Ramping Up a Phytochemical Compound in Crops

A team of Agricultural Research Service scientists has reported a biotechnological approach that enables crop species to produce, or to increase production of, the phytochemical compound pterostilbene. Stilbenes are a subgroup of phytochemicals called "polyphenols." The approach could pave the way for ramping up levels of potentially healthful pterostilbene in crops that normally produce it, such as grapes and berries.

Molecular biologists Scott R. Baerson and Zhiqiang Pan, and chemist Agnes Rimando, headed the study. They and plant physiologist Franck Dayan, a coauthor, are with the Natural Products Utilization Research Unit in Oxford, Mississippi. Also a coauthor, ARS plant pathologist James Polashock is with the Genetic Improvement of Fruits and Vegetables Lab in Beltsville, Maryland, but based in Chatsworth, New Jersey.

There are two stilbenes—resveratrol and pterostilbene—which may possess similar purported beneficial health properties. During their work, the team showed that a previously characterized and patented gene *(SbOMT3),* which they had isolated from the sorghum plant, is capable of converting resveratrol to pterostilbene. They then built on that conversion activity by co-expressing *SbOMT3* with a stilbene-synthase gene *(AhSTS3)* that had been isolated from the peanut plant. The approach was then tested in transgenic plants of two different species that do not naturally produce pterostilbene.

For the proof-of-concept study, both genes were successfully incorporated into the chromosomes of two different model host plants, *Arabidopsis* and tobacco. The two-gene strategy generated transgenic plants that were able to produce pterostilbene, the authors reported.

It is unknown whether most phytochemicals are well absorbed in the body. But based on animal-model studies conducted by other scientists, pterostilbene has significantly higher bioavailability than the parent compound resveratrol.

The study results were published in *Plant Biotechnology Journal* in 2012.

The USDA-ARS patent on the ability of *SbOMT3* to produce transgenic plants that express pterostilbene, which also describes the two-gene strategy, was issued in 2010. The ARS Office of Technology Transfer works with companies interested in obtaining required regulatory approvals, licensing ARS technologies, and conducting trials.—By **Rosalie Marion Bliss,** ARS.

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New, Disease-Resistant Pea Lines Developed

New garden- and dry-pea breeding lines developed by Agricultural Research Service and cooperating scientists may offer growers added insurance against outbreaks of *Aphanomyces* root rot, a disease that can cause yield losses of 20 to 100 percent in the legume crop.

The moldlike culprit, *Aphanomyces euteiches,* infects roots and underground stems of susceptible pea plants and other legumes, rotting them and causing stunted growth, lesions, wilted leaves, and other symptoms.

Currently no fungicides are registered for use with peas to control *Aphanomyces* root rot. Growers must either avoid planting in fields with a history of the disease or try rotating in nonhost crops until pathogen numbers drop to acceptable levels.

But avoidance and crop rotation may not always be economically feasible. Breeding peas for *Aphanomyces* resistance has proven difficult because multiple genes are involved. Resistance genes are also associated with undesirable traits, which cultivated varieties can inherit when crossed with wild germplasm sources, notes Rebecca McGee, a plant geneticist ARS's Grain Legume Genetics Physiology Research Unit in Pullman, Washington.

McGee, ARS geneticist Clare Coyne, and colleagues have sought to develop pea germplasm lines that can tolerate the pathogen. Coyne is with ARS's Plant Germplasm Introduction and Testing Research Unit, also in Pullman.

"We say the lines are 'highly tolerant,' or 'partially resistant,' because in severe disease conditions, even the best lines show some symptoms, though they may not have significant yield loss," explains McGee, who collaborated with scientists from ARS, New Zealand, and Europe to develop the *Aphanomyces*-tolerant lines.

The pea lines are eighth-generation descendants of an inbred population of plants derived from an ARS cross, made in 1993, between the cultivar Dark Skin Perfection and germplasm line 90-2131. In addition to their high tolerance of *Aphanomyces* root rot, the lines were also selected for their acceptable agronomic characteristics.

The breeding lines themselves aren't intended for commercial production, but rather as a source of *Aphanomyces* tolerance for incorporation into elite pea varieties. Such varieties could be welcome news for growers in Pacific Northwest and North Central states where *Aphanomyces* outbreaks threaten the valued role that peas and other legumes play in cereal-based crop rotation systems.

"Typically, cereals sown after legumes, especially peas and lentils, yield more than cereal-following-cereal plantings," notes McGee. "But if *Aphanomyces* root rot is severe, pea crop losses can be 100 percent."

In addition to releasing *Aphanomyces*-tolerant material, the scientists are working to make DNA markers that breeders can use in their programs, McGee says.—By **Jan Suszkiw,** ARS.

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