

Asian longhorned beetles pheromone could be used to manage pest

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(Phys.org) —Female Asian longhorned beetles lure males to their locations by laying down sex-specific pheromone trails on tree surfaces, according to an international team of researchers. The finding could lead to the development of a tool to manage this invasive pest that affects about 25 tree species in the United States.

"Tens of thousands of hardwood trees, mostly maples, have been cut down and destroyed in New York, Ohio and Massachusetts because of the Asian longhorned beetle," said Kelli Hoover, professor of entomology, Penn State. "We discovered a [pheromone](#) produced by [females](#) of this species that could be used to manage the pest."

The researchers isolated and identified four chemicals from the trails of virgin and mated female Asian longhorned beetles—*Anoplophora glabripennis*—that were not found in the trails of [males](#). They found that the pheromone trails contained two major components—2-methyldocosane and (Z)-9-tricosene—and two minor components—(Z)-9-pentacosene and (Z)-7-pentacosene. The team also found that every trail sample contained all four of these chemical components, although the ratios and amounts changed depending on whether the female was virgin or mated and depending on the female's age.

"We found that virgin females do not begin to produce a sufficient amount of the correct pheromone blend—that is, the correct ratios of the four chemicals to each other—until they are about 20 days old, which

corresponds to the timing of when they are fertile," Hoover said. "Females, after emerging from the tree where they pupated, require about two weeks of feeding on twigs and leaves before they develop eggs they can lay."

The researchers found that when the proper ratio and amount of pheromone is produced by females and deposited on the surface where they walk, signaling that they are fertile, males come.

The researchers published their findings in the current issue of the *Journal of Chemical Ecology*.

"What is interesting is that, while the pheromone attracts males, it repels virgin females," Hoover said. "This may be a mechanism to help females avoid competition for a mate."

In addition, the researchers learned that sexually mature females continue to produce the trail pheromone after mating, a practice they think benefits both sexes. According to the scientists, by continuing to produce the pheromone after mating, females can lure the same males back to mate again or they can lure other males to them.

"Females benefit from multiple matings or from a prolonged time spent copulating with one male because these behaviors increase the likelihood that her eggs will be fertile," said Melody Keena, research entomologist, U.S. Department of Agriculture, Forest Service, Northern Research Station.

In contrast, a male benefit from ensuring that only his sperm is used to fertilize the female's eggs, thereby passing only his genes on to the next generation.

"We now have more information about the series of complex behaviors,

as well as chemical and visual cues and signals that facilitate mate location and help the male find the female again on a huge tree in order to guard her from other males," Hoover said.

All four trail pheromone components have been synthesized and behavior activities have been evaluated in the laboratory bioassays, according to Aijun Zhang, research chemist, U.S. Department of Agriculture, Agricultural Research Service, Beltsville Agricultural Research Center, Invasive Insect Biocontrol and Behavior Laboratory. The synthetic trail pheromone may be useful in managing the invasive beetles in the field. Zhang isolated, identified and synthesized the pheromone.

"It is possible that the synthetic version of pheromone could be used in combination with an insect pathogenic fungus that is being studied at Cornell University by Ann Hajek," Hoover said. "This fungus can be sprayed on a tree, and when beetles walk on it, they pick up the fungus, which infects and kills them. By also applying the pheromone that female beetles use to attract males, we can trick the male beetles into going to the deadly fungicide rather than to a fertile female."

The team plans to further investigate the pheromone by attempting to identify where on the body the female produces it, how the pheromone is detected by the male, how long the pheromone remains detectable on the tree and if there are other behaviors that might be mediated by these chemicals.

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Other authors on the paper include Maya Nehme of Lebanese University; Peter Meng, graduate student in entomology, Penn State; and

Shifa Wang of Nanjing Forestry University.

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