**Sub-Guide to Freely Branched Mosses -- MidWest**

Revised through 30 April 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

<table>
<thead>
<tr>
<th>Shoots</th>
<th>Group P1</th>
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<td><strong>angular</strong> with leaves folded (conduplicate); plants aquatic, submerged part of year.</td>
<td>Brachelyma subulatum</td>
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<tr>
<td>Leaves with a <strong>narrow</strong>, <strong>single</strong> costa; SE</td>
<td>Fontinalis†</td>
<td>Leaves <strong>complanate</strong>.</td>
<td>Homalia trichomanoides</td>
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<tr>
<td>Leaves <strong>ecostate</strong> (costa lacking); leaves keeled or flat; WS</td>
<td>Steerecleus serrulatus</td>
<td>Leaves with a <strong>long</strong>, <strong>double</strong> costa ending above leaf middle.</td>
<td>Leptodictyum riparium†</td>
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<td>Plants <strong>without both</strong> large and small leaves.</td>
<td>Homaliadelphus sharpii</td>
<td>Leaves <strong>smooth</strong>, costa about 3/4 of leaf length.</td>
<td>Hookeria</td>
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<td>Leaf tips <strong>rounded-obtuse</strong>, leaves <strong>asymmetric</strong>, upper leaf cells &gt;5:1; WS*</td>
<td>Plagiothecium†</td>
<td>Leaves <strong>short</strong> &amp; <strong>double</strong> costa, or none.</td>
<td>Neckera</td>
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<td>Leaf tips <strong>acuminate to acute</strong>.</td>
<td>Steerecleus serrulatus</td>
<td>Leaf cells <strong>large</strong>, <strong>lax</strong>, <strong>hexagonal</strong>, often rhizoids and papillose gemmae on leaf tips; E, N, CA</td>
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<td>Leaf margins <strong>distinctly serrulate</strong>, leaf tip <strong>twisted</strong> at apex; E, WA</td>
<td>Homaliadelphus sharpii</td>
<td>Leaf cells <strong>firm-</strong> to <strong>thick-walled</strong>, <strong>rounded to linear</strong>.</td>
<td>Hookeria</td>
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<td>Leaf margins <strong>entire</strong>, leaf tip <strong>not</strong> twisted, in wet swampy places; WS</td>
<td>Brotherella recurvans</td>
<td>Leaves <strong>slenderly long</strong> decurrent; leaf margins <strong>entire</strong>, or serrulate at tip; WS</td>
<td>Herzogiella surfacea†</td>
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<td>Leaves <strong>shortly decurrent</strong>, undulate or not; on vertical substrates; WS*</td>
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<td>Leaves <strong>secund</strong>; very <strong>shiny</strong> plants; margins sharply <strong>serrulate</strong> above; WS</td>
<td>Brotherella recurvans</td>
<td>Leaves <strong>straight</strong> or slightly secund at tips.</td>
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<td>Rhizoids <strong>axillary</strong> and <strong>papillose</strong>; stem <strong>hyalodermis</strong> well or moderately developed.</td>
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<td>Rhizoids <strong>below</strong> leaf insertions and <strong>smooth</strong>; stem <strong>hyalodermis</strong> <strong>lacking</strong>.</td>
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<td>Alar cells <strong>enlarged</strong>, <strong>subquadrate</strong> and <strong>thick-walled</strong>; WS.</td>
<td>Callicladium haldanianum</td>
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<td>Leaf apical cells <strong>short</strong>; pseudoparaphyllia <strong>foliose</strong>; E, SW</td>
<td>Taxiphyllum†</td>
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</table>
**Group P2 — Shoots julaceous (especially when dry) — shoots smoothly cylindric with crowded, overlapping and appressed leaves**

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

- Leaf margins with *cilia*, plant stem and branches with *paraphyllia*; E
- Leaf margins *serrulate*; leaves *concave-cucullate*; leaf tips *twisted* and apiculate; E
- 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
  - Median leaf cells *short*; stems growing *singly* at *right angles* to bark; SE

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

- Leaves *serrulate* to *dentate*; alar cells *indistinctly* subquadrate; WS(N)
- Leaves spinulose-*serrate* to serrulate at the *apex*.
  - Leaves spinulose-*serrate* & *hyaline* above; shoots *julaceous*; cells *papillose*; WS
  - Leaves with a slightly *serrulate tip*; cells *smooth*.
    - Shoots curved-*ascending* (dry); alar cells *+undifferentiated*; E
    - Shoots *straight* (dry); alar cells *numerous* & *quadrate*; E
  - Leaves *entire*; plants in very wet places, e.g., shallow water; alar cells *short* and *wide*; WS*

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

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

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

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

Costa *long* and *single*.

- Alar cells *quadrate* to *oblate*.
  - Branching *irregular*; costa *not* toothed; alar cells *extending* up leaf margin; E
  - Alar cells *+undifferentiated*.
    - Leaves *channeled* at the costa; margins erect or *incurved* at the apex; E

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

Costa **long**, **single** and **narrow**.
- Paraphyllia **abundant** and **filamentous**; stem leaves deeply plicate, not complanate; WS
- **Palustriella**

Costa **short** and **double**, or none.
- **Rhytidium rugosum**

**Group P5**

Leaves **neither** complanate nor undulate.

- **Paraphyllia** lacking; leaves plicate and **rugose**; WS*
- **Rhytidium rugosum**

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

- Leaves **plicate** and **denticulate** in upper portion; WS*
- **Sanionia**

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

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

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

Plants on 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*
- **Drepanoclados**†

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

- Leaf margins finely **denticulate**; WS*
- **Warnstorfia**

- Central **strand** (small cells) in stem; WS*
- **Drepanoclados**†

- Central strand **lacking**; N
- **Hamatocaulis**

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 **lacking** the above unique characters.

- Leaves **plane**.

- Leaf cells **prorulose**.
- Leaves crowded, **spreading** and **secund**; alar cells **subquadrate**; E, AK, BC
- **Ctenidium**

- Leaf cells **smooth**.

- 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
- **Pylaisiadelpha tenuirostris**

- Alar cells in **triangular** patches; leaves **entire**.
- **Hygrohypnum**†

- Plants on **wet rocks** in mountain streams; branching **irregular**; WS
- **Hygnum**
Group P6 – Plants with paraphyllia or tomentum on stem.

Stems with tomentum, calciphile in fens, swamps; WS*

Group P6

Stems with paraphyllia.

Leaves with a short, double costa or none; plants irregularly pinnate.

Leaves with a long, double costa.

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

Plants irregularly to 1-2-pinnate; cells smooth or prorulose.

Leaves spinulose-serrate all around; NE, N

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

Leaves with a long, narrow costa.

Plants dendroid; upper leaf cells short (2-5:1).

Plants little altered dry; leaf margins strongly serrate in upper half; on rich soil; E

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

Plants lacking the above unique characters.

Alar cells inflated in well marked groups.

Stem leaves deeply plicate; paraphyllia filamentous and abundant; soil and rocks; WS

Stem leaves plane; paraphyllia foliose and few to many; wet areas; WS*

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

Continued below at left margin

Paraphyllia papillose.

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

Leaf cells pleuripapillose both sides of leaf; E

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

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

Plants 1-pinnate, suberect and wiry; WS

Plants 2-3-pinnate, mostly spreading and softer; E, NW

Paraphyllia smooth.

Leaf cells either forked, or elongate and curved papillae; leaves ovate; E

Leaf cells either prorulose or with short and simple papillae; leaves lanceolate.

Stem and branch leaves somewhat differentiated; 1-pinnate; E, AZ

Stem and branch leaves uniform.

Leaf cells elongate, oblong-rhombic to oblong-linear.

Paraphyllia linear-lanceolate and numerous.

Capsules inclined, asymmetric; W

Paraphyllia filiform and abundant; capsules inclined to horizontal and curved; WS*

Leaf cells short (isodiametric or nearly so, hexagonal to short-rhombic); W

Group P6

Tomentypnum

Hylocomium splendens

Loeskeobryum brevirostre

Hylocomiastrum umbratum

Climacium

Palustriella

Cratoneuron

Cyrto-hypnum

Abietinella abietina

Thuidium

Bryohaplocladium

Pseudoleskea

Helodium

Pseudoleskea
**Group P7 – Plants with red stems**

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*

Costa long and single.

Costa short & double, 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

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

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*

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

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

Leaves with a narrow, single costa.

Leaves rugose; shoots round; paraphyllia lacking.

Leaf cells prorulose; WS*

Leaves with a short, double costa or none.

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

Plants not julaceous; leaves complanate & undulate; on rocks or trees; WS*

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

None
Group P11 – Leaves with awns, hair-points or hyaline apices

Leaves with a narrow, single costa.
Leaf cells smooth.
- Cell walls nodulose (wavy) throughout; WS
- Cell walls straight.
  - Leaf apex flat, filiform and serrate; leaves abruptly acuminated; N* (S to NC)
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
  - Leaf cells smooth, leaf apex hyaline or yellow.

Group P11

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

Leaves to 1 mm; costa variable; cells rounded-elliptic; pseudoparaphyllia lanceolate; N,W
Leaves 0.5-0.8 mm; costa none or short and double; cells rhombic; paraphyllia few; WS*
Leaves 0.15-0.5 mm; costa none or short and double; cells rhombic; paraphyllia none; WS

Group P12

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

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 + equal length.
Leaf cells smooth; plants in flat mats; secondary stems prostrate.
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*
    - Plants irregularly branched; leaves plicate with broad flat tip; WS*
  - Stems green; plants loosely pinnate; leaves decurrent; costa variable; WS(N)
Leaf cells smooth.
  - Paraphyllia abundant; leaf serrate in upper half; leaves not decurrent; E
  - Paraphyllia lacking.
    - Leaves spinulose-serrate all around and decurrent; NE, N
    - Leaves entire to somewhat serrulate; costa often variable.
      - Leaves slenderly long decurrent; costa branches often unequal; WS
      - Leaves not distinctly decurrent.
        - Alar cells subquadrate and slightly porose; in rich, open fens; N
        - Alar cells quadrate or inflated; on rocks in mountain streams; WS

Group P13

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

Leaf cells pleuripapillose; decurrencies broad to auriculate.
Costa subpercurrent; leaf margins crenulate from projecting papillae; N*
Leaf cells distinctly prorulose; E
Leaf cells smooth or indistinctly ornamented.
  - Plants arching and regularly pinnate; leaf apical cells shorter than medial cells; W
  - 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
    - Leaves smooth with plane or twisted apices; cells mostly >4:1; WS
**Group P15 – Costa single and narrow; leaves with a distinct marginal border**

Leaves bordered with **cilia**.

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

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

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

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

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

Leaves + **ovate** and acute with **serrulate** marginal cells; E

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

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

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

Paraphyllia **present**.

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

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

Paraphyllia **lacking**.

Leaves broadly **rounded** at tip.

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

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

Leaves **falcate-second**.

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

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

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

Leaves **straight**.

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

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

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

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

Leaves + **broadly oblong-ovate**.

Shoots **+julaceous**.

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

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

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

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

Leaf margins **serrate** above.

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

Leaf margins **entire** to serrulate.

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

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

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

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

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

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

Alar cells **symmetrically** arranged; WS

**Group P15**

Thelia

Helodium

**Group P16**

Palustriella

Cratoneuron

Calliergon

Drepanocladus

Hydrohypnum

Campylium polygamum

Drepanocladus aduncus var. kneiffii

Brachythecium

Pseudoscleropodium purum

Hydrohypnum

Forsstroemia producta

Pseudeocerosum brachyptera

Lindbergia brachyptera

Clasmatodon parvulus

Campylium

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

Leaf cells **smooth**; costa short and double, or about 1/2 leaf length
Leaf margins serrulate to **serrate** all around; alar cells abruptly **inflated**; WS*  
**Herzogiella striatella**†  
**Plagiothecium**

Leaf cells **poorly** differentiated; WS

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

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

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

Alar cells **inflated**, and **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 and apiculate; WS*  
**Scorpidium scorpioides**

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

Plants in **other** habitats.
Stems with a **hyalodermis**; alar cells in large, almost decurrent areas; WS  
**Hypnum**

Plants **lacking** a hyalodermis; leaf apices serrate to serrulate.
Alar cells **subquadrated** and in **+triangular** group; apices **serrate**; SE  
**Heterophyllium**

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

Alar cells **oblong** and 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 and strongly inflated as "bubble" cells; E  
**Sematophyllum**

Leaves **neither** falcate-secund nor homomallous.
Stems leaves **without** a setaceous point, acute, acuminate or apiculate.
Leaves **squarrose-recurved**; alar cells oblong and **+inflated**; WS*  
**Rhytidiadelphus squarrosus**†  
**Calliergonella cuspidata**

Leaves **erect** to **spreading**; alar cells hyaline.
Plants **prostrate**; alar cells **not** in auricles; WS  
**Calliergonella cuspidata**

Cells at leaf insertion **enlarged** in 1 or 2 **distinctive rows**.
Alar cells **not** rounded to the insertion.
Alar cells **strongly** inflated as "bubble" cells; setae ~3 cm; E  
**Sematophyllum**

Cells at leaf insertion **not** in a distinctive row; leaves >1mm.
Leaves **serrulate** throughout and **decurrent**; alar cells thin-walled; WS*  
**Herzogiella**

Leaves **entire, not** decurrent; alar cells **thick**-walled; WS  
**Callicladium haldanianum**

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

**Continued below at left margin**
Alar cells **quadrato** to **short** oblong.
Leaves distinctly **secund** or **falcate-secund**; leaf cells **smooth**.
Leaves **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 **shorter** with branches **joining** at the base; pseudoparaphyllia common; WS  
**Hypnum**

Leaves **straight**, or indistinctly falcate-secund.
Leaves **wide-spreading** to squarrose-recurved and with a long, **channeled acumen**; WS*  
**Campylium**†

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**

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

Branches strongly **curved** when dry; straight when moist.
Leaf cells **>5:1**; 5-20 quadrato alar cells at the **basal angles**; WS*  
**Pylaisiella**

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

Branches **loosely curved** when dry.
Plants with clusters of axillary **brood branchlets** at tips of erect branches; WS*  
**Platygyrium**

Branches ±**straight** when dry.
Stems **without paraphyllia**.

Leaves **>1 mm**; cells **smooth**.
Alar cells extending up the margins for **<1/6** of leaf length.
Leaves **acuminate**.
Stem leaves **serrulate** throughout; WS*  
**Herzogiella seligeri**

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

Alar cells extending up margin for **>1/3** leaf length; E  
**Forsstroemia trichomitria**†
**Group P20 – Costa of uncommon or variable form**

Costa of **uncommon** form.

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**

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

**Heterocladium**

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

Stems **scarce**ly branched; leaves **neither** dimorphic **nor** decurrent; fens; **N**

**Pseudocalliergon turgescens**

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 **robust**; stem leaves typically **>2 mm**.

Leaves **serrulate** to near base with **short** and **broad** apical cells; **WS**

**Platyhypnidium riparioides†**

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**

**Drepanoclados simplicissimus†**

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

Leaf margins **ciliate**; **E**

**Thelia†**

Leaf margins **entire**; secondary stems sub-pinnately **branched**; **E**

**Forsstroemia trichomitria†**

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†**

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

**Taxiphyllum**

Costa occasionally to **single**.

Plants **thread-like**; leaves to 1 mm; **N, W**

**Pseudoleskeella tectorum†**

**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**

**Chryso-hypnum diminutivum**

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

**Bryhnia†**
Group P22 – Cells long, smooth or indistinctly ornamented; costa single (long and narrow)

Shoots **complanate**.
- Leaves **serrulate** throughout with **twisted** tips; in mesic habitats; WS*  
- Leaves **entire** and wide **spreading**.
  - Leaves **distant**; alar cells **few** and short-to-long **rectangular**; WS
- Shoots **triangular**; leaves **keeled**, **3-ranked** and slenderly acuminate; in wet places; WS*
- Shoots **lacking** any of the above unique characteristics.
- Plants **large** and **+pinnately** branched; basal cells **porose**.
  - Shoots **prostrate** to arching; leaves **plane**; W
  - 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
      - Plants on moist humic **soil**; branch leaves **<1.2 mm**; WS
    - Cells at apex **similar** to medial cells; costal spine or tooth present or absent.
      - Costa **distinct**; brood bodies **lacking**; WS
      - Costa **indistinct** at mid-leaf; **gemmae** or rhizoids often at back of costa; WS
        - Plants **small**, on **tree trunks**; leaves **serrulate** and **+homomallous**; E
          - Steerecleus serrulatus
          - Leptodictyum riparium†
          - Dichelyma
          - Eurhynchium†
          - Platthyhypnidium
          - Eurhynchium†
          - Brachythecium†
          - Conardia compacta
          - Homalothecciella subcapillata
          - Fontinalis
          - Conardia compacta
          - Homalothecciella subcapillata
          - Eurhynchium†
          - Platyhypnidium
          - Conardia compacta
          - Homalothecciella subcapillata

# Cells with low papillae or short projections.

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

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

# Cells with low papillae or short projections.
**Group P24 – Cells intermediate (3-8:1), distinctly papillose or prorulose**

Leaf cells *papillose*.  
Leaf cells *prorulose*.  
Costa *long* and *single*.  
Costa *short* and *double*; plants small and creeping.  
Plants *dull*; axillary *brood bodies* present; cells *thick*-walled; WS*  

*Group P24*

**Pterigynandrum filiforme**

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

Leaves *falcate-secund*.  
Leaves *keeled*, 3-ranked, slenderly acuminate; plants periodically *submerged*; WS*  
Leaves *plicate*; capsules short and asymmetric; plants of *upland* habitats; WS  
Leaves *straight*.  
Plants on *tree trunks*.  
Plants of *medium* size.  
Plants *small* to very small.  
Leaves with *serrulate* margins and long-*acuminate* apices; branches +*julaceous*; WS  
Leaves with *entire* margins and gradually *acuminate* apices; E  
Plants on *soil* in mesic to wet habitats.  
Plants with *julaceous* shoots; leaves broadly ovate and concave.  
Plants *not* julaceous.  
Leaves broadly *oblong* to ovate, *concave* and with *rounded* to cuculate apices.  
Leaves ovate *lanceolate*, +*plane* and with mostly *acuminate* apices.  
Apical cells much *shorter* than median cells; costa ending in a *spine*; WS  
Apical cells *similar* to medial cells in length.  
Costa *percurrent* to excurrent.  
Costa very *wide* (75-140µ); leaf margins +*entire*; WS  
Costa *narrow* (<35µ); leaf margins serrulate to *serrate* above; WS  
Costa 1/2 to 3/4 leaf length.  
Leaf margins *serrulate* above to throughout.  
Cells 3-5:1; capsules +*cylindric* and *yellowish*; WS  
Cells >5:1; capsules ±*oblong-ovoid* and *reddish*; WS  
Leaf margins +*entire*.  
Leaves ±*wide-spreading*; capsules ±*cylindric* and *yellowish*; WS  
Leaves ±*erect*; capsules ±*oblong-ovoid* and *reddish*; WS  

*Group P25*

**Dichelyma**  
**Brachythecium†**  
**Fabrica**  
**Anacamptodon splachnoides**  
**Eurhynchium†**  
**Hygroamblystegium†**  
**Brachythecium†**  
**Amblystegium serpens†**  
**Brachythecium†**  
**Leptodictyum†**  
**Brachythecium†**

*#* Cells with low papillae or short projections.
**Group P26 – Cells intermediate (3-8:1), smooth or indistinctly ornamented**

Plants growing in **aquatic** habitats.
- Plants **trailing** from a single attachment point in flowing water; leaves keeled or flat; WS
- Plants not trailing from a single attachment point.
  - Plants **large** and **sparsely** branched; foliose **pseudoparaphyllia**; in fens; N

**Group P26**

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

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

Leaf cells **pleuripapillose** (1-5 papillae per cell).
- Leaves **fragile** above a short ovate base, appressed (dry) and spreading (wet); E
- Leaves not fragile.
  - Cells **nodulose** (wavy) throughout the leaf; WS
  - Cells **neither** nodulose nor porose.
    - Leaf margins **papillose-crenulate**; basal, interior cells **pellucid**; E
    - Leaf margins **entire** to **serrulate** throughout; basal, interior cells not pellucid.

Leaf cells strictly **unipapillose**.
- Leaves **appressed** (dry), **squarrose** (wet), ± lanceolate & with a **pale acumen**; WS(E) **Lindbergia brachyptera†**
- Leaves not squarrose (wet).
  - Costa **long** and **single**.
    - Leaf margins **serrulate** to **serrate** throughout; costa **pellucid**; W, AK
    - Leaf margins **entire** to subserrulate above; costa **opaque** and often **flexuose** above; E, OR **Leskea†**
  - Costa **short** and **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 and branch leaves dissimilar); WS(N) **Heterocladium dimorphum†**
- Leaves not dimorphic.
  - Costa **short** and **double** or **none**.
    - Branches **julaceous**; leaves **rounded-ovate** and **obtuse**; WS(N) **Myurella julacea†**
    - Branches **terete**; leaves ovate-lanceolate and **acuminate**; E **Schwetschkeopsis fabronia**
**Group P28 – Cells short (<3:1) and smooth or indistinctly ornamented**

Costa long and **single**.
- Shoots usually with dense clusters of axillary brood branchlets; often on bark; WS
- Shoots juleaceous when dry; leaves wide spreading wet.
- Capsules immersed; usually on bark; alar cells transversely oblong; SE
- Shoots neither juleaceous nor complanate.
- Leaf apices acute to acuminate.
  - Leaf cell walls sinuose to nodulose (wavy edges); WS
  - 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
    - Costa <35µ at base; yellowish cells usually in a single row; WS
  - Upper leaf cells 1-2:1.
    - Costa subpercurrent (>2/3 the leaf length).
      - Costa strongly flexuose above; leaves coarsely serrate above; S
      - Costa +straight; leaves +entire; cells obscurely papillose; E, OR
      - Costa shorter (1/3 – 2/3 the leaf length).
        - Leaf apex symmetric and acute to acuminate; dryer bark; SE, OH

Costa short and double or none.

# Cells with low papillae or short projections.

**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.

End.