Gene discovery may halt a deep-rooted pepper disease

May 22 2014

Scientists have identified a promising candidate gene that encodes resistance to a root rot disease that severely diminishes chili pepper crop yields. Credit: UC Davis photo

(Phys.org) —For more than a century, the global hot pepper industry has been dealing with a problem. A funguslike pathogen, known as

Phytophthora capsici, has spread a root rot disease that severely diminishes crop yields. Despite highly adaptive management practices and the availability of wild pepper varieties that have evolved resistance, the pathogen continues to thrive.

Now, scientists from the University of California, Davis, have identified a promising candidate gene that encodes resistance to P. capsici in peppers. The work is published this month in the journal *The Plant Genome*.

Under the direction of plant scientist Allen Van Deynze, the director of research at UC Davis' Seed Biotechnology Center, doctoral candidate Zeb Rehrig had begun the project by screening 31,000 genes in a population of pathogen-resistant chili peppers and jalapeños—a number far surpassing the standard 1,000 genes screened in this type of test. This allowed the researchers to build a high-density genetic map of 3,600 genes.

They then tested their findings by introducing the peppers to P. capsici samples collected from across Mexico, New Mexico, New Jersey, California, Michigan and Tennessee. Analyses incorporating the pepper genome, from a study Van Deynze recently co-authored, ultimately led them to the P5 chromosome and to the gene related to resistance, CaDMR1.

While breeders have long known of a resistant pepper gene in the area of this chromosome, no one has been able to zero in on it the way the UC Davis team has, Van Deynze said.

"The goal of when you get the gene is of course that you can have the perfect marker," he explained, "which theoretically should be useful in really any population you test it in."

The new DNA markers will pave the way for breeders to selectively target the exact gene and turn on the resistance mechanism, giving an industry worth $29.1 billion worldwide a much-needed new tool in the battle over root rot.

"This paper is the first chance to show all the work I've been doing these last couple of years," said Rehrig. "It's showing things you can apply directly to breeding right away."

Understanding the mechanism of the resistance in pepper is the next goal for Rehrig and Van Deynze.

Funding for Zeb Rehrig and the project has come from a UC Davis Department of Plant Sciences Graduate Student Research grant and from a U.S. Department of Agriculture Plant Breeding and Education grant. The USDA grant also allowed Van Deynze to invite, in collaboration with the UC Davis Student Farm program, a total of about 1,500 kindergarten and elementary students to visit and take a look at the broad diversity of peppers the scientists had collected and hopefully to spark their interest plant breeding and plant science.

More information: The study, "CaDMR1 co-segregates with QTL Pc5.1 for resistance to Phytophthora capsici in pepper (Capsicum annuum)," is available online: www.crops.org/files/publicatio … ok/tpg14-03-0011.pdf

Provided by UC Davis