ASCOCHYTA BLIGHT OF CHICKPEA

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BACKGROUND

The favorable climate and soils of the Palouse region, coupled with existing complementary cropping systems, make chickpea a desirable alternative crop for North Idaho, Eastern Washington, and Northeast Oregon. Chickpea production in the Palouse began in the early 1980s in rotations with wheat, barley, rapeseed, lentils, and dry peas. The large-seeded Kabuli type chickpeas (garbanzo beans) hold special interest because they normally command a high market price.

Chickpea (*Cicer arietinum*) production in the Palouse grew rapidly from initial seed stocks imported from outside the region. Plantings increased from approximately 500 acres in 1982 to nearly 12,000 acres in 1987. During this period, *Ascochyta rabiei*, a fungus that can cause severe blighting of chickpea stems and foliage was discovered in the Palouse. Because this fungus has a very limited capacity to survive on other hosts, it was most likely introduced with chickpea seed imported from outside the region.

By 1987, the fungus was well established in local chickpea fields, seed lots, crop residues, and in volunteer chickpea plants. The frequency and wide local distribution of the pathogen in 1987, coupled with summer rains that otherwise are important to the production of spring crops, permitted widespread development of Ascochyta blight. Consequently, in 1987 more than half the crop was destroyed by Ascochyta blight, especially in northern Idaho. Following this devastating loss, chickpea cultivation was reduced or eliminated especially in northern Idaho in an attempt to eradicate the blight fungus. By 1991, this effort had significantly reduced residual levels of the pathogen, but the blight was not eliminated. Currently, Ascochyta blight remains a threat and continues to occur in many chickpea fields each year. However, recently developed resistant varieties and refined management strategies now make cultivation of chickpeas more attractive than in the past.

ASOCHYTA BLIGHT

Ascochyta blight is perhaps the most frequent and damaging disease of chickpea worldwide. It is caused by *Ascochyta rabiei*, a fungus that selectively attacks chickpea. Then persists in the crop's residues, seed, and volunteer plants. Infections may arise from seedborne inoculum or from windborne spores (ascospores). Infections usually begin low in the crop canopy during periods of cool, wet weather. All parts of the plant above the soil line are subject to attack and may develop elongated, sunken, dark lesions (Figs. 1 and 2). Lesions often girdle stems, weaken and break branches and petioles (leaf stems), and kill all plant parts above the lesion. Within the lesions, the fungus produces fruiting bodies (pycnidia) that become visible as tiny, black, raised spots, often arranged in concentric rings (Fig. 2).

In the field, Ascochyta blight first appears on small groups or patches of plants (Fig. 3). The initial distribution of blight symptoms may reflect how the primary inoculum was spread, which can occur in three ways: 1) in or on seed, 2) by wind, or 3) from site infested residues or volunteer plants. Initial infection sites in a field that are uniformily distributed tend to indicate the infection spread from seedborne inoculum. Less uniform blight distribution may indicate inoclulm spread by wind or residue. Because moisture is essential for infection and blight development, infection sites may be localized in lowlands or under sprinkler irrigation.

Under cool moist conditions, the patches of diseased plants in the field may rapidly increase in size, and lesions may develop higher in the crop canopy on leaves and pods. Pod infection (Fig. 2) leads ultimately to seed infection (Fig. 4). Such seed contamination is not always visible nor is the fungus in or on the surface of seed easy to detect in the laboratory. Only heavily infected seeds will bear visible blight symptoms, which include small size wrinkles, lesions, and/or dark discoloration.

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Fig. 1. Ascochyta blight lesions on chickpea leaflets and stem.

Fig 2. Ascochyta blight lesions on chickpea pod. Note concentric rings of fruiting bodies (dark dots) of the blight fungus, *Ascochyta rabiei*.

THE BLIGHT FUNGUS

Ascochyta rabiei is well adapted for survival, multiplication, and dispersal. It survives in infested crop residues as long as they remain visible on the soil surface. The fungus thrives where moisture and susceptible host plants coexist and where controls such as chemical fungicides and resistant varieties are not used. It appears to have no known biological enemies or antagonists in the Palouse.

Hosts other than chickpea, such as pea, alfalfa, certain other legumes, and some weeds may be rarely and weakly attacked. Such infections may remain latent or invisible, or may result in mild disease symptoms. These alternative hosts, however, may play a roll in the local survival of the blight fungus.

The blight fungus has an asexual and a sexual stage each producing two distinct spore types (Fig. 5). Asexual spores (conidia) are produced abundantly in dark, raised fruiting bodies (pycnidia) embedded in diseased tissues (Fig. 2). Sexual spores (ascospores) are produced in similar dark fruiting bodies (pseudothecia) on over wintered chickpea residues in contact with moist soil (Fig. 5).

The sexual stage of *A. rabiei* (called *Didymella rabiei*), which arises from the mating of compatible strains, may contribute to the development of new races of the blight fungus. Palouse isolates of *A. rabiei* differ in color, colony morphology, and virulence (ability to cause blight on different chickpea varieties). Sexual reproduction contributes to genetic diversity in the fungus, and this may permit it to survive on hosts other than chickpea or to overcome the blight resistance in current chickpea varieties.

DISEASE CYCLE AND SPREAD

Because trace quantities of *A. rabiei* in and on seed are difficult to detect, the blight fungus is readily dispersed in and on chickpea seed. In addition to seed, wind-blown ascopsores are another major source of primary inoculum that can initiate blight infection (Fig. 5). Ascospores are produced abundantly on infested crop residues that persist overwinter on the soil surface. Released in the spring and early summer under fluctuating moisture conditions, the ascopsores may be carried by wind for several miles.

Once infections are established, numerous asexual spores (conidia) produced on blighted plants then cause secondary spread of the disease within the field (Fig. 5). Produced even when minimal moisture is available, these asexual spores are spread by rain splash and somewhat by wind. They may also be dispersed with infested living plant parts, within crop residues, on contaminated machinery, on seed, and within seed.

Infested crop residues and seed are primarily responsible for season to season survival of the fungus. Growers need to remember that apparently symptomless seed

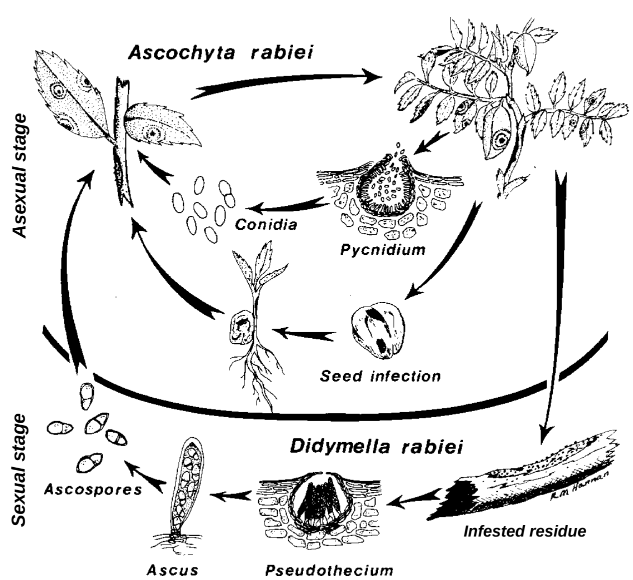

Fig. 5. Disease cycle of Ascochyta blight on chickpea.

Fig. 3. Chickpea field with patches of plants blighted by *Ascochyta rabiei.*

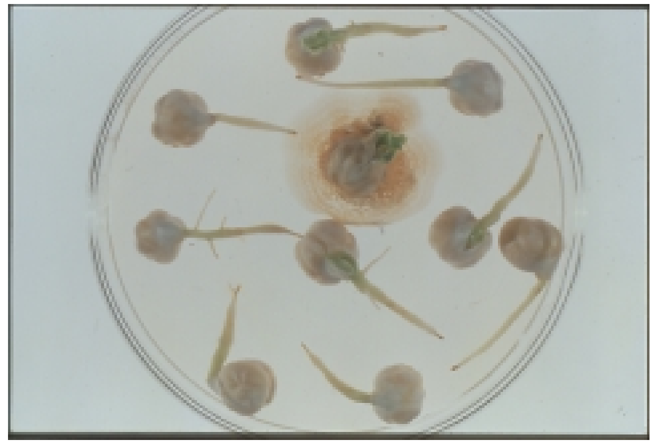

Fig. 4. *Ascochyta rabiei* developing from an infected chickpea seed.

may still carry the fungus. The fungus also has a limited capacity to persist in alternative weed or legume hosts in addition to thriving on volunteer chickpea plants.

Control

Growers should be alert to several different strategies that can limit blight development and spread. In general, blight suppression will depend on the application of combinations of these strategies rather than simply using resistant cultivars or blight-free seed.

Host Resistance - Selecting blight resistant varieties is the most economically and environmentally sound means of controlling Ascochyta blight. Efforts by USDA Agricultural Research Service scientists at Pullman, Washington led to the recent release of the blight resistant varieties Sanford and Dwelley (Kabuli-type) in 1993 and Myles (Desi-type) in 1994 (Table 1). Their use is recommended especially in blight prone or high moisture areas.

Clean Seed - Only clean, healthy seed should be sown. Unfortunately, seed that looks healthy may in fact be infected with low levels of *A. rabiei*. Growers should make certain that their seed comes from fields and areas that are free of Ascochyta blight. Using certified or foundation seed should also provide some assurance that blight was either not present or was not detected in the parent seed fields.

A sensitive laboratory test is crucial to identify infested seed. Currently seedborne *A. rabiei* can only be identified by visual inspection and by plating seed samples on a growth medium on which the fungus grows and becomes visible (Fig. 4). Because of the large seed size, the plating procedure is applicable for tests of approximately 200 seeds per sample. Techniques that are more sensitive or that can be readily applied to additional seeds per sample are currently unavailable.

Fungicides - Various fungicides approved for use on foliage of dry peas and dry beans are potentially eligible for use on chickpeas. In general, any chemical applied to chickpea foliage for blight control should specify "chickpea," "Ascochyta blight," and "foliage application" on its label and must be registered in the state where it is to be applied. Some currently registered chemicals may not

Table 1. Characteristics of locally adapted chickpea varieties.

Variety	Reaction to Blight[1]	Seed Size[2]	Seed Color	Leaf Type	Days to Mature
		Kabuli Types			
Dwelley	R	Large	Cream	Unifoliate	122
Sanford	R	Large	Cream	Unifoliate	121
SpanishWhite	S	Large	White	Fern	125
Surutato-77	S	Large	Cream	Unifoliate	120
Tammany	S	Large	Cream	Unifoliate	120
UC-5	S	Large	Cream	Fern	124
UC-15	S	Large	Cream	Fern	124
UC-27	S	Large	Cream	Fern	124
Spanish White	S	Large	Cream	Fern	125
		Desi Types			
Myles	R	Small	Tan/Spotted	Fern	115
Sarah	MR	Small	Tan/Spotted	Fern	115

[1] S = Susceptible, MR = Moderately Resistant, R = Resistant. Reaction of varieties to blight may vary with environmental conditions.
[2] Small = 15-20 grams per 100 seeds, large = 40-60 grams per 100 seeds.

meet all these criteria. Therefore, fungicide applicators should consult regulatory officials in their state to confirm which, if any, fungicides can be applied to chickpea foliage to control Ascochyta blight. Growers should be alert to any new test results and registrations of chickpea fungicides in their production area.

Where approved fungicides are available, they should not be used indiscriminately. Developing plants should be monitored especially during the spring and early summer to determine if an expenditure for fungicide application is warranted. Growers should take special care to protect green foliage during pod fill, especially if blight symptoms appear and increase in incidence and severity. Foliar fungicide applications may not prove cost effective when blight resistant varieties are grown or when disease pressure is low.

Ideally, all chickpea seed designated for sowing should be treated with a registered fungicide to limit fungal pathogens that may be present on the seed or in the soil. A few specific formulations of metalaxyl, captan, thiabendazole, and benomyl are currently registered for use on chickpea seed. Users of these, or of any chemical fungicide on chickpea seed, must verify that such use is stated on the label and that the formulation in question is registered.

All fungicides currently registered for treatment of chickpea seed have little effect on *A. rabiei*. However, some fungicides, metalaxyl for example, protect seed, seedlings, and roots against other fungal pathogens, such as *Pythium spp*. Similarly, seed treatments with captan, thiabendazole, or benomyl offer varying levels of protection against a variety of troublesome fungal pathogens in Palouse soils.

Crop Residues and Rotations - After a blight infected crop is harvested, all infested crop residues and volunteer plants should be destroyed by thorough tillage, or growers should employ careful crop rotation. *A. rabiei* can survive on infested chickpea straw and/or infected volunteer plants as long as they remain intact and/or visible. For this reason, successive chickpea crops should not be grown on the same field site more frequently than every 3 or 4 years to ensure complete destruction of such residues. Furthermore, successive chickpea crops should not be grown near fields that were infested with blight during the previous year.

Regulation - Certification rules currently in place for foundation, registered, and certified chickpea seed in Washington, Idaho, and Oregon specify that blight must not be present in seed fields nor in seed samples. Other regulatory actions such as quarantines may be imposed to limit the distribution of infested seed to blight free areas. The value of such regulations may be compromised by windborne ascospores and by alternative hosts that support the fungus apart from chickpeas.

Recommendations

To sustain the profitable production of chickpeas in the Palouse, growers should employ these management practices to promote crop vigor and limit Ascochyta blight development:

- Choose rotations that permit 3 to 4 years between successive chickpea crops.
- Choose blight resistant varieties such as Sanford, Dwelley, and Myles.
- Use only certified, disease free seed.
- Protect seed and emerging seedlings with approved fungicide seed treatments.
- Destroy blight infested crop residues and volunteer chickpea plants.
- When necessary, use approved foliar fungicides to limit blight development and associated yield losses.

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