

## ROOT ROT

Plants suffering from root rots often show symptoms of drought and nutrient deficiencies. Root rots are associated with conditions that are too wet or dry to support good growth, or when soil oxygen levels, fertility, and soil tilth are inappropriate. Mechanical damage from excavation, compaction, and transplanting are other factors contributing to root rots. Contaminated soils may carry over the disease from one crop to the next.

Typically, many of the small roots are rotted and brown spots or lesions are visible on larger roots. The cortex sloughs off easily from rotted roots. Crown tissue may become necrotic as the disease progresses. A white mould, dark sclerotia or mushrooms may be evident at the base of the plant.

### Hosts

Almost all plants are susceptible to one form of root rot disease or another.

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# BLACK ROOT ROT

*(Thielaviopsis, Chalara)*

Roots are often blackened and decayed, resulting in symptoms that include stunting, yellowed foliage, wilting and rolling or dieback of lower leaves.

### ***Fuchsia***

Plants show poor growth and develop a yellow, sickly appearance. Fine roots are destroyed and larger roots are shortened, leaving characteristic black root stubs. The fungus enters directly through roots as well as through wounds. Overwinters in plant debris, on infected tissue and in soil, becoming active at low temperatures.

### ***Petunia***

Plants show poor growth, yellow sickly appearance, and temporary wilting. Fine roots are destroyed and larger roots are shortened, leaving characteristic black root stubs. The fungus enters through roots and through wounds. It overwinters in plant debris and infects tissue at low temperatures.



*Thielaviopsis on Arctostaphylos*



*Thielaviopsis of Cyclamen*

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*Thielaviopsis of Fuchsia*



*Petunia with Thielaviopsis*



# FUSARIUM

*Fusarium* species are responsible for a wide variety of root, crown, and stem problems on bulbs, vegetables, and ornamentals. The first symptoms are usually wilting on warm days due to a decreased ability of the plant to take up water. In advanced stages, whitish or pinkish masses of fungus may be visible on affected plant parts. In bulbs, scabs develop grey water-soaked spots that later turn brown or chocolate brown. New shoots are often curved, twisted, and yellow. Plant roots may have sunken brown spots and rotted lesions throughout the crown.



*Fusarium on Lilium*

J. Matteoni

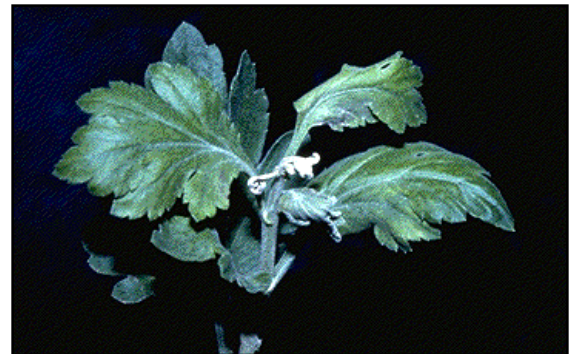


*Fusarium on Lilium*

J. Matteoni

## **Chrysanthemum - Fusarium Stem Rot**

Stems begin to rot at or just below the soil surface causing brittleness; plants appear stunted, scorched and wilted. The fungus is usually able to enter roots through nematode or mechanical damage. It overwinters on plant debris, and becomes active in warm, wet conditions.



*Fusarium of Chrysanthemum*

J. Matteoni

## **Gerbera - Fusarium Crown Rot**

Stems become black and decayed. Leaves, flowers, and entire plants wither and wilt.



*Fusarium Crown Rot of Gerbera*

J. Matteoni

## **Iris - Fusarium Basal Rot**

The fungus infects through host roots, penetrating the base and bulb scales. Leaves turn red, wilt and die. Root development is impaired, the basal plate rots and the bulb becomes dull white. Overwinters on plant debris.



Basal Rot of *Iris*



*Fusarium on Iris Bulbs*

J. Matteoni

### ***Narcissus* - Fusarium Basal Rot**

This fungus enters through the roots and basal plates. It causes stunted, distorted, and yellow shoots. Basal plates are decayed with a red-brown colour that progresses into scales, eventually rotting the entire bulb.

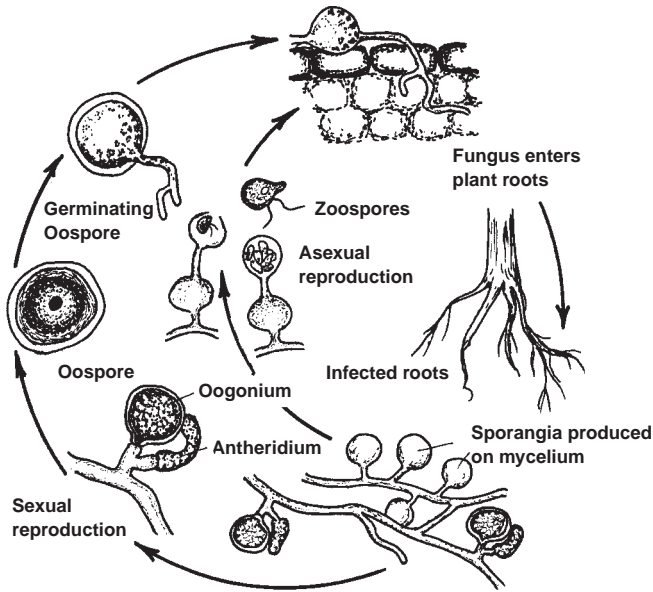


*Narcissus* with Fusarium Basal Rot



# PYTHIUM

## *Pythium* Root Rot Life Cycle



*Pythium* is a water mould pathogen similar to *Phytophthora*. Both are protists and produce a type of spore that is capable of movement in the soil water and both may be harboured in contaminated soils. Propagating infected plant materials can also spread the disease. On herbaceous plants, a watery soft rot of the roots and crown is often indicative of *Pythium* infections. *Pythium* species are often found in untreated water supplies, particularly those originating from ditches or ponds.

### *Gerbera* (*Pythium/Phytophthora*)

Stems and roots appear water-soaked and black from the soft rot, which causes collapse and death. Plants may show symptoms of drought and starvation due to a decreased ability to take up the necessary elements. As a result, leaves of hosts may display purple leaves, or other deficiency symptoms.

### *Saintpaulia* (*Pythium ultimum*)

Crowns and roots of plants turn soft and mushy and leaves wilt. The disease results from over watering and poor soil drainage.



*Pythium* Root Rot of *Saintpaulia*



*Pythium* of Poinsettia



*Pythium* Root Rot of Poinsettia



*Pythium/Phytophthora* Root Rot/Crown Rot of *Gerbera*



*Pythium/Phytophthora* Root Rot/Crown Rot of *Gerbera*

# PHYTOPHTHORA

*Phytophthora* are protists, closely related to *Pythium*. They cause a variety of root rots, crown and canker rots, leaf & stem blights, and damping-off on numerous woody and herbaceous species. (See also *Pythium*.)

## **Anemone - Root Rot**

This condition results in sudden wilting of leaves that turn brown within 3 days. The disease enters through wounds or through young roots. The crown turns dark brown and roots become soft and water-soaked. Warm wet conditions favour the disease.



Phytophthora Crown Rot of *Anemone*

## **Aucuba – Root Rot**

This fungus damages host roots when soil is cold and wet, causing severe wilting. Leaves may be small and yellow, and dieback may occur. Young plants may be killed within a few days, while older trees can be unthrifty for years before dying.



Phytophthora Root Rot of *Aucuba*

## **Azalea - Phytophthora Dieback**

Phytophthora causes olive-coloured blotches on leaves that later become brown with red margins. Terminal buds and leaves turn brown, roll up and droop. Growth becomes stunted and dieback or defoliation occurs as cankers form, and hosts eventually die.



N. Little

Phytophthora of Azalea



Phytophthora Root Rot on *Aucuba*



**Gerbera – Root Rot (*Pythium/Phytophthora*)**

Stems and roots appear water-soaked and black. They eventually collapse and die. Plants may show symptoms of drought and starvation due to a decreased ability to take up the necessary elements. As a result, leaves of hosts may display purple leaves, or other deficiency symptoms.



*Pythium/Phytophthora* Root Rot/Crown Rot of *Gerbera*

**Malus (*Phytophthora cactorum*)**

This soil-borne fungus girdles trunks of trees 3 to 10 years old. The first indication of infection is off-colour foliage in late summer as a result of girdling just below ground level. For propagation, avoid soils and irrigation water with a history of crown rot.



*Pythium/Phytophthora* Root Rot/Crown Rot of *Gerbera*



Crown Rot of *Malus*



*Phytophthora* of *Calluna*



Crown Rot of *Malus*



*Phytophthora* of *Microbiota*

# RHIZOCTONIA

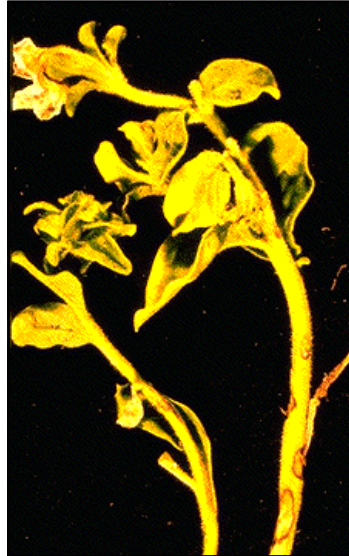
*Rhizoctonia* is one of the principal causes of damping-off with young seedlings and cuttings, and causes a number of root diseases of greenhouse and outdoor ornamental plants. Stem and root lesions are reddish to dark brown in colour and slightly sunken. Brown web-like mycelium may be observed on tissue, and growing into media. As a bulb rot, it often results in partially decayed leaves that discolour and wither before flowering. Bulb scales usually develop greyish-brown spots.



Rhizoctonia on Tulipa Bulb

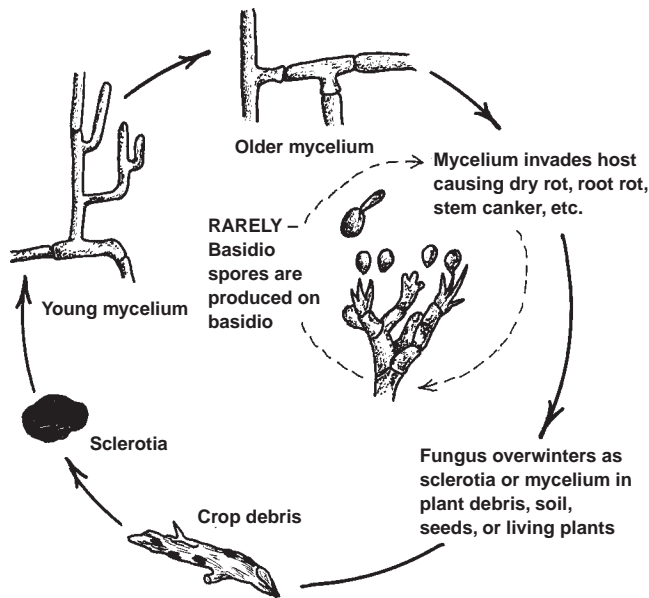
## Petunia - Rhizoctonia Stem Rot

Basal stem canker causes lower leaf drop and collapse. Plants may wilt during the day and recover at night. Roots decay and develop red-brown spots at or below the soil line.



Petunia with Rhizoctonia Stem Rot

### Rhizoctonia Life Cycle





## SOFT ROT (*Erwinia*)

*Erwinia* bacteria (and a few *Pseudomonas* species) produce soft rots on some ornamentals. The bacteria enter through wounds in rhizomes, bulbs, corms, at the leaf base, or at the base of cuttings. Leaves turn yellow or brown and plants often die. Infections result in a foul-smelling watery soft rot of the roots and crowns.

Foul-smelling watery soft rot is an indicator of *Erwinia* diseases.



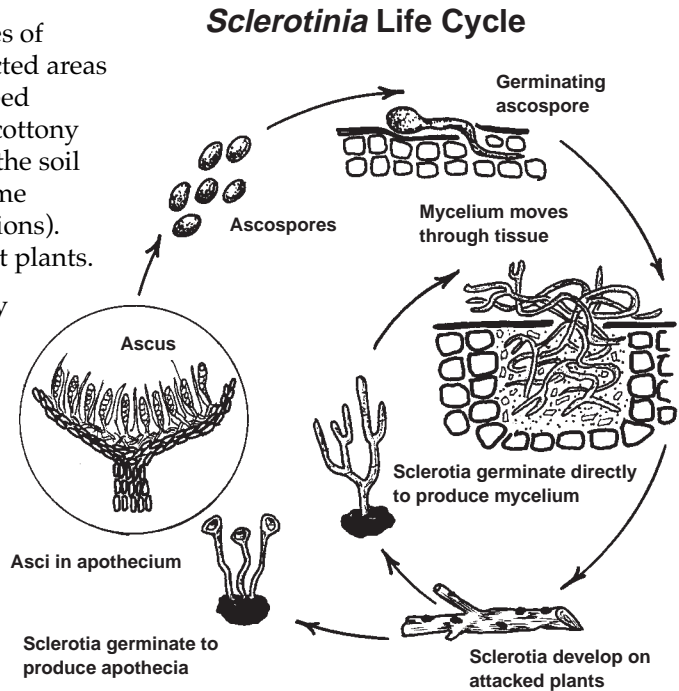
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*Erwinia* on *Chrysanthemum*

# WHITE MOULD (*Sclerotinia*)

This fungal disease is characterized by the masses of white cottony mycelial growth arising from infected areas of roots, stems, and crowns. Dark, irregular-shaped sclerotia may form inside plant tissues or in the cottony mycelium of the fungus. These bodies persist in the soil and will discharge spores when conditions become favourable (usually springtime in outdoor situations). *Sclerotinia* species will attack a wide range of host plants.

Look for: white, fluffy mycelia and sclerotia (grey or black hard bodies, about the size of a grain of rice or larger) lodged in the rotting tissues or in the surrounding mycelia.



## *Chrysanthemum* (*Sclerotinia sclerotiorum*)

The lower stem area shows a dark green wet rot, and a white mycelial growth develops on stems. Stems are killed and plants wilt. Later, hard black growths, known as sclerotia, form.



J. Matteoni

Sclerotinia White Mould on *Chrysanthemum*

## *Tagetes* (*Sclerotinia sclerotiorum*)

White cottony mycelia and black resistant structures called sclerotia form on stem bases of wilted plants.



*Tagetes* with Sclerotinia Rot



## OTHER ROOT ROT FUNGI

### *Armillaria*, *Cylindrocladium*, *Cylindrocarpon*, *Penicillium*, *Stromatinia*

Many other parasitic fungi will produce root or crown rot symptoms. These may often be host specific. Laboratory examination is usually required for an accurate diagnosis. This is important, since the control strategy may depend upon the individual species responsible.

#### **Gladiolus - Stomatina Dry Rot (*Stromatinia gladioli*)**

Small dark fungal fruiting bodies are present on leaf bases and corm husks. Brown or black spots appear on corms and eventually run together and destroy the corm. This disease is usually a problem when corms are stored in moist storage areas. In the field, husks or leaf bases are yellowed and brittle.

#### **Thuja - Armillaria Root Rot (*Armillaria ostoyae*)**

Invades roots and base of many woody plants, killing live roots, usually of weakened trees, as well as continuing decay of dead wood. Causes growth reduction, yellowish or undersized foliage, premature leaf drop, branch dieback in the upper crown, and rapid browning and death of the entire plant during summer. The fungus spreads slowly through the soil in circular patches. Avoid growing susceptible species near native forests or in soils recently cleared of native forest vegetation. Diseased plants should be completely removed, including all traces of roots and fungus.

#### **Tulipa - Blue Mould (*Penicillium*)**

Bulbs and shoots may be rotted and covered with a blue-green mould with water-soaked areas separating the diseased and healthy tissues. Pale-green and stunted plants are produced which die prematurely. Flowers are of poor quality. Often associated with mechanical bulb damage, poor storage and handling, and adverse field conditions before bulb lifting.



*Stromatinia* Dry Rot of *Gladiolus*



*Thuja* with *Armillaria* Root Rot



*Thuja* with *Armillaria* Root Rot



*Penicillium* of *Tulipa*