Novel 'attract-and-kill' approach could help tackle Argentine ants

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This photo shows Argentine ants. Credit: D-H Choe Lab, UC Riverside.

After being inadvertently introduced in the United States from South America, Argentine ants have successfully invaded urban, agricultural, and natural settings nationwide. In urban California, the Argentine ant is among the primary pest ants. For example, this particular species of ants

makes up 85 percent of ants sampled by commercial pest control companies in just the Greater San Diego Area.

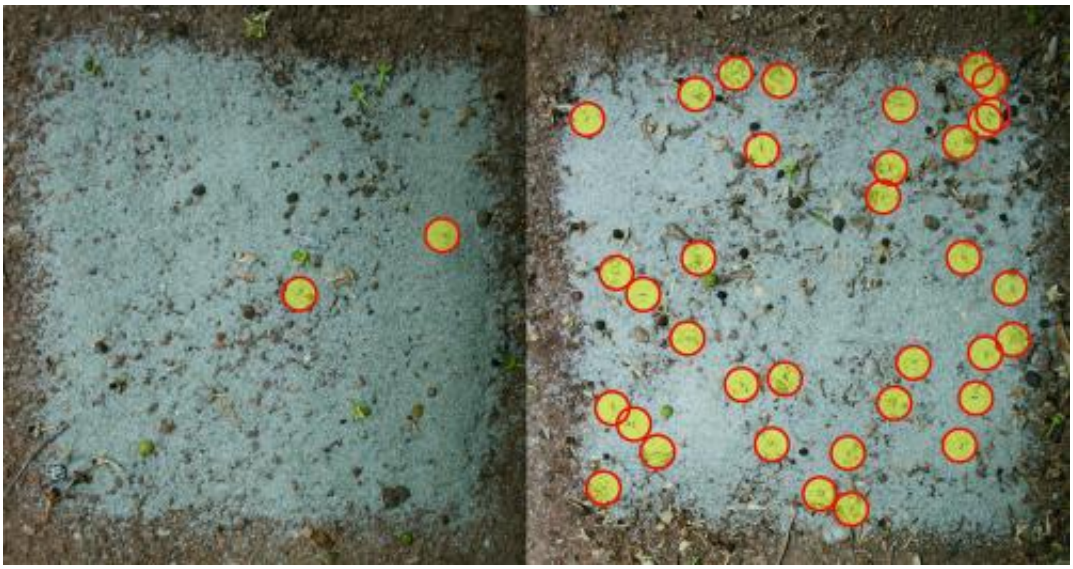
Entomologists at the University of California, Riverside have now developed a "pheromone-assisted technique" as an economically viable approach to maximize the efficacy of conventional sprays targeting the invasive Argentine ant.

They supplemented insecticide sprays with (Z)-9-hexadecenal, a pheromone compound attractive to ants, and were able to divert Argentine ants from their trails and nest entrances. Lured by the pheromone, the ants were eventually exposed to the insecticide residue, and killed.

Study results appeared Dec. 23, 2013, in the online fast track edition of the *Journal of Economic Entomology*.

"Our experiments with fipronil and bifenthrin sprays indicate that the overall kill of these insecticides on Argentine ant colonies is substantially improved—by 57 to 142 percent—by incorporating (Z)-9-hexadecenal in the sprays," said Dong-Hwan Choe, an assistant professor of entomology and the research project leader, whose lab focuses on urban entomology, insect behavior and chemical ecology.

According to Choe's research team, the current "attract-and-kill" approach, once it is successfully implemented in practical pest management programs, could potentially provide maximum control efficacy with reduced amount of insecticides applied in the environment.



A field study was conducted to determine if Argentine ants would be attracted from a nest entrance and nearby trails to an aqueous pheromone spray deposit. The red circles indicate the positions of ants. The sand patch on right was sprayed with water supplemented with the synthetic pheromone (Z)-9-hexadecenal. The sand patch on left was sprayed with water only. After a few minutes, the number of ants on the pheromone-treated patch exceeded the number of ants on the water-treated patch. The nest entrance and nearby trails were located between the patches of sand. Credit: D-H Choe Lab, UC Riverside

"Given the amount of insecticides applied today to urban settings for Argentine ant control and the impact of these insecticides on urban waterways, it is critical to develop alternative integrated pest management strategies in order to decrease the overall amounts of insecticides applied and found in urban waterways, while still providing effective control of the target ant species," Choe said.

He explained that other studies have explored the possibility of using the synthetic pheromone (Z)-9-hexadecenal for Argentine management program. These studies, however, only explored the use of the pheromone to disrupt the foraging of Argentine ants.

"What makes our study unique is that we combine the insecticide sprays and low-dose pheromone to attract ants," Choe said. "Our ultimate goal is to minimize the impact of pest damages on urban life with, at the same time, no—or minimal—negative impact on the environment, non-target organisms, and human health."

According to Choe, from a practical standpoint, future development of the proper formulation of (Z)-9-hexadecenal would help improve its efficacy and usability.

"The physicochemical characteristics of the pheromone formulation are important factors in improving the persistence of its effect," he said. "Proper packaging also would be necessary because the pheromone's stability could be compromised if the pheromone is mixed with the insecticide formulation and held in long-term storage. Some of these questions could be addressed with assistance from industry collaborators."

This photo shows Argentine ants. Credit: D-H Choe Lab, UC Riverside.

The UCR Office of Technology Commercialization has filed a patent on the pheromone-assisted technique developed by the researchers.

Choe was accompanied in the research by UCR undergraduate students Kasumi Tsai and Carlos M. Lopez; and laboratory staff research associate Kathleen Campbell.

Study details

The study used one milligram of synthetic (Z)-9-hexadecenal per 500 milliliters of spray preparation (0.002 milligrams per milliliter). Given that the typical amount of spray preparation applied in an average size house is about 1.9-3.8 liters (0.5-1 gallons), the total amount of pheromone required for treating a house would be less than 10 milligrams. Based on the current price of the synthetic pheromone (less than $40 for one gram), 10 milligrams of synthetic (Z)-9-hexadecenal would cost approximately $0.40. If the pheromone-assisted techniques are effective in reducing the amount of insecticide for achieving a satisfactory level of control, homeowners or commercial pest management companies could reduce both the amount of active ingredient applied in the environment and the insecticide cost.

Provided by University of California - Riverside