Wild Potatoes Pull Late Blight Guard Duty

Distant cousins of cultivated potato may hold key to resisting crop's most devastating disease

Provided by Jan Suszkiw, U.S. Department of Agriculture ARS (Agricultural Research Service)

Distant cousins of cultivated potato may hold the key to unlocking new sources of resistance to the tuber crop's most devastating disease, late blight.

That is the hope of a team of U.S. Department of Agriculture ARS (Agricultural Research Service) scientists affiliated with the University of Wisconsin-Madison College of Agricultural and Life Sciences (CALS).

The scientists conducted laboratory trials in which they exposed the leaves of 72 species of wild potato to spores of the late blight pathogen *Phytophthora infestans*—the same culprit that triggered the Irish Potato Famine of the 1840's.

Late blight remains a worldwide threat today to not only potato, but also tomato crops, inflicting an estimated $6.7 billion annually in yield losses and control costs.

In susceptible varieties, the fungus-like pathogen causes dark lesions and other disease symptoms that rapidly destroy the plant's leaves, stem, fruit or tubers, noted Dennis Halterman, a plant geneticist with the ARS Vegetable Crops Research Unit in Madison, Wisconsin, who is also an honorary associate in the CALS Department of Plant Pathology.

There, Halterman specializes in the genetic "arms race" that potato

Above: A research associate with the U.S. Department of Agriculture ARS, Hari Karki prepares to crossbreed plants to move late blight resistance from a wild species into cultivated potato.

plants engage in with the pathogens that attack and sicken them, often forcing growers to retaliate with chemical controls like fungicides that can ratchet up production costs and concerns over environmental harm.

HARD-SCRABBLE RELATIVES

Halterman set his sights on the hard-scrabble relatives of cultivated potato growing wild in Central and South America, and Mexico, where late blight originated and co-evolved with the plant, a member of the nightshade family.

The collaborative project involved Shelley Jansky, retired ARS scientist and CALS professor emeritus of horticulture, and Hari Karki, ARS research associate and CALS honorary associate in the horticulture department.

"Although most wild species make small potatoes that you would not want to eat—they could actually make you pretty sick—they exist in harsh natural environments without fertilizer, irrigation or pesticides," notes Halterman in an educational video on his efforts.

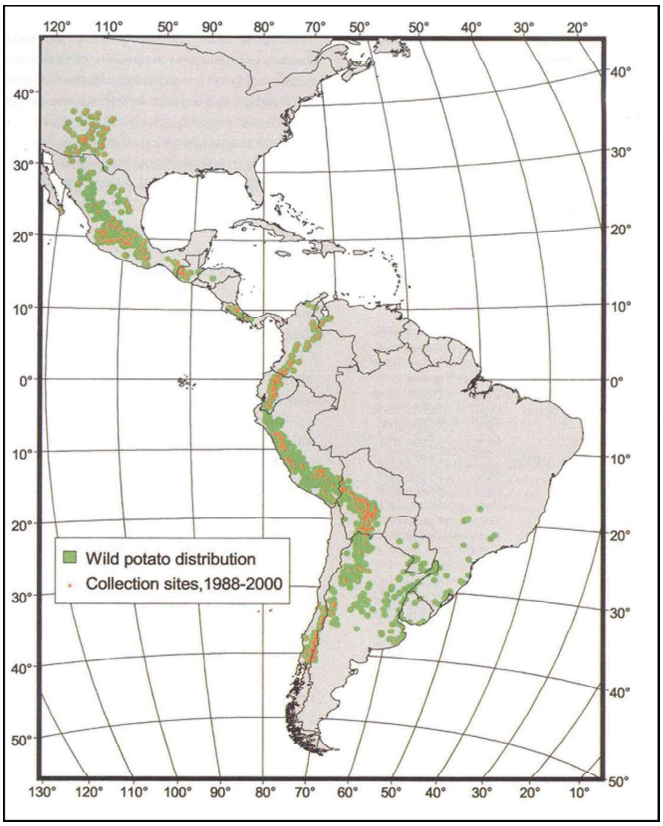
The wild potato species kept by the U.S. Potato Genebank, in Sturgeon Bay, Wisconsin, all produce tubers like the cultivated crop, but usually smaller. The idea is to find and transfer the disease resistances of wild species into the cultivated crop.

In addition to adapting to diverse growing conditions, many wild potato species boast formidable defenses

continued on pg. 20

Wild Potatoes Pull Late Blight Guard Duty

continued from pg. 19



Left: The natural origin of potato relatives stretches from the Southwest United States to southern Chile.

Right: A late blight lesion has formed on the leaf of a potato plant.

against diseases like late blight.

This makes them an especially valuable resource for resistance genes that can benefit farmed varieties, and more broadly, contribute to world food security.

"Once we identify a species that contains resistance, our goal is to transfer that resistance into cultivated potato so that farmers can grow healthy crops using less pesticide," Halterman explains.

The wild potato species *bulbocastanum* (left) and *microdontum* (right) have long been known as sources of late blight resistance, but there are more sources to be discovered.

Wild stocks are kept for just such research at the U.S. Potato Genebank in Sturgeon Bay, Wisconsin, so that scientists do not have to go out into the wild lands to search for them.

Some of the oldest stocks with known late blight resistance have been housed in the U.S. Potato Genebank collection since 1957. A few samples were kept there for years before their novel late blight resistance was discovered.

NEW RESISTANCE SOURCES

The need for new sources of late blight resistance is a constant one. Partly, this is because of the pathogen's uncanny ability to mutate into new variants that can overcome a potato variety's existing genes for protection against the disease.

Among those are US-23, the most common variant circulating in U.S. potatoes, and NL13316, an even more potent variant that can "neutralize" a valuable potato gene known for conferring broad-spectrum late blight resistance, namely RB.

Of the 72 total species the researchers examined, 12 of them showed high levels of leaf resistance that had never been documented before, opening the door to entirely new defense mechanisms against late blight.

That said, developing new potato varieties with new traits is a lengthy process, taking 10-15 years before they are ready for market.

But Halterman is hopeful that with new approaches like marker-assisted selection, genome mapping and the ability to clone (copy) and insert specific genes of interest, prized traits like late blight resistance can be passed into promising new varieties faster and more efficiently.

Five of 12 stand-out species, namely, *S. agrimonifolium*, *S. albornozii*, *S. chomatophilum*, *S. hypacrarthrum* and *S. piurae*, can be used in potato breeding programs immediately without a critical first research step that is necessary to overcome chromosomal incompatibilities typical of wild potato, the researchers reported in the December 2020 issue of the journal "Plant Disease." BC'T

Note: This CALS news release is a modified version of an ARS news release. The original ARS release is posted online at https://www.ars.usda.gov/news-events/news/research-news/2021/wild-potatoes-tapped-for-late-blight-guard-duty/.

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