Ergots *Claviceps* spp. in the Outer Hebrides

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Ergots are parasitic fungi which infect a wide range of grass species, both wild and cultivated. They have been challenging for farmers of grains, because they replace the seeds and can become mixed with the harvest. They produce a range of toxins, and exposure to these produces a disease known as ergotism. With modern farming procedures this is generally avoided, but in damper climates there is a greater risk. The Outer Hebrides therefore provide good conditions for the growth of ergots.

Archaeological evidence for ergots

Ergots are not commonly discovered in the archaeological record, probably because they are not widely recognised in flotation material (Barclay & Fairweather 1984, Boyd 1986). There are only a few records from archaeological investigations in Scotland, and I did not trace any evidence from digs in the Outer Hebrides.

Ergots on cereals

The damp climate and poor soils of the Outer Hebrides have meant that land races of small oats (*Avena strigosa*), bere (*Hordeum vulgare*) and rye (*Secale cereale*) are grown in preference to other crops. Rye is particularly adapted to cool, wet conditions, but is also particularly susceptible to infection by *Claviceps*. Scholten *et al*. (2009) find levels of infection well above the recommended limits in seed collections on rye, mainly from the Uists.

I expected to find references to the effect of ergot on cereal growing or ergotism from consumption of infected grains in the Outer Hebrides, but drew a complete blank. Ergotism has been known for a very long time, but perhaps it was not sufficiently well-known by visiting naturalists to be identified or noted.

Ergots in natural populations

There are, however, lots of recent records from wild grasses. The first published record seems to be from Dennis (1975). *Claviceps purpurea* was considered to be a single species, but in common with many fungi, recent work analysing regions of its DNA demonstrate that it is a complex of several closely related species, some more or less host specific, and some with a wide host range (Pažoutová *et al*. 2015).

In vc110, *C. purpurea* s.l. has been recorded on *Alopecurus pratensis*, *Ammophila arenaria*, *Anthoxanthum odoratum*, *Elytrigia juncea*, *Glyceria fluitans*, *Leymus arenarius*, *Lolium perenne*, *Molinia caerulea*, *Nardus stricta*, *Puccinellia maritima* and *Secale cereale*, but it's quite likely that it occurs on a many other grass species. Its size varies radically according to the size of the seed that it replaces – on *Nardus stricta* it produces small, narrowly elongate sclerotia, whereas on *Leymus arenarius* it produces much larger, chunky fruit bodies. On *Agrostis*, which has tiny florets, it is easily overlooked, which perhaps explains where there are no records from this species yet.

C. purpurea is frequent on *Nardus stricta* (Mat-grass), which is curious as this is a grass which seems particularly resistant to other infections (it has no known rust or smut parasites). The plant in Fig. 1, on the margin of Loch Thundair, N Uist, is particularly heavily infected.

Fig. 1: *Nardus stricta* heavily infected with *Claviceps purpurea*, margin of Loch Thundair, N Uist

There are a few other distinct species outside the *C. purpurea* s.l. complex, and one of these, *Claviceps nigricans* has been recorded a few times, mainly from the extreme west of Harris and Scarp. This species infects *Eleocharis*, and has been found only on *E. multicaulis* in vc110.

Life cycle

The ergot that grows on grasses is only one phase of the life cycle – the conidial stage, which produces simple spores that are genetically the same as their parent, at the edges as the sclerotia grow. If you have the patience to search the ground in places where ergots are found in spring and early summer, you may be able to find the ascospores, which grow on perithecia on the heads of clavae – structures that look like a pin, with the spores in the head part (Fig. 2). But with some effort you can also germinate your own ergots – see Preece *et al*. (2006) for details and instructions.

Fig. 2: Germinated ergot showing clavae with perithecia in the heads. Photo: Arthur Chater.

Hyperparasitism

Claviceps seems to be a very efficient parasite based on the frequency of its occurrence, but it is also susceptible to being (hyper-)parasitized. The fungus *Gibberella gordonii* C. Booth (formerly called *Fusarium heterosporum*) is occasionally found parasitising the ergots of *Claviceps purpurea* s.l.,

Fig. 3: *Glyceria fluitans* infected with ergots parasited by *Giberella gordonii*, Benbecula (see text for details).

where it forms an orange layer of spores, sometimes only at the base of the ergots, sometimes covering the whole fungal body. Preece *et al*. (1994) describe and illustrate this parasite on ergots growing on *Spartina anglica* on the Isle of Wight, and there are scattered records from mainly the southern half of Britain in the Fungal Records Database of Britain & Ireland (FRDBI, www.frdbi.info).

It was a surprise to discover *Glyceria fluitans* with what looked like swollen orange seeds near Loch na Cille, Benbecula (NF784549). But it was only later when Arthur Chater examined the specimen and recognised the secondary infection that the riddle of its identity was solved.

There is another parasite of *Claviceps* on *Glyceria* which has been found only a handful of times – *Neobarya aurantiaca*. It does not form a layer on the outside, but has a mycelium giving rise to a stroma which bears the perithecia. But so far there are no records from the Outer Hebrides, although it was described from (probably) England (Candoussau *et al*. 2007) and there are five English records on NBN. There are photos at http://ascofrance.com/forum/25556/neobarya-aurantiaca to give you an idea what to look for.

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