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Bacterial Virus Gene Confers Disease Resistance in Tall Fescue Grass

FOR IMMEDIATE RELEASE

Researchers at North Carolina State University have discovered that inserting a specific gene from a bacterial virus into tall fescue grass makes the grass resistant to two of its biggest enemies.

The NC State researchers showed that the inserted gene – the T4 lysozyme gene, a gene found in bacteriophages, or bacterial viruses – conferred high resistance to gray leaf spot disease in six of 13 experimental grasses. Three of the six resistant grasses also showed high resistance to brown patch disease. These two diseases are arguably the most important – and severe – fungal diseases affecting tall fescue grass.

The finding has the potential to have wide applications in engineering resistance to a variety of fungal diseases in not only tall fescue grass – the most widely planted turfgrass in North Carolina and a commonly utilized grass in the southeastern United States – but various other crops.

A paper describing the study was published in the February edition of *Transgenic Research*.

The collaborative research involves four faculty members: Dr. Ron Qu in the Department of Crop Science, Drs. H. David Shew and Lane Tredway from the Department of Plant Pathology, and Dr. Eric Miller, in the Department of Microbiology. The research was mainly performed by Dr. Shujie Dong, a post-doctoral researcher who was a graduate student of Qu's, with assistance from two other scientists in Qu's lab – Drs. Jianli Lu and Elumalai Sivamani.

About half of the turfgrass planted in North Carolina – one million acres – is tall fescue grass, a cool-season grass that has a high tolerance for the heat and drought of North Carolina summers, Tredway says. It is ubiquitous in the Southeast, found on lawns, golf courses and commercial acreages.

Gray leaf spot disease is caused by the *Magnaporthe grisea* fungus, the pathogen that also causes rice blast – the major disease of rice plants. Gray leaf spot causes round or oval tan spots that turn gray when there's high humidity. It infects blades to make the grasses die rapidly.

Brown patch disease, caused by the soil-dwelling fungus *Rhizoctonia solani*, a major pest to various plant species, brings about circular, brown lesions on grass. Lawns with brown patch disease appear wilted, even if watered sufficiently, the researchers say.

Miller, the microbiologist, says that the bacterial viruses exist widely in different environments, and produce an array of products that are harmful to bacteria; as viruses attempt to spread, which they need to do in order to survive and thrive, the T4 lysozyme gene produces the enzymes that chew through the bacterial cell walls.

Miller says that the lysozyme now made by the grass does essentially the same thing to a fungus when it tries to infect, thereby providing anti-fungal properties in tall fescue and allowing the grass to withstand fungal disease.

Tredway says the benefits of potential applications may be felt economically and environmentally.

"A lot of money is spent on fungicides, which also have an impact on the environment," he said. "Disease-resistant plants have the potential to reduce those economic and environmental impacts for many years."

Qu says that future research will replicate this experiment in the field, rather than just in the lab, and that other disease resistance genes show anti-fungal properties in tall fescue. He also hopes to study how the group's genetically altered plants interact with other important fungal diseases to further test their anti-fungal mettle.

Much of the work was funded by NC State's Center for Turfgrass Environmental Research and Education and the Turfgrass Council of North Carolina.

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Note to editors: An abstract of the paper follows. Find the entire publication at *http://www.springerlink.com/content/82u1382762466n1v/*.

"Expression of the Bacteriophage T4 Lysozyme Gene in Tall Fescue Confers Resistance to Gray Leaf Spot and Brown Patch Diseases"

Authors: Shujie Dong, H. David Shew, Lane P. Tredway, Jianli Lu, Elumalai Sivamani, Eric S. Miller and Rongda Qu, North Carolina State University
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Abstract: Tall fescue (*Festuca arundinacea* Schreb.) is an important turf and forage grass species worldwide. Fungal diseases present a major limitation in the maintenance of tall fescue lawns, landscapes, and forage fields. Two severe fungal diseases of tall fescue are brown patch, caused by *Rhizoctonia solani*, and gray leaf spot, caused by *Magnaporthe*

grisea. These diseases are often major problems of other turfgrass species as well. In efforts to obtain tall fescue plants resistant to these diseases, we introduced the bacteriophage T4 lysozyme gene into tall fescue through Agrobacterium-mediated genetic transformation. In replicated experiments under controlled environments conducive to disease development, 6 of 13 transgenic events showed high resistance to inoculation of a mixture of two *M. grisea* isolates from tall fescue. Three of these six resistant plants also displayed significant resistance to an *R. solani* isolate from tall fescue. Thus, we have demonstrated that the bacteriophage T4 lysozyme gene confers resistance to both gray leaf spot and brown patch diseases in transgenic tall fescue plants. The gene may have wide applications in engineered fungal disease resistance in various crops.