Anther smuts on Caryophyllaceae in the Outer Hebrides

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The Caryophyllaceae (pink family) is a large family of plants, and quite a number of the species can have their anthers infected by smut fungi, making the flowers look dirty because the smut spores are spread onto the petals. Several species have been reported to be infected in the Outer Hebrides, the first by Campbell (1936) from Edinburgh University's investigations of the natural history of Barra. This was on *Silene uniflora* (Sea Campion), and was reported as *Ustilago violacea*. Lots of things have happened in smut taxonomy since then (particularly aided by electron microscopes and DNA sequencing), and the anther smuts have been moved into the genus *Microbotryum* and split into many species which are largely host-specific (Lutz *et al*. 2005, 2008). Dennis (1975, 1986 p129) in his wide-ranging fungal survey of the Hebrides (Inner and Outer) reported anther smut on *Silene flos-cuculi* (Ragged Robin) from Rubha Ardvule, South Uist on 14 August 1973. But apart from these two records little investigation of anther smuts in the Outer Hebrides has taken place until recently.

In the course of recent botanical recording, anther smuts have been found on *Silene uniflora* and *Silene acaulis* (Moss Campion), and these were analysed in collaboration with researchers in Germany and Poland and found to correspond to *Microbotryum silenes-inflatae* and *M. silenes-acaulis* respectively (Smith *et al*. 2017[1]). *S. uniflora* is generally a plant of rocks, cliffs and shingle by the sea where it has protection from grazing, since it is palatable to livestock. Smutted *S. uniflora* plants are scattered in the Outer Hebrides, and the frequency of infection appears to be quite low in comparison with the wide distribution of the host. Twelve records have been made between 2008 and 2016, all north of the Sound of Harris where the host is most frequent, and these are all *M. silenes-inflatae*. There is a second species of anther smut which can be found on *S. uniflora*, *M. lagerheimii*, and mixed populations have been detected in southern England, so there remains a possibility that further recording will show it to be present in the Outer Hebrides. The main difference is in a slightly paler spore colour, but identification needs to be confirmed by analysis of the DNA.

Silene acaulis has a more restricted distribution in the Outer Hebrides with small populations on the higher mountains of North Harris, and larger populations on exposed seacoasts, largely around Uig Bay, Lewis. Most of these populations seem to contain some infected individuals, and the frequency of infection seems to be relatively high compared with other areas where *M. silenes-acaulis* is found. One site on the edge of Uig Bay has been visited repeatedly, and in some years there are many smutted flowers, but in 2017 none were visible. So there is clearly variation in the expression of infection from year to year (or possibly by time of year so that smutted flowers are not visible at certain times).

On a global scale *M. silenes-acaulis* is widely distributed, including in N America, and comparison of the DNA sequences for a particular part of the genome shows that the Outer Hebrides specimens are all the same, and most closely related to specimens from Sweden and Switzerland, and most different from those from N America. Analysis of material from a wider range of locations is needed to form a clearer picture of the spatial variation in this fungus, however.

This investigation has clarified which species of anther smuts are found in the Outer Hebrides, and also contributed to understanding the British distributions, with the first DNA analysis of *M. silenes-acaulis* from Britain. However, it is not the end of the story – Dennis's smut on *Silene flos-cuculi* was

[1] Open access at http://www.imafungus.org/Issue/81/18.pdf

probably a different species, and although it has not been refound recently it is likely that it will turn up as recording continues. And anther smuts are also possible on *Silene latifolia* (mostly a weed of arable fields), *S. dioica* (a rare plant with centres of distribution round Loch Aineort and the Shiant Islands) and various species of *Stellaria* (chickweeds) and *Cerastium* (mouse-ears).

Silene acaulis flower infected by *Microbotryum silenes-acaulis*, Aird Uig, Lewis. © Paul A. Smith

Silene uniflora flower infected by *Microbotryum silenes-inflatae*, Loch Eirearaigh, Lewis. © Paul A. Smith

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