Insect decoys could protect ash trees

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Female emerald ash borer. Since being introduced into the United States in the 1990s, this Asian beetle has devoured ash trees across much of the country. Engineers at Penn State and Western Michigan University have developed a way to produce large numbers of artificial females to use as decoys to trap males. Credit: Penn State

Emerald ash borers have no trouble reproducing themselves as they have now spread through half the United States, but duplicating effective emerald ash borer decoys is not quite as easy. Now, engineers have devised an inexpensive method to produce hundreds of these fake bugs to aid in monitoring and controlling this pest.

Whether for monitoring, containment or eradication, emerald ash borer males must be lured into traps, but they are not easily fooled. Entomologists found that the males approach females from above and look for the sunshine reflecting off the female's green carapace. However, simply placing a green plastic bug in the trap does not work because as the males approach they quickly recognize the fake, flying off before entering the trap.

"We had tried two very different ways of making the decoys," said Akhlesh Lakhtakia, Charles Godfrey Binder Professor in Engineering Science and Mechanics, Penn State.

The researchers produced female emerald ash borer decoys were produced using 3-D printing, but the males quickly became uninterested. This approach, does not replicate the fine structure of the elytra, the hardened forewing of the insect, which is apparently necessary to attract males. The other method required the biomimetic fabrication of a negative die and a positive die, which were used to stamp the decoys on a plastic sheet. The stamped decoys were cut out and first painted black and then metallic green.

"My entomologist colleagues found that our biomimetically produced female emerald ash borer lures were 40 percent more successful than dead females," said Lakhtakia.

However, initially only a few lures could be made at a time. To improve production speed, Lakhtakia; Stephen E. Swiontek, graduate student in engineering science and mechanics, Penn State and Tarun Gupta, professor of industrial and manufacturing engineering, Western Michigan University, enhanced the biomimetic approach. They report their results in a recent issue of the *Journal of Bionic Engineering*.

Ash borer decoys produced in a single die by the heat-cured plastic method developed by engineers at Penn State and Western Michigan University. The decoys, which mimic female ash borers, have proven to be effective at attracting

male ash borers into traps. Credit: Penn State

They made a negative die or mold from 10 euthanized females instead of just one. Then they placed a heat-curing plastic in the mold. After heating the plastic to cure it, the lures were cut out and painted like the stamped lures.

The heat curing method is better, according to Lakhtakia, because it requires only one mold and so is a single step process. This also makes it faster and less expensive to manufacture.

"When we began in 2010, the idea was so that we could wipe out the invasive species with these lures," said Lakhtakia. "We now realize we cannot get rid of them, they have spread over half the country. However, because the species feeds exclusively on ash, once those trees are gone from an area, the insects move on. Perhaps we can use the lures to protect new ash trees planted in that area."

Provided by Pennsylvania State University

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