

PP2072 (Dec. 2022)

Chickpea Disease Diagnostic Series

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NDSU NORTH DAKOTA AGRICULTURAL
EXPERIMENT STATION



Damping-off	PP2072-1
Rhizoctonia seed, seedling and root rot	PP2072-2
Dry root rot.....	PP2072-3
Fusarium root rot	PP2072-4
Fusarium wilt	PP2072-5
Verticillium wilt	PP2072-6
Ascochyta blight.....	PP2072-7
Alternaria blight.....	PP2072-8
Stemphylium blight.....	PP2072-9
Sclerotinia stem and crown rot	PP2072-10
Botrytis gray mold.....	PP2072-11
Pea enation mosaic virus	PP2072-12

Cover photo: Audrey Kalil, NDSU

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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



Photo: M. Wunsch, NDSU

Figure 3



Photo: M. Wunsch, NDSU



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

Card 2 of 12



Dry Root Rot

Macrophomina phaseolina

Photo: M. Senthil-Kumar, NIPGR

Figure 1



Photo: M. Senthil-Kumar, NIPGR

Figure 2



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



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.



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



Photo: M. Ebert, NDSU

Figure 2



Photo: M. Ebert, NDSU

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

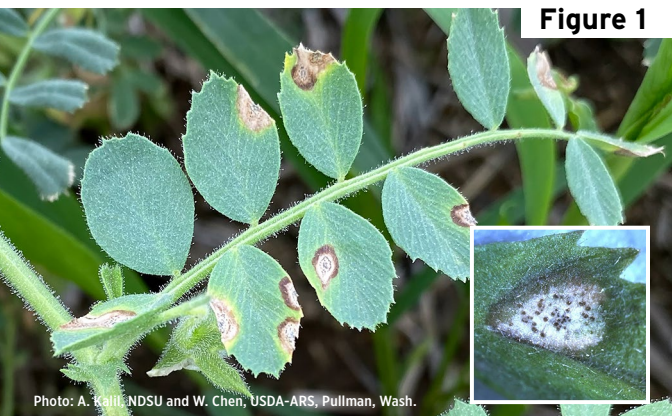


Figure 1

Photo: A. Kalil, NDSU and W. Chen, USDA-ARS, Pullman, Wash.

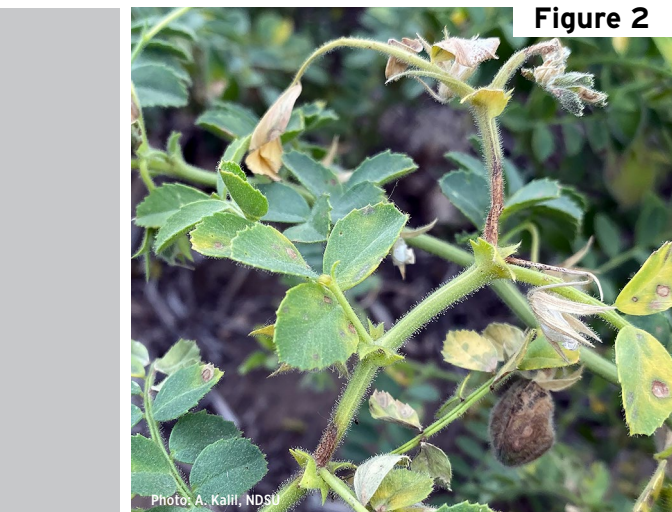


Figure 2

Photo: A. Kalil, NDSU



Figure 3

Photo: A. Kalil, NDSU



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

Card 7 of 12



Alternaria Blight

Alternaria alternata

Figure 1

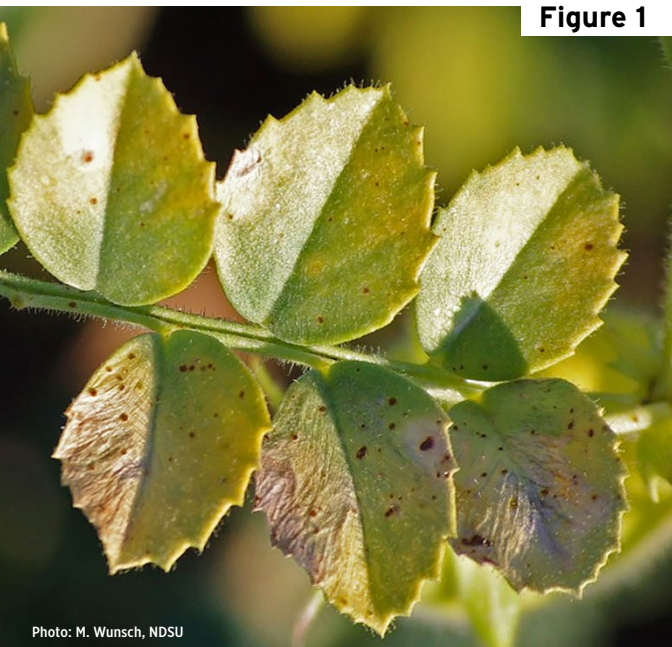


Photo: M. Wunsch, NDSU

Figure 2



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

Card 8 of 12



Stemphylium blight

Stemphylium species

Photo: M. Burrows, MSU

Figure 1



Photo: M. Burrows, MSU

Figure 2





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



Photo: M. Wunsch, NDSU

Figure 3



Photo: M. Wunsch, NDSU



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

Card 10 of 12



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)

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

Figure 1

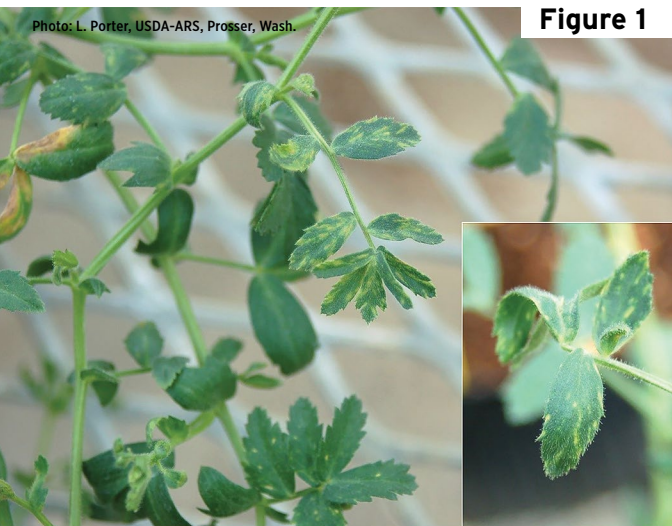


Photo: L. Porter, USDA-ARS, Prosser, Wash.

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