

Researchers discover 'green' pesticide effective against citrus pests

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University of Florida researchers have discovered a key amino acid essential for human nutrition is also an effective insecticide against caterpillars that threaten the citrus industry.

The Lime Swallowtail, or [Citrus Swallowtail](#), is a well-known agricultural pest from southern Asia discovered in the Caribbean in 2006, and researchers say its potential impact on the U.S. [citrus industry](#) is cause for serious concern.

"Everything that's in the Caribbean eventually gets to Florida – Florida is an invasive magnet," said UF lepidopterist Delano Lewis, lead author of the study published in the current issue of the *Journal of Economic Entomology*. "That's why we're trying to make the first strike to see how to stop it."

Experiments conducted on the UF campus at the Florida Museum of Natural History's McGuire Center for Lepidoptera and Biodiversity and the College of Medicine show when methionine is sprayed on leaves it is 100 percent effective in killing larvae related to the Lime Swallowtail [caterpillars](#) within two to three days. If not controlled, the caterpillars can completely defoliate young wild lime plants.

Because the Lime Swallowtail, *Prionoxystus demoleus* (Papilio), is invasive and cannot be legally brought into the U.S., researchers experimented using a genetically related surrogate with a similar life history and appetite for citrus, the Giant Swallowtail, *Heraclides* (Papilio)

crisphonates. Because these pest caterpillars have the same body structure and biology, researchers are confident methionine will also control the Lime Swallowtail, Lewis said.

"Its effectiveness is based on the biochemistry of the insect gut, so although this work was done on a surrogate, the methionine will block the ion channel in the same way," Lewis said.

Methionine is needed in the human diet for many reasons, including protein-building and metabolism. It is environmentally safe and harmless to citrus plants, mammals and birds.

"It's a very curious phenomenon to have this nutrient amino acid that humans can't live without, yet at the concentrations we put on the leaves, it is toxic to crop-destructive caterpillars," said study co-author Bruce Stevens, professor of physiology and functional genomics in the UF College of Medicine. "It's a completely different class of pesticides that has not been seen before – most are toxic to not only the pest, but to people and animals, too."

Stevens first discovered the pesticide properties of methionine while cloning genes that regulate amino acid metabolism in 1998. Working with co-author James Cuda of UF's department of entomology and nematology, Stevens later found this amino acid to be effective against yellow fever mosquito larvae, tomato hornworm and Colorado potato beetle.

Methionine disrupts an ion channel that controls nutrient absorption in larvae with an alkaline intestine, such as in caterpillars of the Citrus Swallowtail. In 2004 and 2007, Stevens obtained two patents for the use of methionine as a pesticide, through the UF Office of Technology Licensing.

"The methionine is sprayed on the leaves, and when the caterpillars begin to eat the leaves, they ingest the compound – it's not in the plant itself," Lewis said. "Once they take those first few bites, they don't feed again and remain stationary until they die."

Methionine is low-cost and serves as fertilizer if it reaches the ground because it's a biodegradable nitrogen source, Stevens said. The amino acid is mass produced and has been used as a nutritional supplement in outdoor livestock feed since the 1960s. The U.S. Department of Agriculture recently approved the use of methionine for organic poultry production.

"This is a neat idea and I'm hoping that more work will be done on this in the future because there's a lot of potential there," said John Ruberson, a professor in the entomology department at the University of Georgia, who was not involved in the study. "The one challenge I can see from a grower's perspective is that it tends to work kind of slowly. Typically, it takes two to three days to kill the insect, but they do show that [insect] feeding is reduced, which is a good thing."

Patent rights for the use of methionine to control turf and ornamental pests have been licensed to Phoenix Environmental Care LLC, which is developing a pest control product.

While researchers are unsure how the Lime Swallowtail reached the Caribbean, its proximity poses a potential threat to Central and South American citrus industries, as well.

"We suspect someone could have brought them to release the adult butterflies in weddings, or perhaps they arrived with imported citrus stock," Lewis said. "Regardless, it's in the Caribbean and it's a very strong flyer."

Provided by University of Florida

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