

NE Sub Guide to Freely Branched (mostly pleurocarpous) Mosses

Revised through 12 January 2009

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.

Group P1 - Shoots strongly flattened (complanate) or angular

	Group P1
Shoots angular with leaves folded (conduplicate); plants aquatic , submerged part of year; WS	<i>Fontinalis</i> †
Shoots complanate .	
Leaves with a narrow, single costa.	
Leaf tip rounded-obtuse , leaves asymmetric , upper leaf cells >5:1; WS*	<i>Homalia trichomanoides</i>
Leaf tips acuminate to acute .	
Leaf margins distinctly serrulate , leaf tip twisted at apex; E, WA	<i>Stereocleus serrulatus</i>
Leaf margins entire , leaf tip not twisted, in wet swampy places; WS	<i>Leptodictyum riparium</i> †
Leaves with a short double costa or none; leaves acute to acuminate , or apiculate.	
Leaf cells large, lax, hexagonal , often rhizoids & papillose gemmae on leaf tips; E, N, CA	<i>Hookeria</i>
Leaf cells firm- to thick-walled, rounded to linear .	
Leaves slenderly long decurrent; leaf margins entire , or serrulate at tip; WS	<i>Plagiothecium</i> †
Leaves shortly decurrent, undulate or not; on vertical substrates; WS*	<i>Neckera</i>
Leaves not decurrent.	
Leaves secund ; very shiny plants; margins sharply serrulate above; WS	<i>Brotherella recurvans</i>
Leaves straight .	
Alar cells inflated , thick-walled; filamentous pseudoparaphyllia; WS	<i>Callicladium haldanianum</i>
Alar cells numerous & quadrate ; no pseudoparaphyllia; WS	<i>Entodon</i> †
Leaves straight or slightly second at tips	
Stem hyalodermis well or moderately developed; rhizoids axillary & papillose .	
Leaves serrate all around; WS*	<i>Herzogiella turfacea</i> †
Leaves upper half entire or serrulate; WS*	<i>Isopterygiopsis muelleriana</i> †
Stem hyalodermis lacking .; rhizoids below leaf insertions & smooth .	
Leaf margins serrulate all around .	
Apical leaf cells shorter than those at mid-leaf; E, SW	<i>Taxiphyllum</i>
Leaf margins entire or serrulate in upper half only.	
Pseudoparaphyllia filiform ; papillose brood bodies rare; E	<i>Isopterygium tenerum</i>
Pseudoparaphyllia lacking ; brood branchlets often present; WS*	<i>Pseudotaxiphyllum</i>

Group P2 – Shoots julaceous – shoots smoothly cylindric with crowded, overlapping & appressed leaves

	Group P2
Leaves with a narrow, single costa.	
Leaf margins with cilia , plant stem and branches with paraphyllia ; E	<i>Thelia</i>
Leaf margins serrulate ; leaves concave-cucullate ; leaf tips twisted & apiculate; E	<i>Bryoandersonia illecebra</i>
Leaf margins entire or slightly serrulate apically; paraphyllia lacking .	
Median leaf cells long .	
Branching ±pinnate & in one plane ; lawns & disturbed areas; WC, NY	<i>Pseudoscleropodium purum</i>
Median leaf cells short ; stems growing singly at right angles to bark; SE	<i>Cryphaea</i>
Leaves with a short, double costa or none.	
Leaves serrulate to dentate ; alar cells indistinctly subquadrate; WS(N)	<i>Myurella</i> †
Leaves spinulose- serrate to serrulate at the apex .	
Leaves spinulose- serrate & hyaline above; shoots julaceous ; cells papillose ; WS	<i>Hedwigia</i>
Leaves with a slightly serrulate tip ; many quadrate alar cells; cells smooth ; WS(E)	<i>Entodon seductrix</i> †

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

Scorpidium

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

Stems **red**; plants **±robust** & loosely **ascending**; costa **double** (long or short) or lacking; WS*
Stems **green**; plants **±slender** & **creeping**; costa long & **single**, short & **double**, or lacking; WS*

Group P3
Rhytidiadelphus
Campylium

Group P4– Plants with erect branches from a creeping stem

Upper leaf cells **short** (1-2:1); costa **single** & **long**;

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

Drummondia prorepens

Upper leaf cells short to **medium** (2-5:1); costa **single**, or **short double**; on trunks of trees; E

Forsstroemia

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

Group P5

Costa **long, single** & **narrow**.

Paraphyllia **abundant** & **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** & **denticulate** in upper portion; WS*

Sanionia

Leaves **striolate** (finely ridged) to **plane**, & **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** & **seeps**.

Leaf margins finely **denticulate**; WS*

Warnstorfia

Leaf margins **entire**.

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

Drepanocladus[†]

Central strand **lacking**; N

Hamatocaulis

Costa **short** & **double**, 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 **complanate**; **brood bodies** often in leaf axils; WS*

Isopterygiopsis

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.

Leaf cells **prorulose**.

Leaves crowded, **spreading** & **secund**; 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 **1-2** rows with **2-3** cells inflated; leaves **±serrulate**; E

Pylaisiadelpha 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

Group P6 – Plants with paraphyllia or tomentum on stem.

	Group P6
Stems with tomentum , calciphile in fens, swamps; WS*	<i>Tomentygium</i>
Stems with paraphyllia .	
Leaves with a short, double costa or none; plants irregularly pinnate; dimorphic ; N, SE	<i>Heterocladium</i> †
Leaves with a long, double costa.	
Plants 2-3-pinnate with stepwise flat fronds; upper leaf cells prorulose ; WS*	<i>Hylocomium splendens</i>
Plants irregularly to 1-2-pinnate ; cells smooth or prorulose.	
Leaves dimorphic (stem & branch leaves differentiated); N, SE	<i>Heterocladium</i> †
Leaves spinulose -serrate all around; NE, N	<i>Hylocomiastrum umbratum</i>
Leaves serrate in upper half; stem leaves rugose at acumen base; E	<i>Loeskeobryum brevirostre</i>
Leaves with a long, narrow costa.	
Plants dendroid ; leaf margins strongly serrate in upper half ; on rich soil; E	<i>Climacium</i>
Plants irregular pinnate ; cells linear (> 8:1); margins spinulose ; NE, N	<i>Hylocomiastrum pyrenaicum</i>
Plants with dimorphic leaves; costa often forked ; N, SE	<i>Heterocladium</i> †
Plants lacking the above unique characters.	
Alar cells inflated in well marked groups.	
Stem leaves deeply plicate ; paraphyllia filamentous & abundant; soil & rocks; WS	<i>Palustriella</i>
Stem leaves plane ; paraphyllia foliose & few to many; wet areas; WS*	<i>Cratoneuron</i>
Alar cells mostly not differentiated, if so, not inflated.	
Paraphyllia papillose .	
Plants small ; stem leaves <0.6mm ; leaf cells minutely pleuripapillose .	
Leaf cells pleuripapillose both sides of leaf; E	<i>Cyrto-hypnum</i>
Leaf cells pleuripapillose back side of leaf only; E, AZ	<i>Rauiella</i>
Plants larger ; stem leaves 1-1.9mm ; branch leaf cells mostly unipapillose .	
Plants 1-pinnate , suberect & wiry; WS	<i>Abietinella abietina</i>
Plants 2-3-pinnate , mostly spreading & softer; E, NW	<i>Thuidium</i>
Paraphyllia smooth .	
Plants with leaf cells with either forked , or elongate & curved papillae; E	<i>Thelia</i>
Plants with leaf cells either prorulose or with short & simple papillae; .	
Stem and branch leaves somewhat differentiated ; 1-pinnate; E, AZ	<i>Bryohaplocladium</i>
Stem and branch leaves uniform .	
Paraphyllia few to none ; capsules erect & symmetric ; E, OR	<i>Leskea</i>
Paraphyllia filiform & abundant; capsules \pm inclined & curved; WS*	<i>Helodium</i>
Plants with sparse or small paraphyllia, sometimes wanting.	
Leaf cells often with single papillae on dorsal surface or smooth; W, AK	<i>Claopodium</i>
Leaf cells with one or two papillae on both surfaces; E, OR	<i>Leskea</i>

Group P7 – Plants with Red Stems
Group P7Costa **long & double**.Stems with **paraphyllia**.Plants **dendroid** (tree-like) on soil in wet, shady places; EPlants **2-3-pinnate** with **stepwise** flat fronds; upper leaf cells **prorulose**; WS*Plants **irregularly** branched; stem leaves **rugose** at acumen base; EStems **without** paraphyllia & irregularly branched; WS**Climacium**Hylocomium splendens**Loeskeobryum brevirostre**Rhytidiadelphus*Costa **short & double** costa or none.Leaves distinctly **falcate-secund**; WSLeaves squarrose to **squarrose-recurved**; WS*Leaves **straight**.*Hypnum**Rhytidiadelphus*Leaves with a **hyaline** tip; shoots **whitish** & **±julaceous** when dry; cells **papillose**; WS*Hedwigia ciliata*Leaves with a **green** tip; leaf cells **smooth**.Alar cells **inflated, hyaline** & **thin**-walled in distinct **auricles**; WS (N)*Calliergonella cuspidata*Alar cells **short**-oblong with **thick orange** walls; WS*Pleurozium schreberi*

Group P8 – Plants with shoots flat on top and appearing “braided”
Group P8Costa **single & narrow**; pseudoparaphyllia present.Cells **prorulose** on leaf back; regularly 1-pinnate; leaves serrulate **all around**; E, AK, BC*Ctenidium*Cells **smooth**; closely 1-pinnate in **feather-like** fronds; leaf **tips** serrulate; WS**Ptilium crista-castrensis*Costa **short & double**, or none; pseudoparaphyllia usually present.Alar cells in **transverse rows** & inflated; leaves **sharply serrulate** above; E, BC, WA*Brotherella*Alar cells in **triangular areas**, inflated or not; leaves entire to serrulate; WS*Hypnum*†

Group P9 – Leaves undulate or rugose (irregular undulations)
Group P9Leaves with a **narrow, single** costa.Leaves **rugose**; shoots **round**; leaf cells **prorulose**; WS**Rhytidium rugosum*Leaves with a **short, double** costa or none.Plants **julaceous** & growing in wet (submerged) areas; WS*Scorpidium scorpioides*Plants **not** julaceous & growing in dryer areas; on rocks or trees; WS**Neckera*†

Group P11 – Leaves with awns, hair-points or hyaline apices
Group P11Leaves with a **narrow, single** costa.Leaf cells **papillose**; creeping on tree bark or rock; W, AK*Claopodium*†Leaf cells **smooth**.Cell walls **nodulose** (wavy) throughout; WS*Racomitrium*†Cell walls **straight**.Leaf apex **flat, filiform** & **serrate**; leaves **abruptly** acuminate; N* (S to NC)*Cirriphyllum*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 with **1 or more**, simple to **forked** papillae; WS*Hedwigia ciliata*

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

Leaves **0.5-0.8mm**; costa none or **short & double**; cells **rhombic**; paraphyllia **few**; WS*
 Leaves **0.15-0.5mm**; costa none or **short & double**; cells **rhombic**; paraphyllia **none**; WS

Group P12
Homomallium
Platydictya

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

Group P13

Note: see Group20 also for several of these mosses where costa form is variable within a single plant.

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*

Rhytidiadelphus triquetrus[†]

Stems **green**; plants **loosely** pinnate; leaves **decurent**; costa **variable**; WS

Heterocladium dimorphum[†]

Leaf cells **smooth**.

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

Loeskeobryum brevirostre

Paraphyllia often **few & inconspicuous**; leaves **decurent & dimorphic**; W

Heterocladium procurrens[†]

Paraphyllia **lacking**.

Leaves **spinulose-serrate** all around & **decurent**; NE, N

Hylocomiastrum umbratum[†]

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

Leaves slenderly long **decurent**; costa branches often **unequal**; WS

Plagiothecium[†]

Leaves **not** distinctly decurrent.

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 & narrow; leaves with distinct decurrencies

Group P14

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

Costa \pm **subpercurrent**; leaf margins **crenulate** from projecting papillae; N*

Anomodon[†]

Costa to **mid**-leaf (forked or shorter); leaf margins **serrulate**; leaves **dimorphic**; W

Heterocladium macounii[†]

Leaf cells **prorulose**; E

Bryhnia

Leaf cells **smooth** or indistinctly ornamented.

Plants **arching & \pm regularly pinnate**; leaf apical cells **shorter** than medial cells; W

Eurhynchium[†]

Plants **complanate**; leaves **squarrose**; costa may be **forked** or **double**; W

Heterocladium procurrens[†]

Plants prostrate, leaves acuminate, alar cells differentiated; cells mostly **>4:1**; WS

Brachythecium[†]

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

Group P15

Leaves bordered with **cilia**.

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

Thelia

Cilia at leaf **base only**; paraphyllia **filiform** & abundant; WS*

Helodium blandowii[†]

Leaves bordered with **linear** cells.

Leaf margins **serrulate** with **multistratose** borders; leaves \pm **ovate** & acute; E

Platylomella lescurii

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

Group P16

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

Paraphyllia **present**.

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

Palustriella

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

Cratoneuron

Paraphyllia **lacking**.

Leaves broadly **rounded** at tip.

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

Sarmenthyphnum 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** groups; WS*

Drepanocladus

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

Hygrohypnum

Leaves **straight**.

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

Campylium polygamum

Leaves ovate-lanceolate & **narrowed** to an **acumen**; WS*

Drepanocladus aduncus var. *kneiffii*

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

Brachythecium[†]

Alar cells **small & subquadrate**.

Leaves ±broadly **oblong-ovate**.

Shoots ±**julaceous**.

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

Pseudoscleropodium purum

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

Hygrohypnum

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

Leaf margins ±**serrate** (teeth **alternating** in size); costa **stout**; cells ±**prorulose**; WS(WC & SA)

Isothecium

Leaf margins **entire** to serrulate; costa **slender**; cells **smooth**; SE

Clasmatodon

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

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

Campylium[†]

Leaves & cells **lacking** any of the above unique characters; WS

Brachythecium[†]

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

Group P17

Leaf cells 1-4 **papillose**; costa **variable**, usually single & forked; leaves **dimorphic**; W

Heterocladium macounii[†]

Leaf cells **prorulose**; costa **variable**, usually ~1/2 leaf length; leaves **dimorphic**; W

Heterocladium dimorphum[†]

Leaf cells **smooth**; costa short & double, or about 1/2 leaf length

Leaf margins serrulate to **serrate** all around; alar cells abruptly **inflated**; WS*

Herzogiella striatella[†]

Leaf margins **entire** or with serrulate tips.

Alar cells abruptly **inflated**; WS*

Herzogiella adscendens[†]

Alar cells **poorly** differentiated; WS

Plagiothecium

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

Group P18

Leaves bordered with **cilia**; paraphyllia few to abundant (costa usually single); E

Thelia

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

Group P19

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

Leaves distinctly **falcate-secund**.

Plants **regularly** pinnate, feather like; **flat** oblong, **triangular** fronds; WS*

Ptilium crista-castrensis

Plants **irregularly** pinnate to unbranched.

Plants in **calcareous** wet areas; leaves concave & apiculate; WS*

Scorpidium scorpioides

Plants **on rocks** in mountain **streams** or wet places; leaves ovate & concave; WS

Hygrohypnum

Plants in **other** habitats.

Stems with a **hyalodermis**; alar cells in large, almost decurrent areas; WS

Hypnum

Stems **lacking** a hyalodermis; leaf apices serrate to serrulate.

Alar cells **subquadrate** & in \pm **triangular** group; apices **serrate**; SE

Heterophyllum

Alar cells **oblong** & in \pm **triangular** group; apices **serrulate**; E, NW

Brotherella

Alar cells **oblong** & in **rows** 1(-2) cells wide; apices \pm **entire**; E

Pylaisiadelpha tenuirostris

Leaves **homomallous**; alar cells abruptly & strongly inflated as "**bubble**" cells; E

Sematophyllum

Leaves **neither** falcate-secund **nor** homomallous.

Stem leaves **without** a setaceous point, acute, acuminate or apiculate.

Leaves **squarrose-recurved**; alar cells oblong & \pm inflated; WS*

Rhytidiadelphus squarrosus[†]

Leaves **erect** to **spreading**; alar cells hyaline.

Plants **erect**; stems with a **hyalodermis**; alar cells in **auricles**; WS

Calliergonella cuspidata

Plants **prostrate**; stems **without** a hyalodermis; alar cells **not** in auricles.

Cells at leaf insertion **inflated** in 1 or 2 **distinctive rows**; E

Sematophyllum

Cells at leaf insertion **not** in a distinctive row; leaves **>1mm**.

Leaves **serrulate** throughout; alar cells **thin**-walled; WS*

Herzogiella[†]

Leaves **entire**; alar cells **thick**-walled; pseudoparaphyllia; WS

Callicladium haldanianum

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

Leaves distinctly **falcate-secund**.

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

Pterogonium gracile

Leaf cells **smooth**.

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

Platygyrium

Plants **without** brood bodies.

Leaves **obtuse-apiculate**; pinnately branched; **reddish** stems; WS

Pleurozium schreberi

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

Hygrohypnum

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

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

Hypnum

Leaves **straight**.

Leaves with a long, channeled **acumen**; WS*

Campylium[†]

Leaves **flattened** into one plane, i.e., shoots **complanate**-foliate, apical cells undifferentiated..

Leaves serrulate **throughout**; no pseudoparaphyllia; WS*

Herzogiella turfacea

Leaves serrulate in **upper half**; pseudoparaphyllia **filamentous**; E

Isopterygium tenerum

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

Entodon

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

Branches **curved** & **secund** when dry, **erect** & straight when moist; WS*

Pylaisiella

Branches **straight** when dry; **alar** cells **extending up** the margin by more than 12 rows.

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

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

Entodon

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

Secondary stems **freely sub-pinnately** branched; E

Forsstroemia

Secondary stems **simple** or with **few** branches; E, AZ

Leucodon

Group P20 – Costa of uncommon or variable form

Group P20

<p>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 & double). Found on rocks or wet places in mountain streams; WS</p>	<i>Hygrohypnum</i>
<p>Costa mostly double (1/3 - 2/3 leaf length), but sometimes single or short & double. Stems loosely pinnate; leaves dimorphic & decurrent; on soil, rock & trees; N, SE</p>	<i>Heterocladium</i>
<p>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 & ±robust; stem leaves typically >2 mm.</p>	
<p>Leaves serrulate to near base with short & broad apical cells; WS</p>	<i>Platyhypnidium riparioides</i> [†]
<p>Leaves entire, broad, concave & with apical cells similar to medial cells.</p>	<i>Pseudoscleropodium purum</i>
<p>Leaves abruptly apiculate (reflexed); weedy habitats; WC, NY</p>	<i>Calliergon</i>
<p>Leaves rounded to bluntly acute; plants of fens & swamps; N</p>	
<p>Plants medium in size; stem leaves typically 1-2 mm.</p>	
<p>Leaf margins strongly serrate; alar cells distinct & quadrate; E, WC</p>	<i>Isothecium</i>
<p>Leaf margins entire; costa occasionally Y-shaped; in bogs; WS*</p>	<i>Drepanocladus simplicissimus</i> [†]
<p>Plants small & slender; stem leaves <1 mm; leaves dimorphic; N, SE</p>	<i>Heterocladium macounii</i>
<p>Costa occasionally to frequently short & double.</p>	
<p>Leaf margins ciliate; E</p>	<i>Thelia</i> [†]
<p>Leaf margins serrulate; leaves dimorphic & decurrent; N, SE</p>	<i>Heterocladium macounii</i>
<p>Leaf margins ±entire; secondary stems sub-pinnately branched; E</p>	<i>Forsstroemia trichomitria</i> [†]
<p>Costa mostly double with one or both branches to 1/2 leaf length.</p>	
<p>Leaves decurrent; leaf margins mostly entire; WS</p>	<i>Plagiothecium</i>
<p>Leaves not decurrent.</p>	
<p>Leaf margins serrulate to dentate; branches terete (round); E</p>	<i>Myurella siberica</i> [†]
<p>Leaf margins serrulate above; branches complanate; E, SW</p>	<i>Taxiphyllum</i>

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 & at the end of this section.

**Group P22 – Cells long, smooth or indistinctly ornamented[#];
 costa single (long & narrow)**

Group P22

<p>Shoots complanate. Leaves serrulate throughout with twisted tips; in mesic habitats; WS*</p>	<i>Stereocleus serrulatus</i>
<p>Leaves entire & wide spreading. Leaves distant, often wide-spreading; alar cells few & rectangular; WS</p>	<i>Leptodictyum riparium</i> [†]
<p>Shoots triangular; leaves keeled, 3-ranked & slenderly acuminate; in wet places; WS*</p>	<i>Dichelyma</i>
<p>Shoots lacking any of the above unique characteristics. Plants large & ±pinnately branched; basal cells porose.</p>	
<p>Shoots prostrate to arching; leaves plane; W</p>	<i>Eurhynchium</i> [†]
<p>Plants with irregular branching; leaves spreading & lanceolate. Cells at branch leaf apex much shorter than median cells; costa ending in spine.</p>	<i>Platyhypnidium</i>
<p>Plants aquatic (on rocks in flowing water); branch leaves 1.2 mm or longer; WS</p>	<i>Eurhynchium</i> [†]
<p>Plants on moist humic soil; branch leaves <1.2 mm; WS</p>	
<p>Cells at apex similar to medial cells; costal spine or tooth present or absent.</p>	
<p>Costa distinct; brood bodies lacking; WS</p>	<i>Brachythecium</i> [†]
<p>Costa indistinct at mid-leaf; gemmae or rhizoids often at back of costa; WS</p>	<i>Conardia compacta</i>

**Group P23 – Cells long, smooth or indistinctly ornamented[#];
costa double (long or short) or none**

	Group P23
Leaves with a long , double costa; E	<i>Loeskeobryum brevirostre</i>
Leaves with a short , double costa or none .	
Plants aquatic , submerged part of year; cells not porose; leaves keeled or flat; WS	<i>Fontinalis</i>
Plants not aquatic .	
Stem hyalodermis well or moderately developed; rhizoids papillose .	
Alar cells inflated or quadrate ; leaves +/- serrate throughout; WS*	<i>Herzogiella</i>
Alar cells +/- undifferentiated ; leaves entire ; WS*	<i>Isopterygiopsis</i>
Stem hyalodermis lacking ; rhizoids smooth.	
Leaf apical cells shorter than medial cells; pseudoparaphyllia foliose ; E, SW	<i>Taxiphyllum</i>
Leaf apical cells similar to medial cells in length.	
Alar cells quadrate ; pseudoparaphyllia filamentous ; E	<i>Isopterygium</i>
Alar cells +/- undifferentiated ; pseudoparaphyllia lacking .	
Leaves complanate , serrate above, brood bodies often present; WS	<i>Pseudotaxiphyllum</i>

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

	Group P24
Leaf cells prorulose .	
Costa short & double ; plants small & creeping.	
Plants dull ; axillary brood bodies present; cells thick-walled ; WS*	<i>Pterigynandrum filiforme</i>

**Group P25 – Cells intermediate, smooth or indistinctly
ornamented[#]; costa single & narrow**

	Group P25
Leaves falcate-secund .	
Leaves keeled , 3-ranked , slenderly acuminate; plants periodically submerged ; WS*	<i>Dichelyma</i>
Leaves plicate ; capsules short & asymmetric; plants of upland habitats; WS	<i>Brachythecium</i> [†]
Leaves straight .	
Plants on tree trunks .	
Leaves serrulate & long- acuminate apices; branches ±julaceous ; WS	<i>Fabronia</i>
Leaves entire margins & gradually acuminate apices; unique capsules ; E	<i>Anacamptodon splachnoides</i>
Plants on soil in mesic to wet habitats.	
Leaves broadly oblong to ovate, concave & with rounded to cucullate apices.	
Plants reddish ; stem tips cuspidate ; leaf tips often apiculate ; A/A	<i>Sarmenthyppnum sarmentosum</i>
Leaves ovate lanceolate , ±plane & with mostly acuminate apices.	
Apical cells much shorter than median cells; costa ending in a spine ; WS	<i>Eurhynchium</i> [†]
Apical cells similar to medial cells in length.	
Costa percurrent to excurrent.	
Costa very wide (75-140 μ); leaf margins ±entire ; WS	<i>Hygroamblystegium</i> [†]
Costa narrow (<35 μ); leaf margins serrulate to serrate above; WS	<i>Brachythecium</i> [†]
Costa 1/2 to 3/4 leaf length.	
Leaf margins serrulate above to throughout.	
Cells 3-5:1 ; capsules ±cylindric & yellowish ; WS	<i>Amblystegium serpens</i> [†]
Cells >5:1 ; capsules ±oblong-ovoid & reddish ; WS	<i>Brachythecium</i> [†]
Leaf margins ±entire .	
Leaves ±wide-spreading ; capsules ±cylindric & yellowish ; WS	<i>Leptodictyum</i> [†]
Leaves ±erect ; capsules ±oblong-ovoid & reddish ; WS	<i>Brachythecium</i> [†]

**Group P26 – Cells intermediate (3-8:1), smooth or indistinctly ornamented[#]
costa short & double or none**

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

Group P26
Fontinalis

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

Group P27

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

Leaves strongly **dimorphic** (stem & branch leaves dissimilar); N, SE

Heterocladium macounii[†]

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

Haplohymenium triste

Leaves **neither** dimorphic **nor** fragile.

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

Racomitrium

Cells **neither** nodulose **nor** porose; primary stems **creeping** & **filiform**/stoloniferous.

Leaf margins **papillose-crenulate**; E

Anomodon

Leaf cells strictly **unipapillose**.

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

Lindbergia brachyptera[†]

Leaves **not** squarrose (wet).

Costa **long** & **single**.

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

Claopodium

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

Leskea

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

Myurella [†]

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

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

Heterocladium dimorphum[†]

Leaves **not** dimorphic; branches **julaceous**; leaves **rounded-ovate** & **obtuse**; WS(N)

Myurella julacea[†]

Group P28 – Cells short (<3:1) & smooth or indistinctly ornamented[#]

Group P28

Costa long & **single**.

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

Leskeella nervosa

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

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

Cryphaea ravenelii[†]

Capsules **exserted**; alar cells nearly to costa; TX, NM

Lindbergia mexicana

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

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

Leaf cell walls **nodulose** (wavy edges) throughout the leaf; WS

Racomitrium

Leaf cell walls **straight**; basal cells at insertion usually **enlarged** & **yellowish**.

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

Hygroamblystegium tenax[†]

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

Amblystegium varium[†]

Costa **short** & **double** or none.

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

Myurella tenerrima[†]

[#]: Cells indistinctly papillose, i.e., low papillae, or prorulose.

Cell length to breadth ratio:

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.

Cells = medial, laminal cells; cells $\sim 2/3$ of the way from insertion to apex, midway between the costa & the margin.

End.