Mycological Notes 20: Keeping lists – the fungi in my garden

Jerry Cooper, January 4th 2013

I don't keep fungal lists deliberately. They just happen. From my suburban 600m^2 garden in Christchurch in 8 years I have a list of 117 records of 105 species. From the village where I work at Lincoln I have 219 collections of 161 species in 10 years. However, clearly I haven't been trying hard enough. Geoff Kibby in Field Mycology v9, n2, 2008 reports the case of British retired biologist Jennifer Owen who, beginning in 1971 catalogued the wildlife in her suburban Leicester garden. After 15 years she published her interim results covering 2,673 (mainly insect) species, which included 533 species of parasitical wasp alone. Fifteen of these had never been recorded in Britain, and four of them were new to science (Wildlife of a Garden: a Thirty-year Study, by Jennifer Owen). Entomologists will always beat mycologists in generating lists, and bird watchers and botanists will never be in the same league.

Geoff Kibby, in the same article, speculated that in 40 years of studying fungi he had seen 1,700 of the 3,200 British basidiomycete species, but I'm sure he will have seen many more fungal species in total. In 30 years of recording fungi I know for certain what I've seen and exactly when I saw it. Up to 31st Dec. 2012 I've handled 10,505 collections, 9,268 of them collected by me, representing 3,314 taxa. How can I be so sure what I recorded and when? Back in the early 1980s when my interest in fungi started I was also a computer geek. As part of my PhD physics research I wrote programs on stacks of punched cards that were fed into a room-sized mainframe computer. In the lab we acquired a DEC PDP-11 mini-computer followed by numerous BBC micro-computers. I quickly learnt the art of writing machine code and turned these computers into robots. The micros did a lot of tedious work for me, collecting and analysing data so I could go off to the woods and hunt fungi. In 1984 I used my first cheque as a research assistant to buy my very own Sinclair QL micro-computer and wrote a database program to store my fungal records. Variations of that same database have since been transferred across many computers and database systems. The result is that I became a mycological life-logger, before the internet came into existence. I can now look back at thirty years of accumulated records and if I was out foraying (which was quite a lot apart from a 5 year break) then I know where I was, what I collected and when. I can dynamically visualise thirty years of foraying around UK, Europe and New Zealand with pins on Google Earth. That database has become an invaluable tool and stores not just what/where/when data, but also my 10,000 photographs, all the notes I've made, re-identifications and even my recent sequence and phylogeny data. I have a reasonably good memory but the database contains the equivalent of very many telephone directories of data, all instantly searchable in many different ways. The power of databases, especially mycological and web-enabled ones, took over my working life, and I've been involved in lots of them over the years, including the foray records database of the British Mycological Society, the British Checklist of Basidiomycetes, the global catalogue of fungal names, IndexFungorum, the NZFUNGI database, and the New Zealand Organisms Register. Nevertheless, my interest in databases has always been driven by the pragmatic need to support my own mycological activities. It has allowed me to record and use data much more usefully than relying on memory alone. Producing a specific list, such as the one in this document, is just a simple query.

Now back to the eclectic list of fungi in my garden. Another reason why I have seen so many fungi is that I don't just look at mushrooms. The vast majority of fungi are microscopic 'moulds' and identifying them is no more difficult than identifying mushrooms, and often a lot easier. Correct identification of both macro and micro-fungi requires two essential ingredients: 1) access to good literature, 2) access to a microscope. Bird watchers can get away with a pair of binoculars and a field guide from the local book store. Botanists, likewise, just need a hand lens, and a local flora. Fungi, nearly everywhere in the world are relatively poorly documented. Identification guides are becoming more numerous, but

not in New Zealand. Fortunately much literature is becoming freely available online, but even so there is still no replacement for access to a set of relevant technical monographs, and they aren't cheap or easy to acquire. My library has been accumulating texts and reprints for 30 years, and I've often had access to the specialist libraries in organisations like Kew, the International Mycological Institute and Landcare. Also, correct identification of nearly all fungi needs confirmation by examination of microscopic features. Microscopes can be seriously expensive, although they don't need to be. Purchasing mine was an alternative to buying a decent car.

So, when it comes to correct identification, If you aren't willing or able to use technical literature and to check identification details with a microscope then your contribution to documenting our diversity of fungi will be minimal. On fungal forays its always useful to have a few extra pairs of eyes looking for things, and it can be a fun activity, but nevertheless please don't collect fungi unless you are prepared to do the subsequent identification work. Collecting material which gets thrown in the bin and never named or recorded is a waste of time. Published data suggest that collecting fruitbodies doesn't negatively affect populations, but it is inappropriate to collect without purpose. And finally, always ensure you have appropriate permission to collect fungal specimens, which isn't an issue in your own garden.

Amongst the 105 species recorded from my garden, 12 represent first records for New Zealand and 5 are probably undescribed species. This is about half the average rates for material I collect from native habitats, where the ratio also shifts in favour of undescribed rather than introduced species. These figures may seem high but that is simply a reflection of how poorly we have documented our fungi. There have been just a relatively small number of New Zealand mycologists, past and present, amateur or professional, compared to the UK or Europe.

Plant pathogens.

On the face of it my garden probably has the highest concentration of plant diseases in the country. In fact most gardens will have a similar range of fungal pathogens. Pathogens rarely wipe out their host. That wouldn't be a smart evolutionary move, and so they will normally just affect a few plants, even just a few leaves. The exception is where we have planted monocultures of inbred plants and then pathogens can cause havoc. Most pathogen species are restricted to just a few host species and the symptoms are usually easy to spot. So, if you know your plants then these fungi are easy to name and record. Once you get into the habit then it's hard not to see plant diseases everywhere. Gardener's don't always appreciate my enthusiasm for peering over garden walls at their sick plants. An early pathogen mentor, Chris Yeates, invented the art of 'Gonzo Mycology'. We would compete for the longest challenging list - like plant diseases recorded from the flower tubs at service stations on a section of a motorway.

White blister rusts

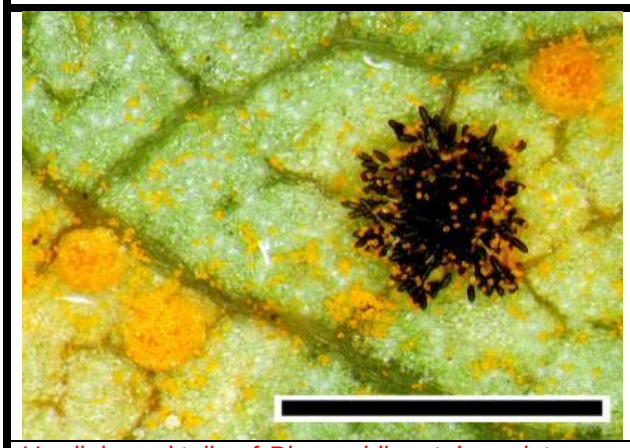
Blister rusts are not true fungi but members of the kingdom Chromista, and are essentially algae without chlorophyll and related to the downy mildews. One part of their life-cycle consists of swimming cells with two flagella, and hence always need free water to complete their life-cycle. Apart from *Albugo tragopogonis* on ragwort another species (*Albugo candida*) is commonly found on brassicas. In Christchurch there is another common species on, *Carpobrotus edulis* which has invaded beach areas.

Albugo tragopogonis on *Senecio vulgaris* (ragwort). PDD 95361

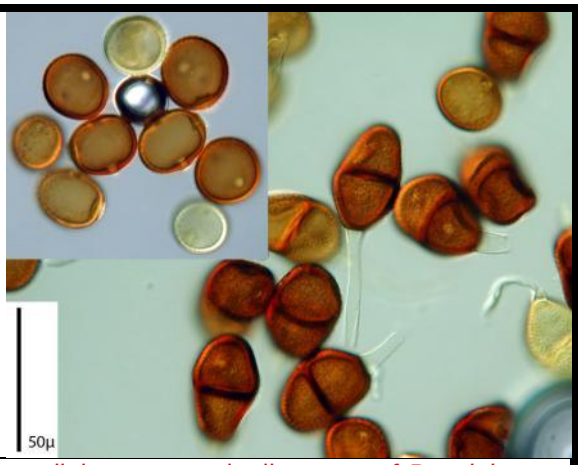
Rusts

Rusts are true fungi and members of the Phylum basidiomcyota, like mushrooms. The rusts have a complex life-cycle sometimes involving up to five different kinds of spore. Sometimes they just produce a single spore type (microcyclic) or produce different spore types at different times of the year (macrocylic). Typically macrocyclic rusts produce yellow aeciospores in the spring, followed by brown or orange urediniospores in the summer, and finally dark brown, overwintering teliospores in the autumn. Sometimes these different stages occur on the same host (autoecious) but to really complicate things, in some species these different stages occur on very different host plants (heteroecious) which need to be physically co-located for the transfer to occur. These heteroecious rusts are uncommon in New Zealand. I expect that's because New Zealand hasn't been above water long enough for such split life-cycles to evolve on the relatively recently evolved endemic flora, and long distance dispersal of introduced spores to a locality with both potential hosts, needed to complete the life cycle, has a low probability.

The rusts on Cornflower and Rhubarb are interesting. In Europe both rusts are rare, and even in Asia, the home of Rhubarb, the rust is rare. It wouldn't surprise me to find that both rusts are also present in New Zealand on related native or introduced hosts which are providing a reservoir of inoculum.

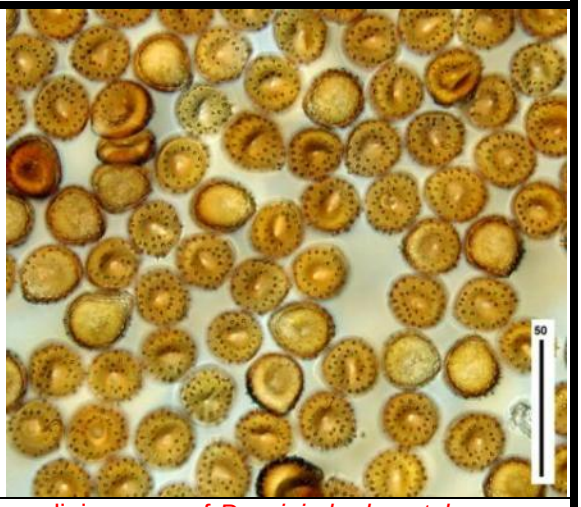
	
Uredinia of *Melampsora lini* (macrocyclic, autoecious) on *Linum monogynum* (linen flax) PDD 86802	Uredinia of *Miyagia pseudosphaeria* (macrocyclic, autoecious) on *Sonchus oleracea* PDD 86882
	
Uredinia and telia of *Phragmidium tuberculatum* (macrocyclic, autoecious) on *Rosa* cvs (rose cultivars) PDD 81060	urediniospores and teliospores of *Phragmidium tuberculatum*
	
Uredinia and telia of *Puccinia allii* (macrocyclic, autoecious) on *Allium schoenoprasum* (onions) PDD 87019	urediniospores and teliospores of *Puccinia allii*

Uredinia and telia of *Puccinia cyani* (macrocyclic, autoecious) on *Centaurea cyanus* (cornflower) PDD 95728



urediniospores and teliospores of *Puccinia cyani*

Uredinia of *Puccinia hydrocotyles* (macrocyclic, autoecious) on *Hydrocotyle novaezelandiae* (pennywort) PDD 87237



urediniospores of *Puccinia hydrocotyles*

Uredinia of *Puccinia menthae* (macrocyclic, autoecious) on *Origanum vulgare* (oregano) PDD 87778

urediniospores of *Puccinia menthae*

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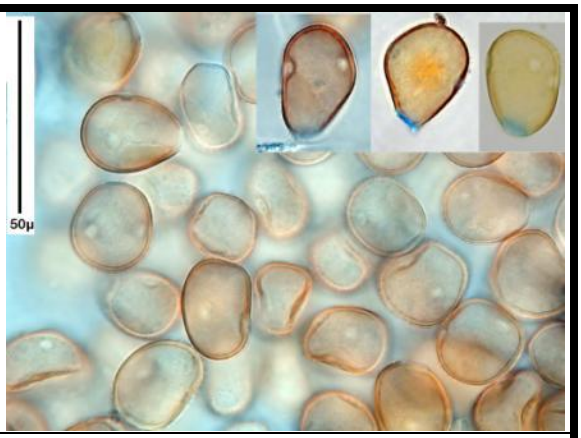
<tr><td>  </td><td> 
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<tr><td>Puccinia rhei-undulati on Rheum rhabarbarum (rubarb) PDD 96389</td><td>urediniospores of Puccinia rhei-undulati</td></tr>
<tr><td> 
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<tr><td>Pucciniastrum epilobii on Fuchsia magellanica (fuchsia) PDD 96662</td><td>urediniospores of Pucciniastrum epilobii</td></tr>
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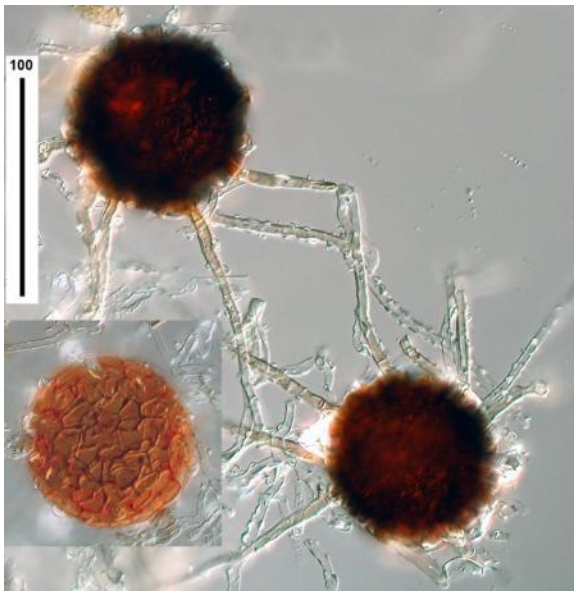
Other recorded rusts: *Tranzschelia discolor* on *Prunus domestica* (plum) PDD 80906, *Uromyces betae* on *Beta vulgaris* subsp. *cicia* (chard) PDD 96086, *Phragmidium* sp on *Acaena novaezelandiae* JAC12661, *Puccinia distincta* on *Bellis perennis* (daisy) PDD 80672, *Puccinia lapsanae* on Lapsana *communis* (nipplewort) PDD 86806, *Puccinia oxalidis* on *Oxalis latifolia* (fish tail oxalis) PDD 86881, *Puccinia variabilis* on *Taraxacum officinale* (dandelion) PDD 95618

Powdery mildews

Powdery mildews, as their name suggests, form a white powdery coating usually on the upper surface of leaves, and they are true fungi and members of the phylum ascomycota. They are most common in high summer and dry conditions. The white powder consists of mycelium and asexual barrel-shaped conidia. The sexual state is less frequent and may be seen as scattered black dots seated on the mycelium. Under the microscope they are seen to be enclosed spherical containers (cleistothecia) for asci containing ascospores. Frequently the cleistothecia are ornamented by characteristically shaped appendages.

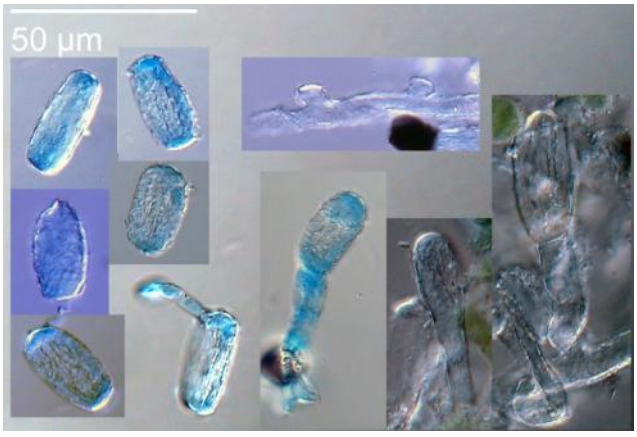
The record of *Sphaerotheca epilobii* represents a first New Zealand record.



Cleistothecia *of Erysiphe aquilegiae var. aquilegiae* on *Aquilegia vulgaris* PDD 86851

Golovinomyces orontii on *Cucumis sativus*, (cucumber). Conidia and conidiophores. PDD 95295

Microsphaera trifolii on *Sophora prostrata* PDD 96102



Conidia and conidiophores of *M. trofolii*

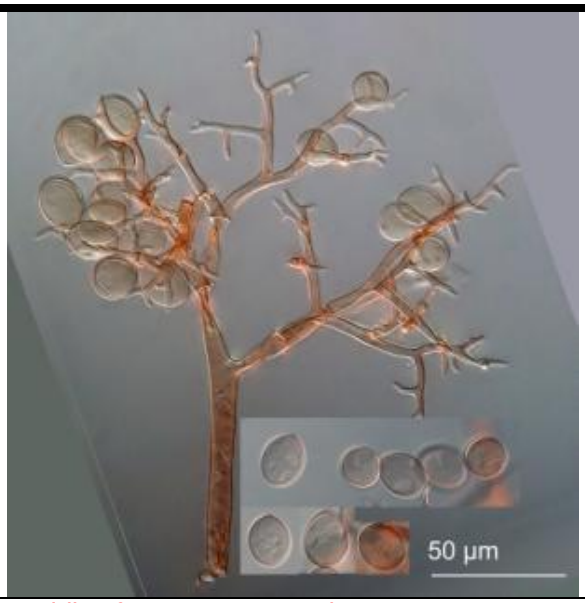
Other powdery mildews: *Golovinomyces biocellatus* on *Salvia officinalis* (sage) PDD 96655, *Microsphaera euonymi-japonici* on *Euonymus japonicus* (japanese spindleberry) JAC 9174, *Sphaerotheca epilobii* on *Epilobium melanocaulon* (willowherb) PDD 86942

Downy mildews

Downey mildews are members of the kingdom Chromista, like white blister rusts. They are more common during warm and humid conditions.

The record of *Plasmopara pusila* represents a first record for New Zealand.

Peronospora grisea on *Hebe hulkeana* (New Zealand lilac) PDD 96104

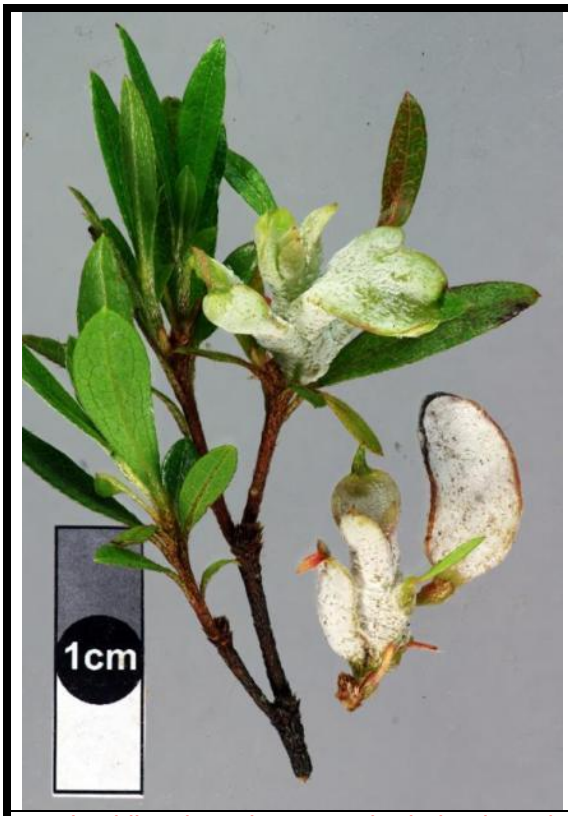


conidia of *Peronsospota grisea*

Other downey mildews: *Plasmopara pusilla* on *Geranium sessiliflorum* (dwarf black cranesbill) PDD 86944

Leaf curls – sensu lato

Exobasidium causes a thickening of the leaves rather than leaf curling. It is a member of the basdidiomcyota. Likewise, *Taphrina pruni* causes aborted fruit formation, a condition known as 'pocket plums'. *Taphrina deformans* on the other hand is a true curler and Taphrinas are members of the ascomycota.



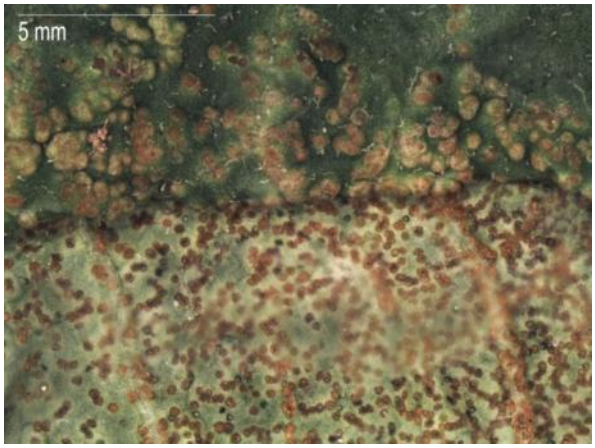
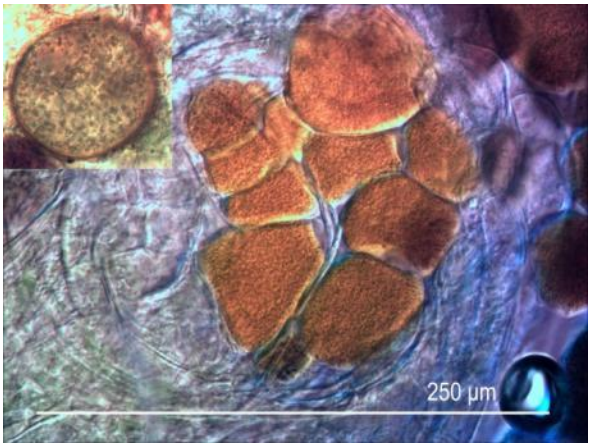
Exobasidium japonicum on *Rhododendron simsii* (Azalea) PDD 96096

Taphrina deformans on *Prunus persica* (peach) PDD 81061

	
Taphrina pruni on *Prunus domestica* (plum)	

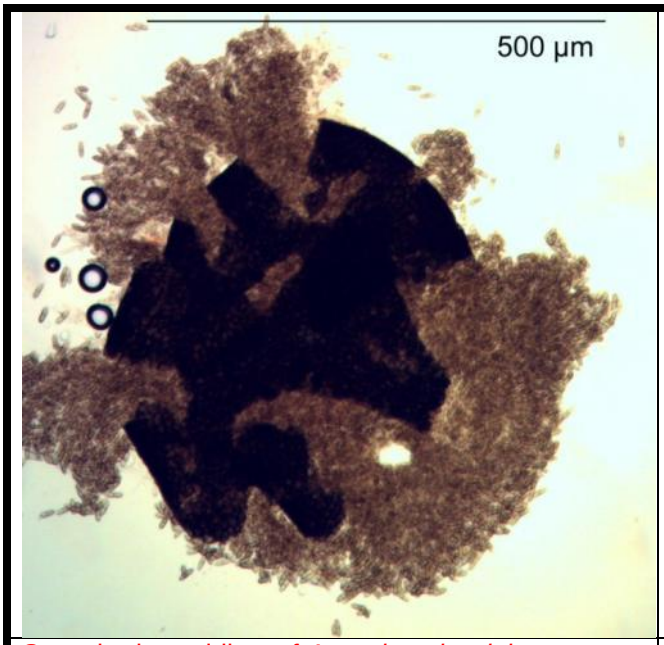
Chytrids

Chytrids (kingdom Chytridiomycota) are primitive true fungi, which like the Chromistans possess a swimming stage and are thus usually aquatic. *Synchytrium* is a genus of plant pathogenic chytrids.

	
Orange pustules of *Synchytrium tasraxaci* on *Taraxacum officinale* (Dandelion) JAC12625	resting spores of *Synchtrium taraxaci*

Micro-fungi, leaf spots, moulds and die-backs (on living or dying plants)

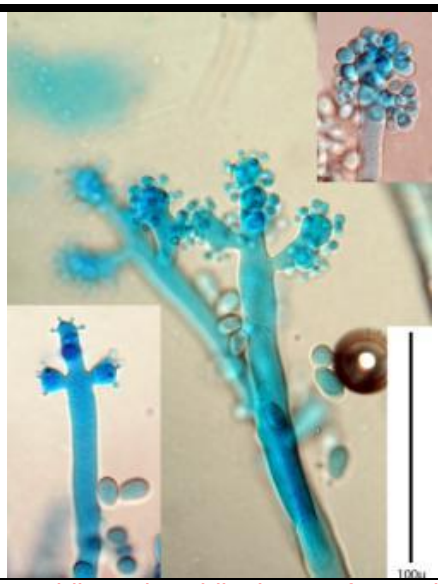
The records of *Camarosporium sophorae* and *Gnomoniopsis idaeicola* represents first records for New Zealand. However, in the case of the *Camarosporium* the identification is on the basis of the host, *Sophora prostrata* and *C. sophorae* was originally described from *C. japonica* which is now placed in a different genus so there is a chance this represents either an undescribed speces, or a described *Camarosporium* which infects a number of host species. *Gnomoniopsis idaeicola* was almost simultaneously detected on the basis of sequence data from other material.



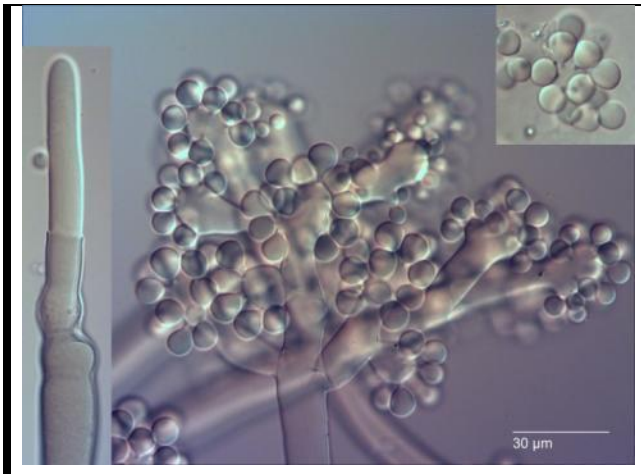
Squashed pycnidium of *Ascochyta hordei* on *Hordeum vulgare* (barley) PDD 96668

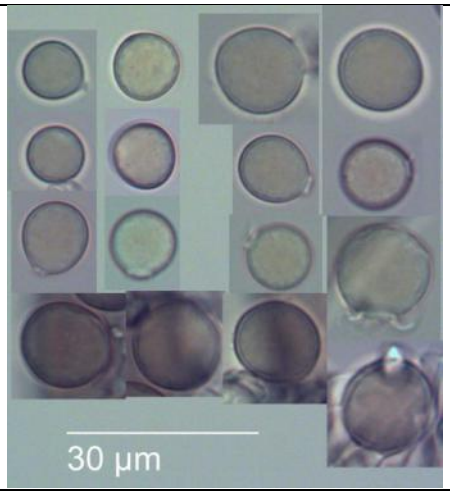
Conidia of *A. hordei*

Botrytis cinerea on dying leaves of *Lycopersicon esculentum* (tomato) PDD 95716



Conidia and conidiophores of *Botrytis cinerea*



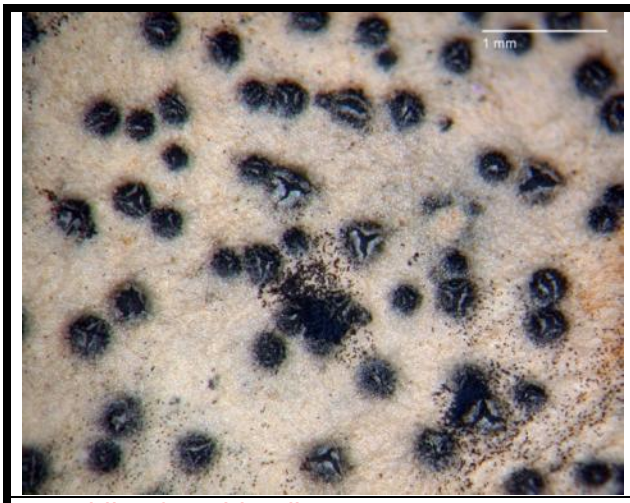
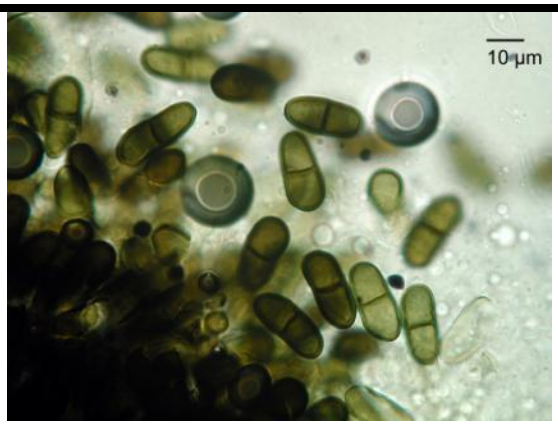
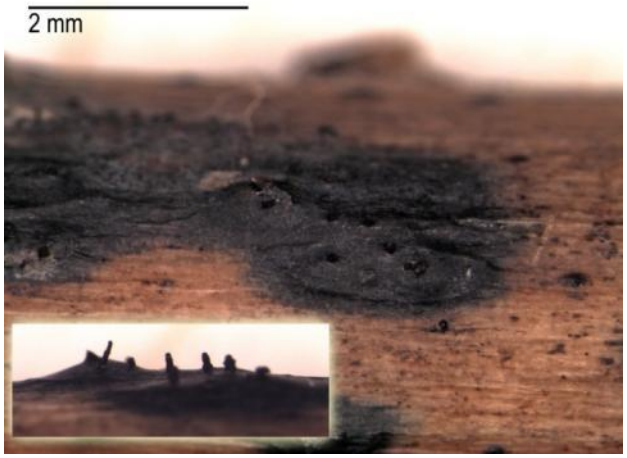
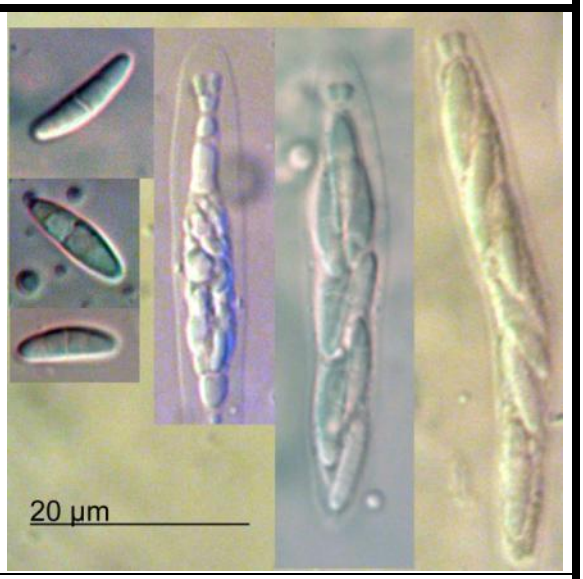
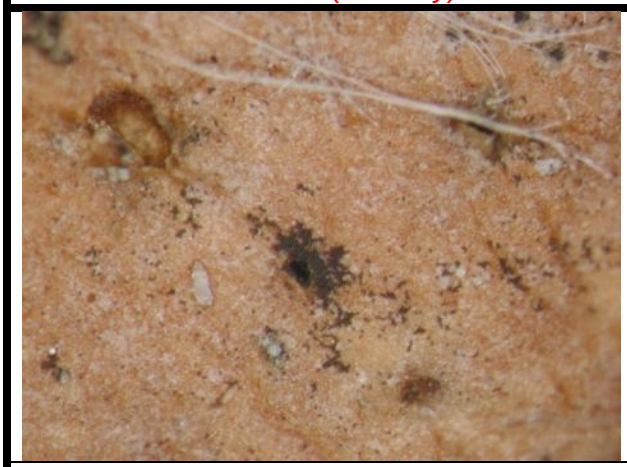
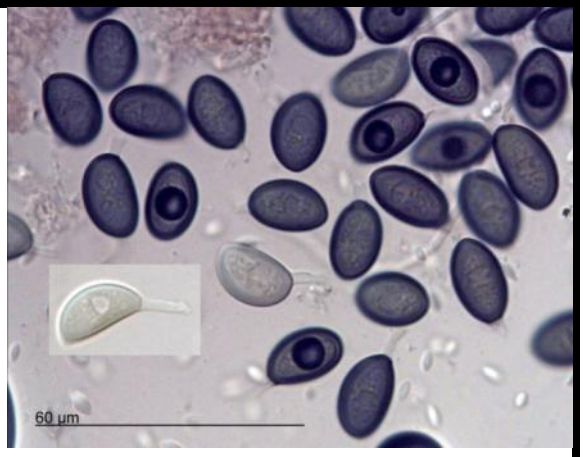


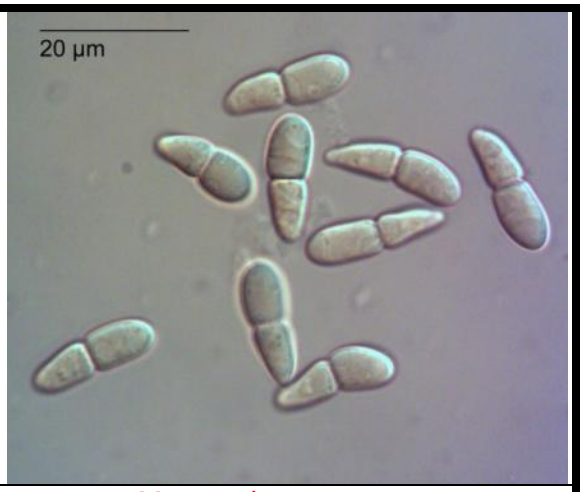
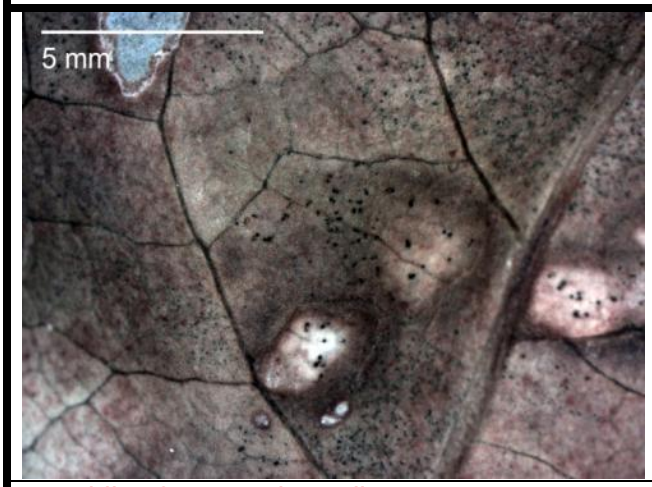
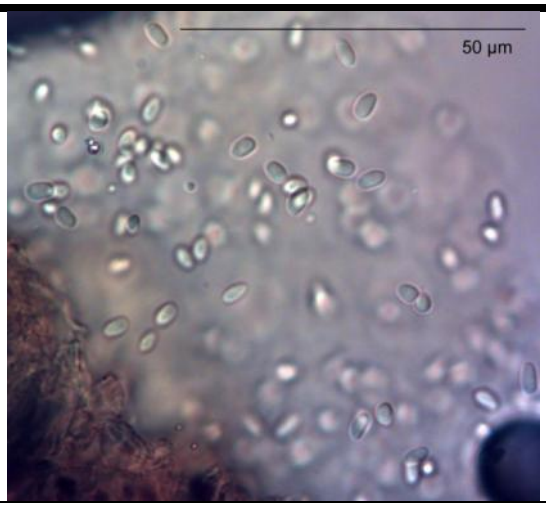
Botrytis paeoniae on dying stems of *Paeonia officinalis (paeony)* JAC 12660

Pycnidia of *Camarosporium sophorae* on dead attached stems of *Sophora prostrata* (prostrate Kowhai) PDD 96051

conidia and conidiophores of *Camarosporium sophorae*

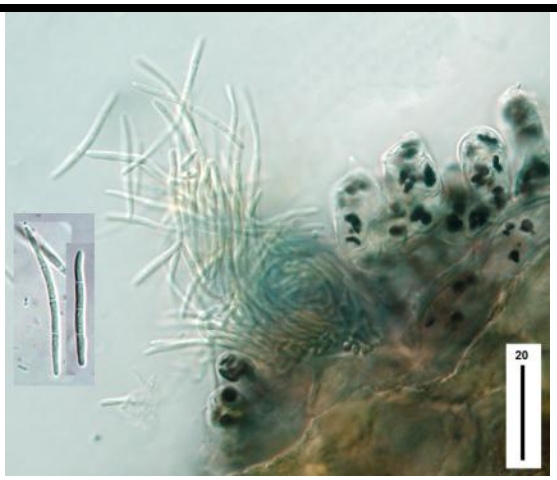
Browning of flowers and apothecia on dead seeds of *Camelia japonica* caused by *Ciborinia camelliae* PDD 95241

	
Pycnidia of *Dothiorella sarmentorum* on dead attached leaves of *Acer palmatum* (japanese maple) PDD 95995 and on *Euonymus japonicus* (japanese spindleberry) PDD 95987	Conidia of *Dothiorella sarmentorum*
	
Perithecia of *Gnomoniopsis idaeicola* on dying stems of *Rubus idaeus* (rasberry) JAC12613	ascospores and asci of *Gnomoniopsis idaeicola*
	
Pycnidium of *Harknessia eucrypta* on dead attached leaves of *Weinmannia racemosa* (kamahi) PDD 96605	Conidia of *Harknessia eucrypta*

	
Marssonina rosae (black blotch) on living leaves of a Rosa cultivar JAC12659	Conidia of *Marssonina rosae*
	
Pycnidia of *Mycosphaerella coacervata* on living leaves of *Coprosma robusta* (karamu) PDD 95599	Conidia of *Mycosphaerella coacervata*
	
Pycnidia of *Phoma hedericola* on living leaves of *Hedera helix* (ivy) JAC12607	Conidia of *Phoma hedericola*

Conidia and conidiophores of *Pyrenophora graminea* on dead stems of *Hordeum vulgare* (barley) PDD 96669

Pycnidia of *Septoria rubi* on living leaves of *Rubus cissoides* (bush lawyer) PDD 87701



Conidia of *Septoria rubi*

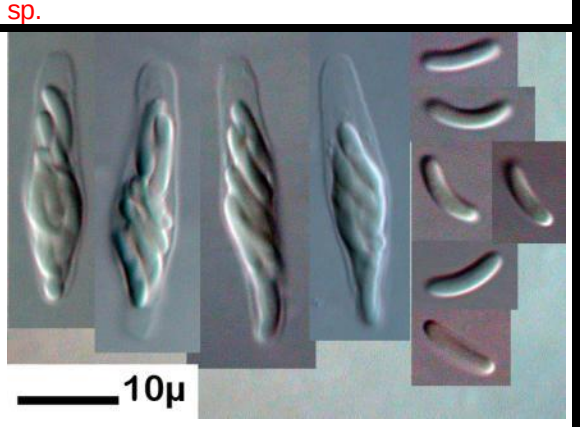
Pycnidia of *Septoria stellariae* on living leaves of *Stellaria media* (stitchwort) PDD 96698

Pycnidium and conidia of *Septoria stellariae*

Coremia of an undescribed *Trullula*? sp. on live branches of *Sophora prostrata* PDD 96052

arthrospores and perimeter hairs of *Trullula* sp.

Valsa ceratophora on dead attached branches of *Euonymus japonicus* PDD 95613



Asci and ascospores of *Valsa ceratophora*

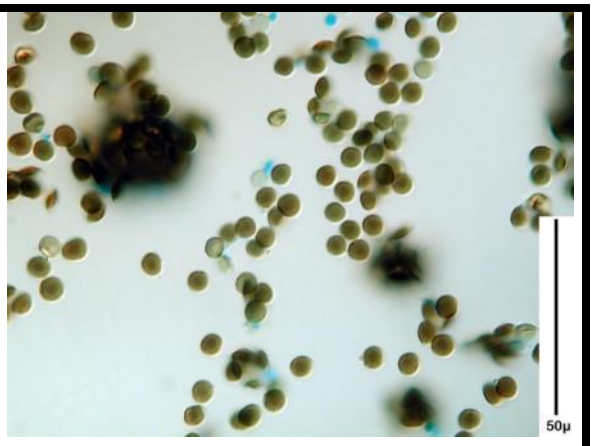
Other fungi on live or dying plants: *Rhytidhysteron hysterinum* on *Sophora prostrata* (prostrate kowhai) PDD 95992, *Botryosphaeria* spp. on *Weimannia racemosa* PDD 96365 and *Vitis vinifera* (grape) PDD 96465, *Peroneutypa heteracantha* on *Cydonia* PDD 87244

Saprophytic fungi

Discosia artoceras, *Gyrothrix grisea* and *Lasiosphaeria strigosa* represent first records for New Zealand.

Micro fungi on dead plant material

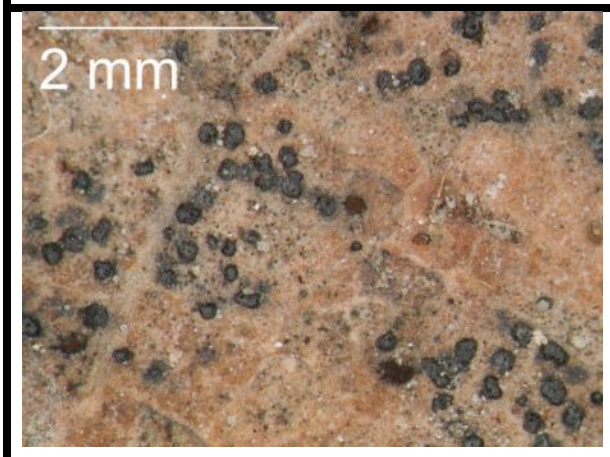
Conidia of *Apiospora montagnei* on *Phyllostachys* (bamboo) PDD 95735



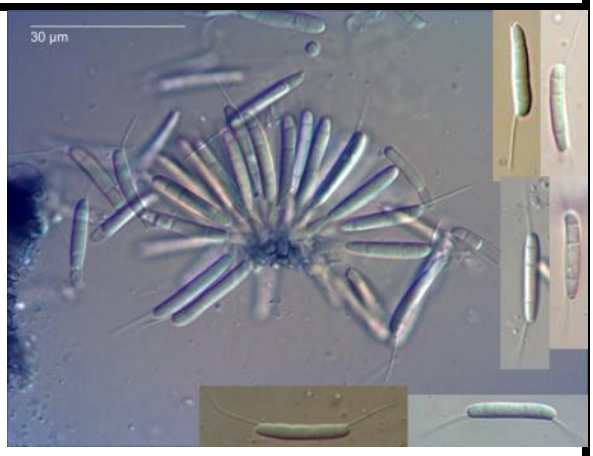
Conidia of *Apiospora montagnei*

Apothecia of *Calycellina* sp. on dead leaves of *Hedera helix* (Ivy) PDD 87225

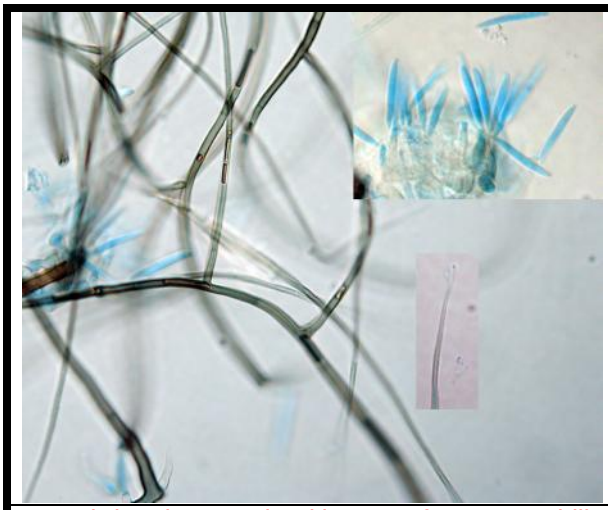
Conidiophores and conidia of *Dendryphion nanum* on dead *Aquilegia vulgaris* stems PDD 96060



Conidiomata of *Discosia artocreas* on dead leaves of *Laurus nobilis* (sweet bay) PDD 96703



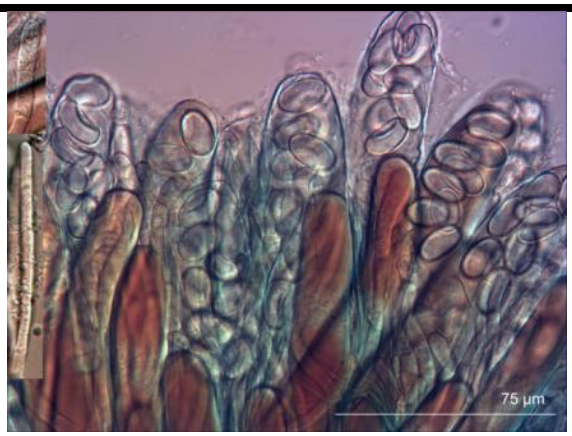
Conidia of *Discosia artocreas*



Gyrothrix grisea on dead leaves of *Laurus nobilis* and *Cordyline australis* (Cabbage Tree) PDD 96374

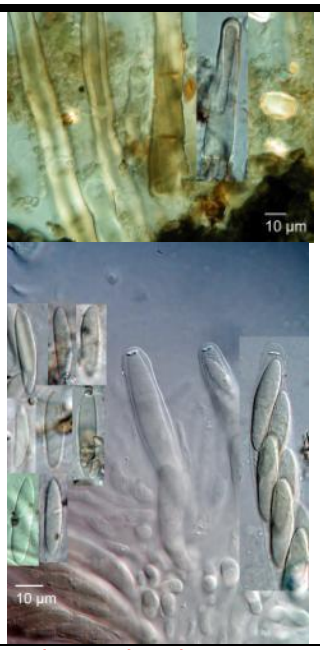
Apothecia of *Hymenoscyphus scutula* on dead stems of *Aquilegia vulgaris* PDD 95902

Apothecia of *Iodophanous carneus* on dead wood JAC12606



asci and ascospores of *Iodophanous carneus*

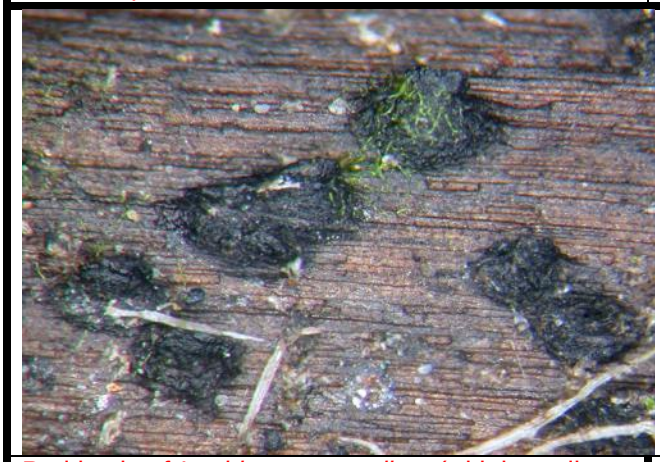
Perithecia of *Lasiosphaeria strigosa* on dead attached stems of *Acer palmatum* (japanese maple) PDD 96064



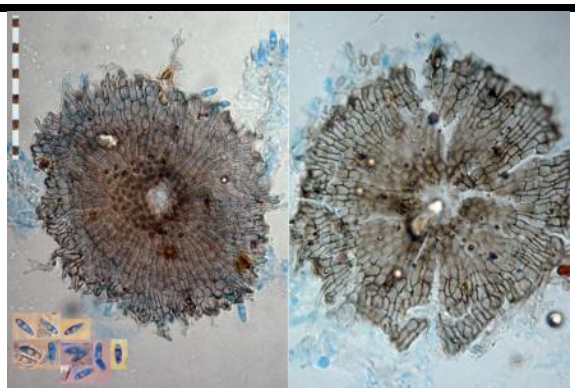
Hairs, asci and ascospores of *Lasiosphaeria strigosa*

Perithecia of a *Leptosphaeria* sp. on dead stems of *Clematis paniculata* PDD 96075

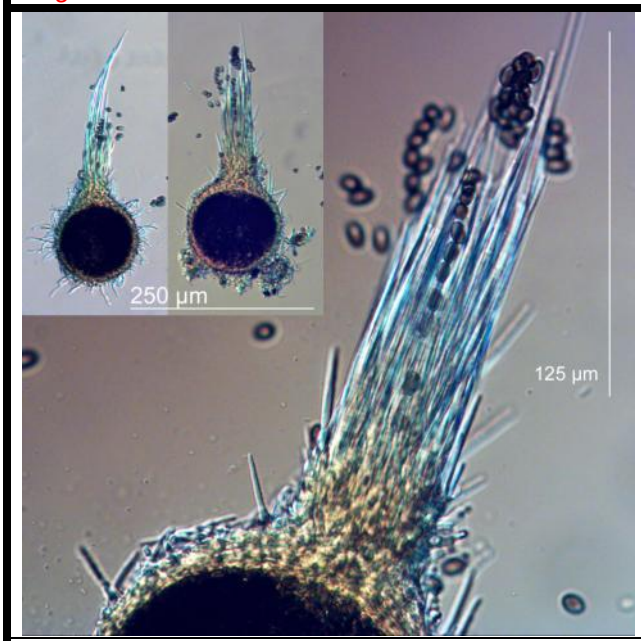
Ascospores of *Leptosphaeria*



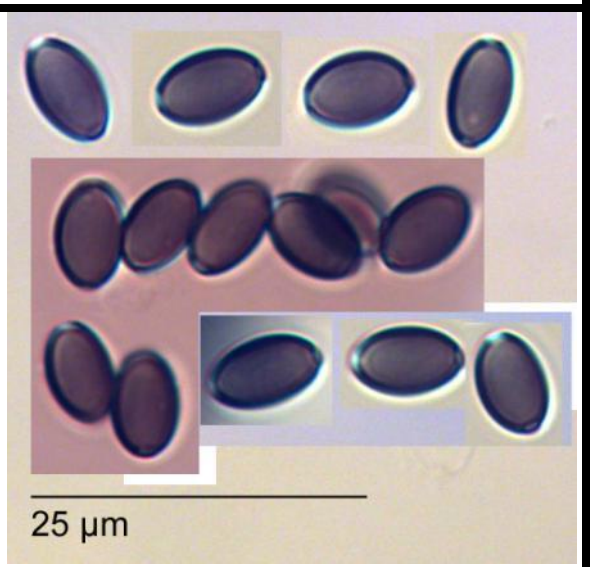
Perithecia of *Lophiostoma caulium* (with laterally compressed necks) on deadstems of *Aquilegia vulgaris* PDD 96061



Microthyrium sp. on dead leaves of *Laurus nobilis* PDD 95265

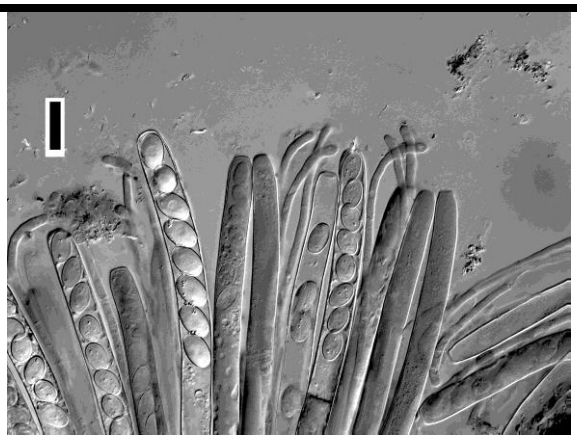


Perithecia of *Melanospora* aff. *longisetosa* on dead leaves of *Laurus nobilis* PDD 96701



Spores of *Melanospora* aff. *longisetosa*.

Apothecia of *Peziza varia* on cardboard and wood chips PDD 80958

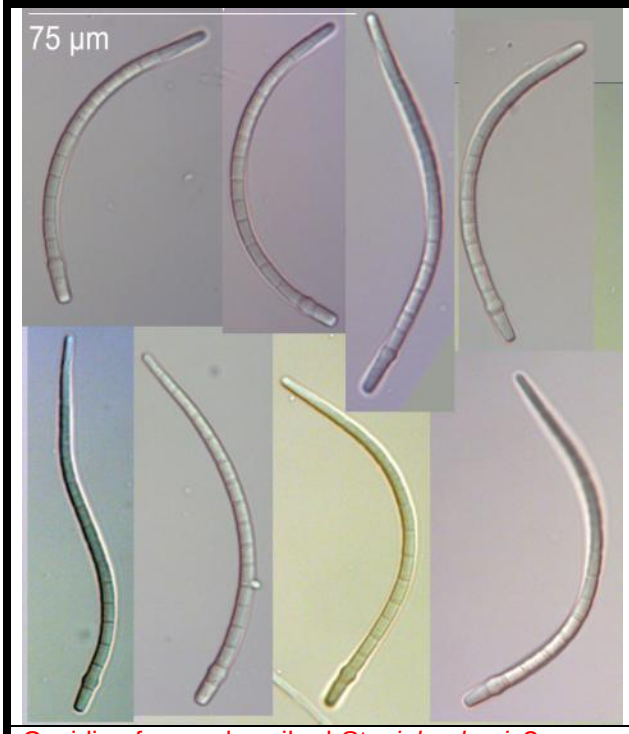


Asci and spores of *Peziza varia*

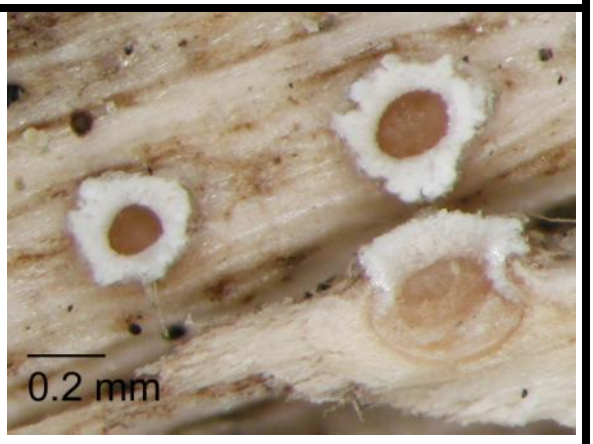
Perithecia of *Pleospora herbarum* on dead stems of *Ocimum basilicum* PDD 95935

asci and ascospores of *Pleospora herbarum*

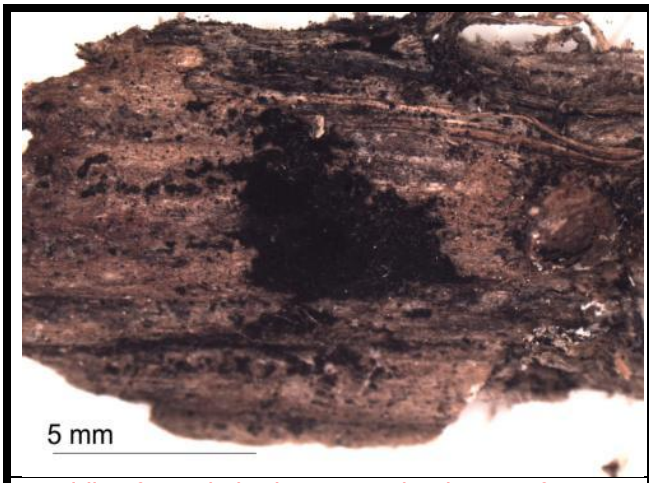
Conidia of *Rutola graminis* on dead stems of *Carex forsteri* (sedge) PDD 96078



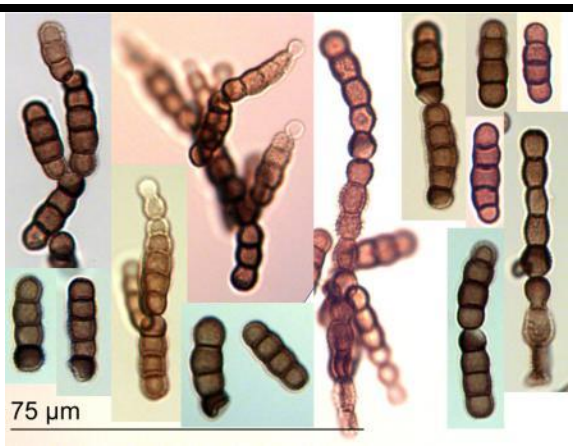
Conidia of an undescribed *Stanjehughesia*? on dead stems of *Cynara scolymus* (Cornfllower) JAC12605



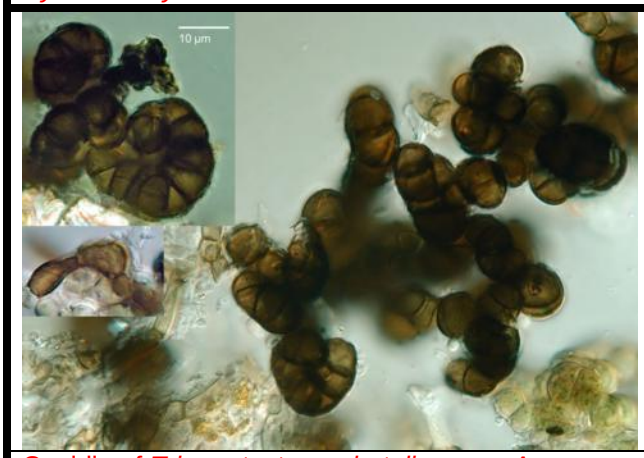
Stictis cordylines on dead leaves of *Cordyline australis* (cabbage tree) PDD 96375



Conidia of *Torula herbarum* on dead stem of *Cynara scolymus* JAC12604



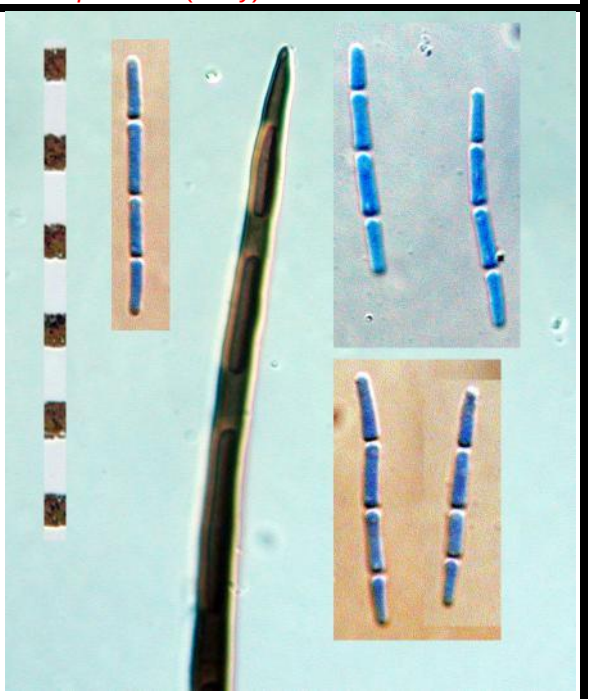
Conidia of *Torula herbarum* on dead stem of *Cynara scolymus*



Conidia of *Trimmatostroma betulinum* on *Acer palmatum* PDD 96067

Apothecia of *Trochila ilicis* on dead leaves of *Ilex aquifolium* (Holly) PDD 96700

Sporodochia of *Wiesneriomyces laurinus* on dead leaves of *Laurus nobilis* PDD 95263



Setae and conidia of *Wiesneriomyces laurinus*

Other saprophytic fungi: *Acrostalagmus luteoalbus (*JAC 12603) on dead stems of *Cynara scolymus*

Mushrooms

Agrocybe erebia, *Conocbe rickeniana*, *Coprinellus* c.f. *subpurpureus*, *Coprinopsis macrocephala* and *Panaeolus cinctulus* represent first records for New Zealand. There are historic records of *Agrocybe erebia* but Taylor and Watling 1987 considered them to be unsubstantiated.

The record of *Amanita inopinata* is interesting. It belongs to an ancient lineage within *Amanita,* the extant species of which are uncommon and not ectomycorrhizal. Reports of this fungus are increasing in Europe and the literature suggests it was introduced from New Zealand. This assumption rests on the basis of its inclusion in Ridley's 1991 treatment of the genus where he called it 'Amanita sp. 1'. However, there is no reason to believe its status in New Zealand is any different to Europe. It is invariably found in urban, transformed environments and not indigenous dominated habitats. I suspect it is introduced from North America.

Agrocybe erebia PDD 87703

Amanita inopinata PDD 96038

Clitocybe fragrans PDD 87709

Conocybe rickeniana PDD 87705

Coprinellus micaceous PDD 80974

Coprinopsis macrocephala PDD 95401

Deconica subviscida PDD 95223

Entoloma sericeum PDD 86974

Flammulina velutipes PDD 96670

Galerina marginata PDD 86945

Hebeloma mesophaeum with *Nothofagus solandri* (mountain beech) PDD 95499

Hypholoma fasciculare on *Camellia japonica* PDD 95506

Leucoagaricus sp. 'Hay Reserve ' PDD 80977

Leucocoprinus sp. 'Opawa' PDD 87349

Mycena olivaceomarginata PDD 87706

Panaeolina foenisecii JAC9177

Panaeolus cinctulus PDD 95268

Coprinellus c.f. subpurpureus PDD 86805

Pholiotina utricystidiata PDD 95726

Pluteus sp. PDD 86876

Psathyrella candolleana JAC12654

Rugosomyces sp. PDD 86973

Rugosomyces carneus PDD 95276

Stropharia coronilla PDD 81005

Tubaria furfuracea PDD 95904

Volvariella speciosa PDD 95300

Other Basidiomycetes

Typhula culmigena reprsents a first record for New Zealand.

Cyathus olla – a bird's nest fungus PDD 86833

Typhula culmigena- a club fungus PDD 96697

Lachnella alboviolascens on *Sophora prostrata* JAC11607

Physalacria stilboidea on dead leaves of *Griselinia litoralis* PDD 96080

Slime moulds

Not true fungi but a protozoan group traditionally studied by mycologists.

Craterium minutum on Camellia PDD 80684

Physarum bitectum PDD 80959