Plant-pathogenic fungi and oömycetes




Plant pathogens are everywhere



Plant pathogens are everywhere

Plant pathogens are everywhere

Peronospora blauvikensis

Rumex acetosa

Puccinia phragmitis

Asteromella acetosae

Puccinia acetosae

Plant pathogens are everywhere

Coleosporium euphrasiae

Podosphaera phtheirospermi

Euphrasia *Rhinanthus minor*

Plasmopara densa

Plasmopara euphrasiae

Plant pathogens are everywhere

Erysiphe trifoliorum

Ramularia trifolii

Uromyces sp.

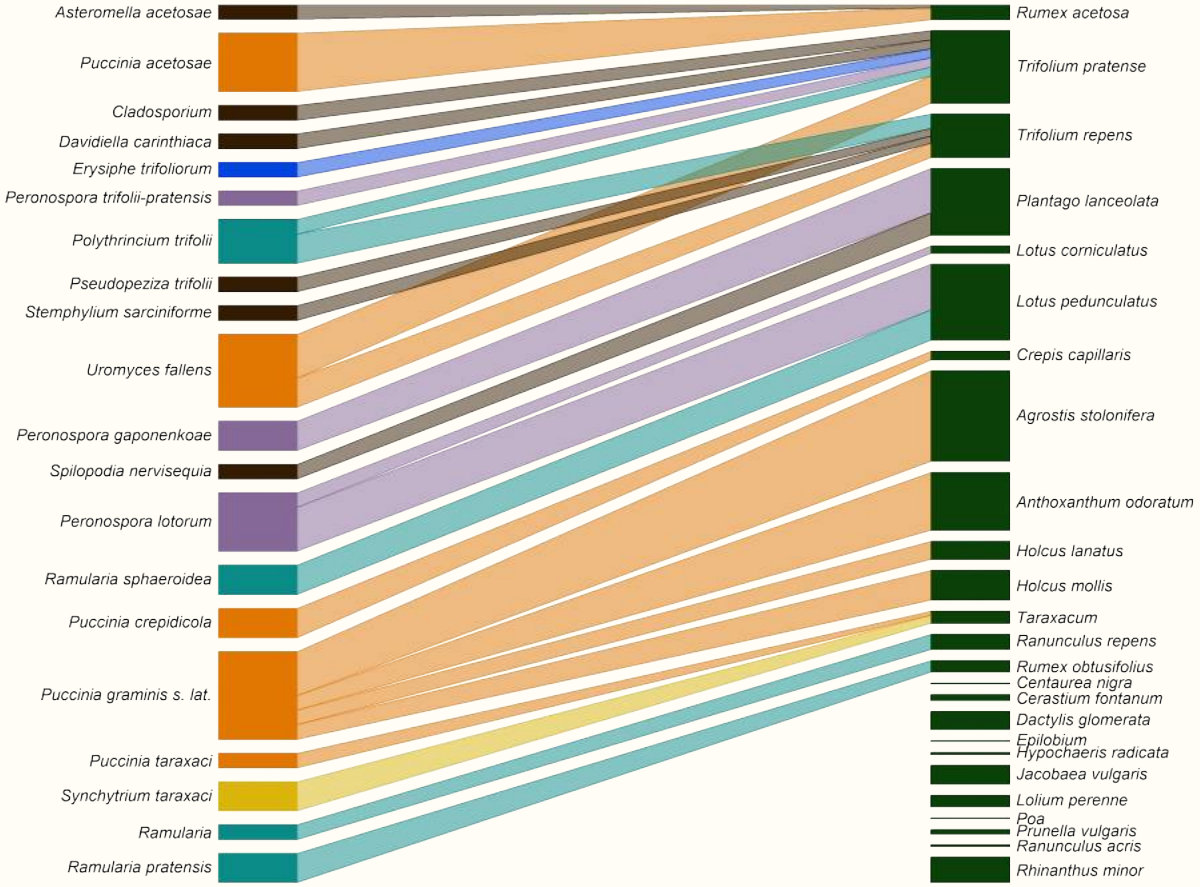
Trifolium pratense

Peronospora trifolii-pratensis

Davidiella carinthiaca

Polythrincium trifolii

Plant pathogens are everywhere



- Most plants in most sites interact with least one pathogen.
- Many interact with several.

So what?

Predators, parasitoids, etc.

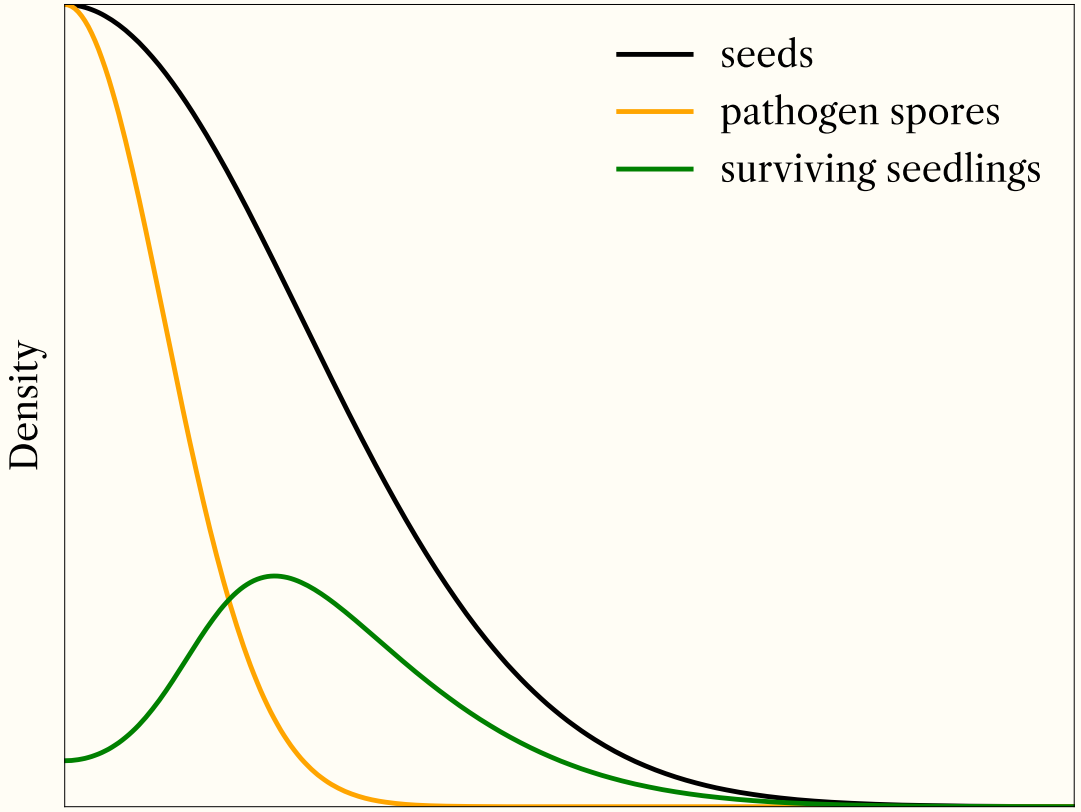
C, N, P

Fungivores

Pathogens

Plants

So what?

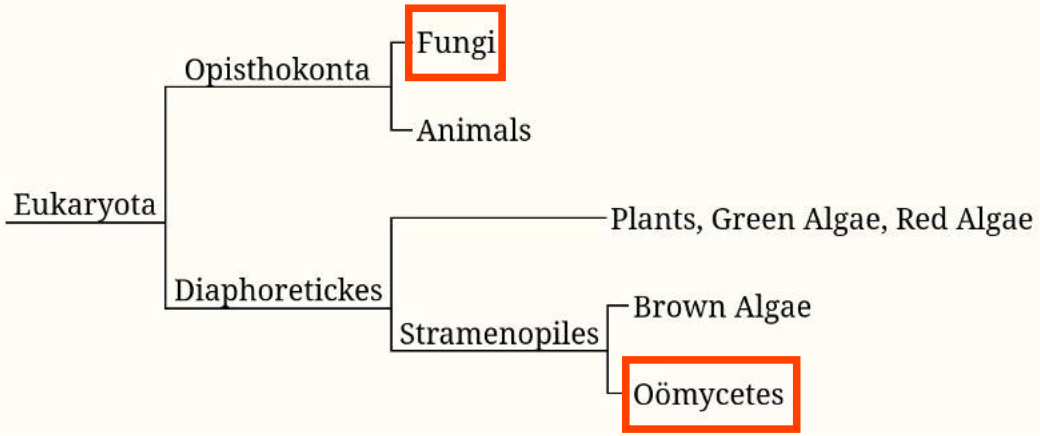


- Pathogens play a key role in **regulating plant population dynamics**.

Model code on my GitHub

Janzen and Connell (and Gillett)

Fungi vs. Oömycetes



- Not closely related at all
- Convergently evolved similar lifestyles
- Many different groups of fungi are parasitic
- Only one major group of oömycetes is parasitic

Important features for ID

- Colour
- Morphology
- Vein-delimited?
- Biotrophs vs. Necrotrophs
- Host

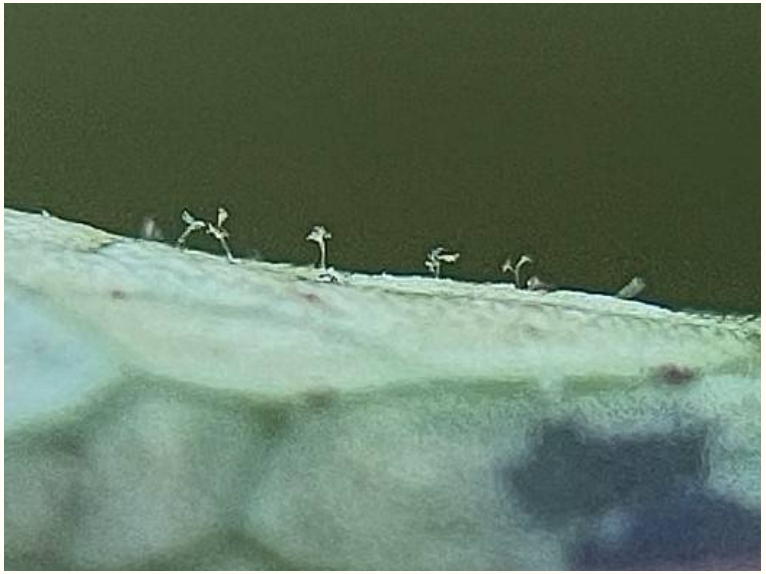
The Importance of Host ID

- Many records have inadequate/erroneous host ID
- As botanists we are well equipped to fix this problem!

Uromyces scillarum	*Uromyces muscari*		Pentire Head	West Cornwall	23/05/1952	Smith, Gill	Smith, Gill	Cornwall, West (with Scilly)	1	Certain
Uromyces scillarum	*Uromyces muscari*		Cother ('Croft') Wd	Herefordshire | Worcestershire	31/12/1799 - 31/12/1899	HerefordFSG, Admin		Herefordshire	36	Certain
Uromyces scillarum	*Uromyces muscari*		Great Doward	Herefordshire | Monmouthshire	31/05/1914	HerefordFSG, Admin		Herefordshire	36	Certain
Uromyces scillarum	*Uromyces muscari*	Bluebell (*Hyacinthoides non-scripta*)	Mains Wd Putley	Herefordshire	22/05/1966	HerefordFSG, Admin		Herefordshire	36	Certain

Do you need a microscope?

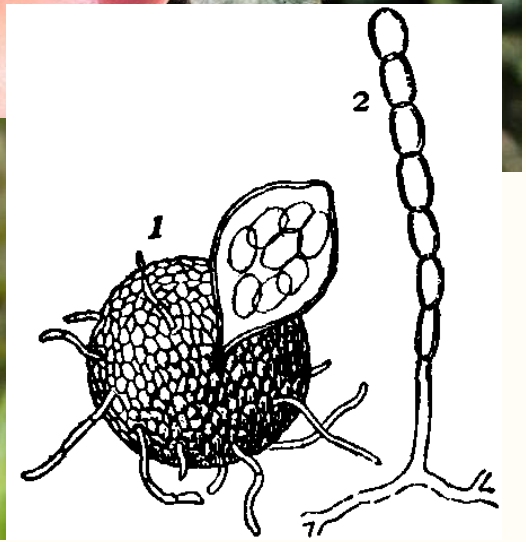
Naked eye



Hand lens

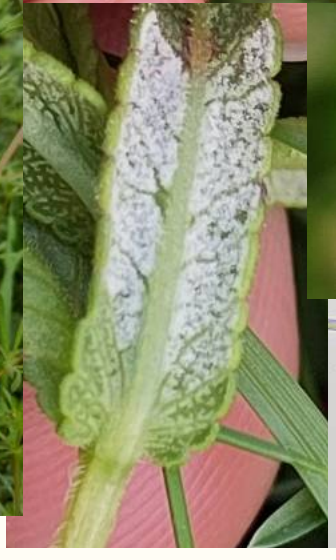
Stereo microscope

Powdery Mildews



- White mycelium
- **External** web-like growth
- Often on upper side of the leaf
- Black/brown spherical fruiting bodies (cleistothecia/ chasmothecia)

Downy Mildews



- White/lilac/brown **branched** conidiophores usually on underside of leaf
- **Internal** growth
- Vein-delimited
- **Yellowing**
- Downward curling of leaves

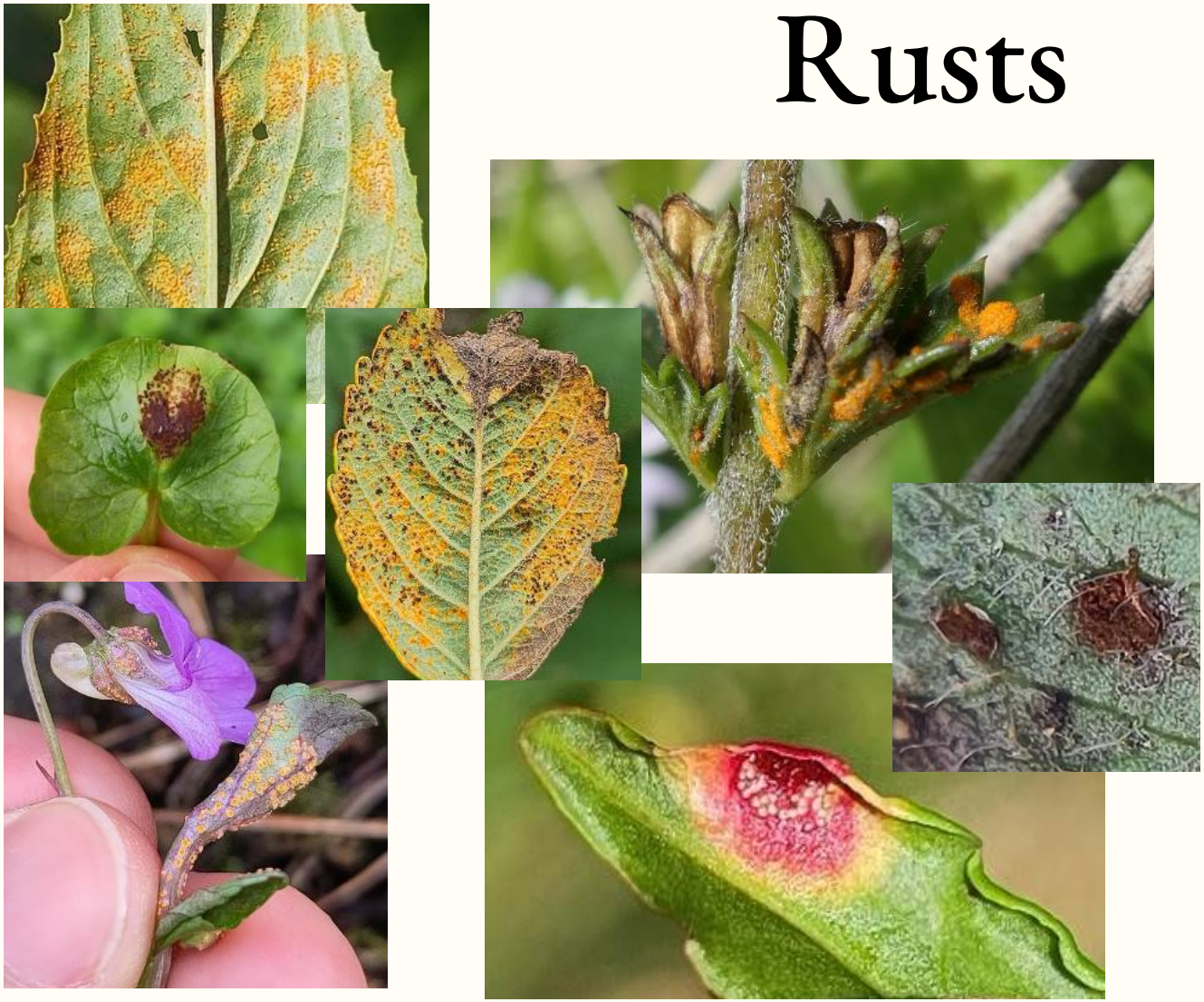
Floricolous Downy Mildews

- Conidiophores on petals
- Deformation of flowers
- Changes in flowering time

White Moulds

- **Internal** growth
- White conidiophores on underside of leaf
- Smaller than Downy Mildews
- Often form necrotic leaf spots
- Rarely vein-delimited

Rusts



- Orange, brown, yellow, rarely white pustules
- Powdery spores usually visible under lens

Rusts

Aecia

Uredinia

Telia

- Up to five different stages, sometimes across two different plants
- Of these, three are obvious and important for ID
- Uredinia and telia often look very similar

False Rusts

Synchytrium taraxaci

- Pustules orange, yellow, or other colours
- One common species on *Taraxacum*
- Lots of rare species
- Spores **not** powdery

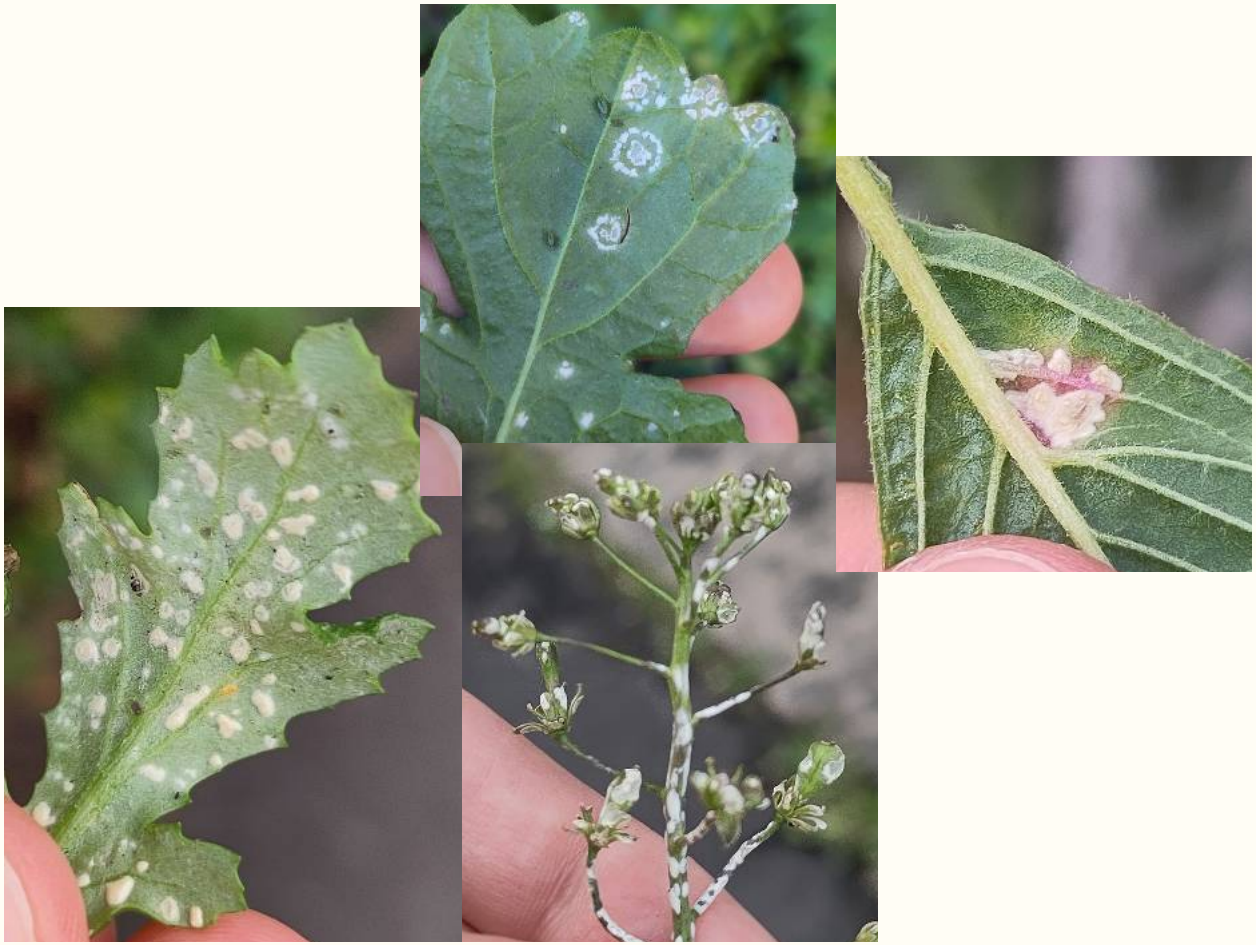
Flower smuts

- Spores produced in anthers and sometimes ovary
- Often spilling out onto petals
- Mostly brown, some species black or white
- Very host-specific

Leaf smuts

- White leaf spots (*Entyloma*)
- Brown/black powdery blisters (*Urocystis, Ustilago)*

White Rusts



- Look a bit like chewing gum
- On Brassicaceae, Asteraceae, Amaranthaceae, and Portulacaceae
- Very common in urban environments

Other leaf spots

- Many unrelated groups
- Generally need microscopic examination
- Many are undescribed
- Sometimes leaf spots are not caused by fungi

Recording checklist

1. **Photos of the pathogen and its host**
2. **Location**
3. **Date**
4. If possible take a specimen of the pathogen and potentially its hostplant

Puccinia longicornis Research Grade

Edit

Photos *in situ*

Microscopy added later

jakedalzell

4,768 observations

Location, Date

Observed:
Apr 26, 2025 · 4:58 PM BST

Submitted:
Apr 26, 2025 · 6:51 PM BST

Castlereagh, Northern Ireland, G... Show

Details

Be the first to fave this observation!

Host, morphology

Notes

on a Bamboo

capitate paraphyses, long-horned 2-celled teliospores

Community Taxon

What's this?

Puccinia longicornis

Cumulative IDs: 2 of 2

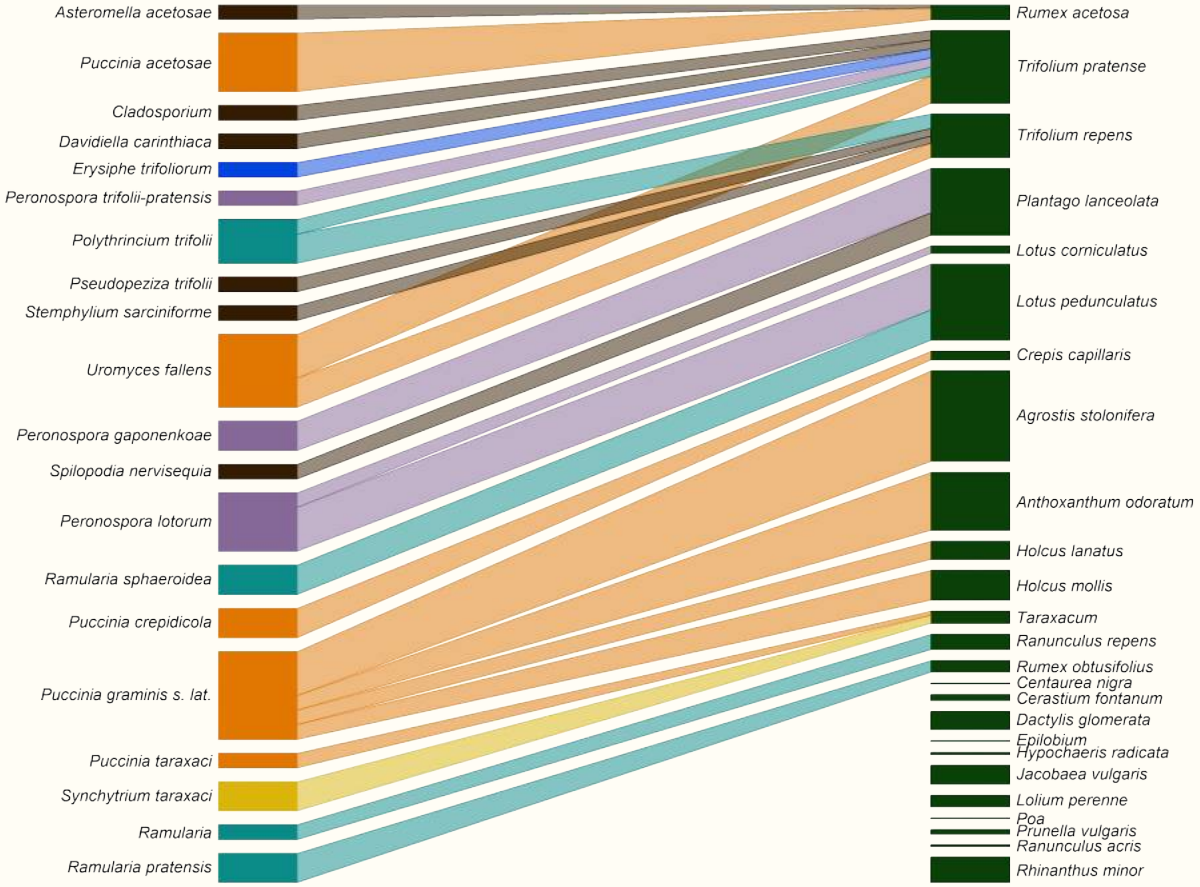
iNaturalist now feeds into BRC

- Research-grade iNaturalist records are added to iRecord as unverified

(Figure stolen from Martin Harvey BRC https://youtu.be/8pbgbhocYks)

ID Example 1

Host plant



- Most pathogens are fairly host-specific
- Knowing the host and broad group often narrows it down to a single species

Host plant

Host plant

Ficaria verna

ENGLISH VERNACULAR NAME
lesser celandine, pilewort

DUTCH VERNACULAR NAME
gewoon speenkruid

SYNONYM
Ficaria ranunculoides, Ranunculus ficaria, Ranunculus ficaria subsp. bulbifer

Filter: fungi

ORGAN	MODE	STAGE	MAIN GROUP	GROUP	FAMILY	PARASITE	P	G	S
leaf	down	anamorph	Fungi	Ascomycota	Sclerotiniaceae	*Botryotinia ficariarum*		1	2
leaf	down		Fungi	Ascomycota	Sclerotiniaceae	*Botrytis ficariarum*		1	1
leaf	leaf spot		Fungi	Ascomycota	Glomerellaceae	*Colletotrichum dematium*		38	41
leaf	leaf spot		Fungi	Basidiomycota	Entylomataceae	*Entyloma ficariae*		1	2
leaf	pustule	aecia	Fungi	Basidiomycota	Pucciniaceae	*Schroeteriaster alpinus*		3	11
leaf	leaf spot		Fungi	Ascomycota	Mycosphaerellaceae	*Septoria ficariae*		2	2
leaf	pustule		Fungi	Chytridiomyceta	Synchytriacee	*Synchytrium anomalum*		4	4
leaf	pustule		Fungi	Basidiomycota	Urocystidaceae	*Urocystis ficariae*		1	2
leaf	pustule	telia	Fungi	Basidiomycota	Pucciniaceae	*Uromyces ficariae*		1	3
leaf	pustule	aecia	Fungi	Basidiomycota	Pucciniaceae	*Uromyces poae*		5	43
leaf	pustule	aecia	Fungi	Basidiomycota	Pucciniaceae	*Uromyces rumicis*		2	21
root	gall	teleomorph	Fungi	Ascomycota	Sclerotiniaceae	*Botryotinia ficariarum*		1	2
root	macro fungus		Fungi	Ascomycota	Sclerotiniaceae	*Dumontinia tuberosa*		2	5
systemic	down		Fungi	Ascomycota	Sclerotiniaceae	*Botrytis cinerea*		152	160
systemic	pustule		Fungi	Ascomycota	Sclerotiniaceae	*Sclerotinia sclerotiorum*		88	89

- Plant Parasites of Europe (bladmineerders.nl) has a page for each host
- Can filter with search box

Broad pathogen group

- White leaf spots
- No clear structures visible under hand lens
- Some necrosis but essentially a biotroph
- **White leaf smut** (*Entyloma*)

Broad pathogen group

Filter leaf spot

ORGAN	MODE	STAGE	MAIN GROUP	GROUP	FAMILY	PARASITE	P	G	S
leaf	leaf spot		Fungi	Ascomycota	Glomerellaceae	*Colletotrichum dematium*		38	41
leaf	leaf spot		Fungi	Basidiomycota	Entylomataceae	*Entyloma ficariae*		1	2
leaf	leaf spot		Fungi	Ascomycota	Mycosphaerellaceae	*Septoria ficariae*		2	2

ID Example 1

Entyloma ficariae

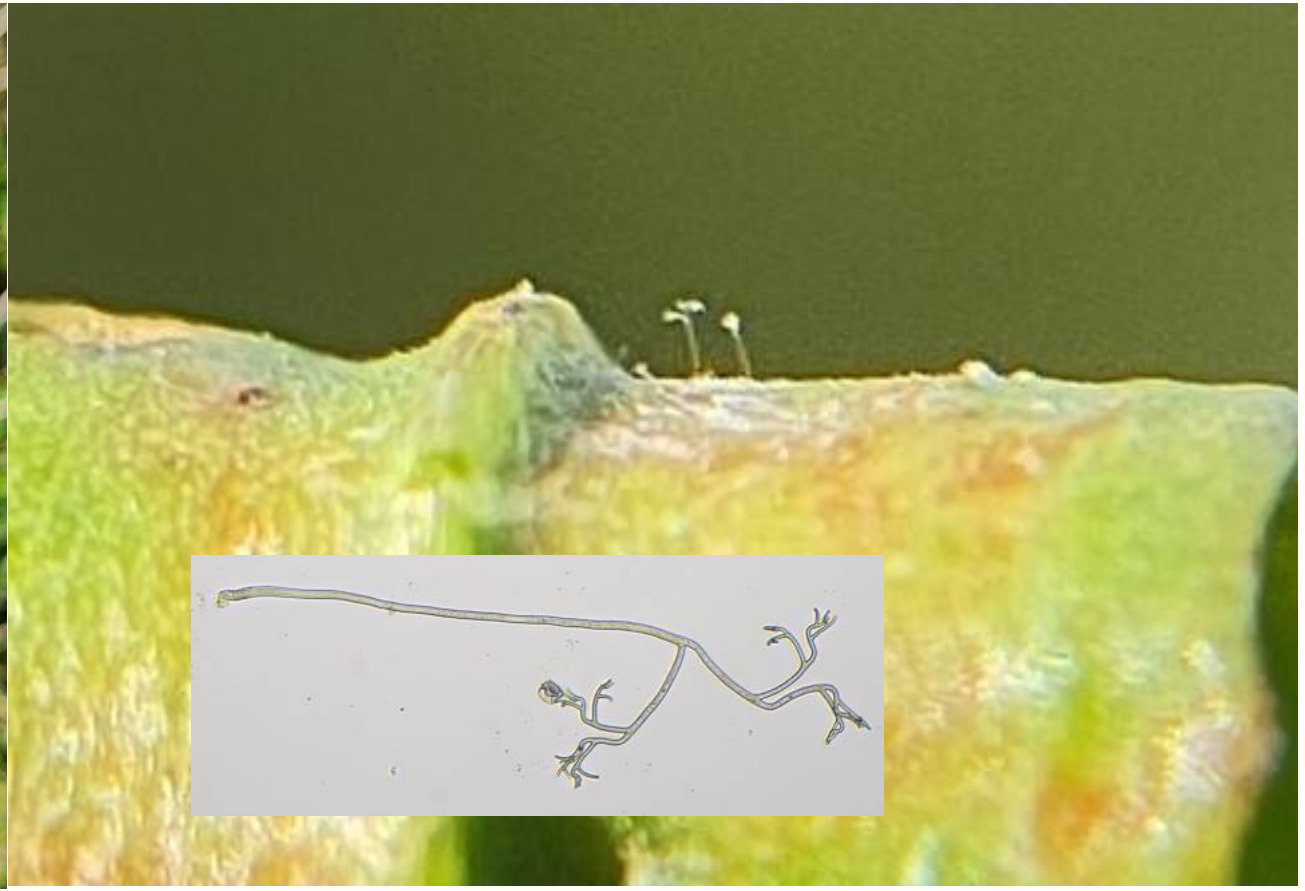
Fischer von Waldheim, 1877

on *Ranunculus*

***Ranunculus ficaria*, Ittervooord, Vijverbroek**

- Yes

ID Example 2



ID Example 2

Plantago lanceolata

ENGLISH VERNACULAR NAME

ribwort plantain

DUTCH VERNACULAR NAME

smalle weegbree

SYNONYM

Plantago glabriflora, Plantago lanuginosa

- Yes (*sensu lato*)
- iNaturalist is the place where people will know about recent changes to pathogen taxonomy

Filter Peronosporaceae

ORGAN	MODE	STAGE	MAIN GROUP	GROUP	FAMILY	PARASITE	P	G	S
leaf	down		Chromista	Oomycota	Peronosporaceae	*Peronospora alta*		1	9

ID Example 3

ID Example 3

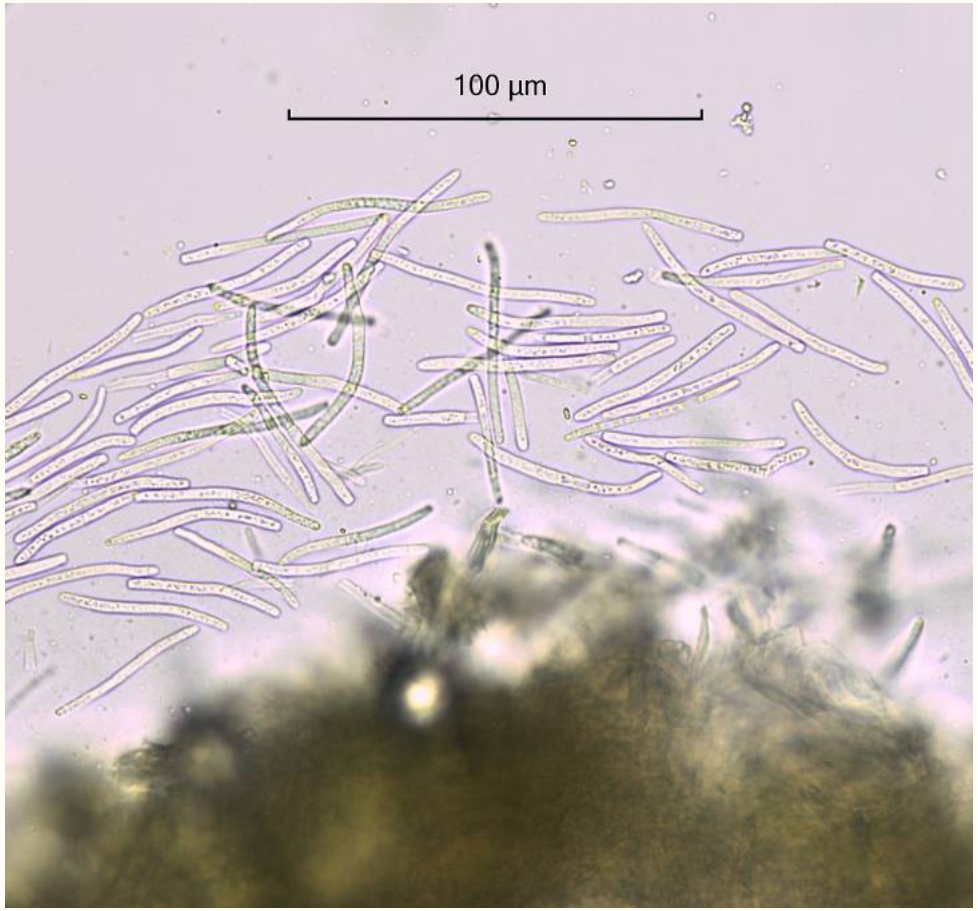
genus Stellaria

Filter: leaf spot

ORGAN	MODE	STAGE	MAIN GROUP	GROUP	FAMILY	PARASITE	P	G	S
leaf	leaf spot		Fungi	Ascomycota	Pleosporaceae	*Alternaria alternata*		32	33
leaf	leaf spot		Fungi	Ascomycota	Ascomycota incertae sedis	*Apiocarpella anisomera*		2	3
leaf	leaf spot		Fungi	Ascomycota	Didymellaceae	*Ascochyta stellariae*		2	4
leaf	leaf spot		Fungi	Ascomycota	Glomerellaceae	*Colletotrichum dematium*		38	41
leaf	leaf spot		Fungi	Ascomycota	Mycosphaerellaceae	*Davidiella woronichinii*		2	2
leaf	leaf spot		Fungi	Ascomycota	Didymellaceae	*Didymella holosteae*		1	1
leaf	leaf spot		Fungi	Ascomycota	Leptosphaeriaceae	*Leptosphaeria stellariae*		2	3
leaf	leaf spot		Fungi	Ascomycota	Pleosporales incertae sedis	*Mycocentrospora acerina*		38	43
leaf	leaf spot		Fungi	Ascomycota	Mycosphaerellaceae	*Mycosphaerella isariphora*	📷	1	2
leaf	leaf spot		Fungi	Ascomycota	Pleosporales incertae sedis	*Phoma exigua var. exigua*		26	27
leaf	leaf spot		Fungi	Ascomycota	Mycosphaerellaceae	*Ramularia episphaeria*	📷	2	8
leaf	leaf spot		Fungi	Ascomycota	Mycosphaerellaceae	*Septoria stellariae*	📷	3	5

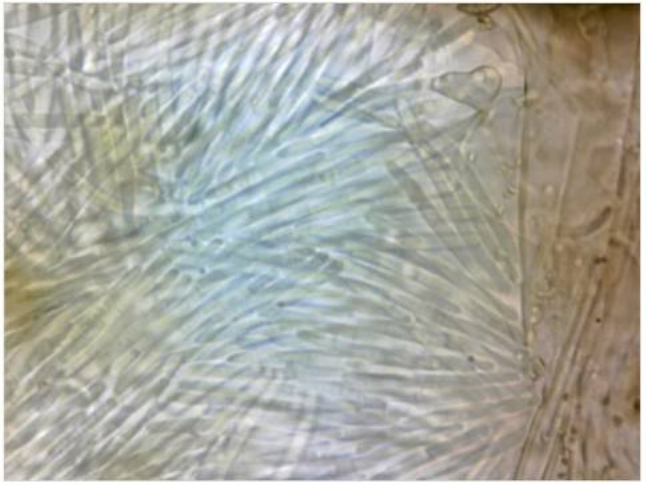
- Not in one of the easy main groups we discussed earlier
- So many leaf spots...

ID Example 3



- Long thin spores within pycnidia embedded in the leaf
- → *Septoria stellariae*?

ID Example 3



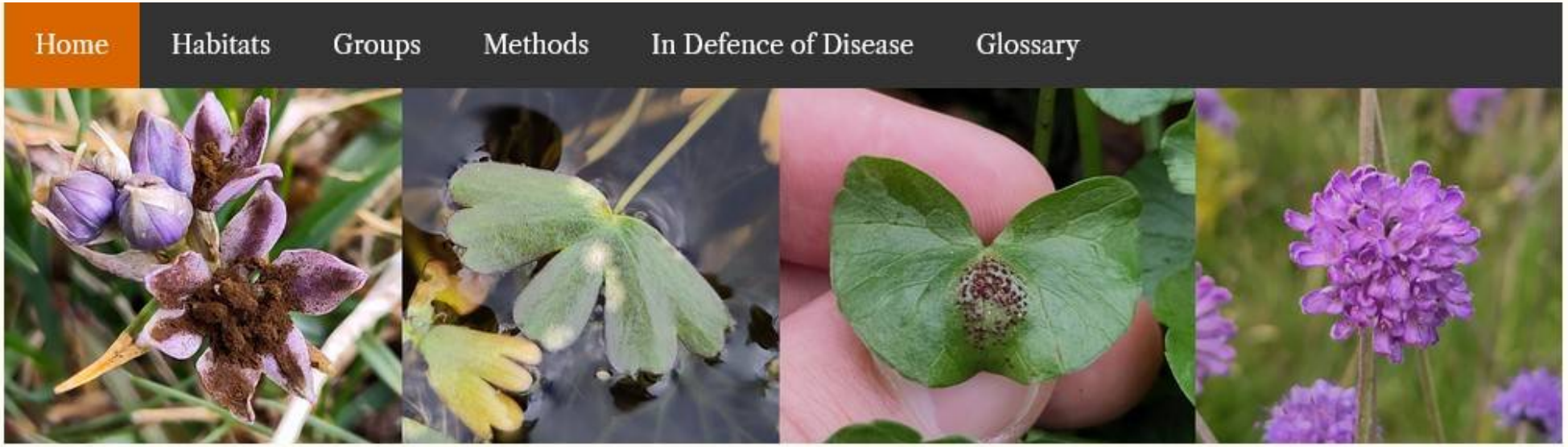
conidia

PARASITE
Leaf spots with pycnidia. Conidia 2-3 x 30-64 µm, 1-3-septate.

HOST PLANTS
Caryophyllaceae, oligophagous

Cerastium; Myosoton aquaticum; Stellaria holosea, media, nemorum.

- Yes



Field Guide to Plant Pathogens

I have more advice on using bladmineerders.nl, common species to look out for, microscopy techniques etc. on my website plantpathogens.net

Books

- (pdf) **Towards a Handlist of Microfungal Parasites of Vascular Plants from Britain and Ireland and a Census Catalogue for Wales.** Woods, R. G., Chater, A. O., Nigel, R., Evans, D. A., & Smith, P. A. (2024).
  A checklist of microfungi (including fungi and oömycetes) known from Britain and Ireland, based on records in the FRDBI. Note the taxonomy is out of date for some groups that have been split up recently, like the *Entyloma eburneum* group, listed here under *Entyloma ranunculi-repentis*.

- (pdf) **Rust Fungus Red Data List and Census Catalogue for Wales.** Woods, R. G., Stringer, R. N., Evans, D. A., & Chater, A. O. (2015).
  An **illustrated** guide to Rusts found in Wales, with conservation status assessments.

- (pdf) **Smut and allied fungi of Wales: A guide, red data list and census catalogue.** Woods, R. G., Chater, A. O., Smith, P. A., Stringer, R. N., & Evans, D. A. (2018).

- (pdf) **Downy Mildews (Peronosporaceae) and White Blister-Rusts (Albuginaceae) of Wales.** Chater, A. O., Woods, R. G., Stringer, R. N., Evans, D. A., & Smith, P. A. (2020).
  An **illustrated** guide to these two groups of oömycetes found in Wales.

- (pdf) **The Powdery Mildews of Britain & Ireland – an Identification Guide and Census Catalogue for Wales.** Woods, R. G., Chater, A. O., Evans, D. A., Smith, P. A., & Stringer, R. N. (2024).
  A guide to studying Powdery Mildews, with a checklist of species found in Wales. Includes an illustrated section on microscopy.

- (pdf) **White moulds, *Ramularia* and *Phacellium* anamorphs, in Wales and Britain: A Guide and Welsh census catalogue.** Chater, A., O., Woods, R. G., Stringer, R. N., Evans, D. A., & Smith, P. A. (2021).
  An **illustrated** guide to White Moulds, with detailed descriptions and a checklist of species.

- The books by Woods et al. have very useful photographs
- Links on my website!!!

Get recording!

1. **Photos of the pathogen and its host**
2. **Location**
3. **Date**
4. If possible take a specimen of the pathogen and potentially its hostplant

Thanks

Chris Preston
Gareth Griffith
Gemma Beatty
Arthur Chater
Wayne Liang
NI DAERA
Irish Naturalists' Journal
BSBI
And more...

Department of
Agriculture, Environment
and Rural Affairs

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Eberl et al., 2020. Herbivory meets fungivory: Insect herbivores feed on plant pathogenic fungi for their own benefit. *Ecology Letters*, **23**(7), 1073–1084. https://doi.org/10.1111/ele.13506

Ellis, 2001-2026. *Plant parasites of Europe: leafminers, galls and fungi*. https://bladmineerders.nl (accessed January 27, 2026)

Gillett, J. B. (1962). Pest Pressure, an Underestimated Factor in Evolution. *Systematics Association Publication Number 4: Taxonomy and Geography*, 37–46.

Janzen, 1970. Herbivores and the Number of Tree Species in Tropical Forests. *The American Naturalist*, **104**(940), 501–528. https://doi.org/10.1086/282687

Ramsell & Paul, 1990. Preferential Grazing by Molluscs of Plants Infected by Rust Fungi. *Oikos*, **58**(2), 145–150. https://doi.org/10.2307/3545421