

THE FIFTH DOUGAL SWINSCOW MEMORIAL LECTURE

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Lichens of the Scottish Mountains

Let me begin with a question. Is the following statement True or False “In alpine areas at least, lichens are important in the 'continental' Eastern Highlands of Scotland and bryophytes in the 'oceanic' western Highlands”? The answer is that it depends what you mean by “important”. The statement is true only in so far as these cryptogams are considered a structural element of terricolous vascular plant communities. The lichen vegetation of the Eastern Highlands consists mostly of terricolous macrolichens, and these can be conspicuous and form dense stands similar to those that occur in Scandinavia. For instance, on Beinn a’Bhuird in the eastern Cairngorms, the nationally rare lichen *Flavocetraria nivalis* can occasionally be the dominant species. However, this and the other nationally rare macrolichens that occur in the eastern Highlands (e.g. *Alectoria ochroleuca* and *Cladonia maxima*) are much more frequent in Scandinavia and, consequently, the lichen vegetation of the eastern Highlands is best considered a fragmented, species-poor outlier of that in Scandinavia and is of national interest only.

By contrast, the lichen vegetation of the Western Highlands consists mainly of saxicolous microlichens; a habitat which most ecologists would describe as ‘bare rock’. However, this lichen vegetation is important both intrinsically, with a number of rare and apparently endemic taxa and communities, and as a major contributor to the biodiversity of the ecosystem. For instance the summit of Bla Bheinn on the Isle of Skye looks bare and uninteresting but a closer inspection shows a diverse flora of crustose species, many of them rare (e.g. *Anioa mooreana*, *Amygdalaria pelobotryon*, ‘*Lecidea*’ *commaculans*, *Placopsis gelida*, *Porpidia contraponenda*, *Rhizocarpon infernulum*, *R. submodestum*, and *Stereocaulon tornense*). This lichen vegetation is apparently unique in Europe, and probably the world, and is of international importance.

The view that lichens are more important in the Eastern Highlands is, inadvertently, perpetuated by the National Vegetation Classification (NVC) because it treats only those lichen communities dominated by macrolichens. Because these communities are mainly confined to the Eastern Highlands, the NVC gives the impression that lichens are only important in the east.

Confirmation of the importance of the oceanic flora is given by the numbers of species that are more or less confined to either the eastern or western Highlands. There are approximately 13 taxa more or less confined to the Eastern Highlands, most of them macrolichens and all of them more frequent in continental Europe. In contrast, the western Highlands supports 42 taxa, mostly microlichens, that are almost unknown further east, and most are rare throughout their range. These include a number of undescribed or only recently described taxa. However, distributions are not that straight forward because oceanic species also occur further east in damp coires and around areas of late snow-lie, and terricolous continental species also occur further west, often on mossy rocks and boulders.

So why is the lichen vegetation of the Western Highlands so special? In a word: CLIMATE! The climate of the Scottish Mountains has been described as “a combination of low temperatures, severe wind exposures, excessive precipitation, cloud and humidity, persistent winter frost and snow cover, deficiency of sunshine, poor visibility, continual ground wetness and low evaporation.” (Taylor 1976). These conditions may be extremely unfavourable for vascular plants (and people) but they are responsible for a rich and diverse lichen flora.

What makes the Scottish climate so special? Barry (1992) lists the major controls on alpine climate as Altitude, Latitude, and Continental Position; and it is the third that gives the Scottish mountains their special character. Situated on the extreme western seaboard of Europe they experience a hyper-oceanic climate, characterized by low seasonal variation in temperature, high atmospheric humidity and precipitation, high winds, and high altitudinal temperature lapse-rates. The oceanicity gradient across the Scottish Highlands is very steep with the result that although the Cairngorms of the eastern Highlands are significantly higher than the Cullin of the Isle of Skye on the west coast, there is a much reduced area above the potential tree-line at the former. Another feature of the climate is its extreme changeable, with 160-180 depressions and 110 frontal systems each year.

Let me now describe three sites in the western Highlands where very special lichens occur. The first is Beinn Dearg in Wester Ross. The River Leal, which flows down Gleann na Sguaib, is, for about 1 km, very slow moving and forms wide shallow pools. Around these pools numerous low rocks occur and these are the habitat for the very rare *Lecanora achariana*. The second site is on the Beinn Eighe NNR, also in Wester Ross. Most of this mountain is composed of acidic Torridonian Sandstone or Cambrian Quartzite and supports a species-poor lichen

flora, but the very summits of the peaks are made up of calcareous rocks thrown up by the Moine Thrust, and these support a much more diverse lichen flora. One of these summits supports the only extant British population of *Nephroma arcticum*, which occurs in a mixed *Racomitrium-Salix herbacia* heath. When first visited in 1990, the thalli of this conspicuous, yellow-green species were found to be heavily grazed, presumably by red deer that were commonly seen feeding on the heath. However on the most recent visit in 1998, this did not appear to be as much of a problem. Deer were not seen on the summit heath, and the lichen appeared to be most in danger from rapidly growing pleurocarpous mosses. Whether this is due to increased visitor pressure preventing the deer from grazing, or the effects of global warming is unknown. The third site is Aonach Mór in Westernness, where the spectacular bright yellow, placodioid species *Catolechia wahlenbergii* occurs on steeply sloping schistose rock faces that make monitoring and photographing the species difficult and somewhat perilous!

I now want to put the Scottish lichen vegetation into a wider context. An oceanic climate similar to that of western Scotland affects the western and, to a lesser extent, the eastern coasts of North America. Recent work on Mt Katahdin, the highest mountain in Maine (Hinds *et al.* 2002, and unpublished) has resulted in ten taxa being recorded for the first time from North America, including the oceanic species *Micarea coppinsii*, and *Stereocaulon plicatile*, which was previously believed to be a British endemic. Similarly a number of taxa characteristic of the western Highlands show a bi-oceanic distribution; being known from only the mountains of NW Europe and NW North America (eg. *Ameliella andreaicola* in ed. and *Rhizocarpon caesium*).

Areas of the southern hemisphere also have a highly oceanic climate, in particular the extreme tip of South America and southern New Zealand. With respect to this, the distribution of the genus *Coccotrema* is extremely enlightening. This has its centre of distribution in the southern hemisphere, being particularly diverse in southern South America, but with apparently disjunct populations in NW North America and NW Europe. However when the distribution of *Coccotrema* is plotted onto a map showing areas with a highly oceanic climate, the two can be seen to correspond almost exactly.

I want to finish with three problems that illustrate how much more work there is still to do in the Scottish mountains. 1) There are several collections of *R. geographicum* without rhizocarpic acid, in which case the thallus is white, but what of a specimen from the cairngorms that is completely orbicular but with one half yellow and the other half white, and the dividing line between the two completely straight? 2) low boulders on the summit of Cairn Gorm show a horizontal lichen zonation of, from the base upwards, *Umbilicaria torrefacta*, *Rhizocarpon geographicum*, and *Umbilicaria cylindrica/Lecidea* spp. It isn't surprising that this occurs, but why are the colours so similar to those of the lichen zonation that occurs on maritime rocks? 3) an inconspicuous brown, granular crust is frequent on damp alpine heaths in the west of Scotland. Under the microscope, the granules are revealed to be composed of a thin 'shell', composed of a single layer of pigmented fungal hyphae, enclosing a mass of green algal cells. There appears to be more than one species involved because the hyphae can be straight or wavy and green or brown. It has been suggested that these may belong to the enigmatic genus *Moriola* but much more work is required.

The Powerpoint presentation of this lecture is available on-line here.

References:

- Barry, R. G. (1992) *Mountain Weather and Climate*. London: Methuen.
- Hinds, J. W., Fryday, A. M. & Dibble, A. (2002) Three additions to the lichen flora of North America from Mt. Katahdin, Maine. *Evansia* **19**: 137-141.
- Taylor, J. A. (1976) Upland climates. In *The Climate of the British Isles* (T. J. Chandler & S. Gregory, eds): 9-38. London: Longmans.