

Plant Pathogens

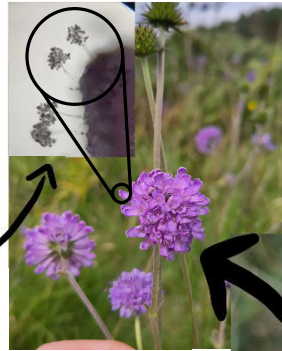
Jake Dalzell

Hijacking pollinators



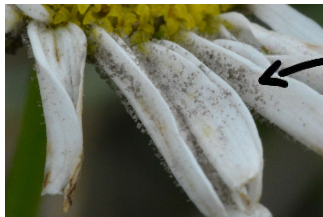
Urocystis primulae, a smut fungus infecting *Primula vulgaris*. White spores are visible around the anthers.

Many pathogens have evolved to be spread by pollinating insects. This means a given spore is more likely to meet another host plant than if it was spread by the wind. Many also produce resting spores in the petals or ovaries of the flower which go into dormancy in the soil.



Peronospora violacea, a floricolous downy mildew.

Microbotryum succisae, a smut fungus.



Peronospora radii on *Tripleurospermum maritimum*

The floricolous downy mildews (a group in the genus *Peronospora*) have evolved sticky spores (conidia) that are brushed onto pollinators by tall conidiophores.



The common *Antherspora tractemae* on *Tractema (Scilla) verna*, which was only described in 2011!

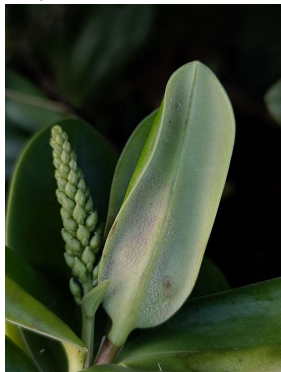
One host, many pathogens

A single species like *Succisa pratensis* can have many different pathogens. Here I have shown three different species that I found on the flowers on one visit to Murlough National Nature Reserve, v.c. Down (H38). Each of these three represents a very distant branch of the tree of life from the other two: Oomycota, Fungi, and Insecta. The fungus and the oomycete show a degree of convergent evolution, having both evolved to be spread by pollinators.



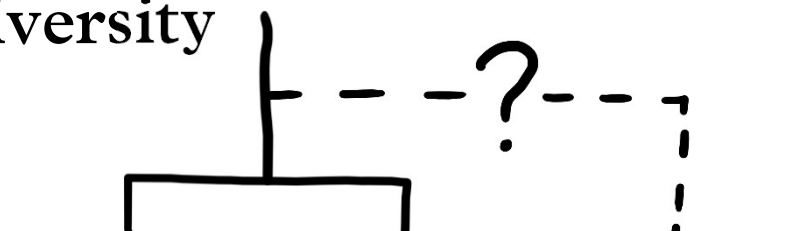
Contarinia dipsacearum, a rare gall midge. Until this record it had been seen once in Britain and Ireland, in 1947 in London.

Cryptic diversity



An undescribed *Peronospora* in the *P. grisea* complex on *Veronica (Hebe) speciosa*. This species is a pest of the horticultural trade, but remains to be given a name.

Many plant pathogen species remain to be described. Generalist species in genera like *Peronospora* (left) and *Entyloma* (right) are often found to be made up of many distinct, host-specific species. *Entyloma* in particular is fantastically diverse, with many *Ranunculus* species having multiple *Entyloma* species that are exclusive to their host. Good collections are essential so that we can describe new species without the struggle of redefining potentially rare or extinct taxa.



Entyloma eburneum on *Ranunculus repens*.

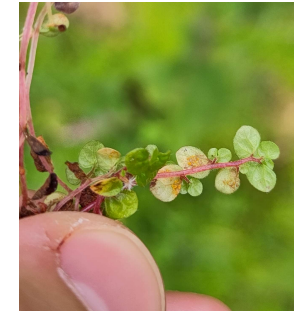


Entyloma ranunculacearum on *Ranunculus acris*.



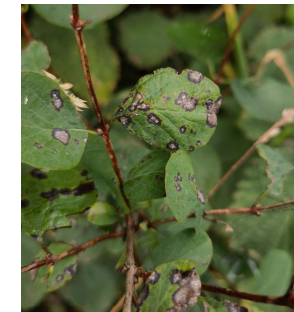
An undescribed *Entyloma* on *Ranunculus baudotii*.

Coinvasion

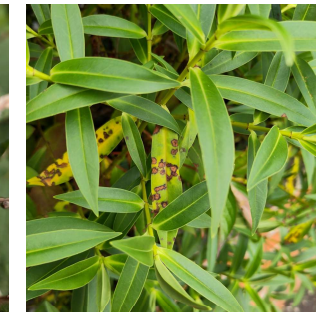


An undescribed *Pucciniastrum* rust on *Soleirolia soleirolii*, originally discovered by Chris Preston.

New plant species are introduced to Britain and Ireland every year. With lax biosecurity, endophytic fungi and oomycetes can be brought in on plants imported for gardens. They may not even show symptoms until after they have passed through a port. *Coinvasion* refers to multiple species with a close symbiosis invading a new area at the same time.



Symphoricarpos albus and its leaf spot fungus *Sphaceloma symphoricarpi*, native to North America.



Veronica (Hebe) salicifolia and its leaf spot fungus *Pseudophacophleopora atkinsonii*, both native to Aotearoa/New Zealand.

Restructured interactions



Fusarium heterosporum infecting *Claviceps spartinae* on *Sporobolus (Spartina) anglicus*.

New species of plants and fungi can alter the interactions of native species. Here the native hyperparasite of ergots, *Fusarium heterosporum*, has formed a new relationship with the ergot *Claviceps spartinae* and its grass host *Sporobolus (Spartina) anglicus*, both of which have been introduced to Ireland in the last 120 years.