig. 16).

canescent, gray or hoary.

capsule, the spore-bearing part of the dipolid generation; the urn plus the operculum and the neck, if present.

carinate, keeled like a boat (Pl. 56, fig. 5).

central strand, a specialized group of cells in the center of the stem (Pl. 48, fig. 20; Pl. 116, fig. 15).

cernuous, nodding or slightly drooping (Pl. 10, fig. 4).

cilia, hair-like structures found between the segments of the inner peristome, or on a leaf (peristome, Pl. 94, fig. 13; leaf, Pl. 6, fig. 2; Pl. 85, fig. 3).

circinate, bent or curved to form a complete or incomplete ring (Pl. 154, fig. 13; Pl. 188, fig. 1).

cirrate, curled (Pl. 64, fig. 9).

cladocarpous, having the fruit terminal on a short lateral shoot.

clavate, club-shaped, gradually thickening near one end (Pl. 126, figs. 16, 17).

cleistocarpous, with the capsule opening irregularly, not by an operculum or valves (Pl. 17, fig. 12).

collenchymatous, of cells, having the walls thickened at the angles or corners (Pl. 101, fig. 23; Pl. 103, fig. 16).

columella, the sterile central axis of the capsule surrounded by the spores (Pl. 67, fig. 12).

complanate, flattened or compressed more or less in one plane (Pl. 88, fig. 11; Pl. 133, fig. 1; Pl. 135, fig. 6).

conduplicate, folded together lengthwise (Pl. 127, fig. 13).

conic, resembling a cone (Pl. 13, fig. 19).

convex, having a curved or rounded surface, bulging out (operculum, Pl. 80, fig. 13).

convolute, rolled together (Pl. 20, fig. 8; Pl. 37, fig. 13).

cordate, heart-shaped, with the broadest part at the attachment (Pl. 149, fig. 9; Pl. 165, fig. 2).

cortical cells, the outer layer or layers of stem cells (outer layer large and thin-walled, Pl. 188, fig. 8; outer layers small and thick-walled, Pl. 189, fig. 9).

costa, the midrib of a leaf.

crenate, with rounded teeth on the leaf margin.

crenulate, crenate, the teeth small.

cribrose, perforated like a sieve (Pl. 67, fig. 13).

crisped, curled or twisted (Pl. 34, fig. 11; Pl. 64, fig. 9).

cryptopore, with the guard cells of the stoma immersed below the plane of the epidermal cells (Pl. 123, fig. 8).

cucullate, of a calyptra, hood-shaped and split on one side only; of a leaf, hood-shaped, the apex curved in (Pl. 6, fig. 17; Pl. 9, fig. 6; Pl. 36, fig. 1).

cuneiform, wedge-shaped.

cuspidate, with a stiff, acute point.

cuticle, a thin or sometimes thick layer of material covering the outer cells of a leaf or capsule.

cygneous, with the seta curved downward like a swan's neck (Pl. 18, fig. 13; Pl. 64, fig. 8).

deciduous, falling off, not persistent.

decurrent, with the leaf base extending down the stem beyond the main part of the insertion, forming ridges or wings on each side (Pl. 159, figs. 9, 10; Pl. 183, figs. 2, 3).

dehiscent, splitting into definite parts.

deltoid, triangular (Pl. 164, fig. 8).

dendroid, with an erect branching stem, resembling a small tree (Pl. 129, fig. 1; Pl. 130, fig. 7).

dentate, with sharp teeth pointing outward.

denticulate, finely dentate.

dimorphic or *dimorphous*, occurring in two forms (Pl. 136, figs. 1–4).

dioicous, with the male and female sex organs borne on different plants.

discoid, like a disc or plate (Pl. 101, fig. 9; Pl. 103, fig. 6).

distichous, in two opposite rows on the stem (leaves, Pl. 14, fig. 13).

dorsal, the back or abaxial side of a leaf; the upper side of a prostrate stem or branch.

dwarf male, a small male gametophyte borne on rhizoids, stem, or leaves of female plant (Pl. 32, fig. 5; Pl. 169, fig. 11; Pl. 171, fig. 20).

ecostate, without a midrib.

ellipsoid, a solid outlined by an ellipse revolving on its long axis.

elliptic, oval in outline, narrowed to the rounded ends and widest at or near the middle.

emarginate, with a notch at the end.

emergent, half-uncovered; having the capsule extending slightly above the perichaetium (Pl. 119, fig. 1).

endemic, confined to a given geographic area.

endostome, the inner circle of teeth of a double peristome, when fully developed consisting of a basal membrane, segments, and cilia (Pl. 94, fig. 13).

entire, not toothed.

eperistomate, without a peristome.

epiphragm, the membrane which closes the mouth of the capsule (Pl. 6, fig. 8; Pl. 10, fig. 4).

equitant, with the lower part of the leaf folded and standing astride the stem and often the base of the next leaf above (Pl. 11, figs. 1, 2).

excurrent, with the costa extending beyond the leaf apex (Pl. 47, fig. 11).

exostome, the outer circle of teeth of a double peristome, usually consisting of 16 teeth.

exothecial cells, the epidermal cells of the capsule wall (Pl. 20, fig. 17; Pl. 83, fig. 16; Pl. 119, fig. 7).

exserted, having the capsule extending beyond the perichaetial bracts.

falcate, curved like a sickle (Pl. 189, figs. 1, 2).

falcate-secund, with each leaf falcate and all the leaves turned to the same side of the stem (Pl. 20, fig. 5).

fascicle, a close bundle.

filiform, filamentous, thread-like, long and slender.

fimbriate, fringed with cilia.

flagellum, a slender, runner-like branch bearing small leaves.

flexuose or *flexuous*, bent backward and forward, wavy (Pl. 46, fig. 18).

foot, the part of the sporophyte at base of seta, buried in the gametophyte and absorbing nutrients from it (Pl. 58, fig. 17).

fugacious, soon perishing.

fuscous, dull brown.

fusiform, spindle-shaped, tapering at each end (Pl. 184, fig. 11).

gametophyte, the haploid generation, consisting of stem, leaves, and rhizoids, and bearing the sex organs (Pl. 36, fig. 8; Pl. 101, fig. 9).

gemma, an asexual reproductive structure, unicellular or multicellular, bud-like, leaf-like, or branch-like (Pl. 2, fig. 26; Pl. 48, fig. 12; Pl. 102, fig. 19; Pl. 125, fig. 19).

gemmiform, bud-like.

geniculate, abruptly bent (Pl. 2, fig. 17).

gibbose or *gibbous*, humpbacked, swollen or enlarged on one side or at the base (Pl. 82, fig. 5; Pl. 148, fig. 13).

glabrous, smooth, without hairs.

glaucous, covered with a bluish or whitish bloom.

gregarious, growing together, associated but not matted.

guard cells, the specialized cells surrounding a stoma (Pl. 119, fig. 7).

guide cells, large parenchyma cells in the midrib, evident in cross section (Pl. 30, fig. 12; Pl. 33, fig. 3).

gymnostomous, without a peristome (Pl. 57, fig. 22; Pl. 129, figs. 6, 23).

habit, the general appearance.

habitat, the kind of environment in which the plant grows.

hair-point, a filamentous, usually hyaline leaf tip (Pl. 50, fig. 10).

heterogeneous, dissimilar.

heteroicous, with more than one form of inflorescence in the same species, with the antheridia and archegonia on the same branch and also on different branches of the same plant.

heteromallous, with leaves spreading in all directions.

hispid, rough with short stiff hairs.

homogeneous, uniform.

homomallous, with leaves turned in one direction but arising from all sides.

hyaline, clear and colorless.

hygroscopic, capable of absorbing water and as a result changing form or direction.

hypnaceous peristome, a perfect peristome with fine horizontal striations on the basal plates between the lamellae of the outer teeth.

hypnoid, like a *Hypnum*.

hypophysis, a swelling at the base of a capsule; a differentiated region at the top of the seta and below the urn proper, often inflated (Pl. 9, fig. 12; Pl. 85, figs. 11, 12).

imbricate, closely overlapping (Pl. 93, fig. 1; Pl. 114, fig. 17; Pl. 136, fig. 7).

immersed, of a capsule, more or less covered by leaves (Pl. 70, fig. 10; Pl. 72, fig. 1); of guard cells of a stoma, sunken below the surface of the epidermal cells (Pl. 123, fig. 8).

inclined, of a capsule, referring to a position between erect and horizontal (Pl. 141, fig. 5); or between horizontal and pendent (Pl. 91, figs. 8, 9).

incrassate, of cells, having thick walls (Pl. 140, fig. 4; Pl. 174, fig. 4).

inflated, swollen (Pl. 148, fig. 12; Pl. 149, fig. 11).

innovation, a branch or fresh shoot from a stem.

involute, having the margins rolled inward (Pl. 52, fig. 9).

isodiametric, of equal dimensions.
julaceous, cylindric, worm-like or catkin-like (Pl. 136, fig. 7; Pl. 175, fig. 10).
keeled, with a longitudinal ridge on the back of an organ, similar to the keel of a boat (Pl. 56, fig. 5).
lacerate, torn or irregularly cleft.
laciniate, cut into narrow lobes (Pl. 73, fig. 19).
lamellae, plates of cells on the surface of a leaf (Pl. 6, fig. 15; Pl. 9, figs. 10, 11); thickened plates on peristome teeth, derived from cell walls (Pl. 116, fig. 6).
lamina, the expanded part of the leaf as distinct from the costa.
lanceolate, longer than broad, tapering to the apex from below the middle, usually widest at about one-third the distance above the base (Pl. 111, fig. 12; Pl. 166, fig. 5).
ligulate, strap-shaped, longer and narrower than lingulate (Pl. 4, fig. 7).
linear, long and narrow with the edges parallel or nearly so (Pl. 114, fig. 1).
lingulate, tongue-shaped (Pl. 55, fig. 1).
lumen, the area bounded by the walls of an organ.
mammilla, a single large swelling or curvature of the unthickened cell wall covering the cell and including an extension or bulge of the cell cavity, thus increasing the size of the lumen.
mammillose, with mammillae (Pl. 45, fig. 27).
mesophytic, growing under medium conditions of moisture.
micron, 1/1000 of a millimeter, represented by the symbol μ.
mitrate, mitre-shaped, or hood-shaped, entire at the base, or more often with two or more clefts (Pl. 82, fig. 16; Pl. 135, fig. 13).
monoicous, having the male and female organs on the same plant.
mucro, a sharp terminal point.
mucronate, with a short straight point (Pl. 39, fig. 10).
muticous, awnless, not pointed.
neck, the region between the seta and the spore-bearing part of the capsule, often containing photosynthetic cells (Pl. 18, fig. 4; Pl. 35, figs. 22, 27).
nodose, knotty or knobby (Pl. 75, fig. 8).
nodulose, somewhat nodose.
obconic, conic, with the attachment at the small end.
oblanceolate, inversely lanceolate, broader above the middle.
oblong, longer than broad, the sides parallel or nearly so (Pl. 47, fig. 1).
obovate, shaped like the longitudinal section of an egg, attached by the narrow end (Pl. 110, figs. 1, 11).
obtuse, blunt, the sides of the apex making an angle of more than 90°.
operculum, the lid of the capsule (Pl. 9, fig. 4; Pl. 61, fig. 20).
orbicular, circular or nearly so (Pl. 136, figs. 8, 9).
oval, broadly elliptic.
ovate, shaped like the longitudinal section of an egg with the broad end basal (Pl. 2, fig. 28; Pl. 106, fig. 2; Pl. 175, fig. 11).
ovoid, a solid that is more or less oval or ovate in outline (Pl. 61, fig. 10).
papillae, small, rounded, acute, or cone-shaped projections or thickenings on the outer wall of a cell (Pl. 113, fig. 14; Pl. 129, fig. 11; Pl. 41, figs. 20, 21).
papillose, with papillae.
paraphyllia, branched or unbranched filaments or leaf-like structures borne on the stem among the leaves (Pl. 129, fig. 2; Pl. 139, fig. 23; Pl. 145, fig. 21).

paraphyses, hair-like or club-shaped structures borne among the antheridia and archegonia.
paroicous, with the archegonia and antheridia in the same cluster but not mixed, the antheridia in the axils of the lower perichaetial bracts (Pl. 102, fig. 10).
pellucid, translucent, partially transparent but not hyaline.
pendent or *pendulous*, hanging down (Pl. 90, figs. 20, 21).
percurrent, with the costa reaching the apex but not extending beyond it (Pl. 104, figs. 13, 14).
perfect peristome, a double peristome, the exostome of 16 articulate teeth, the endostome with a basal membrane, segments, and cilia (Pl. 94, fig. 13).
perichaetium or *perichaetial bracts*, the specialized leaves surrounding the archegonia and later the base of the seta (Pl. 155, fig. 10).
perigonium or *perigonial bracts*, the specialized leaves surrounding the antheridia (Pl. 6, fig. 11; Pl. 24, fig. 9; Pl. 57, fig. 22).
peristomate, with a peristome.
peristome, the fringe of teeth around the mouth of a capsule (Pl. 2, fig. 9; Pl. 72, fig. 1).
persistent, remaining until the part which bears it is wholly mature.
phaneropore, with the guard cells of the stoma in the same plane as the epidermal cells (Pl. 119, fig. 7).
piliferous, with an awn (Pl. 129, fig. 16; Pl. 183, fig. 2).
pinnate, feather-like; with the branches in two rows on opposite sides of the stem, equal in length or nearly so, and in the same plane (Pl. 145, fig. 1; Pl. 171, fig. 13).
pitted, with small openings or depressions in the otherwise thick cell wall (Pl. 31, figs. 4, 5; Pl. 94, fig. 17).
plane, flat.
pleurocarpous, having the archegonia and later the seta and capsule on short side branches and not at the apices of stems or branches (Pl. 171, fig. 13; Pl. 195, fig. 6).
plicate, folded, forming pleats or furrows (Pl. 171, figs. 15, 16; Pl. 78, fig. 14; Pl. 155, figs. 12, 13).
polyoicous, with male and female sex organs sometimes on the same plant, sometimes on separate plants.
pores, perforations or thin spots in cell walls (Pl. 31, figs. 4, 5; Pl. 94, fig. 17).
porose, with pores.
propagulum, a structure capable of reproducing a plant asexually.
protonema, branched filaments or plate-like growths on which the conspicuous part of the moss plant is produced.
pseudomonicous, with very small male plants growing on the female plant (Pl. 32, figs. 4, 5; Pl. 171, fig. 20).
pseudoparaphyllia, structures similar to paraphyllia but limited to places on the stem where branches originate (Pl. 151, fig. 7; Pl. 187, fig. 14).
pseudopodium, a branch of the gametophyte, often leafless, bearing gemmae or a capsule (Pl. 111, fig. 15).
pulvinate, cushion-shaped.
pyriform, pear-shaped (Pl. 97, fig. 1).
quadrate, of cubical cells, appearing square or nearly so in surface view (Pl. 137, fig. 9; Pl. 191, fig. 14).
radially symmetric, having radial symmetry; capable of division by two or more planes forming halves which are mirror images of each other (Pl. 58, fig. 17).
recurved, curved backward or downward (Pl. 47, figs. 13, 14, 23).

reflexed, abruptly bent or turned backward or downward (peristome teeth, Pl. 119, fig. 1).
revoluble, capable of being rolled back, as an annulus.
revolute, rolled back from the margin or the apex (Pl. 23, fig. 5; Pl. 38, fig. 20).
rhizoids, filaments, usually branched, serving for absorption and anchorage (Pl. 32, fig. 6; Pl. 171, fig. 20).
rhomboidal, of cells, quadrilateral in surface view, with the lateral angles obtuse; diamond-shaped (Pl. 44, figs. 28, 29).
rostrate, narrowed to form a long tip or point (Pl. 31, fig. 8; Pl. 143, figs. 4, 8).
rugose, wrinkled (Pl. 193, fig. 14; Pl. 195, fig. 2).
rugulose, somewhat rugose.
rupestral, growing on rock.
secund, turned to one side.
segments, the main divisions of the endostome (Pl. 93, fig. 21; Pl. 94, fig. 13).
serrate, with teeth pointing forward.
serrulate, minutely serrate.
sessile, without a stalk.
seta, the stalk or the part of the sporophyte which bears the capsule.
setaceous, bristle-like (Pl. 21, fig. 8; Pl. 27, figs. 15, 16).
sheathing, more or less surrounding an enclosing the seta or the stem (Pl. 113, fig. 13).
sinuolate, minutely sinuose.
sinuose or *sinuate*, of cell walls, with a wavy margin or outline (Pl. 65, fig. 7; Pl. 74, fig. 5).
spatulate or *spathulate*, with a narrow base, gradually becoming wider to the broad rounded apex (Pl. 48, fig. 8).
spinose, having spines (peristome teeth, Pl. 15, fig. 8; leaf, Pl. 5, fig. 8).
spinulose, with small spines.
sporangium, the inner sac of the capsule containing the spores.
sporophyte, the diploid generation, consisting of capsule, seta, and foot; the part of the plant which produces the spores.
squarrose, having the leaves bent at right angles to the stem (Pl. 112, figs. 16, 17; Pl. 115, fig. 16).
stereid bands, groups of stereid cells.
stereid cells, small thick-walled cells evident in the cross section of the costa in some species (Pl. 30, fig. 7).
stoloniferous, bearing slender prostrate stems or branches with small leaves.
stoma (pl. *stomata*), a pore in the epidermis surrounded by one or two guard cells (Pl. 81, fig. 10; Pl. 119, fig. 7).
striae, parallel lines forming grooves or ridges, either longitudinal or transverse (capsule, Pl. 14, figs. 6, 7; Pl. 65, fig. 12; peristome teeth, Pl. 119, fig. 14).
striate, with striae.
striolate, minutely striate.
struma, a swelling on one side at the base of the capsule (Pl. 22; figs. 22, 23).
strumose, with a struma.
strumulose, with a small struma (Pl. 30, fig. 11).
sub-, under, below, somewhat, an approach to.
subula, a fine sharp point.
subulate, with a subula; awl-shaped, tapering from base to apex (Pl. 17, figs. 1, 14).
symmetric, with radial or bilateral symmetry, capable of division by one or more planes forming similar halves which are mirror images of each other.

synoicous, with the archegonia and antheridia mingled in one cluster.
systylius or *systylous*, having the operculumn attached to the columella (Pl. 44, fig. 30).
terete, cylindric, often tapering, circular in transverse section.
tomentose, covered with hairs or rhizoids.
trabeculate, of peristome teeth, with prominent cross bars.
triquetrous, with three corners or angles (Pl. 128, fig. 9).
truncate, ending abruptly, as if cut off at the end.
tuft, a cluster or clump.
tumid or *turgid*, inflated or swollen.
turbinate, shaped like a top or an inverted cone (Pl. 67, fig. 12).
undulate, wavy, the margins or surface alternately concave and convex (Pl. 31, fig. 14; Pl. 133, figs. 1, 2; Pl. 186, fig. 2).
unistratose, of one layer of cells.
urceolate, of an urn, swolen below and contracted at the mouth (Pl. 101, fig. 22).
urn, the spore-bearing part of the capsule.
ventral, the upper or adaxial side of a leaf; the lower or under side of a prostrate stem or branch.
ventricose, swollen on one side (Pl. 4, fig. 1; Pl. 57, fig. 22; Pl. 63, fig. 16).
whorled, arranged in a circle around an axis.
zygomorphic, bilaterally symmetric, divisible by one plane only, the halves mirror images of each other (Pl. 4, figs. 1, 3; Pl. 97, fig. 18).

INDEX

"It seems remarkable that the present volume, *The Moss Flora of the Pacific Northwest*, should be the first comprehensive treatment of the mosses of any major part of the West Coast of North America, especially in view of the rich and unique bryological flora characteristic of this regions.... Containing very nearly 600 species distributed among 156 genera and 44 families, this is indeed a monumental work. It represents the largest regional moss flora yet to be published in North America."

Dr. William C. Steere, President,
The New York Botanical Garden.