Biologists unlocking the secrets of plant defenses, one piece at a time

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Researchers examining how the hormone jasmonate works to protect plants and promote their growth have revealed how a transcriptional repressor of the jasmonate signaling pathway makes its way into the nucleus of the plant cell.

They hope the recently published discovery will eventually help farmers experience better crop yields with less use of potentially harmful chemicals.

"This is a small piece of a bigger picture, but it is a very important piece," said Maeli Melotto, a University of Texas at Arlington assistant professor of biology.

Melotto recently co-authored a paper that advances current understanding of plant defense mechanisms with her collaborator Sheng Yang He and his team at Michigan State University's Department of Energy Plant Research Laboratory (DOE-PRL). He is a Howard Hughes Medical Institute-Gordon and Betty Moore Foundation investigator. A paper on the collaboration was published online Nov. 19 in the Proceedings of the National Academy of Sciences under the title, "Transcription factor-dependent nuclear import of transcriptional repressor in jasmonate hormone signaling."

Jasmonate signaling has been a target of intense research because of its important role in maintaining the balance between plant growth and defense. In healthy plants, jasmonates play a role in reproductive

development and growth responses. But, when stressors such as herbivorous insects, pathogen attack, or drought, jasmonate signaling shifts to defense-related cellular processes.

The team from UT Arlington and Michigan State focused on the role of jasmonate signaling repressors referred to as JAZ. Specifically, they looked at how JAZ interacts with a major transcription factor called MYC2 and a protein called COI1, which is a receptor necessary for jasmonate signaling.

The researchers discovered that a physical interaction between the repressors and the MYC2 persisted inside the plant cell nucleus, preventing jasmonate-associated gene transcription.

"This tight repression of transcription factors may be important because activation of jasmonate signaling, although important for plant defense against pathogens and insects, is energy-consuming and could lead to growth inhibition – a widely known phenomenon called growth-defense tradeoff," said He, the Michigan State plant biologist. "In other words, plants have developed a mechanism to tightly repress presumably energy-consuming, jasmonate-mediated defense responses until it becomes necessary, such as upon pathogen and insect attacks."

The National Institutes of Health, the U.S. Department of Energy, Howard Hughes Medical Institute and the Gordon and Betty Moore Foundation funded the work featured in the recent paper.

Melotto said understanding jasmonate signaling at the molecular level is also vital because some plant pathogens, such as Pseudomonas syringae, have developed ways to mimic the hormone's action in the cell. This gives them the ability to aggressively colonize plants without activating natural defense mechanisms, she said.

Melotto, who is currently receiving National Institutes of Health funding to examine plant defenses, said the next step in her jasmonate research is to determine which domain of the JAZ protein is responsible for plant innate immunity.

"This is one way to have sustainable agriculture," Melotto said of the research. "By increasing genetic resistance we could reduce the use of pesticides, decrease crop production costs and promote environmentally friendly farming practices."

More information: www.pnas.org/content/early/201 … /1210054109.abstract

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