

# Guide to Freely Branched (mostly pleurocarpous) Mosses

Revised through 16 November 2009

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**Reminder:** A dagger (†) indicates that not all of the species within a given genus, or the genus containing a species listed, have the character(s) defining that Group. Abbreviations for the **distribution** of taxa are found at the end of the Concordance.

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## Group P1 - Shoots strongly flattened (complanate) or angular

### Group P1

Shoots **angular** with leaves folded (**conduplicate**); plants **aquatic**, submerged part of year.

Leaves with a **narrow, single** costa; SE

*Brachelyma subulatum*

Leaves **ecostate** (costa lacking); leaves keeled or flat; WS

*Fontinalis*†

Shoots **complanate**.

Leaves with a **narrow, single** costa.

Plants prostrate with **large lateral** leaves and **smaller dorsal** ones; FL

*Racopilum tomentosum*

Plants **without both** large and small leaves.

Leaf tip **rounded-obtuse**, leaves **asymmetric**, upper leaf cells >5:1; WS\*

*Homalia trichomanoides*

Leaf tip **obtuse**, leaves **undulate**, asymmetric; leaf cells 4-7:1; W

*Metaneckera menziesii*

Leaf tip **truncate**, leaves asymmetric, **inflexed** on one side; FL

*Neckeropsis*

Leaf tips **acuminate to acute**.

Leaf margins **coarsely serrate**; leaf tip **not** twisted; W

*Porotrichum*

Leaf margins **distinctly serrulate**, leaf tip **twisted** at apex; E, WA

*Steeerocleus serrulatus*

Leaf margins **entire**, leaf tip **not** twisted, in wet swampy places; WS

*Leptodictyum riparium*†

Leaves with a **long, double** costa ending above leaf middle.

Leaf cells **unipapillose** both surfaces, costa ending near leaf apex; FL, LA

*Callicostella pallida*

Leaf cells **smooth**, costa about 3/4 of leaf length.

Leaves **bordered** with linear cells, leaf tip entire or serrulate; FL, LA

*Cyclodictyon varians*

Leaves **not bordered**, leaf acuminate with sharply serrate margins; FL

*Lepidopilum polytrichoides*

Leaves with a **short double** costa or none; leaves **acute to acuminate**, or apiculate.

Leaf cells **large, lax, hexagonal**, often rhizoids and papillose gemmae on leaf tips; E, N, CA

*Hookeria*

Leaf cells firm- to thick-walled, **rounded to linear**.

Leaves slenderly **long** decurrent; leaf margins **entire**, or serrulate at tip; WS

*Plagiothecium*†

Leaves **shortly** decurrent, undulate or not; on vertical substrates; WS\*

*Neckera*

Leaves **not** decurrent.

Leaves **obtuse, asymmetric** and with a **basal lobe**; MS, TN, NC, VA

*Homaliadelphus sharpii*

Leaves **secund**; very **shiny** plants; margins sharply **serrulate** above; WS

*Brotherella recurvans*

Leaves **straight** or slightly secund at tips.

Rhizoids **axillary** and **papillose**; stem **hyalodermis** well or moderately developed.

Leaves **±serrate** throughout; alar cells **quadrate**; WS\*

*Herzogiella turfacea*†

Leaves **±entire**; alar cells **±undifferentiated**; WS\*

*Isopterygiopsis muelleriana*†

Rhizoids **below** leaf insertions and **smooth**; stem hyalodermis **lacking**.

Leaf apical cells **long**.

Alar cells **enlarged, subquadrate** and **thick-walled**; WS

*Callicladium haldanianum*

Alar cells **quadrate**, but **neither** particularly enlarged **nor** thick-walled.

Leaves **acuminate**; pseudoparaphyllia **filamentous**; E

*Isopterygium tenerum*

Leaves **broadly acute**; pseudoparaphyllia **lacking**; WS

*Entodon*†

Alar cells **±undifferentiated**; pseudoparaphyllia **lacking**; WS

*Pseudotaxiphylum*

Leaf apical cells **short**; pseudoparaphyllia **foliose**; E, SW

*Taxiphylum*†

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**Group P2 – Shoots julaceous (especially when dry) – shoots smoothly cylindrical  
with crowded, overlapping and appressed leaves**

**Group P2**

Leaves with a **narrow, single** costa.

Leaf margins with **cilia**, plant stem and branches with **paraphyllia**; E

*Thelia*

Leaf margins **serrate** and strongly **revolute** to near apex; alar cells **differentiated**; W

*Antitrichia californica*<sup>†</sup>

Leaf margins **serrulate**; leaves **concave-cucullate**; leaf tips **twisted** and apiculate; E

*Bryoandersonia illecebra*

Leaf margins **entire** or slightly serrulate apically; paraphyllia **lacking**.

Median leaf cells **long**.

Branching **±pinnate** and in one **plane**; lawns and disturbed areas; WC, NY

*Pseudoscleropodium purum*

Branching **irregular**; wet soil and rocks; W

*Scleropodium*<sup>†</sup>

Median leaf cells **intermediate**; stems **red**; main stems **not** julaceous; A/A

*Plagiobryum*

Median leaf cells **short**; stems growing **singly** at **right angles** to bark; SE

*Cryphaea*

Leaves with a **short, double** costa or none.

Leaves **serrulate** to **dentate**; cells **prorulose**.

Leaves **acute** to acuminate; alar cells **numerous & strongly** differentiated; WC

*Pterogonium*

Leaves **rounded-obtuse**; alar cells **indistinctly** subquadrate; WS(N)

*Myurella*<sup>†</sup>

Leaves spinulose-**serrate** to serrulate at the **apex**.

Leaves spinulose-**serrate** & **hyaline** above; shoots **julaceous**; cells **papillose**; WS

*Hedwigia*

Leaves with a slightly **serrulate tip**; cells **smooth**.

Shoots curved-**ascending** (dry); alar cells **±undifferentiated**; E

*Leucodon*<sup>†</sup>

Shoots **straight** (dry); alar cells **numerous & quadrate**; E

*Entodon*<sup>†</sup>

Leaves **entire**; plants in very wet places, e.g., shallow water; alar cells **short** and **wide**; WS\*

*Scorpidium*

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**Group P3 – Leaves spreading at right angles (squamose)  
or squarrose-recurved; leaf tips often channeled**

**Group P3**

Stems **red**; plants **±robust** and loosely **ascending**; costa **double** (long or short) or lacking; WS\*

*Rhytidiadelphus*

Stems **green**; plants **±slender** and **creeping**; costa long and **single**, short and **double**, or lacking; WS\*

*Campylium*

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**Group P4– Plants with erect branches from a creeping stem**

**Group P4**

Costa **long** and **single**.

Alar cells **oblong** to **linear** and extending up leaf margin as a **border**.

Leaves **contorted** when dry; leaf cells **smooth**; FL

*Groutiella*

Leaves **involute** when dry, leaf cells often **bulging** and **papillose**; GC

*Macromitrium richardii*

Alar cells **quadrate** to **oblate**.

Branching pinnate to **bipinnate** (frondose); costa **toothed** at back; CA

*Bestia longipes*

Branching **irregular**; costa **not** toothed; alar cells **extending** up leaf margin; E

*Forsstroemia producta*

Alar cells **±undifferentiated**.

Leaves **contorted** when dry; basal cells uniformly **elongate**; CP, SA

*Schlotheimia*

Leaves **channeled** at the costa; margins erect or **incurved** at the apex; E

*Drummondia prorepens*

Leaves often **keeled**, never channeled; margins plane or **reflexed**; SA

*Macrocoma sullivantii*

Costa **double** with 1 long and 1 short branch; leaves **concave** or oblong-ovate; ON

*Neomacounia nitida*

Costa **variable** (single, short and double or lacking within the same plant); on trunks of trees.

Secondary stems **sub-pinnately** branched; brood bodies **lacking**; E

*Forsstroemia trichomitria*

Secondary stems **unbranched**; septate **brood bodies** often present; GC

*Jaegerina scariosa*

**Group P5– Plants with leaves sickle-shaped and  
turned to one side (falcate-secund)**

**Group P5**

Costa **long, single** and narrow.

Paraphyllia **abundant** and **filamentous**; stem leaves deeply plicate, not complanate; WS

*Palustriella*

Paraphyllia **lacking**.

Leaf cells **prorulose**; leaves plicate and **rugose**; WS\*

*Rhytidium rugosum*

Leaf cells **smooth**.

Stems with a **hyalodermis** (thin-walled, hyaline cells on stem surface).

Leaves **plicate** and **denticulate** in upper portion; WS\*

*Sanionia*

Leaves **striolate** (finely ridged) to **plane**, and **entire** to slightly denticulate.

Alar cells **inflated**; plants occurring in **streams** on rocks or wet places; WS

*Hygrohypnum*†

Alar cells **little** differentiated; plants in rich **fens**; N

*Limprichtia*

Stems **lacking** a hyalodermis (thick-walled cells on stem surface).

Plants of **upland** habitats, leaves **plicate**; WS

*Brachythecium*†

Plants of **wet** habitats, leaves **not** plicate.

Leaves **keeled, 3-ranked**; WS\*

*Dichelyma*

Leaves **neither** keeled **nor** 3-ranked.

Costa **excurrent**; alar cells abruptly inflated or undifferentiated; WS\*

*Drepanocladus*†

Costa **subpercurrent**; plants in **fens** and **seeps**.

Leaf margins finely **denticulate**; WS\*

*Warnstorfia*

Leaf margins **entire**.

Central **strand** (small cells) in stem; WS\*

*Drepanocladus*†

Central strand **lacking**; N

*Hamatocaulis*

Costa **shorter** than above; alar cells **few** and **thick-walled**; N

*Loeskypnum badium*†

Costa **short** and **double**, or none.

Arms of double costa **not** joined at base; AK

*Gollania turgens*

Arms of double costa **meeting** at the base, or **none**.

Shoots in **flat**, evenly **pinnate, feather-like, fronds**; plants **large**; WS\*

*Ptilium crista-castrensis*

Shoots **loosely complanate**; plants **very shiny**; leaves **very serrulate** above; E, NW

*Brotherella recurvans*

Shoots **julaceous**; found in wet places (often submerged); WS\*

*Scorpidium scorpioides*

Shoots **falcate-secund** when **dry**, erect when moist; on trees; WS\*

*Pylaisiella*

Shoots with many **brood bodies** at tips; usually on trees; WS\*

*Platygyrium*

Shoots **lacking** the above unique characters.

Leaves **rugose**; stems with **paraphyllia**; NW

*Rhytidiopsis robusta*

Leaves **plane**.

Leaf cells **prorulose**; leaves crowded & **spreading**; alar cells **subquadrate**; E, AK, BC

*Ctenidium*

Leaf cells **smooth**.

Alar cells abruptly inflated as "**bubble**" cells; leaves merely **homomallous**; E

*Sematophyllum*

Alar cells in **several** rows and **thick-walled**; leaves **serrate** above; SE

*Heterophyllum affine*

Alar cells in **1-2** rows with **2-3** cells inflated; leaves **±serrulate**; E

*Pylaisiadelphina tenuirostris*

Alar cells in **triangular** patches; leaves **±entire**.

Plants on **wet rocks** in mountain streams; branching **±irregular**; WS

*Hygrohypnum*†

Plants of **mesic** to wet habitats; branching regularly **pinnate**; WS

*Hypnum*

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**Group P6 – Plants with paraphyllia or tomentum on stem.**

	<b>Group P6</b> <i>Tomentypnum</i>
Stems with <b>tomentum</b> , calciphile in fens, swamps; WS*	
Stems with <b>paraphyllia</b> .	
Leaves with a <b>short, double</b> costa or none; plants irregularly pinnate.	
Leaves <b>rugose</b> and <b>falcate-secund</b> ; NW, WA, OR	<i>Rhytidiopsis robusta</i>
Leaves <b>smooth</b> , straight and <b>imbricate</b> when dry; WC	<i>Alsia californica</i>
Leaves with a <b>long, double</b> costa.	
Plants <b>2-3</b> -pinnate with <b>stepwise</b> flat fronds; upper leaf cells <b>prorulose</b> ; WS*	<i>Hylocomium splendens</i>
Plants <b>irregularly</b> to <b>1-2</b> -pinnate; cells smooth or prorulose.	
Leaves <b>spinulose</b> -serrate all around; NE, N	<i>Hylocomiastrum umbratum</i>
Leaves <b>serrate</b> in upper half; stem leaves <b>rugose</b> at acumen base; E	<i>Loeskeobryum brevirostre</i>
Leaves with a <b>long, narrow</b> costa.	
Plants <b>dendroid</b> ; upper leaf cells <b>short</b> (2-5:1).	
Plants <b>little</b> altered dry; leaf margins strongly serrate in <b>upper half</b> ; on rich soil; E	<i>Climacium</i>
Plants <b>curled</b> dry, leaf margins serrate at <b>tip</b> ; on trees primarily; NW, ID	<i>Dendroalsia abietina</i>
Plants <b>irregular pinnate</b> ; cells <b>linear</b> (> 8:1); margins <b>spinulose</b> ; NE, N	<i>Hylocomiastrum pyrenaicum</i>
Plants <b>complanate</b> ; stem leaves <b>undulate</b> ; W	<i>Metaneckera menziesii</i>
Plants <b>lacking</b> the above unique characters.	
Alar cells <b>inflated</b> in well marked groups.	
Stem leaves deeply <b>plicate</b> ; paraphyllia <b>filamentous</b> and abundant; soil and rocks; WS	<i>Palustriella</i>
Stem leaves <b>plane</b> ; paraphyllia <b>foliose</b> and few to many; wet areas; WS*	<i>Cratoneuron</i>
Alar cells mostly <b>not</b> differentiated, if so, <b>not</b> inflated.	

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Paraphyllia <b>papillose</b> .	
Plants <b>small</b> ; stem leaves <b>&lt;0.6mm</b> ; leaf cells minutely <b>pleuripapillose</b> .	
Leaf cells pleuripapillose <b>both sides</b> of leaf; E	<i>Cyrto-hypnum</i>
Leaf cells pleuripapillose <b>back side</b> of leaf only; E, AZ	<i>Raiiella</i>
Plants <b>larger</b> ; stem leaves <b>1-1.9mm</b> ; branch leaf cells mostly <b>unipapillose</b> .	
Plants <b>1-pinnate</b> , suberect and wiry; WS	<i>Abietinella abietina</i>
Plants <b>2-3-pinnate</b> , mostly spreading and softer; E, NW	<i>Thuidium</i>
Paraphyllia <b>smooth</b> .	
Leaf cells with either <b>forked</b> , or <b>elongate</b> and <b>curved</b> papillae; leaves <b>ovate</b> ; E	<i>Thelia</i>
Leaf cells either <b>prorulose</b> or with <b>short</b> and <b>simple</b> papillae; leaves <b>±lanceolate</b> .	
Stem and branch leaves somewhat <b>differentiated</b> ; 1-pinnate; E, AZ	<i>Bryohaplocladium</i>
Stem and branch leaves <b>uniform</b> .	
Leaf cells <b>elongate, oblong-rhombic</b> to oblong-linear.	
Paraphyllia linear- <b>lanceolate</b> and numerous.	
Capsules <b>inclined, asymmetric</b> ; W	<i>Pseudoleskea</i>
Capsules <b>erect, symmetric</b> ; SW, CO, UT	<i>Lescuraea</i>
Paraphyllia <b>filiform</b> and abundant; capsules inclined to horizontal and curved; WS*	<i>Helodium</i>
Leaf cells <b>short</b> (isodiametric or nearly so, hexagonal to short-rhombic); W	<i>Pseudoleskea</i>

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**Group P7 – Plants with red stems**

**Group P7**

Costa **long** and **double**.

Stems with **paraphyllia**.

Plants **dendroid** (tree-like) on soil in wet, shady places; E

Plants **2-3**-pinnate with **stepwise** flat fronds; upper leaf cells **prorulose**; WS\*

Plants **irregularly** branched; stem leaves **rugose** at acumen base; E

Stems **without** paraphyllia and irregularly branched; WS\*

*Climacium**Hylocomium splendens**Loeskeobryum brevirostre**Rhytidiadelphus*

Costa **long** and **single**.

Leaf margins **±revolute** throughout; alar cells **oval** to transversely **elongate**; W, NL

Leaf margins **plane**; alar cells **±undifferentiated**; A/A

*Antitrichia**Plagiobryum*

Costa **short** and **double** costa or none.

Leaves distinctly **falcate-secund**; WS

Leaves squarrose to **squarrose-recurved**; WS\*

Leaves **straight**.

Leaves with a **hyaline** tip; shoots **whitish** and **±julaceous** when dry; cells **papillose**; WS

Leaves with a **green** tip; leaf cells **smooth**.

Alar cells **inflated**, **hyaline** and **thin**-walled in distinct **auricles**; WS (N)

Alar cells **short**-oblong with **thick orange** walls; WS

*Hypnum**Rhytidiadelphus**Hedwigia ciliata**Calliergonella cuspidata**Pleurozium schreberi*


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**Group P8 – Plants with shoots flat on top and appearing “braided”**

**Group P8**

Costa **single** and **narrow**; pseudoparaphyllia present.

Cells **prorulose** on leaf back; regularly 1-pinnate; leaves serrulate **all around**; E, AK, BC

Cells **smooth**; closely 1-pinnate in **feather-like** fronds; leaf **tips** serrulate; WS\*

*Ctenidium**Ptilium crista-castrensis*

Costa **short** and **double**, or none; pseudoparaphyllia usually present.

Alar cells in **transverse rows** and inflated; leaves **sharply serrulate** above; E, BC, WA

Alar cells in **triangular areas**, inflated or not; leaves entire to serrulate; WS

*Brotherella**Hypnum*<sup>†</sup>


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**Group P9 – Leaves undulate or rugose (irregular undulations)**

**Group P9**

Leaves with a **narrow**, **single** costa.

Leaves **undulate** and **asymmetric**; shoots **complanate**; **paraphyllia** on stems; W

Leaves **rugose**; shoots **round**; paraphyllia **lacking**.

Leaf cells **prorulose**; WS\*

Leaf cells **smooth**; leaves stoutly **apiculate**; CP, SA

*Metaneckera menziesii**Rhytidium rugosum**Schlotheimia rugifolia*<sup>†</sup>

Leaves with a **short**, **double** costa or none.

Plants **julaceous** and growing in wet (submerged) areas; WS

Plants **not** julaceous and growing in dryer areas.

Leaves **complanate** and **undulate**; on rocks or trees; WS\*

Leaves **plicate** below, **rugose** above; on soil; NW

*Scorpidium scorpioides**Neckera*<sup>†</sup>*Rhytidiopsis robusta*


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**Group P10 – Leaves dimorphic (two forms on the same axis)**

**Group P10**

Smaller leaves (amphigastria) on the **ventral** (lower) side of stem in a **single** row; FL, BC, AK

Smaller leaves on the **dorsal** (upper) side of the stem in **double** rows; FL

*Hypopterygium**Racopilum*

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**Group P11 – Leaves with awns, hair-points or hyaline apices**

**Group P11**

Leaves with a **narrow, single** costa.

Leaf cells **papillose**; creeping on tree bark or rock; W, AK  
 Leaf cells **smooth**.

*Claopodium*<sup>†</sup>

Cell walls **nodulose** (wavy) throughout; WS

*Racomitrium*<sup>†</sup>

Cell walls **straight**.

Leaf apex **flat, filiform** and **serrate**; leaves **abruptly** acuminate; N\* (S to NC)

*Cirriphyllum*

Leaf apex a **long, flexuose** tip, leaves **concave** and **shiny**; **pendulous**; FL

*Zelometeorium patulum*

Leaves with a **short, double** costa or none; apex **hyaline** or abruptly contracted to long **setaceous** point.

Leaf cells **papillose**; leaf apex **hyaline**.

Leaf cells **unipapillose** on both sides; NW

*Pseudobraunia californica*

Leaf cells with **1** or **more**, simple to **forked** papillae; WS

*Hedwigia ciliata*

Leaf cells with **many, low, rounded** papillae and very **thick** walls; AZ, TX

*Braunia secunda*

Leaf cells **smooth**, leaf apex hyaline or yellow.

Leaf apex **yellow**; alar cells **inflated** and **hyaline**; BC

*Wijkia carlottae*

Leaf apex **hyaline**; alar cells **undifferentiated**; leaves appressed; AK, NW

*Iwatsukiella leucotricha*


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**Group P12 – Plants thread-like (leaves <1mm)**

**Group P12**

Leaves to **1 mm**; costa **variable**; cells **rounded-elliptic**; pseudoparaphyllia **lanceolate**; N,W

*Pseudoleskeella*

Leaves **0.5-0.8 mm**; costa none or **short** and **double**; cells **rhombic**; paraphyllia **few**; WS\*

*Homomallium*

Leaves **0.15-0.5 mm**; costa none or **short** and **double**; cells **rhombic**; paraphyllia **none**; WS

*Platydictya*


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**Group P13 – Costa double and more than 1/3 leaf length**

**Group P13**

*Note: see Group 20 also for several of these mosses where costa form is variable within a single plant.*

Costa **>2/3** the leaf length with branches of  $\pm$ equal length.

Leaf cells **unipapillose** on both surfaces; FL, LA

*Callicostella pallida*

Leaf cells **smooth**; plants in flat **mats**; secondary stems **prostrate**.

Marginal cells **linear** in a **single** row; costa ends **near** apex; FL, LA

*Cyclodictyon varians*

Marginal cells **little differentiated**; costa  $\sim$ **2/3** of leaf length; LA, MS

*Trachyxiphium heteroicum*

Costa **1/3-2/3** the leaf length with branches of  $\pm$ equal length.

Leaf cells **prorulose**.

Stems **red**.

Plants **regularly 2-3**-pinnate with **stepwise** flat fronds; WS\*

*Hylocomium splendens*

Plants **irregularly** branched; leaves **plicate** with broad flat tip; WS\*

*Rhytidadelphus triquetrus*<sup>†</sup>

Stems **green**; plants **loosely** pinnate; leaves **decurrent**; costa **variable**; WS(N)

*Heterocladium dimorphum*<sup>†</sup>

Leaf cells **smooth**.

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*P13 Continued from above*

Leaf cells **smooth**.

Paraphyllia **abundant**; leaf **serrate** in upper half; leaves **not** decurrent; E *Loeskeobryum brevirostre*

Paraphyllia often **few** and **inconspicuous**; leaves **decurrent** and **dimorphic**; W *Heterocladium procurrens*†

Paraphyllia **lacking**.

Leaves **spinulose-serrate** all around and **decurrent**; NE, N *Hylocomiastrum umbratum*†

Leaves **serrate** above; secondary stems **erect-ascending**; FL *Lepidopilum polytrichoides*

Leaves **entire** to somewhat serrulate; costa often **variable**.

Leaves slenderly long **decurrent**; costa branches often **unequal**; WS *Plagiothecium*†

Leaves **not** distinctly decurrent.

Alar cells **subquadrate** and slightly **porose**; in rich, open **fens**; N *Pseudocalliergon turgescens*

Alar cells **quadrate** or **inflated**; on rocks in **mountain streams**; WS *Hygrohypnum*†

Alar cells **thick walled, porose**; plants **irregularly** branched; AK *Rhytidiadelphus japonicus*†

*Group P14 – Costa single and narrow; leaves with distinct decurrencies***Group P14**

Leaf cells **pleuripapillose**; decurrencies broad to **auriculate**.

Costa **±subpercurrent**; leaf margins **crenulate** from projecting papillae; N\* *Anomodon*†

Costa to **mid-leaf** (forked/shorter); leaf margins **serrulate**; leaves **dimorphic**; W,SE *Heterocladium macounii*†

Leaf cells distinctly **prorulose**; E *Bryhnia*

Leaf cells **smooth** or indistinctly ornamented.

Plants large and **dendroid**; leaf tips **rounded** and sometimes apiculate; NW *Pleuroziopsis ruthenica*

Plants **arching** and **±regularly pinnate**; leaf apical cells **shorter** than medial cells; W *Eurhynchium*†

Plants **neither** dendroid, arching-pinnate, **nor** complanate; apical cells **similar** in size to medial cells.

Leaves **minutely prorulose** with **twisted** apices; cells **3-4:1**; E *Bryhnia novae-angliae*

Leaves **smooth** with plane or twisted apices; cells mostly **>4:1**; WS *Brachythecium*†

*Group P15 – Costa single and narrow; leaves with a distinct marginal border***Group P15**

Leaves bordered with **cilia**.

Cilia from leaf base **to apex**; paraphyllia **polymorphous** and few to abundant; E *Thelia*

Cilia at leaf **base only**; paraphyllia **filiform** and abundant; WS\* *Helodium blandowii*†

Leaves bordered with **linear** cells.

Leaf margins **serrulate** to **serrate**.

Shoots **angular**; leaves **conduplicate**; plants **submerged** part of year; SE *Brachelyma subulatum*

Shoots **round**; leaves **plane** with **multistratose** borders.

Leaves **±lanceolate** and acuminate with **serrate, unistratose** marginal cells; OR *Limbella fryei*

Leaves **±ovate** and acute with **serrulate** marginal cells; E *Platylomella lescurii*

Leaf margins **entire**; on rocks and tree trunks.

Border extends to near leaf **apex**; cells **intermediate** in length; BC *Daltonia splachnoides*

Border extends to near **mid-leaf**; cells **short**; **cladocarpous**; FL *Groutiella*

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**Group P16 – Costa single and narrow; leaves with distinct alar cells**

**Group P16**

Alar cells **inflated** and **hyaline**, or **yellow**.

Paraphyllia **present**.

Stem leaves **plicate**; paraphyllia **filamentous** and **abundant**; WS

*Palustriella*

Stem leaves **plane**; paraphyllia **foliose** and either abundant or few; WS\*

*Cratoneuron*

Paraphyllia **lacking**.

Leaves broadly **rounded** at tip.

Leaves with an **apiculus**; plants **reddish**; A/A

*Sarmenthyllum sarmentosum*

Leaves **without** an apiculus; alar cells thin-walled; in fens and swamps; N

*Calliergon*

Leaves **acuminate** or bluntly **acute**.

Leaves **falcate-second**.

In **fens** or other nutrient rich waters.

Alar cells **numerous** in **large** conspicuous groups; WS\*

*Drepanocladus*

Alar cells **few** in **triangular** areas, rectangular and slightly inflated; N

*Loeskyllum*

On **rocks** in or along **streams**; alar cells **subquadrate** to **oblong**; WS

*Hygrohypnum*

Leaves **straight**.

Leaves narrowed to long, **channeled acumen**; WS\*

*Campyllum polygamum*

Leaves ovate-lanceolate and **narrowed** to an **acumen**; WS\*

*Drepanocladus aduncus* var. *kneiffii*

Leaves **acuminate**; alar cells often in broad **decurrencies**; WS

*Brachythecium*<sup>†</sup>

Alar cells **small** and **subquadrate**.

Leaves ±broadly **oblong-ovate**.

Shoots ±**julaceous**.

Leaves abruptly **apiculate**; plants **erect**; in **lawns** and gardens; WC, NY

*Pseudoscleropodium purum*

Leaves **rounded** to acute; plants **prostrate**; on **rocks** in or along **streams**; WS

*Hygrohypnum*

Shoots ±**complanate**; costa **stout**; large **patch** of alar cells; SC, GC

*Stereophyllum radiculosum*

Shoots **neither** julaceous **nor** complanate; **creeping** stems and erect branches; E

*Forsstroemia producta*<sup>†</sup>

Leaves **ovate** to **ovate-lanceolate**.

Leaf margins **serrate** above.

Branching pinnate to **bipinnate** (frondose); medial cells <**2:1** (±isodiametric); CA

*Bestia longipes*

Branching **irregular** to sub-pinnate; medial cells >**2:1**; WS(WC & SA)

*Isothecium*

Leaf margins **entire** to serrulate.

Leaf cells distinctly **papillose**; leaf acumen **pale**; WS(E)

*Lindbergia brachyptera*<sup>†</sup>

Leaf cells ±**smooth**; leaf apices **green**.

Shoots ±**julaceous** (dry); costa **stout**; exostome teeth **lanceolate**; TX, NM

*Lindbergia mexicana*<sup>†</sup>

Shoots **not** julaceous; costa **slender**; exostome teeth **fragmentary**; SE

*Clasmatodon parvulus*

Leaves ±**lanceolate**; shoots **not** julaceous; plants **prostrate**.

Leaves on ±**complanate** shoot; costa **stout**; large **patch** of alar cells; SC, GC

*Stereophyllum leucostegum*

Leaves **plicate** and coarsely **serrate**; upper leaf cells **thick**-walled; SA, TX

*Palamocladium leskeoides*

Leaves narrowed to long, **channeled acumen** and ±**squarrose-recurved**; WS\*

*Campyllum*<sup>†</sup>

Leaves and cells **lacking** any of the above unique characters.

Alar cells **asymmetrically** grouped (more on one side of costa.); FL

*Entodontopsis leucostega*

Alar cells **symmetrically** arranged; WS

*Brachythecium*<sup>†</sup>

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**Group P17 – Costa short and double, or none; leaves with distinct decurrencies**

**Group P17**

Leaf cells 1-4 <b>papillose</b> ; costa <b>variable</b> , usually single/forked; leaves <b>dimorphic</b> ; W, SE	<i>Heterocladium macounii</i> †
Leaf cells <b>smooth</b> ; costa short and double, or about 1/2 leaf length	
Leaf margins serrulate to <b>serrate</b> all around; alar cells abruptly <b>inflated</b> ; WS*	<i>Herzogiella striatella</i> †
Leaf margins <b>entire</b> or with serrulate tips.	
Alar cells abruptly <b>inflated</b> ; WS*	<i>Herzogiella adscendens</i> †
Alar cells <b>poorly</b> differentiated; WS	<i>Plagiothecium</i>

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**Group P18 – Costa short and double, or none; leaves with a distinct marginal border**

**Group P18**

Leaves bordered with <b>cilia</b> ; paraphyllia few to abundant (costa usually single); E	<i>Thelia</i>
Leaves bordered with <b>linear</b> cells from base to mid-leaf; margins entire; on rocks or trees; FL	<i>Groutiella</i>

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**Group P19 – Costa short and double, or none; leaves with distinct alar cells**

**Group P19**

Alar cells <b>inflated</b> , and <b>hyaline</b> or <b>yellow</b> .	
Leaves distinctly <b>falcate-secund</b> .	
Plants <b>regularly</b> pinnate, feather like; <b>flat</b> oblong, <b>triangular</b> fronds; WS*	<i>Ptilium crista-castrensis</i>
Plants <b>irregularly</b> pinnate to unbranched.	
Plants in <b>calcareous</b> wet areas; leaves concave and apiculate; WS*	<i>Scorpidium scorpioides</i>
Plants <b>on rocks</b> in mountain <b>streams</b> or wet places; leaves ovate and concave; WS	<i>Hygrohypnum</i>
Plants in <b>other</b> habitats.	
Stems with a <b>hyalodermis</b> ; alar cells in large, almost decurrent areas; WS	<i>Hypnum</i>
Stems <b>lacking</b> a hyalodermis; leaf apices serrate to serrulate.	
Alar cells <b>subquadrate</b> and in <b>±triangular</b> group; apices <b>serrate</b> ; SE	<i>Heterophyllum</i>
Alar cells <b>oblong</b> and in <b>±triangular</b> group; apices <b>serrulate</b> ; E, NW	<i>Brotherella</i>
Alar cells <b>oblong</b> and in <b>rows</b> 1(-2) cells wide; apices <b>±entire</b> ; E	<i>Pylaisiadelpha tenuirostris</i>
Leaves <b>homomallous</b> ; alar cells abruptly and strongly inflated as " <b>bubble</b> " cells; E	<i>Sematophyllum</i>
Leaves <b>neither</b> falcate-secund <b>nor</b> homomallous.	
Stem leaves contracted to a long, yellow, <b>setaceous point</b> ; BC	<i>Wijkia carlottae</i>
Stem leaves <b>without</b> a setaceous point, acute, acuminate or apiculate.	
Leaves <b>squarrose-recurved</b> ; alar cells oblong and <b>±inflated</b> ; WS*	<i>Rhytidiadelphus squarrosus</i> †
Leaves <b>erect</b> to <b>spreading</b> ; alar cells hyaline.	
Plants <b>erect</b> ; stems with a <b>hyalodermis</b> ; alar cells in <b>auricles</b> ; WS	<i>Calliergonella cuspidata</i>
Plants <b>prostrate</b> ; alar cells <b>not</b> in auricles.	
Cells at leaf insertion <b>enlarged</b> in 1 or 2 <b>distinctive rows</b> .	
Alar cells <b>rounded</b> to the insertion; on rotten logs; FL	<i>Acroporium smallii</i>
Alar cells <b>not</b> rounded to the insertion.	
Alar cells <b>strongly</b> inflated as " <b>bubble</b> " cells; setae ~3 <b>cm</b> ; E	<i>Sematophyllum</i>
Alar cells <b>somewhat</b> inflated; setae ~3 <b>mm</b> ; epiphytic; FL	<i>Donnellia commutata</i>
Cells at leaf insertion <b>not</b> in a distinctive row; leaves <b>&gt;1mm</b> .	
Leaves <b>serrulate</b> throughout and <b>decurrent</b> ; alar cells <b>thin</b> -walled; WS*	<i>Herzogiella</i>
Leaves <b>entire</b> , <b>not</b> decurrent; alar cells <b>thick</b> -walled; WS	<i>Callicladium haldanianum</i>
Alar cells <b>quadrate</b> to <b>short</b> oblong.	

*Continued below at left margin*

## P19 Continued from above

Alar cells **quadrate** to **short** oblong.

Leaves distinctly **falcate-secund**; leaf cells **smooth**.

Plants with clusters of axillary **brood branchlets** at tips of erect branches; WS\*

*Platygyrium*

Plants **without** brood bodies.

Leaves **ovate** and **concave**; plants of wet places and in mountain streams; WS

*Hygrohypnum*

Leaves **lacking** any of the above unique characters.

Costa to ca. **1/3** the leaf length with the 2 branches **separate** at the base; AK

*Gollania turgens*

Costa **shorter** with branches **joining** at the base; pseudoparaphyllia common; WS

*Hypnum*

Leaves **straight**.

Leaves **wide-spreading** to squarrose-recurved and with a long, **channeled acumen**; WS\*

*Campylium*<sup>†</sup>

Leaves **flattened** into one plane, i.e., shoots **complanate**.

Leaves serrulate **throughout**; stem **hyalodermis** present; WS\*

*Herzogiella turfacea*

Leaves serrulate in **upper half**; stem hyalodermis **lacking**; E

*Isopterygium tenerum*

Leaves **entire** except at apex; alar cells **numerous**; WS (not WC)

*Entodon*

Leaves **±concave** and **imbricate**, i.e., shoots **±julaceous**.

Stems **red**; leaf apical cells **undifferentiated**; alar cell walls **thick** and **orange**; WS *Pleurozium schreberi*

Stems **green**; leaf apical cells **short**; alar cell walls **thin** and **colorless**; SE *Taxiphyllum cuspidifolium*<sup>†</sup>

Leaves **lacking** any of the above unique characters.

Branches strongly **curved** when dry; straight when moist.

Leaf cells **>5:1**; **5-20** quadrate alar cells at the **basal angles**; WS\*

*Pylaisiella*

Leaf cells **~3:1**; **numerous** oblate alar cells extending up **leaf margins**; E, AZ

*Leucodon*

Branches **±straight** when dry.

Stems with numerous **paraphyllia**; WC

*Alsia californica*

Stems **without** **paraphyllia**.

Leaves **<1 mm**; minutely **pleuripapillose**; CO, AK

*Leptopterigynandrum austro-alpinum*

Leaves **>1 mm**.

Leaf cells **prorulose**; alar cells **transversely** elongate; WC

*Pterogonium gracile*

Leaf cells **smooth**.

Alar cells extending up the margins for **<1/6** of leaf length.

Leaves **acuminate**.

Stem leaves **serrulate** throughout; WS\*

*Herzogiella seligeri*

Stem leaves **entire** & somewhat decurrent; WC

*Tripterocladium*

Leaves mostly **obtuse** to **acute**; WS (not WC)

*Entodon*

Alar cells extending up margin for **>1/3** leaf length; E

*Forsstroemia trichomitria*<sup>†</sup>

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**Group P20 – Costa of uncommon or variable form**

**Group P20**

Costa of **uncommon** form.

Costa **long, wide** and with lateral **spurs**; leaves with multistratose **streaks**; TX *Donrichardsia macroneuron*

Costa **single** with several minor basal, **supplementary** costae; stems **red**; W, NL *Antitrichia*

Costa **single** with a **forked** tip (Y-shaped); CO, AK *Leptopterigynandrum austro-alpinum*

Costa **variable** on **same plant** (single or double or variations of these in different leaves).

Costa **usually variable** (double, double with a long branch, Y-shaped, single, forked or short and double).

Found on **rocks** or **wet** places in **mountain** streams; WS *Hygrohypnum*

Found on **trees** near coast; plants with many paraphyllia; WC *Alsia californica*

Costa **mostly double** (1/3-2/3 leaf length), but sometimes single or short and double.

Stems loosely **pinnate**; leaves **dimorphic** and **decurrent**; on soil, rock and trees; WS(N) *Heterocladium*

Stems **scarcely** branched; leaves **neither** dimorphic **nor** decurrent; fens; N *Pseudocalliergon turgescens*

Costa **mostly double** with one **long** branch (to 1/3 leaf length) and one **short** branch, but

occasionally **single** or **short** and **double**; ON *Neomacounia nitida*

Costa **mostly single** within the genus or the given species.

Costa rarely to often **forked** (with or without a spine), Y-shaped or with lateral **spurs**.

Plants **large** and  $\pm$ robust; stem leaves typically **>2** mm.

Leaves **serrulate** to near base with **short** and **broad** apical cells; WS *Platyhypnidium riparioides*<sup>†</sup>

Leaves **entire**, broad, concave and with apical cells **similar** to medial cells.

Leaves abruptly **apiculate** (**reflexed**); **weedy** habitats; WC, NY *Pseudoscleropodium purum*

Leaves **rounded** to bluntly acute; plants of **fens** and **swamps**; N *Calliergon*

Plants **medium** in size; stem leaves typically **1-2** mm.

Leaf margins strongly **serrate**; alar cells distinct and **quadrate**; E, WC *Isothecium*

Leaf margins **entire**; costa occasionally Y-shaped; in bogs; WS\* *Drepanocladus simplicissimus*<sup>†</sup>

Plants **small** and **slender**; stem leaves **<1** mm; W, SE *Heterocladium macounii*

Costa occasionally to frequently **short** and **double**.

Leaf margins **ciliate**; E *Thelia*<sup>†</sup>

Leaf margins **serrulate**; leaves **decurrent**; W, SE *Heterocladium macounii*

Leaf margins  $\pm$ **entire**; secondary stems sub-pinnately **branched**; E *Forsstroemia trichomitria*<sup>†</sup>

Costa **mostly short** and **double** within the genus or the given species.

Costa often **double** with **one** or **both** branches to 1/2 leaf length.

Leaves **decurrent**; leaf margins mostly entire; WS *Plagiothecium*

Leaves **not decurrent**.

Leaf margins **serrulate** to **dentate**; branches **terete** (round); E *Myurella siberica*<sup>†</sup>

Leaf margins serrulate **above**; branches **complanate**; E, SW *Taxiphyllum*

Costa occasionally to often **single**.

Plants with **erect** branches from creeping stems; septate **brood bodies**; GC *Jaegerina scariosa*

Plants **thread-like**; leaves to 1 mm; N, W *Pseudoleskeella tectorum*<sup>†</sup>

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*Note: Only the genera in normal type (NOT in brackets) in the Skeleton to Freely Branched Mosses are included in the following Groups.*

*Reminder: Definitions for cell length to breadth ratios are found in the Introduction, the Overview and at the end of this section. An expanded explanation of the difference between "Distinct" and "Indistinct" surface ornamentation is found in the Introduction.*

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**Group P21 – Cells long (>8:1), distinctly papillose or prorulose**

Leaf cells **papillose**; WS\*

**Group P21**  
*Chryso-hypnum diminutivum*

Leaf cells **prorulose**.

Shoots **curved**-ascending (dry); leaves **plicate**, but not decurrent; W, NL

*Homalothecium*<sup>†</sup>

Shoots **straight** (dry); leaves **smooth & decurrent**; E, AK

*Bryhnia*<sup>†</sup>

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**Group P22 – Cells long, smooth or indistinctly ornamented<sup>#</sup>;  
costa single (long and narrow)**

Shoots **curved-ascending** when dry; leaves **plicate**; WS\*

**Group P22**  
*Homalothecium*<sup>†</sup>

Shoots **julaceous**; leaves obtuse or acute; plants in or near streams; W

*Scleropodium*<sup>†</sup>

Shoots **complanate**.

Leaves **serrulate** throughout with **twisted** tips; in **mesic** habitats; WS\*

*Stereocleus serrulatus*

Leaves **entire** and wide **spreading**.

Leaves **crowded**; alar cells **numerous** and **quadrate**; FL

*Stereophyllum leucostegum*<sup>†</sup>

Leaves **distant**; alar cells **few** and short-to-long **rectangular**; WS

*Leptodictyum riparium*<sup>†</sup>

Shoots **triangular**; leaves **keeled**, **3-ranked** and slenderly acuminate; in wet places; WS\*

*Dichelyma*

Shoots **lacking** any of the above unique characteristics.

Plants **large** and **±pinnately** branched; basal cells **porose**.

Shoots **±erect**; leaves deeply **plicate**; W

*Trachybryum megaptilum*

Shoots **prostrate** to arching; leaves **plane**; W

*Eurhynchium*<sup>†</sup>

Plants with **irregular** branching; leaves spreading and lanceolate.

Cells at branch leaf apex much **shorter** than median cells; costa ending in **spine**.

Plants **aquatic** (on rocks in flowing water); branch leaves **1.2 mm** or longer; WS

*Platyhypnidium*

Plants on moist humic **soil**; branch leaves **<1.2 mm**; WS

*Eurhynchium*<sup>†</sup>

Cells at apex **similar** to medial cells; costal spine or tooth present or absent.

Costa **distinct**; brood bodies **lacking**; WS

*Brachythecium*<sup>†</sup>

Costa **indistinct** at mid-leaf; **gemmae** or rhizoids often at back of costa; WS

*Conardia compacta*

Plants **small**, on **tree trunks**; leaves **serrulate** and **±homomallous**; E

*Homalotheciella subcapillata*

<sup>#</sup> Cells with low papillae or short projections.

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**Group P23 – Cells long, smooth or indistinctly ornamented<sup>#</sup>;  
costa double (long or short) or none**

		<b>Group P23</b>
Leaves with a <b>long</b> , double costa; E		<i>Loeskeobryum brevirostre</i>
Leaves with a <b>short</b> , double costa or <b>none</b> .		
Plants <b>aquatic</b> , submerged part of year; cells <b>not</b> porose; leaves keeled or flat; WS		<i>Fontinalis</i>
Plants <b>not aquatic</b> .		
Rhizoids <b>papillose</b> ; stem <b>hyalodermis</b> well or moderately developed.		
Alar cells <b>inflated</b> or <b>quadrate</b> ; leaves <b>±serrate</b> throughout; WS*		<i>Herzogiella</i>
Alar cells <b>±undifferentiated</b> ; leaves <b>entire</b> ; WS*		<i>Isopterygiopsis</i>
Rhizoids <b>smooth</b> ; stem hyalodermis <b>lacking</b> .		
Leaf apical cells <b>shorter</b> than medial cells; pseudoparaphyllia <b>foliose</b> ; E, SW		<i>Taxiphyllum</i>
Leaf apical cells <b>similar</b> to medial cells in length..		
Alar cells <b>quadrate</b> ; pseudoparaphyllia <b>filamentous</b> ; E		<i>Isopterygium</i>
Alar cells <b>±undifferentiated</b> ; pseudoparaphyllia <b>lacking</b> .		
Leaves <b>complanate</b> and <b>serrate</b> above; brood bodies often present; WS	<i>Pseudotaxiphyllum</i>	
Leaves <b>neither</b> complanate <b>nor</b> serrate; cells mostly <b>porose</b> throughout; A/A	<i>Orthothecium</i>	

<sup>#</sup> Cells with low papillae or short projections.

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**Group P24 – Cells intermediate (3-8:1), distinctly papillose or prorulose**

		<b>Group P24</b>
Leaf cells <b>papillose</b> .		
Cells <b>pleuripapillose</b> ; papillae in a <b>single row</b> over the cell lumen.		
Costa <b>single</b> and narrow; papillae <b>simple</b> , on <b>both</b> surfaces of leaves.		
Leaves <b>±ovate</b> , <b>±plicate</b> and from a <b>chordate</b> , <b>±auriculate</b> base; FL, LA.	<i>Papillaria nigrescens</i>	
Leaves narrowly <b>lanceolate</b> and <b>not</b> auriculate; festoons on twigs and branches; GC	<i>Barbella pendula</i>	
Costa <b>lacking</b> ; papillae simple or <b>forked</b> , on <b>upper surface only</b> ; E, SW	<i>Taxithelium planum</i>	
Cells <b>unipapillose</b> ; axillary, filiforme, septate <b>brood bodies</b> often present; FL	<i>Henicodium geniculatum</i>	
Leaf cells <b>prorulose</b> .		
Costa <b>long</b> and <b>single</b> .		
Paraphyllia <b>abundant</b> ; on <b>rocks</b> in mountains; W	<i>Lescurea</i> <sup>†</sup>	
Paraphyllia <b>lacking</b> ; short, axillary, spindle-shaped <b>brood bodies</b> ; FL to LA.	<i>Pirella</i> <sup>†</sup>	
Costa <b>short</b> and <b>double</b> ; plants small and creeping.		
Plants <b>dull</b> ; axillary <b>brood bodies</b> present; cells <b>thick</b> -walled; WS*	<i>Pterigynandrum filiforme</i>	
Plants <b>shiny</b> ; brood bodies <b>lacking</b> ; cells <b>thin</b> -walled; NC, TN	<i>Leptohyemium sharpii</i>	

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**Group P25 – Cells intermediate, smooth or indistinctly ornamented<sup>#</sup>;  
costa single and narrow**

**Group P25**

Leaves **falcate-secund**.

Leaves **keeled, 3-ranked**, slenderly acuminate; plants periodically **submerged**; WS\*

*Dichelyma*

Leaves **plicate**; capsules short and asymmetric; plants of **upland** habitats; WS

*Brachythecium*<sup>†</sup>

Leaves **straight**.

Plants on **tree trunks**.

Plants of **medium** size.

**Short**, axillary, spindle-shaped **brood bodies**; FL to LA.

*Pireella*

**Long**, axillary, filiform brood **branchlets**; FL.

*Pseudocryphaea domingensis*

Plants **small** to very small.

Leaves with **serrulate** margins and long-**acuminate** apices; branches **±julaceous**; WS

*Fabronia*

Leaves with **entire** margins and gradually **acuminate** apices; E

*Anacamptodon splachnoides*

Plants on **soil** in mesic to wet habitats.

Plants with **julaceous** shoots; leaves broadly ovate and concave.

Stems **red**; main stems **not** julaceous; leaf margins **±revolute** throughout; W, NL

*Antitrichia*

Stems **green**; leaf margins **plane** or recurved below.

Median leaf cells **>8:1**; AK

*Myuroclada maximowiczii*

Median leaf cells **<8:1**; W

*Scleropodium*

Plants **not** julaceous.

Leaves broadly **oblong** to ovate, **concave** and with **rounded** to cucullate apices.

Plants **reddish**; stem tips **cuspidate**; leaf tips often **apiculate**; A/A

*Sarmenthypnum sarmentosum*

Plants **green**; stems **±julaceous**; costa often with **spines**; W

*Scleropodium*

Leaves ovate **lanceolate**, **±plane** and with mostly **acuminate** apices.

Apical cells much **shorter** than median cells; costa ending in a **spine**; WS

*Eurhynchium*<sup>†</sup>

Apical cells **similar** to medial cells in length.

Costa **percurrent** to excurrent.

Costa very **wide** (75-140 $\mu$ ); leaf margins **±entire**; WS

*Hygroamblystegium*<sup>†</sup>

Costa **narrow** (<35 $\mu$ ); leaf margins serrulate to **serrate** above; WS

*Brachythecium*<sup>†</sup>

Costa **1/2** to **3/4** leaf length.

Leaf margins **serrulate** above to throughout.

Cells **3-5:1**; capsules **±cylindric** and **yellowish**; WS

*Amblystegium serpens*<sup>†</sup>

Cells **>5:1**; capsules **±oblong-ovoid** and **reddish**; WS

*Brachythecium*<sup>†</sup>

Leaf margins **±entire**.

Leaves **±wide-spreading**; capsules **±cylindric** and **yellowish**; WS

*Leptodictyum*<sup>†</sup>

Leaves **±erect**; capsules **±oblong-ovoid** and **reddish**; WS

*Brachythecium*<sup>†</sup>

Plants **±erect** on forest **litter**, **large** and **pinnately** branched; leaves deeply **plicate**; W

*Trachybryum megaptilum*

<sup>#</sup> Cells with low papillae or short projections.

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**Group P26 – Cells intermediate (3-8:1), smooth or indistinctly ornamented<sup>†</sup>  
costa short and double or none**

**Group P26**

Plants growing in **aquatic** habitats.

Plants **trailing** from a single attachment point in flowing water; leaves keeled or flat; WS

*Fontinalis*

Plants **not** trailing from a single attachment point.

Plants **large** and **sparsely** branched; foliose **pseudoparaphyllia**; in fens; N

*Pseudocalliergon turgescens*

Plants **medium** and **freely** branched; cells lax, **translucent** and **empty** looking; FL

*Vesicularia vesicularis*

Plants growing in **terrestrial** habitats; plants small to medium in size.

Leaves **dimorphic** (stem vs. branch) and **decurrent**; costa **1/3-1/2** leaf length; W

*Heterocladium procurrens<sup>†</sup>*

Leaves **±homomallous**; alar cells abruptly and strongly **inflated**; on rotten logs; FL

*Acroporium smallii*

Leaves of stem **straight**, with a long **setaceous** point; on trees; AK, BC

*Iwatsukiella leucotricha*

Leaves **striate** to **plicate**; leaf cells **porose** throughout; paraphyllia foliose if present; A/A

*Orthothecium*

Leaves **obtuse**, symmetric and **incurved** at base on one side **only**; NC, SC

*Bryocrumia vivecolor*


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**Group P27 – Cells short (<3:1) and distinctly papillose or prorulose**

**Group P27**

Leaf cells **pleuripapillose** (1-5 papillae per cell).

Leaves **fragile** above a short ovate base, appressed (dry) and spreading (wet); E

*Haplohymenium triste*

Leaves **not** fragile.

Cells **nodulose** (wavy) throughout the leaf; WS

*Racomitrium*

Cells **thick-walled** and **porose**; plants coarse and forming large mats; rocks; AZ, TX

*Braunia secunda*

Cells **neither** nodulose **nor** porose.

Leaf margins **papillose-crenulate**; basal, interior cells **pellucid**; E

*Anomodon*

Leaf margins **entire** to **serrulate** throughout; basal, interior cells **not** pellucid.

Stems **papillose**; costa **variable**; W, SE

*Heterocladium macounii<sup>†</sup>*

Stems **smooth**; costa **not** variable; W, AK

*Claopodium*

Leaf cells strictly **unipapillose**.

Leaves **appressed** (dry), **squarrose** (wet), **±lanceolate** & with a **pale acumen**; WS(E)

*Lindbergia brachyptera<sup>†</sup>*

Leaves **not** squarrose (wet).

Costa **long** and **single**.

Leaf margins **serrulate** to **serrate** throughout; costa **pellucid**; W, AK

*Claopodium*

Leaf margins **entire** to subserrulate above; costa **opaque** and often **flexuose** above; E, OR

*Leskea<sup>†</sup>*

Costa **short** and **double** or none; leaf margins dentate to **spinulose-dentate**; E

*Myurella<sup>†</sup>*

Leaf cells **prorulose** at back, especially at upper ends of leaves.

Leaves strongly **dimorphic** (stem and branch leaves dissimilar); WS(N)

*Heterocladium dimorphum<sup>†</sup>*

Leaves **not** dimorphic.

Branches **julaceous**; leaves **rounded-ovate** and **obtuse**; WS(N)

*Myurella julacea<sup>†</sup>*

Branches **terete**; leaves ovate-**lanceolate** and **acuminate**; E

*Schwetschkeopsis fabronia*

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**Group P28 – Cells short (<3:1) and smooth or indistinctly ornamented<sup>#</sup>**

**Group P28**

Costa long and **single**.

Shoots usually with dense **clusters** of axillary brood **branchlets**; often on bark; WS

*Leskeella nervosa*

Shoots **julaceous** when **dry**; leaves wide spreading wet.

Capsules **immersed**; usually on bark; alar cells **transversely oblong**; SE

*Cryphaea ravenelii*<sup>†</sup>

Capsules **exserted**; alar cells **sub-quadrate** and nearly to costa; TX, NM

*Lindbergia mexicana*<sup>†</sup>

Shoots **±complanate**; costa single and **stout**; large **patch** of **quadrate** alar cells; SC, GC

*Stereophyllum*

Shoots **neither** julaceous **nor** complanate.

Leaf apices **rounded-obtuse**; cells oval; calcareous areas on bark, rocks; CO

*Leptodon smithii*

Leaf apices **acute** to **acuminate**.

Leaf cell walls **sinuose** to **nodulose** (wavy edges); WS

*Racomitrium*

Leaf cell walls **straight**.

Upper leaf cells **>2:1**; basal cells at insertion usually **enlarged** and **yellowish**.

Costa **>35μ** at base; yellowish cells usually in **2-3** rows; WS

*Hygroamblystegium tenax*<sup>†</sup>

Costa **<35μ** at base; yellowish cells usually in a **single** row; WS

*Amblystegium varium*<sup>†</sup>

Upper leaf cells **1-2:1**.

Costa **subpercurrent** (>2/3 the leaf length).

Costa strongly **flexuose** above; leaves coarsely **serrate** above; S

*Herpetineuron toccoeae*

Costa stout & **toothed** at back; leaves **serrate** above; shoots **±bipinnate**; CA

*Bestia longipes*

Costa **±straight**; leaves **±entire**; cells **obscurely** papillose; E, OR

*Leskea*<sup>†</sup>

Costa **shorter** (1/3 – 2/3 the leaf length).

Leaf apex **obliquely asymmetric**; periodically **flooded** bark; NW, NB

*Myrinia pulvinata*

Leaf apex **symmetric** and acute to acuminate; **dryer** bark; SE, OH

*Clasmatodon parvulus*

Costa **short** and **double** or none.

Shoot **±julaceous**; leaves **ovate** with an **apiculus**; arctic-alpine; NW

*Myurella tenerrima*<sup>†</sup>

Shoots usually **±complanate**; leaves **±acuminate**; cells **lax** and **translucent**; FL

*Vesicularia vesicularis*

Shoots **neither** julaceous **nor** complanate; stem leaves with a **setaceous** point; NW

*Iwatsukiella leucotricha*

<sup>#</sup> Cells with low papillae or short projections.

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**Cells** = medial, laminal cells; cells ~2/3 of the way from insertion to apex, midway between the costa and the margin.

Length to breadth **ratios** of medial, laminal cells:

**Long** cells: >8:1; commonly termed linear or linear-flexuose.

**Intermediate** cells: 3-8:1; commonly termed elongated, oblong-rhomboidal, fusiform., or elliptical.

**Short** cells: <3:1; commonly termed isodiametric, quadrate, rounded-quadrate, or rhombic.