Phragmites partners with microbes to plot native plants' demise

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University of Delaware researchers have uncovered a novel means of conquest employed by the common reed, *Phragmites australis*, which ranks as one of the world's most invasive plants.

The invasive strain, which hails from Eurasia, overtakes its "native" cousin, which has lived in North America for the past 10,000 years, ironically by provoking the native plant to "take itself out," through a combination of microbial and enzymatic activity in the soil.

The research by an interdisciplinary UD team led by Harsh Bais, assistant professor of plant and soil sciences, is reported in the December issue of the scientific journal *Plant Physiology* and also is highlighted in one of the journal's editorials.

Bais's co-authors include postdoctoral researchers Gurdeep Bains and Amutha Sampath Kumar in the Department of Plant and Soil Sciences in the College of Agriculture and Natural Resources; Thimmaraju Rudrappa, a former UD postdoctoral researcher who is now a research scientist at DuPont; Emily Alff, an undergraduate who became involved in the study through a Research Experiences for Undergraduates (REU) fellowship; and Thomas Hanson, associate professor of marine biosciences in the College of Earth, Ocean, and Environment.

In previous research, a team led by Bais determined that *Phragmites* employs a strategy known as allelopathy, in which plants release toxic chemicals into the soil to deter other plants from growing close to them.

In soil studies at the Delaware Biotechnology Institute, a premier center for life sciences research at UD, the scientists discovered that invasive *Phragmites* produces elevated levels of a benign compound, a precursor of gallic acid known as gallotannin, relative to its native cousin.

However, when this gallotannin, a polymeric phenol, is attacked by tannase produced through enzymatic activity by native plants and rhizospheric microbes, toxic gallic acid is produced and released in the root zone, exacerbating the invasive *Phragmites*' noxiousness.

"The tannins are like partners in crime in the process," Bais said.

He noted that Hanson and Kumar collected microbes present on the root surface of the plants and revealed that the "bugs" cleave the polymer (gallotannin) to release the monomer (gallic acid) because the microbes are using the tannins as a carbon source.

"It's like a two-way highway," Bais said, "the plant is working with bacteria to secrete gallic acid into the soil."

Bais says that the microbial population is the same in the native versus the invasive *Phragmites*. The invasive variety simply secretes more gallotannins into the soil than its native cousin, putting the native plant at a disadvantage in turf battles between the two strains.

Phragmites has overtaken millions of acres of wetlands in the United States, thanks to the aggressive, invasive strain of the plant that came on the scene some 200 years ago from Eurasia.

The exotic species has displaced the non-aggressive native variety of the plant, relegating the native strain to isolated patches and wetland margins along the Atlantic coast.

"Now we have a way to remedy the sick soil," Bais said. "After years of research, we have identified a mechanism that may lead to a solution to the *Phragmites* invasion."

Provided by University of Delaware

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