



VEGE *notes*

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Greenhouse Cucumber Diseases

In an effort to develop effective management strategies, research project VG00069 studied greenhouse cucumber diseases and their causes.

The most important disease detected across Australia was a root rot, stem and wilt that frequently caused one third of plants to die prematurely.

Plants wilt and die soon after transplanting and right throughout the life of the crop, particularly when plants are carrying a heavy fruit load.

Many growers suffering losses from this disease terminate crops early as their yields diminish.

What is a disease complex?

Many textbooks and factsheets on plant diseases describe individual diseases with a single causal organism, such as Powdery Mildew or Downy Mildew diseases of cucumbers.

A disease complex is where more than one causal organism act together. In some cases, they can interact so their combined effect is greater than the sum of their individual effects.

For example, let us say Fungus A causes 5% of plants to wilt and die, and Fungus B has a similar effect. We would expect 10% of plants to be lost if both fungi were present.

However, in practice it was found that plant losses exceeded 50%. This is called a synergistic interaction and, as can be seen from this example, can lead to far more serious losses than when the effects are simply added together.

What causes this disease complex?

There are many different fungal pathogens that can cause cucumber seedlings to wilt and die, known as 'damping-off'.



Plants collapsing from *Pythium* and *Fusarium* root rots.

The Bottom Line

- The most common greenhouse cucumber disease detected across Australia is root rot, stem and wilt
- A disease complex is where more than one causal organism act together
- There are currently no chemicals for this disease, however it can be managed with certain farming conditions and good hygiene practices

Environmental conditions and crop hygiene play an important role in the incidence and severity of 'damping-off' losses.

In cucumbers, *Pythium*, *Phytophthora*, *Fusarium*, *Rhizoctonia* and a few less common fungi are associated with these losses. They may occur individually or as a combination.

The more serious losses found during this research project occurred when a combination of *Fusarium oxysporum* and various *Pythium* species continued to cause plants to wilt and die throughout the life of the crop.

The major *Pythium* species found causing root rots in greenhouse cucumbers in Australia include:

- *P. aphanidermatum* and *P. deliense*, which favour warm temperatures and can grow at temperatures in excess of 40°C
- *P. spinosum* and *P. irregulare*, which favour cool to moderate temperatures and can grow at 5°C
- *P. ultimum*, which favour moderate temperatures between 10-30°C

What symptoms distinguish this disease?

Infections occurring through roots cause them to turn from white to a creamy-yellow colour.

Initial symptoms above ground are pale-yellow to brown rots at the base of stems (Picture 1). In the middle of the day, leaves may tilt downwards or be slightly wilted. If left untreated, plants permanently wilt and die.

Fusarium infects the water-conducting tissue (xylem) and moves into stems from root infections. *Pythium* generally remains in the outside ring of root tissue, and can also move into lower stems (Picture 2).

F. oxysporum has one distinguishing feature in that it causes a stem rot, the outside of which becomes covered in powdery orange spore masses (Pictures 3 and 4). Maggots of sciarid flies (fungus gnats) can become numerous in the crown and larger roots as the disease develops.



Picture 1: Early symptoms of *Pythium* and *Fusarium* infections are pale bleached tissue near the stem bases.



Picture 2: *Pythium* and *Fusarium* infections develop into a watery brown rot at the base of stems.



Picture 3 (above) and 4 (below): Typical symptoms of *Fusarium* stem rot are reddish-brown rotted areas on which salmon-pink masses of fungal spores form that spread through the air or through handling.



Pythium root rot causing a young cucumber plant to collapse.

Where do these fungi come from and how are they spread?

Pythium species are widely distributed in nature and can infect a wide range of plants. They are commonly known as water moulds and can enter untreated water supplies.

Some species produce minute motile spores that rapidly swim towards and infect roots.

Other types of spores have thickened walls that can survive drier conditions and become soil and air-borne. *Fusarium* have a more restricted host range but also produce spores that are very resistant to drying out.

F. oxysporum can be spread through the air or easily spread when plants are handled from the orange spore masses on stems. The adult sciarid flies can also spread spores of both *Fusarium* and *Pythium*.

What management strategies can be used to control this disease?

The choice of management options partly depends on correct diagnosis and the production system currently being used. Use a reputable diagnostic laboratory to give you an accurate diagnosis, and remember there are other diseases and disorders that can cause plants to collapse which should not be confused with this disease complex.

Also, there are no chemicals (excluding soil fumigants) currently registered for controlling these pathogens. Therefore, cultural controls feature heavily in this list of strategies:

- Use clean seed that has good vigour and has been stored correctly. Old seed is more susceptible to these pathogens.
- Avoid stress to plants by optimising timing of fertiliser applications and irrigation. Avoid long irrigation periods and high fertiliser rates.

High rates of soluble fertilisers burn the surface tissue of roots and allow these fungi to infect. Root tips and root hairs are killed when soluble nutrient levels have an EC measurement of 3.5–5.0 mS/cm.

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- Avoid low oxygen conditions developing in the root zone. Excessive watering and high temperatures can cause these conditions. Similar conditions can result from poorly aerated root substrates or soils. These conditions predispose plants to infection.

Reusing substrates or repeatedly cultivating soils can change their structure, which results in poorer structures and low oxygen levels in the root zone.

- Cold and wet soils or root substrates also predispose plants to infection, particularly to certain *Pythium* species.
- Practice good farm and crop hygiene. If possible, have concreted or sealed paths that can be cleaned of organic matter and disinfected. Remove crop residues and infected plants carefully to avoid spreading spores and infecting surrounding plants.

Use trolleys with plastic liners and put infected material directly into them rather than allowing organic matter to sit on the ground or dragging crop residues through the house.

Schedule 'dirty' operations so that workers do not enter 'clean' areas afterwards without washing up and changing clothes.

Disinfect pruning tools and use footbaths at greenhouse entrances. Ensure that disinfectants are changed regularly, particularly when they become dirty, rather than on a calendar basis.

- Disinfect and regularly test the water supply to ensure it does not carry these fungal pathogens.

This may not be necessary where sanitised town water is used, but remember any stored water can be contaminated, and reused water is likely to require disinfection.

- Soil can be fumigated before planting. Ensure fumigation treatments are applied correctly because these fungi can quickly recolonise soils.

Do not bring dirty machinery or contaminated footwear into greenhouses or allow untreated soil to come into contact with sterile soil soon after fumigation. Remember these fungi can blow in and recolonise fumigated soil.

- Quality composted organic matter used as root substrates or incorporated into soils can suppress this disease.
- Certain commercial microbial products (biocontrols) can be added to soil or substrates and suppress this disease.

Note that they are preventative treatments and are less likely to succeed after the disease has occurred.

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