Chickpea Disease Diagnostic Series

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Cover photo: Audrey Kalil, NDSU

This work is/was supported by the USDA National Institute of Food and Agriculture, Crop Protection and Pest Management Program through the North Central IPM Center (2022-70006-38001).

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Damping-off

*Pythium* and *Globisporangium* species

**Figure 1**
Photo: W. Chen, USDA-ARS, Pullman, Wash.

**Figure 2**
Photo: L. Porter, USDA-ARS, Prosser, Wash.

**Figure 3**
Photo: L. Porter, USDA-ARS, Prosser, Wash.
Damping-off

*Pythium* and *Globisporangium* species

**AUTHORS:** Weidong Chen and Lyndon D. Porter

**SYMPTOMS**
- Rotten seeds coated with hard-to-remove soil
- Infected seeds and root tissue are light brown in color
- Bare patches where plants fail to emerge
- Emerged plants are chlorotic, stunted, with poor vigor

**FIGURE 1** - Infected root radical and infected seed tissue coated in soil
**FIGURE 2** - Washed infected seed
**FIGURE 3** - Infected roots with pinching-off of secondary roots and discoloration

**FACTORS FAVORING DEVELOPMENT**
- Planting into cool (below 50 degrees Fahrenheit) and compacted soils
- Deep seeding (more than 2 inches)
- Poor quality/old seed
- Soil is water-saturated at or soon after planting

**IMPORTANT FACTS**
- Manage with metalaxyl seed treatment, shallow seeding in warm soils and planting high vigor seed
- Effective seed treatments are available for metalaxyl-resistant *Pythium*
- Kabuli varieties are more susceptible than desi
- Resistant kabuli varieties are not available
- Commonly confused with Fusarium and Rhizoctonia root rot and water logging
Rhizoctonia seed, seedling, and wet root rot

*Rhizoctonia solani*

Photo: M. Wunsch, NDSU

Figure 1

Figure 2

Figure 3
Rhizoctonia seed, seedling, and wet root rot

*Rhizoctonia solani*

**AUTHORS:** Michael Wunsch and Erin E. Gunnink Troth

**SYMPTOMS**
- Seed decay and damping-off, resulting in poor emergence
- Sunken reddish to brown lesions on the epicotyl and tap root
- Distribution may be patchy to widespread in a field

**FIGURE 1** - Reduced stand establishment and plant vigor resulting from high *Rhizoctonia* pathogen pressure

**FIGURE 2** - Cotyledon rot and a sunken lesion at the seed attachment site

**FIGURE 3** - Older lesions turn black as secondary microbes invade diseased tissues

**FACTORS FAVORING DEVELOPMENT**
- Cool, wet soils
- Damage from herbicide carryover

**IMPORTANT FACTS**
- Plant residues and soil can harbor the pathogen
- Wide host range includes faba bean, dry bean, field pea, lentil, soybean, canola and sunflower
- Fungicide seed treatments are highly effective, particularly SDHI (FRAC 7) fungicides
- Commonly confused with other root rots and often occurs in a complex with them
Dry Root Rot

*Macrophomina phaseolina*

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**Figure 1**

Photo: M. Senthil-Kumar, NIPGR

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**Figure 2**

Photo: M. Senthil-Kumar, NIPGR

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**Figure 3**

Photos: M. Senthil-Kumar, NIPGR
Dry Root Rot
Macrophomina phaseolina

AUTHORS: Malaika Ebert and Muthappa Senthil-Kumar

SYMPTOMS
• Rapidly dying plants scattered throughout the field during reproductive growth stages
• Taproot dry and dark without lateral roots
• Lower taproot often missing, easy to uproot plants

FIGURE 1 - Field symptoms with straw-colored plants (arrow)
FIGURE 2 - Diseased plants are straw-colored with brittle and rotten primary taproot
FIGURE 3 - Black microsclerotia on the exterior and interior of the stem (arrow)

FACTORS FAVORING DEVELOPMENT
• Hot and dry conditions, with daily minimum above 68 degrees Fahrenheit and maximum above 86 degrees Fahrenheit
• Drought stress
• Poor or sandy soil

IMPORTANT FACTS
• Pathogen is seedborne, soilborne and survives on infected residue as microsclerotia
• Resistant cultivars are available
• Survives in soil for more than 12 months
• Fungicide seed treatment or preventative foliar fungicides help manage disease
• Pathogen has a broad host range of over 500 plant species, including many legumes
• May be confused with Fusarium wilt and other root rots

Card 3 of 12
**Fusarium root rot**

*Fusarium* species

**Figure 1**

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

**Figure 2**

Photo: L. Porter, USDA-ARS, Prosser, Wash.
Fusarium root rot
*Fusarium* species

**AUTHOR:** Lyndon D. Porter

**SYMPTOMS**
- Yellowing and necrosis of foliage at plant base and moving upwards
- Dark black, reddish or brown root rot beginning at seed attachment point and spreading to roots
- Stunting
- Symptoms can develop early but are most pronounced at flowering

**FIGURE 1** - Black discoloration of infected roots and progressive yellowing of foliage from base upwards

**FIGURE 2** - Loss of secondary roots (middle plant)

**FACTORS FAVORING DEVELOPMENT**
- Compacted soil and plant stress
- Short chickpea crop rotations (two-year rotations)
- Warm, moist soil (68 to 82 degrees Fahrenheit)

**IMPORTANT FACTS**
- Pathogen survives in soil and on seed
- Often associated with other root rots
- No known cultivars with complete resistance
- Alternate hosts include peas and lentils
- Commonly confused with Rhizoctonia and Black streak root rots
Fusarium wilt

*Fusarium oxysporum* f. sp. *ciceri*

**Figure 1**

![Photo: L. Porter, USDA-ARS, Prosser, Wash.]

**Figure 2**

![Photo: L. Porter, USDA-ARS, Prosser, Wash.]

**Figure 3**

![Photo: L. Porter, USDA-ARS, Prosser, Wash.]

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Chickpea Disease Diagnostic Series
**Fusarium wilt**

*Fusarium oxysporum f. sp. ciceri*

**AUTHOR:** Lyndon D. Porter

**SYMPTOMS**
- Symptoms typically appear at flowering
- Drooping, wilted, dull-green leaves
- Leaf symptoms may be more severe on one side of the plant than the other

**FIGURE 1** - Scattered distribution of infected plants dying in the field

**FIGURE 2** - Leaf yellowing, wilting and death progresses from lower canopy upward

**FIGURE 3** - Dark brown to black vascular stem tissue near plant base

**FACTORS FAVORING DEVELOPMENT**
- Warm soil temperatures (77 to 86 degrees Fahrenheit), especially during early growth stages
- Short chickpea crop rotations (two-year or less)
- Planting infected seed and susceptible cultivars

**IMPORTANT FACTS**
- Races 0, 1A, 1B/C, 5 and 6 are found in the U.S.
- Cultivars vary in resistance to different races
- Pathogen has two pathotypes, one causes slow yellowing, the other wilt
- Commonly confused with Fusarium root rot and abiotic stresses such as waterlogging
Verticillium wilt

Verticillium dahliae and Verticillium albo-atrum

Photo: M. Ebert, NDSU

Figure 1

Figure 2

Figure 3
Verticillium wilt
Verticillium dahliae and Verticillium albo-atrum

AUTHORS: Dimitri Fonseka, Julie Pasche and Malaika Ebert

SYMPTOMS
• Leaves turn yellow, wilt and eventually die
• Light brown discoloration of vascular tissue in the stem

FIGURE 1 - Yellowing of leaves and dead leaf tissue
FIGURE 2 - Uneven necrosis of leaflets moving up stem
FIGURE 3 - Light-brown discoloration of the vascular tissue (arrow)

FACTORS FAVORING DEVELOPMENT
• Warm, moist soils (61 to 68 degrees Fahrenheit)
• Warm air temperatures (72 to 82 degrees Fahrenheit)
• Planting susceptible cultivars

IMPORTANT FACTS
• The pathogen is spread in irrigation water, on farm machinery and via infested seed
• Verticillium can survive in the soil for up to 10 years
• Verticillium has a broad host range which includes woody and herbaceous plants. Rotation to non-host crops (small grains) is recommended
• Sanitation of farm equipment between fields reduces spread
• Commonly confused with Fusarium wilt and drought stress
Ascochyta blight
*Ascochyta rabiei*
Ascochyta blight
Ascochyta rabiei

AUTHOR: Weidong Chen

SYMPTOMS
• Leaf lesions are initially water-soaked, irregular flecks and/or circular to oval lesions, with concentric ring pattern of small brown pycnidia
• Stem lesions develop at nodes, elongate and cause stem breakage
• Shriveled seed with brown discoloration

FIGURE 1 – Leaf lesion with pycnidia and water-soaked border
FIGURE 2 – Ascochyta blight lesion girdling the stem
FIGURE 3 – Pod lesion with concentric rings of pycnidia

FACTORS FAVORING DEVELOPMENT
• Moderate temperatures (60 to 77 degrees Fahrenheit) and frequent rainfall
• Short rotation interval between chickpea crops
• Planting chickpea adjacent to where chickpea was planted the previous year

IMPORTANT FACTS
• Pathogen survives in crop residue and is seed-borne
• Pathogen host range is limited to chickpeas
• Strobilurin (QoI) fungicide resistance has been documented
• Plant disease-free seed with fungicide seed treatment
• Managed with minimum three-year crop rotation, less susceptible cultivars and timely application of foliar fungicides
Alternaria Blight

*Alternaria alternata*

**Figure 1**

![Image of Alternaria Blight on chickpea leaves](Photo: M. Wunsch, NDSU)

**Figure 2**

![Image of Alternaria Blight on chickpea plant](Photo: M. Wunsch, NDSU)
Alternaria Blight

Alternaria alternata

AUTHOR: Malaika Ebert

SYMPTOMS
• Symptoms occur on all above-ground plant parts
• Small, water-soaked, circular lesions turn reddish brown to purple
• Infected flowers and leaves may turn straw-colored before falling off
• Infected seed is shriveled and blackened
• In moist conditions, infected plants appear black from fungal sporulation

FIGURE 1 – Reddish-brown lesions on stems and leaves with yellowing and dead tissue
FIGURE 2 – Foliar symptoms of Alternaria blight

FACTORS FAVORING DEVELOPMENT
• Planting infected seed and susceptible cultivars
• Warm temperatures (75 to 82 degrees Fahrenheit) and high humidity (above 85%)
• Older plants are more susceptible

IMPORTANT FACTS
• Pathogen has broad host range including lentil, pea, mungbean and cowpea
• Pathogen survives in seed for up to 20 months
• Infected seed may be unfit for human or livestock consumption
• Manage with disease-free seed, resistant cultivars and seed and foliar applied fungicides
• May be confused with Ascochyta or Stemphylium blight
Stemphylium blight

Stemphylium species

Photo: M. Burrows, MSU

Figure 1

Figure 2

Photo: M. Burrows, MSU
**Stemphylium blight**

*Stemphylium* species

**AUTHOR:** Uta McKelvy

**SYMPTOMS**
- Develops as large irregular patches in the field
- Older leaf lesions may develop yellow or gray borders
- Leaf loss may occur
- Small, elongated, brown spots on the stems

**FIGURE 1** - Initial lesions are small, roughly circular and brown

**FIGURE 2** - Leaf lesions merge, develop irregular shapes and cover large areas

**FACTORS FAVORING DEVELOPMENT**
- Cool temperatures (59 to 68 degrees Fahrenheit) and high humidity
- Excessive vegetative growth
- Disease usually develops at and after flowering

**IMPORTANT FACTS**
- Disease is present in the U.S. but is of minor importance
- Pathogen is transmitted on/in residue, soil and seed
- No fungicides are registered for disease control
- May be confused with Alternaria blight and Ascochyta blight
Sclerotinia stem and crown rot

*Sclerotinia sclerotiorum, S. minor and S. trifoliorum*

Photo: M. Wunsch, NDSU

**Figure 1**

**Figure 2**

**Figure 3**
Sclerotinia stem and crown rot
*Sclerotinia sclerotiorum*, *S. minor* and *S. trifoliorum*

**AUTHOR:** 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** - Premature senescence of plant caused by a lesion girdling the stem

**FIGURE 2** - Sclerotinia stem rot lesions typically exhibit a bleached coloration

**FIGURE 3** - Round sclerotia

**FACTORS FAVORING DEVELOPMENT**
- Cool, wet weather particularly after canopy closure
- Dense canopy
- Tight crop rotations with other susceptible crops including other legumes, sunflower and canola

**IMPORTANT FACTS**
- The pathogen persists in the soil as sclerotia for many years
- Sclerotinia stem rot often develops concurrently with Ascochyta blight and Botrytis gray mold
- Fungicides must be applied preventatively for successful Sclerotinia stem rot management
- Fungicides have no efficacy against Sclerotinia crown rot
Botrytis gray mold

*Botrytis cinerea*

Figure 1

Photo: M. Wunsch, NDSU

Figure 2

Photo: M. Wunsch, NDSU

Figure 3

Photo: M. Wunsch, NDSU
Botrytis gray mold
Botrytis cinerea

AUTHORS: Michael Wunsch and Audrey Kalil

SYMPTOMS

- Water-soaked lesions on leaves, stems, flowers and pods that turn gray to dark brown
- Fluffy, gray mold produced under humid conditions
- Flower drop and seed abortion

FIGURE 1 - High humidity promotes abundant gray sporulation on lesions
FIGURE 2 - Stem symptoms include brown speckling and lesions that girdle the stem
FIGURE 3 - Diseased pods are initially brown and become gray from sporulation when humid

FACTORS FAVORING DEVELOPMENT

- Planting infested seed
- Dense crop canopy
- High humidity (above 95%) and moderate temperatures (68 to 77 degrees Fahrenheit)

IMPORTANT FACTS

- Pathogen has a wide host range of more than 100 plant species
- Pathogen is seedborne, survives in the soil and on infected plant residue
- Disease progresses rapidly
- Foliar fungicides have poor efficacy due to difficulty achieving good coverage inside the canopy
- Seed treatment with effective fungicides reduces seed to seedling transmission

Card 11 of 12
Pea enation mosaic

*Pea enation mosaic virus (PEMV)*

Figure 1

Figure 2
Pea enation mosaic

Pea enation mosaic virus (PEMV)

AUTHOR: Lyndon D. Porter

SYMPTOMS

- Small spots or flecks on leaves
- Severe stunting
- Leaves and pods are malformed

FIGURE 1 – “Windows” of yellow spots and streaks on distorted and curled leaves and close-up of “windows” on leaflets

FIGURE 2 – Close-up of distorted leaflets with PEMV (see arrows)

FACTORS FAVORING DEVELOPMENT

- Virus-carrying aphids, such as the pea aphid, present and feeding on plants
- Warm spring temperatures favoring early aphid development and migration
- Infections at early growth stages are more severe

IMPORTANT FACTS

- All currently available commercial cultivars are susceptible to PEMV
- PEMV is not seed-transmitted
- Insecticides to manage aphids may reduce secondary spread of PEMV
- Pea, lentil, faba bean and vetch are also susceptible
- Commonly confused with thrips, herbicide or other virus damage