Corn-Friendly Fungus Tapped for Service

Acremonium zeae is a type of fungus called an endophyte that lives inside the kernels of corn plants, neither harming nor benefiting its host.

Or so scientists thought.

Now, Agricultural Research Service (ARS) and University of Iowa (UI) scientists have found that corn plants do indeed benefit from the endophyte's presence—especially as they try to ward off other fungi, like *Aspergillus flavus* and *Fusarium verticillioides*. Both are species of toxin-producing molds that can cause multimillion-dollar losses to the U.S. corn crop.

In studies at ARS's National Center for Agricultural Utilization Research in Peoria, Illinois, and UI's Department of Chemistry in Iowa City, collaborating scientists Don Wicklow and Jim Gloer showed, for the first time, that the endophyte secretes an antifungal concoction that may stop the molds from growing inside the seed.

"*Acremonium zeae* is mostly a benign player in corn, but it produces compounds called pyrrocidines that work against the *Aspergillus* and *Fusarium* fungi as well as some bacteria," says Wicklow, a microbiologist in the ARS center's Mycotoxin Research Unit. "Pyrrocidines are the first natural products reported from this common fungal endophyte in corn."

Lab tests by Wicklow's group showed that the endophyte is antagonistic to the molds and interferes with *Aspergillus's* ability to infect ripening corn kernels and contaminate them with a carcinogen called aflatoxin. Such antagonism may also protect the corn plant from the *F. verticillioides* disease, stalk rot. Gloer's lab studied the antifungal activity of extracts from *A. zeae* lab cultures and identified the source as two recently reported antibiotics, pyrrocidines A and B.

In 2002, Wicklow followed up that work by inoculating field plots of corn with the endophyte. He demonstrated that *A. zeae* can naturally produce the pyrrocidines in corn and that the treatment could slow spread of *Aspergillus* in the crop's seed.

"This was important to nail down," Wicklow says, "because then we would have documentation that the compounds are also produced naturally in corn kernels, where interference with *A. flavus* or *F. verticillioides* infection would occur."

Initially, they found pyrrocidines as major components in culture extracts of just 2 of 13 *A. zeae* isolates obtained from the ARS Culture Collection, housed at the Peoria center. But a later switch to liquid chromatography and mass spectrometry detection methods revealed that 12 of the 13 isolates produced the pyrrocidines.

The discovery warrants a closer look at *A. zeae's* importance in corn, Wicklow notes, but the practical implications remain to be seen. "You can't simply pump these pyrrocidines into corn," he notes. "But *A. zeae* is carried naturally within the seed, growing into the seedling and spreading throughout the plant. We can study the environmental conditions under which it becomes the dominant fungus in corn and look there for clues to controlling *Aspergillus* and *Fusarium.*"—By **Jan Suszkiw,** ARS.

This research is part of Plant Diseases, an ARS National Program (#303) described on the World Wide Web at www.nps.ars.usda.gov.

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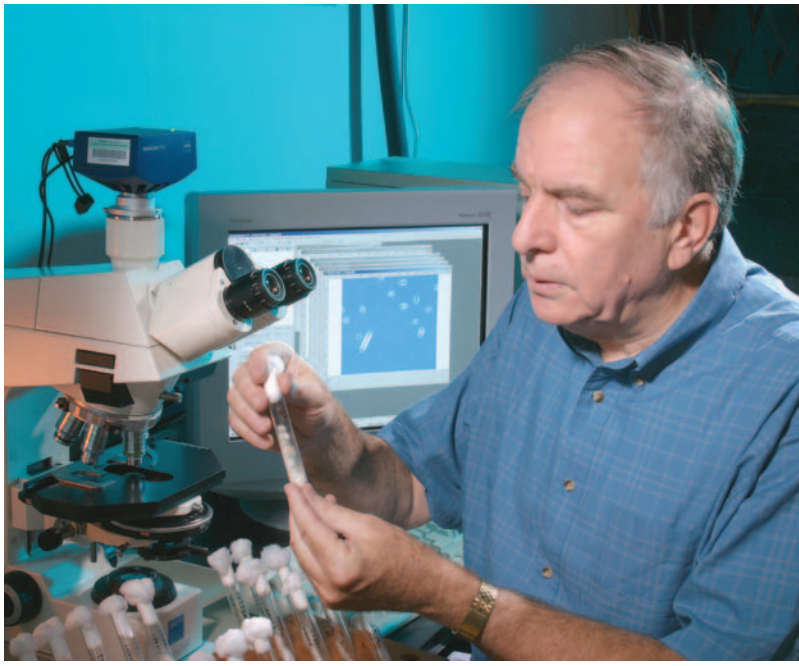

Microbiologist Don Wicklow examines a culture of *Acremonium zeae.* Cultures of *A. zeae* isolates from corn can be seen on the computer screen.