## LETTUCE, ENDIVE AND ARTICHOKE

<table>
<thead>
<tr>
<th>Anthracnose (shot hole or ring spot)</th>
<th>Black root rot</th>
<th>Bottom rot</th>
<th>Corky root rot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Page 176</td>
<td>Page 180</td>
<td>Page 184</td>
<td>Page 188</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Damping off</th>
<th>Lettuce big-vein disease</th>
<th>Sclerotinia rot (white mould)</th>
<th>Root-knot nematode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Page 192</td>
<td>Page 196</td>
<td>Page 200</td>
<td>Page 204</td>
</tr>
</tbody>
</table>
**LETTUCE, ENDIVE AND ARTICHOKE**

**ANTHRACNOSE (SHOT HOLE/RING SPOT)**

*Microdochium panattonianum*

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**WHAT SHOULD I LOOK FOR?**

- **Begins as small water-soaked brown lesions**

**FAVOURABLE CONDITIONS FOR DISEASE DEVELOPMENT**

- **COOL**
  - Lower leaves
- **HIGH HUMIDITY**
  - 15-22°C
- **WET**
  - Leaf wetness of 8 hours or more increases infection risk

**WHERE WILL I SEE SYMPTOMS?**

- Leaves

**HOW DOES IT SPREAD?**

- **SCATTERED**
  - Individual/small patches of infected plants
- **FREE WATER**
- **WIND**
- **MOVEMENT OF CONTAMINATED SOIL**

- Mostly through splash

**SURVIVAL TIME WITHOUT HOST**

- More than 3 years

---

**WHERE WILL I SEE SYMPTOMS?**

- Leaves

**FAVOURABLE CONDITIONS FOR DISEASE DEVELOPMENT**

- COOL
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**WHAT SHOULD I LOOK FOR?**

- Begins as small water-soaked brown lesions

**DISTRIBUTION IN THE FIELD**

- SCATTERED
  - Individual/small patches of infected plants

**HOW DOES IT SPREAD?**

- Mostly through splash

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<td><strong>CROP ROTATION</strong></td>
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<tr>
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<td>• Minimum 4 year break</td>
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<td>Choose a resistant/less susceptible cultivar</td>
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<td><strong>IRRIGATION MANAGEMENT</strong></td>
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<td>Monitor crop and soil to optimize amount and timing</td>
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<td><strong>CHEMICAL TREATMENT</strong></td>
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<td>Treat plant with registered foliar fungicide</td>
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<td>• Avoid excess periods of leaf wetness</td>
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### Host Range

Lettuce, prickly lettuce and endive
Aboveground symptoms will appear in small scattered patches. Depending on the timing and severity of infection, plant may appear small and stunted but otherwise healthy. In more severe cases lower leaves will turn yellow or brown.

S. Koike, TriCal Diagnostics

Belowground the main tap root may be severely stunted (left) compared to the root system of a healthy lettuce plant (right). Diseased roots also develop dark brown to black lesions, particularly on the fine feeder roots.

S. Koike, TriCal Diagnostics

**Where will I see symptoms?**

**Favourable conditions for disease development**

- Roots
- Wet
- Warm
- • 17-25°C

**Distribution in the field**

- Scattered
  - Individual/small patches of infected plants

**How does it spread?**

- Movement of contaminated soil
- Contaminated plant debris

**Survival time without host**

More than 10 years
### How Do I Control It?

<table>
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<tr>
<th>Farm Hygiene</th>
<th>Crop Rotation</th>
<th>Bio Fumigation</th>
<th>Improve Soil Health</th>
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<tr>
<td>Stop movement of contaminated soil, water, plants and equipment</td>
<td>Select non-host rotation or cover crops</td>
<td>Grow a biofumigant crop</td>
<td>Add organic matter or amendments to boost beneficial microbes</td>
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- 5 to 6 year break from susceptible crops

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<th>Drainage</th>
<th>Crop Selection</th>
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<tr>
<td>Ensure no plant residues from host crops at planting</td>
<td>Plant on raised beds or well-draining soil</td>
<td>Choose a resistant/less susceptible cultivar</td>
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<th>Irrigation Management</th>
<th>Avoid Plant Injury</th>
<th>Good Nutrition</th>
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<td>Monitor crop and soil to optimize amount and timing</td>
<td>Avoid any physical damage to plant</td>
<td>Ensure plants' nutritional needs are met</td>
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- Minimise irrigation splash

### Host Range

Wide host range, including beans, peas, cotton, lettuce, lucerne, lupin and soybean
LETTUCE, ENDIVE AND ARTICHOKE

BOTTOM ROT

Rhizoctonia spp.

WHAT SHOULD I LOOK FOR?

Starts as brown spots on underside of leaf midrib and develops to rot on midrib leaf blade

Gerald Holmes, California Polytechnic State University, Bugwood.org

Heads can be slimy brown to dark brown/black as they collapse. Brown mycelium can grow over lesion with small brown sclerotia. Brown rot of root may also be seen

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

WHERE WILL I SEE SYMPTOMS?

FAVOURABLE CONDITIONS FOR DISEASE DEVELOPMENT

WET

WARM

•25-27°C

DISTRIBUTION IN THE FIELD

HOW DOES IT SPREAD?

SURVIVAL TIME WITHOUT HOST | 3-10 years

LARGE AREAS

Large areas of infected plants clearly visible

WIND

FREE WATER

MOVEMENT OF CONTAMINATED SOIL

CONTAMINATED PLANT DEBRIS

3 years

< 3 years

SURVIVAL TIME WITHOUT HOST

3-10 years
### How Do I Control It?

#### 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

#### Biofumigation
- Grow a biofumigant crop

#### Improve Soil Health
- Add organic matter or amendments to boost beneficial microbes

#### Crop Selection
- Choose a resistant/less susceptible cultivar

#### Drainage
- Plant on raised beds or well-draining soil

#### No Residue at Planting
- Ensure no plant residues from host crops at planting

#### Air Circulation
- Increase row/plant spacing to improve air flow

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

#### Avoid Over Irrigation
- Saturated soils favour disease development and spread

#### Chemical Treatment
- Treat plant with registered foliar fungicide

#### Avoid Plant Injury
- Avoid any physical damage to plant

#### Good Nutrition
- Ensure plants' nutritional needs are met

#### Biocontrol Products
- Consult APVMA or InfoPest website for current registered products

### Host Range
- Lettuce, endive

- Minimum 3 year break

- Select cultivars with upright architecture to reduce soil contact

- Excess periods of leaf wetness encourage disease

- Consult APVMA or InfoPest website for current registered products
Aboveground plants appear stunted and wilted, as seen in infected lettuce on the right, compared to a healthy lettuce on the left. Belowground symptoms begin as yellow banding on the root which turns brown.

Eventually roots become swollen, cracked, rough and stop functioning. Side roots are reduced and become brittle, as shown in infected root (right) compared to healthy roots from a corky root resistant variety (left).

**WHAT SHOULD I LOOK FOR?**

**WHERE WILL I SEE SYMPTOMS?**

- Whole Plant
- Roots

**FAVOURABLE CONDITIONS FOR DISEASE DEVELOPMENT**

- **WARM**
  - 20-25°C

**DISTRIBUTION IN THE FIELD**

- **LARGE AREAS**
  - Large areas of infected plants clearly visible

**HOW DOES IT SPREAD?**

- **FREE WATER**
- **MOVEMENT OF CONTAMINATED SOIL**
- **CONTAMINATED PLANT DEBRIS**

**SURVIVAL TIME WITHOUT HOST**

- 3-10 years
## HOW DO I CONTROL IT?

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<tr>
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<th>Host-Free Zone</th>
<th>Crop Rotation</th>
<th>Improve Soil Health</th>
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<tr>
<td><strong>Farm Hygiene</strong></td>
<td><strong>Control volunteer host plants and weeds</strong></td>
<td><strong>Select non-host rotation or cover crops</strong></td>
<td><strong>Add organic matter or amendments to boost beneficial microbes</strong></td>
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<tr>
<td>Stop movement of contaminated soil, water, plants and equipment</td>
<td></td>
<td>• Minimum 18 months</td>
<td></td>
</tr>
</tbody>
</table>

### PLANTING PREPARATION

<table>
<thead>
<tr>
<th>Crop Selection</th>
<th>Fertiliser Selection</th>
<th>Transplants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Choose a resistant/less susceptible cultivar</strong></td>
<td><strong>Nitrate form of fertiliser may increase severity</strong></td>
<td><strong>Use seedling transplants - not direct seeding</strong></td>
</tr>
</tbody>
</table>

### POST-PLANT

<table>
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<th>Avoid Plant Injury</th>
<th>Good Nutrition</th>
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<td><strong>Avoid any physical damage to plant</strong></td>
<td><strong>Ensure plants’ nutritional needs are met</strong></td>
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<td></td>
<td>• Avoid excess nitrogen</td>
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### HOST RANGE

Lettuce, prickly lettuce, sow thistle, endive
Lettuce, Endive and Artichoke

Damping Off

*Pythium* spp. | *Rhizoctonia solani* | *Phytophthora* spp. | *Fusarium* spp.

**What Should I Look For?**

Seeds may not germinate, or plants may rot soon after emergence, leading to large bare patches. Plants that do emerge may be stunted.

*N. Cottin, Alamy Stock Photo*

Seedlings may have yellow to light brown discolouration on stem at ground level. As the disease progresses stem collapses leading to wilting and death.

*E. Tubb, AHR*

**Where Will I See Symptoms?**

- Whole Plant
- Roots

**Favourable Conditions for Disease Development**

- Cool
- Waterlogged soil
- Delayed seedling emergence

- 15°C-18°C
- Some *Pythium* spp. prefer warm weather i.e. >24°C

**Distribution in the Field**

- Large Areas
- Large areas of infected plants clearly visible

**How Does It Spread?**

- Wind
- Free water
- Movement of contaminated soil
- Contaminated plant debris
- Insects

**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

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

**CHEMICAL FUMIGATION**
Always use with care and as per label

**CHEMICAL TREATMENT**
Treat seed/seedlings with registered fungicide

- Consult APVMA or InfoPest website for current registered products

### 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

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

### POST-PLANT

**IRRIGATION MANAGEMENT**
Monitor crop and soil to optimize amount and timing

**AVOID PLANT INJURY**
Avoid any physical damage to plant

**CONTROL PESTS**
Control insect pests that spread spores

**BIOCONTROL PRODUCTS**
Ensure plants’ nutritional needs are met

**GOOD NUTRITION**

### HOST RANGE

Lettuce, endive
LETTUCE BIG-VEIN DISEASE

Mirafiori lettuce big-vein virus transmitted by fungal vector Olpidium virulentus (oomycete)

WHAT SHOULD I LOOK FOR?

WHERE WILL I SEE SYMPTOMS?

FAVOURABLE CONDITIONS FOR DISEASE DEVELOPMENT

- Leaves
- Wet
- Cool
- <16°C

DISTRIBUTION IN THE FIELD

HOW DOES IT SPREAD?

Transmitted by fungus *Olpidium virulentus*

SURVIVAL TIME WITHOUT HOST

More than 10 years
## HOW DO I CONTROL IT?

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<td>Grow a biofumigant crop</td>
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<td>Minimum 18 months</td>
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<table>
<thead>
<tr>
<th>DRAINAGE</th>
<th>NO RESIDUE AT PLANTING</th>
<th>USE CLEAN SEED OR SEEDLINGS</th>
<th>ADJUST DATE</th>
<th>CROP SELECTION</th>
</tr>
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<tbody>
<tr>
<td>Plant on raised beds or well-draining soil</td>
<td>Ensure no plant residues from host crops at planting</td>
<td>Source seed/seedlings from a certified reputable source</td>
<td>Adjust planting/harvest date to reduce infection risk</td>
<td>Choose a resistant/less susceptible cultivar</td>
</tr>
<tr>
<td>• Avoid planting in cool temperatures which increase disease expression</td>
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<th>AVOID PLANT INJURY</th>
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<td>Avoid any physical damage to plant</td>
<td>Contain and dispose of infected plant material away from field</td>
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## HOST RANGE

Lettuce and weed species such as sow thistle and chickweed may act as hosts.
Symptoms begin as (a) watery soft lesions that (b) develop into fluffy white growth sometimes containing black survival structures (sclerotia). Lower leaves and stems are most affected.

Brown, soft decay eventually destroys the tissue around crown. Near maturity the entire plant will wilt and collapse.

**WHERE WILL I SEE SYMPTOMS?**

| LEAVES | STEM | HEAD |

**FAVOURABLE CONDITIONS FOR DISEASE DEVELOPMENT**

- COOL
- MOIST SOIL
- 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**

- 3-10 years
### Host Range

Very wide (more than 400 different plant species). Infects most vegetable crops including lettuce, endive, and chicory.

### How Do I Control It?

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LETTUCE, ENDIVE AND ARTICHOKE

ROOT-KNOT NEMATODE

WARM-CLIMATE SPECIES: Meloidogyne incognita | Meloidogyne javanica | Meloidogyne arenaria

COOL-CLIMATE SPECIES: Meloidogyne hapla | Meloidogyne fallax

WHAT SHOULD I LOOK FOR?

Aboveground plant may appear chlorotic and stunted (left) compared to a healthy lettuce (right)

Ontario Ministry of Agriculture and Food (OMAFRA)

WHERE WILL I SEE SYMPTOMS?

FAVOURABLE CONDITIONS FOR DISEASE DEVELOPMENT

- WARM
- SANDY SOIL
- COOL
- SANDY SOIL

- Active 15°C +
- Active 8.5°C +

D. Blancard, INRA

Belowground roots develop characteristic swelling and galls.

DISTRIBUTION IN THE FIELD

- LARGE AREAS: Large areas of infected plants clearly visible

HOW DOES IT SPREAD?

- FREE WATER
- MOVEMENT OF CONTAMINATED SOIL
- CONTAMINATED PLANT DEBRIS

SURVIVAL TIME WITHOUT HOST: Less than 3 years
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<td><strong>SOIL SOLARISATION</strong></td>
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<tr>
<td>Cover soil with a tarp and kill harmful pathogens</td>
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**• Maximise growth in cool conditions when nematode activity is low. Harvest early in high risk situations**

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### HOST RANGE

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