

Sub-Guide to Rarely Branched Mosses -- MidWest

Revised through 12 January 2009

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.

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	<i>Fissidens</i>
Leaves conduplicate , crowded, and progressively larger; the “Sword” moss; WS*	<i>Bryoxiphium</i>
Leaves flat, decurent and confluent ; protonemata luminous ; “Goblin Gold”; WS*	<i>Schistostega</i>
Leaves needle-like ; a roughened subula from a sheathing, shiny-white base; WS	<i>Distichium</i>
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 and bordered by linear cells; WS	<i>Plagiomnium</i>
Leaves crowded , unbordered and ±undulate ; capsules plicate (dry); E	<i>Aulacomnium</i> †
Shoots triangular ; leaves 3-ranked .	
Plants minute with immersed capsules; leaves broadly ovate with recurved apiculi; WS	<i>Acaulon</i> †
Plants larger with exserted capsules; leaves ovate lanceolate , squarrose and decurent .	
Cells intermediate and smooth ; in calcareous wetlands .	
Capsules with well-defined neck ; endostome longer than exostome; N	<i>Meesia</i> †
Capsules short & black (golf clubs); endostome reduced to lacking; N	<i>Catocypium</i>
Shoots angular ; leaves 4-5 ranked .	
Stems densely tomentose ; leaves squarrose recurved; in calcareous wetlands ; N	<i>Paludella</i>

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*	<i>Anomobryum</i>
Cells intermediate (~4:1).	
Upper leaves apiculate ; capsules pendent ; peristome double ; WS	<i>Bryum</i> †
Stems green .	
Cells unipapillose and ±stellate ; leaves concave-cucullate; A/A.	<i>Aulacomnium</i> †
Cells smooth ; leaves radially arranged.	
Leaves serrulate and unbordered ; immersed capsules: E	<i>Pleuridium</i> †
Leaves entire and bordered with longer cells; exserted capsules; WS	<i>Bryum</i> †

Group A3 – Stems distinctly tomentose

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

Group A4 – Stems red

	Group A4
Plants julaceous .	
Stems occasionally forked; leaves ovate to ovate-lanceolate and concave.	
Leaves broadly obtuse to acute; costa ending subpercurrent ; cells ~ 8:1 ; N*	<i>Anomobryum</i>
Leaves obtuse to acute ; costa percurrent to excurrent ; cells ~ 4:1 ; WS	<i>Bryum</i> †
Plants with stems covered with pigmented (reddish to brownish) tomentum.	
Leaf cells >3:1 ; WS	<i>Bryum</i> †
Leaf cells <2:2 .	
Rhizoidal initials in longitudinal rows ; endostome fused into a dome; N	<i>Cinclidium</i>
Rhizoidal initials not in rows; endostome segments free ; N*	<i>Rhizomnium</i>
Plants neither julaceous nor tomentose.	
Leaves bordered by elongated cells.	
Leaves distinctly toothed .	
Cells smooth .	
Cells smaller (up to 50 μ); leaves plane ; WS	<i>Mnium</i> †
Leaves entire .	
Leaves of one kind; WS	<i>Bryum</i> †
Leaves not bordered.	
Leaves serrulate \pm throughout ; cells prorulose ; WS	<i>Philonotis</i> †
Leaves \pm serrulate near the apex ; cells smooth .	
Leaves subulate ; alar cells inflated , thick -walled and reddish ; N*	<i>Blindia</i>
Leaves not subulate; alar cells \pm undifferentiated ; WS	<i>Pohlia</i> †

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

Leptodontium

Leaves **lacking** the above unique characteristics.

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

Cells **intermediate** in length; WS

Dicranella[†]

Cells **short**.

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

Tortula[†]

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

Barbula[†]

Group A6 –Leaves falcate-secund

Group A6

Plants **grayish**, longitudinal, green **striations** on back of leaves; costa **>1/3** leaf breadth; N*

Paraleucobryum[†]

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

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

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

Dicranum[†]

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

Dicranella[†]

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

Group A7

<p>Plants small to minute (mostly <5 mm high) with ±immersed capsules growing on bare soil, usually as winter annuals; the "pygmy ephemerals" as defined here. Setae straight; capsules immersed and cleistocarpous. Capsules pyriform with a conspicuous, stomatose neck; spores small; WS Capsules globose to ovoid, lacking a distinct neck. Calyptrae mitrate or cucullate; spores numerous and small; WS Calyptrae rudimentary; spores few and large (>100µ); E</p> <p>Plants larger with exserted capsules growing on various substrates. Leaves squarrose-recurved (wet); subula roughened throughout by cell ends; N Leaves with bases distinctly incurved to expanded and clasping. Cells intermediate in length and prorulose/papillose; upper cells ±bistratose; WS Cells intermediate in length and smooth. Capsules with distinct, very long necks; WS Capsules lacking a distinct neck. Plants larger; peristome single with forked teeth. Teeth divided to base, round and papillose; WS Teeth divided to mid-point, flat and pitted-striolate; WS Cells short and smooth. Upper cells ±bistratose; capsules inclined, asymmetric and strumose; WS Leaves with a broad, single costa (>1/3 the leaf width). Alar cells inflated and hyaline or colored (brownish to reddish). Leaves with green, longitudinal striations on the back; N* Leaves lacking striations. Inner basal cells pale, enlarged and extending up along the costa; N* Inner basal cells little differentiated; WS Alar cells ±undifferentiated; capsules pyriform; WS</p> <p>Leaves lacking the above unique characteristics. Alar cells distinctly differentiated. Capsules obovoid to pyriform; on rocks. Capsules smooth (dry); peristome teeth erect, ±entire and papillose; N* Capsules lacking any of the above unique characters; substrates various. Cells with cuticular ridges; peristome teeth ±entire and papillose; N* Cells smooth; peristome teeth forked and pitted-striolate below; WS Alar cells ±undifferentiated. Cells intermediate to long; peristome teeth usually present. Plants small (<2mm); leaves little altered (dry); on rocks; WS</p>	<p><i>Bruchia</i>†</p> <p><i>Pleuridium</i>†</p> <p><i>Archidium</i>†</p> <p><i>Trichodon</i></p> <p><i>Bartramia</i>†</p> <p><i>Trematodon</i>†</p> <p><i>Ditrichum</i>†</p> <p><i>Dicranella</i>†</p> <p><i>Oncophorus</i>†</p> <p><i>Paraleucobryum</i></p> <p><i>Dicranodontium</i></p> <p><i>Campylopus</i>†</p> <p><i>Leptobryum</i></p> <p><i>Blindia</i></p> <p><i>Dicranoweisia</i></p> <p><i>Dicranum</i>†</p> <p><i>Seligeria</i>†</p>
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Group A8 – Leaves dimorphic

Group A8

None.

Group A9 – Leaves with hair-points or awns

	Group A9
Plants minute (mostly <5 mm high) with \pm immersed capsules growing on bare soil , usually as winter annuals ; the " pygmy ephemerals " as defined here.	
Leaves with lamellae on the upper end of the costa; WS	<i>Pterygoneurum</i>
Leaves with filaments on the upper end of the costa.	
Leaves " fleshy " with inrolled margins; filaments on very broad costa; WC	<i>Aloina</i> †
Leaves lacking lamellae or filaments.	
Leaves with a revolute margin; cells pleuripapillose ; WS	<i>Phascum</i>
Leaves with reflexed tips; cells with single blunt papillae; WS*	<i>Acaulon</i> †
Leaves with plane margins and tips; cells smooth .	
Capsules \pm emergent and operculate ; calyptrae persistent , 4-angled and split ; E	<i>Pyramidula</i>
Plants growing on dung , animal remains, or other highly nitrogenous materials; the " dung mosses ".	
Hypophysis greatly differentiated and colored ; peristome teeth chambered ; N, CP, SA	<i>Splachnum</i> †
Hypophysis narrowly pyriform and \pm urn-colored; peristome teeth not chambered; N	<i>Tetraplodon</i> †
Plants lacking any of the above unique characteristics.	
Leaves "fleshy" from crowded lamellae covering a very broad costa; WS	<i>Polytrichum</i> †
Leaves with a broad (1/3 – 1/2 leaf width) single costa ; WS	<i>Campylopus</i> †
Leaves with distinct border .	
Cells short (\pm isodiametric); pleuripapillose or smooth; WS	<i>Desmatodon</i> †
Cells intermediate in length; smooth.	
Capsules pendent and pyriform ; WS	<i>Bryum</i> †
Leaves with large, lax and hyaline basal cells contrasting with dense upper cells.	
Basal cells pale with brown , thickened cross walls; calyptrae campanulate ; WS	<i>Encalypta</i> †
Basal cells thin-walled and non-pigmented throughout; calyptrae cucullate .	
Peristome of 32 twisted teeth on a high basal membrane; WS	<i>Tortula</i> †
Peristome of 32 \pm erect teeth on a low basal membrane; WS	<i>Desmatodon</i> †
Leaves lacking the above unique characteristics.	
Plants in tufts on tree trunks and branches (rarely on rocks); diplolepidious .	
Leaves crisped (dry); basal cells yellow , thick -walled and in diagonal rows; WC	<i>Ulotia</i> †
Leaves not crisped when dry; basal cells undifferentiated ; WS*	<i>Orthotrichum</i> †
Plants in tufts, cushions and mats on rocks ; haplolepidious .	
Calyptrae large, campanulate , plicate and lacerate at base.	
Leaves ovate to obovate; WS (W)	<i>Jaffueliobryum</i>
Calyptrae small, cucullate or mitrate .	
Capsules systylious ; calyptrae short ; in wetter habitats; WS	<i>Schistidium</i> †
Capsules not systylious; calyptrae reaching operculum; dryer habitats; WS	<i>Grimmia</i> †
Plants on soil primarily.	
Cells intermediate in length; capsules pendent and pyriform ; WS	<i>Bryum</i> †
Cells short (\pm isodiametric); capsules mostly erect and cylindrical ; WS	<i>Desmatodon</i> †

Group A10 – Leaves with lamellae, ridges, or filaments

Group A10

Leaves with green , sheet-like lamellae .	
Leaves with a very broad costa covered by >20 lamellae.	
Leaves mostly unistratose ; peristome present .	
Lamellar apical cells papillose ; capsules \pm terete .	
Leaves subtubulose ; lamellar apical cells elliptic- pyriform ; WS	<i>Polytrichastrum</i>
Leaves oblong lanceolate ; lamellar apical cells \pm rounded ; WS	<i>Pogonatum</i>
Lamellar apical cells smooth or ridged; capsules sharply 4-5 angled ; WS	<i>Polytrichum</i>
Leaves with a narrow costa having <20 lamellae.	
Lamellae restricted to the upper surface of leaves.	
Leaves with awns ; 2-4 lamellae; plants \pm bulbiform ; WS	<i>Pterygoneurum</i>
Leaves bordered by hyaline, elongate cells; 2-8 lamellae; WS	<i>Atrichum</i>
Leaves with ridge -like lamellae on the back (dorsal side) of the costa.	
Stems tomentose (wooly; white to rusty brown); alar cells hyaline and yellow-brown ; WS	<i>Dicranum</i> [†]
Stems smooth ; alar cells not pigmented.	
Costa broad (>1/3 leaf width); ridges weak (1-2 cells); cells short- rectangular ; WS	<i>Campylopus</i> [†]
Leaves with green , branched filaments .	
Leaves “ fleshy ”: filaments on lamina and costa, but covered by inrolled leaf margins; WS*	<i>Aloina</i>
Leaves with fine, white , threadlike filaments in a tangled, cobwebby weft ; N*	<i>Saelania</i>

Group A11 – Leaves undulate

Group A11

Leaves complanate (attached all around the stem but twisted into one plane); E	<i>Aulacomnium</i> [†]
Leaves with lamellae on the costa; WS	<i>Atrichum</i> [†]
Leaves lacking any of the above unique characteristics; N	<i>Dicranum</i> [†]

Group A12 – Leaves involute

Group A12

Leaf margins involute wet or dry.	
Leaf margins infolded/inflexed over photosynthetic lamellae or filaments.	
Leaves with green, sheet-like lamellae ; WS	<i>Polytrichum</i> [†]
Leaves with green, branched filaments ; WS*	<i>Aloina</i>
Leaf margins inrolled over laminae lacking lamellae or filaments.	
Leaf cells papillose .	
Capsules exserted and operculate ; WS	<i>Weissia</i>
Capsules immersed to emergent, cleistocarpous ; E	<i>Astomum</i>
Leaf margins involute when dry ; plane to erect when wet ; cells bulging on upper surface.	
Leaves \pm toothed above; costa with two stereid bands; peristome lacking ; E	<i>Hyophila</i>

Group A13 – Leaves \pm all costa

Group A13

Leaves channeled and subtubulose ; E	<i>Leucobryum</i>
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Group A14 – Leaves with a broad, single costa

	Group A14
Leaves bristle-like (setaceous) or with distinct hair-points.	
Leaves with green , longitudinal striations on the back; N*	<i>Paraleucobryum</i>
Leaves crowded at stem tips; reddish, axillary hairs common; WS	<i>Leptobryum</i>
Leaves lacking the above unique characteristics.	
Leaves with strongly differentiated alar cells (inflated and hyaline).	
Inner basal cells pale, enlarged and extending up along the costa; N*	<i>Dicranodontium</i>
Inner basal cells little differentiated; WS	<i>Campylopus</i>
Leaves with alar cells little differentiated.	
Leaves >3mm ; upper cells elongate ; MO	<i>Campylopodiella</i>
Leaves <3mm ; upper cells rectangular to linear .	
Costa with median row of green cells; brood leaves common; E	<i>Brothera</i>
Costa lacking median row; brood leaves lacking ; WS	<i>Dicranella</i> †
Leaves oblong-lanceolate ; capsules elongate, curved and with a conspicuous neck.	
Upper leaf cells pale, lax , thin-walled and oblong-hexagonal ; N	<i>Amblyodon</i>
Upper leaf cells short rectangular , but not lax; N	<i>Mesia</i> †

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

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	<i>Trichodon</i>
Leaves subulate / setaceous (needle or bristle-like).	
Cells intermediate in length and prorulose/papillose ; upper cells ±bistratose ; WS	<i>Bartramia</i> †
Cells intermediate in length and smooth .	
Capsules with distinct , very long necks ; WS	<i>Trematodon</i>
Capsules lacking a distinct neck.	
Plants larger ; peristome single with forked teeth.	
Teeth divided to base , round and papillose ; WS	<i>Ditrichum</i> †
Teeth divided to mid-point , flat and pitted-striolate ; WS	<i>Dicranella</i> †
Cells short and smooth .	
Upper cells ±bistratose ; capsules inclined , asymmetric and strumose ; WS	<i>Oncophorus</i> †
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	<i>Polytrichastrum</i>
Leaves oblong lanceolate ; lamellar apical cells ±rounded ; WS	<i>Pogonatum</i>
Lamellar apical cells smooth or ridged; capsules sharply 4-5 angled ; WS	<i>Polytrichum</i>
Leaves lacking any of the above unique characteristics; cells strongly bulging on upper surface;	
endostome of 64 papillose filaments ; WS	<i>Timmia</i>

Group A16 – Leaves with long decurrencies

	Group A16
Shoots angular in cross-section; leaves squarrose recurved; cells short and papillose . Leaves 5-ranked ; stems densely tomentose ; calcareous wetlands ; N	<i>Paludella</i>
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	<i>Mnium</i>
Marginal teeth single ; sterile stems prostrate and complanate ; WS	<i>Plagiomnium</i>
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	<i>Bryum</i> [†]
Leaves not bordered ; median cells > 4:1 ; WS	<i>Pohlia</i> [†]
Leaves predominantly broader at the base ; setae very long ; capsules \pm inclined ; N	<i>Meesia</i> [†]

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 **apex** of leaves; plants **whitish**.

Stems often **forked** or branched, especially at stem apices.

Cells **papillose** (simple and forked); capsules **immersed**; peristome **lacking**; WS

Hedwigia

Stems **rarely** branched; leaves **apiculate**; capsules **pendent**; cells **smooth**; WS

Bryum[†]

Hyaline cells as **marginal wedges** broadest at the base of leaves.

Leaves **squarrose-recurved** and **serrulate** above; upper cells **pleuripapillose**; S

Pleurochaete

Leaves **spreading** and crenulate to **entire**.

Leaves **acute** to acuminate; upper cells **pleuripapillose**; WS

Tortella

Hyaline cells in **abruptly differentiated**, ±oval "**windows**" (cancellinae) in the lower 1/3 of leaves.

Leaves **lacking** linear, intramarginal cells; calyptrae **deciduous** and cucullate.

Leaf margins **revolute**; peristome of **32 twisted** teeth; **1***; WS

Tortula[†] (*Syntrichia*)

Leaf margins **plane**; peristome of **16 straight** teeth; **2***; E(GC)

Syrhodon

Hyaline, **inflated** and **thin-walled** cells across the **lower 1/3** of leaves.[#]

Leaves abruptly **serrate** at the **shoulder** and **whorled** at branch points; **2***; WS

Eucladium

Leaves **toothed** above; **2***

Older leaves **brick-red**; stems **lacking** a hyalodermis; WS

Bryoerythrophyllum

Leaves **revolute** at least below; **1***.

Leaves ±**rounded** with short to **long** awns; cells **10-13μ**; **peristome** present.

Peristome of 32 **twisted** teeth on a **high** basal membrane; WS

Tortula[†]

Peristome of 32 ±**erect** teeth on a **low** basal membrane; WS

Desmatodon[†]

Leaves ±**acute**; cells **15-20μ**; peristome **none** or **rudimentary**; WS

Pottia[†] (*Microbryum*)

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

Cross walls of basal cells **thick** and **brown**; calyptrae long **campanulate**; **1***; WS

Encalypta[†]

Cross walls of **normal** thickness; calyptrae **cucullate**.

Stems with a **hyalodermis**; papillae usually **bifid**; **2***.

Stems **lacking** a central strand; WS

Oxystegus

Stems **lacking** a hyalodermis; papillae usually **C-shaped**; **1***.

Peristome of 32 **twisted** teeth on a **high** basal membrane; WS

Tortula[†]

Peristome of 32 ±**erect** teeth on a **low** basal membrane; WS

Desmatodon[†]

[#]: *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.*

Group A18 – Leaves with a distinct marginal border

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

Group A19 – Leaves with distinct alar cells

	Group A19
Stems tomentose ; alar cells inflated , hyaline and ±yellow-brown towards the margin; WS	<i>Dicranum</i>
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 .	
Leaves with green , longitudinal striations on the back; N*	<i>Paraleucobryum</i>
Leaves lacking green striations.	
Inner basal cells pale , enlarged and extending up along the costa; N*	<i>Dicranodontium</i>
Inner basal cells little differentiated; WS	<i>Campylopus</i>
Costa narrow , <1/3 leaf width.	
Alar cells enlarged to inflated and yellowish to brownish .	
Capsules obovoid to pyriform ; on rocks .	
Capsules smooth (dry); peristome teeth erect , ±entire and papillose ; N*	<i>Blindia</i>
Capsules cylindrical ; substrates various .	
Cells with cuticular ridges ; peristome teeth ±entire and papillose ; N*	<i>Dicranoweisia</i>
Cells smooth ; peristome teeth forked and pitted- striolate below; WS	<i>Dicranum</i>
Alar cells sub-quadrate and pale ; cells ±thick -walled and often nodulose ; WS	<i>Grimmia</i> †

Group A20 – Leaves with costa extremely reduced to lacking

Leaves in **clusters** of **branches** around a central stem and a **network** of green and hyaline cells; WS
 Leaves **distichous**, **decurrent** and **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** and **valvate** (4x); plants reddish-**black**; on **rocks**; N*
 Cells **smooth**.

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

Group A20*Sphagnum**Schistostega**Ephemerum*†*Andreaea*†*Tetradontium*†*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., ±homogeneous

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

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

Group A21*Pohlia*†

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

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*Philonotis*†*Bartramia*†

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

	Group A23
Setae straight ; capsules asymmetric and furrowed ; peristome teeth lanceolate .	
Leaves with bistratose margins and/or lamina; mesic habitats; WS	<i>Bartramia</i> †
Leaves unistratose ; hydric habitats; WS	<i>Philonotis</i> †
Setae short , capsules immersed	
Leaves \pm linear-lanceolate and \pm spinulose above; protonemata persistent ; WS	<i>Ephemerum</i> †
Leaves \pm subulate and serrulate above; protonemata ephemeral ; WS	<i>Bruchia</i> †

Group A24 – Cells intermediate and smooth (or indistinctly ornamented[#])

	Group A24
Leaves predominantly broader near or above the middle (\pm oblong or obovate).	
Plants small , winter annuals on soil.	
Capsules clearly exserted .	
Costa strong ; protonemata ephemeral ; peristome lacking ; WS	<i>Physcomitrium</i>
Costa weak ; protonemata persistent ; peristome present ; WS*	<i>Discelium</i>
Capsules \pm immersed and \pm pyriform .	
Leaves \pm concave-obovate and serrulate ; capsules operculate ; WS	<i>Physcomitrium</i>
Leaves \pm concave-ovate and entire ; capsules cleistocarpous ; WS	<i>Bruchia</i> †
Plants otherwise .	
Leaves commonly bordered by linear cells; capsules pyriform and pendent ; WS	<i>Bryum</i>
Leaves unbordered .	
Medial cells smooth and >5:1 (linear rhomboidal); capsules pendent ; WS	<i>Pohlia</i> †
Medial cells smooth and <4:1 ; capsules inclined to erect .	
Peristome of 4 massive teeth; plants bud-like ; costa weak ; on rocks ; N	<i>Tetrodontium</i>
Peristome of 16 teeth; costa strong ; on soil .	
Capsules lacking a distinctive neck; calyptrae inflated cucullate .	
Capsules inclined and asymmetric ; WS	<i>Funaria</i>
Capsules erect and symmetric ; WS	<i>Entosthodon</i>
Peristome lacking ; capsules erect and symmetric ; calyptrae mitrate ; WS	<i>Physcomitrium</i>
Leaves predominantly broader near the base (\pm lanceolate).	
Plants small , winter annuals on soil; capsules \pm immersed and cleistocarpous ; WS	<i>Bruchia</i> †
Plants otherwise ; capsules exserted and peristomate .	
Leaves \pm subulate / setaceous .	
Capsules ovoid ; plants minute to very small ; on calcareous rocks; WS (N)	<i>Seligeria</i> †
Capsules long cylindric ; peristome teeth round , fully split and papillose ; WS	<i>Ditrichum</i>
Capsules \pm oblong , often curved ; peristome teeth flat , split 1/2 and pitted ; WS	<i>Dicranella</i>
Leaves with expanded, sheathing leaf bases; WS	<i>Dicranella</i>
Leaves lacking any of the above unique characteristics.	
Leaves >1mm ; capsules terminal .	
Costa percurrent ; capsules erect ; peristome single .	
Upper cells \pm linear ; peristome teeth long & split ; WS	<i>Ditrichum</i>
Upper cells broad ; peristome teeth short & irregular ; N	<i>Catoscopium</i>
Costa subpercurrent ; capsules \pm pendant ; peristome double ; WS	<i>Pohlia</i> †
Leaves <1mm ; capsules lateral ; peristome single ; on Cu or S rich soils; N*	<i>Mielichhoferia</i>

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

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

Group A25

Leaves with expanded, sheathing bases; cells strongly bulging on upper surface; WS	<i>Timmia</i> †
Leaves distinctly toothed in the upper half.	
Cells unipapillose or mammillose; ventral stereid band weak or lacking .	
Leaves ±broad ; cells mammillose ; capsules smooth ; WS	<i>Dichodontium</i>
Leaves ±narrow ; cells coarsely papillose; capsules furrowed ; N	<i>Cynodontium</i> †
Leaves with large, curved, projecting papillae at extreme apex; cells mammillose ; NW	<i>Dichodontium</i>
Leaves ligulate and rounded- obtuse ; cells pleuripapillose ; 0* ; WS*	<i>Gyroweisia</i> †
Leaves lacking the above unique characteristics.	
Cells collenchymatous and stellate ; 2* .	
Leaves ±erect (wet); cells unipapillose ; A/A	<i>Aulacomnium</i> †
Cells pleuripapillose ; but neither collenchymatous nor stellate.	
Papillae forked ; basal cells with brown cross-walls; calyptrae long- cylindric ; WS	<i>Encalypta</i>
Papillae C-shaped .	
Basal cells with brown cross-walls; calyptrae long- cylindric ; 1* ; WS	<i>Encalypta</i>
Basal cell walls uncolored ; calyptrae cucullate .	
Peristome teeth long and twisted ; 2* ; WS	<i>Barbula</i> †
Peristome teeth short and erect ; 1* ; WS	<i>Desmatodon</i> †
Papillae conical .	
Cells with 4-7 papillae; peristome reduced to lacking .	
Stems repeatedly forked; capsules elongate and urn-shaped ; 2* ; WS	<i>Amphidium</i>
Stems sparsely forked; capsules ±pyriform ; 1* or lacking; WS*	<i>Zygodon</i>
Cells with 1-4 papillae.	
Costa with two stereid bands.	
Leaf margins revolute on both sides; peristome present.	
Papillae crowded ; basal cells hyaline ; peristome twisted ; WS	<i>Barbula</i> †
Papillae scattered ; basal cells green ; peristome ±oblique ; WS	<i>Didymodon</i> †
Leaf margins revolute on one side only; peristome lacking ; WS	<i>Hymenostylium</i>
Leaf margins plane ; peristome lacking .	
Leaves <2 mm ; sporophytes terminal ; WS	<i>Gymnostomum</i>
Costa with one stereid band; peristome lacking .	
Sporophytes lateral ; stem rounded- triangular ; WS	<i>Anoetangium</i>
Sporophytes terminal ; stem round ; WS	<i>Gymnostomum</i>
Costa lacking stereid bands; peristome present .	
Basal marginal cells with thickened cross-walls; WS	<i>Ulota</i> †
Basal marginal cells ±undifferentiated ; WS	<i>Orthotrichum</i> †
Cells unipapillose ; but neither collenchymatous nor stellate.	
Leaves serrulate at apex; stems tomentose ; gemmae on stem extensions; WS	<i>Aulacomnium</i> †
Leaves entire .	
Capsules exserted ; peristome of 32 twisted teeth ; plants on soil and rocks; 2* ; WS	<i>Barbula</i> †
Capsules ±emergent and valvate (4x); blackish plants on rocks ; 0* ; N*	<i>Andreaea</i> †
Capsules ±immersed with 16 ±reflexed teeth; plants on trees and rocks; 0* .	
Basal marginal cells with thickened cross-walls; WS	<i>Ulota</i> †
Basal marginal cells ±undifferentiated ; WS	<i>Orthotrichum</i> †

Group A26 – Cells short (<2:1) and smooth (or indistinctly ornamented[#])

Group A26

Leaves ±oblong- spathulate (broad in the middle and even broader above).	
Leaf margins inrolled when dry (erect or plane when wet); cells bulging on upper surface.	
Leaves 1.5-3 mm and ±toothed above; peristome lacking ; 2* ; E	<i>Hyophila</i>
Leaf margins usually revolute , at least in part; cells flat .	
Leaves ±bordered with longer cells; peristome teeth short and erect ; 1* ; WS	<i>Desmatodon</i> [†]
Leaves ±bordered with shorter cells; peristome teeth long and twisted ; 1* ; WS	<i>Tortula</i> [†]
Leaves unbordered .	
Propagula axillary ; peristome of 32 spirally twisted teeth ; 2* ; WS	<i>Barbula</i> [†]
Leaf margins plane ; cells flat and large (>15μ); peristome none or rudimentary; 1* ; WS	<i>Pottia</i> [†]
Leaves ±oblong- lingulate (tongue-shaped) or oblong- ligulate (strap-shaped).	
Leaves ±lingulate ; cells 2(3)stratose ; awns on perichaetial leaves; capsules sessile ; E, BC	<i>Diphyscium</i>
Leaves ±ligulate ; cells unistratose ; perichaetial leaves ±acute ; capsules exserted .	
Leaves acute ; capsules gymnostomous (lacking a peristome); 1* ; WS	<i>Scopelophila</i>
Leaves obtuse ; capsules peristomate (peristome present); 0* ; WS*	<i>Gyroweisia</i> [†]
Leaves ±ovate (broadest in lower third; egg-shaped) and revolute ; peristome of 32 teeth; 2* ; WS	<i>Barbula</i> [†]
Leaves ovate-lanceolate to lanceolate (broadest near the base; lance-shaped).	
Leaves 3-ranked ; setae very long ; plants of calcareous wetlands; N	<i>Meesia</i>
Leaves with expanded, sheathing leaf bases.	
Cells bulging on upper surface; capsules symmetric and oblong-ovoid ; WS	<i>Timmia</i>
Cells smooth ; capsules asymmetric and strumose (goiter-like swelling); WS	<i>Oncophorus</i>
Leaves with paired teeth on bistratose margins.	
Margins revolute below; cells with cuticular ridges ; perichaetia terminal ; N*	<i>Plagiopus</i>
Leaves bistratose , at least in part.	
Leaves curved to crisped (dry); cells bulging or flat.	
Calyptrae mitrate , lobed and plicate ; 2* ; WS	<i>Ptychomitrium</i>
Leaves lacking 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 4 sutures ; plants saxicolous and blackish ; N*	<i>Andreaea</i> †
Capsules with 4, massive teeth; leaves pellucid ; terminal gemmae cups ; WS	<i>Tetraphis</i>
Capsules with 8, 16 or 32 lanceolate teeth.	
Plants in tufts on tree trunks (rarely on rocks); diplolepidous .	
Leaves crisped when dry; basal cells yellow, thick -walled; WC	<i>Ulota</i> †
Leaves not crisped when dry; basal cells ±undifferentiated ; WS*	<i>Orthotrichum</i> †
Plants in tufts, cushions or mats on rocks .	
Peristomes diplolepidous (double).	
Basal cells very thick -walled, yellow and radiating from costa; WS	<i>Ulota</i> †
Basal cells ±thick -walled, neither yellow and nor radiating; WS	<i>Orthotrichum</i> †
Peristomes haplolepidous (single).	
Plants very small (<2 mm); setae cygneous (wet); N	<i>Seligeria</i> †
Plants larger (>2 mm).	
Capsules systylious ; calyptrae short ; in wetter habitats; WS	<i>Schistidium</i> †
Capsules not systylious; calyptrae longer ; in dryer habitats; WS	<i>Grimmia</i> †
Plants on soil primarily.	
Setae cygneous .	
Capsules yellowish and smooth ; calyptrae mitrate ; N*	<i>Campylostelium</i>
Setae bent at capsule base; capsules strumose and purple-red ; leaves revolute throughout and serrate apically; upper cells ±square ; WS	<i>Ceratodon</i>
Setae straight .	
Capsules ribbed ; in crevices of cliffs and boulders.	
Peristome teeth divided to half their length; N	<i>Cynodontium</i> †
Peristome teeth undivided ; E	<i>Rhabdoweisia</i>
Capsules smooth (or wrinkled when dry).	
Setae very long ; capsules inclined ; peristome double ; in fens ; N	<i>Meesia</i>
Setae shorter ; capsules erect ; peristome single ; on mineral soils .	
Basal cells hyaline ; peristome teeth twisted ; WS	<i>Barbula</i> †
Basal cells green ; peristome teeth ±oblique ; WS	<i>Didymodon</i> †

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

End.