Researchers discover key link in understanding billion-dollar pests in agriculture

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MU professor Melissa Mitchum found genetic evidence that is the link to how nematodes attack soybean crops.

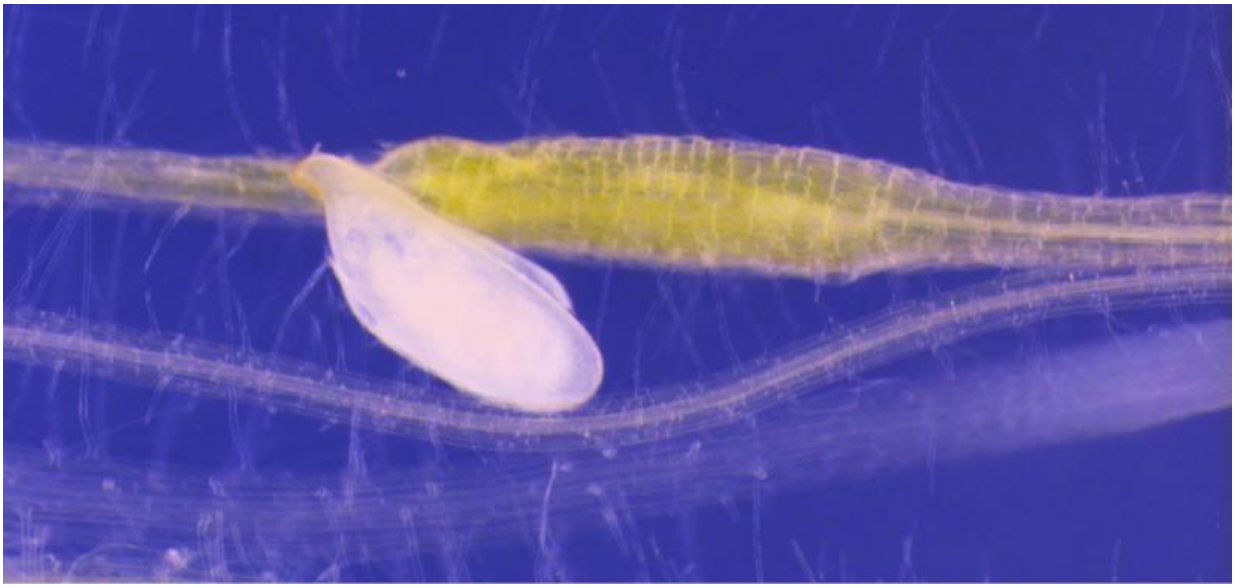
Invisible to the naked eye, plant-parasitic nematodes are a huge threat to

agriculture, causing billions in crop losses every year. Plant scientists at the University of Missouri and the University of Bonn in Germany have found the first genetic evidence linking one method these animals use to attack plants; they proved that these tiny worms use a specialized hormone to help them feed from the plant. This research could allow plant scientists to develop crop plants with enhanced resistance to these devastating agricultural pests.

"Cell cycle regulation is a key aspect of plant development and one of the first events altered during the formation of the feeding sites nematodes use to acquire nutrients from host plants," said Melissa Goellner Mitchum, a researcher in the Bond Life Sciences Center and an associate professor in the Division of Plant Sciences at MU. "These discoveries led scientists to suspect that cytokinin, a hormone that promotes cell division in plants, might play a key role in feeding site formation for nematode parasites."

Carola De La Torre, a doctoral student in the Bond Life Sciences Center, and Demosthenis Chronis, a postdoctoral fellow at MU, worked with Mitchum to determine if nematode infection alters the cytokinin signaling pathways plants use to regulate growth and development and how the process changes due to nematode infection.

"As part of our research, we examined the activation of different components of the cytokinin pathway in response to nematode infection," De La Torre said. "Also, we evaluated numerous plants that lacked the presence of these components and found that most of these plants were less susceptible to nematode infection. These results suggested to us that these little worms are not only utilizing parts of a plant hormonal pathway that is important for plant growth and development, but they also are doing it in a way that allows them to cause disease."



The beet cyst nematode (*Heterodera schachtii*) sucks at a plant root. The pest reprograms the root with a plant hormone. Credit: (c) Photo: Zoran Radakovic

Mitchum's team partnered with Florian Grundler's group at Rheinische Friedrich-Wilhelms-University of Bonn, Germany, who further analyzed the connection between cytokinin and nematodes. Using advanced genetic tools, they discovered that nematodes create their own form of plant cytokinin and that, by secreting the hormone into the plant, they actively control the cell cycle leading to the production of ideal feeding sites to support their development. These findings show the ability of an animal to synthesize and secrete a functional plant hormone to establish long-term parasitism.

"Understanding how plant-parasitic nematodes modulate host plants to their own benefit is an essential first step in finding new technologies needed to develop crop plants with enhanced resistance to these devastating agricultural pests," Mitchum said.

The study "A Plant-Parasitic Nematode Releases Cytokinins that Control Cell Division and Orchestrate Feeding-Site Formation in Host Plants" recently was published by the *Proceedings of the National Academy of Sciences.*

More information: "A parasitic nematode releases cytokinin that controls cell division and orchestrates feeding site formation in host plants" *PNAS* 2015 ; published ahead of print September 28, 2015, DOI: 10.1073/pnas.1503657112

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