

Researchers take aim at invasive, 'pernicious' spotted lanternfly

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The spotted lanternfly threatens agricultural sectors worth nearly \$18 billion to Pennsylvania's economy. Credit: Greg Hoover

As populations of the invasive spotted lanternfly explode—and the state-imposed quarantine area in southeastern Pennsylvania expands—researchers in Penn State's College of Agricultural Sciences

are looking for solutions to help stop the insect's spread and save agricultural crops from serious damage.

The spotted lanternfly was found for the first time in the United States in Berks County in September 2014. More than three years later, the Pennsylvania Department of Agriculture's quarantine, which began with five townships in eastern Berks County, now covers all of Berks, Bucks, Chester, Lehigh, Montgomery, Northampton, Carbon, Delaware, Lancaster, Lebanon, Monroe, Philadelphia and Schuylkill counties. The quarantine regulates or limits the movement of plants, plant-based materials and outdoor household items out of the quarantine area unless certain conditions are met.

Officials are worried about the threat the spotted lanternfly poses to Pennsylvania agriculture, including the grape, tree-fruit, hardwood and nursery industries, which collectively are worth nearly \$18 billion to the state's economy. Homeowners also could sustain damage to high-value ornamentals in their landscape.

Native to China, India, Japan and Vietnam, the spotted lanternfly does not attack fruit or foliage. Rather, it uses its piercing-sucking mouthparts to feed on the woody parts of plants—such as tree trunks or branches and grape vines—where it excretes a substance known as honeydew and inflicts wounds that weep with sap. The honeydew and sap can attract other insects and provide a medium for growth of fungi, such as sooty mold, which covers leaf surfaces and can stunt growth. Plants with heavy infestations may not survive.

Said Tom Baker, distinguished professor of entomology and chemical ecology, who has 40 years of experience in entomology research, "The spotted lanternfly is the weirdest, most pernicious insect I've ever seen."

Penn State researchers are attacking the problem on several fronts.

"After this pest was discovered in Pennsylvania in 2014, we began basic research to learn where it came from and to better understand its biology and behavior before we could start to develop tactics for managing it," said Julie Urban, senior research associate in the Department of Entomology. "As a result, we have several ongoing projects that we hope will lead to practical solutions in the near future."



Despite its colorful wings, the spotted lanternfly — one of a group of insects known as planthoppers — is a weak flyer but a strong and quick jumper. Credit: Pennsylvania Department of Agriculture

For instance, with support from the U.S. Department of Agriculture, Urban is studying the population genetics of spotted lanternfly in Pennsylvania. Identifying novel genetic markers and genotyping the insect can help in the effort to more precisely pinpoint the Asian origin

of the lanternfly invasion and to geographically narrow the search for natural predators and parasitoids.

"Novel genetic markers that are variable within the Pennsylvania population also will help us estimate the effective size of the current population, enable us to track population growth and movement, and detect subsequent invasions," she said.

Another line of inquiry, Urban said, is characterizing bacteria and fungi associated with spotted lanternfly. Using next-generation DNA sequencing, her team tested for the presence of bacterial and fungal communities in the lanternfly salivary glands and proboscis (mouthpart) and in abdominal tissue.

"We found that salivary gland and proboscis tissue did not harbor any detectable levels of bacteria or fungi. This means it's unlikely that spotted lanternfly is transmitting bacterial or fungal pathogens to plants through feeding, although we are continuing to investigate potential transmission of other pathogens," she said.

"In abdominal tissue, some bacteria present can differ depending on geographic range. Comparing the microbiome of the digestive tract of the Pennsylvania population with specimens from Asia may help us understand differences in host-plant preferences and feeding behavior, and we may find that Asian populations harbor bacteria that are natural pathogens of spotted lanternfly."

Researchers also are monitoring the microbial communities on several economically important host plants to assess changes in composition and abundance of bacteria and fungi due to spotted lanternfly feeding and honeydew deposition. In addition, Urban's team is examining the microbial communities present in a frothy substance found at the base of *Ailanthus* (tree-of-heaven) plants that show heavy lanternfly feeding

damage and honeydew deposition.

Tree-of-heaven is one of the spotted lanternfly's highly preferred host plants, and Urban said the froth will be analyzed to determine whether it serves as an attractant to the pest. "We will aim to determine the source of any potentially attractive compounds, which may be helpful in developing spotted lanternfly lures," she said.



The first three stages of immature spotted lanternflies are black with white spots. Fourth-instar nymphs, shown here, begin to appear in July and will molt to become adults. Credit: Penn State Extension

This work also may assist scientists in identifying beneficial bacteria that

could help manage lanternfly-associated sooty mold by killing or out-competing the fungus, Urban explained.

Entomologist Baker has used funding from USDA's Animal and Plant Health Inspection Service to study the mating and dispersal behaviors of spotted lanternfly. He noted that the use of insect pheromones for mating disruption has been deployed successfully for other insect pests.

"However, so far we have found no evidence that the spotted lanternfly uses pheromones to find mates, so that may not be something we can use for mating disruption or to develop lures or traps," he said.

Baker's laboratory has collected data on how spotted lanternflies disperse—how far they fly, what they orient to, what they land on and so forth. "Understanding the natural dispersal behavior could be helpful to state and federal agriculture officials and industry stakeholders in planning for where and in what direction the front edge of an infestation will spread," he said.

In the short term, researchers are closing in on pesticide solutions that can help protect crops from spotted lanternfly damage. Erica Smyers, a doctoral candidate in entomology advised by Urban, has performed efficacy testing on several insecticides to gauge their potential for reducing populations of the pest. Dave Biddinger, research associate professor of entomology at Penn State's Fruit Research and Extension Center in Biglerville, is helping to analyze the results.

Once data analysis is complete, scientists will seek an emergency exemption from the U.S. Environmental Protection Agency under Section 18 of the Federal Insecticide, Fungicide, and Rodenticide Act to permit growers to use the most promising of these chemicals on certain crops.

In the meantime, Penn State entomologists are collaborating with other university and government scientists and seeking additional USDA grants to continue research on spotted lanternfly host-plant requirements, the development of biocontrols such as natural enemies, host-plant effects of sooty mold, and other topics related to this exotic and unusual pest.

Provided by Pennsylvania State University

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