Nematode odors offer possible advantage in the battle against insect pests

February 26 2019

Gardeners commonly use nematodes to naturally get rid of harmful soil-dwelling insects. A new study published today in the journal *Functional Ecology* revealed that these insect-killing nematodes also produce distinctive chemical cues, which deter Colorado potato beetles and make potato leaves less palatable to them.

The Colorado potato beetle is a devastating pest of potato leaves in home and fresh-market gardens, and feeds on tomato, pepper, eggplant and other plants in the nightshade family (Solanaceae) as well. A now widespread species in North America, continental Europe and Asia, control of the Colorado potato beetle often fails due to its ability to rapidly develop resistance to insecticides.

In a project funded by the United States Department of Agriculture, entomologists from Texas A&M University and Penn State University investigated whether Colorado potato beetles and potato plants responded to the presence of entomopathogenic nematodes (EPNs).

Although Colorado potato beetles feed on plant leaves above the ground, they can come in contact with EPNs as they move along the soil to a new host plant and when their larvae burrow themselves in the ground to pupate.

"We know from previous research that predators and parasites are attracted to odours that help them locate their prey. Here, we wanted to flip things around to see whether insects and plants can sense, or "smell",

the chemical signatures of a predator", said Dr. Anjel Helms at Texas A&M University, who led the research.

Nematodes and their symbiotic bacteria attack and kill insects in the soil. They can be used to control a wide variety of insect pests, providing a natural and effective alternative to chemical pesticides, without harming ladybugs, earthworms and other beneficial garden insects.

To determine whether Colorado potato beetles respond to the chemical cues emitted by EPNs, the researchers allowed beetles to choose potato plants with or without nematode-infected insects in the surrounding soil.

They found that the nematode-infected insect cadavers produced characteristic odours different from those of uninfected dead insects. Female Colorado potato beetles laid around 30% fewer eggs on plants surrounded by infected cadavers compared to control plants, indicating that they detect EPNs as a potential threat to the performance and survival of their offspring.

Beetle larvae voraciously feed on potato leaves, before entering the soil to pupate and resurfacing as adult beetles.

"It is becoming increasingly difficult to manage these noxious beetles with conventional methods particularly with their ability to rapidly develop resistance to pesticides.

Nematodes, however, could be added to the soil to target them directly and, as our research demonstrates, could also increase plant resistance to the insects by slowing their development and reducing their attraction to plants", said co-author Dr. Jared Ali from Penn State University.

Interestingly, the potato plants also seemed to respond to the presence of these predatory nematodes, or their odours, by increasing their defences.

As a result, Colorado potato beetle larvae feeding on these plants consumed less leaf tissue and were about 40% smaller than those feeding on control plants, which could have further consequences for their development and fitness.

Helms commented: "One explanation could be that plants perceive the presence of nematodes as a warning of the danger of herbivorous insects, so they mount their defences as a precaution. It's better to be safe than sorry."

While nematodes will likely not provide the only solution to Colorado potato beetles, these tiny worms can offer growers a natural alternative to existing methods and target soil-dwelling insect pests.

"Nematodes may prove more useful than previously thought. Not only do they directly kill insects in the soil, we found they also produce chemical cues that offer plants additional protection", Helms concluded.

More information: Anjel Helms, et al. 'Chemical cues linked to risk: cues from below-ground natural enemies enhance plant defences and influence herbivore behaviour and performance' *Functional Ecology* on 26 February 2019, DOI: 10.1111/1365-2435.13297

Provided by British Ecological Society