

DAYLILIES

UNDER ATTACK

STEPHEN AUSMUS (K10058-1)

Daylilies—one of our most popular perennials—are pretty, easy to grow, and relatively low maintenance. During late spring and summer, their trumpet-shaped flowers and full, green foliage brighten up flowerbeds around mailboxes, on roadsides, and in backyard gardens all over the country. They even have their own fan club in The American Hemerocallis Society.

But something began attacking U.S. daylilies about 2 years ago—a fungus that had never before been seen in the Western Hemisphere. It was first reported in Georgia during the summer of 2000 and has since been found in at least 20 other U.S. states as well as Costa Rica, where growers cultivate thousands of the flowers for the U.S. market.

For a time, scientists weren't sure what, exactly, this threat was. They knew it resembled a species of fungus found on daylilies in eastern Asia, but they didn't have enough hard evidence to identify it conclusively. Now, however, researchers with ARS' Systematic Botany and Mycology Laboratory (SBML) in Beltsville, Maryland, have proof that the fungus attacking American daylilies is an Asian species.

A Fungus Accused . . .

Puccinia hemerocallidis, the fungal culprit, was first described in Siberia and has also been reported in China, Japan, Korea, and Taiwan. It is a type of rust fungus—a group so named because of

the rusty-colored spots, ranging from yellow to orange to dark-brown to black, that form on infected plants. Daylily rust has a short incubation period and has spread rapidly in the United States through the extensive interstate trade of daylilies. The fungus mars the appearance of infected plants, which often exhibit powdery yellow dots on their foliage. In severe cases, it can kill them.

“Although daylily rust is found in Asia, it is not considered to be a significant problem there,” says Mary Palm, a mycologist with the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) who works at SBML. “Both the rust and daylilies originated in Asia and have had a long time to co-exist. That may be why the rust doesn't cause the amount of disease on daylilies in Asia that it does on daylilies in America.”

When scientists in the United States first began working to identify the fungus attacking U.S. and Costa Rican daylilies, they did not have a modern description or illustrations of *P. hemerocallidis* to consult. Researchers at SBML, including José Hernández and Lisa Castlebury, as well as Palm, have since rectified that situation. They compared American daylily rust specimens with *P. hemerocallidis* samples collected in China, Japan, Russia, and Taiwan. Their study included both microscopic examination and DNA sequencing.

. . . and Convicted

Daylily rust fungus is known to produce

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Mycologist Lisa Castlebury extracts DNA from rust spores to determine whether specimens of daylily rust from different geographic locations belong to the same species.



Mycologists José Hernández and Mary Palm observe a digital image of teliospores of an American collection of daylily rust.

five different types of spores. Two types are found on daylilies in the United States and Costa Rica: urediniospores and teliospores. Because rust fungi can usually be identified by the shape of their spores, SBML researchers tried to identify the American fungus by comparing samples taken from U.S. and Costa Rican daylilies with samples taken from daylilies grown across the Pacific. They observed differences between the samples and made note of some general trends.



For example, the wall thickness of the Asian urediniospores was consistent, while it varied in those from the United States and Costa Rica. Also, the American specimens contained more one-celled teliospores than the Asian specimens, which were far more likely to contain two-celled teliospores.

Although variations existed between fungal samples, the researchers found that all the specimens were of the same species.

Their investigation was aided by the U.S. National Fungus Collections, part

of SBML, which houses more than a million fungal specimens from around the world. Scientists use these reference specimens to help identify and characterize agriculturally important fungi. But they don't just compare them by their physical appearance.

Castlebury says, "We also use DNA sequences to identify and characterize new and previously described species and to sort out relationships among various groups of plant-pathogenic fungi. Knowing how these fungi are related to

one another makes it possible to predict how they might behave as pathogens."

Hernández explains the differences they noted between the Asian and American rust fungus specimens. He says, "This fungus can replicate itself on daylilies, but another type of plant host is necessary for it to complete its life cycle. In Asia, *Patrinia*—the alternate plant host—is common. In the United States and Costa Rica, it's not. The differences seen between Asian and American rust specimens may be due to the fungus' apparent lack of sexual recombination in the United States and Costa Rica. It has more limited genetic variability here."

Palm believes the fungus was introduced into the United States accidentally. She says, "Last year APHIS made more than 1,400,000 plant interceptions at ports of entry, in the mail, and through our preclearance and predeparture programs. But we need the cooperation of industry and the traveling public to further enhance our safeguarding efforts."

The journal *Plant Disease* has accepted a paper that Hernández, Palm, and Castlebury submitted for publication. The article provides a modern description, photomicrographs, and DNA sequences of *P. hemerocallidis*. Plant quarantine workers, diagnosticians, and daylily growers will be able to use these descriptions and sequences to identify future cases of daylily rust and help prevent its spread.—By **Amy Spillman**, ARS.

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

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