BBS Autumn Meeting 2019: Leicester, 4-6 October

The 2019 Autumn meeting took place at the University of Leicester Botanic Garden. On Friday 4 October Council and Committee meetings were held in the old Coach House, now used as a class room. An indoor meeting (Saturday) and a field excursion (Sunday) followed.

Saturday 5 October

On Saturday, 38 members of the society came together in "The Knoll", one of the Edwardian buildings in the Botanic Garden and a former student residence, to listen to a varied programme covering topics of taxonomy, recording, floras of other countries and conservation, all presented by enthusiastic speakers. This was followed in the afternoon by the Annual General Meeting.

Bryophytes underground: diaspore banks in coastal dune systems

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Hidden below ground, bryophyte diaspore banks remain very poorly understood and are usually ignored when undertaking conservation management activities. The purpose of this study is to investigate, for the first time, the occurrence and composition of diaspore banks in coastal dune systems. From eight sites in Wales (UK), 327 soil samples were collected from up to 30 cm depth and subject to germination trials in a growth chamber. Species that germinated were identified by morphological characters, supported by DNA barcoding. Bryophytes germinated from 206 samples (63%), mostly at shallow depth (<10 cm), represented by 34 species (7 liverworts and 27 mosses). Analysis of ecological attributes shows species in diaspore banks are significantly smaller in size, shorter lived and produce asexual propagules more frequently than species present aboveground. Of particular note, *Amblyodon dealbatus*, Red Listed in Wales, germinated from the diaspore bank of four sites, including a dune system where it was last seen in 1964 and considered extinct. The study highlights the fact that bryophyte diaspore banks comprise an important conservation resource that deserve careful consideration when planning management activities.

△Fig. 1. Recording a small fragment of *Sphagnum*-rich wet heath at Charnwood Lodge. Uta Hamzaoui.

This study was carried out together with Heinjo During, Laura Forrest, Karen Wilkinson.

Little stars of the liverworts: the genus *Asterella*

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In 1975 I started work on the *Flora of Bhutan* project at the Royal Botanic Garden, Edinburgh (RBGE), which gave me the chance to collect bryophytes on several expeditions to this small Himalayan kingdom, very poorly-known but extremely rich in bryophytes. The liverworts from these trips were studied by the late Riclef Grolle, who identified my first *Asterella* (*A. wallichiana* (Lehm. & Lindenb.) Grolle, Fig. 2), collected in 1979 under *D.G. Long 8108*. In 1990 we published a liverwort checklist for Bhutan. Later, I was able to collect numerous specimens of *Asterella* on expeditions to many parts of Asia and at the suggestion of Riclef I took up a monographic study of this genus in Eurasia for my doctorate.

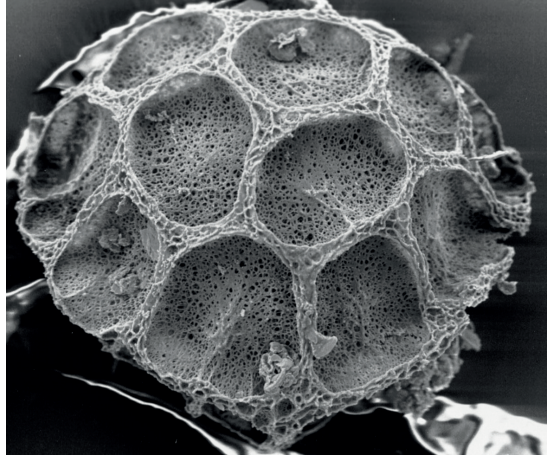
No *Asterella* species has been found in Britain, the closest relative being *Reboulia hemisphaerica* (L.) Raddi, though three *Asterella* species are found nearby on the European continent. More recently at RBGE we have undertaken molecular systematics of all the Complex Thalloid Liverworts (Forrest *et al.*, 2006, Villarreal *et al.*, 2016) which has supported the traditional classification of *Asterella* in the Aytoniaceae along with *Reboulia*, *Cryptomitrium*, *Mannia* and *Plagiochasma.* But the differences between these genera are relatively few, for example *Plagiochasma* is the only one with dorsal (as opposed to terminal) receptacles, and *Asterella* has been traditionally defined by its unique cage-like pseudoperianth which encloses the archegonia, later the sporophyte, on the underside of the female receptacles (Fig. 3). However, our most recent molecular studies (Villarreal *et al.*, 2016) show that this appears to break down as a few *Asterella* species nest with *Cryptomitrium* – an important pointer for future research.

The *Asterella* thallus is typical of most Complex Thalloids - in transverse section it has a lower layer of basal tissue (containing fungal hyphae) and above this a photosynthetic layer with chloroplasts and air chambers which allow

△Fig. 2. *Asterella wallichiana*, female plants with carpocephala and pseudoperianths. From: China, Yunnan, Gongshan County, *D.G. Long 37046* (E). D.G. Long.

▷Fig. 3. *Asterella californica*, female plants with carpocephala and pseudoperianths. From: USA, California, Marin County, *D.G. Long & J. Shevock 45892* (E). D.G. Long.

air movement through epidermal pores. On the underside are protective ventral scales and rhizoids. Some species are hygromorphic with thin and delicate thalli, while others from arid regions are xeromorphic – thick and leathery. On an individual specimen over 100 characters can be scored, giving plenty to distinguish species. However, in its reproductive characters *Asterella* shows exceptional diversity, namely the very precise and species-specific arrangement of male (androecia) and female (carpocephala) reproductive branches on the thalli. Only two species are dioicous, the remainder monoicous. Another remarkable feature of *Asterella* is the diversity of spore ornamentation patterns, which are in many cases species-specific and very useful in taxonomy and classification of species into subgenera (Fig. 4).



△Fig. 4. *Asterella multiflora*, distal surface of spore under SEM. From: Nepal, Pokhara District, *C.C. Townsend 92-155* (E). RBG Edinburgh.

The first *Asterella* to be described was discovered in North America in the mid 18th century – *Asterella tenella* (L.) P.Beauv; only later was the genus found in Europe, and although *Asterella* was first described in 1805 by the French botanist Palisot de Beauvois, his name was ignored in favour of *Fimbriaria* Nees for many decades by most workers including Franz Stephani. *Asterella saccata* (Wahlenb.) A.Evans was first found in the Swiss Alps around 1800 by J.C. Schleicher; it is a rare and declining species of rich calcareous meadows; the second was *A. lindenbergiana* (Nees) Arnell, a member of late-snow communities in the Alps, Pyrenees and Scandinavia, and thirdly *A. africana* (Mont.) A,Evans, a Macaronesian species which extends to a few places around the Mediterranean.

In his *Species Hepaticarum* Franz Stephani (1898–1925) recognized 91 species of *Fimbriaria* worldwide, but this has now been greatly reduced to a global total of 48 species of *Asterella*. Recently (Schill et al. 2010), one species (*A. gracilis* (F.Weber) Underwood) has been removed from the genus and transferred to *Mannia* as *Mannia gracilis* (F.Weber) D.B. Schill & D.G.Long. This transfer was based on molecular evidence but supported by other characters, such as spore ornamentation, even though the sporophytes are enclosed in *Asterella*-like pseudoperianths.

In the Indian region S.R. Kashyap studied complex thalloid liverworts in the early 20th century; he was a good field bryologist and correctly distinguished five North Indian species of *Asterella* (as *Fimbriaria*), though 4 of his 5 names have now changed. In contrast, other workers in India recognized up to 24 species of *Asterella*, many of which are no longer accepted. Indeed, in the monograph of Eurasian *Asterella*, Long (2006) recognized only 13 species in the whole of Asia, including 2 species new to science, and under one species alone (*A. wallichiana*) no fewer than 17 other names were relegated to synonymy. This is a widespread species over the whole of SE Asia though not extending to other continents.

In North America, Alexander W. Evans (1920) published a very thorough revision of *Asterella* recognizing 15 species from North America, Mexico and the Caribbean; Long (2005) published a new monograph of the genus as part of *Flora Neotropica* covering the whole of tropical America, recognizing 10 species. Much work remains to be done in the genus however, particularly monographs which are lacking from Africa and Australasia, but current work is

focusing on molecular methods to elucidate the relationships between the genera of Aytoniaceae and it is likely that at least one new genus will have to be described in the near future.

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Bryophyte recording in Hungary - work in progress.

An article based on this talk by Peter Erzberger is published elsewhere in this issue.

BBS Biological Records: Some thoughts on our processes of collecting, disseminating and using data

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The BBS approach to collecting and processing biological records (i.e. species occurrence data) is well-established, and based on a series of steps designed to both maximise the convenience to the field recorder and ensure high quality (Preston, 2014; Preston *et al.*, 2012). This talk overviewed these procedures and expanded on some of the detail required to keep this machine well-oiled and functional. However, new web-based recording platforms are beginning to supplant local solutions (e.g. spreadsheets or stand-alone databases) in some areas, and these pose several challenges, both to Regional Recorders and to central BBS processes of record dissemination. For example, iRecord (www.brc.ac.uk/irecord) requires that the UK Species Inventory is kept perfectly in-sync with the accepted BBS check-list. Such online systems are an evolution rather than a revolution, but they challenge the existing system because they are more inclusive. One assumes that the BBS is bound to consider this a positive development for British and Irish bryology, but the fact that records from the novice and expert are presented together can reduce confidence in the system, despite the fact that a system in itself is merely a tool, no different in essence from the transfer of spreadsheets by email, or of recording cards by post. Ignoring a spreadsheet from a dubious recorder becomes the more transparent process of verifying records online. The talk concluded by reviewing the recently updated facilities for viewing BBS data offered by the NBN Atlas (www.nbnatlas.org) and by the international platform GBIF (www.gbif.org). I also reviewed recent work on estimating time trends in distributions from biological records, concluding, as elsewhere (Pescott *et al.*, 2019), that the frequency scaling using local occupancy or "Frescalo" model of Hill (2012), applied at broad temporal and spatial scales, is the most sophisticated model that we currently have for dealing with the long-appreciated challenge of variable spatio-temporal effort in biological recording.

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Thorne Moors Sphagnum surveys 2016–2018

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Thorne Moors is the largest terrestrial SSSI in England and is designated as a lowland raised mire. Throughout history (and pre-history) the moors have been exploited for food and fuel and, consequently, they have been subject to various degrees of peat extraction, a process which intensified in the 18th century and again in the latter half of the 20th century with the advent of peat milling. Peat extraction eventually stopped, with the odd hiccough, in the early 21st century when the UK Government purchased 3/4 of the site in 2002 for £17.3m. The site was initially designated as an SSSI in 1970 and re-notified under the Wildlife and Countryside Act in 1986. The initial designation covered the Southern Canals area but this was subsequently extended to cover all of the peat mass in 1975 with a few minor boundary changes since. At the turn of the century the site became a *cause célèbre* for the conservation movement due to a plan by English Nature to de-notify most of the site and, responding to pressure, the Government relented and purchased the site for the nation, subsequently quashing the existing peat-cutting rights. Since the purchase in 2002 a minimum of £4.96m has been spent on restoring the site, pump-primed by the Water Level Management Plan, the implementation of which has achieved the re-wetting of significant areas of peat. However, long-term monitoring of the peatland flora, in particular *Sphagnum* mosses, has not been undertaken systematically and in November 2015 a decision was taken by a group of volunteers and academics to begin a programme of monitoring on Thorne Moors which began on the 3 November 2016.

Sphagnum mosses are the building blocks of Thorne Moors, in particular *Sphagnum austinii* (Paul Buckland, pers. comm.). However, until *c*. 2010 records of *Sphagnum* were from short visits to carry out general recording. Most tantalising amongst the records was the presence of *Sphagnum balticum*, initially found in 1932, then found only once subsequently, in 1980. Some systematic recording was carried out for the Thorne Moors flora (McDonald and Wall, 2014) but in the 2015 'Thornensians' meeting it was decided that a systematic survey of *Sphagnum* would provide valuable information on the condition of the Moors as well as provide an opportunity to re-locate and confirm the presence of *S. balticum* on Thorne Moors. The subsequent surveys have concentrated on the Southern Canals (Fig. 5), one of the least-disturbed areas and the location of the original Nature Reserve established in the 1980s (Sheehan *et al.*, 2017). To date, after three [now four] years of surveys, nineteen species of *Sphagnum* have been recorded from the Moors but *S. balticum* remains elusive.

△Fig. 5. Deep ditch with floating *Sphagnum fallax* surrounded by *S. cuspidatum* in the least disturbed area of Thorne Moors.

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The Catastrophe of Bare Peat: putting the moss back

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Moors for the Future Partnership was established in 2003 with the aim of tackling a major ecological disaster within the Peak District National Park and South Pennines Special Area of Conservation (SAC). Degradation of blanket bog was kick-started by air pollution resulting from the Industrial Revolution. This caused *Sphagnum* mosses to disappear from much of the region's blanket bog habitat. Further degradation in the form of wildfires, weathering and over-grazing exacerbated the problem, leaving vast areas of bare peat. This bare peat was being eroded at an alarming rate and was visibly disappearing from the moors.

To prevent further peat loss, the Partnership was formed and has since developed and honed some demonstrably successful techniques to halt the erosion of peat and bring the blanket bogs back to life. First, heather brash is cut from local moors and then spread onto the bare peat surface to provide a protective layer. Lime, fertiliser and a grass seed mix, known as a 'nurse crop', are then applied by helicopter to brashed areas. Lime is required to raise the pH (which has been recorded as low as pH 2) and fertiliser is used to provide the quick growing grasses with some immediate nutrition. The roots of this nurse crop quickly begin to hold the peat in place, and, protected by the heather brash, are thus able to germinate successfully and form a vegetative cover over the bare peat that would otherwise have continued to erode. Heather seedlings soon germinate from seed within the cut brash and bryophytes are able to colonise once the peat surface has been stabilised. Recent observations on Bleaklow in the Peak District National Park

△Fig. 6. *Sphagnum* plugs on 5 April 2019, 3.5 weeks after planting (left) and on 1 August 2019. Tom Aspinall.

(Maynard, 2017) showed that in areas where brash is not used, acrocarps tended to colonise most quickly, whereas brashed areas tended to see a greater abundance of pleurocarps, as these mosses may more often have been transferred within the brash. Brashed areas also tended to develop a bryophyte community more similar to that of untreated areas of intact moorland more quickly than un-brashed areas.

To begin the process of bringing blanket bogs back into an 'active' state, whereby peat is actively forming, *Sphagnum* mosses need to be returned. Due to a shortage of local *Sphagnum* to act as a source for natural recolonisation, the Partnership now introduces *Sphagnum* plants grown in laboratory conditions by Micropropagation Ltd. A mix of 11 species is used with 30–50% of *S. fallax*, 20–40% of *S. palustre* and *S. papillosum,* 10% of *S. capillifolium* and *S. cuspidatum*, 5–10% of *S. fimbriatum* and *S. subnitens* and c. 1% *S. denticulatum*, *S. magellanicum* (*S. medium*), *S. squarrosum* and *S. tenellum*. The ancestral material used to propagate this lab grown *Sphagnum* was harvested from several areas within the Peak District where *Sphagnum* had clung on (*S. magellanicum* and *S. tenellum* were both sourced from Cumbria due to a lack of source material in the Peak District, but both species have historically been known to occur within the Peak District). *Sphagnum* propagules in the form of Beadamoss®, BeadaGel™ and BeadaHumok™ have been used in the past with BeadaHumok™ (essentially *Sphagnum* 'plug plants') now being the propagule type used most often. These plugs are planted by hand into the peat and are proving to be a successful way of bringing *Sphagnum* cover back to blanket bogs in the South Pennines. Growth rates of plugs have been tracked using fixed-point photography (Fig. 6).

Blanket bog restoration has the potential to provide many benefits, including improved biodiversity, natural flood management, carbon capture (and reduced carbon loss), increases in water quality, and wildfire resistance.

Moors for the Future Partnership undertake research and monitoring to provide evidence for the efficacy of their landscape-scale conservation works and this monitoring takes many forms. Examples include:

- the study of water flow from mini water catchments as part of the MoorLIFE2020 project to assess whether increasing *Sphagnum* cover can reduce peak flows and increase lag times between rainfall and flow off the hills
- studying water tables to see if *Sphagnum* cover can help to raise water tables to a 'healthier' level closer to the surface as required for a functioning blanket bog
- using remote sensing to estimate *Sphagnum*

△Fig. 7. Tom Blockeel and Sally Mousley examining rocks at Charnwood. Steve Woodward.

cover within the landscape

• monitoring *Sphagnum* re-introductions to see which species are most successful when introduced as propagules

A trial was conducted to assess the success of planting *Sphagnum* propagules into a *Molinia* (purple-moor grass) dominated area of blanket bog. This consisted of planting *Sphagnum* plugs into areas of 'untreated' *Molinia*, areas where *Molinia* had been flailed and areas where *Molinia* had been flailed and windrowed (raked into parallel rows approximately 5 m apart). The results 17 months after planting showed that the flailing treatments applied before planting did not significantly increase the rate of increase in *Sphagnum* cover above that of the non-flailed treatment area. An interesting additional finding was that the community of *Sphagnum* species arising from the plugs was comparable to that occurring naturally.

Sphagnum reintroduction and the associated monitoring related to this particular aspect of land management now form a major part of the work of the Partnership with the hope that in the not too distant future, the blanket bogs of the Peak District and South Pennines will flourish once more. For more information about the Partnership and its work please visit https://www.moorsforthefuture.org.uk/.

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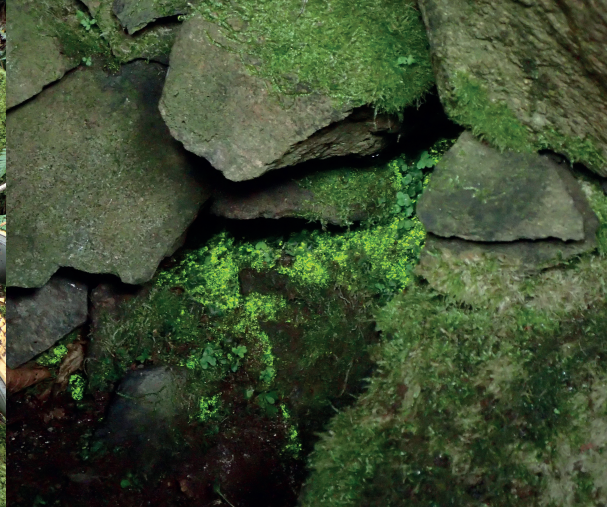
Searching for bryophytes in the Pindus mountains of Greece

We hope to publish an article based on this talk by Tom Blockeel in a future issue of *Field Bryology*.

Sunday 6 October

On the Sunday, 24 participants took part in the field meeting at Charnwood Lodge NNR. Despite the worst possible forecast, the weather luckily turned out to be dry and occasionally sunny and the group enjoyed a pleasant day. Charnwood Lodge is a large nature reserve of the Leicestershire and Rutland Wildlife Trust in Charnwood Forest, which owes its unexpected upland character to the Precambrian volcanic rocks. These are apparent as rock outcrops and give rise to shallow acidic soils and a characteristic heathland vegetation. The reserve is a relic of the landscape that would have been common in Charnwood Forest around the time of the enclosure act at the beginning of the 19th century. It has a particularly diverse bryophyte

△Fig. 8. Liz Kungu and Nick Hodgetts hunting for goblin gold. Steve Woodward.



△Fig. 9. The gametophyte of *Schistostega pennata* shining under boulders. Steve Woodward.

flora for Leicestershire. The group split into two to explore different parts of the reserve. While the first group headed to a wooded rocky ridge and a remnant wet heathland area, the second group was directed to some traditionally managed stubble fields in the hope of finding hornworts.

The first group didn't get far from the reserve entrance before reaching the first rock outcrop, where we found some patches of *Racomitrium heterostichum* and *R. fasciculare*, both species that have been spreading recently in Charnwood but are still rare in vc 55. We also found *Barbilophozia atlantica* together with *B. attenuata* and *B. floerkei*. From here we proceeded along a tarmac track, where a good number of records was made thanks to all the expert eyes. Amongst the usual suite of small acrocarps, some stunted plants of *Philonotis fontana* were found, a first for the reserve, and a small population of *Riccia sorocarpa.* Gordon Rothero spotted *Fossombronia wondraczekii* in a ditch in the surrounding heathland.

The next stop was in woodland on the approach to the former garden where the house of the previous owners once stood. Here *Metzgeria consanguinea* was seen on several trees, and Tom Blockeel found *Sematophyllum substrumulosum* on a log, new to vc 55. Jonathan Sleath also found it at a different site (also on a log) near the farm on the way back to his car in the afternoon, so it seems to be well-established in the Charnwood area, a further extension of its expanding range in Britain. Back at the old house, the group examined the many anthills there and found a few plants of *Riccia glauca* and *Tortula truncata.* There are only two recent records in vc 55 for *R. glauca* and both are from Charnwood Lodge.

We at last arrived on the wooded ridge with a steep north face consisting of large boulders covered in mosses (Fig. 7) which included some particularly large mats of *Plagiothecium undulatum.* We found the locally rare *Scapania nemorea* here. But the main find, and certainly one of the highlights of this field meeting, was a good population of *Schistostega pennata* under a large boulder (Fig. 8, 9), only confirmed after some energetic burrowing under the boulder by Liz Kungu and others. *S. pennata* was found in a few places in the Charnwood Forest in the 1940s, 70s and 80s but since then only in two places, both in 2017, of which one was in Charnwood Lodge under a root plate which has collapsed since its discovery. Gordon Rothero found *Microlejeunea ulicina* with *Zygodon conoideus* on a dying beech in the woodland near the ridge.

After lunch we decided to visit a small but locally important area of remnant wet heath. The way there led through a mixed plantation planted in Victorian times where David Long noticed a patch of *Rhytidiadelphus loreus* (Fig. 10) by the path, a species that has only recently re-appeared in Charnwood Forest, and *Sphagnum squarrosum* was spotted in a wet hollow underneath the root

△Fig. 10. *Rhytidiadelphus loreus* at Charnwood. Steve Woodward.

plate of a fallen tree. Tom Blockeel found *Ulota intermedia* growing on an oak, providing the first vc record of this species. The remnant of wet heath is the last remaining fragment of this habitat in the county in good condition (Fig. 1) and it covers only about a quarter of a hectare. I hoped that all those trained eyes would help to find new and so far undetected species there but none was found. However we confirmed the presence of five species of *Sphagnum* (*S. fallax, S. capillifolium* subsp. *rubellum, S. denticulatum, S. palustre* and *S. subnitens*).

All in all, this group made some interesting records, somewhat surprisingly in areas that were not our primary target, in particular on the tarmac track and the woodland rides of the Victorian plantations. This shows the value of examining all habitats and not just the glamorous areas. But the number of top bryologists scanning the ground on that day also helped!

▽Fig. 11. The species-rich barley strip with *Anthoceros* in Compartment 14. Chris Preston.

△Fig. 12. *Anthoceros agrestis* and friend (*Arion ater*). Des Callaghan.

The smaller party headed along a track across the heath towards some arable fields at the edge of the reserve. A *Tortula* growing on the track caused some debate in the field and much discussion afterwards. We eventually recorded it as *Tortula truncata* with two characters of *T. modica* (recurved leaf margins and narrow capsules). *Cephaloziella divaricata* also grew on the track, but the richest areas of the heath for bryophytes were around rock outcrops, where *Ptilidium ciliare* was locally frequent and we found *Barbilophozia attenuata* and *B. floerkii*. Within a minute or two of entering the first arable field (compartment 14) we were finding *Anthoceros agrestis*, which was frequent over a small area in a strip of unharvested barley (Figs 11, 12); this was the first record of the species from Leicestershire since 1941. *Riccia sorocarpa* was locally abundant and *R. glauca* was also frequent; other species in the field included *Bryum violaceum, Fossombronia* sp. (lacking mature capsules) and *Pohlia wahlenbergii*. We found no more *Anthoceros* in the stubble fields on either side of this one though we did see one small patch of *Dicranella rufescens* with abundant immature fruits, the first record of this species in v.c. 55 since 1909, and we added *Bryum subapiculatum, Ephemerum minutissimum* and *Pohlia lutescens* to the day's list. Finally we investigated an area of open oak wood, rock outcrops and block scree before heading back to the cars.

In addition to the new and first recent vice-county records identified above, several of the records are of species which are uncommonly recorded in the county and these include second records for *Didymodon nicholsonii*, the second recent record of *Fossombronia wondraczekii*, third records for *Pohlia lutescens* and *Racomitrium fasciculare* and the fourth record for *Microlejeunea ulicina*.

Acknowledgements

I would like to thank everyone who helped with the preparation in the background and also during the day when more hands were needed. Chris Preston contributed the account of the smaller field party. Special thanks go to Tom Blockeel for helping to choose a site for the excursion and for his continuous support in general.

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