

## Key to British and Irish bryophytes

### Key to Sections

This was the most difficult part of the key to write. The intention is to divide the plants broadly, if vaguely, into more or less taxonomic groups, with the idea that budding bryologists should get to know what these broad groups look like, as they all have their own distinctive 'jiz'. However, this has meant that some of the couplets here are rather long, complex and inelegant. In particular I was in two minds about whether, like Watson, to place all mosses with hyaline hairpoints into their own Section. In the end I decided against it, because hyaline hairpoints have evolved in so many different unrelated groups, but I understand if others disagree with this decision. 'Road testing' the key has also shown that couplet 11 is rather unsatisfactory. However, once one gets to know what the genera *Orthotrichum*, *Ulota* and *Zygodon* look like, the difficulties largely disappear. I have included potentially problematic species, which might key out to either Section 10 or Section 11, in the keys for both Sections.

1. a. Plants consisting of numerous upright stems on which branches arise strictly in fascicles (2-5 branches from one point); leaves composed of two types of cell (i) narrow and green (chlorocysts), (ii) narrow and colourless (hyalocysts); in wet places, variously coloured, and holding water like a sponge..... Section 1 (*Sphagnum*)  
b. Plants not as above.....2.
2. a. Small plants adhering closely to siliceous mountain rocks, appearing dull blackish when dry, but olive-green or red-brown when moist; dry cushions crumbling to dust-like fragments when removed; leaves to 1 mm long; capsules (common) ca. 1 mm long, opening by 4 longitudinal slits ('Japanese lanterns')..... Section 2 (*Andreaea*)  
b. Plants various, if small and blackish rock mosses, then leaves usually more than 1 mm long; capsules not Japanese lantern-like, and cushions remaining  $\pm$  intact when removed from substrate.....3.
3. a. Leaves with thin, colourless, often sheathing bases and thick deep green limbs made opaque by outgrowths of green tissue (lamellae) on their upper surfaces..... Section 3 (*Polytrichum* etc)  
b. Leaves without lamellae, or having them confined to narrow nerve region, so that whole limb of leaf not thick and opaque.....4.
4. a. Leaves *strictly* in two opposing ranks on the stems..... Section 4 (*Fissidens* etc)  
b. Leaves not strictly 2-ranked, although sometimes flattened in one plane.....5.
5. a. Mid-leaf cells *with  $\pm$  strongly sinuose walls*, usually small (< ca. 10(-12)  $\mu$ m wide); if not, or only slightly, sinuose, then cells isodiametric to *shortly* elongate, leaves usually with hyaline hairpoints and/or capsules  $\pm$  immersed, with bright orange-red peristome; usually forming cushions or patches on rocks & walls.....Section 5 (*Grimmia* etc)  
b. Mid-leaf cells *with non-sinuose,  $\pm$  straight or gently curving cell walls*, small to large, isodiametric to very long; hyaline hairpoints sometimes present; capsules, if  $\pm$  immersed, then lacking bright orange-red peristome; habit and substrate various.....6.

6. a. Acrocarpous..... 7.  
b. Pleurocarpous<sup>1</sup>.....12.
7. a. Leaves usually very long and narrow, tapering gradually from base or near it to long, fine points composed mainly of costa; often curved to one side; *if shorter, then mid-leaf cells mainly long and narrow*, usually smooth (so leaves usually shiny), or if papillose or mamilliose, never so strongly that cells are obscured.....Section 6 (*Dicranum* etc)  
b. Leaves shorter, wider; or, if long and narrow, then rarely curved to one side; *mid-leaf cells mainly isodiametric to only very shortly elongate*, papillose, sometimes densely so (so leaves usually matt), or smooth (but beware perichaetial leaves of *Pohlia* spp.!)......8.
8. a. Plants moderately to very robust (stems 2-10 cm), leaves large (*ca.* 3.5-10 mm long, 1-3 mm wide); *leaf with evident border* (formed by narrow thick-walled cells); cells in rest of leaf large (15-45 µm), nearly isodiametric except in leaf base.....Section 7 (*Mnium* etc)<sup>2</sup>  
b. Plants slender or robust; leaves lacking this combination of size, border and cell type.....9.
9. a. Leaves (except perichaetial leaves of *Pohlia* spp.) comparatively broad (length not more than 2.5x breadth), oval, ovate or obovate, usually broadest in mid-leaf, narrowing slightly at base and forming short acute apex; mid-leaf cells rectangular to hexagonal (or occasionally linear), smooth, clearly defined (so plants usually shiny) and at least 15µm wide in mid-leaf.....10.

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<sup>1</sup> The acrocarp-pleurocarp distinction can be difficult for beginners, so I make no apology for here reproducing Watson's excellent 'small print' (p.40 of the 3<sup>rd</sup> edition of *British Mosses & Liverworts*), which is very helpful: "...it is impossible to give a single clear-cut criterion on which to base a decision in barren material. If, however, attention be paid to the following three classes of characters a wrong decision should very rarely be made at this point:

- (i) *General habit and mode of branching.* Acrocarpous mosses are usually unbranched or sparingly branched, and of *erect or ascending* habit; they are never regularly pinnately branched and the leaves are rarely glossy and 'chaff-like'. The majority form cushions or turfs (like the pile of a carpet). Almost all pleurocarpous mosses are *freely branched, often pinnately* so, various in habit but frequently forming dense intricate mats (or looser wefts) of the *prostrate or ascending* secondary stems; and the leaves are most often glossy and 'chaff-like' in character.
- (ii) *Cell structure and nerves.* Almost all doubtful examples can be settled immediately if the leaf is examined under the compound microscope, for the *range* of cell structure is totally different in the two groups. Thus very few acrocarpous mosses have long narrow cells throughout the leaf, whereas this is the cell structure that is most prevalent among the pleurocarps. Again, extremely few pleurocarpous mosses have short (isodiametric) cells in the upper part of the leaf and elongated rectangular cells in the leaf base; but in many acrocarpous families this is the usual type of cell structure. A further useful point: nerveless leaves are very rare among acrocarps; leaves with excurrent nerves are almost equally rare in the pleurocarpous series.
- (iii) *Position of archegonia and capsules.* In almost all the acrocarpous series the archegonia – and hence the capsules – arise terminally, i.e. *at the tip* of a stem or branch, while in the pleurocarpous mosses they arise, surrounded only by the perichaetial leaves, *on the side* of a stem or branch. Acrocarpous mosses that are particularly likely to be mistaken for pleurocarps are *Cinclidotus fontinaloides*, *Breutelia chrysocoma* and *Plagiomnium affine*."

<sup>2</sup> Many species of *Bryum* have a border, but are mostly smaller plants, and have ± hexagonal mid-leaf cells that are longer than wide. Species of Pottiales with a border are all much smaller.

- b. Leaf shape and cell structure not as above, or, if so, then plants minute with globose or nearly globose cleistocarpous capsules on very short (<1 mm) setae; mid-leaf cells usually isodiametric to shortly elongate, often papillose or mamilllose (so plants usually matt), sizes various.....11.
10. a. Mid-leaf cells lax, large (>15µm wide), ± rectangular; often ephemeral plants, sometimes growing directly on dung.....Section 8 (*Funaria*, *Splachnum*, etc.)  
 b. Mid-leaf cells usually smaller, firm, ± hexagonal to linear; usually ± persistent plants, not growing on dung.....Section 9 (*Bryum*, *Pohlia*, etc)
11. a. Medium-sized plants, usually forming discrete, rather loose, tufts or cushions on trees and rocks; leaves relatively broad, (narrowly) lanceolate to ovate, usually obtuse or shortly pointed at apex; capsule ± ovoid to cylindrical, usually borne on a short seta (*ca.* 0.5-5 mm); calyptra often large, hairy and persistent; leaves nearly always unistratose at margins, never with hyaline hairpoints (except *Orthotrichum diaphanum*)..... Section 10 (*Orthotrichum*, *Ulota*, etc)  
 b. Minute to large plants, habit and habitat various; leaves various, often tapering to long, fine points at apex; capsules various, capsule ± sphaerical to very longly cylindrical, borne on a very short to very long seta; calyptra usually small, glabrous and ephemeral; leaves uni-, bi- or multistratose at margins, sometimes with hyaline hairpoints.....Section 11 (*Tortula*, *Didymodon*, *Syntrichia*, etc)<sup>3</sup>
12. a. Cells in mid-leaf from isodiametric to only moderately long in proportion to breadth (3-4 x as long as wide); if slightly narrower, then hardly any cells above 30 µm long.....Section 12.  
 b. Cells in mid-leaf long and narrow, more than 4-5 x as long as wide, many cells clearly exceeding 30-40 µm long.....13.
13. a. Leaves without a costa or with short double costa only.....14.  
 b. Leaves with a costa reaching mid-leaf or beyond.....15
14. a. Leaves ± falcate, at least at shoot tips.....Section 13 (*Hypnum* etc)  
 b. Leaves not falcate.....Section 14 (*Campylium*, *Plagiothecium*, *Rhytidiadelphus*, etc)
15. a. Leaves ± falcate, at least at shoot tips ..... Section 15 (*Drepanocladus* sens. lat., *Palustriella*, etc)  
 b. Leaves not falcate.....Section 16 (*Brachythecium*, *Eurhynchium*, etc)

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<sup>3</sup> This can be a difficult dichotomy, but mosses in the Orthotrichales have a distinctive 'jiz' to them, which will soon be recognised. Species of 'Pottiales' with wide leaves may also be taken for Orthotrichales, but if there is difficulty deciding whether a plant is likely to be found in this Section or Section 10, try both – some of the less easily placed species appear in both Sections. Species of *Schistidium* and *Grimmia* may also have capsules on very short setae, but (i) the leaves often have hyaline hairpoints; (ii) the leaf cell walls are at least somewhat sinuose; and (iii) *Schistidium* normally has a bright orange-red peristome.

## Section 1 – *Sphagnum* (Bog mosses)

The best approach to demystifying *Sphagnum* is to divide it into smaller bite-sized chunks, corresponding to the taxonomic divisions (Sections) within the genus. Once one gets to know the characteristic 'jiz' of a Section, then that is the time to use a more traditional dichotomous key to drill down to the species.

**Characters identifying the six sections of the genus *Sphagnum* in Britain and Ireland** (adapted from Hill *et al.* 1992)

The most important and diagnostic characters are in **bold**. Species within each Section are arranged approximately in order of frequency, starting with the most common, with the exception of the anomalous *S. tenellum*, a common plant in bogs.

Section	Characteristic features	Species
<i>Sphagnum</i>	<ul style="list-style-type: none"><li>Plants large and swollen</li><li><b>Branch leaves with hooded (cucullate) apices</b></li><li>Stem leaves large, obtuse, <math>\pm</math> lingulate</li><li>Stem cortex occupying <math>\frac{1}{3}</math>-<math>\frac{1}{2}</math> diameter of stem</li></ul>	<i>S. palustre</i> <i>S. papillosum</i> <i>S. medium</i> ('magellanicum') <i>S. divinum</i> ('magellanicum') <i>S. austinii</i> <i>S. affine</i>
<i>Rigida</i>	<ul style="list-style-type: none"><li>Compact habit, often crumbling in hands, with individual shoots hard to differentiate</li><li><b>Minute stem leaves</b></li><li>Very strongly differentiated pendent branches</li></ul>	<i>S. compactum</i> <i>S. strictum</i>
<i>Squarrosa</i>	<ul style="list-style-type: none"><li>Plants not markedly swollen</li><li>Stem leaves large and lingulate</li><li>Branch leaves often squarrose, not hooded</li><li>Stem cortex <math>&lt; \frac{1}{4}</math> diameter of stem</li></ul>	<i>S. squarrosus</i> <i>S. teres</i>
<i>Subsecunda</i>	<ul style="list-style-type: none"><li><b>Branches often curved, <math>\pm</math> swollen, ('cow horns'), with the leaves often curved in the same direction</b></li><li>Coppery colours often present</li><li>Branch leaves not hooded at apex</li><li>Some or all stem leaves large and spreading*</li><li>Stem cortex <math>&lt; \frac{1}{4}</math> diameter of stem</li><li><b>Pores on abaxial (convex) face of branch leaves many, usually in conspicuous rows running down both sides of the hyaline cells</b></li></ul>	<i>S. auriculatum</i> ( <i>denticulatum</i> ) <i>S. inundatum</i> <i>S. contortum</i> <i>S. subsecundum</i> * <i>S. platyphyllum</i>
<i>Cuspidata</i>	<ul style="list-style-type: none"><li>Branch leaf margins recurved when dry, usually narrow</li><li>Habit usually medium-sized</li><li><b>Stem leaves usually hanging</b></li><li>Brownish or orange colours dominant, sometimes with weak pink tinges but never deep red</li><li><b>Green cells of branch leaves more exposed on abaxial (convex) face</b></li></ul>	<i>S. fallax</i> <i>S. cuspidatum</i> <i>S. flexuosum</i> <i>S. angustifolium</i> <i>S. pulchrum</i> <i>S. lindbergii</i> <i>S. riparium</i> <i>S. majus</i>

		<i>S. balticum</i> <i>S. tenellum</i> **
<i>Acutifolia</i>	<ul style="list-style-type: none"> <li>• <b>Deep red tints often present</b></li> <li>• Habit usually slender</li> <li>• Branches not swollen</li> <li>• Pendent and spreading branches usually well differentiated</li> <li>• <b>Stem leaves mostly erect</b></li> <li>• <b>Green cells of branch leaves more exposed on adaxial (concave) face</b></li> </ul>	<i>S. subnitens</i> <i>S. rubellum</i> <i>S. capillifolium</i> <i>S. fimbriatum</i> <i>S. girgensohnii</i> <i>S. quinquefarium</i> <i>S. russowii</i> <i>S. molle</i> <i>S. warnstorffii</i> <i>S. fuscum</i> <i>S. beothuk</i> <i>S. skyense</i>

\*Stem leaves very small and hanging in *Sphagnum subsecundum*!

\*\**S. tenellum* is an anomalous species but easily identifiable by its small size, relatively enormous stem leaves, and concave, shell-like branch leaves, the terminal two of which on each branch resemble shrimp claws. It is often placed in its own Section *Molluscum*.

## Reference

Hill, M.O., Hodgetts, N.G. & Payne, A.G. 1992. *Sphagnum: a field guide*. Joint Nature Conservation Committee, Peterborough.

## Section *Sphagnum*

1. a. Junction between hyaline cells and green cells of branch leaves ornamented with minute papillae (like sandpaper) or lamellae (like a comb).....2.  
b. Junction between hyaline cells and green cells of branch leaves smooth.....4.
2. a. Junction between hyaline cells and green cells of branch leaves papillose (like sandpaper).....*S. papillosum*  
b. Junction between hyaline cells and green cells of branch leaves with lamellae (like a comb).....3.
3. a. Branches in fascicles (bunches) of 3; compact, often very large, hummocks in northern and western bogs.....*S. austinii*  
b. Branches in fascicles of 4; carpets in  $\pm$  base-rich seepages, valley mires, etc.....*S. affine*
4. a. Green to pinkish plants; green cells of branch leaves  $\pm$  exposed on both surfaces (TS), particularly the adaxial surface (albeit via thick cell walls in var. *centrale*).....*S. palustre*  
b. Usually wine red plants; green cells of branch leaves completely and deeply enclosed on both surfaces (TS).....5.
5. a. Spreading branches short, blunt, stubby; stem leaves 0.75-0.9  $\mu$ m wide (some < 0.75  $\mu$ m); branch leaves with dorsal pores near base >50% cell width.....*S. medium*  
b. Spreading branches longer, gradually tapering; stem leaves 0.9-1.1 $\mu$ m wide (none < 0.75  $\mu$ m); branch leaves with dorsal pores near base <50% cell width.....*S. divinum*

### Section *Rigida*

1. a. Colour usually dark, mottled green/orange/yellow/brown; stem dark brown/black; very compact; branch leaves  $\pm$  appressed; common.....*S. compactum*  
b. Colour pale green to yellowish green; stem pale green; less compact; branch leaves  $\pm$  squarrose; uncommon Atlantic species.....*S. strictum*

### Section *Squarrosa*

1. a. Robust bright green or slightly brownish plant; branch leaves usually squarrose; plant of ditches, swampy woodland, etc.....*S. squarrosus*  
b. Medium-sized greenish-yellow, orange or brown plant, rarely completely green; branch leaves  $\pm$  appressed, occasionally squarrose; plant of base-rich flushes and fens.....*S. teres*

### Section *Subsecunda*

1. a. Branches in fascicles of 4-7; pendent and spreading branches clearly differentiated; stem leaves fibrillose for 40% or less of the leaf length.....2.  
b. Branches in fascicles of 1-5; pendent and spreading branches not clearly differentiated; stem leaves fibrillose in upper 40% or more of the leaf length .....4.
2. a. Stem cortex always 2-3 cells thick, stems pale.....*S. contortum*  
b. Stem cortex 1 cell thick (rarely irregularly 1-3 cells thick); stems dark.....3.
3. a. Slender plant; stem leaves very small (0.4-0.9 mm long), hanging, fibrillose in upper 0-25%.....*S. subsecundum*  
b. Medium-sized plant; stem leaves larger (0.9-1.5 mm long), fibrillose in upper 20-40%.....*S. inundatum*
4. a. Branches in fascicles of 3-5; stem leaves lingulate; stem cortex always uniformly 1 cell thick; common.....*S. auriculatum*  
b. Branches in fascicles of 1-3(-4); stem leaves broadly elliptic; stem cortex irregularly 1-2(-3) cells thick; rare plant of base-rich flushes and fens.....*S. platyphyllum*

### Section *Cuspidata*

1. a. Small green to golden plant; pendent and spreading branches hardly differentiated; branch leaves ovate, concave, shell-like; stem leaves very large relative to the size of the plant, spreading; hyaline cells near branch leaf apex 10-40  $\mu$ m wide, 1-4x as long as wide.....*S. tenellum*  
b. Habit, colour and branch leaves various; pendent and spreading branches often well differentiated; stem leaves not strikingly large, hanging; hyaline cells near branch leaf apex <20  $\mu$ m, 3-9x as long as wide.....2.

2. a. Stem dark brown to blackish, rare plants.....3.  
b. Stem pale.....4.
3. a. Stem leaves with broad, tattered apex; arctic-alpine plant.....*S. lindbergii*  
b. Stem leaves triangular with acute apex; lowland bogs.....*S. pulchrum*
4. a. Stem leaves conspicuously cleft at apex; rare.....*S. riparium*  
b. Stem leaves rounded or acute at apex, not conspicuously cleft, common.....5.
5. a. Little or no differentiation between pendent and spreading branches; branch leaves very long and narrow, often curved; plants with flaccid 'drowned kitten' appearance, submerged or in very wet places; when terrestrial, leaves at branch tips rolled into a cusp.....6.  
b. Pendent and spreading branches well differentiated; branch leaves lanceolate, straight (until dried); leaves at branch tips not rolled into a cusp; usually not submerged & flaccid....7.
6. a. Plant green; hyaline cells of branch leaves with 0-3 abaxial pores; very common  
.....*S. cuspidatum*  
b. Plant dingy olive; hyaline cells of branch leaves with abundant (*ca.* 10) abaxial pores; very rare except in the Caithness Flow Country.....*S. majus*
7. a. Stem leaves with the margins inrolled at apex to form an acute point..... *S. fallax*  
b. Stem leaves obtuse, the margins plane.....8.
8. a. Small green to beige plant, often tinged pinkish at branch bases, with pendent branches tending to be longer than spreading branches; stem leaves equilaterally triangular, rounded and entire at apex.....*S. angustifolium*  
b. Large green plant with spreading branches tending to be longer than pendent branches; stem leaves longer than wide, fringed at extreme apex.....*S. flexuosum*

### Section *Acutifolia*

1. a. Brown plants with stems always dark brown to blackish; stem leaves  $\pm$  lingulate, obtuse.....2.  
b. Usually green to red plants with stems always pale; if brownish, then stems pale or stem leaves  $\pm$  triangular, acute.....3.
2. a. Plant pale to mid-brown with individual capitula  $\pm$  flat; all hyaline cells on abaxial surface of upper part of of branch leaves with conspicuous large (12-30  $\mu$ m) pores.....*S. fuscum*  
b. Plant dark chocolate-colour with individual capitula convex, making the hummocks blackberry-like; many hyaline cells on abaxial surface of upper part of branch leaves lacking conspicuous large pores..... *S. beothuk*
3. a. Stem leaves lingulate to spatulate, with apices broadly rounded to wide and tattered.....4.  
b. Stem leaves  $\pm$  triangular, with acute apices.....6.

4. a. Red pigmentation present, often making plant look 'stripy'; stems leaves lingulate, entire or slightly tattered at apex.....*S. russowii*  
b. Green to brownish plants with no red pigmentation; stem leaves conspicuously tattered at apex.....5.
5. a. Stem leaves spatulate, conspicuously tattered around most of upper leaf, forming 'Elizabethan ruff' around stem apex when capitulum removed.....*S. fimbriatum*  
b. Stem leaves lingulate, tattered only across truncate apex, not forming a ruff.....*S. girgensohnii*
6. a. Stem leaves large (1.5-2.8 mm long), normally widest above base, strongly fibrillose; plants pale, often whitish or pink.....*S. molle*  
b. Stem leaves smaller (up to 1.4 mm long), normally widest at base, weakly fibrillose; plants green to deep red.....7.
7. a. Branches in fascicles of 4-5, usually with 3 spreading branches; usually on well-drained ground such as banks in woodland and heath.....*S. quinquefarium*  
b. Branches in fascicles of 3-4, with up to 2 spreading branches; usually in wet places.....8.
8. a. Stem leaves with fibrils weak or absent, apices acute with inrolled leaf margins; plants usually iridescent when drying out; capitulum salmon pink but more weakly pigmented in the centre.....9.  
b. Stem leaves usually with conspicuous fibrils, occasionally weak or absent, apices  $\pm$  plane, so more bluntly triangular; plants not iridescent, usually with deep red coloration; capitulum more strongly pigmented in the centre.....10.
9. a. Plant medium-sized, most fascicles with 3 branches, two spreading and one pendent; common.....*S. subnitens*<sup>1</sup>  
b. Plant very large, most fascicles with 4 branches, two spreading and two pendent; rare, oceanic.....*S. skyense*
10. a. Medium-sized plants of base-rich flushes and fens, never forming large hummocks; stem leaves with fibrils weak or absent; branch leaves often strikingly 5-ranked, with pores on abaxial side near apex small (2-8  $\mu$ m) with thick rings (so resembling tiny ring doughnuts).....*S. warnstorffii*  
b. Small plants (but often forming large hummocks) of bogs and other acid wet places; stem leaves usually with conspicuous fibrils; branch leaves not strikingly 5-ranked, with large (6-13  $\mu$ m) pores on abaxial side near apex.....11. (*S. capillifolium* sens. lat.)
11. a. Forming dense, hard hummocks from which it is difficult to extract individual shoots without damage; capitulum convex; stem leaves 1.1-1.4  $\mu$ m long.....*S. capillifolium*

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<sup>1</sup>*S. subnitens* subsp. *ferrugineum*, which is rare but probably under-recorded, resembles subsp. *subnitens* in all respects except that it is entirely brown in colour, with dark stems.



b. Forming looser hummocks from which it is easy to extract individual shoots without damage; capitulum flat; stem leaves 0.9-1.2 µm long.....*S. rubellum*

## Section 2 – *Andreaea* (Rock mosses)

1. a. Leaves costate (nerved to apex)..... 2.  
b. Leaves ecostate (nerveless).....4.
2. a. Leaf margins papillose-crenulate to serrate throughout; leaf cells papillose; confined to areas of late snow-lie in Scottish mountains..... *Andreaea nivalis*  
b. Leaf margins entire or very rarely dentate above; leaf cells smooth; widespread.....3.
3. a. Spores mostly 50-90  $\mu\text{m}$ ; leaf apex relatively broad, with lamina  $\pm$  distinct to apex..... *A. megistospora*  
b. Spores mostly 36-52  $\mu\text{m}$ ; leaf apex narrow, with leaf lamina indistinct in upper part of leaf (costa filling upper part of leaf)..... *A. rothii*<sup>1</sup>
4. a. Plants 2-7 cm tall, deep purple/red coloration usually present; leaves strongly constricted and denticulate above base; cells smooth.....*A. hookeri* ('*A. alpina*')  
b. Plants 0.5-2 cm tall, green or red-brown to black; leaves not strongly constricted above base, entire, cells papillose.....5.
5. a. Basal marginal cells quadrate; spores 12-21  $\mu\text{m}$ ; yellowish patch often present in middle of lower part of leaf; usually growing above 600 m altitude..... *A. mutabilis*  
b. Basal marginal cells elongate; spores mostly 20-26  $\mu\text{m}$ ; no yellowish patch; growing from sea level to high altitude..... *A. rupestris*<sup>2</sup>

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<sup>1</sup> Two very rare arctic-alpine species will also key out here; *A. blyttii* resembles, *en masse*, the pelt of a black dog and has small spores 10-20  $\mu\text{m}$ ; *A. frigida* has leaves gradually tapering to apex (abruptly narrowed from a broad base in *A. rothii* and *A. megistospora*). *A. frigida* may however be locally abundant in the Cairngorms and upper Eskdale in Cumbria.

<sup>2</sup> Two further very rare arctic-alpine species will also key out at this dichotomy; *A. alpestris* is poorly differentiated from *A. rupestris*, but is supposed to have straighter leaves with less papillose cells; *A. sinuosa* has small spores (like *A. mutabilis*), but strongly sinuose and pitted basal leaf cells and no trace of a yellow patch; it is also unique among our *Andreaea* species in that the capsule splits only in the upper half.

### Section 3 – *Polytrichum* etc ('Hair-cap' mosses)

Leaves with thin, colourless, often sheathing bases and thick deep green limbs made opaque by outgrowths of green tissue (lamellae) on their upper surface.

1. a. Leaves thick and opaque, the opacity caused by many (> ca. 30) longitudinal lamellae obscuring costa; leaves with colourless sheathing bases.....2.  
b. Leaves thin and translucent with a clearly visible costa which has few (<10) longitudinal lamellae running along its length; leaf bases not sheathing..... 13.
2. a. Leaf margin incurved and toothed, lamellae forming wavy band of variable width down centre of leaf.....*Oligotrichum hercynicum*  
b. Leaf margin incurved or not, lamellae straight.....3.
3. a. Leaf margin incurved<sup>1</sup>.....4.  
b. Leaf margin plane.....6.
4. a. Leaves ending in a long, hyaline hairpoint.....*Polytrichum piliferum*  
b. Leaves ending in an orange/ginger point.....5.
5. a. Plants small (<6 cm), on dry substrates, often with orange tomentum.....*Polytrichum juniperinum*  
b. Plants large (>6 cm), in wet places (usually growing through *Sphagnum* hummocks), stems with whitish tomentum.....*Polytrichum strictum*
6. a. Leaves glaucous blue-green; apical cells of lamellae papillose....*Pogonatum urnigerum*  
b. Leaves deep mid-green; apical cells of lamellae papillose or not.....7.
7. a. Plants small (<2 cm tall), with short wide leaves; protonema persistent.....8.  
b. Plants large (>2 cm tall), or if smaller then with long thin leaves; no persistent protonema.....9.
8. a. Capsule shortly ovoid, nearly smooth; always with bluntly toothed leaves; rare.....*Pogonatum nanum*  
b. Capsule cylindrical, rough; well developed plants with sharply toothed leaves; common.....*Pogonatum aloides*
9. a. 4-6 or more rows of clear cells along margin of leaf; cells 14-25 µm wide.....*Polytrichum longisetum*  
b. 1-3(-5) rows of clear cells along margins of leaf; cells usually <16 µm wide.....10.
10. a. Leaves long and thin; apical cells of lamellae flat to bifid.....11.  
b. Leaves shorter and wider; apical cells of lamellae rounded to conical.....12.

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<sup>1</sup> *Polytrichastrum sexangulare* is a rare high altitude plant of late-lying snow patches; it has a cucullate (hooded) leaf apex.

11. a. Apical cells of lamellae flat to slightly concave; small plant of ruderal habitats.....*Polytrichum perigoniale*  
b. Apical cells of lamellae deeply bifid; often very large plant of wet habitats.....*Polytrichum commune*
12. a. Apical cells of lamellae papillose; dark green, branched shoots in rock crevices and other upland habitats.....*Polytrichastrum alpinum*  
b. Apical cells of lamellae smooth; mid-green, mainly unbranched shoots in many relatively dry habitats.....*Polytrichum formosum*
13. a. Leaves strongly undulate when moist, lingulate-lanceolate to narrowly lanceolate, hardly narrowed towards base; lamellae 3-6, 3-7 cells high.....*Atrichum undulatum*<sup>2</sup>  
b. Leaves not or only slightly undulate when moist;  $\pm$  ovate to lanceolate, narrowed towards base; lamellae 1-5, 1-9 cells high.....14.
14. a. Lamellae 1-2(-4), 1-3 cells high.....*Atrichum crispum*  
b. Lamellae 2-4(-5), 5-9 cells high.....*Atrichum tenellum*

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<sup>2</sup> *Atrichum angustatum*, a very rare south-eastern plant, has small mid-leaf cells (12-20  $\mu\text{m}$  vs. 30-50  $\mu\text{m}$  in the other species); the leaves may be smooth or undulate.

#### Section 4 – *Fissidens* etc

Leaves strictly arranged in two ranks on the stem.

1. a. Leaves lacking a costa, cells very large (100 x 25 µm).....*Schistostega pennata*  
b. Leaves with a costa, cells small.....2.
2. a. Leaves transversely inserted with sheathing bases and long, narrow points.....3.  
b. Leaves longitudinally inserted, with broader points and unique double lamina forming a 'boatlike pocket' at base (illustration?).....4.
3. a. Capsule erect, cylindrical.....*Distichium capillaceum*  
b. Capsule inclined, narrowly ovoid.....*D. inclinatum*
4. a. Leaves very long and thin (*ca.* 10 x longer than wide); sheathing lamina *ca.* ⅓ length of leaf; strictly aquatic.....*Fissidens fontanus*  
b. Leaves shorter and wider; sheathing lamina *ca.* ½ length of leaf; habitat various.....5.
5. a. Leaves gradually tapering to apex from below middle; leaf cells *ca.* 2x as long as wide.....*F. curvatus*  
b. Leaves ± abruptly narrowed to apex; leaf cells ± isodiametric.....6.
6. a. Leaves with distinct border formed of very narrow elongated cells, at least on sheathing laminae.....7.  
b. Leaves unbordered (but a pale 'pseudo-border'<sup>1</sup> can sometimes be seen).....15.
7. a. Leaf border multistratose, often pigmented; plants aquatic.....8.  
b. Leaf border usually unistratose, occasionally bistratose; usually not pigmented; plants terrestrial.....10.
8. a. Leaf border confluent with costa at apex, usually yellowish.....*F. rivularis*<sup>2</sup>  
b. Leaf border not confluent with costa at apex, orange/red or colourless.....9.
9. a. Leaf cells large, mostly 10-14µm wide; peristome teeth 51-86 µm wide at base.....*F. crassipes*  
b. Leaf cells smaller, mostly 6-10µm wide; peristome teeth 43-66 µm wide at base.....*F. rufulus*
10. a. Terminal pair of leaves much longer than the rest; on shaded sandstone or limestone rock.....*F. gracilifolius*  
b. Terminal pair of leaves not much longer than the rest; normally on soil.....11.

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<sup>1</sup> Border cells the same size and shape as other lamina cells, but paler.

<sup>2</sup> The rarer *F. monguillonii*, which also has the leaf border confluent with the costa, has a colourless border and larger leaf cells (10-14 µm wide vs. 8-10 µm wide in *F. rivularis*); it also has the perichaetial leaves clearly narrower than the other leaves, while those of *F. rivularis* are ± the same width.

11. a. Bud-like male inflorescence conspicuous in axils of leaves along the main stem; capsule erect.....*F. bryoides*  
 b. Male inflorescence normally on separate basal branch, so no bud-like structure in leaf axils; capsules various.....12.
12. a. Capsule almost horizontal, curved and somewhat asymmetrical; seta bright red.....*F. incurvus*  
 b. Capsule erect and  $\pm$  symmetrical, or more rarely slightly inclined; seta dull reddish.....13.
13. a. Leaf cells 4-8  $\mu\text{m}$  wide, bulging..... *F. crispus*  
 b. Leaf cells 8-15  $\mu\text{m}$  wide, not bulging.....14.
14. a. Leaf  $\pm$  concave at each side of costa at apex; on soil..... *F. viridulus*  
 b. Leaf  $\pm$  flat or convex at each side of costa at apex; on rock.....*F. pusillus*
15. a. Plant minute, shoots <5 mm long; costa ending below apex to percurrent.....16.  
 b. Plant larger, shoots usually >1 cm long, costa ending below apex to excurrent.....17.
16. a. Shoots with only 2-4 pairs of leaves; costa straight; leaf cells 8-12  $\mu\text{m}$  wide.....*F. exilis*  
 b. Shoots with up to 18 pairs of leaves; costa with distinct bend halfway up leaf; leaf cells 12-20  $\mu\text{m}$  wide.....*F. celticus*
17. a. Nerve projecting in a short point, seta arising from near base of stem.....*F. taxifolius*  
 b. Nerve ceasing just below extreme apex of leaf, seta terminal or arising laterally from near middle of stem.....18.
18. a. Leaves curved strongly downwards, with no marginal band of clear cells; leaf apex entire or merely minutely and regularly crenulated through projecting cells; mainly on wet rocks in uplands.....*F. osmundoides*<sup>3</sup>  
 b. Leaves not, or only weakly, curved downwards, with  $\pm$  obvious marginal band of slightly larger, more clearly defined cells; leaf apex coarsely and irregularly toothed; habitats various..... 19.
19. a. Leaf cells mainly in range 6-10  $\mu\text{m}$  wide, bistratose in patches; marginal band well defined; usually smaller plants in dry rock crevices.....*F. dubius*<sup>4</sup>  
 b. Leaf cells mainly in range 18-18  $\mu\text{m}$ , unistratose throughout; marginal band less well defined; usually large plants in fens and flushes.....*F. adianthoides*

<sup>3</sup> *F. polyphyllus*, a rare plant of south-western streamsides, is much larger and with smaller leaf cells (shoots up to 20 cm long and cells 8-14  $\mu\text{m}$  wide, vs. shoots up to 10 cm and cells 12-22  $\mu\text{m}$  wide in *F. osmundoides*); also, the rather blunt leaves of *F. osmundoides* are decurved downwards in a very characteristic way.

<sup>4</sup> *F. serrulatus*, another rare plant of south-western streamsides, has conically mamillate leaf cells (cells  $\pm$  smooth in both *F. dubius* and *F. adianthoides*).

## Section 5 – *Grimmia*, *Racomitrium*, *Schistidium*, etc

Plants cushion-forming to tuft-forming, usually growing directly on rocks or walls, more rarely on soil or epiphytic; often with hyaline hairpoints; leaf texture matt, not shiny; leaf cells  $\pm$  sinuose (pictures!).

1. a. Leaves completely lacking a costa..... 2. (*Hedwigia* etc)  
b. Costa always present .....5.
2. a. Hyaline hairpoint absent..... *Braunia imberbis*  
b. Hyaline hairpoint present .....3.
3. a. Upper leaf cells mostly with a single papilla; hair points often recurved or reflexed; plants frequent.....*Hedwigia stellata*  
b. Upper leaf cells mostly with 1-4 papillae; hair points usually erect or following curve of leaf; plants uncommon.....4.
4. a. Leaves at least indistinctly plicate; cilia of perichaetial leaves straight or weakly curved..... *Hedwigia striata*  
b. Leaves smooth; cilia of perichaetial leaves with irregular bends and kinks.....*Hedwigia ciliata*
5. a. Basal leaf cells linear, transverse walls thin, longitudinal walls thick, *strongly and regularly sinuose*; capsules always exserted, produced on a long seta..... 6. (*Racomitrium*)<sup>1</sup>  
b. Basal leaf cells short or long, weakly sinuose; capsules on a short or long seta, sometimes  $\pm$  immersed .....19.
6. a. Hyaline hairpoints always present, both papillose and coarsely and irregularly toothed..... *Racomitrium lanuginosum*  
b. Hyaline hairpoints, if present, entire or denticulate, smooth or papillose, but never coarsely and irregularly toothed.....7.
7. a. Leaf cells strongly conically papillose; hyaline hairpoints, if present, papillose at least at base,  $\pm$  denticulate; usually on soil or gravel..... 8.  
b. Leaf cells smooth or slightly papillose with low papillae; hyaline hairpoints, if present, entire or denticulate, not papillose; usually on rock.....10.
8. a. Costa reaching *ca.*  $\frac{1}{2}$ - $\frac{3}{4}$  way up leaf; abaxial papillae 1-2x taller than wide; hyaline hairpoint always present, papillose throughout; uncommon but locally abundant on sand dunes and some other habitats..... *Racomitrium canescens*  
b. Costa reaching leaf apex; abaxial papillae 0.5-1x taller than wide; hyaline hairpoint, if present, papillose below, becoming smooth to weakly papillose at apex; common.....9.

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<sup>1</sup> Note that *Grimmia ramondii*, which resembles a *Racomitrium* in the field, also has strongly sinuose cell walls, but not so strongly or regularly as in *Racomitrium*; it has distinctive wings or ridges on the dorsal side of the costa (TS).

9. a. Hyaline hairpoint always present, papillose to near apex, decurrent down margins; supra-alar marginal cells thick-walled, quadrate; mostly in semi-natural habitats..... *Racomitrium elongatum*  
b. Hyaline hairpoint, if present, papillose only at base, not decurrent down margins; supra-alar marginal cells thin-walled, rectangular; common in ruderal habitats..... *Racomitrium ericoides*
10. a. Leaves, at least upper leaves, with hyaline hairpoints..... 11.  
b. Leaves without hyaline hairpoints.....14.
11. a. Upper leaf margins bistratose over 2-4 rows; plants tinged reddish; Arctic-alpine species..... *Racomitrium macounii*  
b. Upper leaf margins unistratose or bistratose over 1(-2) rows; plants not tinged reddish; habitat various.....12.
12. a. Costa 4-8 cells wide in middle part of leaf, predominately bistratose in TS usually *ca.* 100  $\mu$ m or more wide at base; capsules long, cylindrical; often forming spreading, hoary patches, sometimes more compact..... *Racomitrium heterostichum*<sup>2</sup>  
b. Costa *ca.* 4 cells wide in middle part of leaf, predominately 3-4-stratose in TS, usually <85  $\mu$ m wide at base; capsules short, ellipsoid to shortly cylindrical; often forming small tufts or cushions, sometimes more spreading.....13.
13. a. Leaves V-shaped in upper half (TS); costa 50-85  $\mu$ m wide, sometimes forming tight cushions; inner perichaetial leaves similar to stem leaves; capsule ellipsoid..... *Racomitrium sudeticum*  
b. Leaves not V-shaped in upper half (TS); costa up to nearly 100 $\mu$ m wide never forming tight cushions; inner perichaetial leaves small, hyaline, blunt, without hyaline hairpoints; capsule cylindrical..... *Racomitrium affine*
14. a. Cells in upper part of leaf narrowly rectangular to linear; stems with numerous short branches; usually yellow-green to olive-green plants..... *Racomitrium fasciculare*  
b. Cells in upper part of leaf quadrate to rectangular; stems variously branched. but not uniformly with short branches; colour various, often dark green to black.....15.
15. a. Small plants forming tufts or cushions; cells in upper part of leaf bistratose, opaque; most of upper part of leaf filled by costa; capsules shortly ovoid, reddish-brown..... *Racomitrium ellipticum*  
b. Often larger plants, forming cushions, tufts or spreading mats; cells in upper part of leaf unistratose, clear; costa not filling upper part of leaf; capsules ellipsoid to shortly cylindrical, brown.....16.

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<sup>2</sup> *R. obtusum* sometimes has short hairpoints, but has many leaves with *broadly* recurved margins (less and more narrowly recurved in *R. heterostichum*), brown patches on individual leaves, and the costa is often 4-stratose at base (usually 2-3-stratose in *R. heterostichum*). *R. himalayanum*, a rare plant of mica-schist rocks on higher Scottish mountains, is an orange-tinged dark green plant and has narrowly rectangular upper leaf cells (like *R. fasciculare*).



16. a. Leaves rounded or very obtuse at apex, usually toothed..... *Racomitrium aciculare*  
 b. Leaves acuminate to obtuse at apex, entire.....17.
17. a. Costa 50-85µm wide near base; leaf apices acute..... *Racomitrium sudeticum*  
 b. Costa >100µm wide near base; leaf apices obtuse.....18.
18. a. Plants dark green to blackish, sparsely branched, often forming hanging 'brackets' on vertical rocks; upper part of leaf short and wide..... *Racomitrium aquaticum*  
 b. Plants olive green, richly branched, usually forming tufts or spreading patches; upper part of leaf long and narrow but blunt at extreme apex..... *Racomitrium obtusum*
19. a. Leaves with plane margins; leaves appearing plicate with bistratose streaks forming 'pseudo-nerves' each side of the costa; capsules emergent, with strongly perforated peristome teeth..... *Coscinodon cribrosus*  
 b. Leaves with margins plane, recurved or incurved; leaves not appearing plicate; capsules immersed to exserted; peristome teeth various.....20.
20. a. Capsules (usually present) ± immersed, often with bright orange-red peristome; plants usually forming straggling patches or, if forming neat cushions, maritime or montane..... 21. (*Schistidium*)<sup>3</sup>  
 b. Capsules (often absent) emergent to exserted, peristome not bright orange-red; plants usually forming neat cushions, not maritime.....34. (*Grimmia*)<sup>4</sup>
21. a. Leaves lacking hyaline hairpoints; spores 16-28 µm; plants semi-aquatic or maritime<sup>5</sup>.....22.  
 b. Leaves with hyaline hairpoints; spores 8-15 µm; plants not usually semi-aquatic or maritime.....25.
22. a. Plants forming compact dark green cushions on maritime rocks; costa percurrent to excurrent; spores 20-28 µm.....*Schistidium maritimum*  
 b. Plants forming lax tufts on rocks in or by fresh water; costa ending in or below apex; spores 16-20 µm.....23.
23. a. Leaves oblong-ligulate to linear-lanceolate, margins plane..... *Schistidium agassizii*  
 b. Leaves lanceolate to broadly ovate, margins recurved.....24.

<sup>3</sup> *Schistidium* is a difficult genus, with many of the species separated by subtle characters; capsules are usually necessary for a confident identification. This is a simplified treatment which does not include some of the very rare species; it is also likely that further European species, not yet recorded in Britain and Ireland, may occur. Two rare species of *Grimmia*, *G. anodon* and *G. crinita*, have immersed capsules, but form tight cushions and have curved setae. *G. anodon* lacks a peristome.

<sup>4</sup> *Grimmia* is also difficult; this key is largely based on the one provided in *Field Bryology* (Porley 2016).

<sup>5</sup> *S. atrofusum* also usually lacks a hairpoint; it is a shiny jet black plant of calcareous rocks in the central Highlands (non-aquatic; spores ca. 10 µm).

24. a. Leaves lanceolate to ovate-lanceolate; costa 65-145  $\mu\text{m}$  wide near base; perichaetial leaves overtopping capsules..... *Schistidium rivulare*  
 b. Leaves ovate-lanceolate to ovate; costa 48-90(-105)  $\mu\text{m}$  wide near base; perichaetial leaves not or hardly overtopping capsules..... *Schistidium platyphyllum*
25. a. Leaf lamina papillose dorsally.....26.  
 b. Leaf lamina smooth (but papillae often present on leaf margins and dorsal side of costa).....28.
26. a. Leaf lamina partly (but extensively) bistratose above  $\pm$  densely papillose abaxially, less so adaxially; mainly on basalt..... *Schistidium pruinolum*  
 b. Leaf lamina unistratose or bistratose in small patches, sparsely papillose abaxially, almost smooth adaxially; on various base-rich substrates.....27.
27. a. Capsule short, ovoid, 1.1-1.4x as long as wide..... *Schistidium strictum*  
 b. Capsule long, cylindrical, 1.5-2x as long as wide..... *Schistidium papillosum*
28. a. Plants black with yellow-green young leaves at shoot tips; peristome erect with incurved tips forming a dome above the urn; columella persistent..... *Schistidium trichodon*  
 b. Plants various; peristome erecto-patent to squarrose-recurved; columella falling with lid.....29.
29. a. Dorsal side of costa papillose; upper leaf margins usually papillose-denticulate or denticulate; very common.....30.  
 b. Dorsal side of costa and leaf margins smooth.....31.
30. a. Exothelial cells predominately longer than wide; hyaline hairpoints coarse (long and wide at base), so patches often hoary; leaves not falcate..... *Schistidium crassipilum*  
 b. Exothelial cells irregularly isodiametric to wider than long; hyaline hairpoints fine (shorter and narrower), so patches not hoary; leaves often  $\pm$  falcate..... *Schistidium apocarpum*
31. a. Exothelial cells irregularly-shaped, with many isodiametric to wider than long..... *Schistidium apocarpum*<sup>6</sup>  
 b. Exothelial cells predominately  $\pm$  rectangular, mostly clearly longer than wide.....32.
32. a. Capsules with 0-4 stomata at base; very common plants of lowland walls etc..... *Schistidium crassipilum*<sup>7</sup>

<sup>6</sup> Two much rarer small cushion- or tuft-forming species of upland areas may key out here. *S. dupretii* has the leaf apex narrowing abruptly to the short hyaline hairpoint, and narrower perichaetial leaves that do not conceal the capsule (which sticks out proud from the cushions) in side view. *S. frigidum* has patches of thin-walled basal cells forming well differentiated hyaline 'windows' each side of the costa; the capsules are deeply immersed in the perichaetial leaves. Neither has falcate leaves.

<sup>7</sup> *S. helveticum*, a rare upland plant, is blackish and the leaves have very short hyaline hairpoints; the capsules have many irregularly-shaped exothelial cells intermixed with the rectangular ones, and completely lack stomata.

- b. Capsule with >6 stomata at base; uncommon plants of limestone rocks and walls, usually in upland areas<sup>8</sup> .....33.
33. a. Leaf margins recurved  $\pm$  from base to apex; hyaline hairpoint broad below, decurrent down margin; mid-leaf cells strongly sinuose..... *Schistidium robustum*  
b. Leaf margins plane or recurved up to  $\frac{2}{3}$  on one side of leaf; hyaline hairpoint narrow, not decurrent down margin; mid-leaf cells weakly sinuose..... *Schistidium elegantulum*
34. a. Clusters of multicellular gemmae at apices of upper leaves.....35.  
b. Leaves lacking clusters of multicellular gemmae at leaf apices.....36.
35. a. Gemmae brown; leaves  $\pm$  falcate; costa with 6-8 guide cells at insertion in TS.....*Grimmia hartmanii*  
b. Gemmae yellowish; leaves not falcate; costa with 4 guide cells at insertion in TS..... *Grimmia anomala*
36. a. Hyaline hairpoint completely absent.....37.  
b. Hyaline hairpoint present, at least on some leaves, occasionally much reduced.....38.
37. a. Costa with distinct dorsal wings or ridges in TS.....*Grimmia ramondii*  
b. Costa lacking wings or ridges .....*Grimmia atrata*<sup>9</sup>
38. a. Basal marginal cell walls uniformly thin.....39.  
b. Basal marginal cell walls thickened, often with the transverse wall more thickened than the longitudinal wall.....42.
39. a. Hyaline hairpoints very short (up to 150  $\mu$ m).....40.  
b. Plants hoary, the leaves with long, conspicuous hyaline hairpoints (sometimes longer than main part of leaf).....41.
40. a. Leaves straight to flexuose when dry; leaf apex channelled,..... *Grimmia elongata*  
b. Leaves crisped/incurved when dry; leaf apex forming a terete subula (not channelled)..... *Grimmia incurva*
41. a. Leaves not homomallous when dry; seta straight, capsules erect..... *Grimmia donniana*  
b. Leaves homomallous when dry; seta curved when moist, so that capsules  $\pm$  horizontal..... *Grimmia arenaria*

<sup>8</sup> *S. confertum* may also key out here; it has 3-8 rather obscure stomata per capsule, and forms small, neat cushions on acidic rocks (*S. robustum* and *S. elegantulum* are both larger, more straggling plants); the hyaline hairpoints are short and flat, and the short capsules, surrounded by long, narrow perichaetial leaves, stick out proud from the cushions.

<sup>9</sup> Note that *G. elongata* and *G. incurva* can sometimes lack hairpoints, but both have uniformly thin-walled basal marginal cells (transverse walls thick in *G. atrata*). The very rare *G. unicolor* has the leaf ovate at the base, abruptly narrowed to the lingulate bistratose to multistratose upper half; the leaf of *G. atrata* is mostly unistratose and tapers gradually from near the base.

42. a. Leaves broadly concave in TS (lunate to semicircular), plane; costa poorly defined; upper leaf lamina bistratose to multistratose.....43.  
 b. Leaves not concave in TS, keeled or costa well defined; margins plane, recurved or incurved; upper leaf lamina unistratose to bistratose.....45.
43. a. Basal marginal cells to twice as wide as long; large, well-defined zone of wider-than-long cells in leaf base..... *Grimmia laevigata*  
 b. Basal marginal cells to twice as long as wide; no well-defined zone of wider-than-long cells in leaf base.....44.
44. a. Leaf apex narrow, acuminate, hyaline hairpoint not or hardly decurrent; basal paracostal cells 4-8 x as long as wide..... *Grimmia ovalis*  
 b. Leaf apex broad, hyaline hairpoint decurrent; basal paracostal cells 2-3x as long as wide..... *Grimmia tergestina*
45. a. Costa with 6-8 guide cells at insertion in TS.....46.  
 b. Costa usually with 4 guide cells at insertion in TS.....49.
46. a. Basal paracostal cells with strongly nodulose walls; leaves erecto-patent when moist, never falcate.....47.  
 b. Basal paracostal cells normally with smooth or weakly nodulose walls; leaves sometimes squarrose or  $\pm$  falcate when moist.....48.
47. a. Large plant with strongly toothed, decurrent hyaline hairpoint; upper part of leaf unistratose to bistratose in patches; seta arcuate (so that capsule appears to 'burrow back' into cushions)..... *Grimmia decipiens*  
 b. Small plant with smooth to slightly denticulate, hardly decurrent hairpoint; upper part of leaf mostly bistratose; seta straight..... *Grimmia longirostris*
48. a. Leaves squarrose when moist; well developed central strand in stem (TS); costa rounded on dorsal side (TS)..... *Grimmia lisae*  
 b. Leaves  $\pm$  falcate when moist; no central strand in stem (TS); costa sometimes  $\pm$  angulate on dorsal side (TS)..... *Grimmia hartmanii*
49. a. Leaf mainly bistratose above, only leaf base unistratose.....*Grimmia montana*<sup>10</sup>  
 b. Leaf mainly unistratose above; often bistratose at margins or in patches.....50.
50. a. Leaves spirally crisped when dry.....*Grimmia torquata*  
 b. Leaves straight or flexuose when dry, not spirally crisped.....51.
51. a. Leaves abruptly narrowed from obtuse apex into hyaline hairpoint.....52.

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<sup>10</sup> Three very rare species also have the upper leaf lamina bistratose: *G. alpestris* has strongly bulging lamina cells in TS; *G. elatior* is a large plant with strongly papillose leaf cells; *G. reflexidens* has the leaf margin recurved below (plane in *G. montana*).

- b. Leaves gradually tapering from acuminate apex into hyaline hairpoint.....53.
52. a. Basal cells of leaf 2-4x longer than wide; lid of capsule rostrate; very common plant on walls etc.....*Grimmia pulvinata*  
 b. Basal cells of leaf 4-8x longer than wide; lid of capsule mamillate; scarce plant on basic rocks and walls, mainly limestone..... *Grimmia orbicularis*
53. a. Plants greyish, forming tight soft 'mouse-like' cushions; thin string-like catenulate shoots always present, at least inside cushions at base of old stems..... *Grimmia funalis*  
 b. Plants various, but cushions usually looser and coarser, not 'mouse-like'; catenulate shoots absent.....54.
54. a. Guide cells in costa TS in two layers; basal paracostal cells  $\pm$  smooth; basal marginal cells mainly narrow elongate-rectangular, hyaline..... *Grimmia trichophylla*  
 b. Guide cells in costa TS in one layer; basal paracostal cells  $\pm$  nodulose; basal marginal cells mostly shortly rectangular.....55.
55. a. Leaves patent when moist; costa in TS angulate to shallowly winged dorsally; hyaline hairpoint denticulate,  $\pm$  reflexed when dry; usually on basic igneous rock..... *Grimmia muehlenbeckii*  
 b. Leaves spreading when moist; costa in TS rounded dorsally; hyaline hairpoint slightly denticulate, not reflexed when dry; usually on limestone..... *Grimmia dissimulata*

## Section 6 – *Dicranum*, *Dicranella*, *Campylopus*, etc

Leaves usually very long and narrow; *cells also mainly long and narrow*, mainly smooth (so leaves usually shiny; or if papillose or mamilllose, never so strongly papillose that cells are obscured), not sinuose; very small to very large plants. *Philonotis* and allies are included in this group; although their leaves are relatively short, they are sharply pointed (giving the plants a spiky appearance) and, importantly, have elongate mid-leaf cells.

1. a. Costa broad, at least  $\frac{1}{3}$  total breadth of leaf base..... 2.  
b. Costa narrow, less than  $\frac{1}{3}$  total breadth of leaf base.....18.
2. a. Leaves with hyaline hair-points at apex (sometimes short and inconspicuous).....3.  
b. Leaves completely without hyaline hair-points.....6.
3. a. Upper leaf cells long and thin, vermicular.....4.  
b. Upper leaf cells short and wide, trapeziform or rectangular.....5.
4. a. Medium-sized green plants; hyaline points very short and inconspicuous; costa section with stereids both dorsally and ventrally.....*Campylopus brevipilus*  
b. Large, usually blackish plants; hyaline hair-points long, conspicuous; costa section with dorsal stereids only.....*Campylopus atrovirens*
5. a. Hyaline hair-points reflexed when dry, collectively forming a 'star' at the shoot tip; shoots often nodose; dorsal side of costa (TS) with ribs 1 cell high; common..... *Campylopus introflexus*  
b. Hyaline hair-points± straight when dry, collectively not forming a 'star'; shoots not nodose; dorsal side of costa (TS) with ribs 2-4 cells high; rare.....*Campylopus pilifer*
6. a. Glaucous-green when moist, whitish when dry, *forming robust dense cushions*, the broadly lanceolate leaves composed almost entirely of absorbent costa tissue, several layers of cells thick and holding water like a sponge..... 7.  
b. Not as above; if forming robust cushions, then cushions less dense, not glaucous whitish green, cell structure different, and not holding water like a sponge..... 8.
7. a. Lamina 4-10(-12) cells wide on each side of the costa at widest, with sharply defined border of 2 or more narrower cells..... *Leucobryum glaucum*<sup>1</sup>  
b. Lamina (8-)10-17 cells wide on each side of the costa at widest, with poorly defined border..... *Leucobryum juniperoideum*
8. a. Usually large plants (up to 12 cm high, leaves > 3 mm long); if smaller, then leaves not strongly falcato-secund; capsules striate when moist, seta ± cygneous; habitat various..... 9.

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<sup>1</sup> *L. albidum*, recently recognised in Britain, can be differentiated (in TS of the leaf base) by having only a single layer of cells on the ventral side of the chlorocysts in the middle of the leaf, and normally narrower (<10 µm vs. >10µm in *L. glaucum*) pores in the hyalocysts.

- b. Small plants (1-3 cm high, leaves < 3mm long) with  $\pm$  strongly falcato-secund leaves; capsules smooth when moist, seta straight; very common on woodland banks or as colonists of bare soil.....51.
9. a. Costa section with stereid cells.....10.  
b. Costa section without stereid cells.....16.
10. a. Costa section with stereid cells both dorsally and ventrally; alar cells differentiated,  $\pm$  inflated, hyaline or pigmented.....11.<sup>2</sup>  
b. Costa section with stereid cells dorsally only; alar cells differentiated or not.....12.
11. a. Costa clearly defined; basal cells forming conspicuous hyaline 'windows' on either side of costa; rare, oceanic.....*Dicranodontium uncinatum*  
b. Costa not very clearly defined; basal cells not differentiated..... *Dicranodontium denudatum*<sup>3</sup>
12. a. Basal auricles absent or very rarely weakly developed.....13.  
b. Basal auricles conspicuous.....14.
13. a. Leaves widest at base; individual shoots distinct, wide.....*Campylopus fragilis*  
b. Leaves narrowed at base, widest above base; individual shoots narrow, hardly distinct.....*Campylopus pyriformis*
14. a. Small to medium-sized plants; costa in section with ventral cells smaller and more numerous than median cells; common.....*Campylopus flexuosus*  
b. Large plants; costa in section with ventral cells often very large, equal in number to median cells; rare oceanic species.....15.
15. a. Leaves toothed above; costa in section with ventral cells occupying up to  $\frac{1}{2}$  leaf thickness; mainly in ravines etc.....*Campylopus setifolius*  
b. Leaves almost entire; costa in section with ventral cells occupying  $> \frac{1}{2}$  leaf thickness; bogs..... *Campylopus shawii*
16. a. Conspicuous auricles present; costa very wide,  $\frac{2}{3}$  or more of leaf base, excurrent from mid-leaf.....*Campylopus gracilis*  
b. Auricles  $\pm$  absent; costa narrower, less than  $\frac{2}{3}$  leaf base, excurrent near apex.....17.
17. a. Lax, non-tomentose plants; ruderal lowland habitats.....*Campylopus subulatus*  
b. Densely tufted, tomentose plants; montane..... *Campylopus schimperi*

<sup>2</sup> Forms of *Dicranum fuscescens* and *D. scottianum* with a very strong nerve may key out here, but both have a well-defined nerve and no basal 'windows'.

<sup>3</sup> The rare *D. asperulum* has the leaf margin toothed almost throughout, whereas *D. denudatum* is toothed only in the upper half of the leaf. The even rarer *D. subporodictyon* has thick-walled porose cells throughout the leaf and persistent orange/brown rhizoids on the leaf base.

18. a. Minute plants with bristle-like leaves (<6 mm tall, including sporophyte) on bare rock, often forming a thin 'fuzz'; often fertile.....19<sup>4</sup>.  
b. Larger plants or, if minute, growing on soil.....26.
19. a. Capsule with longitudinal furrows when dry.....*Brachydontium trichodes*  
b. Capsule smooth.....20.
20. a. Leaves distinctly trifarious.....*Seligeria trifaria* s.l.<sup>5</sup>  
b. Leaves not trifarious.....21.
21. a. Leaf margin denticulate in basal part; peristome absent.....*Seligeria donniana*  
b. Leaf margin  $\pm$  entire or slightly denticulate below; peristome present.....22.
22. a. Seta strongly curved when moist; mainly on sandstone..... *Seligeria recurvata*<sup>6</sup>  
b. Seta  $\pm$  straight ; mainly on chalk and limestone.....23.
23. a. Capsule narrowing at mouth (widest below mouth) when dry and empty  
.....*Seligeria calycina*  
b. Capsule widest at mouth when dry and empty.....24.
24. a. Costa ending in or below apex in upper and perichaetial leaves.....*Seligeria pusilla*  
b. Costa excurrent in upper and perichaetial leaves.....25.
25. a. Upper and perichaetial leaves bluntly pointed , spores 14-18  $\mu$ m.....*Seligeria calcarea*  
b. Upper and perichaetial leaves acutely pointed , spores 9-14  $\mu$ m.....*Seligeria acutifolia*
26. a. Well-differentiated alar cells, usually inflated and/or orange-brown or hyaline, present.....27.  
b. Distinctive alar cells absent.....44.
27. a. Small cushion- or tuft-forming plants, leaves <4 mm long.....28.  
b. Larger, usually looser plants, leaves >4 mm long.....36.
28. a. Cells in upper part of leaf linear; costa excurrent in subulate point; alar cells bright orange, conspicuous; plants usually blackish.....*Blindia acuta*  
b. Cells in upper part of leaf quadrate to rectangular; costa excurrent or not, not forming subulate point ; alar cells relatively inconspicuous, usually hyaline or brownish; plants usually green.....29.
29. a. Plants lowland epiphytes.....30.

<sup>4</sup> Note that there are several very rare species of *Seligeria* that are not included in this key.

<sup>5</sup> Most British and Irish material of this rare complex belongs to *S. patula*.

<sup>6</sup> The rare *Campylostelium saxicola* will also key out here; it has rounded-quadrate cells (short-rectangular-quadrate in *S. recurvata*), the upper part of the leaves flat (subulate in *S. recurvata*), and longer capsules. *S. campylopoda*, another rare species, has the nerve ending below the leaf apex.



- b. Plants montane, on rocks.....32.
30. a. Leaves straight, appressed when dry; many leaves with broken tips.....*Dicranum tauricum*  
b. Leaves flexuose, curved or crisped when dry; most leaves intact.....31.
31. a. Upper leaf cells mamilllose; flagelliform branches absent..... *Dicranum montanum*  
b. Upper leaf cells smooth; flagelliform branches usually present..... *Dicranum flagellare*
32. a. Leaves abruptly narrowed above base to long acumen consisting of longly excurrent costa; capsules wide-mouthed when dry and empty.....*Arctoa fulvella*  
b. Leaves gradually tapering, costa not so longly excurrent; capsules not wide-mouthed when dry and empty.....33.
33. a. Leaves strongly and regularly falcato-secund both wet and dry ; leaf apex rough and slightly 'knobbly'; plants yellow-green.....*Kiaeria falcata*  
b. Leaves falcato-secund or not; leaf apex rough or smooth; plants green to brownish-green.....34.
34. a. Mid-leaf cells striate; capsules erect, straight.....*Dicranoweisia crispula*  
b. Mid-leaf cells smooth; capsules inclined, sometimes curved.....35.
35. a. Leaves  $\pm$  crisped when dry; leaf apex rough and 'knobbly'.....*Kiaeria blyttii*  
b. Leaves flexuose when dry; leaf apex smooth or slightly denticulate.....*Kiaeria starkei*
36. a. Leaves flexuose or crisped when dry; costa wide, up to  $ca. \frac{1}{3}$  leaf width at base.....37.  
b. Leaves straight or falcate when dry; costa narrow,  $< \frac{1}{4}$  leaf width at base.....39.
37. a. Leaf margins usually entire; basal cells 2-4 x as long as wide; capsules erect.....*Dicranum scottianum*  
b. Leaf margins usually denticulate; basal cells 3-8 x as long as wide; capsules inclined.....38.
38. a. Leaf margins distinctly denticulate; upper leaf cells  $\pm$  quadrate, usually  $\pm$  mamilllose.....*Dicranum fuscescens*  
b. Leaf margins entire to weakly denticulate; upper leaf cells smooth, irregular and variable in shape.....*Dicranum flexicaule*
39. a. Leaf cells porose throughout; common.....40.  
b. Leaf cells non-porose, or porose only at base; rare.....43.
40. a. Leaf margins recurved below, spinosely toothed above.....*Dicranum polysetum*  
b. Leaf margins plane below, toothed above but not spinosely.....41.
41. a. Leaves strongly and regularly falcato-secund, 9-15 mm long; seta yellowish.....*Dicranum majus*

- b. Leaves erect to irregularly falcato-secund, up to *ca.* 10 mm long; seta reddish, at least below.....42.
42. a. Leaves transversely undulate above, costa thin, 40-70 µm wide, not or hardly toothed on dorsal side near apex; leaf apex broad.....*Dicranum bonjeanii*  
 b. Leaves undulate or not, costa broad, 75-120 µm wide, toothed on dorsal side near apex; leaf apex narrow.....*Dicranum scoparium*
43. a. Leaves incurved and crisped when dry; leaf cells mamilllose on dorsal side near apex.....*Dicranum spurium*  
 b. Leaves ± erect when dry, cells smooth.....*Dicranum undulatum*
44. a. Mid-leaf cells smooth.....45.  
 b. Mid-leaf cells papillose, mamilllose or striate.....73.
45. a. Small plants on soil, shoots <1 cm tall (usually much less), with spherical or nearly spherical cleistocarpous, immersed capsules (capsules usually present).....46.  
 b. Larger plants (1-10 cm tall) on various substrates; capsules exserted on a long seta, not cleistocarpous (capsules present or not).....49.
46. a. Capsules perfectly spherical, without an apiculus, containing 16-32 very large (150-250 µm) spores.....*Archidium alternifolium*  
 b. Capsules with apiculus, containing many small (<40 µm) spores<sup>7</sup>.....47.
47. a. Perichaetial bracts similar in length to upper stem leaves.....*Pseudephemerum nitidum*  
 b. Perichaetial bracts much longer than upper stem leaves.....48.
48. a. Antheridia in conspicuous dwarf axillary buds.....*Pleuridium subulatum*  
 b. Antheridia inconspicuous, naked in outer perichaetial leaf axils.....*Pleuridium acuminatum*
49. a. Leaves strictly in two opposing ranks on the stem.....50.  
 b. Leaves not strictly two-ranked.....51.
50. a. Capsule erect, cylindrical.....*Distichium capillaceum*  
 b. Capsule inclined, narrowly ovoid.....*Distichium inclinatum*
51. a. Leaves weakly to strongly falcato-secund, gradually narrowed from base; leaf base not sheathing<sup>8</sup>.....52.  
 b. Leaves variously spreading; if slightly falcato-secund, then abruptly contracted from sheathing base<sup>9</sup>.....57.
52. a. Costa *ca.* ½ width of leaf base; seta yellow at maturity.....53.

<sup>7</sup> Note that some species of *Ephemerum* may also key out here; see 'Pottiales' key.

<sup>8</sup>*Kiaeria falcata* (plant of montane rocks, see above) may also key out here if the alar cells are not very distinct.

<sup>9</sup>*Kiaeria blyttii* (plant of montane rocks, see above) may also key out here if the alar cells are not very distinct.

- b. Costa up to 1/5 width of leaf base; seta red to purple at maturity.....54.
53. a. Capsule strumose; basal leaf cells 70-115 µm long, rare.....*Dicranella cerviculata*  
b. Capsule not strumose; basal leaf cells 30-50 µm long, common.....*Dicranella heteromalla*
54. a. Plants tinged reddish; leaf margin plane.....*Dicranella rufescens*  
b. Plants greenish; leaf margins narrowly recurved below (sometimes weakly and only on one side).....55.
55. a. Upper leaves lanceolate; mid-leaf cells 10-14 µm wide; base-poor substrates.....*Dicranella staphylina*  
b. Upper leaves linear-lanceolate; mid-leaf cells 4-9 µm wide; base-rich substrates.....56.
56. a. Leaf margins recurved on both sides of leaf to above mid-leaf; costa well-defined, usually occupying 1/5 or less of the leaf base ..... *Dicranella varia*  
b. Leaf margins almost plane, or weakly recurved at the base, often on one side only; costa poorly-defined, occupying ¼ or more of the leaf base.....*Dicranella howei*
57. a. Upper leaf cells long (up to *ca.* 80 µm) and narrow.....58.  
b. Upper leaf cells from isodiametric to shortly rectangular (<*ca.* 40 µm).....59.
58. a. Costa > ¼ width of leaf at base; capsule pyriform; seta usually > 1 cm long; weed of disturbed ground, flowerpots, etc.....*Leptobryum pyriforme*  
b. Costa < ¼ width of leaf at base; capsule ovoid-cylindrical; seta usually < 1 cm long; on base of trees, rotten wood, acid rocks and peat.....*Orthodontium lineare*
59. a. Leaves abruptly contracted from erect sheathing base<sup>10</sup>.....60.  
b. Leaves gradually tapering from non-sheathing base.....64.
60. a. Leaves squarrose or reflexed from sheathing base; small plants of ruderal habitats .....61.  
b. Leaves erect, erecto-patent or secund from sheathing base; habitat various.....62.
61. a. Leaves ending in long narrow subula, 'knobbly' all round.....*Trichodon cylindricus*  
b. Leaves ending in long, narrow apex, entire or toothed at margin only.....  
.....*Dicranella schreberiana*<sup>11</sup>
62. a. Leaves long (3-8 mm), flexuose, giving plant a silky appearance; marginal cells at middle of basal part thin-walled, hyaline; common plant of base-rich substrates.....*Flexitrichum (Ditrichum) gracile*

<sup>10</sup>*Oncophorus* spp., uncommon plants of upland flushes, may also key out here; the most common, *O. virens*, is a medium-sized to large plant, bright green, with the leaves spreading and spiky when moist, flexuose to crisped when dry, the margins recurved below and toothed above.

<sup>11</sup> The rare but widely overlooked *D. crispa* has mid-leaf cells 4-6 µm wide (6-14 µm in *D. schreberiana*); plants keying out to *D. schreberiana* in montane habitats may be *D. grevilleana*.

- b. Leaves short (1-4 mm), flexuose or sometimes secund; plants lacking a silky appearance; marginal cells at middle of basal part not differentiated as above; uncommon, habitat various.....63.
63. a. Leaves often secund when moist; costa narrow (*ca.* 1/5 leaf width at base), well defined; plant of damp acid ground.....*Dicranella subulata*  
 b. Leaves flexuose, not secund when moist; costa wide (up to *ca.* 1/3 leaf width at base), poorly defined; plant of strongly base-rich soils and rocks...*Flexitrichum (Ditrichum) flexicaule*
64. a. Plants forming  $\pm$  tight cushions on rocks (including rock crevices) and trees.....65.  
 b. Plants forming loose mats, tufts or dispersed colonies; usually on soil .....70.
65. a. Leaves clearly to obscurely toothed above.....66.  
 b. Leaves completely entire<sup>12</sup>.....70.
66. a. Plants large, leaves > 3 mm long, or if less then strongly toothed above and with globose capsule on seta 5-15 mm long.....67.  
 b. Plants small, leaves < 3 mm long, fresh green; capsule ovoid on seta < 3 mm long.....69.
67. a. Leaf cells large, 11-22  $\mu$ m wide in mid-leaf.....*Cynodontium jenneri*  
 b. Leaf cells small, 8-12  $\mu$ m wide in mid-leaf.....68.
68. a. Leaves plicate; forming neat, dingy green to blackish cushions directly on non-basic rock; capsules narrowly ellipsoidal, smooth.....*Ptychomitrium polyphyllum*  
 b. Leaves not plicate; forming deep green tufts on base-rich rock; capsules globose (narrower and furrowed when dry and empty).....*Plagiopus oederianus*
69. a. Leaves narrow, with lamina 3-4(-5) cells wide on each side of costa 220  $\mu$ m from apex.....*Rhabdoweisia fugax*  
 b. Leaves wider, with lamina 5-7 cells wide on each side of costa 220  $\mu$ m from apex.....*Rhabdoweisia crispata*
70. a. Bright green to yellowish-green plants; capsules narrowly ellipsoid on seta > 5 mm long; smooth cylindrical gemmae often present; common on trees, fence posts and lowland rocks and walls.....*Dicranoweisia cirrata*  
 b. Dark green; capsules ovoid on seta 2-3 mm long; strongly papillose cylindrical gemmae often present; almost restricted to rocks in hyperoceanic parts of Britain and Ireland.....*Glyphomitrium daviesii*
71. a. Leaf margin recurved from base to near apex; leaf apex usually with 1-3 small but distinct teeth; very common.....*Ceratodon purpureus*  
 b. Leaf margin plane, entire, even at apex.....72.

<sup>12</sup> The uncommon *Ditrichum zonatum* may also key out here – see below.

72. a. Cells in lower part of leaf narrowly rectangular to linear, mostly 40-80 µm long; sporophytes common; common plant of ruderal habitats such as forestry tracks, at least in upland areas.....*Ditrichum heteromallum*  
 b. Cells in lower part of leaf rectangular, mostly 10-24 µm long; sporophytes unknown; uncommon mountain plant.....*Ditrichum zonatum*<sup>13</sup>
73. a. Stems tall, commonly 8-15 cm, strongly squarrose leaves giving a bottle-brush effect; leaves markedly plicate.....*Breutelia chrysocoma*  
 b. Stems shorter; no bottle-brush effect; leaves not markedly plicate.....74.
74. a. Leaves long, 3-5 mm or more, with long, narrow apices; if shorter, then longly lanceolate to linear.....75.  
 b. Leaves shorter, ovate to lanceolate, 1-3 mm, broad-based with shorter, sharply pointed, apices.....82.
75. a. Small, dark green cushion-forming plants (cushions often large and fairly dense); leaves 1.5-3.5 mm long, entire or obscurely and irregularly toothed.....76.  
 b. Larger, glaucous or vivid green plants forming loose cushions or tufts; leaves up to 5-6 mm long, sharply toothed .....78.
76. a. Plants matt, forming small cushions; leaf margins irregularly toothed above; sporophytes common, seta *ca.* 5 mm long .....*Cynodontium bruntonii*<sup>14</sup>  
 b. Plants with silky sheen, often forming large cushions; leaf margins entire, or nearly so; cells; sporophytes absent or with seta up to *ca.* 3 mm long.....77.
77. a. Basal cells of leaves thin-walled; upper cells strongly papillose with round papillae; capsules common, just emerging above leaves; plant of mountain rocks.....*Amphidium lapponicum*  
 b. Basal cells of leaves thick-walled; upper cells faintly striate with oval papillae; capsules rare; common plant of slightly base-rich rock crevices.....*Amphidium mougeotii*
78. a. Soft-textured plants with rather distant leaves; leaf margin variably and irregularly toothed; usually on damp soil or gravel, often next to streams.....79.  
 b. Hard-textured, often 'spiky' plants with crowded leaves; leaf margin strongly and regularly toothed; usually growing in rock crevices, often dry.....80.
79. a. Leaves < 4 x longer than wide, finely toothed; capsules inclined...*Dichodontium pellucidum*  
 b. Leaves > 4 x longer than wide; irregularly and coarsely toothed; capsules erect.....*Dichodontium flavescens*
80. a. Upper cells of leaf much longer than wide; leaf base conspicuously sheathing, silvery.....*Bartramia ithyphylla*

<sup>13</sup> A number of rare species of *Ditrichum* may also key out here.

<sup>14</sup> Several rare species of *Cynodontium* (occurring mainly in and near the Cairngorms) may also key out here.

- b. Upper cells of leaf margin scarcely longer than wide; leaf base not conspicuously sheathing or silvery.....81.
81. a. Plants bright green above; leaves  $\pm$  crisped when dry; seta curved, 2-3 mm long, capsules usually concealed by leaves.....*Bartramia halleriana*  
 b. Plants glaucous green; leaves flexuose to  $\pm$  crisped when dry; seta 5-25 mm long, capsules exerted above leaves.....*Bartramia pomiformis*
82. a. Plants soft-textured, pale green throughout; leaves distant on stem, not arranged in 5 ranks; leaf margins recurved below only, with single teeth; leaf cells mamilllose, never prorate.....*Dichodontium pellucidum*  
 b. Plants hard-textured and 'spiky', often with pale green leaves contrasting with reddish stem; leaves crowded on stem, sometimes arranged in 5 clear ranks; leaf margins often recurved to near apex, usually with double teeth; leaf cells often prorate.....83.
83. a. Large plants with distinctly falcate leaves 1.8-3 mm long; inner perigonal bracts acute; confined to very calcareous fens and flushes.....*Philonotis calcarea*  
 b. Small plants with leaves 0.5-2 mm long, not or weakly falcate; inner perigonal bracts usually obtuse (or if acute then plants slender); habitats various but not notably calcareous.....84.
84. a. Leaves spirally imbricate; costa coarsely mamilllose on dorsal side; mountain flushes.....*Philonotis seriata*  
 b. Leaves not spirally imbricate; costa smooth or only slightly mamilllose on dorsal side; habitats various.....85.
85. a. Leaves clearly arranged in 5 ranks on stem; entire plant glaucous green; leaf cells mamilllose; forming dense cushions on mountain rocks and turf.....*Conostomum tetragonum*  
 b. Leaves not clearly arranged in 5 ranks on stem; usually sharp contrast between pale green leaves and reddish stem; leaf cells prorate; habitat various.....86.
86. a. Leaf margin  $\pm$  recurved, with double teeth; stems often  $\pm$  densely tomentose below; common.....87.  
 b. Leaf margin plane or narrowly recurved with single teeth; stems not or weakly tomentose below; scarce.....88.
87. a. Leaves  $\pm$  ovate with costa not or scarcely excurrent; stems  $\pm$  tomentose below; inner perigonal bracts obtuse; common in a variety of wet habitats..... *Philonotis fontana*  
 b. Leaves  $\pm$  lanceolate with costa  $\pm$  longly excurrent; stems densely tomentose below; inner perichaetial leaves acute; rare upland plant.....*Philonotis tomentella*
88. a. Upper leaf cells narrower than lower leaf cells, smooth or only distally prorate..... *Philonotis capillaris* (*P. arnellii*)

b. Upper leaf cells not much narrower than lower leaf cells, proximally  
prorate.....*Philonotis caespitosa*<sup>15</sup>

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<sup>15</sup> *Philonotis rigida*, a rare south-western plant of wet cliffs, has narrow, strikingly rigid leaves and single teeth; the plant is much more spiky and rigid-looking than either *P. capillaris* or *P. caespitosa*, both of which tend to occur in more ruderal habitats. *P. cernua* is an extremely rare oceanic species of peaty rock crevices; it has an arcuate seta (straight in *P. rigida*).

## Section 7 – *Mnium* etc

Plants moderately to very robust (stems 2-10 cm), leaves large (3.5-10 cm long, 1-3 mm wide); leaves with evident border formed by narrow thick-walled cells; cells in rest of leaf large (15-45 µm), nearly isodiametric except in leaf base.<sup>1</sup>

1. a. Costa of leaf with outgrowths consisting of longitudinal plates of green cells (lamellae), appearing as thin dark lines running the length of the costa..... 2.  
b. Costa without such outgrowths.....3.
2. a. Leaves undulate, cells rather small, ca. 20 µm wide.....*Atrichum undulatum*  
b. Leaves not undulate, cells larger, reaching 35-45 µm wide.....*Atrichum crispum*<sup>2</sup>
3. a. Sterile stems erect; leaves ± orbicular; leaf margins entire; reddish pigmentation often present.....4.  
b. Sterile stems erect or arcuate; leaf shape various; leaves leaf margins usually toothed; if reddish pigmentation present, then leaves ovate to ovate-lanceolate, not orbicular.....6.
4. a. Mid-leaf cells 15-35 µm wide; costa always reaching apex; dark, richly pigmented plant.....*Cinclidium stygium*  
b. Mid-leaf cells 35-50 µm wide; costa often ceasing below apex; any reddish pigmentation pale.....5.
5. a. Costa ceasing well below apex, leaf border unthickened; stems with micronemata (uncommon plant in fens and base-rich flushes).....*Rhizomnium pseudopunctatum*<sup>3</sup>  
b. Costa reaching apex, or nearly so, leaf border thickened; stems without micronemata (common plant on soil and streamsides).....*Rhizomnium punctatum*
6. a. Teeth along leaf margins consisting of double structures.....7.  
b. Teeth along leaf margins single structures.....9.
7. a. Costa ending below leaf apex, spiny at back; leaves scarcely decurrent; reddish coloration absent; abundant species in many habitats.....*Mnium hornum*  
b. Costa percurrent to excurrent (at least in upper leaves of fertile shoots), not spiny at back; leaves decurrent; reddish coloration often present; less common upland plants.....8.
8. a. Mid-leaf cells ca. 14-18 µm wide.....*Mnium thomsonii*  
b. Mid-leaf cells ca. 18-28 µm wide.....*Mnium marginatum*<sup>4</sup>

<sup>1</sup> Note that *Mnium stellatum* lacks a leaf border, so keys out in Sections 9 and 11. *Pseudobryum cinclidioides*, a rare wetland plant, has very much the appearance of a large *Rhizomnium*, but lacks a border to the leaf.

<sup>2</sup> Rarer species of *Atrichum* may also key out here; see Polytrichaceae key (Section 3).

<sup>3</sup> *R. magnifolium*, a rare plant of higher altitudes in the Scottish Highlands, will also key out here; it differs in the leaves having a small apiculus (lacking in *P. pseudopunctatum*).

<sup>4</sup> Two rare plants of base-rich mountain rocks, *Mnium spinosum* and *M. lycopodioides*, will also key out here.



9. a. Leaves narrowly lingulate, transversely undulate when moist; mid-leaf cells 10-16  $\mu\text{m}$  wide.....*Plagiomnium undulatum*  
b. Leaves  $\pm$  ovate, not undulate; mid-leaf cells 15-50  $\mu\text{m}$  wide.....10.
10. a. Leaves serrate from middle, apex acute (leaf cells hexagonal, not in rows, thickened at corners).....*Plagiomnium cuspidatum*  
b. Leaves serrate from base (rarely entire), apex acute to obtuse.....11.
11. a. Leaf bases not decurrent (or only very shortly so); leaves occasionally entire.....12.  
b. Leaf bases long decurrent; leaves hardly ever completely entire<sup>5</sup>.....13.
12. a. Leaf cells isodiametric to shortly elongate, thickened at corners, not or hardly porose, 27-50  $\times$  20-32  $\mu\text{m}$ ; marginal teeth blunt; operculum rostrate; on moist rocks and soil.....*Plagiomnium rostratum*  
b. Leaf cells elongate, often in distinct diagonal rows, with slight corner thickenings, porose, 40-77  $\times$  22-37  $\mu\text{m}$ ; marginal teeth sharp, mostly of 1(-2) cells; operculum convex; in damp/wet habitats..... *Plagiomnium ellipticum*
13. a. Leaves with long and broadly decurrent base; cells with walls  $\pm$  uniformly thickened; teeth directed forward and mostly formed by 1-2 cells; Costa strong apically, excurrent or percurrent; sterile shoots sometimes erect; fens, marshes & other wet habitats..... *Plagiomnium elatum*  
b. Leaves with long but narrow decurrent base; cells with weak corner thickenings; at least some of teeth more or less perpendicular to margin, formed by 1-3(-4) cells; Costa weak, mostly ending below apex; sterile shoots arcuate; damp woods and turf..... *Plagiomnium affine*

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<sup>5</sup> *Plagiomnium medium*, a rare plant of base-rich ground in the Scottish mountains, may also key out here; it has isodiametric to slightly elongate leaf cells that are not arranged in distinct rows (unlike *P. elatum* and *P. affine*), sharp forward-directed teeth of 1-2 cells, an excurrent costa and a broadly decurrent leaf base.

## Section 8 – *Funaria*, *Splachnum* (dung mosses) etc

1. a. Growing on dung, bones, or other animal remains.....2.  
b. Growing on the ground.....5.
2. a. Seta arcuate when moist, flexuose and twisted when dry; capsule asymmetrical.....*Funaria hygrometrica*  
b. Seta straight or flexuose; capsule symmetrical.....3.
3. a. Leaves abruptly contracted into long, fine acumen; apophysis± the same width as main body of capsule.....*Tetraplodon mnioides*<sup>1</sup>  
b. Leaves with short acute (or occasionally obtuse) apices; or, if longer, then apophysis significantly wider than main body of capsule, giving a characteristic 'amphora' shape.....4.
4. a. Leaves usually strongly dentate; apophysis much wider than main body of capsule.....*Splachnum ampullaceum*<sup>2</sup>  
b. Leaves entire to obscurely dentate; apophysis± the same width as main body of capsule.....*Splachnum sphaericum*
5. a. Capsule immersed, cleistocarpous, globose.....*Physcomitrium patens*  
b. Capsule exserted, not cleistocarpous or globose.....6.
6. a. Capsule inclined, asymmetrical, with oblique mouth; peristome double.....7.  
b. Capsule erect, symmetrical; peristome single or absent.....8.
7. a. Leaves entire to obscurely dentate; seta flexuose and twisted when dry, arcuate when moist; very common ruderal plant, especially on bonfire sites.....*Funaria hygrometrica*  
b. Leaves usually clearly dentate above; seta ± straight; uncommon plant of base-rich soils.....*Entosthodon muhlenbergii*<sup>3</sup>
8. a. Lid of capsule apiculate to rostellate; calyptra symmetrical, erect.....*Physcomitrium pyriforme*<sup>4</sup>  
b. Lid of capsule plano-convex; calyptra asymmetrical, directed to one side.....9.
9. a. Rhizoids deep red; capsules narrowly pyriform with neck ½-¾ length of capsule body.....*Entosthodon attenuatus*

<sup>1</sup> The rarer *Tetraplodon angustatus* has dentate leaf margins and a seta up to 5 mm long (± entire and (7-)10-30 mm in *T. mnioides*).

<sup>2</sup> The rarer *Splachnum vasculosum* has broadly ovate, ± entire, obtuse leaves, with the apophysis much wider than the main body of the capsule.

<sup>3</sup> *Entosthodon pulchellus*, a rare southern plant of base-rich soils, has a ± entire leaf margin, a shorter apical leaf cell, and finely papillose spores (coarsely papillose in *E. muhlenbergii*).

<sup>4</sup> There are a number of much rarer species of *Physcomitrium* that grow primarily on the exposed mud at the edge of ponds and reservoirs (*P. pyriforme* is a relatively common plant of muddy places); all have a ± spherical capsule on a short (1-5 mm) seta (v. ± pyriform on a seta 5-15 mm long in *P. pyriforme*).

b. Rhizoids brownish; capsules ovoid, obovoid or shortly pyriforme with neck  $\frac{1}{4}$ - $\frac{1}{3}$  length of capsule body.....10.

10. a. Leaves entire to bluntly denticulate, distinctly bordered with 1-2 rows of narrow incrassate cells; spores 30-38  $\mu\text{m}$ ; plant primarily of wet peaty or gravelly soils in the north and west.....*Entosthodon obtusus*
- b. Leaves dentate above, with marginal cells narrower but not forming distinct border; spores 24-28  $\mu\text{m}$ ; plant primarily of agricultural soils in the southern lowlands.....*Entosthodon fascicularis*

## Section 9 – *Bryum*, *Pohlia*, etc

1. a. Bulbils present and obvious in at least some leaf axils; shoots never julaceous.....2.  
b. Bulbils absent (although red sphaerical gemmae sometimes present in leaf axils); shoots sometimes (but usually not) julaceous<sup>1</sup>.....8.
2. a. Leaves broadly ovate to lanceolate, entire to obscurely denticulate above, with mid-leaf cells short and wide (ca. 2-5 x longer than wide) and costa often reaching apex or excurrent.....3.  
b. Leaves ovate-lanceolate, usually bluntly denticulate above, with mid-leaf cells relatively long and narrow (ca. 3-7x longer than wide) and costa always ending below apex.....4.
3. a. Bulbils orange or reddish, up to 20-30 per leaf axil.....*Bryum gemmiferum*  
b. Bulbils green, 5 or fewer per leaf axil.....*Bryum dichotomum*<sup>2</sup>
4. a. Bulbils 1 per leaf axil, reddish-brown when mature.....*Pohlia drummondii*<sup>3</sup>  
b. Bulbils > 1 per leaf axil, green to orange-brown.....5.
5. a. Bulbils 2-6 per axil, yellow-green, obovoid, with leaf primordia incurved to enclose a small hollow which is usually occupied by an air bubble under the microscope.....*Pohlia bulbifera*  
b. Bulbils various shapes, sizes and colours, leaf primordia  $\pm$  erect, or, if incurved or absent, up to 35 bulbils per leaf axil .....6.
6. a. Bulbils greenish, ovoid-oblong with large leaf primordia (ca. 1/5-1/3 length of bulbil) and 160-300 x 80-150  $\mu$ m, or filamentous with leaf primordia > 1/10 total length.....*Pohlia annotina*<sup>4</sup>  
b. Bulbils green to orange,  $\pm$  globose to ovoid with leaf primordia very short or absent and 60-180 x 35-120  $\mu$ m, or filamentous with leaf primordia < 1/10 total length.....7.
7. a. Bulbils all  $\pm$  globose, brownish, with short filamentous stalks and 2-3 unicellular leaf primordia.....*Pohlia camptotrachela*  
b. Bulbils globose to filamentous, greenish to orange; if  $\pm$  globose, then without clear leaf primordia (just small protuberances) and usually sessile.....*Pohlia flexuosa*
8. a. Costa ceasing in or below leaf apex.....9.  
b. Costa excurrent as short cusp or longish arista.....24.

<sup>1</sup> Note that *Anomobryum concinatum* (see footnote 5, below) sometimes has clavate bulbils grading into short leafy branches, but this species has  $\pm$  julaceous shoots.

<sup>2</sup> *B. gemmilucens* has yellowish bulbils with indistinct leaf primordia (clear in *B. dichotomum*). *B. gemmiparum*, a rare plant of riverside rocks, has few, large green or reddish bulbils and a very strong costa 75-100  $\mu$ m wide at base (< 70  $\mu$ m in *B. dichotomum*).

<sup>3</sup> The rarer *P. filum* has yellowish bulbils 350-500  $\mu$ m long (500-1000  $\mu$ m in *P. drummondii*).

<sup>4</sup> The rarer *P. prolifera* has only filamentous bulbils, with leaf primordia usually unicellular (mainly multicellular in *P. annotina*); *P. andalusica*, mainly a plant of heavy metal-rich soils, has reddish-brown bulbils with large overlapping leaf primordia 1/3-1/2 the length of the bulbil.

9. a. Upper leaves large, 8-12 mm long, 3-4 mm wide, forming striking rosette.....*Rhodobryum roseum*  
b. All leaves much smaller, not forming wide rosettes.....10.
10. a. Shoots ±julaceous with obviously concave leaves closely appressed to stem.....11.  
b. Shoots not julaceous, leaves less concave, ±spreading from stem.....13.
11. a. Shoots± yellowish-green, shiny.....*Bryum (Anomobryum) julaceum*<sup>5</sup>  
b. Shoots± silvery-white.....12.
12. a. Pink tinge in lower parts; capsules ± horizontal, elongate-pyriform; base-rich rock crevices in uplands.....*Bryum (Plagiobryum) zieri*  
b. Pink tinge lacking; capsules pendulous, shortly ovoid-pyriform; abundant in ruderal habitats (roadsides, walls, etc).....*Bryum argenteum*
13. a. Leaf cells up to 20 µm wide or wider<sup>6</sup>.....14.  
b. Leaf cells not above 15 µm wide.....19.
14. a. Plants large, leaves 2-3 mm long; cells ± uniformly isodiametric throughout leaf; leaf margin with conspicuous teeth, each made by a whole enlarged cell.....*Mnium stellare*  
b. Plants smaller, leaves usually <2 mm long; cells hexagonal-rhomboidal, longer than wide; leaf margin at most slightly denticulate.....15.
15. a. Leaves strongly and broadly decurrent; flushes.....16.  
b. Leaves not or scarcely and narrowly decurrent; habitat various.....17.
16. a. Plants bright green; costa ending well below leaf apex.....*Pohlia ludwigii*  
b. Plants pink or greenish-pink; costa ending just below leaf apex.....*Bryum weigelii*
17. a. Leaves ovate, obtuse; rare plant of maritime dune slacks.....*Bryum marratii*<sup>7</sup>  
b. Leaves ovate to narrowly lanceolate, acute; habitat various; common.....18.
18. a. Plants relatively tall (> 5 cm), usually in loose tufts; leaves pale glaucous green.....*Pohlia wahlenbergii*

<sup>5</sup>*Bryum (Anomobryum) concinatum* has less concave leaves with the costa nearly reaching the apex (extending up to ¾ leaf length in *B. julaceum*), wider leaf cells (9-12 µm, v. 7.5-10 µm in *B. julaceum*), and grows on dry base-rich rocks, notably basalt (*B. julaceum* is mainly a plant of wet rocks in and by streams).

<sup>6</sup>*Bryum muehlenbeckii*, a rather rare plant of upland rocks near water, may also key out here. It has broad leaves and sphaerical rhizoidal gemmae are sometimes present.

<sup>7</sup> Some other rare mosses may key out here. The '*Bryum neodamense*' form of *B. pseudotriquetrum* has clearly bordered leaves (only very obscurely bordered in *B. marratii*), and is not a distinctively coastal plant. *B. calophyllum*, another rare coastal plant, also has a clear border, but a longer costa ending in or below the pointed but ± obtuse leaf apex. Two rare wetland plants have ovate to orbicular leaves: *B. cyclophyllum* has distant leaves up to ca. 2 mm long; *Pseudobryum cinclidioides* is much larger, with leaves up to 5 mm long, and has the appearance of a *Rhizomnium*, but lacks a border.

- b. Plants relatively short (< 5 cm), usually in scattered patches; leaves shiny green, not glaucous.....*Pohlia melanodon*
19. a. Plants partly or completely deep glossy red, robust (up to ca. 6 cm high).....*Bryum alpinum*  
b. Plants green, usually small to medium-sized.....20.
20. a. Leaves pale green with an iridescent metallic lustre; leaf cells long (80-200 µm).....*P. cruda*  
b. Leaves green, without metallic lustre; cells up to 120 µm long.....21.
21. a. Plants small, <1 cm high, rhizoidal gemmae present; primary colonists of ruderal habitats.....22.  
b. Plants larger, >1 cm high, rhizoidal gemmae absent; not normally primary colonists, habitat various.....23.
22. a. Perichaetial leaves linear-lanceolate with mid-leaf cells up to 180 µm long; rhizoidal gemmae yellowish, ellipsoid, with knobby outline.....*Pohlia lutescens*  
b. Perichaetial leaves narrowly lanceolate with mid-leaf cells up to 80 µm long; rhizoidal gemmae pale brown, sphaerical to pyriform, not knobby.....*Pohlia lescuriana*
23. a. Pale green plants; capsule inclined, narrowly pyriform to fusiform, with well-defined neck ¼-½ total length of capsule.....*Pohlia elongata*  
b. Dark green plants; capsule shorter and wider, with poorly defined shorter neck.....*Pohlia nutans*
24. a. Shoots silvery-white, julaceous; very common.....*Bryum argenteum*  
b. Shoots not silvery-white, rarely julaceous.....25.
25. a. Leaves ± spirally twisted around stems when dry ('corkscrew twist'), broadest near or above middle, with long flexuose greenish to whitish hair-point.....26.  
b. Leaves without a 'corkscrew twist', often broadest below middle, without a long flexuose hair-point.....27.
26. a. Filamentous axillary gemmae present in leaf axils; usually epiphytic in lowlands.....*Bryum moravicum*  
b. Filamentous gemmae absent; very common in various habitats.....*Bryum capillare*<sup>8</sup>
27. a. Plants partly or completely deep glossy red, robust (up to ca. 6 cm high); leaf cells long and thin, ca. 8-15 µm wide.....*Bryum alpinum*  
b. Plants not deep glossy red (but sometimes wholly or partly salmon pink or reddish), usually smaller; leaf cells much shorter and wider.....28.

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<sup>8</sup> The similar *B. torquescens*, a plant of base-rich soil, has only weakly twisted leaves and is usually synoicous (*B. capillare* is dioicous). *B. elegans*, also on base-rich substrates, has ± julaceous leaves, again only weakly twisted, and very tall conical papillae on the larger rhizoids.

28. a. Plants with rhizoidal gemmae ('tubers'); usually primary colonists of ruderal habitats.....29.  
 b. Rhizoidal gemmae lacking; habitats various.....38.
29. a. Rhizoidal gemmae 2-dimensional, flat, irregularly and angularly lobed.....*Bryum riparium*  
 b. Rhizoidal gemmae 3-dimensional,  $\pm$  sphaerical, not lobed but cells often protuberant....30.
30. a. Rhizoidal gemmae mostly < 100  $\mu$ m in diameter.....31.  
 b. Rhizoidal gemmae mostly > 120  $\mu$ m in diameter.....33.
31. a. Gemmae pyriform, brown to reddish-brown, ca. twice as long as wide (3-5 cells long, 2 cells wide).....*Bryum sauteri*  
 b. Gemmae  $\pm$ sphaerical, reddish, at least 3 cells wide.....32.
32. a. Rhizoids mauve to violet; cells of gemmae not protuberant.....*Bryum violaceum*  
 b. Rhizoids pale brown; cells of gemmae protuberant.....*Bryum klinggraeffii*
33. a. Rhizoids deep violet.....*Bryum ruderale*  
 b. Rhizoids paler, yellowish to brown.....34.
34. a. Leaves not, or hardly, bordered; mid-leaf cells 10-16  $\mu$ m, wide.....35.  
 b. Leaves clearly bordered; mid-leaf cells 14-20  $\mu$ m, wide.....37.
35. a. Costa strong, longly excurrent; rhizoids very coarsely papillose, brownish, with gemmae the same colour; usually on old wall mortar, rocks or very hard calcareous soil.....*Bryum radiculosum*  
 b. Costa weaker, shortly excurrent, rhizoids less coarsely papillose, brownish, contrasting with the yellowish or red gemmae; usually on soil.....36.
36. a. Gemmae yellowish, rarely > 180  $\mu$ m in diameter.....*Bryum tenuisetum*  
 b. Gemmae red, often > 200  $\mu$ m in diameter.....*Bryum subapiculatum*
37. a. Gemmae never present in leaf axils, translucent, cells not protuberant.....*Bryum bornholmense*  
 b. Gemmae often present in leaf axils, opaque, cells protuberant.....*Bryum rubens*
38. a. Plants robust (up to 12 cm high), usually pinkish throughout; leaf bases longly and broadly decurrent; scarce plant of upland flushes.....*Bryum weigeli*  
 b. Plants robust or not, leaves not conspicuously decurrent, or, if moderately decurrent, then plants not pinkish throughout (usually pinkish towards leaf base and stems only – see *B. pseudotriquetrum*, below); habitat various.....39.
39. a. Leaves unbordered or very obscurely bordered; margins plane or weakly recurved below.....40.

- b. Leaves clearly bordered, or, if more obscurely bordered, margins always recurved, often strongly so.....43.
40. a. Plants large; leaves often > 2 mm long, distinctly toothed above, the upper leaves strongly crowded in a comal tuft (and sometimes forming successive annual comal tufts).....*Bryum canariense*  
 b. Plants smaller; leaves usually < 2 mm long, entire to obscurely denticulate, the upper leaves not strongly crowded in a comal tuft.....41.
41. a. Plants in dense tufts; leaves strongly imbricate, giving shoots a julaceous appearance; costa excurrent in an awn 100-500 µm long, recurved when dry.....*Bryum kunzei*  
 b. Plants in loose to moderately dense tufts; leaves not or slightly imbricate, but shoots hardly julaceous; costa percurrent to shortly excurrent.....42.
42. a. Leaves ca. 600 µm long, ovate and acute to acuminate, margins plane; apparently endemic to Scotland.....*Bryum dixonii*  
 b. Leaves > 1 mm long, ovate-lanceolate and acuminate, margins recurved below; scarce but widespread.....*Bryum mildeanum*
43. a. Robust plants with decurrent leaves ca. 3 mm long, not forming comal tuft, but equal all along the stem; plants usually tinged pink; common plant of wet places.....*Bryum pseudotriquetrum*  
 b. Slender plants with non-decurrent leaves up to ca. 2 mm long, usually forming a comal tuft; plants green, entirely pink or reddish at base of leaves; habitat various.....44.
44. a. Basal cells of leaves of similar colour to cells above; whole leaf sometimes pink or red...45.  
 b. Basal cells of leaves reddish, differing in colour from cells above.....46.
45. a. Plants usually entirely pink; exostome teeth without obvious vertical or oblique lines joining transverse articulations; common.....*Bryum pallens*<sup>9</sup>  
 b. Plants green; exostome teeth with obvious vertical or oblique lines joining transverse articulations; rare plant of coastal dune slacks.....*Bryum warneum*
46. a. Leaf border very strong, 2-3-stratose, confluent with excurrent costa; leaves widest in middle.....*Bryum donianum*  
 b. Leaf border indistinct or much weaker, unistratose, not confluent with excurrent costa; leaves widest below middle.....47.
47. a. Leaf border indistinct, but margin strongly recurved ± from base to apex.....48.  
 b. Leaf border distinct, margin less strongly and extensively recurved.....49.
48. a. Dioicous; spores ca. 10-14 µm; costa longly excurrent (usually > 200 µm).....  
 .....*Bryum caespitium*

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<sup>9</sup> The rare arctic-alpine *B. arcticum* will also key out here: it is deep red and synoicous (*B. pallens* is dioicous).



- b.Synoicous; spores *ca.* 18-24  $\mu\text{m}$ ; costa shortly to longly excurrent (sometimes > 200  $\mu\text{m}$ ).....*Bryum intermedium*
49. a. Exostome teeth with obvious vertical or oblique lines joining transverse articulations; usually on coastal dunes.....*Bryum algovicum* (var. *rutheanum*)  
b. Exostome teeth without obvious vertical or oblique lines joining transverse articulations; habitats various.....50.
50. a. Endostome cilia rudimentary or absent; spores mainly > 24  $\mu\text{m}$  in diameter..... *Bryum archangelicum/inclinatum/imbricatum*<sup>10</sup>  
b. Endostome cilia appendiculate; spores 18-22  $\mu\text{m}$  in diameter .....*Bryum pallescens*<sup>11</sup>

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<sup>10</sup> The very rare coastal dune slack species *B. knowltonii* and *B. salinum* will also key out here.

<sup>11</sup> The rare but overlooked *B. creberrimum* has smaller spores 14-16  $\mu\text{m}$  in diameter and endostome perforations about as long as wide (up to twice as long as wide in *B. pallescens*).

## Section 10 – *Orthotrichum*, *Ulota*, *Zygodon*, etc

Leaves relatively broad, rarely bi- or multi-stratose at margins, rarely (*Orthotrichum diaphanum*) with hyaline hairpoints ; leaf cells  $\pm$  isodiametric, *not sinuose*; seta usually short, calyptra often large,  $\pm$  hairy and relatively persistent. Mainly medium-sized cushion- or tuft-forming plants, usually epiphytic but also frequently on rocks, rarely on soil. Occasionally with hair-points but usually without.

1. a. Leaves with hyaline hairpoints.....*Orthotrichum diaphanum*  
b. Leaves lacking hyaline hairpoints.....2.
2. a. Gemmae, if present, borne in clusters on specialised long stalks (pseudopodia or 'drumsticks') at shoot apices; sometimes growing on wet boggy ground .....3.  
b. Gemmae, if present, borne on leaf surfaces or in leaf axils; never growing on wet boggy ground.....4.
3. a. Large plant with orange-brown tomentum; leaves entire to finely denticulate above; basal cells enlarged, brownish; gemmae pseudopodia uncommon; growing on  $\pm$  acid wet ground, often with *Sphagnum*.....*Aulacomnium palustre*  
b. Small plant with less conspicuous tomentum; leaves irregularly denticulate above; basal cells rectangular, greenish; gemmae pseudopodia almost always present; growing on trees, rocks, etc..... *Aulacomnium androgynum*
4. a. Leaves remotely and coarsely toothed above.....*Ptychomitrium polyphyllum*  
b. Leaves entire, crenulate or slightly denticulate above.....5.
5. a. Leaves narrowly lanceolate to linear (as in Section 5), only *ca.* 0.2-0.3 mm wide at widest point .....6.  
b. Leaves usually shorter and wider,  $\pm$  ovate (or wider) to lanceolate; if narrowly lanceolate, then at least 0.3 mm wide at widest point.....9.
6. a. Leaf cells completely smooth; gemmae often present among leaves.....7.  
b. Leaf cells faintly to strongly papillose; gemmae absent.....8.
7. a. Bright green to yellowish-green plants; capsules narrowly ellipsoid on seta > 5 mm long; smooth cylindrical gemmae often present; common on trees and lowland rocks and walls.....*Dicranoweisia cirrata*  
b. Dark green; capsules ovoid on seta 2-3 mm long; strongly papillose cylindrical gemmae often present; almost restricted to rocks in hyperoceanic parts of Britain and Ireland.....*Glyphomitrium daviesii*
8. a. Basal cells of leaves thin-walled; upper cells strongly papillose with round papillae; capsules common, only just emergent above leaves.....*Amphidium lapponicum*  
b. Basal cells of leaves thick-walled; upper cells faintly striate with oval papillae; capsules rare.....*Amphidium mougeotii*

9. a. Plants with gemmae; capsules rare, or usually produced on a long seta (up to *ca.* 10x longer than capsule).....10.  
b. Plants without gemmae; capsules common, produced on a short seta (<5x longer than capsule).....16.
10. a. Plants small; leaves usually sharply pointed, with a slight and subtle 'gyre twist', giving shoots a characteristic star-like appearance from above; numerous multicellular  $\pm$  club-shaped gemmae produced in leaf axils (not normally visible in the field but conspicuous under the microscope).....11. (*Zygodon*)  
b. Plants usually larger; leaves acute to obtuse, not star-like or with a 'gyre twist'; gemmae absent or produced on leaf surfaces or tips, clearly visible in the field.....14.
11. a. Gemmae 7-8 cells long, without longitudinal cell walls; seta with a characteristic 'kink' .....*Zygodon conoideus*  
b. Gemmae 4-6 cells long, often with longitudinal cell walls; seta  $\pm$  straight (but often sterile).....12.
12. a. Gemmae without longitudinal cells walls.....*Zygodon rupestris*  
b. Gemmae with longitudinal cell walls.....13.
13. a. Costa excurrent.....*Zygodon stirtonii*  
b. Costa ending below apex..... *Zygodon viridissimus*
14. a. Leaves broadly spatulate.....*Syntrichia latifolia*  
b. Leaves narrowly lanceolate.....15.
15. a. Leaves crisped when dry; gemmae in conspicuous brown clusters ('blobs') at shoot tips; epiphytic or saxicolous, very common in oceanic areas.....*Plenogemma (Ulota) phyllantha*  
b. Leaves flexuose when dry; gemmae scattered on leaf surface, conspicuous but not forming clusters; usually epiphytic, not oceanic.....*Pulvigera (Orthotrichum) lyellii*<sup>1</sup>
16. a. Leaves curved to crisped when dry, sometimes narrowly lanceolate to linear (as in Section 5); if leaves straight to flexuose, then capsules exerted on seta > 2mm long and peristome teeth brown or occasionally whitish.....17. (*Ulota*)<sup>2</sup>  
b. Leaves straight to flexuose when moist,  $\pm$  imbricate when dry, shorter and wider,  $\pm$  ovate to lanceolate; if leaves more curved when dry, then capsules on seta < 2mm long and peristome teeth orange-red or yellow.....24. (*Orthotrichum* s.l.)

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<sup>1</sup> *Lewinskya affinis* (*Orthotrichum affine*), a common epiphyte, also sometimes has gemmae on the leaves, but they are usually sparse, and sporophytes are usually present, whereas they are rare in *P. lyellii*. Two rare plants with much wider,  $\pm$  ovate, obtuse leaves and gemmae on the leaf surfaces will also key out here: *Nyholmiella obtusifolia* (*Orthotrichum obtusifolium*) has plane or slightly incurved margins, and leaf cells with a single large papilla; *N. gymnostoma* (*Orthotrichum gymnostomum*) has strongly incurved leaf margins and leaf cells with 2-3 papillae.

<sup>2</sup> This part of the key is based largely on Blockeel (2017); refer to that for more detail.

17. a. Leaves stiff, imbricate,  $\pm$  straight when dry; saxicolous.....*Ulota hutchinsiae*  
 b. Leaves curved or crisped when dry; usually epiphytic.....18.
18. a. Capsules inflated, pear-shaped, smooth except immediately below the very narrow mouth.....*Ulota coarctata*  
 b. Capsules not inflated or pear-shaped,  $\pm$  strongly furrowed; capsule mouth narrow to wide.....19.
19. a. Leaves with intra-marginal band of elongate cells above base; seta long, 4-6 mm.....*Ulota calvescens*  
 b. No intra-marginal band of cells above leaf base; seta shorter, 2-5 mm.....20.
20. a. Capsule not contracted below mouth, but tapering to narrow, usually star-shaped mouth; outer peristome teeth reflexed, erect or irregularly spreading.....21.  
 b. Capsule contracted below the wide, rounded mouth, or cylindrical; outer peristome teeth reflexed.....22.
21. a. Plants forming spreading patches; outer peristome teeth whitish, with a coarse, open network of lines and papillae, at least in upper half.....*Ulota drummondii*  
 b. Plants forming tufts or cushions; outer peristome teeth brownish, densely and finely papillose.....*Ulota bruchii*
22. a. Capsule strongly contracted below mouth, with ribs 4-5(-6) cells wide, which reach up to mouth..... *Ulota crispa*  
 b. Capsule weakly contracted below mouth, with ribs 2-4 cells wide; ribs ceasing below capsule mouth ((1-)2-3 small cells between ribs and mouth).....23.
23. a. Leaf base weakly concave, gradually narrowed at the shoulder; mainly southern distribution.....*Ulota crispula*  
 b. Leaf base strongly concave, abruptly narrowed at the shoulder; mainly northern distribution.....*Ulota intermedia*
24. a. Leaf margins 2-5 stratose..... 25.  
 b. Leaf margins unistratose (but often recurved).....27.
25. a. Large, trailing, well-branched plants up to 12 cm long; leaf cells faintly papillose; capsule immersed.....*Cinclidotus fontinaloides*<sup>3</sup>  
 b. Smaller, sparsely branched plants up to 5 cm high; leaf cells strongly papillose; capsule exserted on seta 8 mm or more long.....26.
26. a. Leaves not very fragile, fragmenting slightly and irregularly, not in straight lines.....*Dialytrichia mucronata*

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<sup>3</sup>*Cinclidotus riparius*, restricted to the banks of the R. Teme, has capsules slightly exserted on a seta 3-6 mm long.

- b. Leaves very fragile, fragmenting extensively along  $\pm$  straight lines.....*Dialytrichia saxicola*
27. a. Leaf apices broad, usually rounded..... 28.  
b. Leaf apices tapering to acute to obtuse apices.....29.
28. a. Plants 1-3 cm high; mid-leaf cells 10-14  $\mu\text{m}$  wide.....*Orthotrichum rivulare*  
b. Plants 0.5-1 cm high; mid-leaf cells (14-)16-24  $\mu\text{m}$  wide.....*Orthotrichum sprucei*
29. a. Stomata on capsule superficial..... 30.  
b. Stomata on capsule immersed.....33.
30. a. Capsules smooth; outer peristome teeth 16,  
unpaired.....*Lewinskya striata* (*Orthotrichum striatum*)<sup>4</sup>  
b. Capsules  $\pm$  furrowed; outer peristome teeth in 8 pairs.....31.
31. a. Calyptra densely hairy; spores 14-20  $\mu\text{m}$ ; usually  
saxicolous.....*Lewinskya rupestris* (*Orthotrichum rupestre*)  
b. Calyptra glabrous or  $\pm$  hairy; spores 18-26  $\mu\text{m}$ ; usually epiphytic.....32.
32. a. Capsules smooth below, striate above; calyptra hairy; seta *ca.* 2 mm long; spores 24-26  
 $\mu\text{m}$ .....*Lewinskya speciosa* (*Orthotrichum speciosum*)  
b. Capsules striate from base; calyptra glabrous or sparsely hairy; seta 0.4-1.2 mm long;  
spores 18-24  $\mu\text{m}$ .....*Lewinskya affinis* (*Orthotrichum affine*)
33. a. Capsules exserted (seta longer than perichaetial leaves).....34.  
b. Capsule immersed (seta concealed by perichaetial leaves).....37.
34. a. Leaves somewhat contorted when dry; outer peristome teeth recurved when dry;  
epiphytic.....35.  
b. Leaves  $\pm$  erect and straight when dry; outer peristome teeth erect or patent when dry;  
usually saxicolous.....36.
35. a. Peristome orange-red; stomata in middle and upper half of  
capsule.....*Orthotrichum pulchellum*  
b. Peristome pale yellow; stomata in middle and lower half of  
capsule.....*Orthotrichum colombicum*
36. a. Capsules reddish-orange; seta (1.5-)2-4 mm long,.....*Orthotrichum anomalum*  
b. Capsules pale brown; seta 1-1.6 mm long.....*Orthotrichum cupulatum*
37. a. Outer peristome teeth erect or patent when dry; capsule 16-ribbed; usually  
saxicolous.....*Orthotrichum cupulatum*

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<sup>4</sup> *Lewinskya acuminata* (*Orthotrichum acuminatum*), a rare vagrant, differs in the lack of a well-developed outer peristome. *L. (O.) shawii*, which has not been seen in Britain recently, differs in having whitish (not brownish) outer peristome teeth, inner peristome  $\pm$  absent, and spores 14-17  $\mu\text{m}$  (30  $\mu\text{m}$  in *L. striata*).

- b. Outer peristome teeth recurved when dry; capsules  $\pm$  strongly 8-ribbed; usually epiphytic.....38.
38. a. Calyptra conspicuously *dark*-tipped; vaginula with numerous long hairs..... *Orthotrichum stramineum*<sup>5</sup>  
 b. Calyptra not dark-tipped (but may be tipped paler orange or brown), vaginula glabrous or with a few short hairs.....39.<sup>6</sup>
39. a. Capsules orange-brown, narrowly ellipsoid to subcylindrical, stomata restricted to neck.....*Orthotrichum tenellum*  
 b. Capsule pale, ellipsoid, stomata scattered at least in lower half.....40.
40. a. Calyptra plicate, capsule gradually tapering into seta; stomata not obscured by overlying exothecial cells..... *Orthotrichum pallens*<sup>7</sup>  
 b. Calyptra smooth, capsules abruptly narrowed into seta; stomata  $\pm$  obscured by overlying exothecial cells.....*Orthotrichum pumilum*

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<sup>5</sup> The rare (but potentially spreading) *Orthotrichum alpestre* and *O. patens* will also key out here; *O. alpestre* has the outer peristome teeth densely papillose below, striate-papillose above (not uniformly papillose), and thick, papillose hairs on the calyptra (not thin and hardly papillose); *O. patens* has capsules with ribs only 2-3 cells wide (4 cells wide in *O. stramineum* and most other species).

<sup>6</sup> Several other rare species (which may also, however, become frequent) are similar to the species listed here. *O. rogeri* is like *O. tenellum* but with straight (not incurved) inner peristome teeth; *O. scanicum* has capsules with ribs only 2-3 cells wide (4 cells wide in most species), a dome-shaped lid and a very pale calyptra; See Bosanquet (2012) and Blockeel (2012) both in *Field Bryology* 107) for more information. *O. cambrense* (known so far only from the type locality in South Wales) is believed to be close to *O. tenellum*, but has distinctive rounded to obtuse leaf apices.

<sup>7</sup> *O. schimperi* is very close to *O. pallens*, but with differently shaped leaves and the capsule abruptly contracted into the seta (gradually in *O. pallens*).

## Section 11 – Pottiales and ‘Pottiales-like’ mosses

Leaves ovate-lanceolate to narrowly lanceolate, sometimes bi- or multi-stratose at margins, sometimes with hyaline hairpoints; *mid-leaf cells isodiametric to very shortly elongate*, often papillose, sometimes strongly (so leaves usually matt), not sinuose. Mainly small plants forming tufts or mats, sometimes cushions, on soil or rock, occasionally epiphytic. Sometimes with hair-points. Plants with  $\pm$  isodiametric, strongly papillose leaf cells key out here, even if the leaves are very long and narrow.

1. a. Leaves mostly lingulate or spatulate, rarely oblong-lanceolate; upper leaf cells with large ‘hobnail boot’ papillae; basal cells hyaline, with thick transverse walls and thin longitudinal walls; calyptra large, ‘extinguisher-shaped’, completely enveloping capsule until maturity.....2.  
b. Leaves various, often narrowly lanceolate; upper leaf cells papillose or not, but papillae small and simple; basal cells differentiated or not, but usually with uniform wall thickening; calyptra smaller, not enveloping whole capsule.....6.
2. a. Plants large, with leaves up to 5 mm long; costa ending in or below apex, papillose on dorsal side above; filiform axillary propagules often present; sporophytes usually absent; common.....*Encalypta streptocarpa*  
b. Plants smaller, with leaves up to 3.5 mm long; costa usually percurrent to longly excurrent, or if ending below apex then  $\pm$  smooth on dorsal side; filiform propagules lacking; sporophytes usually present; less common.....3.
3. a. Leaves **oblong-lanceolate to ovate-lanceolate**, tapering from middle to apex; costa often excurrent in hyaline hairpoint; mid-leaf cells 8-10  $\mu\text{m}$  wide.....*Encalypta alpina*  
b. Leaves lingulate or spatulate; costa excurrent in hairpoint or not; mid-leaf cells 10-20  $\mu\text{m}$  wide.....4.
4. a. Costa excurrent, often in a long hyaline point, dorsally papillose above; capsules longitudinally ribbed when moist.....*Encalypta rhaptocarpa*<sup>1</sup>  
b. Costa ending below apex to excurrent, but rarely forming a long hyaline point, dorsally  $\pm$  smooth above; capsules smooth when moist.....5.
5. a. Calyptra ciliate at base, smooth towards apex.....*Encalypta ciliata*  
b. Calyptra entire (or eroded) at base, papillose towards apex.....*Encalypta vulgaris*
6. a. Small plants on soil, shoots <1 cm tall (usually much less), with spherical or nearly spherical cleistocarpous capsules which are immersed or barely exerted on very short setae up to 1.5 mm (capsules usually present)....7.  
b. Usually larger plants (1-10 cm tall) on various substrates; capsules exerted on a longer seta; if plants smaller, then capsules not cleistocarpous<sup>2</sup>(capsules present or not).....14.

<sup>1</sup> The rare *Encalypta pilifera* may also key out here; its capsule is less strongly ribbed and lacks a peristome.

<sup>2</sup>*Tortula protobryoides* is cleistocarpous but has an elongate capsule on a longer seta, so keys out here. Very minute plants with long thin leaves growing directly on rock may be species of *Seligeria* and its allies, which are included in Section 6.

7. a. Leaf margin toothed, at least near apex.....8.  
b. Leaf margin entire.....11.
8. a. Leaves with a costa.....9.  
b. Leaves without a costa.....10.
9. a. Leaves narrowly lanceolate; capsules obliquely pointed at apex.....*Ephemerum recurvifolium*<sup>3</sup>  
b. Leaves ovate; capsules with tiny symmetrical apiculus at apex.....*Acaulon muticum*<sup>4</sup>
10. a. Marginal teeth of leaves straight; spores coarsely papillose, without hyaline membrane.....*Ephemerum stoloniferum* ('*E. serratum*')  
b. Marginal teeth of leaves often recurved; spores finely papillose, usually surrounded by hyaline membrane..... *Ephemerum serratum* (*E. minutissimum*)
11. a. Capsules immersed.....12.  
b. Capsules exserted on evident seta (up to 1.5 mm long).....13.
12. a. Plants relatively large (1-5 mm high), green; perichaetial leaves enlarged....*Tortula acaulon*  
b. Plants very small (<1.2 mm high), brownish-reddish; perichaetial leaves not noticeably enlarged.....*Microbryum floerkeanum*
13. a. Seta straight, capsule subspherical.....*Microbryum rectum*  
b. Seta curved downward, capsule ovoid.....*Microbryum curvicolium*
14. a. Leaves with silvery-white hair-points, contrasting with green leaves.....15.  
b. Leaves with contrasting hair-points lacking.....23.
15. a. Spherical or ovoid gemmae present on adaxial surface of costa; leaf margin incurved above.....*Syntrichia papillosa*  
b. Spherical or ovoid gemmae lacking; leaf margin plane to recurved.....16.
16. a. Plants small, shoots usually < 1 cm high; hair-point **completely** smooth.....17.  
b. Plants large, shoots usually **> 1 cm high**; hair-point at least obscurely toothed, often spinose .....19.
17. a. 2-4 chlorophyllous lamellae on adaxial side of costa; leaf margins  $\pm$  plane; rare southern plant of calcareous soil and rock.....*Pterygoneurum ovatum*  
b. Lamellae absent; leaf margins recurved; common in various habitats.....18.

<sup>3</sup> Some very rare species of *Ephemerum* may also key out here.

<sup>4</sup> The very rare *Acaulon triquetrum* has triangular shoots and a curved seta.



18. a. Leaf margins recurved almost from base to apex; capsule longly cylindrical on a seta 1-2 cm long; very common plant on walls etc.....*Tortula muralis*<sup>5</sup>  
b. Leaf margins usually recurved to *ca.* ¾ way up leaf; capsule ovate-oblong on a seta *ca.* 2-4 mm long; scarce southern plant of coastal soils.....*Tortula viridifolia*<sup>6</sup>
19. a. Leaves not 'waisted'; margins recurved from base to apex.....20.  
b. Leaves 'waisted'; margins plane to recurved to ¾ way up leaf.....21.
20. a. Leaf apex acute, tapering gradually into hair-point.....*Syntrichia ruraliformis*  
b. Leaf apex obtuse or rounded, the hair-point abruptly excurrent .....*Syntrichia ruralis*
21. a. Hair-point sparsely toothed or nearly smooth; gemmae resembling minute leaves sometimes present.....*Syntrichia laevipila*  
b. Hair-point strongly toothed.....22.
22. a. Plants small (*ca.* 1-2 cm high); basal leaf cells 20-40 µm long; costa in TS with 1-2 rows of stereids abaxially.....*Syntrichia virescens*  
b. Plants larger (1-4 cm high); basal leaf cells 50-80 µm long; costa in TS with many rows of stereids.....*Syntrichia montana*<sup>7</sup>
23. a. Gemmae present and abundant at shoot tips, on leaf surfaces, or in leaf axils.....24.  
b. Gemmae absent or very rare.....35.
24. a. Gemmae clustered at shoot apices, often on specialised structures.....25.  
b. Gemmae on leaf surfaces or in leaf axils, not clustered at shoot apices.....27.
25. a. Gemmae on long terminal stalks like drumsticks.....*Aulacomnium androgynum*<sup>8</sup>  
b. Gemmae not on long stalks.....26.
26. a. Gemmae discoid, green, in a terminal cup formed from enlarged leaves forming a 'nest'; leaves orbicular to ovate, not crisped when dry; usually on dead wood, generally distributed.....*Tetraphis pellucida*  
b. Gemmae ± cylindrical, brown, clustered at shoot apices in a 'blob'; leaves narrowly lanceolate, crisped when dry; epiphytic or saxicolous, abundant in oceanic areas.....*Plenogemma (Ulota) phyllantha*
27. a. Gemmae sphaerical (looking like miniature Brussels sprouts!) .....28.  
b. Gemmae ± cylindrical or club-shaped.....29.

<sup>5</sup> Beware forms of this very common species without a hair-point! Also the rare southern species *Tortula canescens* will key out here, distinguished by its peristome teeth being united in a tube for ½-½ their length.

<sup>6</sup> Some other rare species of *Tortula* have an excurrent costa that might be interpreted as a hyaline hair-point.

<sup>7</sup> The rare *Syntrichia princeps* is synoicous and has leaf cells *ca.* 12-20 µm wide (dioicous and *ca.* 8-10µm wide in *T. montana*).

<sup>8</sup>*Aulacomnium palustre*, which occasionally produces similar gemmae stalks, may also key out here; it is a larger plant with almost entire leaves (irregularly toothed in *A. androgynum*), growing in wet places (*A. androgynum* grows mainly on wood or rocks).

28. a. Leaf tapering to stout subulate apex, blunt at extreme tip; gemmae abundant in leaf axils.....*Didymodon rigidulus*  
 b. Leaf broadly ovate-spathulate, rounded at apex; gemmae on adaxial leaf surfaces.....*Syntrichia latifolia*
29. a. Plants large (up to 5 cm high), forming straggling tufts; gemmae scattered on leaf surface, conspicuous in the field.....*Pulviger (Ulota) lyellii*<sup>9</sup>  
 b. Plants small (1-2 cm high), forming neat cushions or patches; gemmae in leaf axils or on rhizoids, not usually visible in the field.....30.
30. a. Leaves linear-lanceolate, leaf cells smooth; sporophytes abundant.....31.  
 b. Leaves lanceolate, leaf cells papillose; sporophytes uncommon.....32.
31. a. Bright green to yellowish-green plants; capsules narrowly ellipsoid on seta >5 mm long; gemmae cylindrical, smooth; common on trees and lowland rocks and walls.....*Dicranoweisia cirrata*  
 b. Dark green; capsules ovoid on seta 2-3 mm long; gemmae strongly papillose; almost restricted to rocks in hyperoceanic parts of Britain and Ireland.....*Glyphomitrium daviesii*
32. a. Gemmae 7-8 cells long, without longitudinal cell walls; mid-leaf leaf cells 10-12 µm wide; seta with a characteristic 'kink' .....*Zygodon conoideus*  
 b. Gemmae 4-6 cells long, often with longitudinal cell walls; mid-leaf leaf cells 7-9 µm wide; seta ± straight (but often sterile).....29.
33. a. Gemmae without longitudinal cells walls.....*Zygodon rupestris*  
 b. Gemmae with longitudinal cell walls.....30.
34. a. Costa excurrent.....*Zygodon stirtonii*  
 b. Costa ending below apex.....*Zygodon viridissimus*
35. a. Leaves ovate, obovate or lingulate, ± narrowed at base, widest near or above middle, contracted ± abruptly to broad, blunt or sometimes acute apex.....36.  
 b. Leaves ± narrowly triangular to linear-lanceolate, not narrowed at base, widest at or very near base, tapering gradually to acute or sometimes obtuse apex.....71.
36. a. Leaves strongly toothed, at least above.....37.  
 b. Leaves entire or papillose-crenulate.....45.
37. a. Leaf cells smooth or slightly mamilllose; upland rock crevices.....38.

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<sup>9</sup> *Lewinskya affinis* (*Orthotrichum affine*), a common epiphyte, also sometimes has gemmae on the leaves, but they are usually sparse, and sporophytes are usually present, whereas they are rare in *P. lyellii*. Two rare plants with much wider, ± ovate, obtuse leaves and gemmae on the leaf surfaces will also key out here: *Nyholmiella obtusifolia* (*Orthotrichum obtusifolium*) has plane or slightly incurved margins, and leaf cells with a single large papilla; *N. gymnostoma* (*O. gymnostomum*) has strongly incurved leaf margins and leaf cells with 2-3 papillae.

- b. Leaf cells distinctly mamilllose or papillose; damp or peaty soil, or gravel (if cells only faintly papillose, then plant halophytic and coastal).....40.
38. a. Plants large, 1-10 cm high; leaves ovate to ovate-lanceolate.....*Mnium stellare*  
b. Plants small, 0.5-3 cm high; leaves narrowly lingulate to ligulate.....39.
39. a. Leaves lingulate, strongly toothed, lamina 9-14 cells wide on either side of costa in middle of leaf; upper leaf cells 12-20 µm wide.....*Rhabdoweisia crenulata*  
b. Leaves narrowly lingulate, weakly toothed, lamina 6-12 cells wide on either side of costa in middle of leaf; upper leaf cells 8-12(-14) µm wide.....*Rhabdoweisia crispata*
40. a. Upper leaf cells 10-22 µm wide.....41.  
b. Upper leaf cells 8-10(-12) µm wide.....44.
41. a. Marginal leaf cells elongate, forming a border.....42.  
b. Marginal leaf cells undifferentiated or with a pale 'pseudo-border'<sup>10</sup>.....43.
42. a. Leaves obtuse, abruptly contracted to short apiculus 25-75 µm long, mid-leaf cells 12-18 x 15-25 µm.....*Hennediella stanfordensis*  
b. Leaves acute, more gradually contracted to apiculus 100-150 µm long, mid-leaf cells 15-20 x 25-35 µm.....*Hennediella macrophylla*
43. a. Upper leaf cells rounded-hexagonal, strongly papillose; peaty soils, often under bracken.....*Leptodontium flexifolium*<sup>11</sup>  
b. Upper leaf cells ± quadrate, faintly papillose; halophytic/coastal plant.....*Hennediella heimii*
44. a. Leaves < 4 x longer than wide, finely toothed; capsules inclined.....*Dichodontium pellucidum*<sup>12</sup>  
b. Leaves > 4 x longer than wide; irregularly and coarsely toothed; capsules erect.....*Dichodontium flavescens*
45. a. Leaves with distinct border, either of elongate thick-walled cells, or multistratose.....46.  
b. Leaves without border (but margins often recurved or incurved).....50.
46. a. Leaf margins with a border of elongate thick-walled cells; not aquatic.....47.  
b. Leaf margins strongly thickened with a border of multistratose cells; ± aquatic.....48.
47. a. Leaves 3.5-7 mm long; peristome united in a tube in lower 2/3.....*Tortula subulata*

<sup>10</sup> Marginal cells the same size and shape as other laminal cells, but smoother and therefore more pellucid.

<sup>11</sup> The rare oceanic species *Chionoloma recurvifolium* will key out here: it is a larger, laxer plant, typically growing by streams and waterfalls, with shoots up to 10 cm long; the leaves are bordered with a distinct pale zone of smooth cells contrasting with the darker papillose cells elsewhere.

<sup>12</sup> *Bryoerythrophyllum caledonicum*, a rare plant of the Scottish mountains, may key out here; the leaves have a distinct border of smooth cells, and some reddish pigmentation is usually present.

- b. Leaves < 2 mm long; peristome free to base.....*Tortula marginata*
48. a. Large, trailing, well-branched plants up to 12 cm long; leaf cells faintly papillose; capsule immersed.....*Cinclidotus fontinaloides*<sup>13</sup>  
b. Smaller, sparsely branched plants up to 5 cm high; leaf cells strongly papillose; capsule exerted on seta 8 mm or more long.....49.
49. a. Leaves not very fragile, fragmenting slightly and irregularly, not in straight lines..... *Dialytrichia mucronata*  
b. Leaves very fragile, fragmenting extensively along ± straight lines..... *Dialytrichia saxicola*
50. a. Leaves broadly spatulate, up to *ca.* 3 mm long; mainly on silt-encrusted trees, walls and rocks by rivers, **but also on asphalt**.....*Syntrichia latifolia*  
b. Leaves obovate to ovate-lanceolate, up to *ca.* 2 mm long; on soil.....51.
51. a. Leaf margins recurved to revolute.....52.  
b. Leaf margins plane or incurved.....60.
52. a. Leaf cells strongly papillose; leaves oblong-lanceolate to lingulate; seta >5 mm long, capsule long and narrow.....53.  
b. Leaf cells smooth to faintly papillose; if more strongly papillose, then leaves ovate-lanceolate and seta 1-4 mm long; capsule short and oval.....55.
53. a. Leaves strongly and broadly revolute ('rams-horn' shape in TS of leaf).....*Pseudocrossidium revolutum*  
b. Leaves recurved at margins only.....54.
54. a. Costa excurrent; leaf margins recurved almost to apex.....*Barbula unguiculata*  
b. Costa ending below apex; leaf margins recurved below.....*Streblotrichum convolutum*<sup>14</sup>
55. a. Plants very small, 1-2 mm high, with leaves up to *ca.* 1.5 mm long; setae 1-4 mm long; leaf cells papillose.....56.  
b. Plants larger, up to 15 mm high, with leaves up to *ca.* 2 mm long; setae 2-6 mm long; leaf cells smooth to faintly papillose.....57.
56. a. Spores coarsely warty (**pic?**).....*Microbryum starckeanum*  
b. Spores densely papillose to spiny (**pic?**).....*Microbryum davallianum*
57. a. Peristome teeth well developed.....58.  
b. Peristome teeth rudimentary or absent.....59.

<sup>13</sup>*Cinclidotus riparius*, restricted to the banks of the R. Teme, has capsules slightly exerted on a seta 3-6 mm long.

<sup>14</sup>*Streblotrichum convolutum* var. *commutatum* is larger, with undulate leaf margins.

58. a. Leaf margins strongly recurved  $\pm$  from base to apex, costa thickened in upper part of leaves.....*Tortula atrovirens*  
 b. Leaf margins recurved below; costa not thickened in upper part, but with inflated cells over adaxial surface.....*Tortula lindbergii* (*T. lanceola*)
59. a. Capsule cleistocarpous, held just above leaves on seta 2-3 mm long.....*Tortula protobryoides*  
 b. Capsule dehiscent, held well above leaves on seta 4-7 mm long.....*Tortula caucasica* (*T. modica*)<sup>15</sup>
60. a. Very thick-textured plants (like miniature *Polytrichums*!), **leaves** multistratose or with outgrowths on adaxial surface; **leaf** margins plane or  $\pm$  strongly incurved .....61.  
 b. Thin-textured plants; leaves unistratose, and no outgrowths on adaxial leaf surface; leaf margins  $\pm$  plane .....64.
61. a. Leaves multistratose but without outgrowths, narrowly lingulate, with plane margins; capsule disproportionally large ('grain of wheat'!), oblique and  $\pm$  immersed among ciliate perichaetial leaves.....*Diphyscium foliosum*  
 b. Leaves with many green outgrowths on adaxial surface, lingulate to orbicular, with  $\pm$  strongly incurved margins; capsule normal sized and narrowly ellipsoid,  $\pm$  symmetrical and longly exserted.....62.
62. a. Marginal cells near leaf base elongate, hyaline, thin-walled, forming distinct border.....*Aloina rigida*<sup>16</sup>  
 b. Marginal cells near leaf base quadrate or rectangular, if hyaline then thick-walled, not forming distinct border.....63.
63. a. Basal membrane of peristome not projecting above mouth of capsule; spores 18-25  $\mu\text{m}$ .....*Aloina aloides*  
 b. Basal membrane of peristome projecting above mouth of capsule; spores 12-16  $\mu\text{m}$ .....*Aloina ambigua*
64. a. Small plants, with leaves <1mm long; if longer, then leaves ovate to ovate-lanceolate....65.  
 b. Larger plants with leaves >1 mm long; if shorter, then leaves  $\pm$  lingulate/ligulate.....67.
65. a. Very small, with obtuse leaves ca. 0.25 mm long; leaf cells opaque with papillae.....*Gymnostomum viridulum*<sup>17</sup>  
 b. Small, with acute leaves ca. 0.75-2 mm long; leaf cells smooth or weakly papillose.....66.

<sup>15</sup> The rare southern species *Tortula wilsonii* may also key out here, with smaller and more papillose leaf cells (13-17  $\mu\text{m}$  v. 17-22  $\mu\text{m}$ ) and smaller spores (19-26  $\mu\text{m}$  v. 27-34  $\mu\text{m}$ ).

<sup>16</sup> The rarer *Aloina brevirostris* has shorter leaves (2-3.5 x longer than wide v. 4-6 x longer than wide) and larger spores (18-22  $\mu\text{m}$  v. 10-16  $\mu\text{m}$ ).

<sup>17</sup> Some small, broad-leaved forms of *Gymnostomum calcareum* or *Gyroweisia tenuis* may also key out here; see below; both have longer, more tapering leaves than *G. viridulum*.

66. a. Leaf cells papillose; perichaetial leaves larger and wider than vegetative leaves, concave; capsules widest in middle; scarce.....*Pottiopsis caespitosa*  
 b. Leaf cells smooth; perichaetial leaves not differentiated from vegetative leaves; capsules widest at mouth; common.....*Tortula truncata*
67. a. Hyaline basal cells ascending up margin of leaf, producing a ± abrupt V-shaped transition from basal to upper cells.....68.  
 b. Hyaline basal cells not ascending up leaf margin, transition not abrupt or V-shaped.....69.
68. a. Leaves fragile, upper part of leaves usually broken off; transition between lower hyaline cells and upper green cells gradual.....*Tortella nitida*  
 b. Leaves not fragile, leaves usually intact; transition between lower hyaline cells and upper green cells very abrupt.....*Tortella flavovirens*<sup>18</sup>
69. a. Leaf apices cucullate.....*Trichostomum crispulum*  
 b. Leaf apices plane.....70.
70. a. Costa excurrent in stout mucro; margins finely crenulate above.....*Trichostomum brachydontium*<sup>19</sup>  
 b. Costa ending in or below apex; margins crenulate, sinuose, notched or obscurely toothed above.....*Chionoloma cylindrotheca*<sup>20</sup>
71. a. Leaf margins recurved, **at least in lower ⅓ of leaf**.....72.  
 b. Leaf margins plane or incurved.....98.
72. a. Leaf cells completely smooth, pellucid.....73.  
 b. Leaf cells papillose, mamillate or striate, often opaque.....77.
73. a. Leaves recurved almost from base to apex; plants forming scattered patches or mats, usually on ground; very common.....*Ceratodon purpureus*<sup>21</sup>  
 b. Leaves recurved below or in middle; plants usually forming neat cushions on rocks or trees.....74.
74. a. Leaf cells 11-22 µm wide; capsules striate.....*Cynodontium jenneri*  
 b. Leaf cells 6-14 µm wide; capsules smooth.....75.

<sup>18</sup> The rarer *Tortella inclinata* may also key out here; it has consistently smooth elongate cells on the adaxial side of the costa (isodiametric and papillose in *T. flavovirens*).

<sup>19</sup> Some rarer species of *Weissia* (see below) with unusually broad leaves may key out here, but they have incurved, rather than plane, leaf margins.

<sup>20</sup> The tropical/subtropical *Bryoerythrophyllum campylocarpum*, which is now being found in Britain and Ireland, might key out here; it has a very distinctive leaf base, with hyaline 'windows' next to the costa in the leaf base. See Ottley *et al.* 2021.

<sup>21</sup> The very rare *Didymodon cordatus* may also key out here; it has numerous axillary gemmae, smaller, rounder leaf cells, and is restricted to a single site in Devon.

75. a. Leaves ovate-lanceolate to broadly ovate, imbricate and not crisped when dry.....*Didymodon luridus*<sup>22</sup>  
 b. Leaves lanceolate to narrowly lanceolate, strongly crisped when dry.....76.
76. a. Large plants with leaves *ca.* 4 mm long, coarsely and distantly toothed above; usually on rocks.....*Ptychomitrium polyphyllum*  
 b. Small plants with leaves 1-3 mm long, entire; on **trees, fence posts and decaying wood, but also sometimes on rocks**.....*Dicranoweisia cirrata*
77. a. Large pale green plants with orange-brown tomentum on stems; leaf cells mamilllose, pellucid; wet places, usually with *Sphagnum*.....*Aulacomnium palustre*  
 b. Small mid to dark green plants lacking tomentum; leaf cells usually papillose, often opaque; usually on rocks, walls or relatively dry soils.....78.
78. a. Leaves strongly and broadly revolute ('ram's horns' shape in TS of leaf).....79.  
 b. Leaves recurved at margins only.....80.
79. a. Leaves acuminate; mid-leaf cells 10-14 µm wide; scattered patches on paths **and other ruderal habitats**.....*Pseudocrossidium hornschurchianum*  
 b. Leaves obtuse and apiculate; mid-leaf cells 8-10 µm wide; cushions on rocks **and walls**.....*Pseudocrossidium revolutum*
80. a. Leaf margins toothed, crenulate-denticulate or irregularly notched towards apex.....81.  
 b. Leaf margins without teeth or notches near apex (but often regularly and minutely papillose-crenulate).....84.
81. a. Leaves fragile, broken, notched and sinuose above; capsules unknown.....*Didymodon sinuosus*  
 b. Leaves not fragile or notched; capsules common.....82.
82. a. Leaf cells clearly papillose; leaves entire except for 2-3 conspicuous teeth at apex; rusty-red tints often present; tufts or patches among rocks or on soil.....*Bryoerythrophyllum recurvirostrum*  
 b. Leaf cells clearly or obscurely mamilllose; leaves denticulate to crenulate-denticulate in upper part of leaf; entirely green; cushions or tufts on wood, trees or rock.....83.
83. a. Leaves lanceolate; clearly and irregularly denticulate above; leaf cells uniformly rounded-hexagonal with clear conical mamillae; on rocks, trees or wood.....*Aulacomnium androgynum*  
 b. Leaves narrowly lanceolate, crenulate-denticulate above; leaf cells quadrate above, rectangular below; in rock crevices.....*Cynodontium bruntonii*

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<sup>22</sup> The very rare *Didymodon acutus* may also key out here; it has narrower leaves with a sharply acute leaf apex.

84. a. Often forming deep, dense and often massive cushions on  $\pm$  base-rich rocks in upland or coastal areas; leaves often very narrow, not or hardly expanded at base; upper leaf cells sometimes elongate; capsules sometimes only just emergent above leaves.....85.  
 b. Forming smaller, looser cushions or tufts on rocks and walls; leaves usually  $\pm$  triangular, expanded at base; upper leaf cells always  $\pm$  isodiametric; capsules, if present, exserted on a long seta.....87.
85. a. Leaves lanceolate to linear-lanceolate; upper leaf cells elongate.....*Hymenostylium recurvirostrum*  
 b. Leaves ligulate to linear; upper leaf cells isodiametric.....86.
86. a. Basal cells of leaves thin-walled; upper cells strongly papillose with round papillae; capsules common, only just emergent above leaves.....*Amphidium lapponicum*  
 b. Basal cells of leaves thick-walled; upper cells faintly striate with oval papillae; capsules rare.....*Amphidium mougeotii*
87. a. Leaves with distinct and well-marked zone of hyaline cells at base.....88.  
 b. Leaves lacking distinct hyaline basal zone (basal cells often longer and paler than upper cells but not forming a distinct zone).....89.
88. a. Plant tinged red almost throughout.....*Bryoerythrophyllum ferruginascens*  
 b. Reddish tinge absent; plants **completely** green.....*Didymodon umbrosus*<sup>23</sup>
89. a. **Abundant small rhizoidal tubers (sometimes described as 'sausage-shaped')** present; adaxial costa cells somewhat elongate; small plants (< 6 mm high; leaves < 0.7 mm long) of arable fields.....*Didymodon tomaculosus*  
 b. Rhizoidal tubers absent; adaxial costa cells various; larger plants (up to **5cm** high, **but usually much less**; leaves up to 7 mm long) of various habitats.....90.
90. a. Adaxial costa cells in upper half of leaf  $\pm$  isodiametric to shortly rectangular.....91.<sup>24</sup>  
 b. Adaxial costa cells in upper half of leaf strongly elongate.....95.
91. a. Leaf margins bistratose, at least above (**do TS if unsure**).....92.  
 b. Leaf margins unistratose.....93.
92. a. Leaf tapering to stout subulate apex, blunt at extreme tip; globose gemmae (looking like miniature Brussels sprouts!) abundant in leaf axils.....*Didymodon rigidulus*  
 b. Leaf apex acute to obtuse or cucullate; axillary gemmae absent.....*Didymodon nicholsonii*

<sup>23</sup>*Didymodon australasiae*, recently recorded in Britain, has less strongly differentiated basal marginal cells and no hyalodermis; the very rare *D. glaucus* may also key out here; it has undifferentiated basal marginal cells and unistratose leaf margins (bistratose in *D. umbrosus* and *D. australasiae*).

<sup>24</sup>*Didymodon tophaceus* subsp. *sicculus* resembles *D. tophaceus* in having papillose leaf cells (unlike *D. luridus*) but differs in having short adaxial costa cells. It is apparently very rare but may be widely overlooked.



93. a. Leaves flexuose to crisped when dry, often with 'gyre twist' when viewed from above when moist; leaf margin not recurved in upper half of leaf; adaxial costa cells in upper half of leaf somewhat elongate.....*Didymodon insulanus*  
 b. Leaves appressed to slightly twisted when dry, without 'gyre twist' when moist; leaf margin usually recurved from base to over half way; adaxial costa cells in upper half of leaf isodiametric.....94.
94. a. Leaf apex grooved adaxially; costa TS without ventral stereids.....*Didymodon vinealis*  
 b. Leaf apex flat adaxially; costa TS with ventral stereids.....*Didymodon icmadophilus*
95. a. Leaves oblong-lanceolate, usually with obtuse or rounded apex.....*Didymodon tophaceus*  
 b. Leaves ovate to ovate-lanceolate, tapering to acute or acuminate apex.....96.
96. a. Leaves strongly recurved to squarrose when moist.....*Didymodon ferrugineus*<sup>25</sup>  
 b. Leaves erecto-patent to spreading when moist.....97.
97. a. Leaf margins recurved in upper half; peristome twisted; usually small plants (upper leaves 1.2-2.4 mm long) in various habitats.....*Didymodon fallax*  
 b. Leaf margins plane in the upper half; peristome straight; usually larger plants (upper leaves 1.8-4 mm long) among stones by upland streams.....*Didymodon spadiceus*
98. a. Leaf cells completely smooth, pellucid.....99.  
 b. Leaf cells papillose, mamilllose or striate, often opaque.....103.
99. a. Leaves broad with obtuse apex, squarrose from sheathing base; strikingly bright pale green plants of flushes, marshes, springs and riversides.....*Dichodontium palustre*  
 b. Leaves narrow with usually acute apex, flexuose-spreading or erecto-patent, base not sheathing; plants of rock crevices or open soil.....100.
100. a. Upper leaf cells rhomboidal to narrowly hexagonal; small scattered plants on open soils.....*Archidium alternifolium*  
 b. Upper leaf cells isodiametric; tuft- or cushion-forming plants on rocks and in rock crevices.....101.
101. a. Leaves entire; papillose cylindrical gemmae often present; dark green cushions on rock surfaces, usually in strongly oceanic areas.....*Glyphomitrium daviesii*  
 b. Leaves usually toothed near apex, at least obscurely; gemmae absent; pale bright yellow-green tufts in rock crevices, not restricted to oceanic areas.....102.
102. a. Leaves narrow, with lamina 3-4(-5) cells wide on each side of costa 220 µm from apex.....*Rhabdoweisia fugax*

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<sup>25</sup>*Didymodon maximus*, known only from limestone hills in NW Ireland, is a larger plant (leaves 2-4 mm long v. 0.8-1.8 in *D. ferrugineus*) with ventral stereids (absent in *D. ferrugineus*).

- b. Leaves wider, with lamina 5-7 cells wide on each side of costa 220 µm from apex.....*Rhabdoweisia crispata*
103. a. Hyaline basal cells ascending up margin of leaf, usually producing a ± abrupt V-shaped transition from basal to upper cells.....104.  
b. Hyaline basal cells, if present, not ascending up leaf margin, transition usually not abrupt and never V-shaped.....109.
104. a. Leaves squarrose from ± erect sheathing base when moist; basal hyaline cells not forming a V-shaped zone, instead ascending margin in a narrow band.....*Tortella squarrosa*  
b. Leaves not squarrose, and base not sheathing; basal hyaline cells forming a V-shaped zone at junction with upper green cells.....105.
105. a. Leaves fragile, upper part of leaves usually broken off.....106.  
b. Leaves not fragile, upper part of leaves intact.....107.
106. a. Transition between lower hyaline cells and upper green cells gradual.....*Tortella nitida*  
b. Transition between lower hyaline cells and upper green cells very abrupt.....*Tortella fasciculata*<sup>26</sup>
107. a. Plants always small, 2-6 mm high, leaves < 3 mm long; transition between lower hyaline cells and upper green cells gradual; southern plant of chalk and oolitic limestone fragments.....*Tortella inflexa*  
b. Plants usually larger, up to 8 cm high, leaves usually > 3 mm long; transition between lower hyaline cells and upper green cells very abrupt; widespread on various substrates.....108.
108. a. Leaves very long and tapering, strongly crisped when dry; not confined to coast.....*Tortella tortuosa*  
b. Leaves lanceolate to linear-lanceolate, usually contracted ± abruptly to apex; almost exclusively coastal.....*Tortella flavovirens*<sup>27</sup>
109. a. Leaf margins ± strongly incurved, and/or leaf apex distinctly cucullate.....110.  
b. Leaf margins and apex plane .....115.
110. a. Leaf apex cucullate; margins plane below; capsules rare.....*Trichostomum crispulum*  
b. Leaf apex usually not cucullate; leaf margins ± strongly incurved; capsules abundant<sup>28</sup>.....111.

<sup>26</sup>*Tortella pseudofragilis*, rare in the Scottish Highlands, has leaves straight (not curled) in the upper half, and marginal upper leaf cells longer than wide (wider than long in *T. fasciculata*). The very rare *T. fragilis*, confined to Scotland, has an extremely long, straight, fragile, subulate leaf apex in which the lamina and costa cannot be differentiated.

<sup>27</sup> Both *Tortella tortuosa* and *T. flavovirens* have the lamina cells continuous over adaxial side of costa; the much rarer *T. densa* and *T. inclinata* have the elongate costa cells exposed throughout adaxially. *T. densa* has gradually tapering acuminate leaves, whereas *T. inclinata* is abruptly contracted to an acute or obtuse apex.

111. a. Seta longer than capsules.....112.  
b. Seta shorter than or as long as capsules<sup>29</sup>.....114.
112. a. At least a rudimentary peristome present.....113.  
b. Peristome completely absent.....*Weissia brachycarpa*<sup>30</sup>
113. a. Adaxial cells of costa papillose, quadrate, at least in patches;  
common.....*Weissia controversa*<sup>31</sup>  
b. Adaxial cells of costa smooth, elongate in upper half of leaf; common only in western  
coastal areas.....*Weissia perssonii*
114. a. Perichaetial leaves 3-6 mm long; margins plane or narrowly incurved  
above..... *Weissia longifolia*  
b. Perichaetial leaves 2.5-3.7 mm long; margins involute  
above.....*Weissia angustifolia*
115. a. Hyaline basal part of leaf  $\pm$  expanded, sharply toothed at  
'shoulders' .....*Eucladium verticillatum*  
b. Basal part of leaf hyaline or not, expanded or not, but lacking teeth (may be papillose or  
crenulate).....116.
116. a. Leaves with distinct alar cells; leaf cells striate with weak, elongated ridges; small to  
medium-sized cushions on base-rich mountain rocks.....*Dicranoweisia crispula*  
b. Distinct alar cells lacking; leaf cells mamillate or densely papillose; habit and habitat  
various.....117.
117. a. Leaf cells clearly with tall conical mamillae.....*Aulacomnium androgynum*  
b. Leaf cells strongly to obscurely papillose.....118.
118. a. Small plants, leaves usually < 1.5 mm long (although often forming huge  
hummocks).....119.  
b. Large plants, leaves usually well over 1.5 mm long (forming small tufts, mats or scattered  
shoots).....123.
119. a. Leaf apex acute, with smooth apical cell(s) contrasting with the strongly papillose lamina  
cells below; often forming massive cushions<sup>32</sup> .....*Anoetangium aestivum*

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<sup>28</sup>*Weissia* is a difficult genus which is complicated by extensive hybridisation. Only the more common species are included here. Refer to other literature to be sure of an identification.

<sup>29</sup> The rare *Weissia sterilis*, which is branched, and *W. levieri*, which has a dehiscent capsule, will also key out here.

<sup>30</sup> A number of rare species of *Weissia* will also key out here.

<sup>31</sup> The rarer *Weissia rutilans* has larger spores (22-28  $\mu$ m v. 16-20  $\mu$ m); also its leaves are plane or only slightly incurved above.

- b. Leaf apex  $\pm$  obtuse or subacute, with no contrast between extreme apex and lamina cells; forming cushions, tufts or scattered patches.....120.
120. a. Cells in leaf base elongate (ca. 25-50  $\mu$ m long); forming patches, not cushions.....*Gyroweisia tenuis*  
 b. Cells in leaf base shorter (<25  $\mu$ m long); forming patches or cushions.....121.
121. a. Leaf apex rounded; cells  $\pm$  quadrate throughout leaf, **except at extreme base**; scattered shoots on wet, usually vertical rock faces.....*Molendoa warburgii*  
 b. Leaf apex obtuse to subacute; **upper leaf cells  $\pm$  quadrate; extensive zone of rectangular basal cells below**;  $\pm$  dense tufts or cushions, usually in rock crevices.....122.
122. a. Bright green; upper leaf cells 5-10  $\mu$ m wide; costa 30-45  $\mu$ m wide near base.....*Gymnostomum calcareum*<sup>33</sup>  
 b. Dull green; upper leaf cells (8-)10-14  $\mu$ m wide; costa 60-110  $\mu$ m wide near base.....*Gymnostomum aeruginosum*
123. a. Costa excurrent in stout mucro; upper leaf margins finely papillose-crenulate, not fragile, broken, notched or sinuose .....*Trichostomum brachydontium*  
 b. Costa ending below apex, or if slightly excurrent not forming a mucro; upper leaf margins sometimes fragile, broken, notched or sinuose.....124.
124. a. Leaf apex narrowly lingulate to subulate, obtuse, fragile, sinuose or notched but not, or only weakly, papillose-crenulate; hyaline leaf base moderately defined; southern lowland species.....*Didymodon sinuosus*  
 b. Leaf apex  $\pm$  acute, not fragile, papillose-crenulate; hyaline leaf base well-defined; western and northern upland species.....125.
125. a. Leaves with expanded sheathing base with distinct 'shoulders'; margins finely and  $\pm$  regularly crenulate, not notched or sinuose above.....*Chionoloma hibernicum*  
 b. Leaves gradually narrowing  $\pm$  from base to apex, base not expanded or sheathing, without 'shoulders'; margins irregularly crenulate, frequently notched or sinuose above.....*Chionoloma tenuirostre*<sup>34</sup>

**+ drawings, references**

<sup>32</sup>*Amphidium mougeotii* (see above) also forms massive cushions, and may key out near here if the recurved lower leaf margins have been overlooked; it has linear-lanceolate dark green leaves with a characteristic silky sheen.

<sup>33</sup>*Leptobarbula berica*, a scarce southern plant of limestone and walls, also keys out here (*Gymnostomum calcareum* is more an upland plant of base-rich rocks in ravines etc); it differs in its perichaetial and perigonal leaves being much longer than the vegetative leaves.

<sup>34</sup> var. *holtii* (if one believes in it!) has often blackish older parts, upper leaves not longer than lower leaves (so not forming a comal tuft, unlike var. *tenuirostre*), and leaves often breaking along the costa.

## Section 12 – Pleurocarps with short leaf cells

Note that *Hedwigia* (unusual mosses lacking a costa but having hyaline hairpoints) are keyed out in Section 5.

1. a. Well-developed shoots regularly 2x or 3x pinnate (like miniature ferns).....2.  
b. All shoots simply pinnate or irregularly branched (not conspicuously fern-like).....5.
2. a. Apical cell of branch leaves acute, undivided; abundant.....*Thuidium tamariscinum*<sup>1</sup>  
b. Apical cell of branch leaves obtuse, crowned with 2 or 3 papillae; less common.....3.
3. a. Costa of stem leaves percurrent; paraphyllia with papillae mainly over transverse cell walls.....*Thuidium recognitum*  
b. Costa of stem leaves ending well below leaf apex; paraphyllia with papillae mainly over cell lumens.....4.
4. a. Stem leaf apices ending in long point composed of elongate unistratose cells..... *Thuidium assimile*  
b. Stem leaf apices usually ending in a single elongate cell..... *Thuidium delicatulum*
5. a. Shoots complanate (flattened, as if sat on by something heavy).....6.  
b. Shoots not complanate.....10.
6. a. Leaves strongly and regularly transversely undulate.....7.  
b. Leaves not undulate.....8.
7. a. Robust plant, leaves 2-4 mm long; calcareous rocks, walls and tree bases.....*Neckera crispa*  
b. Small, leaves <2 mm long; nearly always epiphytic.....*Neckera pumila*
8. a. Leaves up to 6 mm long; leaf cells very large (100-300 x 60-80 µm).....*Hookeria lucens*  
b. Leaves smaller; leaf cells small (40-70 x 6-10 µm).....9.
9. a. Costa single, extending beyond mid-leaf.....*Homalia trichomanoides*  
b. Costa very short, double.....*Neckera complanata*
10. a. Plants very small, threadlike; leaves <0.4 mm long; costa absent or very short.....11.<sup>2</sup>  
b. Plants larger, not threadlike; leaves mostly >0.4 mm long; if shorter, then costa reaching ca. ¾ way up leaf.....13.

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<sup>1</sup>Branching pattern the same as *Hylocomium splendens*, but texture altogether different, being thick and opaque, owing to different cell structure.

<sup>2</sup> *Myurella julacea*, a rare plant of base-rich upland rocks, also has very short leaves, but they are broadly ovate, concave, often with a small apiculus, denticulate below, and the julaceous bluish-green shoots are distinctive.

11. a. Leaf cells papillose,  $\pm$  quadrate-hexagonal, 1-2 x longer than wide throughout leaf.....*Heterocladium flaccidum*  
 b. Leaf cells smooth, upper cells elongate, 1.5-4 x longer than wide.....12.
12. a. Well developed leaves denticulate above, often subfalcate when moist; perichaetial leaves spinosely denticulate above; leaf axils with rhizoids  
 .....*Platydictya jungermannioides*  
 b. Well developed leaves entire or sinuose, not subfalcate; perichaetial leaves entire or finely denticulate above; leaf axils without  
 rhizoids.....*Serpoleskea (Amblystegium) confervoides*
13. a. Leaf margin distinctly toothed.....14.  
 b. Leaf margin entire or crenulate.....22.
14. a. Nerve single, extending well beyond mid-leaf.....15.  
 b. Nerve absent or very short and double.....20.
15. a. Plants dendroid (tree-like); stems notably tough and wiry.....*Thamnobryum alopecurum*  
 b. Plants not dendroid; stems not notably tough and wiry.....16.
16. a. Leaf apex with unique grapnel form; robust moss, scarce.....*Antitrichia curtispindula*  
 b. Leaf apex lacking grapnel form.....17.
17. a. Costa extending  $\frac{1}{2}$ - $\frac{2}{3}$  way up leaf; paraphyllia sparse.....*Heterocladium wulfsbergii*  
 b. Costa extending to near leaf apex; paraphyllia sometimes numerous.....18.
18. a. Stems lacking paraphyllia; alar cells not strongly differentiated, not forming auricles.....*Scorpiurium circinatum*  
 b. Stems with paraphyllia; if paraphyllia sparse, alar cells in  $\pm$  distinct group, forming auricles.....19.
19. a. Alar cells in  $\pm$  distinct group, forming auricles; paraphyllia lanceolate, unbranched; leaf cells smooth.....*Cratoneuron filicinum*  
 b. Alar cells not differentiated; paraphyllia filamentous, branched; leaf cells mamilllose.....*Abietinella abietina*<sup>3</sup>
20. a. Habit slender, shoots untidy, dull green throughout; leaves up to 0.75 mm long, not concave,  $\pm$  imbricate to spreading both dry and moist (shoots not smooth)..... *Heterocladium heteropterum*  
 b. Habit slender to robust, shoots often neatly curved, with orange/coppery hues often present; leaves up to 1.5 mm long, concave, tightly imbricate when dry (so shoots smooth), imbricate to widely spreading when moist..... 21.

<sup>3</sup> There are two varieties of *A. abietina*: var. *abietina* has stem leaves 1-1.4 mm long and mid-leaf cells of branch leaves 1-2 x longer than wide; var. *hystricosa* has stem leaves 1.5-2 mm long and mid-leaf cells of branch leaves 1.5-3x longer than wide.

21. a. Plants large, leaves often > 1mm long, imbricate when dry, spreading dramatically when moist; extensive zone of isodiametric cells at basal angles extending up margins..... *Nogopterium gracile*  
 b. Plants small, leaves < 1 mm long, imbricate when dry, imbricate to erecto-patent when moist, not spreading dramatically; cells at basal angles shorter, but not forming an extensive zone extending up margins..... *Pterigynandrum filiforme*
22. a. Leaf apex obtuse .....23.<sup>4</sup>  
 b. Leaf apex acute or acuminate.....24.
23. a. Leaves ovate, with very obtuse apex; whole shoot ±curled up into a tight 'ball' when dry.....*Neckera (Leptodon) smithii*  
 b. Leaves with ovate base, narrowed to lingulate-lanceolate upper part; leaves not curled up into a 'ball' when dry.....*Anomodon viticulosus*
24. a. Plants robust; leaves up to 3 mm long, strongly plicate.....*Leucodon sciurioides*  
 b. Plants slender; leaves > 2 mm long, not plicate.....25.
25. a. Upper leaf cells rounded, scarcely longer than broad.....26.  
 b. Upper leaf cells ±rhomboid-hexagonal, 2-4 x as long as broad.....27.
26. a. Epiphytic; seta <1 mm long.....*Cryphaea heteromalla*  
 b. Tress bases, usually by water; seta *ca.* 1 cm long.....*Leskea polycarpa*
27. a. Costa absent or weak, ending well below apex<sup>5</sup>.....28.  
 b. Costa strong, extending into leaf apex.....32.
28. a. Costa absent or very short.....*Habrodon perpusillus*  
 b. Costa extending to at least ½ way up leaf .....29.
29. a. Leaves tapering to long, ± acuminate apices; upper leaf cells *ca.* 3-4x longer than wide; very common.....*Amblystegium serpens*<sup>6</sup>  
 b. Leaves ovate, with short, ± acute apices; if longer, then leaf cells isodiametric to 1-2x longer than wide.....30
30. a. Leaf cells 12-16 µm wide, rhomboidal; costa very weak.....*Myrinia pulvinata*  
 b. Leaf cells 6-12 µm wide, oval to rhomboidal; costa short but strong .....31.

<sup>4</sup> The scarce *Myrinia pulvinata* may have acute to ± obtuse leaves, but is keyed out below under plants with acute leaves.

<sup>5</sup> The scarce *Braunia imberbis* (*Hedwigia integrifolia*) may key out here; the matt, papillose leaves completely lack a costa.

<sup>6</sup> The rare *Pseudoleskeella rupestris* will also key out here, but has a quite different habit, cell structure and habitat.

31. a. Costa ending in a small abaxial tooth; leaf cells  $\pm$  rhomboidal, smooth; common plant in shaded places.....*Microeurhynchium pumilum*  
 b. Costa without a small abaxial tooth; leaf cells  $\pm$  oval, smooth to slightly papillose; scarce plant on base-rich upland rocks.....*Pseudoleskeella catenulata*
32. a. Nerve slender,  $<40\ \mu\text{m}$  wide at base.....*Hygroamblystegium varium*  
 b. Nerve very stout,  $40\ \mu\text{m}$  or more wide at base.....33.
33. a. Plants forming intricate patches, stems  $\pm$  pinnately branched; nerve disappearing in acute leaf apex; leaf margin faintly indented near apex.....*Hygroamblystegium tenax*<sup>7</sup>  
 b. Plants forming  $\pm$  elongate tufts, stems sparsely & irregularly branched; nerve extending to extreme point of blunt leaf apex, margin entire.....*Hygroamblystegium fluviatile*

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<sup>7</sup> The rare *Lescuraea incurvata* and *L. patens* may also key out here: both are rare plants of base-rich rocks in upland areas; *Hygroamblystegium* spp. are  $\pm$  aquatic and widespread.



### Section 13 –Pleurocarps without a costa, with long cells and falcate

Mosses in this section have noticeably falcato-secund leaves, at least at the shoot tips, as in *Hypnum cupressiforme*. Plants with leaves curled irregularly or upwards should be sought in Section 14.

1. a. Shoots red, relatively thick, strong and springy in character; stems red; common and conspicuous in hill districts and the west.....*Rhytidiadelphus loreus*<sup>1</sup>  
b. Shoots mostly thinner and weaker; stems rarely with any tinge of red.....2.
2. a. Leaf margin strongly denticulate from base to apex.....3.  
b. Leaf margin entire or weakly denticulate, usually only towards apex.....4.
3. a. Leaves only slightly falcate; calcifuge, usually by streams in upland areas.....*Hyocomium armoricum*  
b. Leaves strongly falcate, forming a characteristic 'bishop's crozier' or 'snail-shell' shape at shoot tips; usually calcicolous.....*Ctenidium molluscum*
4. a. Shoots densely pinnately branched ('ostrich plumes'); leaves strongly plicate (upland woodland, mainly in Scotland).....*Ptilium crista-castrensis*  
b. Shoots irregularly or loosely pinnately branched; leaves not, or weakly, plicate (widespread).....5.
5. a. Alar cells in distinct group, numerous and small, mostly with granular contents but sometimes a few of them hyaline; plants sometimes pinnately branched.....6.  
b. Alar cells either in distinct group and enlarged and  $\pm$  hyaline, or indistinct; plants sparsely or irregularly branched.....8.
6. a. Plants  $\pm$  regularly pinnately branched, pale whitish green when dry; heathland, bog, acid woodland and other base-poor places.....*Hypnum jutlandicum*<sup>2</sup>  
b. Plants irregularly branched; habitat and colour various.....7.
7. a. Capsule lid mamillate (no real beak); plants pale green, not golden-tinged; often in long, slender unbranched 'tresses' on acid-barked trees and rocks.....*Hypnum andoi*  
b. Capsule lid rostrate (beaked); plants often with golden tinge, slender and poorly branched to robust and richly branched; habitat various.....*Hypnum cupressiforme*<sup>3</sup>
8. a. Habitat in streams, bogs, flushes, fens, occasionally on sloping wet rocks.....9.  
b. Habitat various, but not aquatic or on sloping wet rocks.....11.

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<sup>1</sup> Note that *Orthothecium rufescens* and *O. intricatum*, which also have red coloration but are otherwise quite different, may also have slightly falcate shoots. See Section 14.

<sup>2</sup> *H. imponens*, a rare plant of wet heath, is yellowish-green to brown and has reddish-brown stems, and non-bilobed pseudoparaphyllia with toothed margins (bilobed but with entire margins in *H. jutlandicum*).

<sup>3</sup> A number of rare species of *Hypnum* s.l. will also key out here. *Campylium (Hypnum) bambergeri* has relatively few alar cells and leaf cells porose throughout; *Buckia (Hypnum) vaucheri* has small alar cells (<10  $\mu$ m); *Hypnum uncinulatum* has brownish, excavate alar cells and a row of 5-8 rectangular supra-alar cells (7-15 in *H. cupressiforme*).

9. a. Very robust (branches 2.5-5 mm wide), often dark brown to purple, sparsely branched and  $\pm$  worm-like; in bogs, flushes, fens or growing over wet rocks.....*Scorpidium scorpioides*  
b. Slender (branches up to 1.5 mm wide), yellowish- to reddish-green but not dark brown or purple, irregularly branched and not worm-like; on wet rocks.....10.
10. a. Reddish coloration often present; leaf apex acute to obtuse, distinctly denticulate; alar cells thick-walled, in a group wider than tall.....*Pseudohygrohypnum subeugyrium*  
b. Yellowish-green, never reddish; leaf apex acute,  $\pm$  entire; alar cells thin-walled, in a  $\pm$  isodiametric group.....*Pseudohygrohypnum eugyrium*<sup>4</sup>
11. a. Leaves finely acuminate to filiforme at apex.....12.  
b. Leaves acute to shortly acuminate at apex.....13.
12. a. Plants slender; leaves up to 1 mm long; alar cells  $\pm$  undifferentiated.....*Isopterygiopsis pulchella*<sup>5</sup>  
b. Plants larger; leaves up to *ca.* 2.5 mm long; alar cells inflated, hyaline, forming auricles.....*Stereodon callichrous* (*Hypnum callichroum*)<sup>6</sup>
13. a. Shoots not complanate; alar cells inflated, hyaline, forming auricles but not decurrent; terrestrial on woodland rides etc.....*Calliergonella lindbergii*  
b. Shoots complanate; alar cells enlarged, rectangular, decurrent; on rotten wood, tree stumps and leaf litter.....*Plagiothecium curvifolium*

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<sup>4</sup> *Hageniella micans*, an uncommon oceanic species, may sometimes be slightly falcate at the shoot tips; it is a smaller, more delicate yellow-green plant with leaves well under 1 mm long and just a few alar cells inflated, forming small auricles.

<sup>5</sup> *Orthothecium intricatum* may also key out here; it nearly always has a pinkish tinge, and capsules are very rare; *I. pulchella* is never pinkish and often has capsules. *Stereodon* (*Hypnum*) *hamulosum* is small, golden-green, and has very few (0-2) inflated alar cells, not forming distinct auricles; it looks like a *Hypnum*, which *I. pulchella* does not.

<sup>6</sup> *Herzogiella seligeri* is often weakly falcate; it is a *Hypnum*-like plant with undifferentiated alar cells, usually with abundant curved, cylindrical capsules, growing on logs and tree stumps.

#### Section 14 –Pleurocarps without a costa and with long cells, not falcate

Although plants in this section are not falcato-secund, in the sense of (e.g.) *Hypnum cupressiforme*, the leaves may sometimes be curved  $\pm$  irregularly or predominately upwards (as in *Hypnum cupressiforme* var. *resupinatum*).

1. a. Shoots complanate (flattened, as if sat on by something heavy).....2.  
b. Shoots not complanate.....12.
2. a. Leaves strongly and regularly transversely undulate.....3.  
b. Leaves not undulate.....5.
3. a. Plants robust, little-branched, whitish-green and not glossy.....*Plagiothecium undulatum*  
b. Plants slender or robust, much-branched, bright or olive green, glossy.....4.
4. a. Robust plant, leaves 2-4 mm long; calcareous rocks, walls and tree  
bases.....*Neckera crispa*  
b. Small, leaves <2 mm long; nearly always epiphytic.....*Neckera pumila*
5. a. Leaves broad, abruptly apiculate at apex; cells near leaf apex short, 2-3 x as long as  
wide.....*Neckera complanata*  
b. Leaves tapering gradually to acute to acuminate apex; cells near leaf apex long and  
narrow, >3 x as long as wide.....6.
6. a. Leaf base with decurrent auricles.....7.  
b. Leaf base without decurrent auricles – alar cells  $\pm$  undifferentiated.....11.
7. a. Mid-leaf cells mostly <10  $\mu$ m wide.....8.  
b. Mid-leaf cells mostly >10  $\mu$ m wide.....9.
8. a. Leaves symmetrical, tapering to long acuminate apex.....*Plagiothecium latebricola*  
b. Leaves asymmetrical, with one side curved, the other  $\pm$  flat, tapering to acute or shortly  
acuminate apex.....*Plagiothecium curvifolium*
9. a. Alar cells  $\pm$  inflated, rounded, forming broad decurrent auricles looking like bubbles or  
froth, crenulate at the margin.....*Plagiothecium denticulatum*  
b. Alar cells  $\pm$  rectangular, forming narrowly triangular decurrent auricles, smooth at the  
margin.....10.
10. a. Mid-leaf cells 130-245  $\mu$ m long, not in transverse rows.....*Plagiothecium succulentum*  
b. Mid-leaf cells 80-140  $\mu$ m long, many arranged in transverse  
rows.....*Plagiothecium nemorale*
11. a. Leaves with shortly acute apex; leaf cells 7-10  $\mu$ m wide; lacking axillary flagelliform  
branchlets; calicole.....*Taxiphyllum wissgrillii*

- b. Leaves with filiform apex; leaf cells 4-8  $\mu\text{m}$  wide; usually with axillary flagelliform branchlets; calcifuge.....*Pseudotaxiphyllum elegans*<sup>1</sup>
12. a. Plants exclusively aquatic, submerged except in drought conditions; stems very long and trailing (several cm to 1 m).....13.<sup>2</sup>  
 b. Plants not aquatic (although some species grow at water's edge); stems shorter, not trailing.....14.
13. a. Lower leaves sharply folded longitudinally, so keeled.....*Fontinalis antipyretica*  
 b. Leaves all concave, not keeled.....*Fontinalis squamosa*
14. a. Leaves imbricate, with apex rounded, obtuse or very shortly pointed, so shoots appearing smooth.....15.  
 b. Leaves variously spreading, or if  $\pm$  imbricate, then with narrow,  $\pm$  patent apex, so shoots not smooth.....17.
15. a. Alar cells  $\pm$  undifferentiated; stems green; calcareous grassland.....*Entodon concinnus*  
 b. Alar cells strongly differentiated, forming well-defined auricles; stems usually reddish; various habitats.....16.
16. a. Shoot 'spear-tipped' (cuspidate) and resistant to fingertips because of tightly rolled up leaves (like a rolled up newspaper); stems green to reddish-brown; very common in damp grassland, marsh, etc.....*Calliergonella cuspidata*  
 b. Shoot tips rounded, not cuspidate; stems always red; common in acid habitats, especially heathland.....*Pleurozium schreberi*
17. a. At least stem leaves distinctly and strongly toothed *and/or* shoots regularly pinnately, bipinnately or tripinnately branched *and/or* shoots with conspicuously reddish stems; often large plants (leaves 2-3 mm or more long).....18.  
 b. Leaves entire or weakly toothed; *if somewhat toothed*, then plants irregularly branched and smaller (leaves < 1mm long), and stems not conspicuously reddish.....23.
18. a. Paraphyllia abundant.....19.  
 b. Paraphyllia absent.....21.
19. a. Well-developed shoots regularly 2x or 3x pinnate (like miniature ferns).....*Hylocomium splendens*<sup>3</sup>  
 b. All shoots simply pinnate or irregularly branched (not conspicuously fern-like).....20.

<sup>1</sup> *Isopterygiopsis muelleriana*, a scarce plant of mountain rock crevices, has almost entire leaves and even narrower leaf cells (4-6  $\mu\text{m}$  wide). It lacks flagelliform branchlets,

<sup>2</sup> Two rare plants of mountain streams may key out here; *Platyhypnum* (*Hygrohypnum*) *molle* has broadly ovate leaves tapering from midleaf or below, and indistinct alar cells; *P. duriusculum* has almost circular leaves tapering from well above midleaf, and  $\pm$  distinct, brownish, thick-walled alar cells.

<sup>3</sup> Branching pattern the same as *Thuidium*, but texture altogether different, being delicate and translucent, owing to different cell structure.

20. a. Shoots  $\pm$  regularly pinnate; stem leaves tapering gradually to acuminate apex; plants slender, 'thin' .....*Hylocomiastrum umbratum*  
 b. Shoots irregularly branched; stem leaves abruptly narrowed to acuminate apex; plants robust, bushy.....*Loeskeobryum brevirostre*
21. a. Shoots  $\pm$  pinnately branched; usually next to streams.....*Hyocomium armoricum*  
 b. Shoots sparsely or  $\pm$  irregularly branched; not particularly associated with streams.....22.
22. a. Shoots very robust, richly branched; leaves sharply spreading, making plant look very bushy and spiky.....*Hylocomiadelphus (Rhytidiadelphus) triquetrus*  
 b. Shoots robust, sparsely branched; leaves strongly squarrose, plant neither bushy nor spiky; 'lawn moss' .....*Rhytidiadelphus squarrosus*<sup>4</sup>
23. a. Robust (shoots 4-5 mm wide); leaves strongly concave (giving shoots a 'fat' appearance); leaves abruptly narrowed into long apiculus; confined to extreme west of Scotland.....*Myurium hochstetteri*  
 b. Robust or slender; leaves gradually tapering to apex or, if more abruptly narrowed, then leaves not concave.....24.
24. a. Leaves  $\pm$  patent to squarrose, often contracted abruptly from wide base to long narrow acumen.....25.  
 b. Leaves  $\pm$  erecto-patent, tapering gradually to long acuminate apex.....27.
25. a. Slender, leaves <1 mm long, denticulate below; mid-leaf cells 4-9x longer than wide; deeply shaded sites on chalk and limestone.....*Campylophyllopsis calcarea*<sup>5</sup>  
 b. More robust, leaves >1.2 mm long, entire or very obscurely denticulate; mid-leaf cells 6-15x longer than wide; habitat various.....26.
26. a. Robust, leaves 2-3.6 mm long; fens, flushes, dune slacks, etc.....*Campylium stellatum*  
 b. Slender, leaves 1.2-2 mm long; dry, base-rich grassland, rocks, etc...*Campylium protensum*
27. a. Alar cells differentiated, forming  $\pm$  well-defined patches.....28.  
 b. Alar cells not differentiated .....33.
28. a. Alar cells few, large, hyaline, inflated.....29.  
 b. Alar cells many, small, not hyaline or inflated.....31.
29. a. Leaves  $\pm$  denticulate from base to apex; alar cells decurrent (as in *Plagiothecium*); capsules common, furrowed when dry.....*Herzogiella striatella*

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<sup>4</sup> The very much rarer *R. subpinnatus*, a woodland plant, has less squarrose leaves and in habit looks more like *L. brevirostre*.

<sup>5</sup> *Campylophyllum halleri*, a rare mountain plant, has the leaves strongly squarrose from an erect base, the acumen consisting of  $\frac{1}{3}$ - $\frac{1}{2}$  the total leaf length ( $\frac{1}{2}$ - $\frac{3}{4}$  in *C. calcarea*).

- b. Leaves entire or denticulate only at apex; alar cells not decurrent ; capsules (if present) not furrowed when dry.....30.
30. a. Leaves with a long filiform acumen; mainly epiphytic and on logs.....*Sematophyllum substrumulosum*  
 b. Leaves acute to acuminate; mainly on periodically irrigated sloping rocks in oceanic woodland.....*Hageniella micans*<sup>6</sup>
31. a. Axillary deciduous branchlets usually present at tips of branches; leaf margins recurved below; capsules rare.....*Platygyrium repens*  
 b. Axillary deciduous branchlets absent; leaves recurved below or plane; capsules common.....32.<sup>7</sup>
32. a. Leaf margins plane; capsules with conical lid; two generations of capsules often present simultaneously.....*Pylaisia polyantha*  
 b. Leaf margins recurved below; capsules with rostrate lid; only one generation of capsules present..... *Hypnum cupressiforme* var. *resupinatum*
33. a. *Hypnum*-like green plants; leaves variously curved; on logs and tree stumps in lowland areas.....*Herzogiella seligeri*  
 b. Not *Hypnum*-like, usually with pink or red coloration; leaves  $\pm$  straight; in upland rock crevices.....34.
34. a. Robust; leaves *ca.* 3 mm long, plicate; usually a striking glossy red.....*Orthothecium rufescens*  
 b. Slender; leaves *ca.* 1 mm long, not plicate; often tinged pink.....*Orthothecium intricatum*<sup>8</sup>

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<sup>6</sup> *Sematophyllum demissum*, a rare but very locally frequent plant in Welsh and Irish woodland, has lanceolate leaves with entire margins (ovate and denticulate above in *H. micans*).

<sup>7</sup> *Homomallium incurvatum* is a rare plant of limestone fragments; it has plane leaf margins and inclined to horizontal capsules (erect in both *P. polyantha* and *H. cupressiforme* var. *resupinatum*).

<sup>8</sup> *Isopterygiopsis pulchella* may also key out here; it never has a pinkish tinge, and capsules are common; *O. intricatum* is pinkish and almost never has capsules

## Section 15 –Pleurocarps with a costa and long cells, falcate

Mosses in this section all have a distinct costa to mid-leaf or beyond, and are  $\pm$  falcato-secund, at least at the shoot tips.

1. a. Leaves strongly plicate.....2.  
b. Leaves not or only slightly plicate.....4.
2. a. All leaves narrow, gradually tapering to longly acuminate apex; paraphyllia absent.....*Sanionia uncinata*<sup>1</sup>  
b. Stem leaves cordate-triangular, broad below; paraphyllia abundant.....3.
3. a. Plants  $\pm$  regularly pinnate.....*Palustriella commutata*<sup>2</sup>  
b. Plants irregularly branched.....*Palustriella falcata*
4. a. Leaves denticulate; at least a few teeth at extreme apex.....5.  
b. Leaves entire or at most slightly sinuose.....11.
5. a. Plants robust; leaves transversely undulate; leaf cells papillose on abaxial surface; dry base-rich slopes.....*Rhytidium rugosum*  
b. Plants slender to robust; leaves not transversely undulate; leaf cells smooth; habitat various.....6.
6. a. Alar cells sharply distinct from other leaf cells, forming well-defined patches or auricles.....7.  
b. Alar cells undifferentiated, or, if somewhat different from other leaf cells, then not *sharply* distinct .....10.
7. a. Leaves mostly narrowly lanceolate, tapering to long acuminate apex; usually in flushes, fens and bogs.....8.  
b. Leaves shortly lanceolate to ovate, with short obtuse or acute apex; usually on wet rocks in streams.....9.
8. a. Large plants with leaves up to *ca.* 5 mm long, strongly curved; alar cells inflated, forming large auricles.....*Sarmentypnum exannulatum*<sup>3</sup>  
b. Small plants with leaves < 2 mm long,  $\pm$  curved at branch tips; alar cells enlarged but not inflated, forming small auricles.....*Kandaea elodes*

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<sup>1</sup> *S. orthothecioides*, locally frequent only on coastal turf in the extreme north, is less regularly branched, has the costa folded away in a deep furrow, and the supra-alar cells  $\pm$  porose. The leaves of *Hamatocaulis vernisosus* (see below) are less strongly plicate.

<sup>2</sup> *P. decipiens*, a rare plant of mountain flushes, has very broad stem leaves and mid-leaf cells 3-6x longer than wide (9-15 in *P. commutatum*).

<sup>3</sup> Specimens of *Warnstorfia fluitans* with relatively distinct alar cells may also key out here; it has mid-leaf cells 80-160  $\mu$ m long (40-80  $\mu$ m in *S. exannulatum*).

9. a. Soft-textured plant; leaves with inflated, thin-walled, hyaline alar cells; calcifuge  
.....*Hygrohypnella ochracea* (*Hygrohypnum ochraceum*)  
b. Stiff-textured plant; leaves with alar cells not much inflated, with granular contents;  
callicole.....*Hygrohypnum luridum*
10. a. Leaves mostly narrowly lanceolate, tapering to long acuminate apex; usually in acid pools,  
bogs, etc.....*Warnstorfia fluitans*<sup>4</sup>  
b. Leaves shortly lanceolate to ovate, with short obtuse or acute apex; usually on wet rocks  
in or by streams.....*Sciuro-hypnum plumosum*<sup>5</sup>
11. a. Alar cells sharply distinct from other leaf cells, forming well-defined patches or  
auricles.....12.  
b. Alar cells undifferentiated, or, if somewhat different from other leaf cells, then not  
forming well-defined patches or auricles.....13.
12. a. Leaves variable but mostly narrowly lanceolate, always tapering to long acuminate apex;  
usually on wet ground in the lowlands.....*Drepanocladus aduncus*<sup>6</sup>  
b. Leaves shortly lanceolate to ovate, with short obtuse or acute apex; usually on wet rocks  
in upland streams..... *Hygrohypnella ochracea* (*Hygrohypnum ochraceum*)
13. a. Robust plant; leaves falcate but not very strongly so; hyalodermis absent; rare plant of  
calcareous wetlands.....*Drepanocladus lycopodioides*  
b. Medium-sized plant; leaves strongly falcate to circinate; hyalodermis present; common  
plants of base-rich to neutral wetlands.....14.
14. a. Plants usually relatively slender (shoots *ca.* 2 mm wide), green, irregularly pinnately  
branched; mid-leaf cells of stem leaves 20-90(-120)  $\mu$ m long, with  $\pm$  square  
ends.....*Scorpidium cossonii*<sup>7</sup>  
b. Plants usually relatively robust (shoots *ca.* 3 mm wide), brown or purple, sparsely  
branched; mid-leaf cells of stem leaves 61-140(-180)  $\mu$ m long, with  $\pm$  tapering  
ends.....*Scorpidium revolvens*

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<sup>4</sup> Forms of the rare *Drepanocladus lycopodioides* with slightly denticulate leaves might key out here; it is a much larger, calcicolous plant with broader, concave leaves.

<sup>5</sup>*S. plumosum* is normally distinct from *Brachythecium rutabulum* in its smaller size, slightly falcate leaves and habitat, but in the rare instances where they can be confused, the seta of *S. plumosum* is smooth below, papillose above, whereas that of *B. rutabulum* is papillose throughout; both produce capsules abundantly.

<sup>6</sup>*Drepanocladus sendtneri*, a rarer plant, will also key out here; it has a nerve 60-120  $\mu$  wide at base (40-60  $\mu$  in *D. aduncus*), extending into the leaf apex (3/4 way up in *D. aduncus*), with smaller, yellowish-brown alar cells (large and hyaline in *D. aduncus*). It occurs in base-rich places. Also beware occasional falcate-leaved forms of *Campylium chrysophyllum*, which is a much smaller plant.

<sup>7</sup> *Hamatocaulis vernicosus* is similar to *S. cossonii* and grows in similar habitats, but is much rarer; the shoots are hooked in a characteristic 'bishop's crozier' way at the apices; the leaves are slightly plicate, have a conspicuous orange-brown strip at the extreme base, and tend to taper from an erect base to a rather short apix.



## Section 16 – Pleurocarps with a costa and long cells, not falcate

Mosses in this section all have a distinct costa to mid-leaf or beyond, and are not falcato-secund, even at the shoot tips. Note that *Racomitrium* species (characterised by their very strongly and regularly sinuose cell walls) are not included here (See Section 5).

1. a. Plants dendroid, with a crown of branches at the top, giving a striking resemblance to miniature palm trees ..... *Climacium dendroides*  
b. Plants not strikingly dendroid.....2.
2. a. Alar cells clearly defined, clearly differentiated from other leaf cells; or, if alar cells less clearly defined, then leaves obtuse at apex.....3.  
b. Alar cells not clearly defined; if somewhat different from other leaf cells, then not *clearly* differentiated; leaves always acute to acuminate at apex, or with a hair-point.....17.
3. a. Alar cells small, incrassate, opaque, brownish.....4.  
b. Alar cells large, inflated,  $\pm$  hyaline.....8.
4. a. Habit sub-dendroid, resembling miniature bushes; widespread.....5.  
b. Habit not sub-dendroid, but procumbent and irregularly branched; oceanic species.....*Isothecium interludens*
5. a. Leaves longitudinally plicate; nerve ending in small abaxial tooth.....*Plasteurhynchium striatum*  
b. Leaves not plicate; leaves not ending in abaxial tooth.....6.
6. a. Leaves imbricate, concave (so shoots smooth-looking), their apices not finely drawn out, margins lightly toothed near tip only.....*Isothecium alopecuroides*  
b. Leaves narrowly ovate-lanceolate, finely drawn out at apices (so shoots more shaggy-looking), their margins toothed (sometimes only obscurely) all round.....7.
7. a. Leaves tapering to long or short acumen; pale green; common and widespread plant on tree bases and rocks.....*Isothecium myosuroides*<sup>1</sup>  
b. Leaves gradually or abruptly tapering to acute apex; often tinged orange-brown; scarce (but often locally abundant) plant of boulders by streams in upland areas.....*Isothecium holtii*
8. a. Leaves obtuse or apiculate.....9.  
b. Leaves gradually drawn out to narrowly acute or acuminate apex.....12.
9. a. Leaf with apiculate tip; plant with strong tinge of purplish-red; upland areas.....*Sarmentypnum sarmentosum*  
b. Leaf with broadly rounded tip; plant green to orange or brown, not purplish-red; lowland and upland areas.....10.

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<sup>1</sup> Note that *Scorpiurium circinatum* might key out with *Isothecium*, if the alar cells are interpreted as distinct; it has a very strong nerve and the leaves are much more strongly toothed.

10. a. Leaves narrowly oblong, held appressed to the long, weak, string-like stems.....*Straminergon stramineum*  
b. Leaves widely heart-shaped to ovate, erecto-patent to spreading.....11.
11. a. Plant distantly and irregularly branched; alar cells not forming very well-defined auricles.....*Calliergon cordifolium*  
b. Plant densely branched, giving bushy habit; alar cells forming very well defined auricles.....*Calliergon giganteum*
12. a. Leaves short, ovate-lanceolate, concave, erect or imbricate when dry, often  $\pm$  plicate, often shortly acuminate at apex; pale silvery-green plants.....*Brachythecium rivulare*  
b. Leaves long, lanceolate to narrowly lanceolate, not concave or plicate, variously spreading both wet and dry, tapering to long, acuminate apex; dark or yellow-green plants.....13.
13. a. Plants large, longest leaves 2 mm long or more; nerve never extending beyond  $\frac{3}{4}$  way up leaf.....14.  
b. Plants small, longest leaves <2 mm long; if longer, then nerve extending into acumen.....16.
14. a. Leaves denticulate; acid bog pools etc.....*Warnstorfia fluitans*  
b. Leaves entire; calcareous, coastal or eutrophicated lowland habitats.....15.
15. a. Basal cells porose, auricles extending to costa; leaf acumen long, fine, channelled.....*Drepanocladus polygamus*  
b. Basal cells not porose, auricles not extending to costa; leaf acumen long but not fine or channelled.....*Drepanocladus aduncus*
16. a. Nerve short, not reaching more than  $\frac{3}{4}$  way up the leaf.....*Campylium chrysophyllum*  
b. Nerve long, extending into acumen.....*Kandaea elodes*
17. a. Leaves strongly and clearly plicate.....18.  
b. Leaves not, or only weakly, plicate.....23.
18. a. Stem leaves broadly cordate-triangular, acute or abruptly narrowed to apex; leaf margins sharply toothed from base to apex; habit often 'bushy' .....*Eurhynchium striatum*<sup>2</sup>  
b. Stem leaves ovate to lanceolate, tapering gradually to  $\pm$  finely acuminate apex; entire or weakly denticulate; habit not usually conspicuously bushy.....19.

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<sup>2</sup>*Plasteurhynchium striatulum* may also key out here, if the alar cells have been interpreted as 'not clearly distinct'. It is much smaller than *E. striatum*, and has  $\pm$  distinct rounded-quadrate alar cells, whereas those of *E. striatum* are rectangular and not at all distinctly differentiated from the other leaf cells. It is also much rarer, and  $\pm$  confined to south-western areas. *P. meridionale* is a very rare southern plant about the same size as *E. striatum* but is much more densely branched and lacks the 'bushy' habit, instead forming dense patches.

19. a. Leaves broadly ovate,  $\pm$  acuminate, widening just above base, then contracting rather abruptly near the fine tip of varying length; leaf cells shorter and wider towards base.....20.  
 b. Leaves lanceolate, narrowing gradually from the extreme base to long fine apex; leaf cells all very long and narrow, except at *extreme* base.....22.
20. a. Alar cells  $\pm$  quadrate, ascending up margins; leaves imbricate when dry, giving shoots string-like appearance.....*Brachythecium albicans*  
 b. Alar cells rectangular or rounded, not ascending up margins; leaves  $\pm$  spreading, so shoots not string-like.....21.
21. a. Acumen of stem leaves twisted; leaf margins often denticulate above; alar cells somewhat inflated, slightly differentiated from other leaf cells; usually in calcareous grassland or sand-dunes.....*Brachythecium glareosum*<sup>3</sup>  
 b. Acumen of stem leaves not twisted; leaf margins entire or slightly sinuose; alar cells  $\pm$  rectangular, hardly differentiated from other leaf cells; fens, dune slacks, tracks, car parks, etc.....*Brachythecium mildeanum*<sup>4</sup>
22. a. Plant creeping, the main shoots firmly attached by rhizoids to walls, rocks or tree trunks.....*Homalothecium sericeum*  
 b. Plants  $\pm$  erect, bushy, the main shoots attached to substrate only at base; calcareous grassland and sand-dunes.....*Homalothecium lutescens*
23. a. Leaf as a whole  $\pm$  ovate but abruptly contracted at apex to a long greenish hairpoint.....*Cirriphyllum piliferum*  
 b. This unique leaf form lacking.....24.
24. a. Strongly heterophyllous, stem leaves large, triangular and contracted to long narrow apex; branch leaves small, ovate-lanceolate; very common.....*Kindbergia praelonga*<sup>5</sup>  
 b. Stem and branch leaves  $\pm$  alike in form .....25.
25. a. Leaves strongly concave and  $\pm$  imbricate, giving shoots a smooth appearance; leaf apex shortly acute, obtuse or apiculate, but never finely acuminate.....26.  
 b. Leaves not, or weakly, concave,  $\pm$  spreading, so shoots not smooth; leaf apex usually finely acuminate, occasionally shortly acute.....31.
26. a. Leaf abruptly contracted at apex to short, reflexed apiculus (bristly shoot tips under hand lens); robust plant with very swollen, 'fat' shoots (because of leaf concavity); very common in grassland etc.....*Pseudoscleropodium purum*

<sup>3</sup>*Brachythecium salebrosum* may also key out here; the leaves have fewer alar cells, and the basal cells near the nerve are porose; the stem leaf acumen is not twisted. The seta is smooth, a useful feature distinguishing it from slightly plicate-leaved forms of *B. rutabulum*. It is a scarce southern species of rotting logs etc.

<sup>4</sup> This species can look very different in different habitats. Forms growing in fens and dune slacks can be large and conspicuous, whereas forms in places such as car parks and gravel paths are usually thin and wispy.

<sup>5</sup> *Eurhynchiastrium pulchellum*, a rare plant of dry base-rich crevices in upland areas, may key out here; the crowded,  $\pm$  imbricate leaves are much shorter and stubbier than in *K. praelonga*.

- b. Leaf without apiculus; more slender, less swollen, less abundant species of various habitats.....27.
27. a. Nerve very stout in lower part of leaf, abruptly narrowing and ceasing just above mid-leaf; mid-leaf cells *ca.* 5-8x as long as wide; bright green.....*Cirriphyllum crassinervium*  
b. Nerve slender; mid-leaf cells *ca.* 6-20x as long as wide; usually pale green.....28.
28. a. Plant very glossy, on calcareous rock ledges and walls; leaves with poorly-defined auricles; seta smooth; capsule lid long-beaked.....*Rhynchostegium murale*  
b. Less glossy, not necessarily in calcareous habitats; leaves without auricles; seta rough; capsule lid not beaked (but capsules rare).....29.
29. a. Shoots sparsely branched; on submerged or emergent rocks in fast-flowing streams.....*Rhynchostegium alopecuroides*  
b. Shoots richly branched with short, often curved branches; habitat various.....30.
30. a. Leaf cells *ca.* 6-12x as long as wide; usually growing on walls, rocks, tree roots etc near water.....*Scleropodium cespitosum*  
b. Leaf cells *ca.* 10-20x as long as wide; usually growing in coastal turf.....*Scleropodium touretii*
31. a. Leaves either narrow throughout (3-5x longer than wide) or tapering to long, drawn-out acuminate apex; leaf margin entire or weakly toothed, and usually only near apex.....32.  
b. Leaves usually 2-3x longer than wide, with acute to shortly acuminate apex; if more longly drawn out, then leaf margins  $\pm$  strongly toothed from base to apex.....44.<sup>6</sup>
32. a. Costa extending all the way to apex of leaf.....33.  
b. Costa extending to  $\frac{3}{4}$  the way up leaf at the most.....34.
33. a. Leaves appressed to erecto-patent;  $\pm$  procumbent, silky, green plants on rocks, walls and tree stumps.....*Sciuro-hypnum populeum*  
b. Leaves  $\pm$  widely spreading;  $\pm$  straggling dingy green to yellowish plants in calcareous turf in fens, swamps, etc.....*Kandaea elodes*
34. a. Large plants; longest leaves >2 mm long.....35.  
b. Small plants; longest leaves <2 mm long.....39.
35. a. Leaves long and thin, mostly >3 x longer than wide, often widely spreading.....36.  
b. Leaves shorter and wider, mostly <3 x longer than wide, erecto-patent.....38.

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<sup>6</sup> *Platyhypnum (Hygrohypnum) smithii*, a rare plant of mountain streams, has very broad, ovate to orbicular leaves, unlike the other plants in this part of the key.

36. a. Leaves variously oriented, but not usually widely spreading or sub-complanate, distinctly denticulate near apex; pseudoparaphyllia present; wet, acid, nutrient-poor habitats  
.....*Warnstorfia fluitans*  
b. Leaves widely spreading, sometimes sub-complanate, usually entire; pseudoparaphyllia absent; wet, neutral to basic, often nutrient-rich habitats.....37.
37. a. Leaves sometimes sub-complanate; mid-leaf cells (5-)7-15x longer than wide.....*Leptodictyum riparium*  
b. Leaves not sub-complanate; mid-leaf cells 2.5-5x longer than wide.....*Hygroamblystegium humile*
38. a. Stem leaves longly tapering to fine acuminate apex; leaf margins  $\pm$  entire; seta smooth.....*Brachythecium mildeanum*  
b. Stem leaves ovate or ovate-lanceolate, apices acute to acuminate but not fine; leaf margins denticulate; seta coarsely papillose.....*Brachythecium rutabulum*
39. a. Leaves oblong-lanceolate to lanceolate-triangular, acute to subobtuse at apex or, if longly tapering at apex, then doing so from leaf base; seta smooth or papillose.....40.  
b. Leaves ovate-lanceolate to cordate at base, tapering  $\pm$  abruptly from ca.  $\frac{1}{3}$ - $\frac{1}{2}$  way up leaf to long fine acumen; seta smooth.....43.
40. a. Leaves linear-lanceolate, 5-10x longer than wide; seta smooth.....*Rhynchostegiella tenella*<sup>7</sup>  
b. Leaves lanceolate-triangular, ca. 4x longer than wide; seta papillose.....41.
41. a. Leaves widest at base, lanceolate-triangular with long filiform apex..... *Brachytheciastrum velutinum*  
b. Leaves widest above base, lanceolate to oblong-lanceolate, acute to subobtuse at apex.....42.
42. a. Costa extending  $\frac{1}{2}$ - $\frac{2}{3}$  way up leaf, mid-leaf cells 44-72  $\mu$ m long, 8-10x as long as wide.....*Rhynchostegiella curviseta*  
b. Costa extending  $\frac{3}{4}$  or more way up leaf, mid-leaf cells 32-48  $\mu$ m long, 5-7x as long as wide.....*Rhynchostegiella teneriffae*
43. a. Leaves up to 1.5 mm long, with long channelled acumen; leaf cells 5-7  $\mu$ m wide, 5-8x longer than wide; golden-green patches on chalk or limestone.....*Campylium chrysophyllum*  
b. Leaves <1 mm long, apex not channelled; leaf cells 7-10  $\mu$ m wide, 3-6x longer than wide; green patches in a variety of habitats.....*Amblystegium serpens*
44. a. Large plants; longest leaves >2 mm long.....45.  
b. Small plants; longest leaves <2 mm long.....48.

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<sup>7</sup> *Rhynchostegiella litorea* is a rare southern plant with slightly shorter leaves than *R. tenella* and a papillose seta; it is usually on tree stumps (*R. tenella* usually on base-rich rock).

45. a. Plants bright pale silvery-green; leaves denticulate above; very common plant of lowland anthropogenic habitats.....*Brachythecium rutabulum*  
 b. Plants dark green; leaves denticulate from base to apex.....46.
46. a. Leaf apices acuminate, twisted.....*Rhynchostegium megapolitanum*  
 b. Leaf apices obtuse to acuminate, not twisted.....47.
47. a. Plants little-branched; leaves with nerve not ending in an abaxial tooth; seta smooth; in or beside running water.....*Rhynchostegium riparioides*  
 b. Plants  $\pm$  richly and irregularly branched; leaves with nerve often ending in an abaxial tooth; seta papillose; wet ground, tree boles etc in swamp woodland etc..... *Oxyrrhynchium speciosum*
48. a. Cells in mid-leaf no more than *ca.* 6x longer than wide.....49.  
 b. Cells in mid-leaf up to *ca.* 18x longer than wide.....51.
49. a. Slender plant, branching  $\pm$  sub-dendroid with short curved branches; heterophyllous, with stem leaves  $\pm$  abruptly narrowed from wide triangular base to long acuminate apex, and branch leaves ovate to lanceolate; leaves imbricate to erecto-patent, mostly >1 mm long, strongly toothed.....*Scorpiurium circinatum*  
 b. Very slender plant, irregularly branched; stem and branch leaves of similar shape; leaves spreading, <1 mm long, entire to  $\pm$  denticulate above.....50.
50. a. Leaves ovate to ovate-lanceolate, shortly pointed; seta papillose.....*Microeurhynchium pumilum*  
 b. Leaves tapering to long, acuminate apex; seta smooth.....*Amblystegium serpens*<sup>8</sup>
51. a. Leaf apex twisted, cells very narrow, *ca.* 3-5  $\mu$ m wide..... *Oxyrrhynchium schleicheri*  
 b. Leaf apex not twisted, cells wider, *ca.* 5-11  $\mu$ m wide.....52.
52. a. Leaves triangular-ovate, with shortly acute tips; leaves sometimes ending in an abaxial tooth.....53.  
 b. Leaves ovate-lanceolate, with finely acute to acuminate tips; if leaves relatively short and wide, then nerve not ending in an abaxial tooth.....54.
53. a. Leaves  $\pm$  appressed and imbricate, concave, the margins only slightly denticulate.....*Scleropodium cespitosum*  
 b. Leaves spreading, not at all concave, the margins coarsely toothed...*Oxyrrhynchium hians*
54. a. Leaves narrowly ovate-lanceolate, often faintly plicate and very slightly falcate at shoot tips, tapering to fine points; seta rough; capsule lid short.....*Brachytheciastrum velutinum*

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<sup>8</sup> *Conardia compacta* may key out here; it is a rare plant of dry, deeply shaded limestone soil, and can be identified by having leaves strongly denticulate below, and uniseriate gemmae produced near the leaf apex.

b. Leaves wider and slightly shorter in the point, never plicate or falcate; seta smooth;  
capsule lid long-beaked.....*Rhynchostegium confertum*