Research team uses tiny wasp to wipe out major agricultural pest in Tahiti

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Glass-winged sharpshooters on leaves. Credit: Hoddle lab, UC Riverside

A research team led by Mark Hoddle, a biological control specialist at UC Riverside, has nearly eradicated the glassy-winged sharpshooter, a major agricultural pest, from the island of Tahiti and several other French Polynesian islands in the South Pacific Ocean. To achieve total pest suppression, the researchers used biological control, an inexpensive method that provides permanent control and can be applied to areas where the sharpshooter has become a nuisance.

The method involves introducing *Gonatocerus ashmeadi*, a microscopic parasitic wasp, into an ecosystem under siege from the glassy-winged

sharpshooter. The tiny stingless wasp attacks glassy-winged sharpshooter eggs by drilling a tiny hole in the egg through which the parasite lays its own egg. The wasp larva that hatches from the egg then eats the inside of the glassy-winged sharpshooter egg, killing it. The wasp larva completes its development inside the host egg and then emerges as a tiny winged parasite that searches for more glassy-winged sharpshooter eggs to kill.

“We had the technology to do the job cheaply and in a way that brought about permanent control of the glassy-winged sharpshooter in Tahiti and its neighboring islands,” said Hoddle, an extension specialist in the Department of Entomology and the director of the Center for Invasive Species Research. “When biological control – the use of a pest’s natural enemies to keep the pest’s population growth in check – works, it is very effective and safe in most cases. The parasites spread naturally and on their own, and they fly, requiring little, if any, continuous human assistance over a wide geographic area.”

Study results appear in the February issue of *Biological Invasions*.

With no type of natural control in Tahiti, the excessive number of glassy-winged sharpshooters was a major social, economic, and agricultural nuisance on the island. The pest was especially present in high numbers in urban areas along the coast where it was severely affecting the health of trees and bushes upon which massive numbers of pests were feeding. When the island’s government scientists approached Hoddle for guidance in 2003, he agreed to assist.

After safety evaluations, Hoddle and his colleagues released nearly 14,000 parasitic wasps at 27 sites in Tahiti between May 2005 and October 2005, resulting in rapid parasitism of glassy-winged sharpshooter eggs. By December 2005, the wasp had colonized the entire island of Tahiti, and glassy-winged sharpshooters decreased in number at all study sites to less than 5 percent of their original population density.

As a result of the rapid and dramatic reduction in the population of the glassy-winged sharpshooter in Tahiti, several problems associated with the pest diminished, such as excessive feeding on plants, high levels of sharpshooter excrement raining from trees, and home and shop invasions by hundreds of sharpshooters at night due to the pests' attraction to lights.

"Populations of the glassy-winged sharpshooter have been successfully maintained at a very low level in Tahiti for over two years, the time our experiments ended," Hoddle said. "Tahitian farmers have said their fruit production has improved in comparison to years when the sharpshooter was in abundance. The success of biological control with host-specific natural enemies demonstrates that alternative technologies that are not chemically driven can be very effective in suppressing invasive species."

Native to the southeastern U.S and northeastern Mexico, the sharpshooter is a half-inch long leaf hopper, dark brown in color, that has threatened the wine, table grape, and raisin industries in California since the 1980s because of a lethal bacteria that it spreads when feeding on plants.

The glassy-winged sharpshooter is a vector of *Xylella fastidiosa*, a bacterial pathogen that has potential to wipe out the grape, peach and almond industry, as well as many ornamental bushes and trees. *Xylella fastidiosa* causes Pierce's disease that can kill a grapevine in just two years.

Xylella kills plants by blocking the water conducting system, or xylem. The blockages reduce water flow to leaves. Water stress is visible as scorched leaves, which quickly dry and drop. Plants often die when these symptoms become obvious.

Because of its ability to spread a plant pathogen, the sharpshooter

threatens native biodiversity and agriculture, In addition to grapes, the bacteria it spreads kills almonds, peaches, plums, olives, oleanders, and liquidambar.

A voracious eater, the sharpshooter can consume up to 100 times its body weight per day in plant fluids, and produces copious amounts of watery excreta that often “rains” down from trees, causing a social and recreational nuisance.

The glassy-winged sharpshooter, which invaded Tahiti in 1999, is also proving to be a nuisance in Easter Island (arrived 2005) and the Cook Islands (arrived 2007). It was also a pest in Hawai'i (arrived 2004) until *G. ashmeadi*, which controlled glassy-winged sharpshooters in Tahiti, accidentally arrived in Hawai'i.

Hoddle was joined in the study by Julie Grandgirard, Jerome N. Petit, George K. Roderick and Neil Davies of UC Berkeley. The French Polynesian government provided financial and logistical support for the project in French Polynesia.

Next in his research, Hoddle will work on a variety of pest species in their home countries to explore what controls their local populations.

“We are being proactive in our research by understanding these pests in their home environments,” Hoddle said. “That way we will be better prepared for these new pests should they arrive unexpectedly one day at our doorstep.”

Source: University of California - Riverside

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