



Hedwigia striata in Britain and Ireland

Back from the grave: **Tom Blockeel** and **Sam Bosanquet** report on the resurrection of a neglected moss

H*edwigia striata* was first recognised as a distinct moss by William Wilson from a collection made at Llyn Idwal, Snowdonia, in April 1829. It was originally published under the name *Anictangium striatum* in Hooker (1833). Hooker notes that "Mr Wilson considers the difference in the leaves of this plant, as sufficient alone to keep it distinct from the preceding [= *A. ciliatum* = *Hedwigia ciliata*"]". These distinguishing characters included the obscurely striate leaves and the margins recurved in the upper as well as the lower part of the leaf. In *Bryologia Britannica*, Wilson (1855) subsequently demoted it to the status of variety, following Bruch & Schimper's treatment in *Bryologia Europaea* (Bruch, Schimper & GümbeL, 1846), but remained convinced that

it was a good species ("the whole aspect of the plant is in favour of it being considered a distinct species"). However this comment is surely coloured by the fact that *H. stellata* is much the commonest *Hedwigia* in Britain, whereas the true *H. ciliata* is rare. Most subsequent authors, up to and including Dixon (1924) treated *Hedwigia striata* as a variety of *H. ciliata*, but some field bryologists remained convinced that it was a good species. A documented example of this is from a meeting of the Manchester Cryptogamic Society on 11 August 1879 (Anon, 1879a): "The mosses exhibited by the president [John Whitehead] were *Hedwigia striata*, Wils, from Grasmere, which he, along with Mr. Fergusson, proposed to restore again to the rank of a distinct species". This meeting report is important for



<Fig. 1. *Hedwigia striata* from Ffynnon Lloer, 2015.
Striations are visible on most of the leaves. B. Stewart

the authorship of the name *Hedwigia striata* and is discussed further in the nomenclatural note below.

Collectors continued to name specimens as *Hedwigia ciliata* var. *striata* up to the early part of the 20th century, and such specimens are found in many herbaria. The variety was reported from eight vice-counties in Britain and Ireland in the first and second editions of the *Census Catalogue of British mosses* (Ingham, 1907; Duncan 1926). Thereafter it became neglected and was omitted from subsequent floras and check-lists. Hedenäs (1994) was the first botanist in recent years to recognise greater diversity within *Hedwigia ciliata*. In revising the genus for Sweden he described *H. stellata* as a new species, but included *H. striata* as a synonym of *H. ciliata*. Crundwell (1995) revised British and Irish *Hedwigia* using Hedenäs' criteria, recognising three taxa within the *H. ciliata* group: *H. stellata*, *H. ciliata* var. *ciliata* and *H. ciliata* var. *leucophaea*. A more recent study by Buchbender *et al.* (2014), incorporating molecular analysis, has reinstated *H. striata* as a distinct species. Hespanhol *et al.* (2013) and Gallego *et al.* (2014) have documented its occurrence in Portugal and Spain.

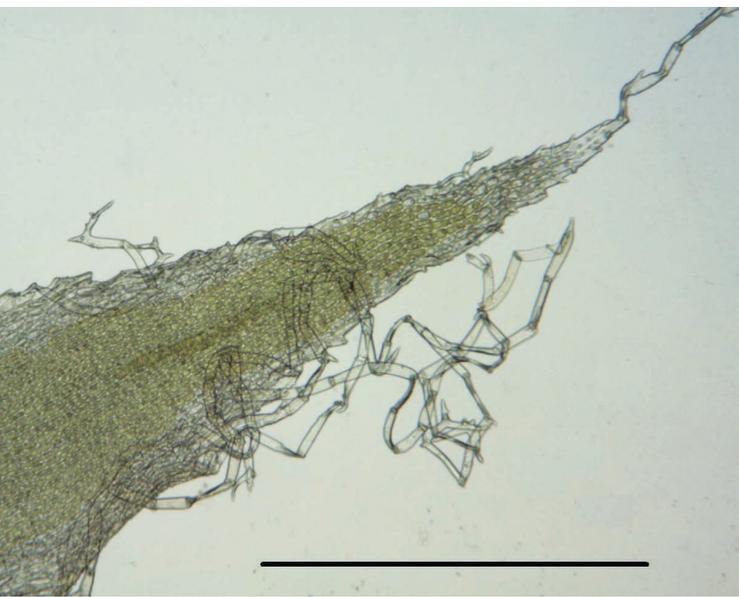
Buchbender *et al.* (2014) cite a number of historical collections of *H. striata* from North Wales, the Lake District and Scotland, all collected in the 19th century. In June 2015 during the B.B.S. summer meeting an extant population of *H. striata* was found in Snowdonia at Ffynnon Lloer, Caernarvonshire (Bosanquet, 2016); in fact it had already been collected there by R.G. Woods in 2010 but named *H. ciliata*, and similarly at another site, Llyn Gafri, Merionethshire, by SDSB in 2013. In November

2015 TLB visited the Grasmere area in Cumbria and succeeded in refinding a small population of *H. striata* at Easedale Tarn. Examination of herbarium material has revealed a further three vice-counties (West Ross, West Sutherland and Co Waterford) in which *H. striata* has been found since 2000. In this note we describe the differentiating characters of *H. striata* and document the known British and Irish records. A full description of the species can be found in the paper by Buchbender *et al.* (2014).

Identification

Hedwigia striata resembles *H. ciliata* and differs from *H. stellata* in having multiple (1–4) papillae on the upper and median leaf cells. The hair-points are often short, and when well-developed they tend to remain erect when dry, rather than spreading or reflexed as in *H. stellata*. The epithet *striata* refers to the leaves; sulcate would perhaps be a better word to describe them. The leaves are furrowed, in the manner of a corrugated asbestos or tin roofing sheet (the furrows are oriented from base to apex) (Fig. 1). The furrows are typically broad and shallow, and sometimes indistinct. They constitute a useful field character for *H. striata*, but are not absolutely diagnostic. We have seen material of *H. ciliata* in which a few weak furrows are visible on some leaves, although they are absent from the majority of *H. ciliata* specimens that we have studied. Other characters, therefore, must be used to confirm the identification.

The most reliable diagnostic character is provided by the cilia of mature perichaetial leaves. In *H. stellata* and *H. ciliata*, the cilia are numerous, long and contorted, often abruptly bent or curled and sometimes bear lateral projections (Fig. 2). In *H. striata* the cilia are fewer, shorter and more or less straight (Fig. 3). This does not mean that they are particularly



△Fig. 2 (top). The cilia of the perichaetial leaves of *H. ciliata*. Scale bar = 0.5 mm. Specimen from Carsington Reservoir, leg. T.L. Blockeel 38/019, 2009. T.L. Blockeel.

△Fig. 3 (below). The cilia of the perichaetial leaves of *H. striata*. Same scale as Figure 2. Specimen from Loch Awe, leg. J. Stirton, 1896. T.L. Blockeel

rigid; they may be slightly bent, but they lack the obvious kinks and contortions of the other two species. The inner perichaetial leaves should be examined, as the outer leaves in *H. ciliata* may bear just a few more or less straight cilia. The cilia can be observed before capsules have developed by carefully dissecting young inflorescences. Care must be taken when the capsules are old, as the cilia may be eroded.

Other characters are less constant. The leaf margins of *H. striata* are usually recurved along the length of the leaf to the base of the hair-point, or almost so, but occasionally only to around 3/4 of the leaf length. In *H. stellata* the margins are typically recurved to around mid-leaf or a little above. *H. ciliata* is much more variable and it shows some overlap with *H. striata*, but we have seen many specimens with almost plane margins. This character is therefore inconclusive as a diagnostic aid.

Gallego *et al.* (2014) pointed out that in *H. striata* the marginal cells at the base of the leaf just above the insertion are often ornamented by prominent papillae and/or double teeth. The same cells are smooth in *H. stellata* and *H. ciliata*. Figure 4 shows a leaf base with exceptionally well-developed papillae and teeth but in fact they are often absent, and it may be necessary to search a number of leaves/shoots to demonstrate their presence. Thus it is their presence that is a useful confirmatory character. Their absence is inconclusive. The extreme base of the leaf should be examined. The base is normally decurrent as a short wing along the stem.

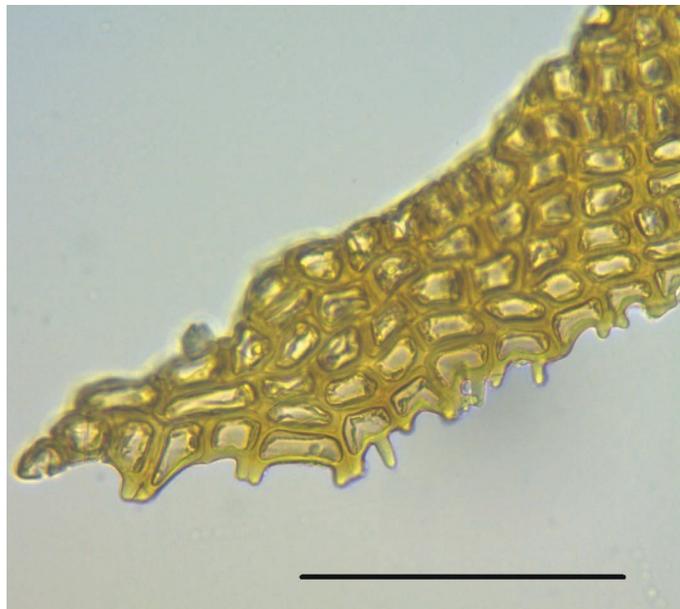
Buchbender *et al.* (2014) give two further differentiating characters. (1) The spores of *H. striata* are ornamented on the distal surface with elongate vermiform (worm-like) papillae. Those of *H. ciliata* have mostly simple papillae, occasionally mixed with vermiform ones. This is consistent with our observations, but we have seen very little material of *H. ciliata* with mature capsules. The vermiform papillae of *H. striata* are visible with the light microscope as lines on the spore

surface. (2) The mid-leaf cells of *H. striata* are shorter than those of *H. ciliata* (7.5–15.0 µm vs. 12–33 µm). This appears to be a less reliable character. Although the cells of *H. striata* are indeed short, we have observed similarly short cells in (≤ 15 µm) in some material of *H. ciliata* (measured at about $\frac{1}{3}$ from the leaf apex).

Habitat of *Hedwigia striata*

At its two extant Welsh localities, *H. striata* grows on basic igneous boulders in mountain llynau (tarns). It is rare at both sites, with records from four boulders at Ffynnon Lloer (Fig. 5) and one at Llyn Gafr. Ffynnon Lloer is at 655 m altitude in the Carneddau mountains, whilst Llyn Gafr is at 415 m altitude. The boulders that support *H. striata* are set a metre or two into the lake from the shore, but are large enough that substantial areas are never submerged, although they are subject to regular splash. Associates recorded at Ffynnon Lloer include *Grimmia ramondii*, *Marsupella emarginata* var. *aquatica*, *Racomitrium aciculare* and *Sciuro-hypnum plumosum*, with *Pterigynandrum filiforme* sharing one boulder with *H. striata* and *Bryum muehlenbeckii* on rocks nearby. *Hedwigia stellata* is present on several boulders but did not share any with *H. striata*. Associates at Llyn Gafr were not recorded in detail.

Most of the historic Welsh records of *H. striata* that mention a habitat come from boulders by lakes, and there are numerous collections from Llyn Idwal, which is ecologically similar to Ffynnon Lloer but at a lower altitude. SDSB searched boulders on $\frac{3}{4}$ of its margin in 2013 without locating *H. striata* or *H. ciliata*, but there is a chance that it might still be present. Other mountain llynau were searched specifically for *H. ciliata* during the 2015 BBS meeting without success. There are also numerous early 20th century collections from a very different habitat



△Fig. 4. The decurrent wing of a leaf of *H. striata*, showing tall papillae and double teeth on the margin. Scale bar = 100 µm. Specimen from Loch Awe, leg. J. Stirton, 1896. T.L. Blockeel

in Merionethshire – described as the "wall of an outhouse" at Tyddyn y Felin near Harlech. The final recorded habitat in Wales is "damp rocks" at Llanfrothen. Neither the Tyddyn y Felin nor Llanfrothen areas have been subject to detailed scrutiny in recent decades.

At Easedale Tarn in the Lake District, *H. striata* was found only on a single boulder, which (as at Ffynnon Lloer) is large enough never to be submerged. The tarn is situated at slightly over 280 m altitude and the bedrock is of Ordovician strata. The lakeside boulders support a calcifuge flora that includes *Andreaea rothii*, *Campylopus atrovirens*, *Grimmia ramondii*, *Racomitrium aciculare*, *R. fasciculare*, *R. aquaticum*, *R. sudeticum* and *R. lanuginosum*. Other species on boulders and outcrops on the banks near the tarn include *Gymnomitrium obtusum*, *G. crenulatum*, *Grimmia donniana* and *Schistidium strictum*. There are scattered tufts and patches of *Hedwigia stellata* (noted on 11 lakeside boulders). There was nothing bryologically distinctive to mark out the boulder supporting *H. striata*. The bryophyte cover on this boulder consisted largely of *Hypnum cupressiforme*, *Racomitrium aciculare* and a little *H. stellata*.



△Fig. 5. The extent of *Hedwigia striata* on one of its four boulders at Ffynnon Lloer. S.D.S. Bosanquet

Less is known in detail about the habitat of the Scottish and Irish specimens, but as in England and Wales most of them are from lakeside habitats; others are from a burn in a ravine and a rock slab by a waterfall. Of the many specimens from New Galloway, one is labelled "on a rock in a field, ½ a mile from the River Ken". The old records from the Ochil Hills stand apart in that they appear to have come from less humid habitats, one specimen being labelled "summit of Alva", which may refer to Wood Hill, an exposed summit above Alva at 525 m.

The status of *Hedwigia ciliata* var. *leucophaea*

Buchbender *et al.* (2014) found that the characters of var. *leucophaea* can be developed independently in different taxa of the *Hedwigia ciliata* complex. Two of the British records of the variety are from localities that have produced numerous specimens of *H. striata* (New Galloway, VC 73, and Glas Bheinn, VC 108). Unfortunately the vouchers of var. *leucophaea*, deposited in the GL herbarium according to Crundwell (1995), can no longer be traced, but it is very likely that these particular records were based on plants of *H. striata*. This leaves the occurrences on stone-

tilled roofs in Monmouth and Herefordshire (Callaghan, 2006) and a recent record from Traprain Law in Scotland as the only confirmed sites for the variety in Britain. Although its status as a good variety remains uncertain, we propose to retain it pending further study.

Distribution of *Hedwigia striata* and *H. ciliata*

Hedwigia striata has an oceanic distribution in Britain and Ireland. In Britain the known sites are scattered from North Wales through the Lake District and SW Scotland north to Sutherland. The old records from the Ochil Hills depart slightly from this pattern, but the oceanic tendency of *H. striata* is clear, and is consistent with its wider distribution in Europe. Buchbender *et al.* (2014) confirm records from SW Norway and S Sweden through Belgium to Spain, Portugal and Morocco.

After the transfer of many of its records to *Hedwigia striata* and the exclusion of some misidentified or ambiguous vouchers, *H. ciliata s.str.* is seen to have a much rarer presence in Britain than previously thought, and it is no longer known from Ireland. The sole remaining records from Scotland are in the south-east, var. *ciliata*

at Sandyknowe Craigs, Smailholm (VC 80) and var. *leucophaea* at Traprain Law (VC 82), both from natural rock outcrops and made within the last five years. The recent vouchers from Earncraig Hill (VC 72) and Ben Lawers (VC 88) are sterile and have some weakly plicate leaves, and may belong to *H. striata*. Records from Skye (VC 104) belong to *H. stellata*. In England and Wales most of the confirmed records are from roof tiles and walls, or as epiphytes (the latter presumably being transitory occurrences), with a single record from a tarmac path. However there are a few occurrences on natural rock outcrops and sarsen stones, in widely scattered localities from Wiltshire north to Leicestershire and Merionethshire. The Merionethshire specimen, an old one mixed with *Syntrichia ruralis* from Barmouth, is of interest as the only confirmed record from the oceanic west of Britain. Otherwise *H. ciliata* has a more southern and eastern distribution than *H. striata*.

Confirmed records of *H. striata*

Vice-county numbers are in bold. Many duplicates exist of some of the old records, especially from Harlech, Llyn Idwal, New Galloway and Loch Awe; not all of them are cited below.

48: walls nr. Harlech [SH62], D.A. Jones *et al.*, Sept 1904 (E), and Tyddyn y Felin, Harlech [SH62], P.G.M. Rhodes, June 1910 (E); walls, Harlech [SH62], J.B. Duncan, March 1921 (NMW); walls of farmhouse above Harlech [SH62], D.A. Jones, May 1904 (GL); wet rocks, Llanfrothen [SH64], S.J. Owen & D.A. Jones, April 1904 (NMW); Llyn Gafr, Cader Idris [SH71], H.H Knight & D.A. Jones, Oct. 1921 (E), and W.N. Tetley, Aug. 1920 (BBSUK); *ibid.*, W. Ingham & J.B. Duncan, Aug. 1914 (E); rocks, Cadair Idris [SH71], E. Armitage, Aug. 1922 (NMW); boulder in lake,

Key to British and Irish species of *Hedwigia*

1 Leaves lacking a well-developed hair-point (sometimes a few discoloured cells are present at the leaf apex); leaf cells with low simple papillae; seta elongate (but capsules rarely present).....
.....*H. integrifolia* (= *Braunia imberbis*)¹

Leaves with a clearly differentiated hyaline apex (but occasionally very short); leaf cells with tall papillae which are often branched and when well-developed have a dendroid or stellate form (at least on the dorsal surface of the leaf); capsules immersed (frequently present).....**2**

2 Upper and median leaf cells mostly with a single papilla that is typically stout and branched (a few cells may have 2-3 papillae); hair-points when dry often recurved or reflexed, especially on the upper leaves.....*H. stellata*

Upper and median leaf cells with 1-4 papillae (many cells with multiple papillae); papillae simple or branched; hair-points when dry tending to be erect or following the curve of the leaf.....**3**

3 Cilia of perichaetial leaves straight or weakly curved; spores with vermiform (worm-like) papillae; leaves usually sulcate or furrowed (but furrows sometimes indistinct); basal margins of leaf sometimes with tall papillae and/or double teeth (Fig. 4).....*H. striata*

Cilia of perichaetial leaves contorted, with irregular bends or kinks, and sometimes with lateral projections; papillae of spores simple, but often with some vermiform papillae also present; leaves usually without furrows (rarely with weak furrows); basal margins of leaf with smooth cells*H. ciliata*

¹ The correct name for *Hedwigia integrifolia* is *Braunia imberbis* (Sm.) N. Dalton & D.G. Long, as explained by Dalton *et al.* (2012)

- 420m, NW corner of Llyn Gafr, SH709142, S.D.S. Bosanquet, 11 Apr 2013 (BBSUK).
- 49:** Llyn Idwell (*sic*) [SH65], 29 August 1828, 23 April 1829, syntype, herb. Wilson (BM) and April 1829, syntype, herb. Wilson (BM) (Buchbender *et al.*, 2014); Llyn Ogwen [SH66], C.H. Binstead & J.B. Duncan, Sept. 1924 (E); boulder on edge of upland lake, Ffynnon Lloer, SH66286202, R.G. Woods, 20 Oct. 2010 (BBSUK); boulder on edge of lake, Ffynnon Lloer, SH66286202, S.D.S. Bosanquet & B Stewart, 7 June 2015 (BBSUK).
- 69:** Grasmere [NY30], August 1869, herb. Wilson (BM) (Buchbender *et al.*, 2014); rocks, Grasmere [NY30], J. Whitehead, August 1869 (NMW); Rydal [NY30], Schimper (S; B117464) (Buchbender *et al.*, 2014); old walls, Rydal [NY30], J.M. Barnes, July 1868 (NMW); Easedale [NY30], J. Appleyard, August 1948 (NMW); on lakeside boulder, Easedale Tarn NY3008, T.L. Blockeel, 13 November 2015 (BBSUK).
- 73:** near Laggan of Dee, New Galloway [NX57], J. McAndrew, 1896 (GL); New Galloway [NX67], J. [Mc]Andrew (S; B117463) (Buchbender *et al.*, 2014); on rocks in Grennan Holm, New Galloway [NX67], J. McAndrew, 27 Oct 1896 (E); Newton Stewart Road, New Galloway [NX67], J. McAndrew, Oct 1896 (E); north end of Grennan Bank, New Galloway [NX67], J. McAndrew, 12 Dec 1896 (GL), plus many additional duplicates from New Galloway.
- 87:** Dumyat [Ochil Hills, ca. NS8397], June 1869, herb. Wilson (BM) (Buchbender *et al.*, 2014); Alva wood [Ochil Hills, ca. NS9098], 12 March 1850, herb. Wilson (BM) (Buchbender *et al.*, 2014); summit of Alva [Ochil Hills, ca. NS9098], herb. Wilson (BM) (Buchbender *et al.*, 2014).
- 97:** ravine of burn, Camasine, Loch Sunart [NM76: ca NM7561], E.C. Wallace, 16 Aug 1972 (NMW)
- 98:** boulders by side of Loch Awe [NN02], Dr Stirton, 1896 (E); Loch Awe, Achnacarron [NN02], J.F. Stirton, 16 Aug 1896 (GL).
- 105:** slabby boulder near waterfall by river in open moorland, Shieldaig, Badachro river, NG7971, N.G. Hodgetts 8343 and J. Smith, 15 August 2013 (BBSUK).
- 108:** sandstone rock near margin of loch, N shore of Loch Veyatie, Assynt, NC198128, G.P. Rothero, 3 May 1999 (BBSUK); boulder by lake, Glas Bheinn, Inchnadamph [NC22], W.E. Nicholson, E.S. Salmon & H.N. Dixon, 22 July 1899 (NMW, several duplicates).
- H6:** boulders by lough in NW-facing corrie, ca 470 m, Scilloge Loughs, Comeragh Mts., S29191141, N.G. Hodgetts 7204, 12 September 2007 (BBSUK; Herb. Hodgetts).

Uncertain records

[72]: on sloping rock below rock face, 530m, Earn Craig, Earncraig Hill, NW of Queensberry Hill, NS977012, R.W.M. Corner, 4 April 1993 (BBSUK).

[88]: large calc-schist boulder below crags, Sron Dha Mhurchiadh, Ben Lawers SSSI, NN60623884, G.P. Rothero, 21 May 2009 (BBSUK).

Both of these specimens are sterile, and the leaves are at most weakly plicate.

[H20]: Luggelaw [=Luggala, ca O1507], Co Wicklow, DM [?D. Moore], May 1861 (NMW).

This specimen is in poor condition and not identifiable with certainty.

Summary of vice-county distribution (brackets indicate that confirmed records are pre-1960): 48, 49, 69, (73, 87), 97, (98), 105, 108, H6.

Amendments to the vice-county distribution of *H. ciliata*

H. ciliata var. *ciliata*. Place **48** in (), there is one confirmed record (with *Syntrichia ruralis*, Barmouth SH61, F.J. Chittenden, August 1904, NMW); delete **49**, records from Snowdonia belong to *H. striata*; delete **69**, records from Rydal, Grasmere and Easedale belong to *H. striata*; delete **72**, the voucher (Earncraig Hill NS977012, R.W.M. Corner, 1993, BBSUK) is sterile and may belong to *H. striata*; delete **73**, records from New Galloway belong to *H. striata*; delete **88**, the voucher (Sron Dha Mhurchiadh, Ben Lawers, G.P. Rothero, 2009, BBSUK) is sterile and may belong to *H. striata*; delete **98**, records from Loch Awe belong to *H. striata*; delete **104**, the voucher (Meal Tuath, Rubha Hunish NG41027607, D.G. Long, 2001, BBSUK) and other checked specimens are *H. stellata*; delete **105**, the voucher (Shieldaig, Badachro river, NG7971, N.G. Hodgetts & J. Smith, 2013) is *H. striata*; delete **108**, the voucher (N shore of Loch Veyatie, Assynt NC11, G.P. Rothero, 1999, BBSUK) is *H. striata*; delete **H6**, records from Sgilloge Loughs, Comeragh Mts, belong to *H. striata*.

H. ciliata* var. *leucophaea. Delete **73** and **108**, the vouchers cannot be traced. They are likely to belong to *H. striata*, which occurs at both of the respective localities (New Galloway and Glas Bheinn).

Nomenclatural note: author citation of the name *Hedwigia striata*

Wilson's name for *Hedwigia striata* was *Anictangium striatum* (published in Hooker, 1833). The first appearance in print of the combination *Hedwigia striata* at the level of species appears to be in two reports of meetings of the Manchester Cryptogamic Society in August/

September 1879, published in *The Naturalist* (Anon, 1879a, 1879b). The relevant parts of the reports are:

(1) MANCHESTER CRYPTOGRAMIC SOCIETY. — Meeting, Aug. 11th, the president [Mr John Whitehead] in the chair. — A number of interesting cryptogamic plants were placed on the table for inspection. ... The mosses exhibited by the president were *Hedwigia striata*, Wils, from Grasmere, which he, along with Mr. [J.] Fergusson, proposed to restore again to the rank of a distinct species. [*Naturalist* (Hull) 5, p. 29]

(2) MANCHESTER CRYPTOGRAMIC SOCIETY. — Monthly meeting, [September,] Mr. John Whitehead, president, in the chair.— The secretary (Mr. Rogers) read a letter from Mr. Boswell, of Oxford, enclosing specimens of several rare mosses. The president laid before the meeting a moss of the genus *Philonotis*, gathered upon Ben Muich-Dhui in 1876..... With regard to *Hedwigia striata*, exhibited at the last meeting, from near Grasmere, the president said that in looking through Mr. Ashton's collection he had found a fruiting specimen gathered in Llanberis Pass. This was a fortunate discovery, as the moss was extremely rare — three localities only being known for it. It was first found by the late Mr. W. Wilson in 1829, at Llyn Idwal, and named by him *Anoetangium striatum*. [*Naturalist* (Hull) 5, p. 46]

In some recent papers, including Buchbender *et al.* (2014), the authorship of the combination *Hedwigia striata* has been attributed to H. Boswell, but this is manifestly incorrect. John Whitehead exhibited the Grasmere specimens and discussed their status on 11 August, a month before the reading of Boswell's letter, and there is nothing in the reports to suggest that Boswell's

letter has any relevance to the *Hedwigia*. The International Code of Botanical Nomenclature allows for indirect references to a basionym for new nomenclatural combinations made prior to 1953. The reference to Wilson ["Wils"] in the meeting report for 11 August is sufficient to validate the new combination, which should therefore be attributed to Whitehead and Fergusson. However Whitehead and Fergusson are not the authors of the report, which is anonymous but is one of a number of Society reports compiled by C.P. Hobkirk and G.T. Porritt as editors of *The Naturalist*. Hobkirk and Porritt can be cited as its authors. Thus the full author citation is *Hedwigia striata* (Wilson ex Hook.) John Whitehead & J. Fergusson ex Hobk. & Porritt, *Naturalist* (Hull) 5: 29. 1879.

Acknowledgements

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