



# The *Ulota crispera* group in Britain and Ireland, with notes on other species of the genus

**Tom Blockeel** introduces some newly recognised species of *Ulota* and discusses the identification of species in this fascinating genus

**U***lota crispera* has been a problematic species since the earliest days of European bryology. In Britain and Ireland the treatment of its status has been inconsistent, and there has been much confusion with *U. bruchii*. Dixon (1924) maintained *U. bruchii* as distinct from *U. crispera*, but included two vaguely defined varieties within *U. crispera*, var. *crispula* and var. *intermedia*. Smith & Hill (1975) united *U. crispera* with *U. bruchii*, distinguishing the latter as a variety, *U. crispera* var. *norvegica*, and this treatment was adopted in the first edition of the *Moss Flora of Britain and Ireland* (Smith, 1978). Subsequently Smith & Proctor (1993) reinstated *U. bruchii* as a separate species using characters based on the cell structure at the capsule mouth and the ornamentation of the outer peristome teeth, but considered that ca 5% of specimens were not satisfactorily identifiable.

However a few years later Garilleti *et al.* (2001) pointed out that the ornamentation of the inner peristome segments provides a clear point of distinction between the two species. Unfortunately this character was underplayed by Smith (2004) in the second edition of his *Flora*. He referred to it but did not describe it, and it has therefore not been appreciated by many British and Irish bryologists. Even after the exclusion of *U. bruchii*, *U. crispera* remained

a variable species, but recently bryologists in Spain have studied it in detail, using both morphological and molecular techniques. They have demonstrated that the old varieties *crispula* and *intermedia* are actually distinct species, and have defined the characters that are most useful for their identification (Caparrós *et al.*, 2016).

*Ulota calvescens* has probably also contributed to the confusion in recognising *U. crispera*. Old sporophytes of *U. calvescens* are similar to those of *U. crispera* s.str., and following the recent discovery of *U. calvescens* in the Pennines (Blockeel & Turner, 2013), it has become clear that it occurs widely in parts of central and southern England. It surely remains much under-recorded, and doubtless it has been overlooked in favour of *U. crispera*. A further source of difficulty within the genus is the separation of *U. bruchii* from *U. drummondii*, especially when capsules are old and it is uncertain whether inner peristome segments are genuinely absent or have simply fallen away. The number of stomata in the capsules is now known to be of limited use in separating the two species (Erzberger, 2003).

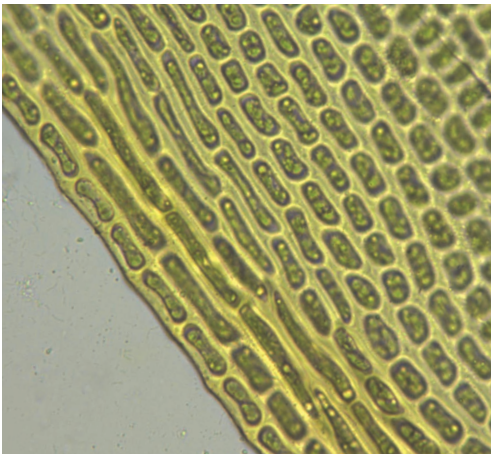
The aim of this paper, therefore, is to describe the segregates of the *U. crispera* group and their diagnostic characters, and to provide notes on the identification of *U. drummondii*, *U. bruchii* and *U. calvescens*.

## Diagnostic characters in the genus *Ulota*

### 1. Leaves

Leaf characters are of limited value in identifying *Ulota* species, but with two notable exceptions.

**1.1 Marginal leaf cells above the base.** In *Ulota calvescens* there is a band of elongate cells inside the margin of the leaf that reaches some distance above the base, up to mid-leaf or thereabouts when well-developed (Fig. 1). It varies in its development from leaf to leaf, even on different sides of the same leaf, but is always distinct and obvious in most leaves. Among our other *Ulota* species, only *U. phyllantha* may have a similar band of elongate cells. The leaves of *U. calvescens* are also characteristic in having a deep fold on each side of the leaf base. However the fold is indistinct in some specimens, and a slight fold may be found in other species of the genus. It is less useful as a diagnostic character than the band of elongate cells.



△Fig. 1. Band of elongate cells inside the lower leaf margin of *Ulota calvescens*.

**1.2 Shape of the leaf base.** Some *Ulota* species have a strongly concave leaf base that is abruptly narrowed at the transition to the lamina (Fig. 2).

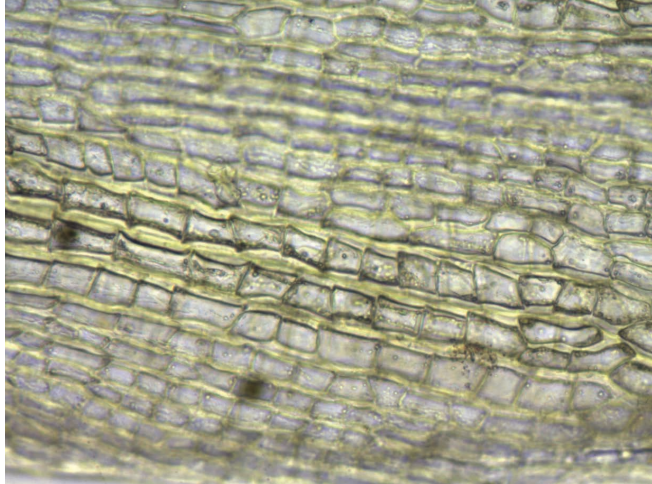
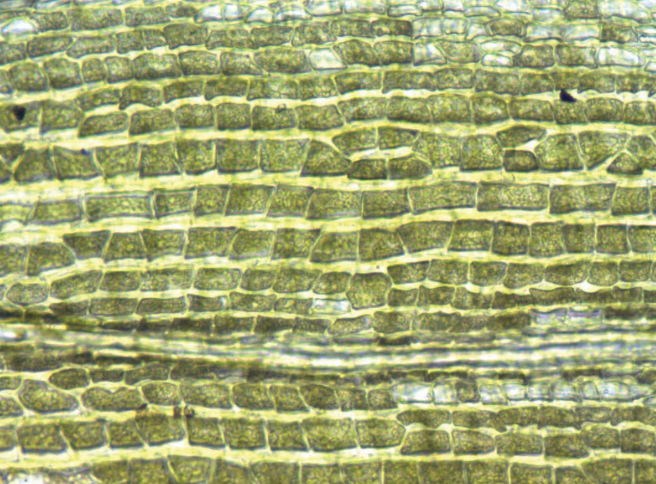
In other species the base is only weakly concave and it narrows gradually to the lamina (Fig. 3). This character is important in separating the species of the *U. crispata* group. The first type (concave and abruptly narrowed) is found in *U. crispata* s.str. and *U. intermedia*, the second type in *U. crispula*. However the difference is not always completely clear-cut, and in such cases it is important to check several mature leaves from more than one shoot.



△Fig. 2. Leaf of *Ulota intermedia* with expanded base.



△Fig. 3. Leaves of *Ulota crispula* gradually tapered at base.



△Fig. 4. Exothelial cells of *Ulota crispera*, with broad ribs. △Fig. 5. Exothelial cells of *Ulota intermedia*, with narrow ribs.

**1.3 Curling of the leaves when dry.** This varies somewhat and it is not therefore a primary character for identification. However it can be useful in the field and as a supporting character. In *U. coarctata* the leaves are almost straight, and in *U. bruchii* and *U. drummondii* only weakly curved or twisted. Within the *U. crispera* group, the leaves of *U. crispula* are less curled or crisped than in *U. crispera* s.str. and *U. intermedia*.

## 2. Sporophytes

Sporophytes are essential for the identification of most of our *Ulota* species. Only *U. phyllantha* and *U. calvescens* can be identified reliably from leaf characters alone. The shape of the capsule changes greatly as it matures and ages, and is at its most distinctive after the spores are shed. However very old capsules can lose their distinctive shape, and the inner peristome segments often break away with age. The capsules must be in dry condition to assess their shape.

**2.1 Seta length.** Seta length is variable but it can be a useful character, particularly in the field. Many species typically have long setae and the tufts take on a characteristic 'pincushion' appearance, notably *U. bruchii*, *U. drummondii*, *U. calvescens* and *U. crispera* s.str. By contrast, *U. crispula* often has short setae and then the capsules are only slightly raised above the tops of the tufts.

**2.2 Shape of dry empty capsules.** Before the fall of the lid, *Ulota* capsules are rather similar

in shape across the different species. Most of the species have ribbed capsules, and as the spores are shed the ribs become more pronounced and the capsules take on a distinctive shape. Only in *U. coarctata* are ribs almost absent, and consequently this species has an inflated capsule, in the shape of an inverted pear, and puckered only at the very narrow mouth. *U. drummondii* and *U. bruchii* are also narrow at the mouth but these species are strongly ribbed and the urns are narrow, tapering gradually to the mouth, which is contracted and normally takes on a stellate (star-like) outline when viewed from above (end-on). *Ulota crispera* s.str. also has strongly ribbed capsules, but the urn is narrowest below the mouth, which is flared and has a more or less circular outline when viewed from above. *U. calvescens* is similar. In *U. crispula* and *U. intermedia* the mouth is wide and circular but the urn has narrower ribs and is only weakly contracted, if at all. The urns therefore tend to have a shortly cylindrical shape.

**2.3 Width of the ribs.** The ribs of the capsules are formed from bands of cells that have extremely thick longitudinal walls. In most species the bands are formed from 4-6 rows of cells, but *U. crispula* and *U. intermedia* have narrower bands, 2-4 cells wide (Figs. 4, 5 from moist capsules). In these two species, the furrows between the bands are clearly visible in empty capsules. In *U. crispera* s.str. there is no gap, or only a slight gap, between the ribs in the contracted part of the urn, and they are almost contiguous. *U. drummondii* has the widest ribs among our species. The bands are

normally 5-8 rows wide, and they are often wider than the furrows, which are deeper than in other species.

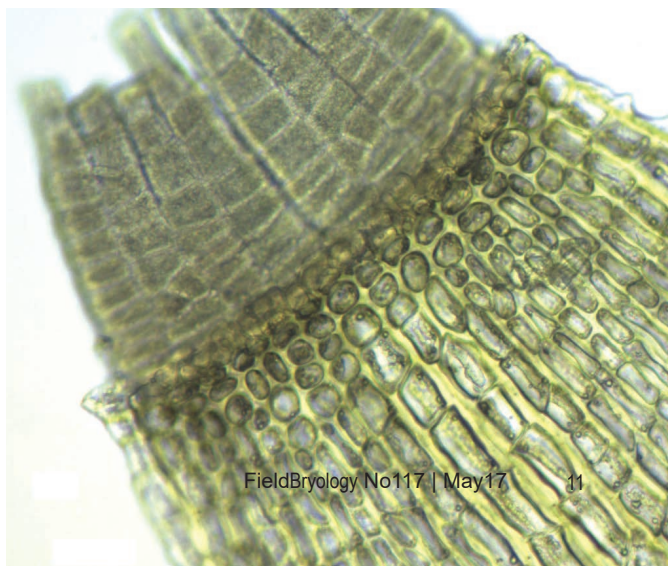
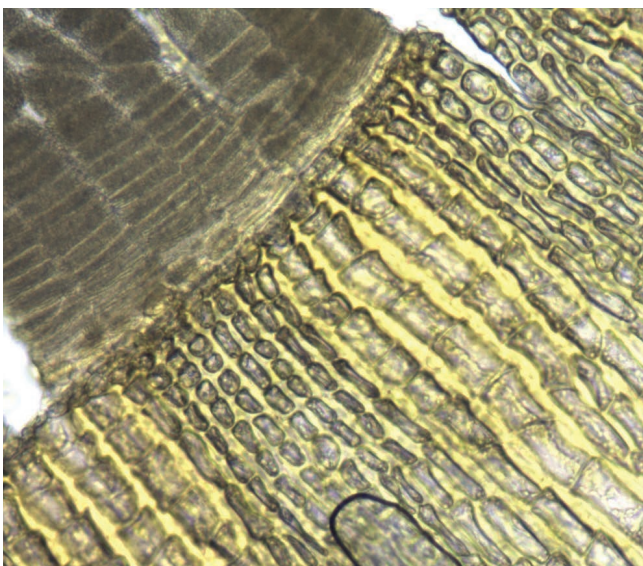
**2.4 Cells at capsule mouth.** This character concerns the extent to which the cells of the ribs reach up to the capsule mouth (Fig. 6) or almost so, or cease clearly below the mouth (separated from it by (1-)2-3 rows of small rounded cells) (Fig. 7). These figures show 'ideal' cases; the difference is occasionally less obvious, but not normally in doubt. In his Moss Flora Smith (2004) uses it as a key character for distinguishing *U. bruchii* and *U. crispera*, and it is indeed important. In fact, however, *U. crispera* in the narrow sense matches *U. bruchii* in having ribs that reach the capsule mouth or almost so (sometimes separated by 1(-2) rows of small cells). Only in *U. crispula* and *U. intermedia* is there a zone of (1-)2-3 rows of small rounded cells (Fig. 7). This explains why bryologists have had difficulty making the character work for *U. crispera* as defined in Smith's Flora.

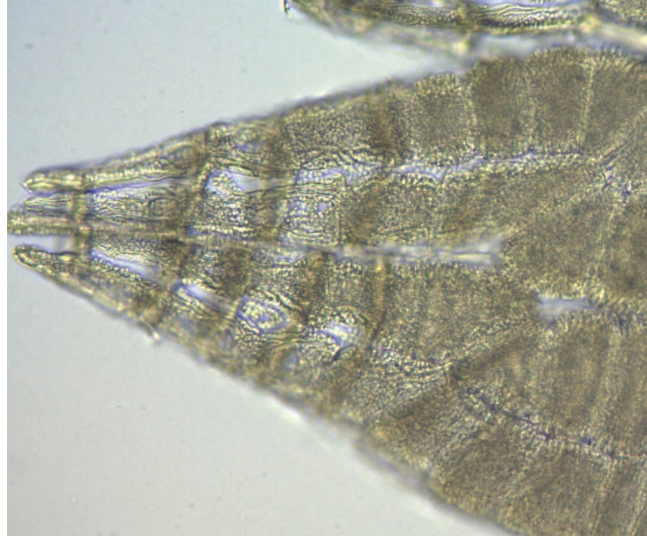
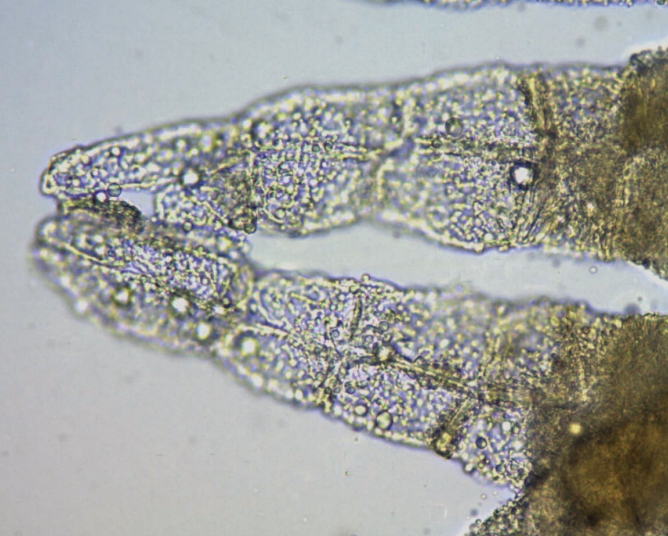
**2.5 Colour of the lid.** In many *Ulota* species the lid is entirely green, but an orange-red basal

rim is present in few species. This contrasts with *Orthotrichum*, where a reddish or orange basal rim is a common feature. In *Ulota*, it often occurs in *U. crispula* and less obviously and less constantly in *U. calvescens* and *U. drummondii*. When present, however, it is a useful supporting character.

**2.6 Outer peristome teeth.** In most species of *Ulota* the outer peristome (exostome) teeth are recurved and pressed against the capsule wall when dry, but in *U. drummondii* the teeth are erect or spreading to deflexed, often irregularly so. Caution is needed, however, as old capsules of *U. bruchii* sometimes have irregularly spreading peristome teeth. The colour of the teeth can also be unreliable. *U. drummondii* usually has white teeth, but the teeth of *U. bruchii* can become pale or whitish with age. There are some subtle differences in the ornamentation of the peristome teeth between different species, but it is not generally very useful for identification. However, *U. drummondii* is distinct in having a coarse openly-spaced ornamentation of lines and papillae, at least in the upper half of the tooth (Fig. 8), and this is a good point of

▽Fig. 6 (left). Capsule of *Ulota bruchii*, showing ribs reaching the capsule mouth. ▽Fig. 7 (right). Capsule of *Ulota intermedia*, showing 2-3 rows of rounded cells separating the ribs from the mouth.





△Fig. 8 (left). Outer peristome of *Uloa drummondii*, with open network of lines and papillae. △Fig. 9 (right). Outer peristome of *Uloa bruchii*, with dense network of lines and papillae.

distinction from *U. bruchii* (Fig. 9), in which the ornamentation is dense over most of the tooth, except at the apex. In most of the species the outer peristome teeth tend to split into 16 with age, but in *U. crispa* s.str. they nearly always remain joined.

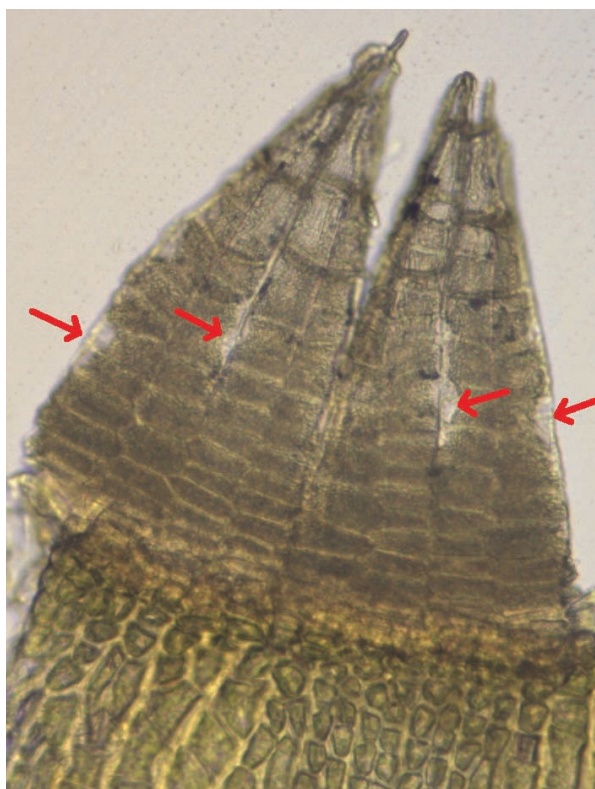
There is an unusual feature in the teeth of *U. crispa* s.str. The outer peristome layer is patchily

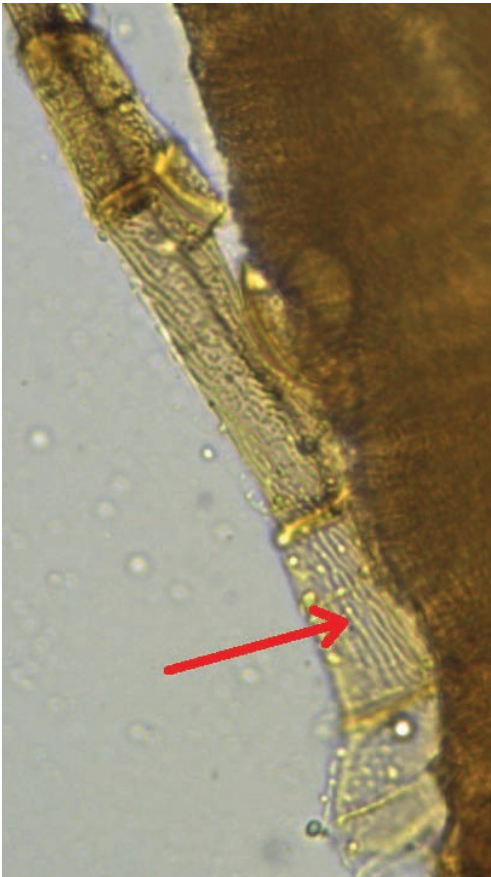
resorbed along the teeth margins, producing a partial 'halo' on the edge of the teeth (Fig.10). Although not absolutely constant (it is indistinct in a small minority of specimens), this is a useful confirmatory character in separating *U. crispa* from related species.

**2.7 Inner peristome segments.** The inner peristome (endostome) segments in *Uloa* are narrow and delicate, but they provide important characters for the identification of *U. bruchii* and the species of the *U. crispa* group. The lower half of the segment is ornamented by distinct lines or striations in *U. bruchii* (Fig. 11), but is smooth or finely papillose in the *U. crispa* group. Within the latter group, the cross-walls of the segments are important in separating *U. intermedia* (with thickened cross-walls) from *U. crispula* (with thin cross-walls) (Figs. 12, 13). The segments are absent or rudimentary in *U. drummondii*.

**2.8 Calyptra.** Most of our *Ulotas* have bristly calyptrae, but in *U. calvescens* the calyptra often has very few hairs (hence the name *calvescens*, 'going bald'). The near-absence of hairs has been treated as diagnostic for *U. calvescens* but in fact it can be moderately bristly, and for that reason it has been widely overlooked.

◁Fig. 10. Outer peristome of *Uloa crispa*, showing teeth with partial 'halo' (arrowed).





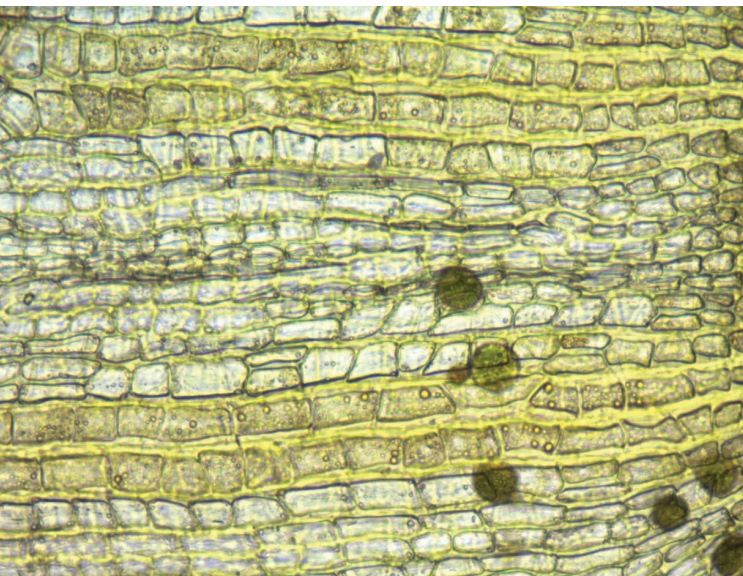
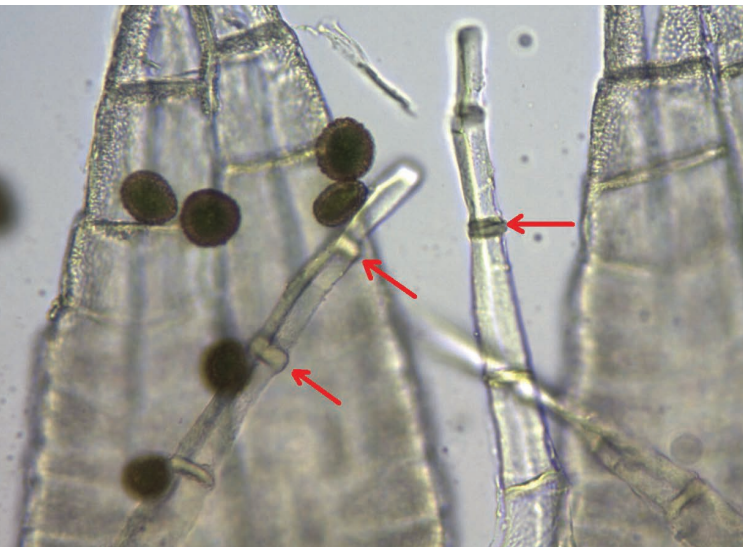
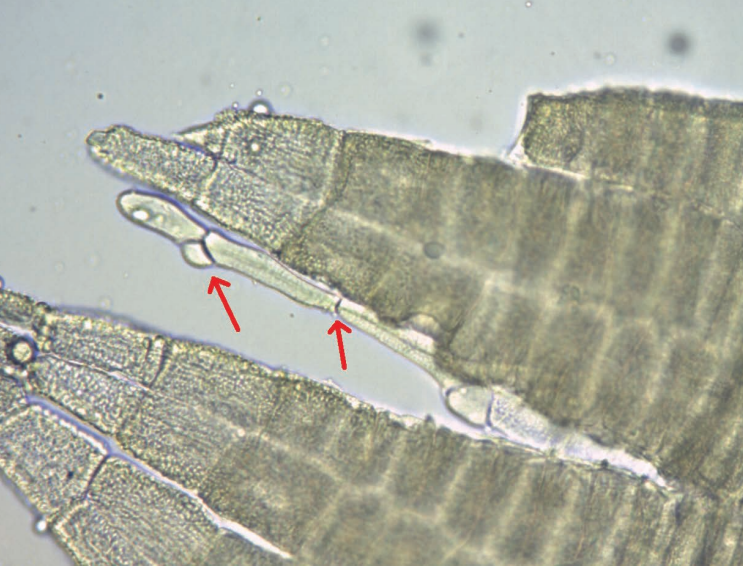
△Fig. 11. Endostome segment of *Ulota bruchii*, ornamented with striations near the base (arrowed).

**2.9 Timing of capsule maturity.** This was discussed by Jones (1947). Some species fruit early, notably *U. calvescens* and *U. crispula*. The capsules dehisce in late spring and early summer (May-July). *U. crisper* s.str. and *U. intermedia* are somewhat later, maturing their capsules in summer (typically July-August). *U. bruchii* and *U. drummondii* are later still, but with a more extended fruiting period, from autumn into winter. These timings are only a guide, and of course there will be variations based on geographical location.

### Notes on individual species

***Ulota crisper* s.str.** The true *Ulota crisper* is quite a distinctive species, and much of the previous confusion has arisen from the fact that the ribs of the capsule reach right up to the mouth, just as in *U. bruchii*. In other respects its capsules are very different from those of *U. bruchii*. They are contracted below the mouth, which is wide and therefore somewhat flared, and has a circular shape when viewed end-on. It is also distinguished from *U. bruchii* in having the inner peristome segments ± smooth or finely papillose (not striate) in their lower half. A further distinctive feature is the partial or interrupted 'halo' along the edges of the outer peristome teeth (see 2.6 above), though this is occasionally indistinct. This last character also separates it from *U. crispula* and *U. intermedia*. In addition, the latter two species have (1-)2-3 rows of small rounded cells separating the tops of the ribs from the capsule mouth. The characters separating all three species of the *U. crisper* group are summarised in Table 1. *U. calvescens* and *U. crisper* both have long setae, and the two species are quite similar after the dehiscence of the capsules. The differences are discussed under *U. calvescens*.

***Ulota crispula* and *U. intermedia*.** These two closely related species are separated from *U. crisper* s.str. by several characters: the width of the ribs, the cells at the capsule mouth, the tendency of the outer peristome teeth to split with age, and the absence of a partial 'halo' on the outer peristome teeth (see 2.3, 2.4 and 2.6 above). The two species, however, are more difficult to distinguish from each other. They share a similar capsule shape and morphology, the urns being shortly cylindrical when dry and empty, and only slightly contracted below the mouth. On average



*U. crispula* has shorter setae, often not exceeding 2mm, such that the capsules often sit just above the top of the tufts rather than being raised well above them. It also usually has an orange-red rim to the capsule lid. The leaves are only lightly curled in *U. crispula*, strongly so in *U. intermedia*. However there is some overlap in the seta length between the two species, and the capsule lid is often unavailable. In practice the two most useful characters are the shape of the leaf base and the inner peristome segments. *U. crispula* has the leaf base weakly concave and gradually narrowed, and the segments are variably bent when dry, uniseriate or irregularly biseriate, with thin cross-walls in their upper part (Fig. 12); *U. intermedia* has a strongly concave, expanded leaf base, and the segments are incurved when dry, uniseriate, with distinctly thickened and prominent cross-walls (Fig. 13). Caparrós *et al.* (2016) give a further difference between the two species. The cells of the capsule ribs are said to be evenly pale yellow in *U. crispula*, but hyaline with yellow lateral walls in *U. intermedia*. However, I have not been able to see this character clearly

△Fig. 12 (Top). Peristome of *Ulota crispula*, showing two outer teeth and between them an endostome segment with thin cross-walls (arrowed).

△Fig. 13 (middle). Peristome of *Ulota intermedia*, showing two endostome segments with thickened cross-walls (arrowed).

△Fig. 14 (bottom). Exothecial cells of *Ulota crispula*, with narrow ribs in which the cells are uniformly pale yellow.

in some specimens of *U. crispula*, although the pale yellow ribs are sometimes distinct (Fig. 14, compared with Fig. 5). Like *U. calvescens*, *U. crispula* is an early fruiter, the capsules maturing in late spring (May-July). *U. intermedia* is somewhat later, maturing in summer (July-August).

***Ulotia calvescens*.** This is our only *Ulotia* with a long seta that produces capsules early in the year. In the field, therefore, it is fairly easy to detect in spring and early summer, when its pincushion tufts with maturing capsules are distinctive. Sometimes the calyptra has few hairs (a good field character in that case) but it may also be bristly, a feature that has been understated in the Floras. When the capsules are old and empty, they are similar to those of *U. crisper*, contracted below the mouth and with strong ribs. A useful field character at this time is provided by the outer peristome teeth. The eight pairs of teeth tend to split readily so that there appear to be 16 teeth, whereas in *U. crisper* the eight pairs remain united. Under the microscope, *U. calvescens* is easily recognised by the presence of a band of elongate cells near the lower leaf margins above the base (see 1.1 and Fig. 1).

***Ulotia bruchii*.** This is the commonest epiphytic *Ulotia* in most parts of Britain and Ireland. The dry empty capsules are tapered to the narrow mouth (occasionally slightly contracted below the mouth), which usually takes on a star-like shape when viewed end-on. The ribs of the capsule reach right up to the mouth, and this separates it from *U. intermedia* and *U. crispula*. The true *U. crisper* also has ribs that reach right up to the mouth, but it is distinct from *U. bruchii*, even in the field, by the shape of the dry empty capsule (contracted below the mouth, which is wide and has a circular shape when viewed

end-on). If there is any uncertainty, *U. bruchii* can be separated from all the species of the *U. crisper* group by the ornamentation of the inner peristome segments (see 2.7 above and Fig. 11). The peristome teeth in old capsules of *U. bruchii* can take on an irregular posture and can then be confused with *U. drummondii*. The presence of inner peristome segments immediately eliminates *U. drummondii*, but this may be difficult to prove in old capsules. The two species can then be separated by the ornamentation of the outer peristome teeth (2.6 above) and the width of the capsule ribs (2.3 above). *U. bruchii* is one of the last of our *Ulotia* species to mature its capsules during the year. Typically they dehisce from autumn into winter.

***Ulotia drummondii*.** This *Ulotia* has several distinctive characters. The capsules are typically deeply ribbed, very narrow, and tapering to the mouth (or occasionally slightly widened at the mouth). The outer peristome teeth are whitish and very variable in posture, characteristically erect or spreading, sometimes deflexed, often twisted or contorted, and this can be striking in the field. Care is needed, however, as old capsules of *U. bruchii* can sometimes take on a similar appearance. The absence of well-developed inner peristome segments is diagnostic for *U. drummondii*, but the fragility of the segments in species that have them makes this a difficult character to evaluate in old capsules. Microscopically *U. drummondii* can be confirmed by the ornamentation of the outer peristome teeth (2.6 above, and Fig. 8) and to some extent by the width of the capsule ribs (2.3 above). Floras emphasise the tendency of the shoots to become prostrate at the edges of the tufts, but in practice this may not be apparent in young growths.



**Key to British and Irish *Ulotia* species**

*Note: capsule shape in the key is based on dry empty capsules.*

- 1a.** Brownish gemmae produced in abundance on the leaf apices; nerve excurrent as a strong cusp, which is usually tinged red-brown and visible after dispersal of the gemmae; capsules extremely rare.....*U. phyllantha*
- 1b.** Leaf apices without gemmae, nerve not forming a strong cusp; capsules commonly present.....**2**
  
- 2a.** Capsule inflated, pear-shaped (widest above the middle), smooth almost throughout, ribs formed only at the mouth, which is very narrow and puckered.....*U. coarctata*
- 2b.** Capsule variously shaped but not inflated or pear-shaped, ribs prominent, at least in the upper half of the capsule; mouth wide or narrow. ....**3**
  
- 3a.** Leaves when dry rigidly erect; capsule mouth wide and rounded; on rocks and boulders in northern and western Britain, very rare in Ireland.....*U. butchinsiae*
- 3b.** Leaves curled, twisted or crisped when dry; capsule mouth wide and rounded or narrow and star-shaped; mostly on trees, very occasionally on walls and rocks.....**4**
  
- 4a.** Band of elongate cells present inside the leaf margin above the base; calyptra sometimes only sparsely hairy, but often with numerous hairs. ....*U. calvescens*
- 4b.** Leaves without a distinct band of elongate cells inside the lower leaf margin; calyptra always strongly hairy.....**5**
  
- 5a.** Capsules tapered in the upper part to a narrow mouth, which is typically star-shaped when viewed from above (rarely slightly widened at the mouth); outer peristome teeth reflexed, erect or irregularly spreading; inner peristome segments ornamented with striations in their lower part, or rudimentary.....**6**
- 5b.** Capsules contracted below the mouth or cylindrical; mouth wide, rounded when viewed from above; outer peristome teeth reflexed; inner peristome segments smooth or finely papillose in their lower part, always well-developed but often lost from old capsules.....**7**
  
- 6a.** Inner peristome segments absent or rudimentary; outer peristome teeth with an open network of lines and papillae, at least in the upper half; ribs of capsule normally 5-8 rows wide, often broader than the furrows.....*U. drummondii*
- 6b.** Inner peristome segments present, well-developed (but may be lost from old capsules); outer peristome teeth densely and finely papillose for most of their length; ribs of capsule normally 3-4(-5) rows wide, narrower than the furrows.....*U. bruchii*
  
- 7a.** Capsule contracted below the mouth; capsule ribs 4-5(-6) cells wide; ribs reaching up to the

capsule mouth, occasionally separated by 1(-2) rows of small cells; outer peristome teeth with resorption gaps along the teeth margins (Fig. 10), producing a partial 'halo' on the edge of the teeth (halo rarely lacking).....*U. crispa*

**7b.** Urn of capsule cylindrical or nearly so, only weakly contracted below the mouth; capsule ribs 2-4 cells wide; ribs ceasing below capsule mouth, separated by (1-)2-3 rows of small rounded cells; outer peristome teeth lacking a partial 'halo', or almost so.....**8**

**8a.** Leaf bases weakly concave, gradually narrowed at the shoulder; inner peristome segments variably bent when dry, uniseriate or irregularly biseriate, with thin or weakly thickened cross-walls (Fig. 12); lid of capsule often with an orange-red rim, sometimes green.....*U. crispula*

**8b.** Leaf bases strongly concave, abruptly narrowed at the shoulder; inner peristome segments incurved when dry, uniseriate, with distinctly thickened and prominent cross-walls (Fig. 13); lid of capsule uniformly green.....*U. intermedia*

**Table 1.** Summary of diagnostic characters for the *Ulota crispa* group

Character	<i>Ulota crispa</i> s.str.	<i>Ulota crispula</i>	<i>Ulota intermedia</i>
<b>Shape of leaf base</b>	Strongly concave, expanded with distinct shoulder	Weakly concave, gradually narrowed at shoulder	Strongly concave, expanded with distinct shoulder
<b>Leaves when dry</b>	Strongly curled or crisped	Weakly curled, rarely more strongly so	Strongly curled or crisped
<b>Capsule lid</b>	Green throughout	Usually with an orange-red rim, rarely green	Green throughout
<b>Shape of empty capsule</b>	Strongly contracted below the mouth, flared above	Weakly contracted, urn shortly cylindrical	Weakly contracted, urn shortly cylindrical
<b>Ribs of dry, empty capsule</b>	4-5(-6) cells wide, typically almost touching each other at contracted part of urn	2-4 cells wide, separated by clear furrows	2-4 cells wide, separated by clear furrows
<b>Cells at capsule mouth</b>	Cells of ribs reaching up to capsule mouth or almost so, occasionally separated by 1(-2) rows of small cells	Cells of ribs ceasing clearly below capsule mouth, separated by (1-)2-3 rows of small rounded cells	Cells of ribs ceasing clearly below capsule mouth, separated by (1-)2-3 rows of small rounded cells
<b>Outer peristome teeth</b>	Partial 'halo' usually present (see 2.6); teeth remaining in 8 pairs	'Halo' lacking; teeth with marked tendency to split into 16	'Halo' lacking; teeth tending to split into 16
<b>Inner peristome segments</b>	Incurved when dry, uniseriate, with variably thickened cross-walls	Variably bent when dry, uniseriate or irregularly biseriate, with thin cross-walls	Incurved when dry, uniseriate, with distinctly thickened and prominent cross-walls

### Confirmed records of the *Ulotia crispa* group

Following the recognition of the three segregates of *Ulotia crispa*, it is necessary to record from scratch the separate vice-county distributions of *U. crispa* s.str., *U. crispula* and *U. intermedia*. I have not attempted a revision of herbarium specimens, but would welcome new vouchers for these species. Capsules should be in good condition, and for *U. crispula* and *U. intermedia* the endostome segments should be intact.

Based on my own collections and a few others received, as well as those published in Caparrós *et al.* (2016), records have already been confirmed for the following vice-counties. It is too early to know whether there are significant differences in the distributions of the three species across Britain and Ireland, but all of them are likely to be widespread. Caparrós *et al.* (2015) suggest that *U. intermedia* may have a more northern and montane tendency in Europe than the other two species.

The specimens listed are the most recent for their vice-county, and the vouchers are deposited in the BBS herbarium (BBSUK), except where stated. Other herbarium abbreviations are: BCB = Universitat Autònoma de Barcelona, BM = Natural History Museum, London, E = Royal Botanic Garden, Edinburgh, MAUAM = Universidad Autònoma de Madrid, S = Swedish Museum of Natural History, Stockholm.

***Ulotia crispa* s.str. 5:** on hazel in regenerating coppice, 160 m alt., Prior's Park Wood, Blackdown Hills, ST222171, 1969, M.O. Hill; **9:** on oak, 60 m alt., The Hanging, near Blandford, ST8607, 1972, M.D. Milnes-Smith; **29:** on hawthorn, 70 m alt., Sixteen Acre Plantation, near Newmarket, TL663621, M.O. Hill; **43:** on riverside tree, 350 m alt., nr Newhouse Farm, 5 km NE of Llanbister, SO134764, M.O. Hill; **44:** *Salix* in valley, Cwm

Ferws, SN603114, 2014, S.D.S. Bosanquet; **46:** on tree by river, 91 m alt., ca 3.5 km SSW Machynlleth, Llyfnant Valley, SN79, 1983, S.L. Jury & F.J. Rumsey (Herb. BCB: 12364) (Caparrós *et al.*, 2016); **48:** sycamore in ravine, Tyn-y-groes, SH72692305, 2015, S.D.S. Bosanquet; **49:** on hazel near stream, 100 m alt., Coedydd Aber NNR, SH663718, M.O. Hill; **50:** on willow by stream, 270 m alt., between Cyffylliog and Nantglyn, SJ025595, 1973, M.O. Hill; **56:** on oak in parkland, Clumber Park, SK64357453, 2015, T.L. Blockeel *et al.* 44/768; **57:** on oak in planted woodland, between Blackwell and South Normanton, SK435572, T.L. Blockeel 45/711; **58:** on sycamore, Macclesfield Forest, SJ9671, T.L. Blockeel 45/701; **62:** on ash tree, western end of Roulston Scar, Kilburn, SE51088151, 2015, T.L. Blockeel 44/744; **69:** on oak on stream bank, Easedale, near Grasmere, NY326082, 2015, T.L. Blockeel 44/757; **70:** on ash tree in woodland by stream, banks of R. Greta, near Threlkeld, NY30712461, T.L. Blockeel 45/697; **71:** on *Salix* by stream, Laxey Glen, Isle of Man, SC4284, 2000, T.L. Blockeel 29/410B; **73:** New Galloway, NX67, 1892, J. McAndrew (Herb. S: B177766) (Caparrós *et al.*, 2016); **76:** on rowan at edge of spruce plantation, Munzie Burn, south of Eaglesham, NS589480, 2015, T.L. Blockeel 44/413; **87:** ad truncos *Betula alba*, Pass of Leny prope [near] Callander, NN50, 1865, A McK [presumably A. McKinlay] (BM), det. R. Caparrós; **97:** on hazel, near Fort William, NN17, 1923, H.H. Knight & W.S. Nicholson (BM), det. R. Caparrós; **98:** epiphyte, 20 m alt., Benmore Botanic Garden, courtyard, NS1402485747, E.M. Kungu & A. Kovács (E); **105:** on ash tree in block scree, 95 m alt., Glen Elchaig, west of Falls of Glomach, NG9927, 2001, T.L. Blockeel 30/309; **H2:** Tork Cascade, V98, 1865, no collector (BM, Herb. Schimper) (Caparrós *et al.*, 2016); **H20:** sobre abedul [on birch], aparcamiento del centro de visitantes Glendalough [car park at the visitor

centre, Glendalough], T19, 2009, B. Estebanez (Herb. MAUAM: 4802) (Caparrós *et al.*, 2016); **H35**: on hazel on wooded roadside, NE of Portsalon, C247413, T.L. Blockeel 45/684, *conf.* F. Lara; **C**: on sallow by reservoir, St Catherine's Woods, Jersey, WV705526, 2015, T.L. Blockeel 44/432.

***Ulota crispula***. **16**: on deciduous tree, 70 m alt., Combwell Wood, Bedgebury, TQ710343, 2014, T.L. Blockeel 43/277; **31**: on *Cercis siliquastrum* in churchyard, Diddington, TL190660, M.O. Hill; **45**: *Alnus* in street, Narberth east, SN114146, 2014, S.D.S. Bosanquet; **57**: on *Fraxinus* on stream bank, near Chapel Milton, SK05258186, 2015, T.L. Blockeel 44/710, *conf.* F. Lara; **61**: on *Salix* on river bank, 10 m alt., R. Derwent, Wheldrake Ings, SE69414448, 2014, T.L. Blockeel 43/551; **69**: on *Fagus* by road, Castlegreen, Kendal, SD531922, 2015, S.D.S. Bosanquet; **H20**: sobre abedul [on birch], aparcamiento del centro de visitantes Glendalough [car park at the visitor centre, Glendalough], T19, 2009, B. Estebanez (Herb. MAUAM: 4814) (Caparrós *et al.*, 2016).

***Ulota intermedia***. **41**: *Salix* in wet woodland, Cors Penisa'r-coed, SS704943, 2014, S.D.S. Bosanquet; **52**: *Acer* in park, Cemaes, SH372934, 2014, S.D.S. Bosanquet; **57**: on *Salix*, Bramley Vale, near Glapwell, SK46736675, T.L. Blockeel 45/694, *conf.* F. Lara; **58**: on sycamore, Macclesfield Forest, SJ9671, T.L. Blockeel 45/700; **64**: on ash tree in limestone gill, Caseker Gill, near Kettlewell, SD98667432, T.L. Blockeel 45/706; **73**: New Galloway, NX67, 1892, J. McAndrew (Herb. S: B177766) (Caparrós *et al.*, 2016); 106: on rowan, Strathconon, western end of Loch Achilty, NH42755629, 2013, T.L. Blockeel 42/679; **H2**: nr. Muckcross, V98, ca 1900, R. Braithwaite (BM) (Caparrós *et al.*, 2016); **H36**: on spruce twigs in plantation, Tullymagough, H31515974, T.L. Blockeel 45/699, *conf.* F. Lara.

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#### References

- Blockeel, T.L. & Turner, J. (2013)**. Tales of the unexpected, no. 2: *Ulota calvescens* in the southern Pennines. *Field Bryology* 110: 35–38.
- Caparrós, R., Lara, F., Draper, I., Mazimpaka, V. & Garilleti, R. (2016)**. Integrative taxonomy sheds light on an old problem: the *Ulota crisper* complex (Orthotrichaceae, Musci). *Botanical Journal of the Linnean Society* 180: 427–451.
- Dixon, H.N. (1924)**. *The Student's handbook of British mosses*. Ed. 3. V.V. Sumfield, Eastbourne.
- Erzberger, P. (2003)**. The number of stomata per sporophyte and its variability in the species of the *Ulota crisper* complex and *Ulota drummondii* (Musci, Orthotrichaceae). *Lindbergia* 28: 14–22.
- Garilleti, R., Lara, F., Albertos, B. & Mazimpaka, V. (2001)**. Peristome ornamentation, a precise character for discrimination of *Ulota bruchii* and *U. crisper* (Bryopsida, Orthotrichaceae). *Journal of Bryology* 22: 273–278.
- Jones, E.W. (1947)**. The fruiting time of *Ulota bruchii* Hornsch. and *U. crisper* Brid. *Transactions of the British Bryological Society* 1: 20–21.
- Smith, A.J.E. (1978)**. *The moss flora of Britain and Ireland*. Cambridge University Press, Cambridge.
- Smith, A.J.E. (2004)**. *The moss flora of Britain and Ireland*, ed. 2. Cambridge University Press, Cambridge.
- Smith, A.J.E. & Hill, M.O. (1975)**. A taxonomic investigation of *Ulota bruchii* Hornsch. ex Brid., *U. crisper* (Hedw.) Brid. and *U. crispula* Brid. I. European material. *Journal of Bryology* 8: 423–433.
- Smith, A.J.E. & Proctor, M.C.F. (1993)**. Further observations on the *Ulota crisper* complex. *Journal of the Hattori Botanical Laboratory* 74: 171–182.

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