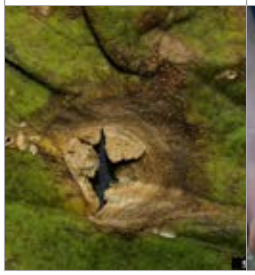
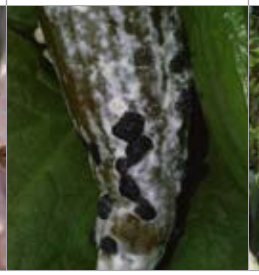
PUMPKIN, SQUASH, ZUCCHINI AND CUCUMBER

Charcoal rot	Damping off	Fusarium foot rot	Fusarium wilt
Page 210	Page 214	Page 218	Page 222
			

Gummy stem blight	Root-knot nematode	Sclerotinia rot	Sclerotium rot
Page 226	Page 230	Page 234	Page 238
			

CHARCOAL ROT

Macrophomina phaseolina

WHAT SHOULD I LOOK FOR?

Seedlings with early infection show water-soaked lesions at soil line that may choke and kill the plant

H. Schwartz, Colorado State University, Bugwood.org

As the disease progresses amber coloured ooze, similar to gummy stem blight, may be released. Lesions eventually dry out and many survival structures (microsclerotia) may be seen in the dead tissue

P. Bachi, University of Kentucky Research and Education Center, Bugwood.org

Infected fruit develop large soft grey to black sunken lesions, shown here in an infected cucumber

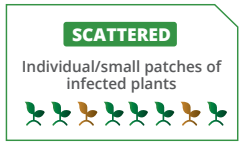
C. Averre North Carolina State University, Bugwood.org

WHERE WILL I SEE SYMPTOMS?

FAVOURABLE CONDITIONS FOR DISEASE DEVELOPMENT

- 27-30°C

DISTRIBUTION IN THE FIELD



HOW DOES IT SPREAD?

SURVIVAL TIME WITHOUT HOST | More than 10 years

HOW DO I CONTROL IT?

FALLOW/COVER CROP

FARM HYGIENE

Stop movement of contaminated soil, water, plants and equipment

CROP ROTATION

Select non-host rotation or cover crops

BIO FUMIGATION

Grow a biofumigant crop

IMPROVE SOIL HEALTH

Add organic matter or amendments to boost beneficial microbes

CHEMICAL FUMIGATION

Always use with care and as per label

- Consult APVMA or InfoPest website for current registered products

PLANTING PREPARATION

CROP SELECTION

Choose a resistant/less susceptible cultivar

NO RESIDUE AT PLANTING

Ensure no plant residues from host crops at planting

GRAFTING

Use transplants grafted onto resistant rootstock

POST-PLANT

AVOID PLANT INJURY

Avoid any physical damage to plant

GOOD NUTRITION

Ensure plants' nutritional needs are met

AVOID WATER STRESS

Ensure plants receive adequate water

HOST RANGE

Very wide host range infecting over 500 plant species including most members of the pumpkin, bean, brassica and pepper vegetable families

DAMPING OFF

Rhizoctonia spp. | *Pythium* spp. | *Phytopthora* spp. | *Fusarium* spp.

WHAT SHOULD I LOOK FOR?

Where direct seeding is used plants may not emerge, resulting in bare patches. Infected seedlings that do emerge develop water soaked dark brown lesions at base of stem, shown here in cucurbit seedlings infected with (a) *Rhizoctonia* spp. and (b) *Pythium* spp.

G. Holmes, California Polytechnic State University, Bugwood.org

Plants experience stunting, wilting and eventual death

G. Holmes, California Polytechnic State University, Bugwood.org

WHERE WILL I SEE SYMPTOMS?

ROOTS

STEM BASE

FAVOURABLE CONDITIONS FOR DISEASE DEVELOPMENT

COOL

WATERLOGGED SOIL

DELAYED SEEDLING EMERGENCE

- 13-18°C

DISTRIBUTION IN THE FIELD

SCATTERED

Individual/small patches of infected plants

HOW DOES IT SPREAD?

WIND

FREE WATER

MOVEMENT OF CONTAMINATED SOIL

SURVIVAL TIME WITHOUT HOST | More than 10 years

HOW DO I CONTROL IT?

FALLOW/COVER CROP

FARM HYGIENE
Stop movement of contaminated soil, water, plants and equipment

HOST-FREE ZONE
Control volunteer host plants and weeds

CROP SELECTION
Choose a resistant/less susceptible cultivar

CHEMICAL FUMIGATION
Always use with care and as per label

- Consult APVMA or InfoPest website for current registered products

BIO FUMIGATION
Grow a biofumigant crop

IMPROVE SOIL HEALTH
Add organic matter or amendments to boost beneficial microbes

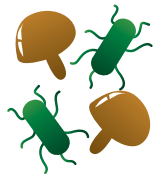
PLANTING PREPARATION

DRAINAGE
Plant on raised beds or well-draining soil

TRANSPLANTS
Use seedling transplants - not direct seeding

NO RESIDUE AT PLANTING
Ensure no plant residues from host crops at planting

BIOCONTROL PRODUCTS



CHEMICAL TREATMENT
Treat seed/ seedlings with registered fungicide

- Consult APVMA or InfoPest website for current registered products

POST-PLANT

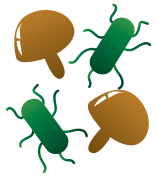
IRRIGATION MANAGEMENT
Monitor crop and soil to optimize amount and timing

AVOID PLANT INJURY
Avoid any physical damage to plant

GOOD NUTRITION
Ensure plants' nutritional needs are met

CONTROL PESTS
Control insect pests that spread spores

BIOCONTROL PRODUCTS



HOST RANGE

Very wide, including all vegetables in the pumpkin (cucurbit) family.

FUSARIUM FOOT ROT

Fusarium solani f.sp. cucurbitae

WHAT SHOULD I LOOK FOR?

Light brown water-soaked rot on crown and upper root which eventually chokes plant. Leaves wilt followed by plant death. Crown often breaks off and secondary pathogens invade decaying plant tissue sometimes producing a bad odour.

M. Lloyd, University of California, Co-operative Extension

Pink to white fungal mycelium is often found on the soil surface beside the lesion and darkened soil may also be evident

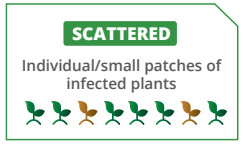
M. Lloyd, University of California, Co-operative Extension

WHERE WILL I SEE SYMPTOMS?

FAVOURABLE CONDITIONS FOR DISEASE DEVELOPMENT

- 25-30°C

DISTRIBUTION IN THE FIELD



HOW DOES IT SPREAD?

SURVIVAL TIME WITHOUT HOST | More than 10 years

HOW DO I CONTROL IT?

FALLOW/COVER CROP

FARM HYGIENE
Stop movement of contaminated soil, water, plants and equipment

HOST-FREE ZONE
Control volunteer host plants and weeds

CROP ROTATION
Select non-host rotation or cover crops

CHEMICAL FUMIGATION
Always use with care and as per label

- Consult APVMA or InfoPest website for current registered products

BIO FUMIGATION
Grow a biofumigant crop

IMPROVE SOIL HEALTH
Add organic matter or amendments to boost beneficial microbes

PLANTING PREPARATION

USE CLEAN SEED OR SEEDLINGS
Source seed/ seedlings from a certified reputable source

NO RESIDUE AT PLANTING
Ensure no plant residues from host crops at planting

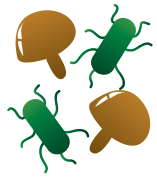
POST-PLANT

AVOID PLANT INJURY
Avoid any physical damage to plant

GOOD NUTRITION
Ensure plants' nutritional needs are met

CONTROL PESTS
Control insect pests that spread spores

BIOCONTROL PRODUCTS



HOST RANGE

Zucchini, pumpkin

FUSARIUM WILT

Fusarium oxysporum f. sp. cucumerinum (cucumber)

WHAT SHOULD I LOOK FOR?

Discolouration of stem at ground level may be seen, in (a) younger seedlings and (b) more mature plants with pale pink fungal growth evident at the base

(a) C. F. Hong, University of Georgia, Bugwood.org (b) L. Tesoriero, Crop Doc Consulting

Lower leaves on young infected plants will be stunted, wilted and turn yellow (often more on one side). Cutting stem reveals brown discolouration of the internal tissue

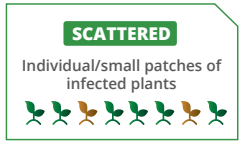
Ontario Crop IPM, OMAFRA

WHERE WILL I SEE SYMPTOMS?

FAVOURABLE CONDITIONS FOR DISEASE DEVELOPMENT

• 25-30°C

DISTRIBUTION IN THE FIELD



HOW DOES IT SPREAD?

SURVIVAL TIME WITHOUT HOST | More than 10 years

HOW DO I CONTROL IT?

FALLOW/COVER CROP

FARM HYGIENE
Stop movement of contaminated soil, water, plants and equipment

CROP ROTATION
Select non-host rotation or cover crops

HOST-FREE ZONE
Control volunteer host plants and weeds

CHEMICAL FUMIGATION
Always use with care and as per label

BIO FUMIGATION
Grow a biofumigant crop

IMPROVE SOIL HEALTH
Add organic matter or amendments to boost beneficial microbes

- Consult APVMA or InfoPest website for current registered products

PLANTING PREPARATION

CROP SELECTION
Choose a resistant/less susceptible cultivar

FERTILISER SELECTION

GRAFTING
Use transplants grafted onto resistant rootstock

NO RESIDUE AT PLANTING
Ensure no plant residues from host crops at planting

USE CLEAN SEED OR SEEDLINGS
Source seed/ seedlings from a certified reputable source

DRAINAGE
Plant on raised beds or well-draining soil

- Consider calcium supplements

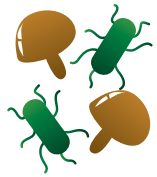
POST-PLANT

CONTROL PESTS
Control insect pests that spread spores

AVOID PLANT INJURY
Avoid any physical damage to plant

GOOD NUTRITION
Ensure plants' nutritional needs are met

BIOCONTROL PRODUCTS



- Especially at seedling stage

HOST RANGE

Cucumber

GUMMY STEM BLIGHT

Stagonosporopsis cucurbitacearum

WHAT SHOULD I LOOK FOR?

Symptoms begin as water-soaked lesions and with age can dry out, form rings and produce small black survival structures (pycnidia)

B. Watt, University of Maine

Small black survival structures (pycnidia) may be seen on older leaf or stem lesions

L. Tesoriero, Crop Doc Consulting

WHERE WILL I SEE SYMPTOMS?

FAVOURABLE CONDITIONS FOR DISEASE DEVELOPMENT

- 20-24°C

DISTRIBUTION IN THE FIELD

LARGE AREAS

Large areas of infected plants clearly visible

HOW DOES IT SPREAD?

SURVIVAL TIME WITHOUT HOST | Less than 3 years

WHAT SHOULD I LOOK FOR?

With age lesions may ooze a characteristic red-brown gummy substance

a) R.Melanson, Mississippi State University Extension, Bugwood.org

b) G.Holmes, California Polytechnic State University, Bugwood.org

In cucumbers, water soaked lesions with brown canker may appear (a) on the skin and (b) internally brown streaks extend from the flower end of the fruit. *L. Tesoriero, NSW DPI*

HOW DO I CONTROL IT?

FALLOW/COVER CROP

IMPROVE SOIL HEALTH

Add organic matter or amendments to boost beneficial microbes

CROP ROTATION

Select non-host rotation or cover crops

- Minimum 2 years break from host

BIO FUMIGATION

Grow a biofumigant crop

CHEMICAL FUMIGATION

Always use with care and as per label

- Consult APVMA or InfoPest website for current registered products

FARM HYGIENE

Stop movement of contaminated soil, water, plants and equipment

PLANTING PREPARATION

NO RESIDUE AT PLANTING

Ensure no plant residues from host crops at planting

USE CLEAN SEED OR SEEDLINGS

Source seed/ seedlings from a certified reputable source

POST-PLANT

CHEMICAL TREATMENT

Treat plant with registered foliar fungicide

- Consult APVMA or InfoPest website for current registered products

AVOID PLANT INJURY

Avoid any physical damage to plant

GOOD NUTRITION

Ensure plants' nutritional needs are met

HOST RANGE

Cucumber, gourd, pumpkin, squash, zucchini

ROOT-KNOT NEMATODE

WARM-CLIMATE SPECIES: *Meloidogyne incognita | Meloidogyne hapla | Meloidogyne javanica*

COOL-CLIMATE SPECIES: *Meloidogyne fallax | Meloidogyne arenaria*

WHAT SHOULD I LOOK FOR?

Aboveground symptoms showing chlorotic stunted squash plants resulting from root-knot nematode infection *G. Holmes, California Polytechnic State University*

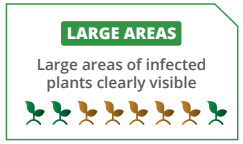
Belowground roots develop characteristic swelling and galls *R. Burns, Texas A&M Agrilife, FLICKR*

WHERE WILL I SEE SYMPTOMS?

FAVOURABLE CONDITIONS FOR DISEASE DEVELOPMENT

- Warm climate species: Active 15°C+
- Cold climate species: Active 8.5°C+

DISTRIBUTION IN THE FIELD



HOW DOES IT SPREAD?

SURVIVAL TIME WITHOUT HOST | Less than 3 years

HOW DO I CONTROL IT?

FALLOW/COVER CROP

FARM HYGIENE

Stop movement of contaminated soil, water, plants and equipment

HOST-FREE ZONE

Control volunteer host plants and weeds

CROP ROTATION

Select non-host rotation or cover crops

CHEMICAL FUMIGATION

Always use with care and as per label

- Consult APVMA or InfoPest website for current registered products

BIO FUMIGATION

Grow a biofumigant crop

SOIL TEST

Conduct a pre-sowing soil test to help predict level of risk

- e.g. PREDICTA® B testing service. If numbers are high consider fallow or non-host break crop

PLANTING PREPARATION

CROP SELECTION

Choose a resistant/less susceptible cultivar

SOIL SOLARISATION

Cover soil with a tarp and kill harmful pathogens

NO RESIDUE AT PLANTING

Ensure no plant residues from host crops at planting

CHEMICAL TREATMENT

Use registered soil drench nematicide at planting

- Consult APVMA or InfoPest website for current registered products

ADJUST DATE

Adjust planting/harvest date to reduce infection risk

- Maximise growth in cool conditions when nematode activity is low. Harvest early in high risk situations

IMPROVE SOIL HEALTH

Add organic matter or amendments to boost beneficial microbes

HOST RANGE

Very wide with over 2000 plant species acting as hosts to root-knot nematode

SCLEROTINIA ROT (WHITE MOULD)

Sclerotinia sclerotiorum | Sclerotinia minor

WHAT SHOULD I LOOK FOR?

Symptoms begin as water-soaked lesions which eventually rot and collapse. As the disease progresses characteristic white fluffy growth develops followed by black fruiting bodies (sclerotia)

M. Gammelgaard, Plantesygdomme

Survival structures (sclerotia) can be up to 25mm long in *S. sclerotiorum* and much smaller (up to 3mm long) in *S. minor*

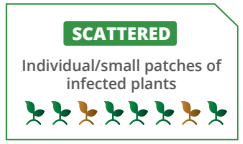
M. Gammelgaard, Plantesygdomme

WHERE WILL I SEE SYMPTOMS?

FAVOURABLE CONDITIONS FOR DISEASE DEVELOPMENT

- 13-18°C

DISTRIBUTION IN THE FIELD



HOW DOES IT SPREAD?

SURVIVAL TIME WITHOUT HOST | 3-10 years

HOW DO I CONTROL IT?

FALLOW/COVER CROP

FARM HYGIENE

Stop movement of contaminated soil, water, plants and equipment

CROP ROTATION

Select non-host rotation or cover crops

HOST-FREE ZONE

Control volunteer host plants and weeds

CHEMICAL FUMIGATION

Always use with care and as per label

- Consult APVMA or InfoPest website for current registered products

IMPROVE SOIL HEALTH

Add organic matter or amendments to boost beneficial microbes

BIO FUMIGATION

Grow a biofumigant crop

PLANTING PREPARATION

AIR CIRCULATION

Increase row/plant spacing to improve air flow

DRAINAGE

Plant on raised beds or well-drawing soil

NO RESIDUE AT PLANTING

Ensure no plant residues from host crops at planting

POST-PLANT

IRRIGATION MANAGEMENT

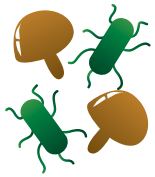
Monitor crop and soil to optimize amount and timing

CHEMICAL TREATMENT

Treat plant with registered foliar fungicide

- Consult APVMA or InfoPest website for current registered products

BIOCONTROL PRODUCTS



HOST RANGE

Very wide (more than 400 different plant species). Infects most vegetable crops including all brassicas and many broadleaf weeds e.g. shepherd's purse, thistles, mustard, pigweed

SCLEROTIUM ROT

Sclerotium rolfsii

WHAT SHOULD I LOOK FOR?

Watery rot that eventually leads to collapse of infected area. Characteristic white "ropey" fungal growth develops along with light brown survival structures (sclerotia)

L. Tesoriero, Crop Doc Consulting

Sclerotia may develop on the infected tissue or soil surface and resemble mustard seeds

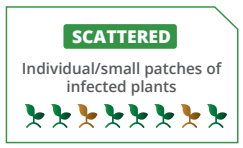
G.Holmes, California Polytechnic State University, Bugwood.org

WHERE WILL I SEE SYMPTOMS?

FAVOURABLE CONDITIONS FOR DISEASE DEVELOPMENT

- 25-35°C

DISTRIBUTION IN THE FIELD



HOW DOES IT SPREAD?

SURVIVAL TIME WITHOUT HOST | 3-10 years

HOW DO I CONTROL IT?

FALLOW/COVER CROP

FARM HYGIENE
Stop movement of contaminated soil, water, plants and equipment

CROP ROTATION
Select non-host rotation or cover crops

HOST-FREE ZONE
Control volunteer host plants and weeds

BIO FUMIGATION
Grow a biofumigant crop

IMPROVE SOIL HEALTH
Add organic matter or amendments to boost beneficial microbes

PLANTING PREPARATION

AIR CIRCULATION
Increase row/plant spacing to improve air flow

DRAINAGE
Plant on raised beds or well-draining soil

NO RESIDUE AT PLANTING
Ensure no plant residues from host crops at planting

POST-PLANT

IRRIGATION MANAGEMENT
Monitor crop and soil to optimize amount and timing

CHEMICAL TREATMENT
Treat plant with registered foliar fungicide

- Consult APVMA or InfoPest website for current registered products

AVOID PLANT INJURY
Avoid any physical damage to plant

GOOD NUTRITION
Ensure plants' nutritional needs are met

HOST RANGE

Very wide (more than 400 different plant species). Infects most vegetable crops including the bean, cabbage and pumpkin families