BUL 1049

Sharp Eyespot Disease of Wheat and Barley

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Introduction

SHARP EYESPOT IS A DISEASE of wheat and barley grown in temperate climates. Found in Europe, North America, Africa, Oceania, Asia, and all parts of Idaho, the causal fungus *Ceratobasidium cereale* (synonyms: *Rhizoctonia cerealis* or Binucleate *Rhizoctonia* AG-D) infects wheat, barley, oats, rye, and triticale and causes yellow patch disease in turfgrass. In wheat and barley, the disease can be associated with yield losses due to interference with nutrient and water uptake from lesions penetrating the stem. Plant damage leads to lodging and the development of whiteheads. Moderate and severe infections reduce yield substantially, with losses of 5%–40% reported (Hamada et al. 2011). Globally, the severity of sharp eyespot disease is thought to have increased during the last few decades (Hamada et al. 2011), likely because of earlier sowing, more frequent use of susceptible varieties, and more favorable weather conditions for infection.

Symptoms

The primary symptom of sharp eyespot is an oval-shaped lesion up to a half inch in length that is typically pale cream to dark brown with distinct dark borders usually located on the lower stem, although it can develop up to 6 inches above the soil surface. In some instances, early infection causes delayed emergence, damping-off, stunted growth, and reduced plant stand. Early infection may also result in stem-base browning and some root infection. In severe infections, white heads and lodging can occur. White mycelia and sclerotia appear inside an infected stem, particularly on mature ones. Severe disease leads to a reduced number and weight of grains per ear (Lemańczyk and Kwaśna 2013). The occurrence of sharp eyespot has been associated with increased colonization of grain by fungi resulting in sooty mold in maturing grain.

Figure 1. Sharp eyespot symptoms on a winter wheat stem.

Sharp eyespot is part of a stem-base disease complex that also consists of eyespot (also called Strawbreaker foot rot) caused by *Oculimacula acuformis* and *O. yallundae* and brown foot rot caused by *Microdochium* and *Fusarium* spp. A species related to *C. cereale*, called *Rhizoctonia solani*, exists as multiple anastomosis groups (AGs) with several of the AGs (AG 2, AG 4, AG 5, and AG 11) causing stem-base diseases in Idaho. However, *C. cereale* tends to cause distinct eyespot lesions (Figures 1 and 2) rather than undefined brown lesions of the various *R. solani* AGs. The sharp eyespot pathogen is also more aggressive to stems than other pathogens in the species complex (Figure 3).

Figure 2. A further developed lesion of sharp eyespot on a winter wheat stem.

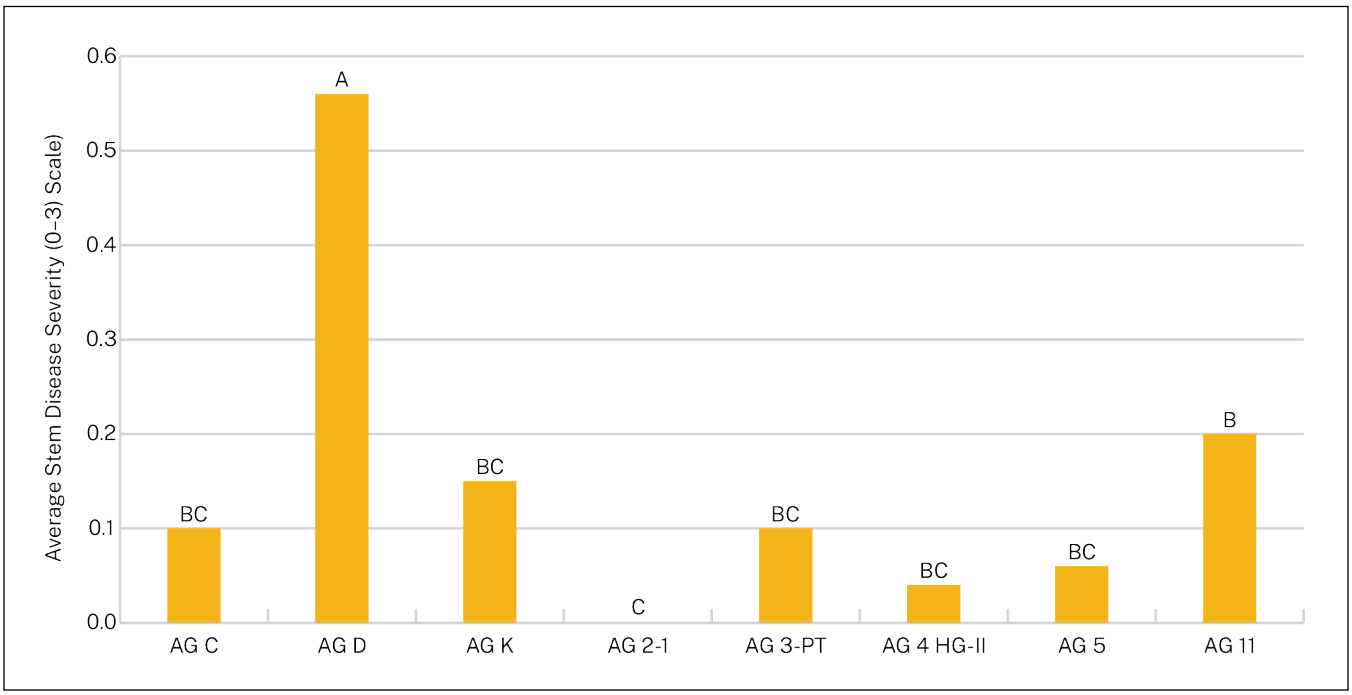

Figure 3. Mean stem-disease severity for winter wheat, inoculated with eight different anastomosis groups of *Rhizoctonia solani* and binucleate *Rhizoctonia* in a greenhouse. Columns with the same letter are not significantly different (P>0.05).

In the early stages of crop development, sharp eyespot can be difficult to identify due to high similarity with other diseases in the stem-base disease complex, particularly eyespot. Sharp eyespot lesions are often more superficial than those of eyespot: they penetrate less into the stem; have a sharply defined edge; and are not as lens shaped. Eyespot is also less likely to cause multiple lesions on a single stem and is rarely found more than 2 inches above the soil in contrast to sharp eyespot.

Accurate identification of the pathogen(s) present in disease complexes are essential to ensure successful management programs. Therefore, we recommend consulting a University of Idaho diagnostic lab or Extension specialist for assistance if you are unsure of the correct diagnosis, particularly in severe outbreaks or long-term problems.

Disease Cycle

The fungus is primarily soilborne, with the ability to overwinter as sclerotia in soil or debris as well as persisting as mycelium in litter, infected stubble, volunteer plants, and some grass weeds. Infection occurs at any time during the growing season. However, cool autumn or spring temperatures (around 48°F) are associated with earlier infection and therefore severe disease. Infection early in the season after wet weather or snow cover can result in winter kill, with symptoms that resemble snow mold, causing reduced stands and yield in winter cereals. Acidic, dry sandy soils are also associated with severe disease, as are wet or humid springs and summers (Brown et al. 2021a). Fields under continuous wheat or barley may result in higher levels of the pathogen and greater disease pressure.

Control

The use of resistant varieties is the most effective way of controlling the disease. Some varieties reportedly have developed disease resistance, although this is more likely tolerance as opposed to absolute resistance. Seed treatments offer early season protection against damping-off and stem-based disease caused by *C. cereale* and other fungal pathogens (Brown et al. 2022b). Fungicide sprays are effective if severe infections are present, but the degree of control highly varies; hence, they are less cost-effective for routine use. Therefore, the following cultural control recommendations are likely better options:

- **Crop rotation and tillage.** If an outbreak of sharp eyespot occurs in the field, rotate with a noncereal crop. Continuous wheat production under no-till systems might increase disease risk. Previous study indicates that rotation into a crop (like potatoes) reduces pathogen levels detected in the soil (Woodhall et al. 2017).
- **Eliminate green bridges.** A **green bridge** is any type of plant material growing out of season that acts as a host to a pest or disease that allows the pathogen to survive from one season's crops to the next. This results in greater damage to the current crop since it allows earlier establishment and more generations of the pathogen. Destroying grassy weeds and volunteer host plants that can act as a green bridge therefore reduces inoculum. Terminate weeds/volunteer plants a minimum of two to three weeks before seeding.
- **Minimize plant stress.** As with any agricultural system, the impact of disease on yield can be reduced by minimizing various factors likely to cause plant stress. Maintain optimum plant vigor during the season through appropriate irrigation and fertilization; and apply optimal fertilization to ensure the availability of sufficient levels of nutrients (such as zinc) to enable carbohydrate storage in crown tissues, allowing the plant to better withstand infection. However, note that the application of zinc after seedling emergence has no effect on the incidence and severity of the disease.
- **Comply with recommended planting dates in your region.** Several studies have shown that sharp eyespot incidence increases in early rather than later autumn-seeded cereals. Early autumn seeding may also be more susceptible to take-all, eyespot, and Cephalosporium stripe. In fact, the most significant losses from sharp eyespot tend to occur when take-all disease is present. However, spring crops planted later in the season tend to avoid environmental conditions favorable to sharp eyespot development.

Further Reading

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