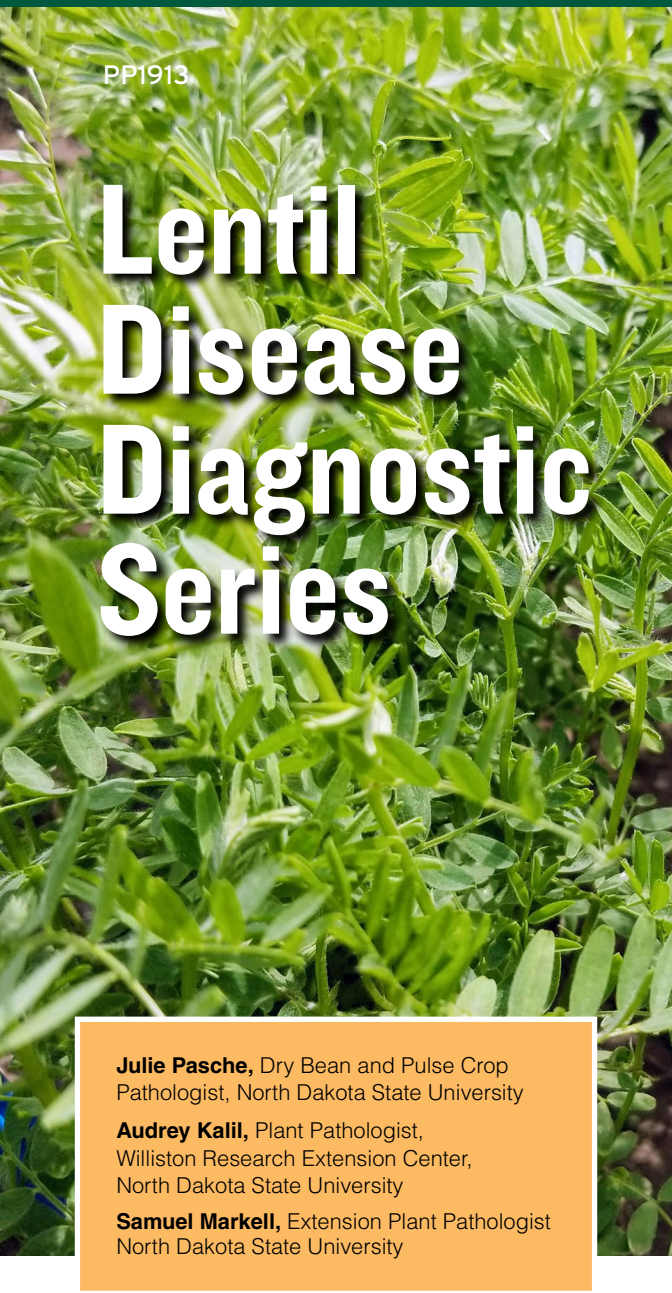
PP1913

# Lentil Disease Diagnostic Series



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NDSU North Central Research Extension Center

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# Pythium seed and seedling rot

*Pythium ultimum, P. irregulare, P. aphanidermatum* and other *Pythium* species

Figure 1

Photos: T. Paulitz, USDA-ARS, Pullman, Wash.

Figure 2

Photo: T. Paulitz, USDA-ARS, Pullman, Wash.

# Pythium seed and seedling rot

*Pythium ultimum, P. irregulare, P. aphanidermatum* and other *Pythium* species

**AUTHORS:** Lyndon Porter, Timothy Paulitz and Kurt Schroeder

## SYMPTOMS

- **Poor emergence, rotted seed with light brown root discoloration**
- **Stunted plants with yellow or purple leaves developing from the bottom**

**FIGURE 1** – Brown/black discoloration and pruning of lateral and tap roots by *Pythium irregulare*

**FIGURE 2** – Range of yellowing on plant foliage

## FACTORS FAVORING DEVELOPMENT

- Cool, water-saturated or compacted soil and poor seed vigor

## IMPORTANT FACTS

- Metalaxyl (mefenoxam)-resistant *Pythium* is present in some growing regions
- Effective seed treatments are available for metalaxyl-resistant and sensitive *Pythium*
- Avoid planting into wet or compacted soils
- Pathogen survives on plant debris and in soil
- Resistant varieties are not available
- Often occurs in complex with other root rots
- Can be confused with other root rots and water logging



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# Fusarium root rot

*Fusarium avenaceum* and other *Fusarium* species

Photo: K. Zitnick-Anderson, NDSU

**Figure 1**

Photo: K. Zitnick-Anderson, NDSU

**Figure 2**

Photo: L. Porter, USDA-ARS, Prosser, Wash.

**Figure 3**

# Fusarium root rot

*Fusarium avenaceum* and other *Fusarium* species

**AUTHORS:** Audrey Kalil and Lyndon Porter

## SYMPTOMS

- **Poor emergence**
- **Wilting, stunting and premature death**

**FIGURE 1** – Brown to reddish-brown lesions on lower stems and roots caused by *Fusarium* infection

**FIGURE 2** – Infected seedlings

**FIGURE 3** – Yellowing progressing upward and premature death caused by *F. avenaceum* (diseased [middle/bottom] and healthy [top] roots)

## FACTORS FAVORING DEVELOPMENT

- Soil compaction and plant stress
- Warm, moist soil (68 to 82 F)
- Short pea and lentil rotations

## IMPORTANT FACTS

- Pathogen survives on plant debris and in soil
- Often occurs in complex with other root diseases
- Resistant varieties are not available
- Fungicide seed treatments may be recommended
- Can be confused with other root rots and water logging



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# Rhizoctonia seed, seedling and root rot

*Rhizoctonia solani*

**Figure 1**

Photo: K. Zitnick-Anderson, NDSU

**Figure 2**

Photo: K. Zitnick-Anderson, NDSU

# Rhizoctonia seed, seedling and root rot

*Rhizoctonia solani*

**AUTHORS:** Jessica Rupp, Myron Bruce and Timothy Paulitz

## SYMPTOMS

- **Poor emergence**
- **Reddish-brown to dark brown lesions on roots and base of stem**
- **Secondary roots absent**
- **Plants are stunted and leaves turn yellow**

**FIGURE 1** – Sunken brown lesions on stem and root just below soil

**FIGURE 2** – Moderate (top) to severe (bottom) Rhizoctonia root rot

## FACTORS FAVORING DEVELOPMENT

- Wet, compacted or waterlogged soils

## IMPORTANT FACTS

- Pathogen survives on plant debris and in soil
- Resistant varieties are not available
- Fungicide seed treatments may be recommended
- Often occurs in a complex with other root rots
- Can be confused with other root rots and water logging



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# Aphanomyces root rot

*Aphanomyces euteiches*

**Figure 1**

Photo: L. Porter, USDA-ARS, Prosser, Wash.

**Figure 2**

Photo: L. Porter, USDA-ARS, Prosser, Wash.

# Aphanomyces root rot

*Aphanomyces euteiches*

**AUTHORS:** Lyndon Porter

## SYMPTOMS

- **Root rot may extend slightly above the soil line**
- **Leaf yellowing progresses from lower canopy upward**
- **Early season stunting and premature plant death**

**FIGURE 1** – Infected roots with caramel-brown root rot (R), compared with healthy roots (L)

**FIGURE 2** – Infection moving up primary stem

## FACTORS FAVORING DEVELOPMENT

- Cool, wet spring conditions
- High soil moisture
- Short rotations with peas and lentils

## IMPORTANT FACTS

- Chickpea, cereals and faba bean are not important hosts
- Often occurs in a complex with other root rot diseases
- Can survive for many (20) years in soil without a susceptible host
- Seed treatments and genetic resistance are not effective
- Can be confused with other root rots and water logging



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# Anthracnose

*Colletotrichum* species

Figure 1

Photo: Michael Wunsch, NDSU

Figure 2

Photo: Michael Wunsch, NDSU

Figure 3

Photo: Michael Wunsch, NDSU

# Anthracnose

*Colletotrichum* species

**AUTHORS:** Michael Wunsch and Julie Pasche

## SYMPTOMS

- **Light-brown stem lesions with a dark border**
- **Symptoms initiate at the base of plant and spread upward**
- **Patches of dead plants develop when stem lesions girdle plant**

**FIGURE 1** – Small black fungal resting structures (microsclerotia) within anthracnose lesions

**FIGURE 2** – Severe anthracnose lesions coalescing

**FIGURE 3** – Anthracnose-infected pods and discolored seeds

## FACTORS FAVORING DEVELOPMENT

- Abundant rainfall during bloom and pod development
- Wide range of temperatures; 68 to 74 F optimal
- Dense canopy

## IMPORTANT FACTS

- Seed quality declines with increasing anthracnose severity
- Varieties differ in susceptibility to anthracnose; none are resistant
- No-till increases degradation of pathogen resting structures
- Commonly confused with Ascochyta blight



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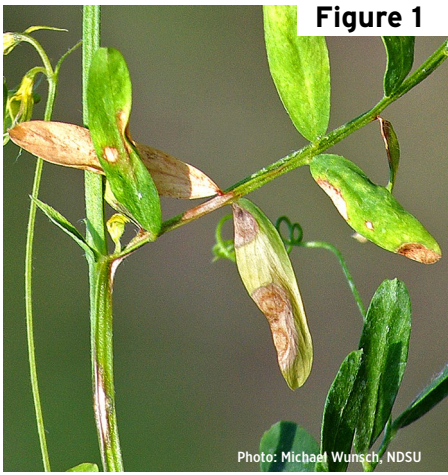
# Ascochyta blight

*Ascochyta lentis*




# Ascochyta blight

*Ascochyta lentis*

**AUTHORS:** Michael Wunsch and Julie Pasche

## SYMPTOMS

- **Light brown leaf, stem and pod lesions with dark brown borders**
- **Small brown fungal fruiting structures (pycnidia) within lesions**
- **Disease lesions and/or picnidia within lesions often exhibit a concentric ring pattern (unlike anthracnose)**
- **Flower and pod abortion**

**FIGURE 1** – Concentric ring pattern from pycnidia inside the light brown lesion

**FIGURE 2** – Mid-canopy Ascochyta blight lesions

**FIGURE 3** – Discolored seeds produced in pods with Ascochtya lesions

## FACTORS FAVORING DEVELOPMENT

- Cool, wet weather; 50 to 68 F optimal
- Planting lentils immediately adjacent to a field where Ascochyta blight occurred on lentils the previous year

## IMPORTANT FACTS

- Ascochyta blight is seed-borne and seed-transmitted; seed should be tested
- Managed with crop rotation (minimum two years out of lentils) and foliar fungicides
- Commonly confused with anthracnose



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# Botrytis gray mold

*Botrytis cinerea, B. fabae*

Photos: Michael Wunsch, NDSU

**Figure 1**

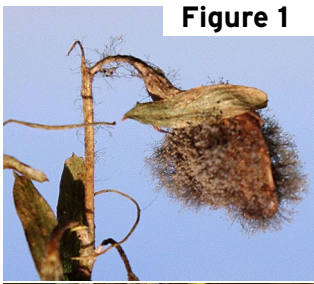

Photo: Michael Wunsch, NDSU

**Figure 2**

# Botrytis gray mold

*Botrytis cinerea, B. fabae*

**AUTHORS:** Michael Wunsch and Julie Pasche

## SYMPTOMS

- **Gray fungal growth on diseased stems, leaves and pods in the lower canopy**
- **Plant tissue is light brown to bleached**
- **Plants become chlorotic, wilt and die when lesions girdle the lower stem**
- **Plant-to-plant spread of Botrytis is common, resulting in dead patches**

**FIGURE 1** – Gray sporulation on diseased tissues when relative humidity is high

**FIGURE 2** – Dead patches in lentil field

## FACTORS FAVORING DEVELOPMENT

- Dense crop canopies that restrict airflow
- High relative humidity and frequent rainfall
- Cool temperatures; 59 to 77 F optimal

## IMPORTANT FACTS

- Resistant varieties are not available
- Fungicides can be effective if applied preventatively
- Commonly confused with white mold and anthracnose



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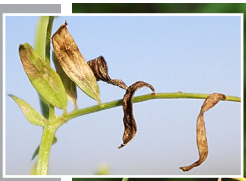
# Stemphylium blight

*Stemphylium botryosum*

Photos: Michael Wunsch, NDSU

Figure 1





Photos: Michael Wunsch, NDSU

Figure 2

Photos: Michael Wunsch, NDSU

Figure 3

# Stemphylium blight

*Stemphylium botryosum*

**AUTHORS:** Weidong Chen and Michael Wunsch

## SYMPTOMS

- **Leaflets may exhibit angular lesions at disease onset**
- **Disease is most severe on leaves but also infects pods, stems and petioles**

**FIGURE 1** – Tan to light brown lesions at disease onset

**FIGURE 2** – Diseased leaflets that have become dark brown to gray due to pathogen sporulation under high relative humidity

**FIGURE 3** – Defoliated plants that have shed diseased leaves

## FACTORS FAVORING DEVELOPMENT

- Extended periods of high relative humidity in the last third of the growing season
- Warm temperatures; 77 to 86 F optimal

## IMPORTANT FACTS

- Red lentils are generally more susceptible than green lentils
- Managed with fungicides and partially resistant varieties
- Can be confused with nutrient deficiencies (such as low nitrogen) or plant senescence



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# Bacterial blight

*Pseudomonas syringae* pv. *syringae*

Photo: F. Mathew, South Dakota State University

**Figure 1**

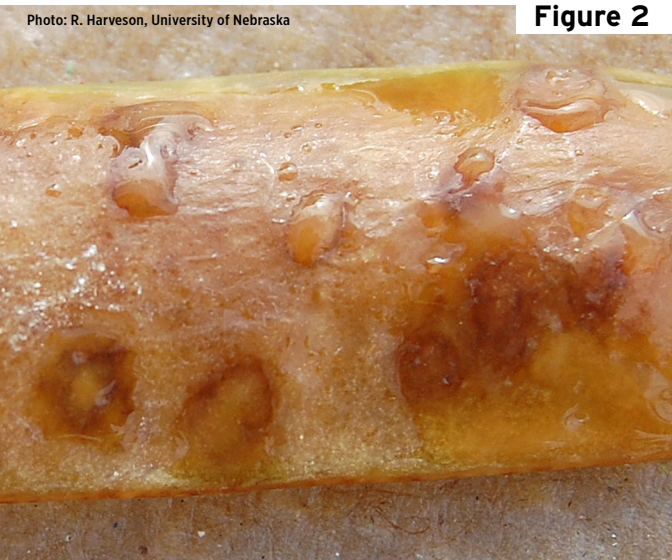

Photo: R. Harveson, University of Nebraska

**Figure 2**

# Bacterial blight

*Pseudomonas syringae* pv. *syringae*

**AUTHORS:** Febina Mathew, Bob Harveson and Bright Agindotan

## SYMPTOMS

- **Lesions observed on all above-ground plant parts**
- **Initial lesions are water-soaked and become necrotic through time**
- **Bacteria may ooze from lesions under high-humidity conditions**

**FIGURE 1** – Brown, circular and translucent foliar lesions

**FIGURE 2** – Bacterial ooze from pod lesions

## FACTORS FAVORING DEVELOPMENT

- Warm temperatures
- High humidity or moisture on leaves
- Hail

## IMPORTANT FACTS

- Bacteria can be spread by rain, wind and mechanical means
- *P. syringae* pv. *syringae* can cause disease on soybean, dry edible beans and other legumes
- Physical damage (such as hail) can facilitate infection and spread
- Fungicides are not effective
- Planting infected seed can increase disease risk
- Can be confused with Ascochyta blight or anthracnose



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# Powdery mildew

*Erysiphe pisi* and *Leveillula taurica*

Figure 1

Photo: L. Porter, USDA-ARS, Prosser, Wash.

Figure 2

Photo: L. Porter, USDA-ARS, Prosser, Wash.

Figure 3

W. Chen, USDA-ARS, Pullman, Wash.

# Powdery mildew

*Erysiphe pisi* and *Leveillula taurica*

**AUTHORS:** Lyndon Porter and Weidong Chen

## SYMPTOMS

- **Most visible starting at flowering and later in the season**
- **Infected leaves can become chlorotic/ necrotic and curled**
- **Infection begins as small spots that enlarge quickly and cover plant surfaces**

**FIGURE 1** – Early infection - white “powdery” spots (yellow arrows)

**FIGURE 2** – Leaf and stem surfaces covered with powdery mildew

**FIGURE 3** – Feltlike white fungal growth

## FACTORS FAVORING DEVELOPMENT

- Late planting
- Conditions limiting sunlight
- Temperatures of 59 to 77 F are optimal

## IMPORTANT FACTS

- Pathogen can be soil-borne, seed-borne and wind-dispersed
- Fungicides may be effective if applied early in disease development
- Crop rotation is important
- Lentil varieties have differing levels of resistance
- Can be confused with white mold and the fungal growth of saprophytes or other pathogens



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# White mold (Sclerotinia stem rot)

*Sclerotinia sclerotiorum*

Photo: W. Chen, USDA-ARS, Pullman, Wash.

Figure 1

Photo: L. Dighans, Pro Co-op Ag Center, Scobey, Mont.

Figure 2

Photo: W. Chen, USDA-ARS, Pullman, Wash.

Figure 3

Photo: W. Chen, USDA-ARS, Pullman, Wash.

Figure 4

# White mold (Sclerotinia stem rot)

*Sclerotinia sclerotiorum*

**AUTHORS:** Mary Burrows, Weidong Chen and Michael Wunsch

## SYMPTOMS

- **First observed as water-soaked lesions**
- **Lesions enlarge and become bleached**
- **White fluffy fungal growth may appear under high humidity**
- **Hard, black sclerotia may appear late in the season**
- **Wilting**

**FIGURE 1** – Dead patches of plants
**FIGURE 2** – White, fluffy fungal growth on leaves and stems
**FIGURE 3** – Bleached lesions with white fungal growth
**FIGURE 4** – Dark, hard fungal structures (sclerotia) on the soil surface (yellow arrows)

## FACTORS FAVORING DEVELOPMENT

- Cool, wet conditions after canopy closure
- Short rotations with susceptible crops
- Lush canopy

## IMPORTANT FACTS

- Sclerotia survive in the soil for several years
- Pathogen infects most broadleaf plants
- Fungicides can be effective if applied preventatively
- Can be confused with powdery mildew, nutrient deficiencies (low nitrogen) or plant senescence



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# Pea enation mosaic

*Pea enation mosaic virus* (PEMV)

**Figure 1**

Photo: W. Chen, USDA-ARS, Pullman, Wash.

**Figure 2**

Photo: W. Chen, USDA-ARS, Pullman, Wash.

**Figure 3**

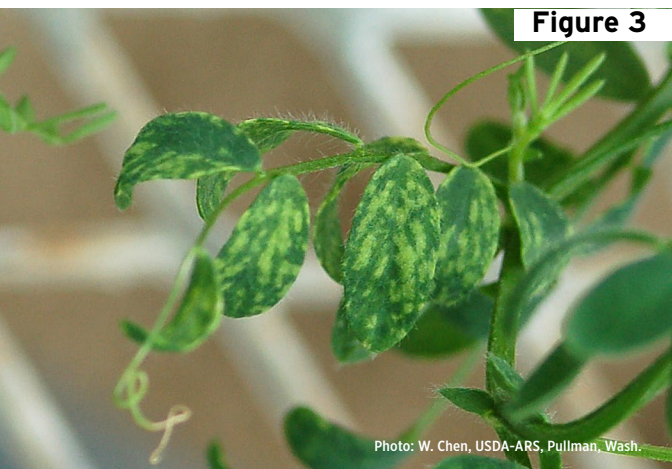

Photo: W. Chen, USDA-ARS, Pullman, Wash.

# Pea enation mosaic

*Pea enation mosaic virus* (PEMV)

**AUTHORS:** Lyndon Porter, Bright Agindotan and Kevin McPhee

## SYMPTOMS

- **Small, circular to elongated translucent spots or streaks on leaves**
- **Vein clearing**
- **Stunted growth and malformed pods**

**FIGURE 1** – Twisted and malformed leaves

**FIGURE 2** – Leaf mottling

**FIGURE 3** – Leaf mottling

## FACTORS FAVORING DEVELOPMENT

- Presence of aphid vectors, including pea, cowpea, green peach, potato or foxglove
- Movement of aphids from virus-infected overwintering hosts in the spring or alfalfa fields during cuttings

## IMPORTANT FACTS

- Can infect chickpea, pea, faba bean, vetch, crimson clover and lambsquarters
- PEMV is not seed-transmitted
- No known resistant varieties
- Insecticides applied to manage aphid vector may help reduce secondary spread
- Can be confused with other viruses or damage from herbicides or thrips



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# Bean leaf roll

*Bean leaf roll virus* (BLRV)

Figure 1

Photo: B. Agindotan, Montana State University, Bozeman

Figure 2

Photo: B. Agindotan, Montana State University, Bozeman

# Bean leaf roll

*Bean leaf roll virus* (BLRV)

**AUTHORS:** Bright Agindotan and Lyndon Porter

## SYMPTOMS

- **Yellowing and stunting**
- **Small leaves**

**FIGURE 1** – Early leaf yellowing symptoms

**FIGURE 2** – Advanced stage of yellowing (Infected [L, R] and healthy [C])

## FACTORS FAVORING DEVELOPMENT

- Presence of other BLRV-infected legume crops and weeds
- Presence of aphid vectors, including pea, cowpea, potato and vetch
- Movement of aphids from alfalfa fields during cuttings

## IMPORTANT FACTS

- Leaf rolling absent
- BLRV is not seed-transmitted
- BLRV infects pea, chickpea, lentil, alfalfa and other legumes
- Insecticides applied to manage aphid vectors may help reduce secondary spread
- Resistant varieties may be available
- Can be confused with nutrient deficiencies (low nitrogen) or plant senescence



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