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

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

Shots **complanate**.  

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

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

Leaf tips **acuminate to acute**.  

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

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

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

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

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

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

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

Leaves **not** decurrent.  

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

Leaves **straight**.  

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

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

Leaves **straight** or slightly second at tips  

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

Leaves **serrate** all around; WS*  

Leaves upper half **entire** or serrulate; WS*  

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

Leaf margins **serrulate all around**.  

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

Leaf margins **entire** or serrulate in **upper half** only.  

Pseudoparaphyllia **filiform**; papillose brood bodies rare; E  

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

**Group P1**  

Fontinalis†  

Homalia trichomanoides  

Steerecleus serrulatus  

Leptodictyum riparium†  

Hookeria  

Plagiothecium†  

Neckera  

Brotherella recurvans  

Callicladium haldanianum  

Entodon†  

Herzogiella turfacea†  

Isopterygiopsis muelleriana†  

Taxiphyllum  

Isopterygium tenerum  

Pseudotaxiphyllum
### Group P2 – Shoots julaceous – shoots smoothly cylindric with crowded, overlapping & 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** & apiculate; E
- Leaf margins **entire** or slightly serrulate apically; paraphyllia **lacking**.
  - Median leaf cells **long**.
  - Branching **+pinnate** & in one **plane**; lawns & disturbed areas; WC, NY

**Group P2**

**Thelia**

**Bryoandersonia illecebra**

**Pseudoscleropodium purum**

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*

**Myurella**

**Hedwigia**

**Leucodon**

**Entodon**

**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* | Group P3 |
| Stems green; plants slender & creeping; costa long & single, short & double, or lacking; WS* | 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 | Group P4 |
| Upper leaf cells short to medium (2-5:1); costa single, or short double; on trunks of trees; E | Drummondia prorepens Forsstroemia |

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

| Costa long, single & narrow. | Group P5 |
| Paraphyllia abundant & filamentous; stem leaves deeply plicate, not complanate; WS | Palustriella |
| Paraphyllia lacking. | Rhytidium rugosum |
| Leaf cells prorulose; leaves plicate and rugose; WS* | Sanonia |
| Leaf cells smooth. | Brachythecium† |
| Stems with a hyalodermis (thin-walled, hyaline cells on stem surface). | Dichelyma |
| Leaves plicate & denticulate in upper portion; WS* | Warnstorfa |
| Leaves striolate (finely ridged) to plane, & entire to slightly denticate. | Drepanoclados† |
| Alar cells inflated; plants occurring in streams on rocks or wet places; WS | Hamatocaulis |
| Alar cells little differentiated; plants in rich fens; N | Hygrohypnum † |
| Plants of upland habitats, leaves plicate; WS | Arctostaphylos |
| Plants of wet habitats, leaves not plicate. | Isopterygiopsis |
| Leaves keeled, 3-ranked; WS* | Pylaisiadelpha tenuirostris |
| Leaves neither keeled nor 3-ranked. | Pylaisiadelpha tenuirostris |
| Costa excurrent; alar cells abruptly inflated or undifferentiated; WS* | Pylaisiadelpha tenuirostris |
| Costa subpercurrent; plants in fens & seeps. | Pylaisiadelpha tenuirostris |
| Leaf margins finely denticulate; WS* | Pylaisiadelpha tenuirostris |
| Leaf margins entire. | Pylaisiadelpha tenuirostris |
| Central strand (small cells) in stem; WS* | Pylaisiadelpha tenuirostris |
| Central strand lacking; N | Pylaisiadelpha tenuirostris |

| Costa short & double, or none. | 
| Shoots in flat, evenly pinnate, feather-like, fronds; plants large; WS* | Pylaisiadelpha tenuirostris |
| Shoots loosely complanate; plants very shiny; leaves very serrulate above; E, NW | Pylaisiadelpha tenuirostris |
| Shoots complanate; brood bodies often in leaf axils; WS* | Pylaisiadelpha tenuirostris |
| Shoots julaceous; found in wet places (often submerged); WS* | Pylaisiadelpha tenuirostris |
| Shoots falcate-secund when dry, erect when moist; on trees; WS* | Pylaisiadelpha tenuirostris |
| Shoots with many brood bodies at tips; usually on trees; WS* | Pylaisiadelpha tenuirostris |
| Shoots lacking the above unique characters. | Pylaisiadelpha tenuirostris |
| Leaf cells prorulose. | 
| Leaves crowded, spreading & secund; alar cells subquadrate; E, AK, BC | 
| Leaf cells smooth. | 
| Alar cells abruptly inflated as "bubble" cells; leaves merely homomallous; E | Pylaisiadelpha tenuirostris |
| Alar cells in 1-2 rows with 2-3 cells inflated; leaves ± serrulate; E | Pylaisiadelpha tenuirostris |
| Alar cells in triangular patches; leaves ± entire. | Hygro hypnum † |
| Plants on wet rocks in mountain streams; branching ± irregular; WS | Pylaisiadelpha tenuirostris |
| Plants of mesic to wet habitats; branching regularly pinnate; WS | Pylaisiadelpha tenuirostris |
Group P6 – Plants with paraphyllia or tomentum on stem.

Stems with tomentum, calciphile in fens, swamps; WS*  
Stems with paraphyllia.  
Leaves with a short, double costa or none; plants irregularly pinnate; dimorphic; N, SE  
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 dimorphic (stem & branch leaves differentiated); N, SE  
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; 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 & abundant; soil & rocks; WS  
Stem leaves plane; paraphyllia foliose & few to many; wet areas; WS*  
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  
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 & wiry; WS  
Plants 2-3-pinnate, mostly spreading & softer; E, NW  
Paraphyllia smooth.  
Plants with leaf cells with either forked, or elongate & curved papillae; E  
Plants with leaf cells either prorulose or with short & simple papillae;  
Stem and branch leaves somewhat differentiated; 1-pinnate; E, AZ  
Stem and branch leaves uniform.  
Paraphyllia few to none; capsules erect & symmetric; E, OR  
Paraphyllia filiform & abundant; capsules ±inclined & curved; WS*  
Plants with sparse or small paraphyllia, sometimes wanting.  
Leaf cells often with single papillae on dorsal surface or smooth; W, AK  
Leaf cells with one or two papillae on both surfaces; E, OR

Group P6  
Tomentypnum  
Heterocladium†  
Hildocodium splendens  
Heterocladium†  
Hylocomium umbratum  
Loeskeobryum brevirostre  
Heterocladium†  
Hylocomiastrum pyrenaicum  
Climacium  
Hylocomiastrum umbratum  
Palustriella  
Cratoneuron  
Palustriella  
Cyrto-hypnum  
Rautilia  
Abietinella abietina  
Thuidium  
Thelia  
Bryohaplocladium  
Leskea  
Helodium  
Claopodium  
Leskea
**Group P7 – Plants with Red Stems**

Costa long & double.

- Plants 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 & irregularly branched; WS*

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** & **julaceous** when dry; cells **papillose**; WS
  - Leaves with a **green** tip; leaf cells **smooth**.
    - Alar cells **inflated**, **hyaline** & **thin**-walled in distinct **auricles**; WS (N)
    - Alar cells **short** oblong with **thick orange** walls; WS

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

Costa single & 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 & double, or none; pseudoparaphyllia usually present.

- Alar cells in **transverse rows** & inflated; leaves **sharply serrulate** above; E, BC, WA
- Alar cells in **triangular areas**, inflated or not; leaves entire to **serrulate**; WS

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

Leaves with a narrow, single costa.

- Leaves **rugose**; shoots **round**; leaf cells **prorulose**; WS*

Leaves with a short & double costa, or none.

- Plants **julaceous** & growing in wet (submerged) areas; WS
  - Plants **not** julaceous; leaves **complanate** & undulate; on rocks or trees; WS*

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

Leaves with a narrow, single costa.

- Leaf cells **papillose**; creeping on tree bark or rock; W, AK
  - Leaf cells **smooth**.
    - Cell walls **nodulose** (wavy) throughout; WS
    - Cell walls **straight**.
      - Leaf apex **flat**, **filiform** & **serrate**; leaves abruptly acumenate; 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
**Group P12 – Plants thread-like (leaves <1mm)**

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

  - Leaves **0.6-0.9mm & squarrose** with a long, channeled acumen; cells ±elongate; WS
  - Leaves **0.5-0.8mm**; cells rhombic; paraphyllia few; WS*
  - Leaves **0.15-0.5mm**; cells rhombic; paraphyllia none; WS

**Group P12**
- **Campylophyllum**
- **Homomallium**
- **Platydictya**

**Group P13 – Costa double & 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 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*

  - Leaf cells **smooth**.

  - Paraphyllia **abundant**; leaf serrate in upper half; leaves not decurrent; E
  - Paraphyllia often **few & inconspicuous**; leaves decurrent & dimorphic; W
  - Paraphyllia **lacking**.

  - Leaves **spinulose-serrate** all around & 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 **quadrate** or **inflated**; on rocks in **mountain streams**; WS
  - Alar cells **thick walled, porose**; plants **irregularly** branched; AK

**Group P13**
- **Hylocomium splendens**
- **Rhytidiadelphus triquetrus**†
- **Heterocladium dimorphum**†
- **Loeskeobryum brevirostre**
- **Heterocladium procurrens**†
- **Hylocomiastrum umbratum**†
- **Plagiothecium**†
- **Hygrohypnum**†
- **Rhytidiadelphus japonicus**†

**Group P14 – Costa single & narrow; leaves with distinct decurrences**

- Leaf cells **pleuripapillose**; decurrences broad to auriculate.

- Costa **subpercurrent**; leaf margins crenulate from projecting papillae; N*

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

  - Leaf cells prorulose; E
  - Leaf cells smooth or indistinctly ornamented.

  - Plants arching & ±regularly pinnate; leaf apical cells shorter than medial cells; W
  - Plants complanate; leaves squarrose; costa may be **forked or double**; W
  - Plants prostrate, leaves acuminate, alar cells differentiated; cells mostly >4:1; WS

**Group P14**
- **Anomodon**†
- **Heterocladium macounii**†
- **Bryhnia**
- **Eurhynchium**†
- **Heterocladium procurrens**†
- **Brachythecium**†

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

- Leaves bordered with **cilia**.

  - Cilia from leaf base to apex; paraphyllia polymorphous, laciniate, ciliate & few to abundant; E
  - Cilia at leaf base only; paraphyllia filiform & abundant; WS*

  - Leaves bordered with **linear** cells.

  - Leaf margins serrulate with multistratose borders; leaves ±ovate & acute; E

**Group P15**
- **Thelia**
- **Helodium**
- **Platylomella lescurii**
Group P16 – Costa single & narrow; leaves with distinct alar cells

Alar cells inflated and hyaline, or yellow.
Paraphyllia present.
- Stem leaves plicate; paraphyllia filamentous & abundant; WS
- Stem leaves plane; paraphyllia foliose & either abundant or few; WS*

Paraphyllia lacking.
- Leaves broadly rounded at tip.
  - Leaves with an apiculus; plants reddish; A/A
  - Leaves without an apiculus; alar cells thin-walled; in fens and swamps; N
- Leaves acuminate or bluntly acute.
  - In fens or other nutrient rich waters; alar cells numerous in large groups; WS*
  - On rocks in or along streams; alar cells subquadrate to oblong; WS
- Leaves straight.
  - Leaves ovate-lanceolate & narrowed to an acumen; WS*
  - Leaves acuminate; alar cells often in broad decurrencies; WS

Alar cells small & subquadrate.
- Leaves +broadly oblong-ovate.
  - Shoots +julaceous.
  - Leaves abruptly apiculate; plants erect; in lawns & gardens; WC, NY
  - Leaves rounded to acute; plants prostrate; on rocks in or along streams; WS
  - Leaves ovate to ovate-lanceolate.
  - Leaf margins +serrate (teeth alternating in size); costa stout; cells +prorulose; WS(WC & SA)
  - Leaf margins entire to serrulate; costa slender; cells smooth; SE
  - Leaves +lanceolate; shoots not julaceous; plants prostrate.
  - Leaves narrowed to long, channeled acumen & +squarrose-recurred; WS*
  - Leaves & cells lacking any of the above unique characters; WS

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

Leaf cells 1-4 papillose; costa variable, usually single & forked; leaves dimorphic; W
- Leaf cells prorulose; costa variable, usually ~1/2 leaf length; leaves dimorphic; W
- Leaf cells smooth; costa short & double, or about 1/2 leaf length
  - Leaf margins serrulate to serrate all around; alar cells abruptly inflated; WS*
  - Leaf margins entire or with serrulate tips.
  - Alar cells poorly differentiated; WS

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

Leaves bordered with cilia; paraphyllia few to abundant (costa usually single); E
**Group P19 – Costa short & double, or none; leaves with distinct alar cells**

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 +triangular** group; apices **serrate**; SE  
      - **Heterophyllum**
    - Alar cells **oblong & in +triangular** group; apices **serrulate**; E, NW  
      - **Brotherella**
    - Alar cells **oblong & in rows** 1(-2) cells wide; apices **+entire**; E
    - Alar cells **few** with short-oblong cells above; apices **serrulate**; WS
  - Leaves **homomallous**; alar cells abruptly & strongly inflated as "bubble" cells; E
  - Leaves neither falcate-secund nor homomallous.
  - Stem leaves **without** a setaceous point, acute, acuminate or apiculate.
    - Leaves **squarrose-recurred**; alar cells oblong & +inflated; WS*
      - **Rhytidiadelphus squarrosus**
    - Leaves **erect** to spreading; alar cells hyaline.
      - **Calliergonella cuspidata**
    - Plants **erect**; stems with a **hyalodermis**; alar cells in **auricles**; WS
      - **Sematophyllum**
    - Plants **prostrate**; stems **without a** hyalodermis; alar cells **not** in auricles.
      - Cells at leaf insertion **inflated** in 1 or 2 distinctive rows; E
      - Cells at leaf insertion **not** in a distinctive row; leaves >1 mm.
      - Leaves **serrulate** throughout; alar cells **thin**-walled; WS*
      - Leaves **entire**; alar cells **thick**-walled; pseudoparaphyllia; WS
        - **Callicladium haldanianum**
  - Alar cells **quadrate to short** oblong.
  - Leaves distinctly **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 turFACE**
      - 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
            - **Forstroemia**
          - Secondary stems **simple** or with **few** branches; E, AZ
            - **Leucodon**
**Group P20 – Costa of uncommon or variable 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 & double).

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

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**

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**

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

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

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

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

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

Leaf margins **entire**; costa occasionally Y-shaped; in bogs; **WS**

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

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

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

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

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

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

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

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

Leaves **not decurrent**.

Leaf margins **serrulate** to **dentate**; branches **terete** (round); **E**

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

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**Note:** Only the genera in **normal** type (NOT in brackets) in the Skeleton to Freely Branched Mosses are included in the following Groups.  **Reminder:** Definitions for cell length to breadth ratios are found in the Introduction, the Overview & at the end of this section.

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

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

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**Group P20**

- **Hygrohypnum**
- **Heterocladium**
- **Plagiothecium**
- **Calliergon**

**Group P21**

- **Bryhnia**
- **Platyhypnidium riparioides**
- **Pseudoscleropodium purum**
- **Calliergon**
- **Isothecium**
- **Drepanocladus simplicissimus**
- **Heterocladium macounii**
- **Thelia**
- **Forsstroemia trichomitria**
- **Myurella siberica**
- **Taxiphyllum**
Group P22 – Cells long, smooth or indistinctly ornamented; costa single (long & narrow)

Shoots complanate.
Suches serrulate throughout with twisted tips; in mesic habitats; WS*
Leaves entire & wide spreading.
Leaves distant, often wide-spreading; alar cells few & rectangular; WS
Shoots triangular; leaves keeled, 3-ranked & slenderly acuminate; in wet places; WS*
Shoots lacking any of the above unique characteristics.
Plants large & +pinnately branched; basal cells porose.

Shoots prostrate to arching; leaves plane; W
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
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

Group P22

Steerecleus serrulatus
Leptodictyum riparium†
Dichelyma

Eurhynchium†

Platypnuidium

Eurhynchium†

Brachythecium†

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

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

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

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

Plants not aquatic.

Stem hyalodermis well or moderately developed; rhizoids papillose.

Alar cells inflated or **quadrat**e; leaves +/-serrate throughout; WS*

Alar cells +/- **undifferentiated**; leaves **entire**; WS*

Stem hyalodermis **lacking**; rhizoids smooth.

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

Leaf apical cells similar to medial cells in length.

Alar cells quadrat; pseudoparaphyllia filamentous; E

Alar cells +/-undifferentiated; pseudoparaphyllia lacking.

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

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

Leaf cells **prorulose**.

Costa short & double; plants small & creeping.

Plants dull; axillary **brood bodies** present; cells thick-walled; WS*

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

Leaves falcate-secund.

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

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

Leaves straight.

Plants on tree trunks.

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

Leaves entire margins & gradually acuminate apices; unique capsules; E

Plants on soil in mesic to wet habitats.

Leaves broadly oblong to ovate, concave & with rounded to cuculate apices.

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

Leaves ovate lanceolate, +/- plane & 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 & yellowish; WS

Cells >5:1; capsules ±oblung-ovoid & reddish; WS

Leaf margins +/-entire.

Leaves wide-spread; capsules +/-cylindric & yellowish; WS

Leaves erect; capsules ±oblung-ovoid & reddish; WS
**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**

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

**Group P26**

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

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

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

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

Group P27

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

Group P27

Leaves *nor* fragile.

Group P27

Leaves *nudulose* (wavy) throughout the leaf; WS

Group P27

Cells *nudulose* nor porose; primary stems *creeping* & *filiform* / stoloniferous.

Group P27

Leaf margins *papillose-crenulate*; E

Group P27

Leaf margins strictly *unipapillose*.

Group P27

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

Group P27

Leaves *not* squarrose (wet).

Group P27

Costa long & single.

Group P27

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

Group P27

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

Group P27

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

Group P27

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

Group P27

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

Group P27

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

Group P27

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

Costa long & single.

Group P28

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

Group P28

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

Group P28

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

Group P28

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

Group P28

Shoots *nor* complanate.

Group P28

Leaf apices *acute* to *acuminate*.

Group P28

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

Group P28

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

Group P28

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

Group P28

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

Group P28

Costa short & double or none.

Group P28

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

Group P28

#: 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.