Deciphering plant immunity against parasites

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These researchers are from the Department of Molecular Phytomedicine at the University of Bonn. Credit: Molekulare Phytomedizin/Uni Bonn

Nematodes are a huge threat to agriculture since they parasitize important crops such as wheat, soybean, and banana; but plants can defend themselves. Researchers at Bonn University, together with collaborators from the Sainsbury Laboratory in Norwich, identified a protein that allows plants to recognize a chemical signal from the worm and initiate immune responses against the invaders. This discovery will help to develop crop plants that feature enhanced protection against this type of parasites. The work is published in the current issue of *PLoS Pathogens*.

Plant-parasitic nematodes are microscopic worms that parasitize their host plants to withdraw water and nutrients. The feeding process seriously damages the host plant. Nematode infection distorts root and shoot structure, compromises the plant´s ability to absorb nutrients from soil, and eventually reduces crop yield. Yearly losses exceed ten percent in important crops such as wheat, soybean, and banana. In addition to causing direct damage, nematode infection also provides an opportunity for other pathogens to invade and attack the host plants.

Until now, near to nothing was known about the general innate immune response of plants against nematodes. A team of researchers at the University of Bonn, in cooperation with scientists from the Sainsbury Laboratory in Norwich, has now identified a gene in thale cress (Arabidopsis thaliana), called NILR1, that helps plants sense nematodes. "The NILR1 is the genetic code for a receptor protein that is localized to the surface of plant cells and is able to bind and recognize other molecules," says Prof. Florian Grundler, chair at the Department of Molecular Phytomedicine at the University of Bonn. "NILR1 most probably recognizes a molecule from nematodes, upon which, it becomes activated and immune responses of plants are unleashed."

NILR1 recognizes a broad spectrum of nematodes

Although a few receptors, so-called resistance genes, providing protection against specific types of plant-parasitic nematodes have already been identified, NILR1 recognizes rather a broader spectrum of nematodes. "The nice thing about NILR1 is that it seems to be conserved among various crop plants and that it provides protection against many nematode species," says group leader Dr. Shahid Siddique. "The discovery of NILR1 also raises questions about the nematode derived molecule, whose recognition is thought to be integral to this process." Now that an important receptor is discovered, the scientists are working to find the molecule which binds to NILR1 to switch on the immune responses. The two first authors, PhD students at the department share tasks in the project. Whereas Mary Wang´ombe focuses on the receptor protein and its function, Badou Mendy concentrates on isolating the signal molecule released by the nematodes.

New options for breeding resistant crop plants

The findings of the University Bonn Scientists open new perspectives in making crops more resistant against nematodes. They could already show that important crop plants such as tomato and sugar beet also possess a functional homologue of NILR1 - an excellent basis for further specific breeding. Once the nematode signal is characterized, a new generation of natural compounds will be available that is able to induce defense responses in plants thus paving the way for safe and sustainable nematode control.

More information: Mendy, B., Wang'ombe, M.W., Radakovic, Z., Holbein, J., Ilyas, M., Chopra, D., Holton, N., Zipfel, C., Grundler, F.M.W., and Siddique, S.: Arabidopsis leucine-rich repeat receptor-like kinase NILR1 is required for induction of innate immunity to parasitic nematodes, *PLoS Pathogens*, Internet: doi.org/10.1371/journal.ppat.1006284

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