Questions and Answers: 
Ug99–Black Stem Rust

Black or wheat stem rust is a serious fungal disease of wheat and barley caused by *Puccinia graminis* f. sp. *Tritici*. Crops infected with black stem rust (BSR) suffer severe yield losses. The disease can be identified by the presence of rust-colored or black fungal spore masses on the stems and leaves of wheat and barley host plants. To view images of BSR, visit the U.S. Department of Agriculture’s (USDA) online photo gallery at http://www.aphis.usda.gov/plant_health/plant_pest_info/barberry/Ug99_gallery.shtml.

**Q.** What is the BSR pathogen Ug99 and how is this strain different from the other BSR strains?

**A.** In 1999, a new and more virulent strain of the stem rust fungus was observed on previously resistant wheat varieties in Uganda, and it was designated as Ug99. This strain and its variants differ from other strains of the BSR pathogen by their ability to overcome resistance genes in wheat that have been durable against the BSR pathogen for decades. These resistance genes have been incorporated into 80 percent of commercial wheat varieties currently planted around the world, including North American varieties. If Ug99 strikes U.S. wheat or barley, the potential yield loss has been estimated at 40 percent to 50 percent.

**Q.** Where is Ug99 currently found?

**A.** Ug99 and related variants are mostly confined to Eastern Africa but have also expanded into the Middle East. Rust spores can travel great distances on wind currents. From its initial detection site in Uganda in 1999, Ug99 has moved to Kenya, Sudan, Ethiopia, Yemen, and, most recently in 2008, Iran. For more details on the current locations and movement of Ug99, visit the “Ug99—RustMapper” Web site at http://www.cimmyt.org/gis/rustmapper/rustmapper_web.html (requires the Web browser plug-in for Google Earth).

**Q.** How is Ug99 disseminated?

**A.** The BSR pathogen produces different spore types. The long-living spores (teliospores) can survive the winter in plant debris, and the short-living ones (urediniospores), which are viable for at least 10 days, can be carried by wind currents across continents. In addition, urediniospores can be spread accidentally or unknowingly by individuals walking through rust-infected fields. Rust spores can cling to clothes, shoes, farm implements, and vehicles. Dormant and desiccation-resistant teliospores can be dispersed through wheat and barley stubbles, debris, or straws used as packaging materials.

**Q.** What are the potential pathways for Ug99 to appear in the United States?

**A.** Currently, the most likely pathway into the United States is accidental, human-mediated introduction through contaminated clothing, shoes, debris from shipments of wheat and barley, or vehicles. There is a risk, albeit minimal, of Ug99 being spread from East Africa or Asia into the United States and Canada through wind-borne spores. The likelihood of Ug99 being spread from other countries into the United States would increase if Ug99 becomes established in the wheat-growing regions of South America, such as Chile, Argentina, and Brazil, and of Mexico.

**Q.** What is USDA currently doing to prevent the spread of Ug99?

**A.** USDA’s Animal and Plant Health Inspection Service (APHIS) is working closely with other Federal agencies, such as USDA’s Agricultural Research Service (ARS) and National Institute of Food and Agriculture (NIFA), to develop a detailed action plan to address the potential threat from Ug99. One of the plan’s goals is to reduce the likelihood of the pathogen being spread by human activity.

To learn more about APHIS’ role, visit our Web site at http://www.aphis.usda.gov/plant_health/plant_pest_info/barberry/Ug99.shtml. In addition to partnering with ARS and NIFA, APHIS is working on preparedness strategies with State departments of agriculture, universities, industry, international research institutes, and neighboring countries, especially Canada and Mexico.

**Q.** What is APHIS’ regulatory policy on wheat imports?

**A.** The United States is the world’s largest exporter of wheat; however, some shipments of specialty wheat are imported into the United States, mainly from Canada. Inspection at the U.S. border helps to ensure compliance with import requirements, which prohibit the import of wheat and plant debris from various countries where certain pests of quarantine significance—such as Ug99—exist. Although there is no evidence that Ug99 can be transmitted through wheat or barley seed, importation of seed for planting from Ug99-infested fields is not permitted.
Q. What actions will APHIS take if Ug99 is discovered in the United States?
A. APHIS will provide leadership for emergency response actions and crop bio-security in close cooperation with ARS, NIFA, and State departments of agriculture. APHIS will provide general protocols for communicating pest-identification procedures and diagnostic results and post the first confirmation of Ug99 to the North American Plant Protection Organization's Phytosanitary Alert System. APHIS will also notify foreign countries as required. ARS will regularly report on the rust situation through its cereal rust bulletins. To view the bulletins, visit ARS' Web site at http://www.ars.usda.gov/Main/docs.htm?docid=9757.

Q. What can I do to prevent the spread of this disease?
A. Several common-sense approaches can minimize accidental introductions and dispersal of plant pathogens in general and of Ug99 in particular. Most importantly, before departing from a Ug99-affected country, make sure that clothes, hats, shoes, and similar articles used during your visits to agricultural areas are thoroughly washed or disinfected in dilute bleach. If this is not possible, wear clothes for your fieldwork that you can discard or leave behind. Pack those items that cannot be washed during your visit in sealed plastic bags and wash them immediately upon your return.

In addition, minimize or avoid taking to the field items (e.g., camera cases, notebooks, or laptops) that cannot be washed. Be sure to thoroughly bathe and wash your hair before leaving the Ug99-affected country. If you are using a vehicle (e.g., a car or truck), large machinery, or equipment and are moving it from areas known to have Ug99 back into the United States or into non-infested areas, make sure to follow the guidelines described in our publication “Manual for Agricultural Clearance,” which is available online at http://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/mac.pdf.

Q. What other plants can Ug99 infect?
A. In addition to infecting the major cereal crops wheat and barley, the BSR pathogen Ug99 also thrives on its alternate host, the common barberry (Berberis vulgaris). Common barberry was brought into the United States by early settlers, who used it as hedge plants and harvested its edible berries. The BSR pathogen needs an alternate host such as the common barberry to complete its sexual lifecycle. As a consequence of the sexual cycle and genetic recombination that follows, new and often more virulent strains of the pathogen arise.

Q. What is the history of USDA's role in previous BSR epidemics?
A. In the early- to mid-20th century, recurring BSR epidemics were catastrophic for wheat farmers in the United States and around the world as the majority of wheat and barley cultivars grown lacked resistance to new, emerging strains of the pathogen. It was established that the alternate host common barberry had a significant role in causing frequent epidemics in the last century. As a result of this discovery, the majority of common barberry plants, especially those growing in major wheat-producing States, were eradicated. Eradication of alternate hosts is considered one of the most important factors in the reduction of rust epidemics in the early part of the 20th century.

Q. What was achieved through the historical eradication program?
A. The USDA-funded eradication program lasted for almost 60 years—from 1919 to 1979—during which more than 500 million common barberry plants were found and removed. Over the years, as a result of the eradication program, the number of new rust races emerging reduced significantly, and the resistance to rust in wheat varieties grown in the United States was rendered more durable.

Q. Are ornamental barberry species sold in major wheat-growing States alternate hosts of the BSR pathogen?
A. APHIS regulates ornamental barberry plants sold by nurseries through quarantine measures and nursery inspections to ensure that only rust-resistant varieties are shipped into or are commercially available in the 17 major U.S. wheat-growing States. The Canadian Food Inspection Agency has imposed similar regulations in Canada. To view the details of APHIS' BSR program, visit APHIS' Web site at http://www.aphis.usda.gov/plant_health/plant_pest_info/barberry/index.shtml.

Q. Are fungicides that are effective against Ug99 available and registered for use in the United States?
A. Fungicides are being tested in Kenya for their efficacy against Ug99. Several of these fungicides can be used to manage BSR effectively and are also registered for use in the United States. For more information, contact your State agriculture and extension departments or specialists.
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