NSF Grant Funds U Of A Division Of Ag Study Of Gray Leaf Spot Disease In Corn

FAYETTEVILLE, ARK.

Burt Bluhm, University of Arkansas Division of Agriculture plant pathologist, has a $500,000 National Science Foundation grant to fund research on a fungal pathogen that can lead to significant yield losses in corn.

The fungus causes gray leaf spot, a disease that can reduce yields as much as 40 bushels per acre, and more if disease levels are high. "Gray leaf spot is a big problem in Ark-ansas, as well as throughout the Midwest and the world," Bluhm said.

Extension aronomist Jason Kelley said gray leaf spot has not been as big a problem in Arkansas as in Corn Belt states. However, heavy rainfall and cooler temperatures in 2009 resulted in higher infections of the disease than is normal for Arkansas.

Plant pathologist Burt Bluhm received a $500,000 grant from the National Science Foundation for a genetic study of the fungal pathogen that causes gray leaf spot in corn.

"One field I looked at in northeast Arkansas could have lost 20 to 30 bushels per acre because of the extent of gray leaf spot infection," Kelley said.

Bluhm is studying the genetics of Cercospora zeae-maydis, the fungus that causes the disease. He said the disease is unique in the way it attacks its plant hosts.

"Most fungi invade inner plant tissues by puncturing the outer tissue," Bluhm said. "Cercospora zeae-maydis infects a plant through stomata, the natural openings in the leaves through which plants respire."

After the spores land on the plant, Bluhm said, the fungus begins to grow across its surface until it finds a stomate. The fungus homes in on those openings.

"As the fungus grows across the surface of a leaf," Bluhm said, "if it comes within a certain distance of a stomate, it dramatically reorients its growth pattern and makes a beeline for the opening."

Bluhm said the daily activities of plants follow a circadian rhythm. The stomata, for example, open before dawn, begin closing in the afternoon and remain closed through the night.

"The pathogen seems to have evolved to take advantage of that circadian clock," Bluhm said. "It coordinates its response to find the best time to attack the plant."

Once inside the plant, Bluhm said, the fungus is able to overcome the plant's natural defenses, which could include closing a stomate that was being infected.

"There's some pretty sophisticated chemical warfare going on," Bluhm said. "Once the fungus is inside the plant, it's all over."

Bluhm has already identified one of the genes involved in the pathogen's attack strategy. He discovered that mutated Cercospora zeae-maydis fungi, in which the gene is turned off, are "blinded." They can't find their way to stomata and, so, cannot infect the plants.

The NSF grant will support further investigation of the genetic traits of both the pathogen that causes gray leaf spot and corn plants. Bluhm said understanding the genetics can lead to improved strategies to combat the disease. One avenue of attack could be to disrupt the pathogen's adaptation to the circadian rhythm.

"If you can throw off the pathogen's sense of timing, you give the plant an advantage," Bluhm said.

Bluhm's investigation is targeting the early stages of infection; early events that, if understood, may help growers reduce the occurrence of infections.

"We may be able to develop new chemical controls," Bluhm said. "And we hope to design more intelligent screens to look for resistance to the disease in corn breeding lines."

Bluhm's hope is that breeders will be able to increase disease resistance at multiple levels. "Even though we'll never eliminate the disease, you can develop a sustainable management strategy."

The grant also supports investigation of the broader group of fungal pathogens to which Cercospora zeae-maydis belongs, Bluhm said.

"This is one of the most common groups of fungi in the world," Bluhm said. "They present problems for almost every plant in the world."

Relatives of the gray leaf spot pathogen are responsible for such diseases as frogeye leaf spot and purple seed stain in soybeans, Bluhm said.

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