

Scientists fight stem rust UG99 before it becomes a threat

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(PhysOrg.com) -- Wheat breeders and plant pathologists at Montana State University are part of a global effort to develop varieties of wheat resistant to a new fungus. UG99, a stem rust strain that was first discovered in Africa and is slowly creeping towards the United States, could be devastating to Montana's wheat industry.

Like other stem rusts, UG99 infects the above-ground part of the wheat causing it to produce fewer shoots and seeds, and negatively affects crop yields 50-70 percent. In some cases, the rust will cause the plant to die. UG99 has caused greater crop yield losses than other rusts.

"It will take some time for the rust to get here, if it does at all," said MSU plant geneticist and pathologist Li Huang. "That doesn't mean we don't have to do something about it now; we want to be part of the national and international effort to control stem rust."

In 1999, what is now known as UG99 was found on wheat that was bred to be resistant to rusts. A particular gene, Sr31, was responsible for keeping the wheat rust-free. Sr31 worked, keeping wheat around the world free of stem rust until UG99 came on the scene. UG99 was observed in 2001 in Kenya and 2003 in Ethiopia. The fungus has since spread to the Middle East and South-east Asia, and could spread throughout the world.

"We are at less of a risk in Montana because it is drier and the harsh winters kill off the fungus, however we know the threat is real because

we've had episodes (of rust infections) in the past," said Phil Bruckner, MSU winter wheat breeder.

Huang has a three-part plan to prepare Montana for the possibility of a UG99 infection. First she is looking at wheat lines obtained from the International Maize and Wheat Improvement Center and identifying genes that may be resistant to UG99 but are different from those already in use. Wheat lines that might be resistant to the rust will be sent to the USDA, which will then forward them on to a nursery in Kenya, or a quarantined nursery in Minnesota, to be tested for resistance.

After the field tests have determined a new resistant gene, Huang will begin work on the development of a marker for marker-assisted selection. MAS is a molecular technique that uses markers to tag genes of interest, in this case to track UG99 resistant genes. The marker will allow Huang and other researchers to test wheat for UG99 resistance in-state and without the stem rust present.

When a marker gene is found to be closely linked to a new stem rust resistance gene, it leads to the third step: to introduce the new UG99 resistant gene into Montana's wheat varieties.

Huang's work with MAS will guide wheat crosses by Bruckner and MSU spring wheat breeder Luther Talbert. Bruckner and Talbert are already creating crosses that may have resistance to UG99 while still maintaining the traits Montana growers need, such as resistance to wheat stem sawfly and winter hardiness. Both have sent wheat lines to Kenya for field testing, but with the assistance of a marker they will be able to work more quickly since they will not need to send their lines out of the country.

MSU's scientists are part of a larger effort of wheat breeders from around the world who are working together to prevent the UG99 rust

from expanding its range and to have a back-up plan if the fungus does arrive in the United States.

UG99 has mutated two times already and overcome three stem rust resistant genes in wheat--Sr31, Sr24 and Sr26. Another mutation would send researchers back to the drawing board again to find a new resistant gene.

Like a flu virus that reinvents itself every year sending scientists scurrying to create a new vaccine, UG99 mutates, keeping researchers on their toes as they try to stay one step ahead of the rust.

"We need to have a diversity of tools to use," continued Huang.

In addition to finding a rust resistant gene, MSU scientists are looking for a fungicide that will kill the rust in the unlikely event that it arrives in Montana before a resistance gene is found, or to supplement partially resistant varieties. Extension plant pathologist Mary Burrows is starting a uniform fungicide trial (along with South Dakota and Indiana) next summer. A fungicide will also be useful to farmers who opt to use a non-resistant variety.

"Hopefully, we will have resistant varieties of wheat and an effective fungicide for stem rust control before the pathogen gets here," said Burrows.

Provided by Montana State University

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