

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

Revised through 23 July 2012

**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 and at the end of this section.

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

	<b>Group A1</b>
Shoots <b>flattened</b> ; leaves <b>2-ranked</b> (lying in one plane).	
Leaves <b>distichous</b> (attached in two rows on opposite sides of the stem).	
Leaves <b>cleft</b> at anterior edge and clasping posterior edge of next leaf; WS	<i>Fissidens</i>
Leaves <b>conduplicate</b> , crowded, and progressively larger; the “Sword” moss; WS*	<i>Bryoxiphium</i>
Leaves flat, <b>decurent</b> and <b>confluent</b> ; protonemata <b>luminous</b> ; “Goblin Gold”; WS*	<i>Schistostega</i>
Leaves <b>needle-like</b> ; a roughened subula from a sheathing, shiny-white base; WS	<i>Distichium</i>
Leaves <b>complanate</b> (attached all around the stem, but twisted into one plane).	
Leaves with a long, single <b>costa</b> ; cells <b>smooth</b> .	
Leaves <b>distant</b> on stoloniferous shoots and <b>bordered</b> by linear cells; WS	<i>Plagiomnium</i>
Leaves <b>crowded</b> , unbordered and <b>±undulate</b> ; capsules plicate (dry); E	<i>Aulacomnium</i> †
Leaves <b>ecostate</b> ; cells short and <b>pleuripapillose</b> ; GC	<i>Erpodium</i> †
Shoots <b>triangular</b> ; leaves <b>3-ranked</b> .	
Plants <b>minute</b> with <b>immersed</b> capsules; leaves <b>broadly</b> ovate with <b>recurved</b> apiculi; WS	<i>Acaulon</i> †
Plants <b>larger</b> with <b>exserted</b> capsules; leaves <b>±lanceolate</b> .	
Cells strongly <b>papillose</b> ; plants on <b>dry</b> soils; CA	<i>Triquetrella</i>
Cells <b>smooth</b> ; in calcareous <b>wetlands</b> .	
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>
Shoots <b>angular</b> ; leaves <b>4-5 ranked</b> .	
Stems densely <b>tomentose</b> ; leaves <b>squarrose</b> recurved; in calcareous <b>wetlands</b> ; N	<i>Paludella</i>
Stems <b>smooth</b> ; leaves crowded and <b>appressed</b> ; on <b>soil</b> near rocks; A/A	<i>Conostomum</i>

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## *Group A2 – Shoots julaceous when wet*

	<b>Group A2</b>
Stems <b>red</b> .	
Stems <b>freely</b> forked; plants <b>whitish</b> ; capsule necks <b>extremely long</b> ; A/A	<i>Plagiobryum</i>
Stems <b>sparsely</b> forked; capsule necks mostly <b>short</b> to <b>moderate</b> in length.	
Cells <b>long</b> (~8:1); N*	<i>Anomobryum</i>
Cells <b>intermediate</b> (~4:1).	
Upper leaves <b>abruptly acuminate</b> ; capsules <b>erect</b> ; peristome <b>single</b> ; NW	<i>Aongstroemia</i>
Upper leaves <b>apiculate</b> ; capsules <b>pendent</b> ; peristome <b>double</b> ; WS	<i>Bryum</i> †
Stems <b>green</b> .	
Cells <b>unipapillose</b> and <b>±stellate</b> ; leaves concave-cucullate; A/A.	<i>Aulacomnium</i> †
Cells <b>±prorulose</b> ; leaves <b>5-ranked</b> and serrate; plants bluish- <b>white</b> ; A/A	<i>Conostomum</i>
Cells <b>smooth</b> ; leaves radially arranged.	
Leaves <b>serrulate</b> and <b>unbordered</b> ; <b>immersed</b> capsules; E	<i>Pleuridium</i> †
Leaves <b>entire</b> and <b>bordered</b> with <b>longer</b> cells; <b>exserted</b> capsules; WS	<i>Bryum</i> †

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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> and 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> †
Cells <b>smooth</b> ; leaves broadly <b>lingulate</b> ; a <b>copper-sulfur</b> moss; WS (E)	<i>Scopelophila</i> †
Leaves <b>narrowly lanceolate</b> from an <b>ovate, plicate</b> base; WC, NW	<i>Anacolia</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 freely <b>forked</b> ; leaves with distinct, $\pm$ reflexed <b>point</b> ; cells in <b>oblique</b> rows; A/A	<i>Plagiobryum</i>
Stems <b>occasionally</b> forked; leaves ovate to ovate-lanceolate and concave.	
Leaves <b>broadly</b> obtuse to acute; costa ending <b>subpercurrent</b> ; cells <b>~8:1</b> ; N*	<i>Anomobryum</i>
Leaves <b>abruptly acuminate</b> ; costa <b>percurrent</b> ; cells <b>~4:1</b> ; NW	<i>Aongstroemia</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> .	
Leaf cells <b>&gt;3:1</b> ; WS	<i>Bryum</i> †
Leaf cells <b>&lt;2:1</b> .	
Leaves <b>setaceous, serrate</b> above & <b>recurved</b> below; WC, NW	<i>Anacolia</i>
Leaves <b>neither</b> setaceous, serrate <b>nor</b> recurved.	
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 strongly <b>bulging</b> ; AK	<i>Trachycystis</i>
Cells <b>smooth</b> .	
Cells very <b>large</b> (to 150x50 $\mu$ ); leaves <b>rugose</b> ; WC, NW, CO	<i>Roellia</i>
Cells <b>smaller</b> (up to 50 $\mu$ ); leaves <b>plane</b> ; WS	<i>Mnium</i> †
Leaves <b>entire</b> .	
Leaves $\pm$ <b>dimorphic</b> ( $\pm$ <b>distichous</b> lateral leaves and smaller <b>dorsal</b> leaves); WC	<i>Epipterygium</i>
Leaves of <b>one</b> kind; WS	<i>Bryum</i> †
Leaves <b>not</b> bordered.	
Leaves serrulate $\pm$ <b>throughout</b> ; cells <b>prorulose</b> ; WS	<i>Philonotis</i> †
Leaves $\pm$ serrulate near the <b>apex</b> ; cells <b>smooth</b> .	
Leaves <b>subulate</b> ; alar cells <b>inflated, thick-walled</b> and <b>reddish</b> ; N*	<i>Blindia</i>
Leaves <b>not</b> subulate; alar cells $\pm$ <b>undifferentiated</b> ; WS	<i>Pohlia</i> †

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**Group A5 – Leaves squarrose-recurved**

**Group A5**

Leaves squarrose-recurved when **dry (or wet)**.

Leaves **5-ranked** and folded to appear **heart shaped**; stems densely **tomentose**; fens; N

*Paludella*

Leaves squarrose-recurved **only** when **wet** ( $\pm$ appressed when dry).

Leaves **3-ranked**, long-**decurrent** and with papillose-**crenulate** margins; CA

*Triquetrella*

Leaves **subulate-setaceous** from a **sheathing** base; disturbed soil; N

*Trichodon*

Leaves with **wavy** margins; **hyaline** basal and marginal cells; on dry limestone; SE

*Pleurochaete*

Leaves distinctly **toothed** in upper half; cells **papillose**.

Leaf lamina  $\pm$ **bistratose**; stem **hyalodermis** present; peristome **lacking**; SW

*Rhexophyllum*

Leaf lamina **unistratose**; stem hyalodermis **lacking**; peristome present; SE

*Leptodontium*

Leaves **lacking** the above unique characteristics.

Cell walls irregularly **thickened**; cell lumens **stellate**; A/A

*Didymodon*<sup>†</sup>

Cell walls of **uniform** width; cell lumens  $\pm$ **rounded**.

Cells **intermediate** in length; WS

*Dicranella*<sup>†</sup>

Cells **short**.

Leaves  $\pm$ **bordered** by **longer**, or **shorter** and **thick**-walled cells; **1\***; WS

*Tortula*<sup>†</sup>

Leaves **unbordered**; **2\***; WS

*Barbula*<sup>†</sup>


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**Group A6 –Leaves falcate-secund**

**Group A6**

Plants **blackish**; leaves **multistratose**; capsules **valvate**; on rocks; NW

*Andreaebryum*

Plants **grayish**; costa  $>1/2$  leaf breadth with **3(4)** cell layers; green **striations** on leaves; N\*

*Paraleucobryum*<sup>†</sup>

Plants **green**; costa usually  $<1/5$  leaf breadth; leaves **lacking** striations.

Alar cells clearly **differentiated**; plants **large**, mostly  $>1$ cm.

Alar cells **pigmented**; capsules **rarely** strumose; **various** habitats; **2\***; WS

*Dicranum*<sup>†</sup>

Alar cells **pale**; capsules **strumose**; on **alpine rocks**; **0\***; A/A

*Kiaeria*<sup>†</sup>

Alar cells  $\pm$ **undifferentiated**; plants **small**, mostly  $<1$ cm; WS

*Dicranella*<sup>†</sup>

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

	<b>Group A7</b>
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.	
Setae <b>curved</b> ; capsules <b>laterally</b> emergent and <b>operculate</b> ; FL and GA	<i>Eccremidium</i>
Setae <b>straight</b> ; capsules <b>immersed</b> and <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 and <b>small</b> ; WS	<i>Pleuridium</i> †
Calyptrae <b>rudimentary</b> ; spores few and <b>large</b> (>100μ); E	<i>Archidium</i> †
Plants <b>larger</b> with <b>exserted</b> capsules growing on <b>various</b> substrates.	
Leaves <b>squarrose-recurved</b> (wet); subula <b>roughened</b> throughout by cell ends; N	<i>Trichodon</i>
Leaves with bases distinctly <b>incurved</b> to <b>expanded</b> and <b>clasping</b> .	
Cells <b>intermediate</b> in length and <b>prorulose/papillose</b> ; upper cells <b>±bistratose</b> ; WS	<i>Bartramia</i> †
Cells <b>intermediate</b> in length and <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>minute</b> ; peristome <b>double</b> with <b>entire</b> , papillose teeth; NT	<i>Pseudoditrichum</i>
Plants <b>larger</b> ; peristome <b>single</b> with <b>forked</b> teeth.	
Teeth divided to <b>base</b> , <b>round</b> and <b>papillose</b> ; WS	<i>Ditrichum</i> †
Teeth divided to <b>mid-point</b> , <b>flat</b> and <b>pitted-striolate</b> ; WS	<i>Dicranella</i> †
Cells <b>short</b> and <b>smooth</b> .	
Upper cells <b>±bistratose</b> ; capsules <b>inclined</b> , <b>asymmetric</b> and <b>strumose</b> ; WS	<i>Oncophorus</i> †
Upper cells <b>unistratose</b> ; capsules <b>erect</b> , <b>symmetric</b> and <b>cylindrical</b> ; SW	<i>Symblypharis</i>
Leaves with a <b>broad, single</b> costa (>1/3 the leaf width).	
Alar cells <b>inflated</b> and <b>hyaline</b> or <b>colored</b> (brownish to reddish).	
Costa of <b>3(4)</b> cell <b>layers</b> (middle layer <b>green</b> ; external layers <b>hyaline</b> ); N*	<i>Paraleucobryum</i>
Costa <b>lacking</b> the above unique characters.	
Inner basal cells <b>pale, enlarged</b> and extending up along the costa; N*	<i>Dicranodontium</i>
Inner basal cells <b>little</b> differentiated; WS	<i>Campylopus</i> †
Alar cells <b>±undifferentiated</b> ; WS	
Costa of <b>3(4)</b> cell <b>layers</b> (middle layer <b>green</b> ; external layers <b>hyaline</b> ); E	<i>Brothera</i>
Costa <b>lacking</b> the above unique characters; reddish, <b>axillary hairs</b> common; WS	<i>Leptobryum</i>
Leaves <b>lacking</b> the above unique characteristics.	

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*Continued from Group A7 above*

Leaves **lacking** the above unique characteristics.

Alar cells distinctly **differentiated**.

Capsules **curved** and **strumose** (goiter-like swellings); on **rocks**; A/A

*Kiaeria*

Capsules **obovoid** to **pyriform**; on **rocks**.

Capsules **ribbed** (dry); peristome teeth wide-**flaring**, **±split** and **striolate**; N

*Arctoa*

Capsules **smooth** (dry); peristome teeth **erect**, **±entire** and **papillose**; N\*

*Blindia*

Capsules **lacking** any of the above unique characters; substrates **various**.

Cells with **cuticular ridges**; peristome teeth **±entire** and **papillose**; N\*

*Dicranoweisia*

Cells **smooth**; peristome teeth **forked** and pitted-**striolate** below; WS

*Dicranum*<sup>†</sup>

Alar cells **±undifferentiated**.

Stems **tomentose & red**; leaves **serrate** above & **recurved** below; WC, NW

*Anacolia*

Stems tomentose at base; leaves margins **doubly serrate**; archegonia **±basal**; CP

*Pyrrhobryum*

Stems **lacking** tomentum & **green**.

Cells **intermediate** to long; peristome **teeth** usually present.

Plants **small** (<2mm); leaves **little** altered (dry); on **rocks**; WS

*Seligeria*<sup>†</sup>

Plants **larger** (>5mm); leaves **twisted** (dry); on **wood**; SA, WC

*Orthodontium*<sup>†</sup>

Cells **short**; annulus **compound**; peristome teeth mere **stubs**; WS\*

*Brachyodontium*

***Group A8 – Leaves dimorphic***

Leaves **costate**, 4-ranked and **bordered**; **dorsal** leaves smaller; stems **red**; cells **smooth**; WC

**Group A8**  
*Epipterygium*

Leaves **ecostate**, 4-ranked and **complanate**; **ventral** leaves smaller; cells **pleuripapillose**; GC

*Erpodium*<sup>†</sup>

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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 $\pm$ <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>lamellae</b> on the upper end of the costa; WS	<i>Pterygoneurum</i>
Leaves with <b>filaments</b> on the upper end of the costa.	
Leaves " <b>fleshy</b> " with <b>inrolled</b> margins; filaments on very <b>broad</b> costa; WC	<i>Aloina</i> <sup>†</sup>
Leaves thin with <b>reflexed</b> to revolute margins; filaments on <b>narrow</b> costa; W	<i>Crossidium</i>
Leaves <b>lacking</b> lamellae or filaments.	
Leaves with a <b>revolute</b> margin; cells <b>pleuripapillose</b> ; WS	<i>Phascum</i>
Leaves with <b>reflexed</b> tips; cells with <b>single</b> blunt papillae; WS*	<i>Acaulon</i> <sup>†</sup>
Leaves with <b>plane</b> margins and tips; cells <b>smooth</b> .	
Capsules <b>exserted</b> and <b>peristomate</b> ; calyptrae <b>cucullate</b> ; NW	<i>Stegonia</i> <sup>†</sup>
Capsules $\pm$ <b>emergent</b> and <b>operculate</b> ; calyptrae <b>persistent</b> , <b>4-angled</b> and <b>split</b> ; E	<i>Pyramidula</i>
Capsules <b>immersed</b> and <b>cleistocarpous</b> ; spores few and <b>large</b> (>100 $\mu$ ); TX	<i>Lorentziella</i>
Plants growing on <b>dung</b> , animal remains, or other highly nitrogenous materials; the " <b>dung mosses</b> ".	
Hypophysis greatly <b>differentiated</b> and <b>colored</b> ; peristome teeth <b>chambered</b> ; N, CP, SA	<i>Splachnum</i> <sup>†</sup>
Hypophysis narrowly <b>pyriform</b> and $\pm$ urn-colored; peristome teeth <b>not</b> chambered; N	<i>Tetraplodon</i> <sup>†</sup>
Hypophysis <b>lacking</b> ; <b>cleistocarpous</b> ; A/A	<i>Voitia</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> <sup>†</sup>
Leaves with a <b>broad</b> (1/3 – 1/2 leaf width) single <b>costa</b> ; WS	<i>Campylopus</i> <sup>†</sup>
Leaves <b>ecostate</b> .	
Cells $\pm$ <b>isodiametric</b> throughout with conspicuous <b>primordial utricles</b> ; TX	<i>Erpodium</i> <sup>†</sup>
Cells <b>short rhomboidal</b> (>3:1) above; TX, OK.	<i>Venturiella</i>
Leaves with distinct <b>border</b> .	
Cells <b>short</b> ( $\pm$ isodiametric); pleuripapillose or smooth; WS	<i>Desmatodon</i> <sup>†</sup>
Cells <b>intermediate</b> in length; smooth.	
Capsules <b>pendent</b> and <b>pyriform</b> ; WS	<i>Bryum</i> <sup>†</sup>
Capsules <b>erect</b> and $\pm$ <b>cylindric</b> ; GC, SW and SA	<i>Brachymenium</i> <sup>†</sup>
Leaves with large, lax and <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> <sup>†</sup>
Basal cells <b>thin-walled</b> and <b>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> <sup>†</sup>
Peristome of 32 $\pm$ <b>erect</b> teeth on a <b>low</b> basal membrane; WS	<i>Desmatodon</i> <sup>†</sup>
Leaves <b>lacking</b> the above unique characteristics.	

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Leaf cells distinctly <b>papillose</b> ; marginal cells <b>greener</b> ; on <b>mountain</b> rocks and soil; WC, SW	<i>Pseudocrossidium</i> †
Leaf cells <b>smooth</b> or indistinctly ornamented.	
Plants in <b>tufts</b> on <b>tree</b> trunks and branches (rarely on rocks); <b>diplolepideous</b> .	
Leaves <b>crisped</b> when dry; basal cells <b>yellow</b> , <b>thick</b> -walled and in <b>diagonal</b> rows; WC	<i>Ulota</i> †
Leaves <b>not</b> crisped when dry; basal cells <b>undifferentiated</b> ; WS*	<i>Orthotrichum</i> †
Plants in tufts, <b>cushions</b> and mats on <b>rocks</b> ; <b>haplolepideous</b> .	
Calyptrae large, <b>campanulate</b> , plicate and lacerate at base.	
Leaves <b>ovate</b> to obovate; WS (W)	<i>Jaffueliobryum</i>
Leaves ovate- <b>lanceolate</b> and <b>biplicate</b> ; N*	<i>Coscinodon</i>
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>reaching</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</b> and <b>pyriform</b> ; WS	<i>Bryum</i> †
Cells <b>short</b> (±isodiametric); capsules mostly <b>erect</b> and <b>cylindrical</b> ; WS	<i>Desmatodon</i> †

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

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.	
Leaves mostly <b>bistratose</b> ; caducous <b>awns</b> ; peristome <b>lacking</b> ; A/A	<i>Lyellia</i>
Leaves mostly <b>unistratose</b> ; peristome <b>present</b> .	
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.	
Lamellae on <b>both</b> surfaces of leaves; leaves unbordered; 5-15 lamina; WC, NW	<i>Oligotrichum</i>
Lamellae restricted to the <b>upper</b> surface of leaves.	
Leaves with <b>awns</b> ; 2-4 lamellae; plants <b>±bulbiform</b> ; WS	<i>Pterygoneurum</i>
Leaves with <b>cilia</b> at leaf shoulder; 5-15 lamellae; WA, BC, AK	<i>Bartramiopsis</i>
Leaves bordered by <b>hyaline</b> , <b>elongate</b> cells; 2-8 lamellae; WS	<i>Atrichum</i>
Leaves bordered by <b>hyaline</b> , <b>short</b> , <b>diagonally</b> oriented cells; 5-15 lamellae; A/A.	<i>Psilopilum</i>
Leaves with <b>ridge</b> -like lamellae on the <b>back</b> (dorsal side) of the costa.	
Stems <b>tomentose</b> (wooly; white to rusty brown); alar cells <b>hyaline</b> and <b>yellow</b> -brown; WS	<i>Dicranum</i> †
Stems <b>smooth</b> ; alar cells <b>not</b> pigmented.	
Costa <b>broad</b> (>1/3 leaf width); ridges <b>weak</b> (1-2 cells); cells short rectangular; WS	<i>Campylopus</i> †
Costa <b>narrow</b> (<1/3 leaf width); ridges <b>strong</b> (>6 cells); cells rounded- <b>oblate</b> ; N	<i>Dryptodon</i>
Leaves with <b>green</b> , branched <b>filaments</b> .	
Leaves “ <b>fleshy</b> ”: filaments on <b>lamina</b> and costa, but covered by <b>inrolled</b> leaf margins; WS*	<i>Aloina</i>
Leaves <b>thin</b> ; filaments on <b>costa</b> only; leaf margins <b>reflexed</b> to revolute; W	<i>Crossidium</i>
Leaves with fine, <b>white</b> , threadlike <b>filaments</b> in a tangled, cobwebby <b>weft</b> ; N*	<i>Saelania</i>



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

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

**Group A15**

Leaves **squarrose-recurved**.

Leaves **subulate / setaceous**; subula **roughened** throughout by cell ends; N

*Trichodon*

Leaves ovate-**lanceolate**, strongly **apiculate** and with apical **teeth**; SW

*Rhexophyllum*

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

Cells **intermediate** in length and **prorulose/papillose**; upper cells  $\pm$ **bistratose**; WS

*Bartramia*<sup>†</sup>

Cells **intermediate** in length and **smooth**.

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

*Trematodon*

Capsules **lacking** a distinct neck.

Plants **minute**; peristome **double** with **entire**, papillose teeth; **NT**

*Pseudoditrichum*

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

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

*Ditrichum*<sup>†</sup>

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

*Dicranella*<sup>†</sup>

Cells **short** and **smooth**.

Upper cells  $\pm$ **bistratose**; capsules **inclined**, **asymmetric** and **strumose**; WS

*Oncophorus*<sup>†</sup>

Upper cells **unistratose**; capsules **erect**, **symmetric** and **cylindrical**; SW

*Symblepharis*

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

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

Leaves mostly **bistratose**; caducous **awns**; peristome **lacking**; A/A

*Lyellia*

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

Lamellar apical cells **papillose**; capsules  $\pm$ **terete**.

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

*Polytrichastrum*

Leaves oblong **lanceolate**; lamellar apical cells  $\pm$ **rounded**; WS

*Pogonatum*

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

*Polytrichum*

Leaves with a **narrow costa** having **5-15** lamellae.

Lamellae on **both** surfaces of leaves; leaves **unbordered**; WC, NW

*Oligotrichum*<sup>†</sup>

Lamellae on **upper** surface of leaves only; **cilia** at leaf shoulder; WA, BC, AK

*Bartramiopsis*

Leaves **bistratose** with **spirally inrolled** margins; AK

*Indusiella*

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

endostome of 64 papillose **filaments**; WS

*Timmia*

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**Group A16 – Leaves with long decurrencies**

Plants **dendroid**; stem leaves **bordered** with long, marginal, right-angled **teeth**; WC, NW

Plants **not** dendroid.

Shoots **angular** in cross-section; leaves **squarrose** recurved; cells **short** and **papillose**.

Leaves **3-ranked**; stems **smooth**; CA

Leaves **5-ranked**; stems densely **tomentose**; calcareous **wetlands**; N

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

Leaves distinctly **toothed**  $\pm$ throughout.

Marginal teeth **paired**; sterile stems  $\pm$ **erect** and **round**; WS

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

Leaves **entire** to  $\pm$ serrulate or  $\pm$ toothed at apex.

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

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

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

Leaves predominantly **broader** at the **base**; setae very **long**; capsules  $\pm$ **inclined**; N

**Group A16**

*Leucolepis*

*Triquetrella*

*Paludella*

*Mnium*

*Plagiomnium*

*Bryum*<sup>†</sup>

*Pohlia*<sup>†</sup>

*Meesia*<sup>†</sup>

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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, especially at stem apices.	
Cells <b>papillose</b> (simple and forked); capsules <b>immersed</b> ; peristome <b>lacking</b> ; WS	<i>Hedwigia</i>
Cells <b>smooth</b> ; capsules <b>exserted</b> with <b>extremely long</b> necks; <b>peristomate</b> ; A/A	<i>Plagiobryum</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>squarrose-recurved</b> and <b>serrulate</b> above; upper cells <b>pleuripapillose</b> ; S	<i>Pleurochaete</i>
Leaves <b>spreading</b> and crenulate to <b>entire</b> .	
Leaves <b>lingulate</b> with rounded-obtuse apices; upper cells <b>bulging</b> ; GC	<i>Luisierella</i>
Leaves <b>acute</b> to acuminate; 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.	
Leaves with linear, <b>intramarginal</b> cells; calyptrae <b>persistent</b> , clasping and split; FL	<i>Calymperes</i>
Leaves <b>lacking</b> linear, intramarginal cells; calyptrae <b>deciduous</b> and cucullate.	
Leaf margins <b>revolute</b> ; peristome of <b>32 twisted</b> teeth; <b>1*</b> ; WS	<i>Tortula</i> † ( <i>Syntrichia</i> )
Leaf margins <b>plane</b> ; peristome of <b>16 straight</b> teeth; <b>2*</b> ; E(GC)	<i>Syrhodon</i>
Hyaline, <b>inflated</b> and <b>thin-walled</b> cells across the <b>lower 1/3</b> of leaves.#	
Leaves abruptly <b>serrate</b> at the <b>shoulder</b> and <b>whorled</b> at branch points; <b>2*</b> ; WS	<i>Eucladium</i>
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>
Older leaves <b>brownish-green</b> ; stems with a <b>hyalodermis</b> ; BC	<i>Trichostomum</i>
Upper leaf cells <b>smooth</b> ; capsules <b>8-ribbed</b> (dry); E	<i>Rhabdoweisia</i>
Leaves <b>bistratose</b> along margins, in longitudinal rows or ±throughout.	
Leaf margins <b>erect/involute</b> ; calyptrae <b>plicate</b> ; peristome <b>16</b> ±coherent teeth; <b>2*</b> ; WS	<i>Ptychomitrium</i> †
Leaf margins <b>plane</b> ; calyptrae <b>not plicate</b> ; peristome <b>32</b> ±twisted teeth; <b>1*</b> ; WC, AZ	<i>Didymodon</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> and <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 with a <b>central</b> strand (small cells); NW, WC, GC	<i>Trichostomum</i>
Stems <b>lacking</b> a central strand; WS	<i>Trichostomum</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 A17 represent the extreme, strongly differentiated condition of a gradient while those taxa with the less differentiated basal cells are found in Group A25.*

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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 and <b>ventricose</b> ; WS*	<i>Buxbaumia</i>
Plants <b>leafy</b> ; capsules not differentiated as above.	
Leaves with 4-9 <b>lamellae</b> on costa; cilia at leaf <b>shoulder</b> ; WA, BC, AK	<i>Bartramiopsis</i>
Leaves <b>lacking</b> lamellae; cilia at leaf <b>base</b> ; WA, AK	<i>Oedipodium</i>
Leaves with a border of <b>elongate</b> cells contrasting with <b>shorter</b> medial cells.	
Plants <b>dendroid</b> ; stem leaves <b>bordered</b> with long, marginal, right-angled <b>teeth</b> ; WC, NW	<i>Leucolepis</i>
Plants erect, <b>rosulate</b> -foliate and large; from horizontal, underground stems; WS	<i>Rhodobryum</i>
Plants strongly <b>flattened</b> ; leaves twisted into one plane ( <b>complanate</b> ); WS	<i>Plagiomnium</i>
Plants with <b>red stems</b> .	
Stems densely <b>tomentose</b> , at least below.	
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>
Stems <b>lacking</b> tomentum.	
Leaves <b>±rugose</b> ; cells thin-walled and <b>very large</b> (to 150x50μ); WC, NW, CO	<i>Roellia</i>
Leaves <b>4-ranked</b> and <b>dimorphic</b> (dorsal leaves smaller); WC	<i>Epipterygium</i>
Leaves <b>lacking</b> the above unique characteristics; cells strongly <b>bulging</b> ; AK	<i>Trachycystis</i>
Plants <b>lacking</b> the above unique characteristics.	
Leaves with <b>lamellae</b> on the costa; WS	<i>Atrichum</i>
Leaves with abruptly differentiated <b>cancellinae</b> (hyaline basal cells); E (GC)	<i>Syrhropodon</i> †
Leaves with <b>paired teeth</b> on margins; WS	<i>Mnium</i> †
Leaves with distinct <b>single teeth</b> or serrulations on margins.	
Leaf cells <b>&gt;3:1</b> .	
Leaves <b>rounded-obtuse</b> and apiculate; upper cells in <b>oblique</b> rows; N*	<i>Pseudobryum</i>
Leaves <b>acute</b> to awned; cells <b>not</b> in oblique rows.	
Capsules <b>pendent</b> and <b>pyriform</b> ; WS	<i>Bryum</i> †
Capsules <b>erect</b> and <b>±cylindric</b> ; GC, SW, SA	<i>Brachymerium</i> †
Leaf cells <b>&lt;2:1</b> ; WS	<i>Plagiomnium</i>
Leaves with <b>entire</b> margins.	
Leaf cells <b>&gt;3:1</b> .	
Capsules <b>pendent</b> and <b>pyriform</b> ; WS	<i>Bryum</i> †
Capsules <b>erect</b> .	
Leaves <b>rounded-obtuse</b> ; upper cells in <b>oblique</b> rows; N*	<i>Pseudobryum</i>
Leaves broadly <b>acute</b> ; cells <b>not</b> in oblique rows; WS	<i>Entosthodon</i> †
Leaf cells <b>1-2:1</b> ; A/A	<i>Cyrtomnium</i>
Leaves bordered by <b>hyaline, diagonally</b> oriented cells; 5-15 <b>lamellae</b> on costa; A/A.	<i>Psilopilum</i>
Leaves with <b>short-rhombic</b> marginal cells at the rounded- <b>obtuse</b> apex; GC, SW	<i>Splachnobryum</i>
Leaves with margins differing in <b>color</b> and/or <b>opacity</b> from the medial laminae.	
Margin <b>darker</b> because <b>3-5</b> cell layers thick; plants <b>blackish</b> ; on <b>rocks</b> in rivers; WC, NW	<i>Scouleria</i>
Margin <b>paler</b> and <b>yellowish</b> due to <b>thick</b> -walled, <b>less</b> papillose cells.	
Leaves distinctly <b>toothed</b> above; basal membrane <b>lacking</b> ; <b>2*</b> ; SE	<i>Leptodontium</i> †
Leaves <b>entire</b> ; basal <b>membrane</b> present; <b>1*</b> .	
Peristome (32) <b>spirally</b> twisted above a <b>high</b> basal membrane; WS	<i>Tortula</i> †
Peristome (16) <b>obliquely</b> slanted above a <b>low</b> basal membrane; WS	<i>Desmatodon</i> †
Margin <b>greener</b> (cells <b>thin</b> -walled & <b>less</b> papillose) and <b>spirally</b> revolute; <b>1*</b> ; WC, SW	<i>Pseudocrossidium</i> †
Leaves with an <b>intramarginal</b> "border", i.e., differentiated cells just inside short marginal cells.	

*Continued below at left margin*

*Continued from Group A18 above*

Leaves with an **intramarginal** "border", i.e., differentiated cells just inside short marginal cells.

"Border" of **long, narrow, pellucid** cells along leaf bases.

Basal **cancellinae** (hyaline, inflated cells) present; plants **green**; on **soil**; FL

*Calymperes*†

Basal cancellinae **lacking**; plants **blackish**; on **rocks** in rivers; WC, NW

*Scouleria*

"Border" of **enlarged, ±isodiametric, yellow** to orange, **thick-walled** cells; **1\***; W

*Crumia*

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

Stems **tomentose**; alar cells **inflated, hyaline** and **±yellow-brown** towards the margin; WS

*Dicranum*

Stems **not** or indistinctly tomentose; alar cells **not** as above.

Costa **broad, >1/3** leaf width; alar cells **inflated**, and hyaline to brownish to **reddish**.

Costa of **3(4)** cell **layers** (middle layer **green**; external layers **hyaline**); **N\***

*Paraleucobryum*

Costa **lacking** the above unique characters.

Inner basal cells **pale, enlarged** and extending up along the costa; **N\***

*Dicranodontium*

Inner basal cells **little** differentiated; WS

*Campylopus*

Costa **narrow, <1/3** leaf width.

Alar cells enlarged to **inflated** and **yellowish to brownish**.

Capsules **curved** and **strumose** (goiter-like swellings); on **rocks**; A/A

*Kiaeria*

Capsules **obovoid to pyriform**; on **rocks**.

Capsules **ribbed** (dry); peristome teeth wide-**flaring**, **±split** and **striolate**; **N**

*Arctoa*

Capsules **smooth** (dry); peristome teeth **erect**, **±entire** and **papillose**; **N\***

*Blindia*

Capsules **cylindrical**; substrates **various**.

Cells with **cuticular ridges**; peristome teeth **±entire** and **papillose**; **N\***

*Dicranoweisia*

Cells **smooth**; peristome teeth **forked** and pitted-**striolate** below; WS

*Dicranum*

Alar cells **sub-quadrate** and **pale**; cells **±thick-walled** and often **nodulose**; WS

*Grimmia*†

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

Leaves in **clusters** of **branches** around a central stem and a **network** of green and hyaline cells; WS

*Sphagnum*

Leaves **distichous, decurrent** and **confluent**; protonemata **luminous**; "Goblin Gold"; WS\*

*Schistostega*

Leaves **complanate**; cells **pleuripapillose**; on tree **bark**; GC

*Erpodium*

Leaves **awned**; cells **smooth**; on tree **bark**.

Leaves with conspicuous **primordial utricles**; peristome **lacking**; TX

*Erpodium*

Leaves **lacking** utricles; peristome **present**; OK and TX

*Venturiella*

Leaves **spinose** serrate; protonemata **persistent**; cells **smooth**; pygmy **ephemerals**; WS

*Ephemerum*†

Leaves **lacking** the above unique characters.

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

*Andreaea*†

Cells **smooth**.

Capsules **exserted** with **4 prominent teeth**; on undersides of **rock overhangs**; **N**

*Tetrodontium*†

Capsules **sessile** and **gymnostomous**; pygmy **ephemerals**; on **soil**; WS

*Micromitrium*

**Reminder:** Definitions for cell length to breadth ratios are found in the Introduction and the Overview in addition to below. Abbreviations for the number of stereid bands in costa cross sections are found in the Introduction in addition to below. An expanded explanation of the difference between "Distinct" and "Indistinct" surface ornamentation is found in the Introduction.

**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: >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.

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.,  $\pm$ homogeneous

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

Leaves **flexuose-twisted** (dry); cell walls  $\pm$ **thickened**; capsules mostly **erect**; SA, CA

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

#### **Group A21**

*Orthodontium*<sup>†</sup>

*Pohlia*<sup>†</sup>

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

Leaves broadly **spathulate** with **rounded, crenulate** apices; papillae **C-shaped**; FL

Leaves **ovate** and abruptly narrowed to a **short** acumen; papillae **simple**; W, VT

Leaves linear-lanceolate to **subulate** from an **erect** base; papillae **simple**; WS

#### **Group A22**

*Gymnostomiella*

*Philonotis*<sup>†</sup>

*Bartramia*<sup>†</sup>

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

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

Leaves and peristome teeth **otherwise**.

Setae **flexuose**; capsules **symmetric** and **rugulose**; peristome **reduced**; NC, TN

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

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

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

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

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

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

#### **Group A23**

*Conostomum*

*Bartramidula*

*Bartramia*<sup>†</sup>

*Philonotis*<sup>†</sup>

*Ephemerum*<sup>†</sup>

*Bruchia*<sup>†</sup>

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**Group A24 – Cells intermediate and smooth (or indistinctly ornamented)<sup>#</sup>****Group A24**

Leaves predominantly <b>broader near</b> or <b>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</b> and $\pm$ <b>pyriform</b> .	
Leaves $\pm$ concave- <b>obovate</b> and <b>serrulate</b> ; capsules <b>operculate</b> ; WS	<i>Physcomitrium</i>
Leaves $\pm$ concave- <b>ovate</b> and <b>entire</b> ; capsules <b>cleistocarpous</b> ; WS	<i>Bruchia</i> <sup>†</sup>
Plants <b>otherwise</b> .	
Leaves with an <b>obtuse</b> apex bordered with <b>short-rhombic</b> cells; GC, SW	<i>Splachnobryum</i>
Leaves commonly bordered by <b>linear</b> cells; capsules pyriform and <b>pendent</b> ; WS	<i>Bryum</i>
Leaves <b>unbordered</b> .	
Medial cells strongly <b>bulging</b> on both sides; AK	<i>Bryobrittonia</i>
Medial cells <b>smooth</b> and <b>&gt;5:1</b> (linear rhomboidal); capsules <b>pendent</b> ; WS	<i>Pohlia</i> <sup>†</sup>
Medial cells <b>smooth</b> and <b>&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</b> and <b>asymmetric</b> ; WS	<i>Funaria</i>
Capsules <b>erect</b> and <b>symmetric</b> ; WS	<i>Entosthodon</i>
Peristome <b>lacking</b> ; capsules <b>erect</b> and <b>symmetric</b> ; calyptrae <b>mitrate</b> ; WS	<i>Physcomitrium</i>
Leaves predominantly <b>broader</b> near the <b>base</b> ( $\pm$ lanceolate).	
Plants <b>small, winter annuals</b> on soil; capsules $\pm$ <b>immersed</b> and <b>cleistocarpous</b> ; WS	<i>Bruchia</i> <sup>†</sup>
Plants <b>otherwise</b> ; capsules <b>exserted</b> and <b>peristomate</b> .	
Leaves $\pm$ <b>subulate</b> / <b>setaceous</b> .	
Capsules <b>ovoid</b> ; plants minute to very <b>small</b> ; on <b>calcareous</b> rocks; WS (N)	<i>Seligeria</i> <sup>†</sup>
Capsules long <b>cylindric</b> ; peristome teeth <b>round</b> , fully <b>split</b> and <b>papillose</b> ; WS	<i>Ditrichum</i>
Capsules $\pm$ <b>oblong</b> , often <b>curved</b> ; peristome teeth <b>flat</b> , <b>split</b> 1/2 and <b>pitted</b> ; WS	<i>Dicranella</i>
Leaves flexuose- <b>twisted</b> (dry); cells $\pm$ <b>thick</b> -walled; SA, WC	<i>Orthodontium</i> <sup>†</sup>
Leaves with expanded, <b>sheathing</b> leaf bases; WS	<i>Dicranella</i>
Leaves <b>lacking</b> any of the above unique characteristics.	
Leaves <b>&gt;1mm</b> ; capsules <b>terminal</b> .	
Costa <b>percurrent</b> ; capsules <b>erect</b> to inclined; peristome <b>single</b> .	
Upper cells $\pm$ <b>linear</b> ; peristome teeth <b>long</b> & <b>split</b> ; WS	<i>Ditrichum</i>
Upper cells <b>broad</b> ; peristome teeth <b>short</b> & <b>irregular</b> ; N	<i>Catoscopium</i>
Costa <b>subpercurrent</b> ; capsules $\pm$ <b>pendant</b> ; peristome <b>double</b> ; WS	<i>Pohlia</i> <sup>†</sup>
Leaves <b>&lt;1mm</b> ; capsules <b>lateral</b> ; peristome <b>single</b> ; on <b>Cu</b> or <b>S</b> rich soils; N*	<i>Mielichhoferia</i>

<sup>#</sup> Cells bulging, mammillose (cells both bulging and papillose), or with low papillae or projections.

*Group A25 – Cells short (<2:1) and 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>pleuripapillose</b> ; leaves <b>±squamose</b> -recurved; <b>2*</b> .	
Leaf lamina <b>±bistratose</b> ; stem <b>hyalodermis</b> present; peristome <b>lacking</b> ; SW	<i>Rhexophyllum</i>
Leaf lamina <b>unistratose</b> ; stem hyalodermis <b>lacking</b> ; <b>peristome</b> present; SE	<i>Leptodontium</i>
Cells <b>unipapillose</b> or mammillose; ventral stereid band <b>weak</b> or <b>lacking</b> .	
Leaves <b>±broad</b> ; cells <b>mammillose</b> ; capsules <b>smooth</b> ; WS	<i>Dichodontium</i>
Leaves <b>±narrow</b> ; cells <b>coarsely</b> papillose; capsules <b>furrowed</b> ; N	<i>Cynodontium</i> †
Leaves with large, curved, <b>projecting papillae</b> at extreme apex; cells <b>mammillose</b> : NW	<i>Dichodontium</i>
Leaves <b>ligulate</b> and rounded- <b>obtuse</b> ; cells <b>pleuripapillose</b> ; <b>0*</b> ; WS*	<i>Gyroweisia</i> †
Leaves with <b>revolute</b> margins and <b>smoother</b> , <b>greener</b> marginal cells; <b>1*</b> ; WC, SW	<i>Pseudocrossidium</i>
Leaves <b>lacking</b> the above unique characteristics.	
Cells <b>collenchymatous</b> and <b>stellate</b> ; <b>2*</b> .	
Leaves <b>squamose-recurved</b> (wet); cells <b>pleuripapillose</b> ; A/A	<i>Didymodon</i> †
Leaves <b>±erect</b> (wet); cells <b>unipapillose</b> ; A/A	<i>Aulacomnium</i> †
Cells <b>pleuripapillose</b> ; but neither collenchymatous nor stellate.	
Papillae <b>flower-like</b> (massive and multifid); peristome <b>lacking</b> ; <b>2*</b> ; SE	<i>Tuerckheimia</i>
Papillae <b>forked</b> ; basal cells with <b>brown</b> cross-walls; calyptrae long cylindrical; 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</b> and <b>twisted</b> ; <b>2*</b> ; WS	<i>Barbula</i> †
Peristome teeth <b>short</b> and <b>erect</b> ; <b>1*</b> ; WS	<i>Desmatodon</i> †
Papillae <b>conical</b> .	
Cells with <b>4-7</b> papillae; peristome reduced to <b>lacking</b> .	
Stems <b>repeatedly</b> forked; capsules elongate and <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> .	
Leaves <b>&gt;2 mm</b> ; sporophytes <b>lateral</b> ; A/A	<i>Molendoa</i>
Leaves <b>&lt;2 mm</b> ; sporophytes <b>terminal</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> ; but neither collenchymatous nor stellate.	

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*Continued from Group A25 above*

Cells **unipapillose**; but neither collenchymatous nor stellate.

Leaves **serrulate** at apex; stems **tomentose**; **gemmae** on stem extensions; WS

*Aulacomnium*†

Leaves **entire**.

Capsules **exserted**; peristome of **32 twisted teeth**; plants on **soil** and rocks; **2\***; WS

*Barbula*†

Capsules **±emergent** and **valvate** (4x); **blackish** plants on **rocks**; **0\***; N\*

*Andreaea*†

Capsules **±immersed** with **16 ±reflexed** teeth; plants on **trees** and rocks; **0\***.

Basal marginal cells with **thickened** cross-walls; WS

*Ulota*†

Basal marginal cells **±undifferentiated**; WS

*Orthotrichum*†

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**Group A26 – Cells short (<2:1) and smooth (or indistinctly ornamented<sup>#</sup>)**

**Group A26**

Leaves <b>±obovate</b> (broadest in upper third; shaped like an upside-down egg), <b>concave</b> and broadly <b>obtuse</b> ; <b>1*</b> .	
Leaves <b>cucullate</b> ; costa <b>subpercurrent</b> ; TX	<i>Globulinella</i>
Leaves <b>muticous</b> to <b>piliferous</b> ; costa subpercurrent to <b>excurrent</b> ; NW	<i>Stegonia</i>
Leaves <b>±oblong-spathulate</b> (broad in the middle and even broader above).	
Leaf margins <b>inrolled</b> when dry (erect or plane when wet); cells <b>bulging</b> on upper surface.	
Leaves <b>1.5-3</b> mm and <b>±toothed</b> above; peristome <b>lacking</b> ; <b>2*</b> ; E	<i>Hyophila</i>
Leaves <b>1-2</b> mm and <b>±entire</b> above; <b>peristome</b> present; <b>1*</b> ; FL, GA	<i>Plaubella</i>
Leaf margins usually <b>revolute</b> , at least in part; cells <b>flat</b> .	
Leaves <b>±bordered</b> with <b>longer</b> cells; peristome teeth <b>short</b> and <b>erect</b> ; <b>1*</b> ; WS	<i>Desmatodon</i> <sup>†</sup>
Leaves <b>±bordered</b> with <b>shorter</b> cells; peristome teeth <b>long</b> and <b>twisted</b> ; <b>1*</b> ; WS	<i>Tortula</i> <sup>†</sup>
Leaves with <b>intra-marginal</b> border of enlarged, <b>thick-walled</b> , <b>orange</b> cells; <b>1*</b> ; W	<i>Crumia</i>
Leaves <b>unbordered</b> .	
Propagula on basal <b>leaf surfaces</b> ; sporophytes <b>unknown</b> ; <b>1*</b> ; SE	<i>Rhacithecium</i>
Propagula <b>axillary</b> ; peristome of <b>32</b> spirally <b>twisted teeth</b> ; <b>2*</b> ; WS	<i>Barbula</i> <sup>†</sup>
Leaf margins <b>plane</b> ; cells <b>flat</b> and <b>large</b> (>15μ); peristome <b>none</b> or rudimentary; <b>1*</b> ; WS	<i>Pottia</i> <sup>†</sup>
Leaves <b>±oblong-lingulate</b> (tongue-shaped) or <b>oblong-ligulate</b> (strap-shaped).	
Leaves <b>±lingulate</b> ; cells <b>2(3)stratose</b> ; <b>awns</b> on perichaetial leaves; capsules <b>sessile</b> ; E, BC	<i>Diphyscium</i>
Leaves <b>±ligulate</b> ; cells <b>unistratose</b> ; perichaetial leaves <b>±acute</b> ; capsules <b>exserted</b> .	
Leaves <b>acute</b> ; capsules <b>gymnostomous</b> (lacking a peristome); <b>1*</b> ; WS	<i>Scopelophila</i>
Leaves <b>obtuse</b> ; capsules <b>peristomate</b> (peristome present); <b>0*</b> ; WS*	<i>Gyroweisia</i> <sup>†</sup>
Leaves <b>±ovate</b> (broadest in lower third; egg-shaped) and <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 <b>3-ranked</b> ; setae very <b>long</b> ; plants of <b>calcareous</b> wetlands; N	<i>Meesia</i> <sup>†</sup>
Leaves <b>falcate-secund</b> ; capsules <b>valvate</b> ; plants <b>saxicolous</b> and <b>blackish</b> ; NW	<i>Andreaebryum</i>
Leaves with expanded, <b>sheathing</b> leaf bases.	
Cells <b>bulging</b> on upper surface; capsules <b>symmetric</b> and <b>oblong-ovoid</b> ; WS	<i>Timmia</i>
Cells <b>smooth</b> ; capsules <b>asymmetric</b> and <b>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>
Margins <b>plane</b> ; cells <b>smooth</b> ; perichaetia <b>lateral</b> (basal); GC	<i>Pyrrhobryum</i>
Leaves with an <b>intramarginal band</b> of long, narrow cells at base; WC and NW	<i>Scouleria</i>
Leaves <b>bistratose</b> , at least in part.	
Leaf cells <b>strongly bulging</b> on upper surface & <b>unistratose</b> at margins; <b>2*</b> ; WC, SW, TX	<i>Timmia</i>
Leaf cells <b>smooth</b> to <b>±bulging/papillose</b> & <b>bistratose</b> at margins.	
Leaf margins <b>erect</b> /involute; calyptrae <b>mitrate</b> , <b>lobed</b> and <b>plicate</b> ; <b>2*</b> ; WS	<i>Ptychomitrium</i>
Leaf margins <b>plane</b> ; calyptrae <b>cucullate</b> , <b>entire</b> and <b>smooth</b> ; <b>1*</b> ; WC, AZ	<i>Didymodon</i> <sup>†</sup>
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</b> and <b>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>diplolepidious</b> .	
Leaves <b>crisped</b> when dry; basal cells <b>yellow</b> , <b>thick</b> -walled; WC	<i>Ulota</i> †
Leaves <b>not</b> crisped when dry; basal cells <b>±undifferentiated</b> ; WS*	<i>Orthotrichum</i> †
Plants in <b>tufts</b> , <b>cushions</b> or mats on <b>rocks</b> .	
Peristomes <b>diplolepidious</b> (double).	
Basal cells <b>very thick</b> -walled, <b>yellow</b> and <b>radiating</b> from costa; WS	<i>Ulota</i> †
Basal cells <b>±thick</b> -walled, <b>neither</b> yellow and <b>nor</b> radiating; WS	<i>Orthotrichum</i> †
Peristomes <b>haplolepidious</b> (single).	
Plants very <b>small</b> (<2 mm); setae <b>cygneous</b> (wet); N	<i>Seligeria</i> †
Plants <b>larger</b> (>2 mm).	
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>dryer</b> habitats; WS	<i>Grimmia</i> †
Plants on <b>soil</b> primarily.	
Setae <b>cygneous</b> .	
Capsules yellow-orange with <b>red ribs</b> ; calyptrae <b>cucullate</b> ; A/A	<i>Oreas</i>
Capsules yellowish and <b>smooth</b> ; calyptrae <b>mitrate</b> ; N*	<i>Campylostelium</i>
Setae <b>bent</b> at capsule base; capsules curved, <b>sulcate</b> , <b>±strumose</b> & <b>purple-red</b> (yellow); leaves <b>revolute</b> <b>±throughout</b> & <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 and boulders.	
Peristome teeth <b>divided</b> to half their length; N	<i>Cynodontium</i> †
Peristome teeth <b>undivided</b> ; basal cells <b>hyaline</b> ; E	<i>Rhabdoweisia</i>
Capsules <b>smooth</b> (or wrinkled when dry).	
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> †

# Cells bulging, mammillose (cells both bulging and papillose), or with low papillae.