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THE ONION PROJECT

5th Soilborne Disease Masterclass

Soilborne pathogens of vegetables & onions

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Adelaide 8th and 9th May 2024

Hort Innovation ONION FUND
This project has been funded by Hort Innovation using the onion research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

Hort Innovation MELON FUND
This project has been funded by Hort Innovation using the melon research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

Hort Innovation VEGETABLE FUND
This project has been funded by Hort Innovation using the vegetable research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

AUSVEG

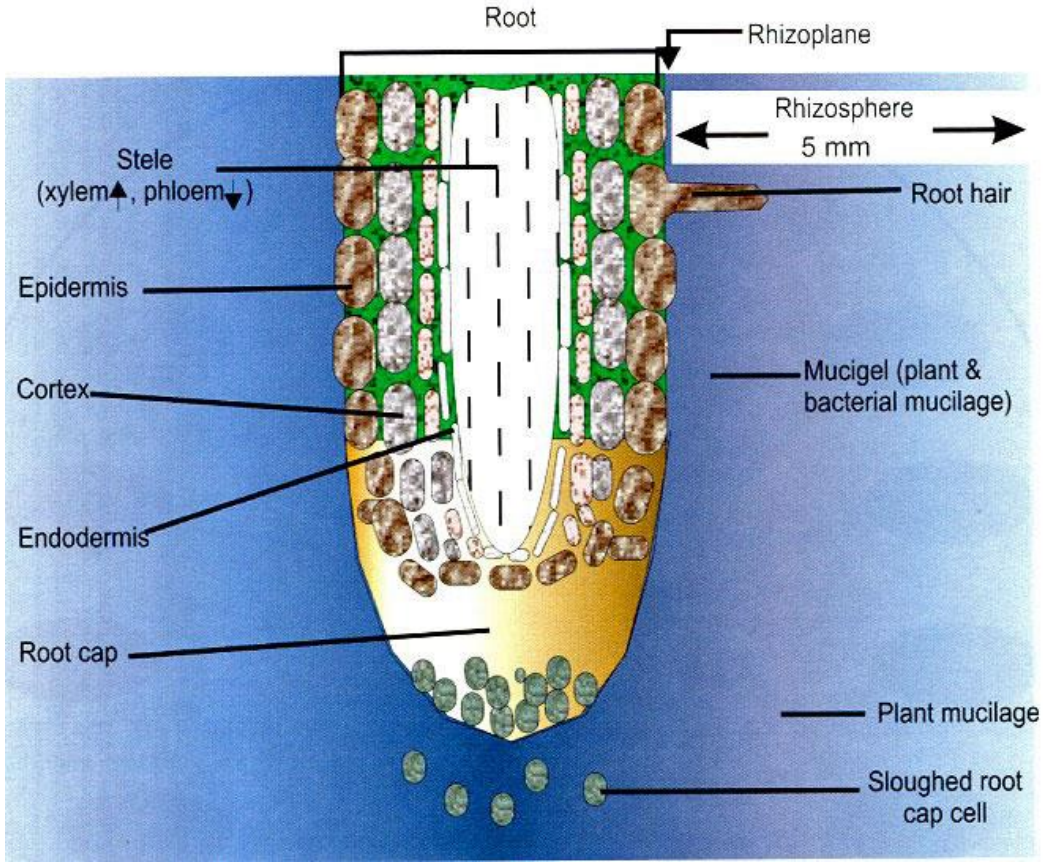
Hort Innovation

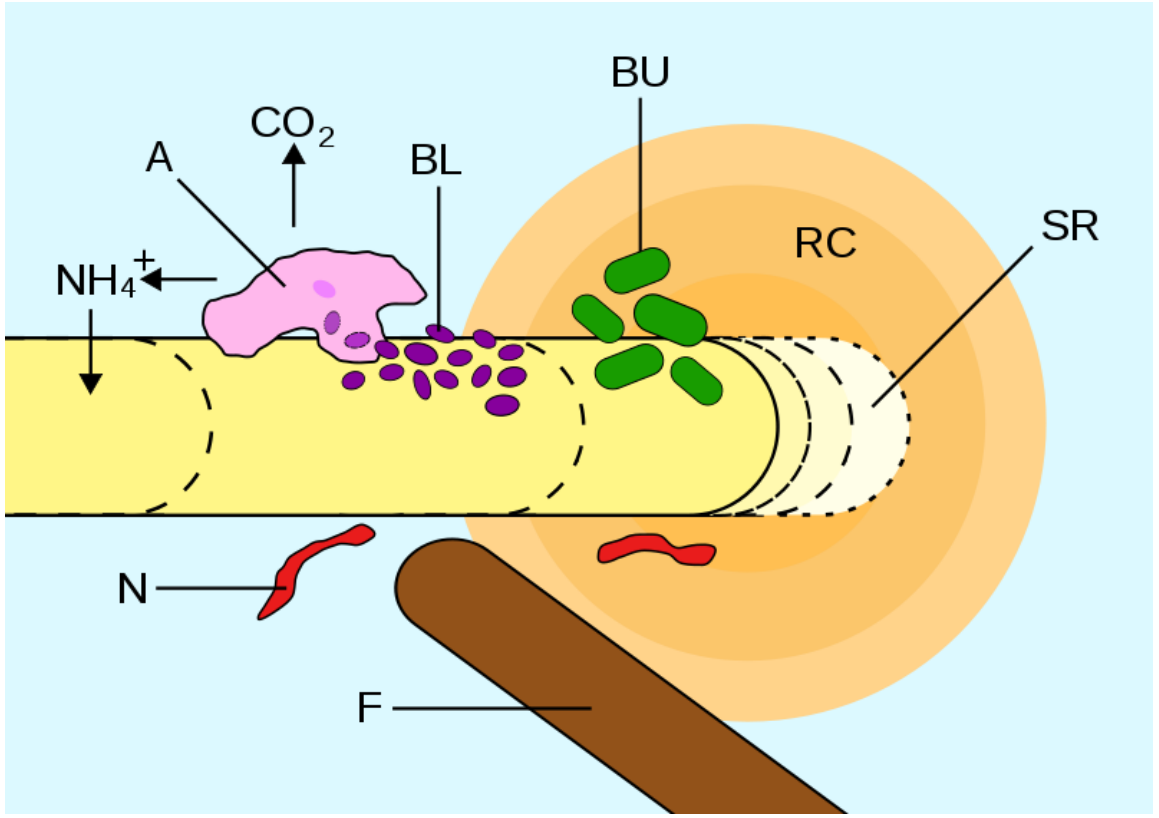
ahr applied horticultural research

RMCG

Soilborne plant pathogens

- They can be divided into *soil inhabitants* (survive for long periods) and *soil transients* (short-term survivors in soil)
- They are a natural part of the complex soil environment & ecology
- Most soilborne plant pathogens directly infect seeds and roots
- Some can cause diseases of leaves, stems and fruit





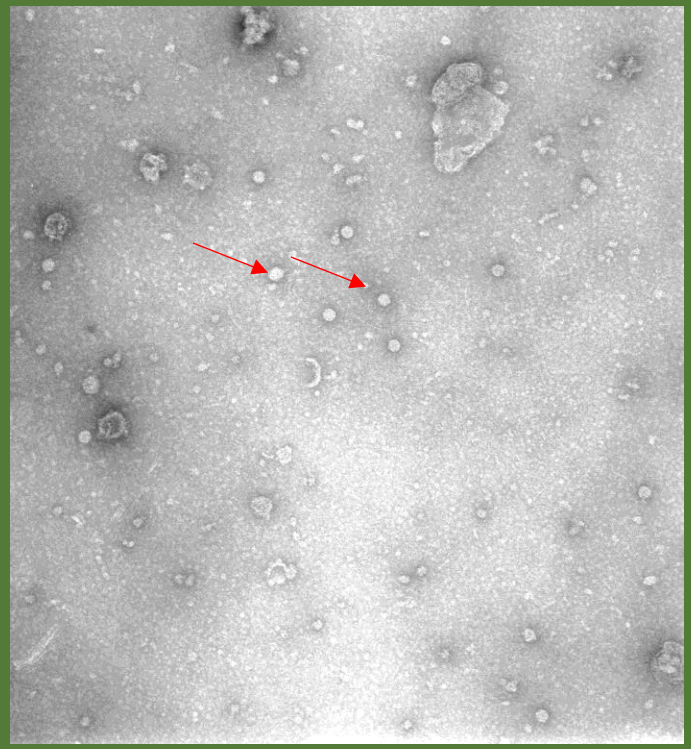
Rhizosphere

- The zone surrounding roots where biology & chemistry
- are affected by plant secretions
- Diverse biology = *Rhizobiome*

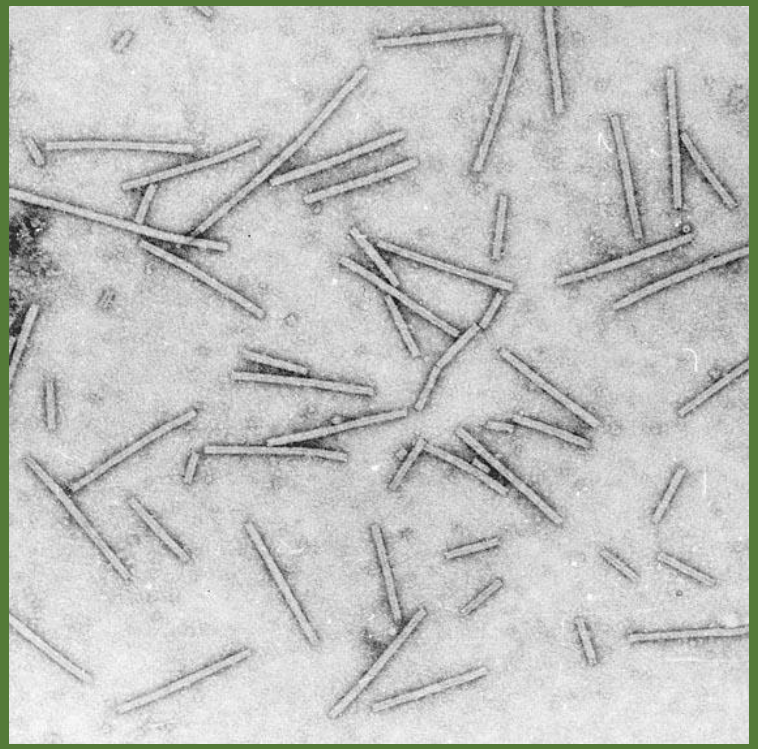
Types of soil-borne pathogens

- Viruses – few from different families
- Bacteria – several from a few families
- Plasmodiophorids – few (Protists)
- Stramenopiles (Oomycetes) – several in a few families
- Fungi- (Zygomycetes, Ascomycetes, Basidiomycetes)
- Nematodes – (roundworms / eelworms) - several

Viruses – nucleic acid core enclosed in a protein capsule



Melon necrotic spot virus



Tobamovirus

Some diseases caused by soil-borne viruses

Lettuce Big Vein

Pepper Mild Mottle

Melon Necrotic Spot

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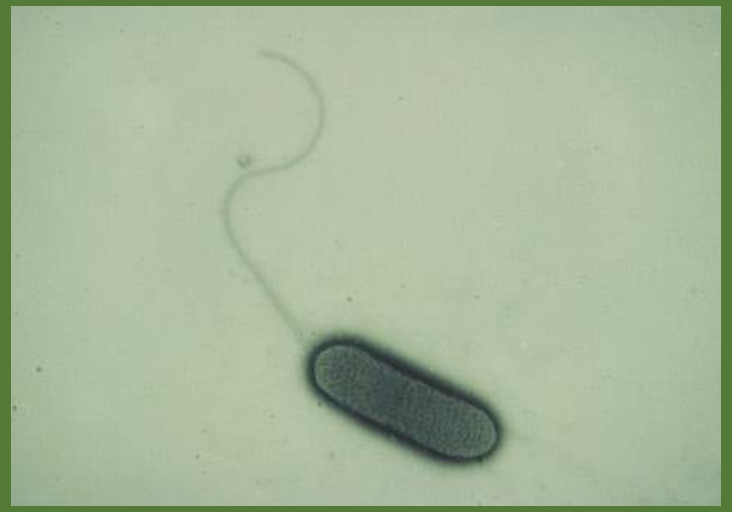
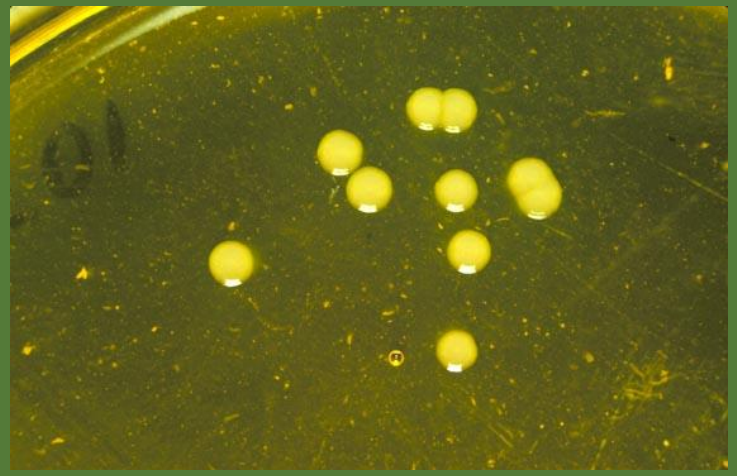
Bacteria

Microscopic cells that reproduce rapidly
and are capable of exchanging genetic material



1-2µm in length

Bacteria oozing from plant



Bacterial colonies on agar

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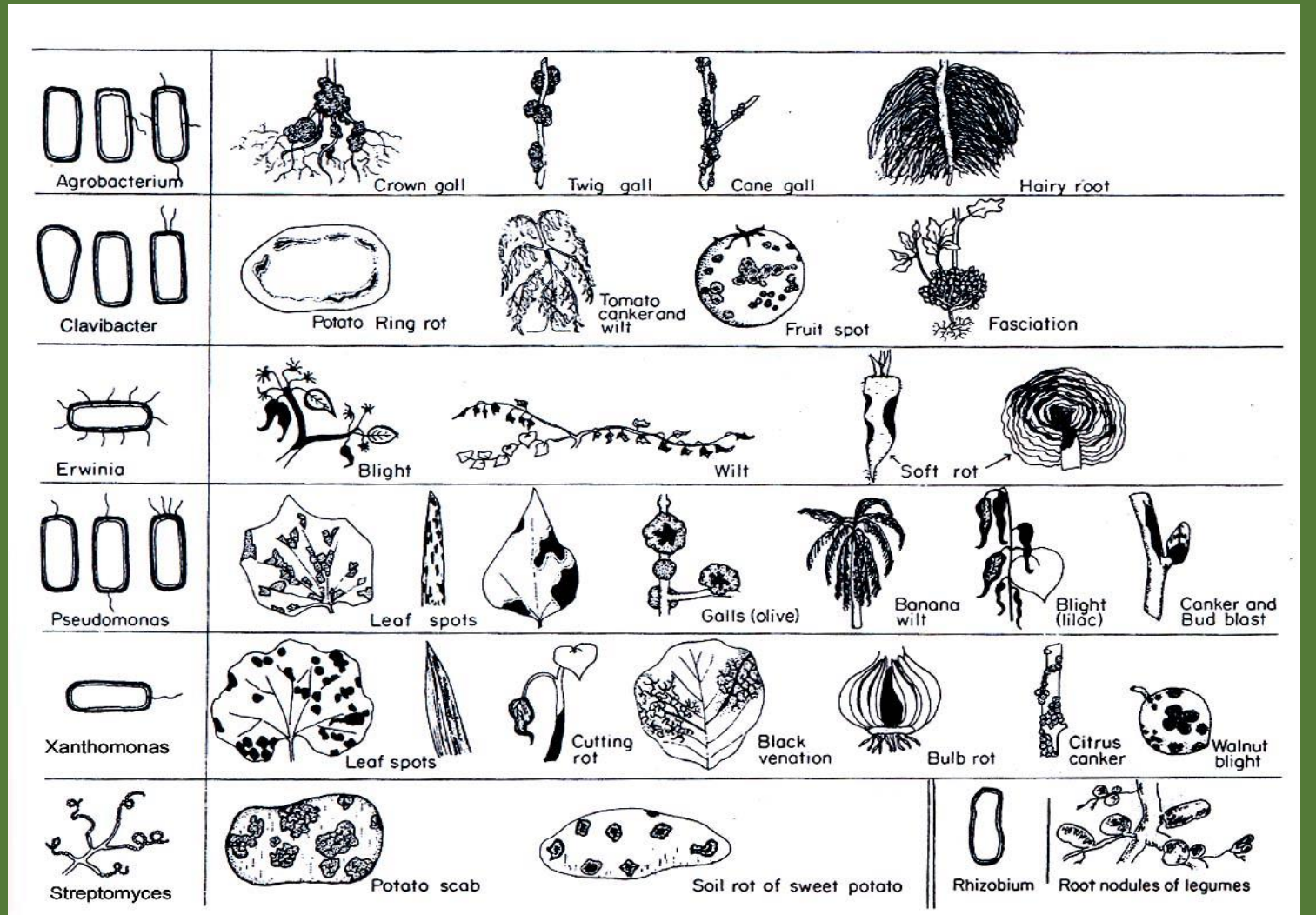
Types of bacterial plant diseases

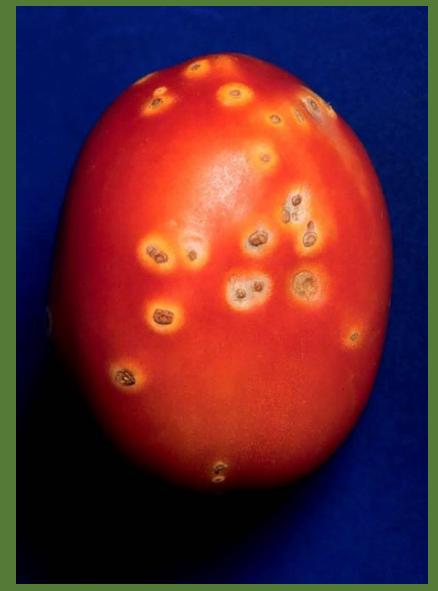


Bacterial Canker of Tomato

Wilt

Leaf Scorch

Vascular browning



Birds-eye spot

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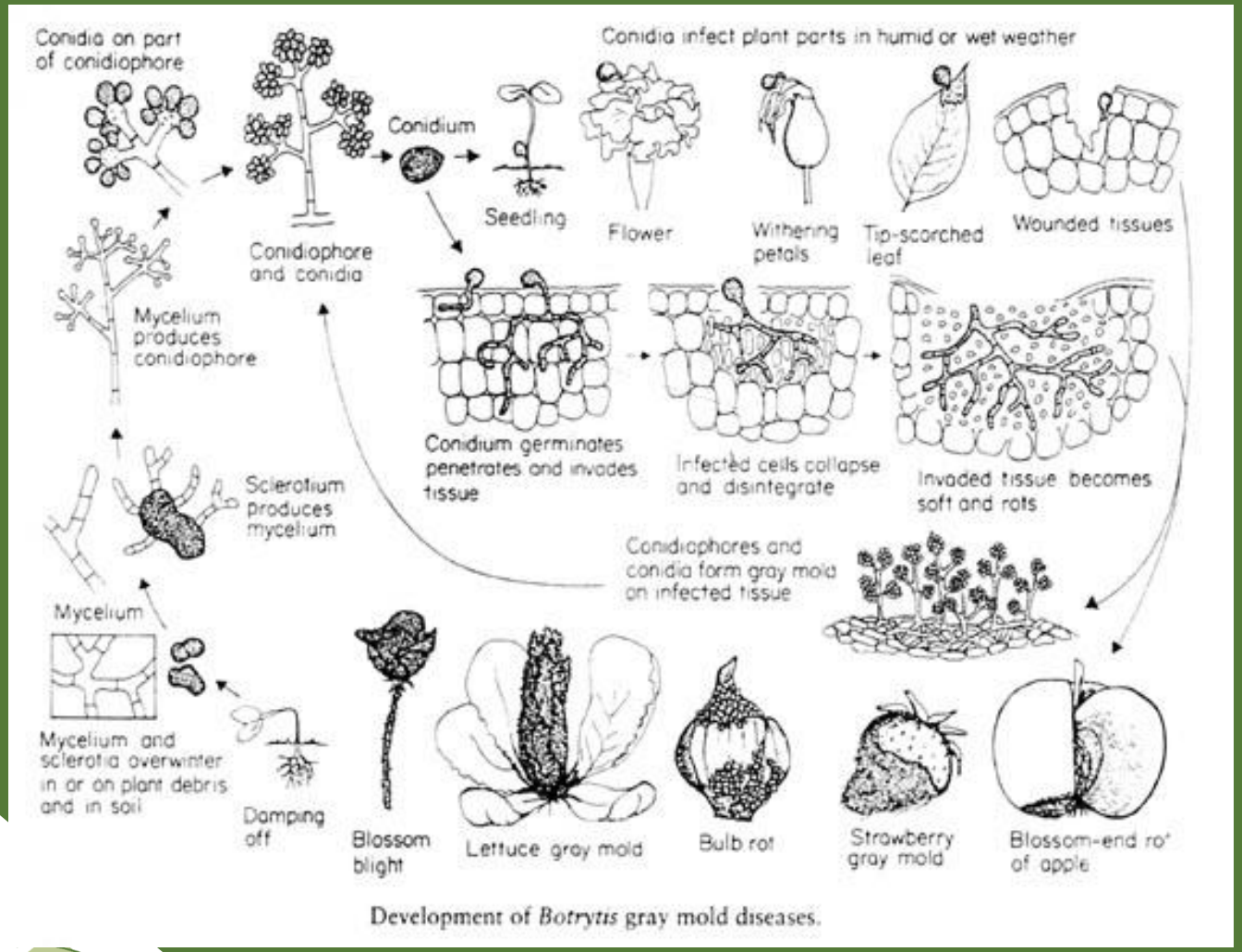
Bacterial soft rots

Managing soilborne bacterial diseases

- Prevention is key - ensure crop residues fully degraded
- Crop rotation, fumigation, biofumigation, organic amendments
- Copper (copper + mancozeb)
- Microbial biocontrols
- MgOH nanoparticles ?

Fungal & fungal-like pathogens



Development of *Botrytis* gray mold diseases.

Mostly associated with root & collar rots

Many can also be spread in water, air or with insects & animals

complex life cycles

Some diseases caused by soilborne fungi & fungal-like pathogens

Damping off & seedling root rots

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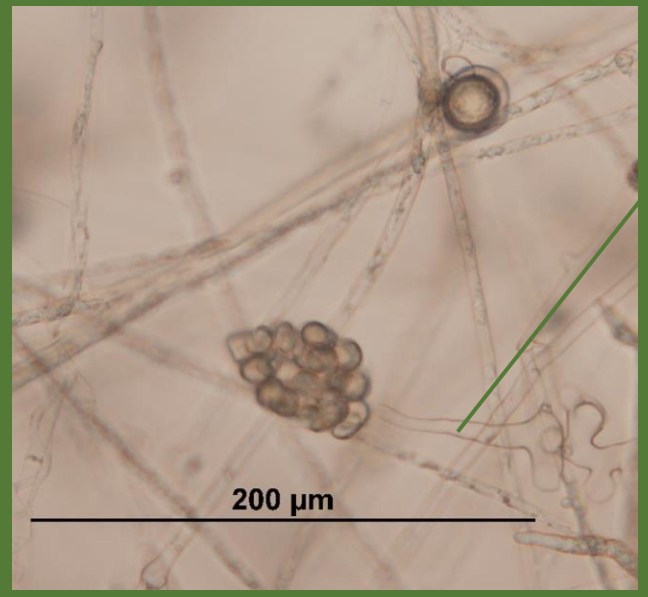
Pythium root rot of lettuce

Note reduced root system and pale brown discoloration (RHS)

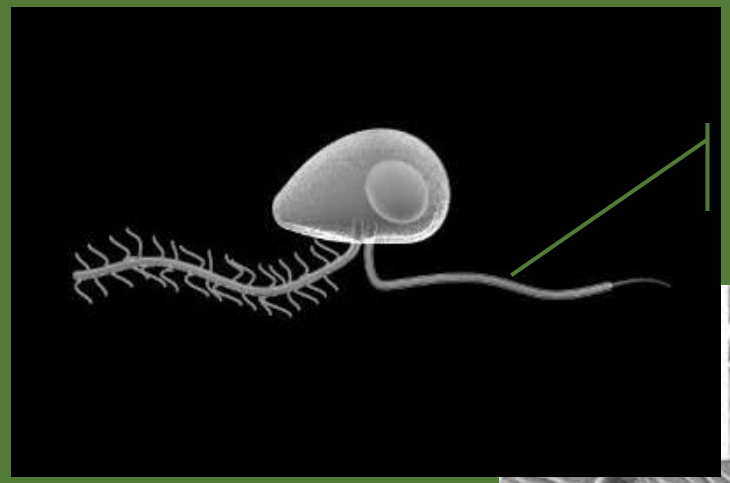
Types of plant diseases caused by *Pythium*

Infection of tap root –
Cavity spot of carrots
Also causes forking

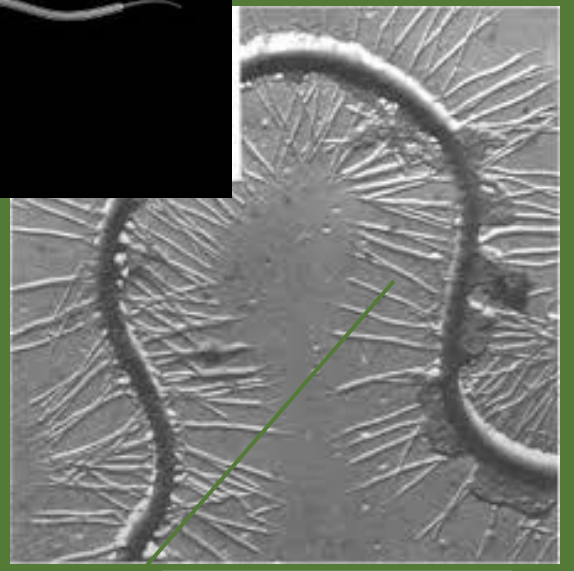
Pythium sporangia & zoospores



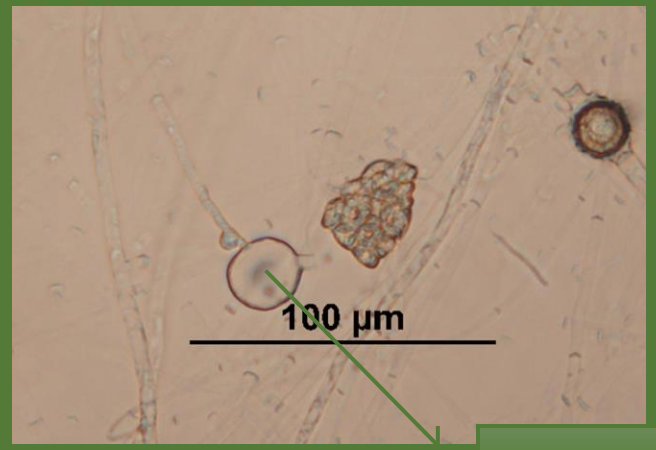
Sporangia - filamentous



Flagellum

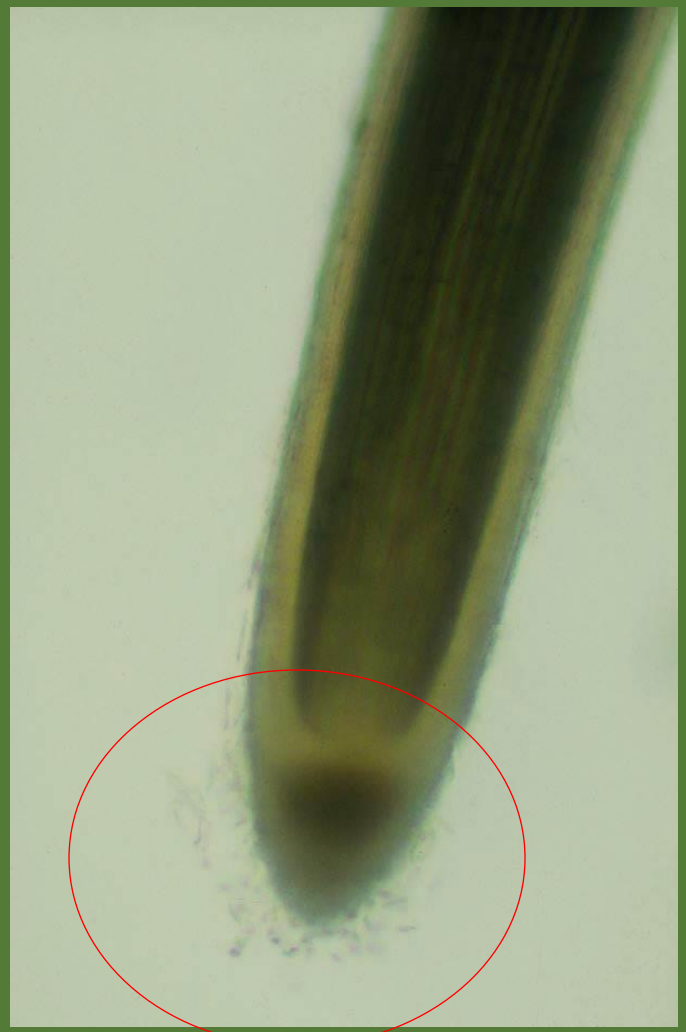


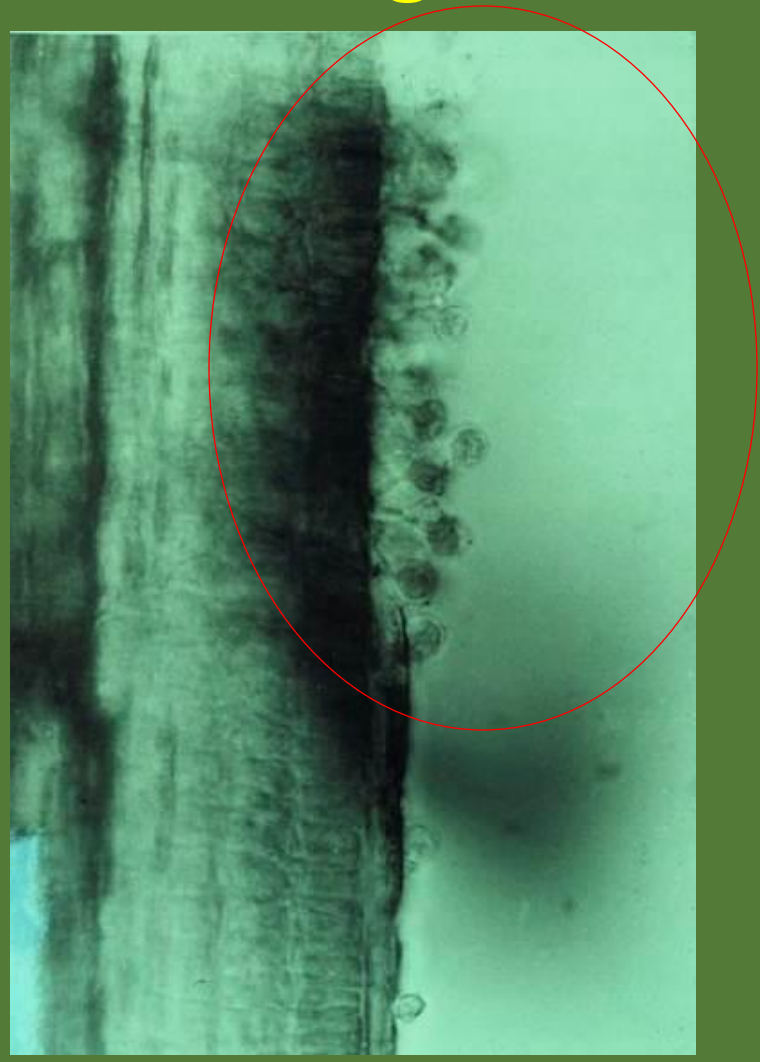
Mastigonemes



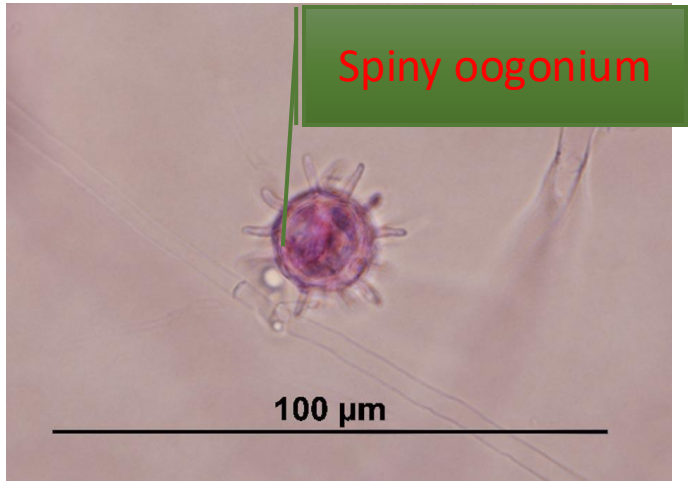
Sporangia - spherical

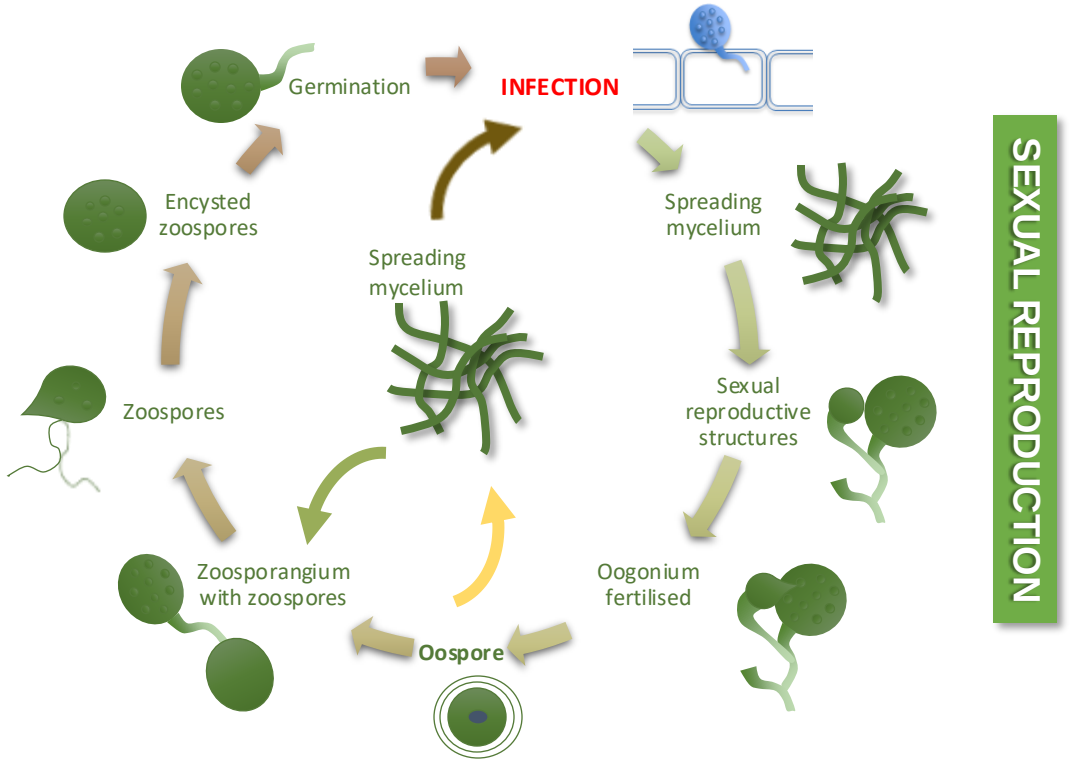
Pythium zoospores infecting roots

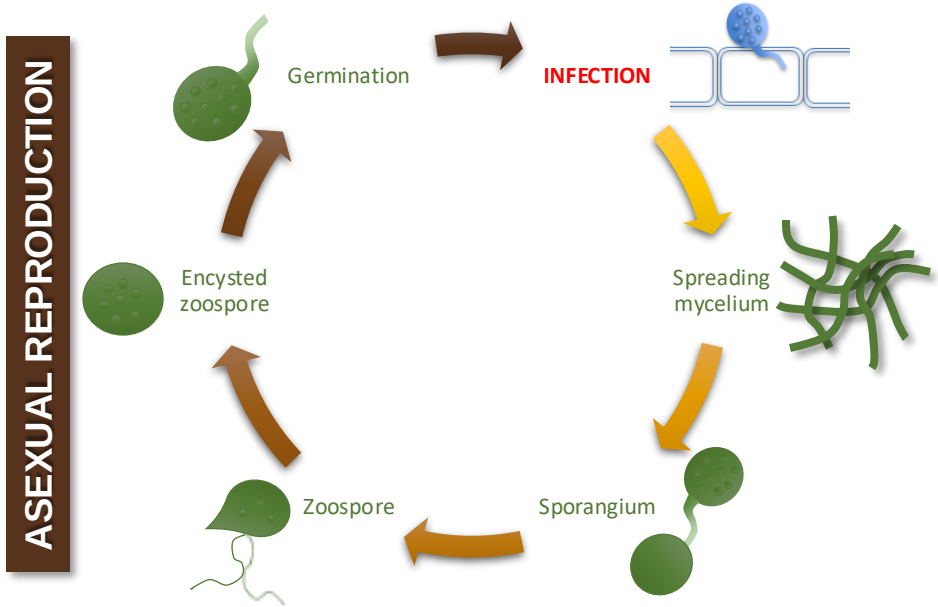


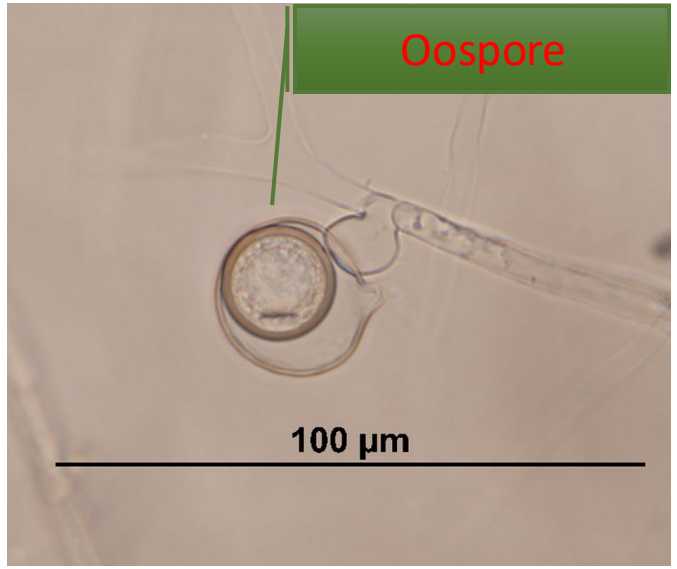


Pythium spp Life Cycle









Interventions to disrupt *Pythium* lifecycle

- Organic amendments suppress *Pythium* spp.
- Detergents demobilise zoospores & dissolve vesicles to prevent them from forming – hydroponic crops (biologicals)
- Chemicals – phenylamides & strobilurins
- Hyperparasites – Streptomycetes, Chitrids, *Trichoderma* spp. & *Pythium* spp.
- Fumigants or biofumigants that kill oospores & mycelia
- Microbial biocontrols or chemicals that induce systemic resistance +/- antibiotic production +/- root stimulation

Fusarium wilt of cucumber – fungus infects roots & moves up xylem into stem

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Interventions to disrupt *Fusarium* lifecycle

- Long crop rotations, organic amaendments
- Chemicals – fludioxanil, some DMIs and strobilurins
- Hyperparasites – Streptomycetes, *Trichoderma* spp.
- Fumigants or biofumigants that kill chlamydospores & mycelia
- Cross-protective non-pathogenic *Fusarium* isolates
- Microbial biocontrols or chemicals that induce systemic resistance
- Avoid ammonium form of nitrogen

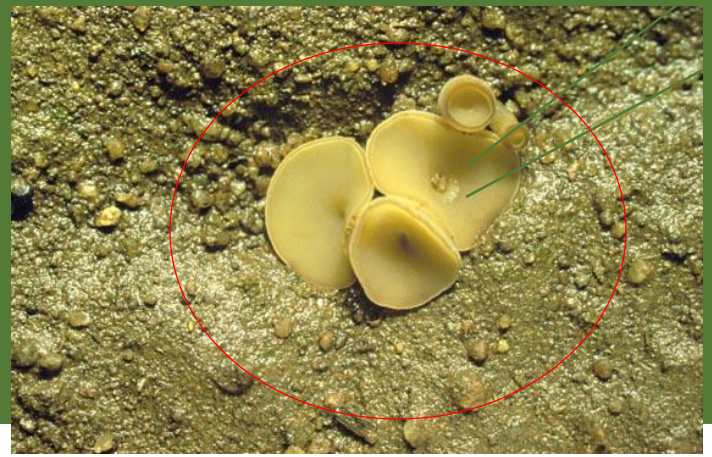
Club root – specific to brassica family

Interventions to disrupt *Plasmodiophora* lifecycle

- Soil pH adjustment – desirable pH 7.2
- Detergents demobilise zoospores
- Chemicals – fluazinam or flusulfamide
- Supplements of Ca and B that strengthen plant physical defences

Sclerotium rot – specific to onion family

Sclerotinia rot – soil & aerial spread – a wide host range



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Interventions to disrupt *Sclerotinia* lifecycle

- Prevent development of sclerotia – oxalate degrading enzymes – certain green manures e.g. barley
- Encourage parasitism by beneficial fungi – composts or microbial biocontrols – *Trichoderma* & *Coniothyrium*
- Fungicides applied at the correct time – after emergence/transplanting to prevent mycelial infection

Disease complexes – virus +/- bacteria +/- stramenopile +/- fungus +/- nematode

What are the main issues?

- There are many different types of pathogens
- Some are specific to a certain family of plants
- Some can infect a wide host range
- Some can cause disease complexes
- Some are favoured or suppressed by opposing types of nutrients, soil types and environmental conditions
- Many can multiply by several orders of magnitude in a short time
- They often have a negative binomial spatial distribution