This second update on glassy-winged sharpshooters (the first appeared in April 2001) details how California researchers and scientists are waging a desperate effort to stop the onslaught of this new threat to both the wine and the horticulture industries.

Above left: Glassy-Winged sharpshooter takes its name from its glass-like wings; above right: GWSS on grape vines. (Photos courtesy of Regents of the University of California.)

Fighting the GWSS With Science

By Beth Meneghini

The bad news is that the disease-spreading glassy-winged sharpshooter (GWSS) continues to grab headlines in California. The good news is that the pest is no longer hogging the spotlight. Through innovative research and generous funding, California entomologists and other researchers finally have some positive research results to send to the industry.

THE VILLAIN

Pierce's Disease is caused by a bacterium (*Xylella fastidiosa*) that clogs a plant's xylem and effectively shuts down its ability to take in water and nutrients. The glassy-winged sharpshooter, which carries Pierce's Disease, has been found in Riverside, San Diego, San Bernardino, Ventura, Orange, Santa Barbara, Los Angeles, Kern and Tulare Counties.

Pierce's Disease is most often associated with the wine industry; the bacteria's "scorch" can completely decimate infected vines in as little as 1-2 years. Unfortunately, GWSS is not as picky. The leaf-hopping pest travels long distances by insect standards and will feed on any number of host plants. The GWSS is partial to citrus trees for egg laying and, because citrus growers are often in close proximity to greenhouses and ornamental growers, the GWSS often hitches a ride on bedding plants.

The growing concern is that the GWSS, now detected as far north as San Jose, may spread Pierce's Disease throughout the state's grape-growing regions. If this occurs, production would be threatened on more than 700,000 acres of wine, raisin and table grapes valued at $2.8 billion a year.

THE GOOD GUYS

The California Department of Food and Agriculture (CDFA) is fighting the half-inch leafhopper with $6.9 million. The state has also pursued federal assistance, leading to the passage of a Congressional bill providing another $22 million to fight the pest.

The CDFA and the University of California system each appointed a task force to address the Pierce's Disease crisis. The CDFA Glassy-Winged Sharpshooter / Pierce's Disease Task Force was established in September 1999.

The primary focus of the CDFA task force is to mobilize the scientific, technical and information-outreach expertise in California to find solutions to this problem. Research projects hone in on the glassy-winged sharpshooter and pursue methods for slowing the spread of Pierce's Disease in Southern California.

"Greenhouse growers have been on board from the start," said Jay Van Rein, information officer for the CDFA. "To stop the immediate spread of the disease, growers were forced to comply with stringent shipping and inspection standards. The investment of time and money was great, but growers did all they could to help."

Now, the Task Force is trying to even the score, overseeing dozens of research projects to eradicate Pierce's Disease and the GWSS, thus eliminating the burden of containment and detection from greenhouse growers.

THE RESEARCH

The task force is utilizing a variety of research strategies to fight the disease and its carrier. From testing "net-like" barriers to trialing insecticide treatments to developing genetically-resistant varieties, researchers are approaching the problem from every angle.

Much of the research is taking place in or around the University of California–Riverside.

"We're right in the thick of things out here," said Dr. James Bethke, staff research associate in the entomology department at UC–Riverside. "We're right on the front lines with the culprit itself."

Bethke's lab has conducted more than 20 greenhouse pesticide screening trials using more than 50,000 insects. Results confirm that adult GWSS are susceptible to a number of insecticide classes.

"Outstanding results were obtained with imidacloprid, bifenthrin and fenopropathrin," said Bethke.

Part of Bethke's work is testing the effectiveness of various pesticides at different stages of the GWSS lifespan. "From my point of view, and that of the floriculture industry, the most important trials are those that target the egg stage of the GWSS," said Bethke.

Unfortunately, GWSS eggs are the most difficult to control. In fact, no

product tested thus far has demonstrated ovicidal effects. There are, however, pesticides with a high efficacy rate for nymphs.

"There are several pesticides that cause 100 percent mortality rates in emerging nymphs," said Bethke. "Carbaryl, diazinon, fenpropathrin, imidacloprid and thiacloprid have shown great results in the lab."

Greg Ballmer, a staff research associate also at UC–Riverside tests novel pesticides such as neonicotinoids, growth regulators and ecdysteroid inhibitors against GWSS. Several groups have shown promise in combating the pest.

"Preliminary observations seem to indicate that commercially available neonicotinoid products are effective in reducing GWSS when applied through irrigation systems," said Ballmer. "More or less 'standard' broad-spectrum pesticides, such as chlorpyrifos and synthetic pyrethroids, are also effective in reducing or eliminating GWSS."

Of course, GWSS pesticide trials also test efficacy of application rates and methods as well as plant size and type.

"Type of crop can certainly impact the efficacy of a particular pesticide," said Bethke. "We've discovered that imidacloprid will work better in potted ornamentals and less consistently in field-grown citrus and grapes."

Bethke's research has also found that most potted plants react differently to imidacloprid than do landscape plants. Size of plant also tremendously affects the amount of time it takes for the entire plant to be protected as well as how long the chemical will remain effective.

THE ORGANIC FIGHT

While pesticides will continue to be the more common weapon used against the glassy-winged sharpshooter, biological controls are becoming an important tool in the fight.

"Solving this problem will require a completely integrated approach," said Bethke. "We are looking at more than simply chemical control of the pest and the disease it spreads. It will take a combined effort to keep the disaster from becoming complete."

Biological studies such as survivorship of the GWSS, host plant preference and performance, temperature development, and biology and behavior of the GWSS, help researchers understand and interpret results from chemical trials.

According to Mark Hoddle, a biological control specialist with UC–Riverside, establishing new species of natural enemies to the GWSS will significantly reduce the densities of the GWSS and result in fewer insecticide applications.

"We are particularly interested in establishing egg parasitoids for GWSS control," said Hoddle.

He recently led a seven-month breeding and quarantine program on a tiny, stingerless wasp that may help combat the GWSS. The parasitic, non-native *Gonatocerus triguttatus* is successfully reducing popula-

tions of the sharpshooter in Mexico and Texas. The wasp parasitizes the sharpshooter by laying its eggs inside those of the larger insect. Once hatched, the wasps eat their way out.

David Morgan, a postdoctoral researcher, has raised the wasps and is releasing them in limited numbers in citrus groves and other locations, where they can begin to form field populations. Additional releases are planned in Ventura, Kern, Tulare and Fresno Counties.

Another egg parasitoid of the GWSS, *Gonatocerus ashmeadi*, is also being reared in mass numbers. These native California wasps are currently being studied for their susceptibility to more common pesticides used in the nursery industry.

Another innovative research tactic takes advantage of the sharpshooters' natural tendency to fly low to the ground.

"Sharpshooters normally fly between 3-16 feet from the ground," said Matthew Blua, a UC–Riverside post-doctoral researcher. "We would like to take advantage of that potential weak link in the system to keep sharpshooters out of vineyards, citrus groves and nurseries."

Last year, Blua placed sharpshooter traps on poles at 3, 10, 16 and 23 feet from the ground. "Ninety-five percent of glassy-winged sharpshooters were caught at five meters (about 16 feet) or lower," Blua said. "We want to determine what happens when sharpshooters make contact with the barrier: if they walk or fly up and over, or if they turn around and fly the other way. We'll also be looking at the barrier combined with pesticide treatments to see what impact they have on preventing infection of grapevines with Pierce's Disease."

A GWSS-FREE FUTURE?

While researchers have not yet been able to completely rid greenhouses of glassy-winged sharpshooters, most are cautiously optimistic that they are on the right track.

"Both biological and chemical controls hold promise in fighting this pest and disease combo," said Bethke. "If growers hang in there and continue to be proactive, this thing can be beat."

Growers' vigilance has already had a tremendous effect on the GWSS population in California. Ballmer's lab, which reports observations of the area-wide GWSS/Pierce's Disease control program in the Temecula Valley, has found a dramatic reduction in GWSS densities (more than 90 percent) since one year ago.

"The research and regulation now underway in California could teach all of us in agriculture some important lessons about working together to combat a common enemy," said Van Rein. GPN

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