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National Research Initiative (NRI)

Selecting the Perfect Insect Pest

by Stacy Kish, CSREES

America's forests are under attack, but scientists believe the careful release of insect predators may effectively control the invasion. Garlic mustard (*Alliaria petiolata*) has become an invasive species spreading throughout temperate forests across the United States. >>

This plant is choking out native plants on forest floors, threatening ecosystem diversity. With funding from USDA's Cooperative State Research, Education, and Extension Service, an international group of scientists created a computer model to predict the perfect insect predators for this invasive plant.

Adam Davis and colleagues at the University of Illinois, Michigan State University, and Cornell University tackled this issue along with the Commonwealth Institute of Biological Control in Switzerland. The scientists believe by introducing the perfect pest, in combination with quarantined research tests, will help reduce the garlic mustard population."

"The traditional method [of eradication] was to release multiple agents into the environment to overwhelm the pest," Davis said. "But multiple introductions also lead to an increased likelihood that one of the agents will become invasive as well. So, what we're trying to do is to figure out which one is the most likely to actually have an impact on garlic mustard and release as few agents as possible."

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Right: The weevil (***Ceutorhynchus scrobicollis***) may be the biocontrol answer to invasive garlic mustard.

Credit: Harriet Hinz and Esther Gerber

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Above: Garlic mustard attacked by weevils appear water-stressed, have reduced seed production, and at high infestations, die prematurely in early spring without producing seeds.

Credit: Harriet Hinz and Esther Gerber

The computer model simulates changes in the pest population in relation to introduction, growth cycle and environmental stressors. Scientists enter each pest into the program one at a time until the perfect biological control agent is identified. Scientists then collect data during field experiments and enter it into the computer model to make the most accurate predictions possible.

For garlic mustard, the model identified a tiny weevil by the name of *Ceutorhynchus scrobicollis*. This insect, which is no larger than an "o" in 12-point type, is a native pest to the plant in Europe; it feeds on the plant at several stages of its life cycle.

Before a control agent is released, scientists perform a stringent battery of tests in a quarantined environment. For the garlic mustard test, the weevil was exposed to no-choice feeding tests on 76 different species, which included 45 members of the cabbage family, of which garlic mustard belongs. Horitculture varieties of the cabbage family were also included as test plants. If the weevil liked, and could complete its life cycle on any of the horticultural varieties, the weevil would be a threat to an important agricultural crop. The weevil passed that test and proved it was an acceptable biological control agent for use with a wide variety of plants.

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The weevil is scheduled for release into an infested forest once it receives approval from the species evaluation and quarantine arm of the USDA, the Animal and Plant Health Inspection Service. Davis believes the models provide the guidance to effectively and safely select biological control organisms to reduce the threat of invasive plants

Garlic mustard came to the United States from Europe in the 1870s as a culinary herb. The weevil, its natural enemy, did not make the same journey.

CSREES funded this research project through the National Research Initiative Biology of Weedy and Invasive Species in Agroecosystems program. Through federal funding and leadership for research, education, and extension programs, CSREES focuses on investing in science and solving critical issues impacting people's daily lives and the nation's future. For more information, visit visit www.csrees.usda.gov. ■

References

Davis, A. S., D. A. Landis, V. Nuzzo, B. Blossey, H. Hinz and E. Gerber. 2006. Demographic models inform selection of biocontrol agents for garlic mustard (*Alliaria petiolata*). *Ecol. Appl.* 16: 2399-2410.