Moth larvae saliva boosts yield of Colombian spud

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Tuber damage by Guatemalan potato moth larvae, Tecia solanivora.

(PhysOrg.com) -- When a major South American pest infests potato tubers, the plant produces bigger spuds, reports a study by Cornell, University of Goettingen and National University of Colombia researchers.

The secret is in the spit, write the researchers online in the journal *Ecological Applications* (April 28).

They found that the saliva of the Guatemalan potato moth larvae (Tecia solanivora) -- a major pest that forces farmers to spray plants with pesticides every two weeks -- contains compounds from the insect's foregut that elicits a systemwide response in the Colombian Andes commercial potato plant (Solanum tuberosum) to produce larger tubers.

When the larvae infested fewer than 10 percent of the tubers, the plant produced marketable yields (after infested tubers were removed) that weighed 2.5 times more than undamaged plants, according to the study. When up to 20 percent of the potatoes were damaged, marketable yields still doubled. And when as many as half of the potatoes were infested, yields equaled those of plants with no infestation.

The findings have implications for potato farmers, as the compound, once isolated, could lead to considerably higher yields in some varieties of potatoes. "Initially, I wanted to show how much these pests reduce potato yields, but we actually found they increase the yield" in this potato, said Katja Poveda, the study's principal investigator and a postdoctoral researcher at the Agroecology Institute of the University of Goettingen, Germany, and the Cornell entomology department.

The researchers found that when the spit of the tuber moth caterpillar gets into a tuber, all the other tubers of the plant grow bigger even though the infested tuber itself does not increase in size, said co-author André Kessler, Cornell assistant professor of ecology and evolutionary biology.

Guatemalan potato moth larva (Tecia solanivora) boring through potato tuber.

"The moth eats all varieties of potatoes, but so far only this one variety responded" with increased yields among seven varieties that were tested as part of a larger project, said Poveda. Future experiments will test more commercial varieties, as well as wild potatoes, she added. Plants have a number of responses to insects and other animals that eat them (herbivory), including changing metabolism to cope with physiological stress or producing toxins that make plants more resistant, for example, said Kessler. In turn, the herbivores may develop strategies to counter the plant's defenses and influence its signaling pathways, creating a kind of arms race where herbivores and plants co-evolve.

"This could be an example where the co-evolutionary arms race led to a beneficial outcome for both," said Kessler.

While more research is needed, the researchers believe that compounds from the insect's saliva somehow increases the rate of the plant's

photosynthesis to compensate for the tuber(s) lost to the caterpillar damage; as a result of more photosynthesis, more carbon is drawn into the plant and used to create starch, which makes for bigger tubers.

Kessler, who studies similar elicitor compounds in tobacco plants, recently received grants from the U.S. Department of Agriculture as part of the land grant system and administered though the Cornell University Agricultural Experiment Station and the National Science Foundation to identify the compounds that elicit increased plant growth and to understand the physiology of the tobacco plant's response.

Provided by Cornell University