

Microbes help beetles defeat plant defenses

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This is a Colorado potato beetle larva. Credit: Gary Felton, Penn State

Some symbiotic bacteria living inside Colorado potato beetles can trick plants into reacting to a microbial attack rather than that of a chewing herbivore, according to a team of Penn State researchers who found that the beetles with bacteria were healthier and grew better.

"For the last couple of decades, my lab has focused on induced defenses in plants," said Gary W. Felton, professor and head of entomology. "We had some clues that oral secretions of beetles suppressed defenses, but no one had followed up on that research."

Seung Ho Chung, graduate student in entomology working with Felton, decided to investigate how plants identified chewers and how herbivores subverted the plants defenses.

"I thought we could identify what was turning the anti-herbivore reaction off," said Felton. "But it was a lot more difficult because we had not considered microbes."

According to Felton, the beetles do not have salivary glands and so they regurgitate oral secretions onto the leaves to begin digestion. These secretions contain [gut bacteria](#).

Plant defenses against chewing insects follow a jasmonite-mediated pathway that induces [protease inhibitors](#) and polyphenol oxidase, which suppress digestion and growth. Plant defenses against pathogens follow a salicylic acid mediated pathway. When the antimicrobial response turns on, it interferes with the response to chewing, allowing the beetles to develop more normally.

Chung and Felton used [tomato plants](#) to identify exactly what was turning off the response to chewing. They note, however, that the Colorado potato beetle also attacks eggplant and [potato plants](#). They report the results of their work in the current online edition of the *Proceedings of the National Academy of Sciences*.



This is a Colorado potato beetle. Credit: Gary Felton, Penn State

The researchers allowed beetle larva to feast on antibiotic-treated leaves and natural leaves and found that on the antibiotic-treated leaves, the beetles suffered from the plant's anti-herbivore defense, but on the natural leaves the larva gained more weight and thrived.

Chung and Felton then investigated expression of genes in the anti-herbivore pathway and the production of enzymes. They found that the presence of bacteria decreases the anti-herbivore response.

The researchers also isolated and grew the bacteria from the Colorado potato beetle guts. They found 22 different types of bacteria, but only three types suppressed the anti-herbivore response. During a variety of other experiments, they found that in all cases presence of the bacteria that could suppress the anti-herbivore response led to healthier beetles.

The researchers are now beginning to see if these bacteria are present in Colorado potato beetles all over the U.S. and also in Europe.

More information: Herbivore exploits orally secreted bacteria to suppress plant defenses,

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