NE Sub Guide to Freely Branched (mostly pleurocarpous) Mosses

Revised through 17 May 2010

***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 *Fontinalis*†

Shoots **complanate**.

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

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

 Leaf tips **acuminate to acute**.

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

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

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

 Leaf cells **large, lax, hexagonal**, often rhizoids & 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 **secund**; very shiny plants; margins sharply serrulate above; WS *Brotherella recurvans*

 Leaves **straight**.

 Alar cells **inflated**, thick-walled; filamentous pseudoparaphyllia; WS *Callicladium haldanianum*

 Alar cells **numerous** & **quadrate**; no pseudoparaphyllia; WS *Entodon*†

 Leaves **straight** or slightly second at tips

 Stem **hyalodermis** well or moderately developed; rhizoids **axillary** & **papillose**.

 Leaves **serrate** all around; WS\* *Herzogiella turfacea*†

 Leaves upper half **entire** or serrulate; WS\* *Isopterygiopsis muelleriana*†

 Stem hyalodermis **lacking**.; rhizoids below leaf insertions & **smooth**.

 Leaf margins **serrulate all around**.

Apical leaf cells **shorter** than those at mid-leaf; E, SW *Taxiphyllum*

Leaf margins **entire** or serrulate in **upper half** only. Pseudoparaphyllia **filiform**;papillose brood bodies rare; E *Isopterygium tenerum*

Pseudoparaphyllia **lacking**; brood branchlets often present; WS\* *Pseudotaxiphyllum*

***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 *Thelia*

 Leaf margins **serrulate**; leaves **concave**-**cucullate**; leaf tips **twisted** & apiculate;E *Bryoandersonia illecebra*

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

 Median leaf cells **long**.

 Branching +**pinnate** & in one **plane**; lawns & disturbed areas; WC, NY *Pseudoscleropodium purum*

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

 Leaves **serrulate** to **dentate**; alar cells **indistinctly** subquadrate; WS(N) *Myurella*†

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

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

 Leaves with aslightly **serrulate tip**; cells **smooth**.

 Shoots curved-**ascending** (dry); alar cells +**undifferentiated**; E *Leucodon*†

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

 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***

 **Group P3**

Stems **red**; plants +**robust** & loosely **ascending**; costa **double** (long or short) or lacking; WS\* *Rhytidiadelphus*

Stems **green**; plants +**slender** & **creeping**; costa long & **single**, short & **double**,or lacking; WS\* *Campylium*

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

 **Group P4**

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** cellsinflated; 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\* *Tomentypnum*

Stems with **paraphyllia**.

Leaves with a **short**, **double** costa or none; plants irregularly pinnate; dimorphic ; N, SE *Heterocladium*†

Leaves with a **long**, **double** costa.

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

Plants **irregularly** to **1-2**-pinnate;cellssmooth or prorulose.

 Leaves **dimorphic** (stem & branch leaves differentiated); N, SE *Heterocladium*†

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

 Leaves **serrate** in upper half; stem leaves **rugose** at acumen base; E *Loeskeobryum brevirostre*

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

 Plants **dendroid**;leaf marginsstronglyserratein **upper** **half**; on rich soil; E *Climacium*

Plants **irregular pinnate**; cells **linear** (> 8:1); margins **spinulose**; NE, N *Hylocomiastrum pyrenaicum*

 Plants with **dimorphic** leaves; costa often **forked**; N, SE *Heterocladium*†

 Plants **lacking** the above unique characters.

 Alar cells **inflated** in well-marked groups.

 Stem leavesdeeply **plicate**; paraphyllia **filamentous** & abundant; soil & rocks; WS *Palustriella*

Stem leaves **plane**; paraphyllia **foliose** & few to many; wet areas; WS\* *Cratoneuron*

 Alar cells mostly **not** differentiated, if so, **not** inflated.

 Paraphyllia **papillose**.

Plants **small**; stem leaves **<0.6mm**; leaf cells minutely **pleuripapillose**.

Leafcellspleuripapillose **both sides** of leaf;E *Cyrto-hypnum*

 Leaf cells pleuripapillose **back side** of leaf only; E, AZ *Rauiella*

 Plants **larger**; stem leaves **1-1.9mm**; branch leaf cells mostly **unipapillose**.

 Plants **1-pinnate**, suberect & wiry; WS A*bietinella abietina*

Plants **2-3-pinnate**, mostly spreading & softer; E, NW *Thuidium*

 Paraphyllia **smooth**.

 Plants with leaf cells with either **forked**,or **elongate** & **curved** papillae; E *Thelia*

 Plants with leaf cells either **prorulose** or with **short** & **simple** papillae; .

 Stemandbranchleavessomewhat **differentiated**;1-pinnate; E, AZ *Bryohaplocladium*

 Stem and branchleaves **uniform**.

 Paraphyllia **few** to **none**; capsules **erect** & **symmetric**; E, OR *Leskea*

 Paraphyllia **filiform** & abundant; capsules +inclined & curved; WS\* *Helodium*

 Plants with **sparse** or small paraphyllia, sometimes wanting.

 Leaf cells often with **single papillae** on **dorsal** surface or smooth; W, AK *Claopodium*

 Leaf cells with one or two **papillae** on both surfaces; E, OR *Leskea*

***Group P7 – Plants with Red Stems***

 **Group P7**

Costa **long** & **double**.

 Stems with **paraphyllia**.

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

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

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

Stems **without** paraphyllia & irregularly branched; WS\* *Rhytidiadelphus*

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

 Leaves distinctly **falcate**-**secund**; WS *Hypnum*†

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

 Leaves **straight**.

 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 P8**

Costa **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 P9**

Leaves 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; leaves **complanate** & **undulate**; on rocks or trees; WS\* *Neckera*†

***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 *Claopodium*†

 Leaf cells **smooth**.

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

 Cell walls **straight**.

 Leafapex **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**,simpleto **forked** papillae; WS *Hedwigia ciliata*

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

 **Group P12**

Costa none or **short** & **double**; paraphyllia sparse to lacking.

 Leaves **0.6-0.9mm** & +**squarrose** with a **long**, **channeled** acumen; cells +elongate; WS *Campylophyllum*

 Leaves **0.5-0.8mm**; cells **rhombic**; paraphyllia **few**; WS\* *Homomallium*

 Leaves **0.15-0.5mm**; cells **rhombic**; paraphyllia **none**; WS*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 +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 **decurrent**; 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 **decurrent** & **dimorphic**; W *Heterocladium procurrens*†

Paraphyllia **lacking.**

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

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

 Leaves slenderly long **decurrent**; 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 +**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** & +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**, lacinate, ciliate & few to abundant; E *Thelia*

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

Leaves bordered with **linear** cells.

 Leaf margins **serrulate** with **multistratose** borders; leaves +**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 *Sarmenthypnum 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 **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** wetareas; 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 +**triangular** group; apices **serrate**; SE *Heterophyllium*

 Alar cells **oblong** & in +**triangular** group; apices **serrulate**; E, NW *Brotherella*

 Alar cells **oblong** & in **rows** 1(-2) cells wide; apices +**entire**; E *Pylaisiadelpha* *tenuirostris*

 Alar cells **few** with short-oblong cells above; apices **serrulate**; WS *Hypnum*

 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 & +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.

 Leavesdistinctly **falcate-secund**; leaf cells **smooth**.

 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**, or indistinctly falcate-secund.

 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 **strongly** **curved** & **second** when dry, **erect** & straight when moist; WS\* *Pylaisiella*

 Branches **loosely** **curved** when dry.

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

 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**

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 *Hygrohypnum*

 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 *Heterocladium*

 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.

 Leaves **serrulate** to near base with **short** & **broad** apical cells; WS *Platyhypnidium riparioides*†

 Leaves **entire**, broad, concave & 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** & **swamps**; N *Calliergon*

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

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

 Leaf margins **entire**; costa occasionallyY-shaped; in bogs; WS\* *Drepanocladus simplicissimus*†

Plants **small** & **slender**; stem leaves **<1** mm; leaves **dimorphic**; N, SE *Heterocladium macounii*

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

 Leaf margins **ciliate**; E *Thelia*†

Leaf margins **serrulate**; leaves **dimorphic** & **decurrent**; N, SE *Heterocladium macounii*

 Leaf margins +**entire**; secondary stems sub-pinnately branched; E *Forsstroemia trichomitria*†

 Costa mostly **double** with **one** or **both** branchesto 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*†

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

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

 **Group P21**

Leaf cells **prorulose**; shoots **straight** (dry); leaves **smooth** & **decurrent**; E, AK *Bryhnia*†

***Group P22 – Cells long, smooth or indistinctly ornamented***#***;***

***costa single (long & narrow)***

 **Group P22**

Shoots **complanate**.

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

 Leaves **entire** & wide **spreading**.

 Leaves **distant**, often wide-spreading; alar cells **few** & **rectangular**; WS *Leptodictyum riparium*†

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

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

 Plants **large** & +**pinnately** branched; basal cells **porose**.

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

 Plants with **irregular** branching; leaves spreading & 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*†

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

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

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

***Group P23 – Cells long, smooth or indistinctly ornamented***#***;***

***costa double (long or short) or none***

 **Group P23**

Leaves with a **long**,double costa; E *Loeskeobryum brevirostre*

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

 Plants **aquatic**, submerged part of year; cells **not** porose; leaves keeled or flat; WS *Fontinalis*

 Plants **not aquatic.**

Stem **hyalodermis** well or moderately developed;rhizoids **papillose.**

Alar cells **inflated** or **quadrate;** leaves **+/-serrate** throughout; WS\**Herzogiella*

Alar cells +/\_**undifferentiated**; leaves **entire**; WS\* *Isopterygiopsis*

Stem hyalodermis **lacking**; rhizoids smooth.

 Leaf **apical cells** shorter than medial cells; pseudoparaphyllia **foliose**; E, SW *Taxiphyllum*

Leaf apical cells similar to medial cells in length.

 Alar cells **quadrate**; pseudoparaphyllia **filamentous**; E *Isopterygium*

Alar cells +/-**undifferentiated**; pseudoparaphyllia **lacking***.*

Leaves **complanate**, **serrate** above, brood bodies often present; WS *Pseudotaxiphyllum*

***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\* *Pterigynandrum filiforme*

***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\* *Dichelyma*

 Leaves **plicate**; capsules short & asymmetric; plants of **upland** habitats; WS *Brachythecium*†

Leaves **straight**.

 Plants on **tree trunks**.

 Leaves **serrulate** & long-**acuminate** apices; branches +**julaceous**; WS *Fabronia*

 Leaves **entire** margins & gradually **acuminate** apices; unique **capsules**; E *Anacamptodon* *splachnoides*

 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 *Sarmenthypnum sarmentosum*

 Leaves ovate **lanceolate**, +**plane** & with mostly **acuminate** apices.

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

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

 Costa **percurrent** to excurrent.

 Costa very **wide** (75-140µ); leaf margins +**entire**; WS *Hygroamblystegium*†

 Costa **narrow** (<35µ); leaf margins serrulate to **serrate** above; WS *Brachythecium*†

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

 Leaf margins **serrulate** above to throughout.

 Cells **3-5:1**; capsules +**cylindric** & **yellowish**; WS *Amblystegium serpens*†

 Cells **>5:1**; capsules +oblong-**ovoid** & **reddish**; WS *Brachythecium*†

 Leaf margins +**entire**.

 Leaves +wide-**spreading**; capsules +**cylindric** & **yellowish**; WS *Leptodictyum*†

 Leaves +**erect**; capsules +oblong-**ovoid** & **reddish**; WS *Brachythecium*†

***Group P26 – Cells intermediate (3-8:1), smooth or indistinctly ornamented***#

***costa short & double or none***

 **Group P26**

Plants **trailing** from a single attachment point in flowing water; leaves keeled or flat; WS *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), +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 **>35µ** at base; yellowish cells usually in **2-3** rows; WS *Hygroamblystegium tenax*†

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

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

 Shoot +**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 ~2/3 of the way from insertion to apex, midway between the costa
 & the margin.

End.