

# NE Sub-Guide to Rarely Branched (mostly acrocarpous) Mosses

Revised through 17 May 2010

**Reminder:** A dagger (†) indicates that not all of the species within the given genus have the character(s) defining that Group. Abbreviations for the **distribution** of taxa are found at the end of the Concordance. Abbreviations for the number of **stereid bands** in costa cross sections are found in the Introduction & at the end of this section.

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## Group A1 – Shoots flat or angular, not round

### Group A1

Shoots **flattened**; leaves **2-ranked** (lying in one plane).

Leaves **distichous** (attached in two rows on opposite sides of the stem).

Leaves **cleft** at anterior edge and clasping posterior edge of next leaf; WS

Leaves **conduplicate**, crowded, & progressively larger; the “Sword” moss; WS\*

Leaves flat, **decurent** & **confluent**; protonemata **luminous**; “Goblin Gold”; WS\*

Leaves **needle-like**; a roughened subula from a sheathing, shiny-white base; WS

Leaves **complanate** (attached all around the stem, but twisted into one plane).

Leaves with a long, single **costa**; cells **smooth**

Leaves **distant** on stoloniferous shoots & **bordered** by linear cells; WS

Leaves **crowded**, unbordered &  $\pm$  **undulate**; capsules plicate (dry); E

*Fissidens*

*Bryoxiphium*

*Schistostega*

*Distichium*

*Plagiomnium*

*Aulacomnium*†

Shoots **triangular**; leaves **3-ranked**.

Plants **minute** with **immersed** capsules; leaves **broadly** ovate with **recurved** apiculi; WS

Plants **larger** with **exserted** capsules; leaves ovate **lanceolate**, squarrose & **decurent**.

Cells **intermediate** & **smooth**; in calcareous **wetlands**.

Capsules with well-defined **neck**; endostome **longer** than exostome; N

Capsules **short** & **black** (golf clubs); endostome **reduced** to lacking; N

*Acaulon*†

*Meesia*†

*Catospidium*

Shoots **angular**; leaves **4-5 ranked**.

Stems densely **tomentose**; leaves **squarrose** recurved; in calcareous **wetlands**; N

Stems **smooth**; leaves crowded and **appressed**; on **soil** near rocks; A/A

*Paludella*

*Conostomum*

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## Group A2 – Shoots julaceous when wet

### Group A2

Stems **red**.

Stems **sparsely** forked; capsule necks mostly **short** to **moderate** in length.

Cells **long** (~8:1); N\*

Cells **intermediate** (~4:1).

Upper leaves **apiculate**; capsules **pendent**; peristome **double**; WS

*Anomobryum*

*Bryum*†

Stems **green**.

Cells  $\pm$  **prorulose**; leaves **5-ranked** and serrate; plants bluish-**white**; A/A

Cells **smooth**; leaves radially arranged.

Leaves **serrulate** & **unbordered**; **immersed** capsules: E

Leaves **entire** & **bordered** with **longer** cells; **exserted** capsules; WS

*Conostomum*

*Pleuridium*†

*Bryum*†

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**Group A3 – Stems distinctly tomentose**

	<b>Group A3</b>
Stems covered with <b>pigmented</b> (reddish to brownish) rhizoidal tomentum to near apex.	
Leaves <b>squarrose-recurved</b> & heart shaped; fens; N	<i>Paludella</i>
Leaves <b>ovate</b> to broadly elliptical.	
Rhizoidal initials in <b>longitudinal rows</b> ; endostome fused into a <b>dome</b> ; N	<i>Cinclidium</i>
Rhizoidal initials <b>not</b> in rows; endostome segments <b>free</b> ; N*	<i>Rhizomnium</i> †
Leaves <b>oblong</b> -lanceolate to oblong-lingulate.	
Cells <b>pleuripapillose</b> ; terminal cell long and <b>smooth</b> ; brood bodies <b>axillary</b> ; N*	<i>Zygodon</i> †
Cells <b>unipapillose</b> ; terminal cell <b>papillose</b> ; brood bodies <b>terminal</b> ; WS	<i>Aulacomnium</i> †
Leaves <b>lanceolate</b> to <b>subulate-setaceous</b> ; WS	<i>Dicranum</i>
Stems covered with <b>white-wooly</b> tomentum.	
Leaves with green sheets ( <b>lamellae</b> ) on their surface; bogs; N*	<i>Polytrichum</i> †
Leaves <b>lacking</b> lamellae; WS	<i>Dicranum</i>

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**Group A4 – Stems red**

	<b>Group A4</b>
Plants <b>julaceous</b> .	
Stems <b>occasionally</b> forked; leaves ovate to ovate-lanceolate & concave.	
Leaves <b>broadly</b> obtuse to acute; costa ending <b>subpercurrent</b> ; cells ~ <b>8:1</b> ; N*	<i>Anomobryum</i>
Leaves obtuse to <b>acute</b> ; costa percurrent to <b>excurrent</b> ; cells ~ <b>4:1</b> ; WS	<i>Bryum</i> †
Plants with stems covered with <b>pigmented</b> (reddish to brownish) <b>tomentum</b> .	
Rhizoidal initials in <b>longitudinal rows</b> ; endostome <b>fused</b> into a dome; N	<i>Cinclidium</i>
Rhizoidal initials <b>not</b> in rows; endostome segments <b>free</b> ; N*	<i>Rhizomnium</i>
Plants <b>neither</b> julaceous <b>nor</b> tomentose.	
Leaves <b>bordered</b> by elongated cells.	
Leaves distinctly <b>toothed</b> ; cells <b>smooth</b> ; leaves <b>plane</b> ; WS	<i>Mnium</i> †
Leaves <b>entire</b> ; WS	<i>Bryum</i> †
Leaves <b>not</b> bordered.	
Leaves <b>serrulate ±throughout</b> ; cells <b>prorulose</b> ; WS	<i>Philonotis</i> †
Leaves <b>±serrulate</b> near the <b>apex</b> ; cells <b>smooth</b> .	
Leaves <b>subulate</b> ; alar cells <b>inflated, thick-walled &amp; reddish</b> ; N*	<i>Blindia</i>
Leaves <b>not</b> subulate; alar cells <b>±undifferentiated</b> ; WS	<i>Pohlia</i> †

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**Group A5 – Leaves squarrose-recurved**

	<b>Group A5</b>
Leaves squarrose-recurved when dry (or wet).	
Leaves <b>5-ranked</b> & folded to appear <b>heart shaped</b> ; stems densely <b>tomentose</b> ; fens; N	<i>Paludella</i>
Leaves squarrose-recurved only when wet ( <b>±appressed</b> when dry).	
Cells <b>intermediate</b> in length; WS	<i>Dicranella</i> †
Cells <b>short</b> .	
Leaves <b>±bordered</b> by <b>longer</b> , or <b>shorter &amp; thick-walled</b> cells; <b>1*</b> ; WS	<i>Tortula</i> †
Leaves <b>unbordered</b> ; <b>2*</b> ; WS	<i>Barbula</i> †

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**Group A6 –Leaves falcate-secund**

Plants <b>grayish</b> ; costa <b>&gt;1/2</b> leaf breadth with <b>3(4)</b> cell layers; green <b>striations</b> on leaves; N*	<b>Group A6</b> <i>Paraleucobryum</i> †
Plants <b>green</b> ; leaves unistratose & <b>lacking</b> striations; costa usually <b>&lt;1/5</b> leaf breadth.	
Alar cells <b>obvious</b> ; capsules <b>rarely</b> strumose; <b>various</b> habitats; <b>2*</b> ; WS	<i>Dicranum</i> †
Alar cells <b>±undifferentiated</b> ; plants <b>small</b> , mostly <1cm; WS	<i>Dicranella</i> †

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**Group A7 –Leaves subulate / setaceous (8:1 or greater)**

Plants small to <b>minute</b> (mostly <5 mm high) with <b>±immersed</b> capsules growing on bare <b>soil</b> , usually as winter <b>annuals</b> ; the " <b>pygmy ephemerals</b> " as defined here.	<b>Group A7</b>
Setae <b>straight</b> ; capsules <b>immersed</b> & <b>cleistocarpous</b> .	
Capsules <b>pyriform</b> with a conspicuous, <b>stomatose</b> neck; spores <b>small</b> ; WS	<i>Bruchia</i> †
Capsules <b>globose</b> to <b>ovoid</b> , <b>lacking</b> a distinct neck.	
Calyptrae mitrate or <b>cucullate</b> ; spores numerous & <b>small</b> ; WS	<i>Pleuridium</i> †
Calyptrae <b>rudimentary</b> ; spores few & <b>large</b> (>100µ); E	<i>Archidium</i> †
Plants <b>larger</b> with <b>exserted</b> capsules growing on <b>various</b> substrates.	
Leaves with bases distinctly <b>incurved</b> to <b>expanded</b> & <b>clasping</b> .	
Cells <b>intermediate</b> in length & <b>prorulose/papillose</b> ; upper cells <b>±bistratose</b> ; WS	<i>Bartramia</i> †
Cells <b>intermediate</b> in length & <b>smooth</b> .	
Capsules with <b>distinct</b> , very long <b>necks</b> ; WS	<i>Trematodon</i> †
Capsules <b>lacking</b> a distinct neck.	
Plants <b>larger</b> ; peristome <b>single</b> with <b>forked</b> teeth.	
Teeth divided to <b>base</b> , <b>round</b> & <b>papillose</b> ; WS	<i>Ditrichum</i> †
Teeth divided to <b>mid-point</b> , <b>flat</b> & <b>pitted-striolate</b> ; WS	<i>Dicranella</i> †
Cells <b>short</b> & <b>smooth</b>	
Upper cells <b>±bistratose</b> ; capsules <b>inclined</b> , <b>asymmetric</b> & <b>strumose</b> ; WS	<i>Oncophorus</i> †
Leaves with a <b>broad</b> , <b>single</b> costa (>1/3 the leaf width).	
Alar cells <b>inflated</b> & <b>hyaline</b> or <b>colored</b> (brownish to reddish).	
Costa <b>3(4)</b> cell <b>layers</b> thick (middle & dorsal layers <b>green</b> & " <b>striped</b> "); N*	<i>Paraleucobryum</i>
Costa <b>lacking</b> the above unique characters.	
Inner basal cells <b>pale</b> , <b>enlarged</b> & extending up along the costa; N*	<i>Dicranodontium</i>
Alar cells <b>±undifferentiated</b> ; capsules <b>pyriform</b> ; WS	<i>Leptobryum</i>
Leaves <b>lacking</b> the above unique characteristics.	
Alar cells distinctly <b>differentiated</b> .	
Capsules <b>obovoid</b> to <b>pyriform</b> ; on <b>rocks</b> .	
Capsules <b>ribbed</b> (dry); peristome teeth wide- <b>flaring</b> , <b>±split</b> & <b>striolate</b> ; N	<i>Arctoa</i>
Capsules <b>smooth</b> (dry); peristome teeth <b>erect</b> , <b>±entire</b> & <b>papillose</b> ; N*	<i>Blindia</i>
Capsules <b>lacking</b> any of the above unique characters; substrates <b>various</b> .	
Cells with <b>cuticular ridges</b> ; peristome teeth <b>±entire</b> & <b>papillose</b> ; N*	<i>Dicranoweisia</i>
Cells <b>smooth</b> ; peristome teeth <b>forked</b> & <b>pitted-striolate</b> below; WS	<i>Dicranum</i> †
Alar cells <b>±undifferentiated</b> .	
Cells <b>intermediate</b> to long; peristome <b>teeth</b> usually present.	
Plants <b>small</b> (<2mm); leaves <b>little</b> altered (dry); on <b>rocks</b> ; WS	<i>Seligeria</i> †
Cells <b>short</b> ; annulus <b>compound</b> ; peristome teeth mere <b>stubs</b> ; WS*	<i>Brachydontium</i>

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**Group A9 – Leaves with hair-points or awns**

	<b>Group A9</b>
Plants <b>minute</b> (mostly <5 mm high) with <b>±immersed</b> capsules growing on bare <b>soil</b> , usually as winter <b>annuals</b> ; the " <b>pygmy ephemerals</b> " as defined here.	
Leaves with <b>reflexed</b> tips; cells with <b>single</b> blunt papillae; WS*	<i>Acaulon</i> †
Plants growing on <b>dung</b> , animal remains, or other highly nitrogenous materials; the " <b>dung mosses</b> ".	
Hypophysis greatly <b>differentiated &amp; colored</b> ; peristome teeth <b>chambered</b> ; N, CP & SA	<i>Splachnum</i> †
Hypophysis narrowly <b>pyriform</b> & <b>±urn-colored</b> ; peristome teeth <b>not</b> chambered; N	<i>Tetraplodon</i> †
Plants <b>lacking</b> any of the above unique characteristics.	
Leaves "fleshy" from crowded <b>lamellae</b> covering a very broad costa; WS	<i>Polytrichum</i> †
Leaves with distinct <b>border</b> .	
Cells <b>short</b> ( <b>±isodiametric</b> ); pleuripapillose or smooth; WS	<i>Desmatodon</i> †
Cells <b>intermediate</b> in length; smooth.	
Capsules <b>pendent &amp; pyriform</b> ; WS	<i>Bryum</i> †
Leaves with large, lax & <b>hyaline</b> basal cells contrasting with dense upper cells.	
Basal cells pale with <b>brown, thickened</b> cross walls; calyptrae <b>campanulate</b> ; WS	<i>Encalypta</i> †
Basal cells <b>thin-walled &amp; non-pigmented</b> throughout; calyptrae <b>cucullate</b> .	
Peristome of 32 <b>twisted</b> teeth on a <b>high</b> basal membrane; WS	<i>Tortula</i> †
Peristome of 32 <b>±erect</b> teeth on a <b>low</b> basal membrane; WS	<i>Desmatodon</i> †
Leaves <b>lacking</b> the above unique characteristics.	
Leaf cells mostly <b>smooth</b> .	
Plants in <b>tufts</b> on <b>tree</b> trunks & branches (rarely on rocks).	
Leaves <b>crisped</b> when dry; basal cells <b>yellow, thick-walled</b> ; WC	<i>Uloa</i> †
Leaves <b>not</b> crisped when dry; basal cells <b>undifferentiated</b> ; WS*	<i>Orthotrichum</i> †
Plants in tufts, <b>cushions</b> & mats on <b>rocks</b> .	
Calyptrae small, <b>cucullate</b> or <b>mitrate</b> .	
Capsules <b>systylious</b> ; calyptrae <b>short</b> ; in <b>wetter</b> habitats; WS	<i>Schistidium</i> †
Capsules <b>not</b> systylious; calyptrae <b>to</b> operculum; in <b>dryer</b> habitats; WS	<i>Grimmia</i> †
Plants on <b>soil</b> primarily.	
Cells <b>intermediate</b> in length; capsules <b>pendent &amp; pyriform</b> ; WS	<i>Bryum</i> †
Cells <b>short</b> ( <b>±isodiametric</b> ); capsules mostly <b>erect &amp; cylindrical</b> ; WS	<i>Desmatodon</i> †

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**Group A10 – Leaves with lamellae, ridges or filaments**

	<b>Group A10</b>
Leaves with <b>green</b> , sheet-like <b>lamellae</b> .	
Leaves with a very <b>broad costa</b> covered by <b>&gt;20</b> lamellae.	
Lamellar apical cells <b>papillose</b> ; capsules <b>±terete</b> .	
Leaves <b>subtubulose</b> ; lamellar apical cells elliptic- <b>pyriform</b> ; WS	<i>Polytrichastrum</i>
Leaves oblong <b>lanceolate</b> ; lamellar apical cells <b>±rounded</b> ; WS	<i>Pogonatum</i>
Lamellar apical cells <b>smooth</b> or ridged; capsules sharply <b>4-5 angled</b> ; WS	<i>Polytrichum</i>
Leaves with a <b>narrow costa</b> having <b>&lt;20</b> lamellae; WS	<i>Atrichum</i>
Leaves with <b>ridge</b> -like lamellae on the <b>back</b> (dorsal side) of the costa; WS	<i>Dicranum</i> †
Leaves with fine, <b>white</b> , threadlike <b>filaments</b> in a tangled, cobwebby <b>weft</b> ; N*	<i>Saelania</i>

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**Group A11 – Leaves undulate**

Leaves **complanate** (attached all around the stem but twisted into one plane); E  
 Leaves with **lamellae** on the costa; WS  
 Leaves **lacking** any of the above unique characteristics; N

**Group A11**  
*Aulacomnium*†  
*Atrichum*†  
*Dicranum*†

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**Group A12 – Leaves involute**

Leaf margins involute **wet** or dry.  
 Leaf margins **infolded** / **inflexed** over **photosynthetic** lamellae or filaments; WS  
 Leaf margins **inrolled** over laminae **lacking** lamellae or filaments.  
 Leaf cells **papillose**.  
     Capsules **exserted** & **operculate**; WS  
     Capsules **immersed** to emergent, **cleistocarpous**; E  
 Leaf margins involute when **dry**; **plane** to erect when **wet**; cells **bulging** on upper surface; E

**Group A12**  
*Polytrichum*†  
  
*Weissia*  
*Astomum*  
*Hyophila*

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**Group A13 – Leaves ±all costa**

Leaves channeled & **subtubulose**; E

**Group A13**  
*Leucobryum*

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**Group A14 – Leaves with a broad, single costa**

Leaves **bristle-like** (setaceous) or with distinct hair-points.  
 Leaves with costa of **3(4)** cell **layers** (middle & dorsal layers **green** & “**striped**”); N\*  
 Leaves **crowded** at stem tips; reddish, axillary **hairs** common; WS  
 Leaves **lacking** the above unique characteristics.  
 Leaves with **strongly differentiated** alar cells (inflated & hyaline).  
     Inner basal cells **pale**, **enlarged** & **extending** up along the costa; N\*  
 Leaves with alar cells **little** differentiated; WS  
 Leaves **oblong-lanceolate**; capsules elongate, curved & with a conspicuous neck; N

**Group A14**  
  
*Paraleucobryum*  
*Leptobryum*  
  
  
*Dicranodontium*  
*Dicranella*†  
*Meesia*†

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*Reminder: The costa in Groups A15 through A19 is long & single.*

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**Group A15– Leaves with bases distinctly incurved to expanded & clasping**

**Group A15**

Leaves **subulate** / **setaceous** (needle or bristle-like).

Cells **intermediate** in length & **prorulose/papillose**; upper cells **±bistratose**; WS

*Bartramia*†

Cells **intermediate** in length & **smooth**.

Capsules with **distinct**, very long **necks**; WS

*Trematodon*

Capsules **lacking** a distinct neck.

Plants **larger**; peristome **single** with **forked** teeth.

Teeth divided to **base**, **round** & **papillose**; WS

*Ditrichum*†

Teeth divided to **mid-point**, **flat** & **pitted-striolate**; WS

*Dicranella*†

Cells **short** & **smooth**; capsules **inclined**, **asymmetric** & **strumose**; WS

*Oncophorus*†

Leaves with **lamellae** or **ridges** on their laminae or costa.

Leaves with a very **broad costa** covered by **>20** lamellae.

Leaves mostly **unistratose**; peristome **present**.

Lamellar apical cells **papillose**; capsules **±terete**.

Leaves **subtubulose**; lamellar apical cells elliptic-**pyriform**; WS

*Polytrichastrum*

Leaves oblong **lanceolate**; lamellar apical cells **±rounded**; WS

*Pogonatum*

Lamellar apical cells **smooth** or ridged; capsules sharply **4-5 angled**; WS

*Polytrichum*

Leaves **lacking** any of the above unique characteristics; cells strongly **bulging** on upper surface; WS

*Timmia*

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**Group A16 – Leaves with long decurrencies**

**Group A16**

Shoots **angular** in cross-section; leaves **squarrose** recurved; cells **short** & **papillose**; N

*Paludella*

Shoots **terete** (round in cross-section); capsules **pyriform** or **pendulous**.

Leaves distinctly **toothed** **±throughout**.

Marginal teeth **paired**; sterile stems **±erect** & **round**; WS

*Mnium*

Marginal teeth **single**; sterile stems **prostrate** & **complanate**; WS

*Plagiomnium*

Leaves **entire** to **±serrulate** or **±toothed** at apex.

Leaves predominantly **broader near** the middle; capsules **pendent**.

Leaves commonly **bordered**; median cells **<4:1**; WS

*Bryum*†

Leaves **not bordered**; median cells **>4:1**; WS

*Pohlia*†

Leaves predominantly **broader** at the **base**; setae very **long**; capsules **±inclined**; N

*Meesia*†

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**Group A17 – Leaves with a distinct group of hyaline cells**

**Group A17**

*Note: hyaline cells may not be clearly distinct in very old leaves that have lost their chlorophyll.*

Hyaline cells at <b>apex</b> of leaves; plants <b>whitish</b> .	
Stems often <b>forked</b> or branched; cells <b>papillose</b> (simple & forked); capsules <b>immersed</b> ; WS	<i>Hedwigia</i>
Stems <b>rarely</b> branched; leaves <b>apiculate</b> ; capsules <b>pendent</b> ; cells <b>smooth</b> ; WS	<i>Bryum</i> †
Hyaline cells as <b>marginal wedges</b> broadest at the base of leaves.	
Leaves <b>spreading</b> & crenulate to <b>entire</b> ; upper cells <b>pleuripapillose</b> ; WS	<i>Tortella</i>
Hyaline cells in <b>abruptly differentiated</b> , ±oval " <b>windows</b> " (cancellinae) in the lower 1/3 of leaves.	
Leaf margins <b>revolute</b> ; peristome of <b>32 twisted</b> teeth; <b>1*</b> ; WS	<i>Tortula</i> † ( <i>Syntrichia</i> )
Hyaline, <b>inflated</b> & <b>thin-walled</b> cells across the <b>lower 1/3</b> of leaves.#	
Leaves <b>toothed</b> above.	
Upper leaf cells densely <b>pleuripapillose</b> ; capsules <b>smooth</b> ; <b>2*</b>	
Older leaves <b>brick-red</b> ; stems <b>lacking</b> a hyalodermis; WS	<i>Bryoerythrophyllum</i>
Leaves <b>revolute</b> at least below; <b>1*</b> .	
Leaves ± <b>rounded</b> with short to <b>long</b> awns; cells <b>10-13μ</b> ; <b>peristome</b> present.	
Peristome of 32 <b>twisted</b> teeth on a <b>high</b> basal membrane; WS	<i>Tortula</i> †
Peristome of 32 ± <b>erect</b> teeth on a <b>low</b> basal membrane; WS	<i>Desmatodon</i> †
Leaves ± <b>acute</b> ; cells <b>15-20μ</b> ; peristome <b>none</b> or <b>rudimentary</b> ; WS	<i>Pottia</i> † ( <i>Microbryum</i> )
Leaves <b>lacking</b> any of the above unique characteristics.	
Cross walls of basal cells <b>thick</b> & <b>brown</b> ; calyptrae long <b>campanulate</b> ; <b>1*</b> ; WS	<i>Encalypta</i> †
Cross walls of <b>normal</b> thickness; calyptrae <b>cucullate</b> .	
Stems with a <b>hyalodermis</b> ; papillae usually <b>bifid</b> ; <b>2*</b>	
Stems <b>lacking</b> a central strand; WS	<i>Oxystegus</i>
Stems <b>lacking</b> a hyalodermis; papillae usually <b>C-shaped</b> ; <b>1*</b> .	
Peristome of 32 <b>twisted</b> teeth on a <b>high</b> basal membrane; WS	<i>Tortula</i> †
Peristome of 32 ± <b>erect</b> teeth on a <b>low</b> basal membrane; WS	<i>Desmatodon</i> †

#: *Note: Many taxa with short, papillose, medial cells possess basal cells that are somewhat differentiated, i.e., pale (translucent), less papillose, somewhat elongated and/or colored, especially near the insertion. The taxa in this Group A16 represent the extreme, strongly differentiated condition of a gradient while those taxa with the less differentiated basal cells are found in Group A23.*

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**Group A18 – Leaves with a distinct marginal border**

	<b>Group A18</b>
Leaves <b>ciliate</b> at the margins. Plants primarily <b>protonemata</b> ; capsules inclined, ovoid & <b>ventricose</b> ; WS*	<i>Buxbaumia</i>
Leaves with a border of <b>elongate</b> cells contrasting with <b>shorter</b> medial cells. Plants erect, <b>rosulate</b> -foliate & large; from horizontal, underground stems; WS Plants strongly <b>flattened</b> ; leaves twisted into one plane ( <b>complanate</b> ); WS Plants with <b>red stems</b> ; stems <b>tomentose</b> . Rhizoidal initials in <b>longitudinal rows</b> ; endostome fused into a <b>dome</b> ; N Rhizoidal initials <b>not</b> in rows; endostome segments <b>free</b> ; N*	<i>Rhodobryum</i> <i>Plagiomnium</i> <i>Cinclidium</i> <i>Rhizomnium</i>
Plants <b>lacking</b> the above unique characteristics. Leaves with <b>lamellae</b> on the costa; WS Leaves with <b>paired teeth</b> on margins; WS Leaves with <b>single teeth</b> on margins. Leaves <b>rounded-obtuse</b> & apiculate; upper cells in <b>oblique</b> rows; N* Leaves <b>rounded-obtuse</b> & apiculate; upper cells <b>not</b> in oblique rows; N* Leaves <b>acute</b> to awned; cells <b>not</b> in oblique rows; capsules <b>pendent &amp; pyriform</b> ; WS	<i>Atrichum</i> <i>Mnium</i> † <i>Pseudobryum</i> <i>Plagiomnium</i> <i>Bryum</i> †
Leaves with <b>entire</b> margins. Leaf cells <b>&gt;3:1</b> . Capsules <b>pendent &amp; pyriform</b> ; WS Capsules <b>erect</b> ; leaves <b>rounded-obtuse</b> ; upper cells in <b>oblique</b> rows; N* Leaf cells <b>1-2:1</b> ; A/A	<i>Bryum</i> † <i>Pseudobryum</i> <i>Cyrtomnium</i>
Leaves with margins differing in <b>color</b> and/or <b>opacity</b> from the medial laminae. Peristome (32) <b>spirally</b> twisted above a <b>high</b> basal membrane; WS Peristome (16) <b>obliquely</b> slanted above a <b>low</b> basal membrane; WS	<i>Tortula</i> † <i>Desmatodon</i> †

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**Group A19 – Leaves with distinct alar cells**

	<b>Group A19</b>
Stems <b>tomentose</b> ; alar cells <b>inflated, hyaline</b> & <b>±yellow-brown</b> towards the margin; WS Stems <b>not</b> or indistinctly tomentose; alar cells <b>not</b> as above. Costa <b>broad</b> , <b>&gt;1/3</b> leaf width; alar cells <b>inflated</b> , & hyaline to brownish to <b>reddish</b> . Costa <b>3(4)</b> cell <b>layers</b> thick (middle & dorsal layers <b>green</b> & “ <b>striped</b> ”); N* Costa <b>lacking</b> the above unique characters. Inner basal cells <b>pale, enlarged</b> & extending up along the costa; N*	<i>Dicranum</i> <i>Paraleucobryum</i> <i>Dicranodontium</i>
Costa <b>narrow</b> , <b>&lt;1/3</b> leaf width. Alar cells enlarged to <b>inflated &amp; yellowish to brownish</b> . Capsules <b>obovoid to pyriform</b> ; on <b>rocks</b> ; N* Capsules <b>cylindrical</b> ; substrates <b>various</b> . Cells with <b>cuticular ridges</b> ; peristome teeth <b>±entire &amp; papillose</b> ; N* Cells <b>smooth</b> ; peristome teeth <b>forked</b> & pitted- <b>striolate</b> below; WS Alar cells <b>sub-quadrate &amp; pale</b> ; cells <b>±thick</b> -walled & often <b>nodulose</b> ; WS	<i>Blindia</i> <i>Dicranoweisia</i> <i>Dicranum</i> <i>Grimmia</i> †

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**Group A20 – Leaves with costa extremely reduced to lacking**

Leaves in **clusters** of **branches** around a central stem & a **network** of green & hyaline cells; WS  
 Leaves **distichous**, **decurrent** & **confluent**; protonemata **luminous**; “Goblin Gold”; WS\*  
 Leaves **spinose** serrate; protonemata **persistent**; cells **smooth**; pygmy **ephemerals**; WS  
 Leaves **lacking** the above unique characters.

Cells **papillose**; capsules **exserted** & **valvate** (4x); plants reddish-**black**; on **rocks**; N\*  
 Cells **smooth**.

Capsules **exserted** with **4 large teeth**; on undersides of **rock overhangs**; N  
 Capsules **sessile** & **gymnostomous**; pygmy **ephemerals**; on **soil**; WS

**Group A20**

*Sphagnum*  
*Schistostega*  
*Ephemerum*†

*Andreaea*†

*Tetradontium*†  
*Micromitrium*

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*Reminder: Definitions for cell length to breadth ratios are found in the Introduction, the Overview & at the end of this section.*

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**Group A21 – Cells long (>5:1) & smooth**

Leaves **little** altered (dry); cell walls **not** thickened; capsules inclined to **pendulous**; WS

**Group A21**

*Pohlia*†

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**Group A22 – Cells intermediate (2-5:1) & distinctly papillose**

Leaves **ovate** & abruptly narrowed to a **short** acumen; papillae **simple**; W & VT  
 Leaves linear-lanceolate to **subulate** from an **erect** base; papillae **simple**; WS

**Group A22**

*Philonotis*†

*Bartramia*†

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**Group A23 – Cells intermediate (2-5:1) & distinctly prorulose**

Leaves **julaceous** and **5-ranked**; peristome teeth **fused** at tip; A/A  
 Leaves and peristome teeth **otherwise**.

Setae **straight**; capsules **asymmetric** & **furrowed**; peristome teeth **lanceolate**.

Leaves with **bistratose** margins &/or lamina; **mesic** habitats; WS

Leaves **unistratose**; **hydric** habitats; WS

Setae **short**, capsules **immersed**

Leaves  $\pm$ linear-**lanceolate** &  $\pm$ **spinulose** above; protonemata **persistent**; WS

Leaves  $\pm$ **subulate** & **serrulate** above; protonemata **ephemeral**; WS

**Group A23**

*Conostomum*

*Bartramia*†

*Philonotis*†

*Ephemerum*†

*Bruchia*†

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**Group A24 – Cells intermediate & smooth (or indistinctly ornamented\*)**
**Group A24**

Leaves predominantly <b>broader near or above</b> the middle ( $\pm$ oblong or obovate).	
Plants <b>small, winter annuals</b> on soil.	
Capsules clearly <b>exserted</b> .	
Costa <b>strong</b> ; protonemata <b>ephemeral</b> ; peristome <b>lacking</b> ; WS	<i>Physcomitrium</i>
Costa <b>weak</b> ; protonemata <b>persistent</b> ; peristome <b>present</b> ; WS*	<i>Discelium</i>
Capsules $\pm$ <b>immersed &amp; <math>\pm</math>pyriform</b> .	
Leaves $\pm$ <b>concave-obovate &amp; serrulate</b> ; capsules <b>operculate</b> ; WS	<i>Physcomitrium</i>
Leaves $\pm$ <b>concave-ovate &amp; entire</b> ; capsules <b>cleistocarpous</b> ; WS	<i>Bruchia</i> <sup>†</sup>
Plants <b>otherwise</b> .	
Leaves commonly bordered by <b>linear</b> cells; capsules pyriform & <b>pendent</b> ; WS	<i>Bryum</i>
Leaves <b>unbordered</b> .	
Medial cells <b>smooth &amp; &gt;5:1</b> (linear rhomboidal); capsules <b>pendent</b> ; WS	<i>Pohlia</i> <sup>†</sup>
Medial cells <b>smooth &amp; &lt;4:1</b> ; capsules inclined to <b>erect</b> .	
Peristome of <b>4</b> massive teeth; plants <b>bud-like</b> ; costa <b>weak</b> ; on <b>rocks</b> ; N	<i>Tetrodontium</i>
Peristome of <b>16</b> teeth; costa <b>strong</b> ; on <b>soil</b> .	
Capsules with well- <b>differentiated</b> necks; calyptrae <b>mitrate</b> ; N*	<i>Tayloria</i>
Capsules <b>lacking</b> a distinctive neck; calyptrae inflated <b>cucullate</b> .	
Capsules <b>inclined &amp; asymmetric</b> ; WS	<i>Funaria</i>
Peristome <b>lacking</b> ; capsules <b>erect &amp; symmetric</b> ; calyptrae <b>mitrate</b> ; WS	<i>Physcomitrium</i>
Leaves predominantly <b>broader near the base</b> ( $\pm$ lanceolate).	
Plants <b>small, winter annuals</b> on soil; capsules $\pm$ <b>immersed &amp; cleistocarpous</b> ; WS	<i>Bruchia</i> <sup>†</sup>
Plants <b>otherwise</b> ; capsules <b>exserted &amp; peristomate</b> .	
Leaves <b>3-ranked</b> ; setae very <b>long</b> ; plants of <b>calcareous</b> wetlands.	
Capsules with well-defined <b>neck</b> ; endostome <b>longer</b> than exostome; N	<i>Meesia</i>
Capsules <b>short &amp; black</b> (golf clubs); endostome <b>reduced</b> to lacking; N	<i>Catoscopium</i>
Leaves $\pm$ <b>subulate / setaceous</b> .	
Capsules <b>ovoid</b> ; plants minute to very <b>small</b> ; on <b>calcareous</b> rocks; WS (N)	<i>Seligeria</i>
Capsules long <b>cylindric</b> ; peristome teeth <b>round</b> , fully <b>split &amp; papillose</b> ; WS	<i>Ditrichum</i>
Capsules $\pm$ <b>oblong</b> , often <b>curved</b> ; peristome teeth <b>flat, split 1/2 &amp; pitted</b> ; WS	<i>Dicranella</i>
Leaves with expanded, <b>sheathing</b> leaf bases; WS	<i>Dicranella</i>
Leaves <b>lacking</b> any of the above unique characteristics.	
Plants on <b>calcareous rocks &amp; small</b> (<2mm); setae <b>cygneous</b> (wet); N	<i>Seligeria campylopoda</i>
Plants of <b>calcareous wetlands</b> ; setae very <b>long</b> ; peristome <b>double</b> ; N	<i>Meesia</i>
Plants of <b>Cu or S</b> rich soils; setae <b>lateral</b> ; peristome <b>endostome</b> only; N*	<i>Mielichhoferia</i>
Plants of <b>disturbed</b> soil; setae <b>terminal</b> ; peristome <b>single</b> ; WS	<i>Ditrichum</i>

\*: bulging, mammillose, indistinctly papillose (i.e. low papillae) or slightly prurlose.

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**Group A25 – Cells short (<2:1) & distinctly papillose**

	<b>Group A25</b>
Leaves with <b>expanded</b> , <b>sheathing</b> bases; cells strongly <b>bulging</b> on upper surface; WS	<i>Timmia</i> †
Leaves distinctly <b>toothed</b> in the upper half.	
Cells <b>unipapillose</b> or mammillose; ventral stereid band <b>weak</b> or <b>lacking</b> .	
Leaves <b>±narrow</b> ; cells <b>coarsely</b> papillose; capsules <b>furrowed</b> ; N	<i>Cynodontium</i> †
Leaves <b>lacking</b> the above unique characteristics.	
Cells <b>pleuripapillose</b> .	
Papillae <b>forked</b> ; basal cells with <b>brown</b> cross-walls; calyptrae long- <b>cylindric</b> ; WS	<i>Encalypta</i>
Papillae <b>C-shaped</b> .	
Basal cells with <b>brown</b> cross-walls; calyptrae long- <b>cylindric</b> ; <b>1*</b> ; WS	<i>Encalypta</i>
Basal cell walls <b>uncolored</b> ; calyptrae <b>cucullate</b> .	
Peristome teeth <b>long &amp; twisted</b> ; <b>2*</b> ; WS	<i>Barbula</i> †
Peristome teeth <b>short &amp; erect</b> ; <b>1*</b> ; WS	<i>Desmatodon</i> †
Papillae <b>conical</b> .	
Cells with <b>4-7</b> papillae;	
Stems <b>repeatedly</b> forked; capsules elongate & <b>urn-shaped</b> ; <b>2*</b> ; WS	<i>Amphidium</i>
Stems <b>sparsely</b> forked; capsules <b>±pyriform</b> ; <b>1*</b> or lacking; WS*	<i>Zygodon</i>
Cells with <b>1-4</b> papillae.	
Costa with <b>two</b> stereid bands.	
Leaf margins <b>revolute</b> on <b>both</b> sides; <b>peristome</b> present.	
Papillae <b>crowded</b> ; basal cells <b>hyaline</b> ; peristome <b>twisted</b> ; WS	<i>Barbula</i> †
Papillae <b>scattered</b> ; basal cells <b>green</b> ; peristome <b>±oblique</b> ; WS	<i>Didymodon</i> †
Leaf margins <b>revolute</b> on <b>one</b> side only; peristome <b>lacking</b> ; WS	<i>Hymenostylium</i>
Leaf margins <b>plane</b> ; peristome <b>lacking</b> ; WS	<i>Gymnostomum</i>
Costa with <b>one</b> stereid band; peristome <b>lacking</b> .	
Sporophytes <b>lateral</b> ; stem rounded- <b>triangular</b> ; WS	<i>Anoetangium</i>
Sporophytes <b>terminal</b> ; stem <b>round</b> ; WS	<i>Gymnostomum</i>
Costa <b>lacking</b> stereid bands; peristome <b>present</b> .	
Basal marginal cells with <b>thickened</b> cross-walls; WS	<i>Ulota</i> †
Basal marginal cells <b>±undifferentiated</b> ; WS	<i>Orthotrichum</i> †
Cells <b>unipapillose</b> .	
Leaves <b>serrulate</b> at apex; stems <b>tomentose</b> ; <b>gemmae</b> on stem extensions; WS	<i>Aulacomnium</i> †
Leaves <b>entire</b> .	
Capsules <b>exserted</b> ; peristome of <b>32 twisted teeth</b> ; plants on <b>soil &amp; rocks</b> ; <b>2*</b> ; WS	<i>Barbula</i> †
Capsules <b>±emergent &amp; valvate</b> (4x); <b>blackish</b> plants on <b>rocks</b> ; <b>0*</b> ; N*	<i>Andreaea</i> †
Capsules <b>±immersed</b> with <b>16 ±reflexed</b> teeth; plants on <b>trees &amp; rocks</b> ; <b>0*</b> .	
Basal marginal cells with <b>thickened</b> cross-walls; WS	<i>Ulota</i> †
Basal marginal cells <b>±undifferentiated</b> ; WS	<i>Orthotrichum</i> †

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**Group A26 – Cells short (<2:1) & smooth (or indistinctly ornamented\*)**

	<b>Group A26</b>
Leaves $\pm$ oblong- <b>spathulate</b> (broad in the middle & even broader above).	
Leaf margins <b>inrolled</b> when dry (erect or plane when wet); cells <b>bulging</b> on upper surface; E	<i>Hyophila</i>
Leaf margins usually <b>revolute</b> , at least in part; cells <b>flat</b> .	
Leaves $\pm$ <b>bordered</b> with <b>longer</b> cells; peristome teeth <b>short &amp; erect; 1*</b> ; WS	<i>Desmatodon</i> <sup>†</sup>
Leaves $\pm$ <b>bordered</b> with <b>shorter</b> cells; peristome teeth <b>long &amp; twisted; 1*</b> ; WS	<i>Tortula</i> <sup>†</sup>
Leaves <b>unbordered</b> .	
Propagula <b>axillary</b> ; peristome of <b>32</b> spirally <b>twisted teeth; 2*</b> ; WS	<i>Barbula</i> <sup>†</sup>
Leaf margins <b>plane</b> ; cells <b>flat &amp; large (&gt;15<math>\mu</math>)</b> ; peristome <b>none</b> or rudimentary; <b>1*</b> ; WS	<i>Pottia</i> <sup>†</sup>
Leaves $\pm$ oblong- <b>lingulate</b> (tongue shaped) or oblong- <b>ligulate</b> (strap shaped); E & BC	<i>Diphyscium</i>
Leaves $\pm$ <b>ovate</b> (broadest in lower third; egg-shaped) & <b>revolute</b> ; peristome of <b>32</b> teeth; <b>2*</b> ; WS	<i>Barbula</i> <sup>†</sup>
Leaves ovate-lanceolate to <b>lanceolate</b> (broadest near the base; lance-shaped).	
Leaves with expanded, <b>sheathing</b> leaf bases.	
Cells <b>bulging</b> on upper surface; capsules <b>symmetric &amp; oblong-ovoid</b> ; WS	<i>Timmia</i>
Cells <b>smooth</b> ; capsules <b>asymmetric &amp; strumose</b> (goiter-like swelling); WS	<i>Oncophorus</i>
Leaves with <b>paired teeth</b> on <b>bistratose</b> margins.	
Margins <b>revolute</b> below; cells with cuticular <b>ridges</b> ; perichaetia <b>terminal</b> ; N*	<i>Plagiopus</i>
Leaves <b>bistratose</b> , at least in part;	
Leaves <b>curved to crisped</b> (dry); cells bulging or flat.	
Calyptrae <b>mitrate, lobed &amp; plicate; 2*</b> ; WS	<i>Ptychomitrium</i>
Leaves <b>lacking</b> any of the above unique characters.	

*Continued below at left margin*

*Continued from Group A26 above*

Leaves **lacking** the above unique characteristics.

Capsules split along <b>4 sutures</b> ; plants <b>saxicolous &amp; blackish</b> ; N*	<i>Andreaea</i> †
Capsules with <b>4, massive</b> teeth; leaves <b>pellucid</b> ; terminal gemmae <b>cups</b> ; WS	<i>Tetraphis</i>
Capsules with 8, <b>16</b> or 32 <b>lanceolate</b> teeth.	
Plants in <b>tufts</b> on <b>tree</b> trunks (rarely on rocks); <b>diplolepidous</b> .	
Leaves <b>crisped</b> when dry; basal cells <b>yellow, thick-walled</b> ; WC	<i>Ulota</i> †
Leaves <b>not</b> crisped when dry; basal cells <b>±undifferentiated</b> ; WS*	<i>Orthotrichum</i> †
Plants in <b>tufts, cushions</b> or mats on <b>rocks</b> .	
Peristomes <b>diplolepidous</b> .	
Basal cells <b>very thick-walled, yellow &amp; radiating</b> from costa; WS	<i>Ulota</i> †
Basal cells <b>+thick-walled, neither yellow &amp; nor radiating</b> ; WS	<i>Orthotrichum</i> †
Peristomes <b>haplolepidous</b> .	
Capsules <b>systylious</b> ; calyptrae <b>short</b> ; in <b>wetter</b> habitats; WS	<i>Schistidium</i> †
Capsules <b>not</b> systylious; calyptrae <b>longer</b> ; in <b>drier</b> habitats; WS	<i>Grimmia</i> †
Plants on <b>soil</b> primarily.	
Setae <b>cygneous</b> ; capsules yellowish & <b>smooth</b> ; calyptrae <b>mitrate</b> ; N*	<i>Campylostelium</i>
Setae <b>bent</b> at capsule base; capsules strumose & <b>purple-red</b> ; leaves <b>revolute</b> throughout & <b>serrate</b> apically; upper cells <b>±square</b> ; WS	<i>Ceratodon</i>
Setae <b>straight</b> .	
Capsules <b>ribbed</b> ; in <b>crevices</b> of cliffs & boulders.	
Peristome teeth <b>divided</b> to half their length; N	<i>Cynodontium</i> †
Peristome teeth <b>undivided</b> ; E	<i>Rhabdoweisia</i>
Capsules <b>smooth</b> (or wrinkled when dry); calyptrae <b>cucullate</b> .	
Setae very <b>long</b> ; capsules <b>inclined</b> ; peristome <b>double</b> ; in <b>fens</b> ; N	<i>Meesia</i>
Setae <b>shorter</b> ; capsules <b>erect</b> ; peristome <b>single</b> ; on mineral <b>soils</b> .	
Basal cells <b>hyaline</b> ; peristome teeth <b>twisted</b> ; WS	<i>Barbula</i> †
Basal cells <b>green</b> ; peristome teeth <b>±oblique</b> ; WS	<i>Didymodon</i> †

\*: bulging, mammillose (cells both bulging & papillose) or indistinctly papillose, i.e. low papillae

Cell length to breadth ratio:

Long cells: >5:1; commonly termed linear.

Intermediate cells: 2-5:1; commonly termed elongated, rectangular, hexagonal or rhomboidal.

Short cells: <2:1; commonly termed isodiametric, quadrate, rounded-quadrate or sub-quadrate.

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

Number of stereid bands evident in costa cross-sections:

2\* = costa with two stereid bands

1\* = costa with one stereid band

0\* = costa lacking stereid bands, i.e., ±homogeneous

End.