Tracking the Invasion: New Technique Traces Spotted Lanternflies for Life

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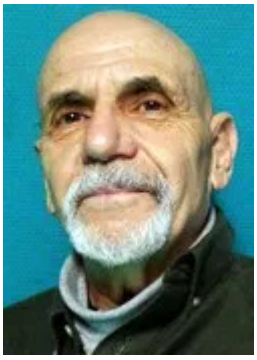
A tracing technique involving a stable nitrogen isotope is giving scientists a new window into the life cycle of the invasive spotted lanternfly (*Lycorma delicatula*). Sprayed on host plants, the isotope is ingested by spotted lanternflies that feed on them, thus labeling the insects so they can be traced for life, from egg to adult. (Photo by Emelie Swackhamer, Penn State University, Bugwood.org)

By Ed Ricciuti



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Since its arrival in Pennsylvania in 2014, the invasive spotted lanternfly (*Lycorma delicatula*) has afflicted not only U.S. foresters, orchardists, farmers, and others dependent on growing plants for a living but also homeowners who like to keep patios and backyards neat. Vividly marked with red, black, white, and yellow hues that could make the most gorgeous of butterflies envious, this so-called fly (really a planthopper in the infraorder Fulgoromorpha), can suck the sap and life out of about 70 different plant species, from grapes to hardwoods.

Its crusty, gray egg masses, moreover, stick to almost any surface: basketball backboards, patio furniture, kiddie pools, screen doors, firewood, and motor homes, to name a few. The egg masses, which adhere even to the tires of vehicles, enable the spotted lanternfly (SLF) to travel well. In a few years, it has spread from Pennsylvania to nearby states, and, according to the U.S. Department of Agriculture (USDA), is capable of going national.

A New Tracing Technique

Scientists have been working feverishly to figure out the lanternfly's life cycle to reveal any Achilles' heel that could make it vulnerable to control measures. The search has just become easier. Researchers at Pennsylvania State University reported in the journal *Environmental Entomology* (https://doi.org/10.1093/ee/nvaa067) how a safe, stable isotope of nitrogen sprayed on host plants is ingested by spotted lanternflies that feed on them, thus labeling the insects so they can be readily traced for life, from egg to adult.

"We demonstrated that two stable isotope dosages applied to the host plants were assimilated by the insect and equally detectable in the exoskeleton, wings, and mature eggs ready to be oviposited," the scientists reported. "This safe and reliable method can be used to examine fundamental processes of the biology and ecology of SLF that range from dietary resources and resource allocation to food-web structure and dispersal patterns."

This new tool for combating SLF could be coming just in time. "If allowed to spread in the United States, this pest could seriously impact the country's grape, orchard,

and logging industries," warns (https://www.aphis.usda.gov/aphis/resources/pests-diseases/hungry-pests/slf/spotted-lanternfly#:~:text=Spotted%20lanternflies%20are%20invasive%20and,%2C%20orchard%2C%20and%20logging%20industries.) USDA. The major concerns are its enormous host range on plants and its lack of natural enemies in the United States.

The technique developed at Penn State is based on a process called isotope enrichment, in which a chemical element—in this case, nitrogen—is heavily laced with one of its isotopes, which then can be tracked when transmitted from the treated plant to the SLF that feeds upon it, and then through the insect's life cycle. For the record, an isotope is a different form of an element, with atoms that differ in the number of neutrons, and thus atomic weight.

Radioactive isotopes are used as tracers—as in a CT scan—by their radioactive decay, but their emissions can pose health and environmental problems. Stable

isotopes, which pose no danger, can be traced by measuring their amount and ratios in samples, typically by mass spectrometry (https://entomologytoday.org/2020/06/05/advanced-mass-spectrometry-method-could-give-forensic-entomologists-faster-fly-ids/).

The stable isotope method seems to have no impact on the normal functioning of SLF, in contrast to the most common marking method, dusting with fluorescent powders, which may affect the movement and other biological functions of the organism.

Once ingested by the SLF, moreover, the tracer is long-lasting. “If an insect feeds for two weeks on an enriched plant,” says lead author Mitzy F. Porras, Ph.D., of Penn State’s entomology department, “the isotope mark remains detectable despite the insect movements, such as flying or jumping to an unenriched plant.”

The experiments were carried out on grape plants under artificial shade, mimicking the temperature that SLF experiences under natural conditions. The researchers found that SLF thermal sensitivity was a determining factor in conducting the experiment. SLF is commonly found on trees and bushes that provide food and shelter and which are cooled by the overarching tree canopy. Artificial shelter, known as a shade house, kept the insects out of direct sunlight and higher temperatures that could adversely impact their natural behavior.

The new technique, says Porras, is ready to use: “Our aim is to use this method to examine how land use affects the SLF dispersal patterns. This year we will develop a … model to determine the significance of finding one marked insect per thousands of unmarked. Then, when we mark the SLF in the field, this model will allow us to find the needle in the haystack.”

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“A Method for a Long-Term Marking of Spotted Lanternfly (Hemiptera: Fulgoridae) Using a Stable Isotope of Nitrogen (https://doi.org/10.1093/ee/nvaa067)”

Environmental Entomology

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