

P*araleucobryum longifolium* (Fig. 1) was first validly described by Hedwig (1801) as *Dicranum longifolium* Hedw., based on earlier published European descriptions and illustrations from Hedwig, Ehrhart, Bridel and Dickson. Hedwig (1801) cited specimens as follows: ‘*In Suecia Upsaliae et in Scotiis alpibus ad rivulorum ripas (in Hercyniae et in Sudetibus Ludwig, in Austria Host).*’ These localities equate with Sweden, Scotland, Germany, the Sudety mountains of the Poland/Czech Republic border and Austria. The ‘holotype’ listed in the online *Hedwig Types Catalogue* in Geneva is an Uppsala specimen collected by Ehrhart. The Scottish reference is based on the plant James Dickson had described as *Bryum longifolium* Dicks. from Ben Nevis (Dickson, 1793). However, Dickson had described a plant with capsules which Wilson (1855) later identified as *Kiaeria starkei* (F. Weber & D. Mohr) I. Hagen, not *P. longifolium*.

Paraleucobryum longifolium (Hedw.) Loeske in Scotland

Paraleucobryum longifolium is a rare British moss confined to montane habitats in the Scottish Highlands. **David Long, Gordon Rothero** and **Maren Flagmeier** review the early Scottish reports of this species, several of which are erroneous, summarize recent finds and ecological observations, and describe vegetative reproduction by fragile shoots, not previously reported for the species.

The next British Isles record, as *Dicranum longifolium* Hedw., was from Ireland, published by Hooker & Taylor (1818) in the first edition of their *Muscologia Britannica*: ‘*In wet spots on rocks; Ireland*’, and ‘*has lately been found in Ireland in the county of Wicklow, under dripping rocks at Glenmalur.*’ In the second edition (Hooker &

Taylor, 1827) this distribution was expanded to include Scotland: ‘*In wet spots on rocks, Ireland. Upon Ben Voirlach, and Ben-y-Gloe, Scotland.*’ However, Wilson (1855), in the third edition

▽ Fig. 1. A typical habitat for *P. longifolium* on a large rock on the margin of the Dubh Lochan, Beinn a’ Bhuid in the Cairngorms (September 2007). *Gordon Rothero*



of this work, challenged these records: 'The reputed specimens from Glenmalur, Ireland and from Ben Voirlich, Scotland, prove to be different from authentic specimens of this moss which must therefore be excluded from the list of British species.'

In the same work he described the Ben Voirlich specimen, collected by R.K. Greville, as a new species, *Dicranum circinnatum* Wilson. The Irish specimen, from Glenmalur, collected by Thomas Taylor, Wilson described on the same page as a new variety, *Dicranum heteromallum* Hedw. var. *commutatatum* Wilson. Isotypes of both these collections exist in the Edinburgh herbarium (E) and these are now considered to be synonyms of other species: *D. circinnatum* is *Dicranodontium uncinatum* (Harv.) A.Jaeger, and var. *commutatatum* is merely a form of *Dicranella heteromalla* (Hedw.) Schimp. What happened to the Ben-y-Gloe specimen is unknown.

No further mention of this species from Britain appeared until Stirton (1870) reported *D. longifolium* Hedw. from Ben Lawers in Perthshire: 'On large blocks of stone, in a ravine on the western slopes of the mountain, in great luxuriance, but barren. First detected in July 1865, and identified by Professor Schimper of Strasbourg with this species.' The next record came from Angus, collected between 1866 and 1868, published by Fergusson (1870): 'Clova, second British station; barren; J.F.' Braithwaite (1887) cited the Stirton and Fergusson collections and added a third 'Maidenbower Craigs, Dumfries, with *Grimmia patens* (Herb. Kew)', though neither collector nor date was given. The Dumfries record was repeated by McAndrew (1893). Dixon & Jameson (1896) gave no localities, merely 'Mountains, rare. Sterile in Britain.' Finally, Murray (1900) included it in lists of his findings on Ben Lawers in June 1898 and June 1899. The following specimens support the pre-1900 reports from Perthshire (v.c. 88) and Angus (v.c. 90):

Gentian rocks, Ben Lawers, vii 1884, Dr Stirton (E).

Killin, vii 1885, J. McAndrew (E).

Ben Lawers, vii 1885, P. Ewing (E).

Ben Lawers, viii 1892, R.H. Meldrum (E).

Glen Fiaadh, Clova, viii 1880, J. Fergusson (E).

However, no further information on the somewhat enigmatic report from Maidenbower Craigs, Dumfries (NX9874, v.c. 72) has ever been published, but the record remained in subsequent editions of the *Census Catalogue* up to Blockeel & Long (1998). Braithwaite (1887) cited a voucher for the record from 'herb. Kew' and this specimen (BM000857930) has now been located in Hooker's herbarium in the Natural History Museum, London. The specimen is mounted on a small sheet (11.3 × 9.7 cm) which has in the past been stuck to a larger herbarium sheet, later trimmed to the same size. It is stamped 'Herbarium Hookerianum 1867.' It is annotated in the hand of William Wilson: 'Dicranum longifolium ♂ *Grimmia patens* Hb. Hook., Maidenbower Craig, Dumfries W. Wilson'. It is not clear if the specimen was collected by Wilson or William Hooker, or some other botanist, or was perhaps part of Wilson's herbarium donated to Hooker at Kew. Study of this specimen confirms its correct determination as *P. longifolium*. It consists of only a few stems mixed with *Grimmia curvata* (Brid.) De Sloover (with sporophytes), *Anastrophyllum minutum* (Schreb.) R.M.Schust. and two shoots of *Barbilophozia* cf. *lycopodioides* (Wallr.) Loeske. The identity of the last is not certain as the specimen is inadequate for definite identification; however, its leaves are 4-lobed, have interlocking dorsal merophytes, basal cilia with elongated cells and lack gemmae. These characters are indicative of *B. lycopodioides* rather than *B. hatcheri* (A.Evans) Loeske, though the latter would be a more likely species from lowland Dumfriesshire. Amongst the older parts of the tuft there are flecks of mica

which would not be expected from the given locality. Hence, there are substantial grounds for questioning the provenance of this specimen – could it have originated from the mica-schist rocks of Ben Lawers, Clova or even the European Alps and been mislabelled?

According to Lawley (2008), most of William Wilson's bryological collecting took place in the late 1820s and early 1830s, and included visits to the Hooker family in Glasgow and excursions to Breadalbane, Aberdeenshire and Ben Lomond. Although Dumfries would have been a natural halt on his journeys between Lancashire and Scotland, there is no mention of the record in Wilson (1855), but it is unlikely that he collected it after that date. Thus there remain questions concerning the history of this specimen, but from the annotations it was clearly first identified by Wilson, and not by Braithwaite who first published it. These unresolved questions, and the surprising associates mixed with the *Paraleucobryum* specimen for a lowland habitat only 60–80 m above sea level, mean that the provenance must be regarded as doubtful. In 1961 the BBS visited Maidenbower Craigs (Milne-Redhead, 1962) and searched for the moss, but found no trace, although they reported a little *Grimmia curvata*. On 2 April 2008 DGL visited Maidenbower Craigs with Sumudu Rubasinghe. The crags constitute an outcrop of Permian New Red Sandstone, including bands of breccia. The rocks and associated soil have no traces of mica. The crags are shaded by mature beech trees (*Fagus sylvatica* L.) with many fallen dead trees of wych elm (*Ulmus glabra* Hudson). Beneath the trees are scattered elders (*Sambucus nigra* L.) and thickets of bramble (*Rubus fruticosus* agg.). The crags are base-rich with colonies of *Anomodon viticulosus* (Hedw.) Hook. & Taylor, localized patches of *Marchesinia mackaii* (Hook.) Gray, and luxuriant lowland woodland mosses

such as *Eurhynchium praelongum* (Hedw.) Bruch *et al.* and *Neckera complanata* (Hedw.) Huebener. No montane bryophyte species were seen, and the present-day ecology seems totally at odds with that of other Scottish *Paraleucobryum* sites and published reports. In our view, this adds to the overwhelming evidence that the record for v.c. 72 cannot be accepted as sound and it should be deleted.

Recent records

After 1900, 80 years passed without further news of *P. longifolium* in Scotland. Its discovery was quite unexpected, far from any of the 19th century localities, on the Newtonmore BBS meeting in 1981, on boulders by Loch Avon in the Banffshire Cairngorms (v.c. 94). Long (1982) reported it thus: 'on a large block, a tuft of *P. longifolium* was collected by Sandy Payne, a species thought to be extinct in Britain'. It was seen again in this area in 1987 and 2000. This discovery prompted new searches on Ben Lawers (v.c. 88), where Stirton had commented on its 'great luxuriance' and eventually it was refound by DGL and GPR in June 1990 in schist block scree below the cliffs of Creag Loistge at 910 m, later published by Blockeel (1991).

Since 1990 we have discovered a number of new localities and learned a great deal about this species and its ecological preferences. In Angus it was re-found by GPR by Loch Brandy (90) in 1993 (Blockeel, 1994), then on boulders by the Falls of Fee by DGL in 2002 (Hill, 2004). Other recent vice-county records have been for v.c. 92 on boulders by Lochan Uaine in the Garbh Coire of Carn Toul in 1989 by DGL & GPR (Blockeel, 1990), for v.c. 96 on boulders by Coire an Lochain, Braeriach, by GPR in 1989 (Blockeel, 1991), and the northernmost record (v.c. 108) on a boulder by Lagan Mhuirich, north of Beinn an Fhurain, Assynt, by GPR in



◁ Fig. 2. Habitat of *P. longifolium* on large boulders by Lochan Uaine, Derry Cairngorm, September 2007. David Long

▷ Fig. 3. *P. longifolium* with deciduous branchlets on boulder by Lochan Uaine, Derry Cairngorm, September 2007 (Long & Flagmeier 37031, E). David Long



2002 (Rothero, 2003). It is now known from six vice-counties (88, 90, 92, 94, 96 and 108), in 20 localities which fall in 9 hectads (NC22, NH90, NJ00, NN53, NN64, NN99, NO09, NO27 and NO37). The recorded altitudinal range is from 600 m in Glen Clova to 1,000 m on Ben Lawers.

Ecology

P. longifolium in Scotland is a plant of sheltered sites on the sides of large rocks in, or associated with, areas of scree in the mountains. In the Cairngorms and in Glen Clova, most sites are on acidic boulders on or near loch margins (Fig. 2) with two exceptions, one by a waterfall and the other in a small incised valley. On the Ben Lawers SSSI it seems to be restricted to large, calcareous rocks in scree with all sites, except that in the northern coire of Beinn Ghlas, having a southerly aspect and thus being rather drier than the Cairngorms and Clova sites. The screes do attract and keep snow later than the surrounding

slopes, but the preferred sites, on the tops and sides of rocks, will be snow-free for much of the year. The sheltered nature of the sites for most stands suggests that the buffering capacity of the scree and the water bodies, in terms of both temperature and humidity, may be an important factor in this preference. This rather restricted habitat is hard to reconcile with its more catholic requirements on the continent where it can be abundant in a variety of habitats.

Most cushions of *P. longifolium* are small, and some populations seem to consist of a very small number of cushions, often contained within larger cushions of *Dicranum fuscescens* Sm.; indeed, close inspection of cushions of *D. fuscescens* is often the easiest way to find the plant. Larger cushions do occur on Ben Lawers and by Loch Brandy in Glen Clova, with some as much as 20 cm in diameter, but the bigger cushions are mostly in the range 4–5 cm to 10 cm diameter. *D. fuscescens* is the most consistent associate, and

in the Cairngorms there may be no other close associates, though *Kiaeria blyttii* (Bruch *et al.*) Broth., *Racomitrium heterostichum* (Hedw.) Brid. and *R. sudeticum* (Funck) Bruch & Schimp. occur nearby in some sites. On Ben Lawers, the most common associates are much the same, but *Andreaea rupestris* Hedw., *Dicranoweisia crispula* (Hedw.) Milde, *Grimmia curvata*, *Pterigynandrum filiforme* Hedw., *Diplophyllum albicans* (L.) Dumort. and *Lophozia sudetica* (Huebener) Grolle also occur on several sites.

Reproduction

Sporophytes are produced commonly in North America (Ireland, 2007), but are unknown in Scotland. Most recent literature on *P. longifolium* (Ireland, 2007; Long, 1992; Nyholm, 1987; Smith, 2007) makes no mention of specialized vegetative reproduction in this species in Europe and North America, although Crum & Anderson (1981) state ‘sometimes apparently reproducing by

means of fragile leaves.’ On 5 September 2007, DGL and MF discovered a new population of *P. longifolium* beside Lochan Uaine on Derry Cairngorm (v.c. 92) at 755 m. Amongst several cushions growing with cushions of *Dicranum fuscescens* was one which was clearly producing deciduous leafy branchlets (Fig. 3). In this population it is the stems which are fragile rather than the leaves. The photograph also shows the whitish sheen so characteristic of this species. This may be taken as clear evidence of an adaptation for vegetative reproduction.

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