RIVERSIDE COUNTY GLASSY-WINGED SHARPSHOOTER AREA-WIDE MANAGEMENT PROGRAM IN THE COACHELLA AND TEMECULA VALLEYS

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Reporting Period: The results reported here are from work conducted October 2005 through September 2006.

ABSTRACT
Riverside County has two general areas where citrus groves interface with vineyards, the Coachella and Temecula Valleys. The Coachella Valley with 10,438 acres of table grapes in proximity to 12,000 acres of citrus and the Temecula Valley with 2,000 acres of wine grapes in proximity to 1,600 acres of citrus are vulnerable to Pierce's disease (PD), *Xylella fastidiosa* (*Xf*). The grapes in the Coachella and Temecula areas of Riverside County are in jeopardy because of the glassy-winged sharpshooter (GWSS), the vector of the PD bacterium, build up in adjacent citrus groves. Citrus is an important year around reproductive host of GWSS in Riverside County, but also one that concentrates GWSS populations over the winter months during the time that grapes and many ornamental hosts are dormant. GWSS weekly monitoring in citrus and in grapes began in March 2000 in Temecula Valley and 2003 in Coachella Valley by trapping and visual inspections. Systemic insecticides such as Admire (imidacloprid), gave excellent control. Coachella Valley GWSS populations have increased since the treatment program was initiated in 2003 but have declined substantially relative to the pre-action levels due to insecticide applications.

INTRODUCTION
The glassy-winged sharpshooter (GWSS) vectors a bacterium that causes Pierce's disease (PD). This insect and bacterium are a severe threat to California's 890,000 acres of vineyards and $30 billion dollar industry. An area-wide GWSS management program was initiated in Temecula in 2000 to prevent this vector's spread into other California grape growing regions. In Temecula valley itself, the wine grape industry and its connecting tourist industry generate $100 million of revenue for the economy of the area. GWSS/PD caused a 30% vineyard loss and almost destroyed the connected tourist industry. The area wide GWSS management program initiated in the spring of 2000 saved the industry from a 100% loss. Only a continuation of an area-wide GWSS management program will keep the vineyards viable in Temecula. The table grape industry in the Coachella Valley is represented by 10,465 acres of producing vines, which generate fresh market grapes valued at an average of over $110 million annually. The GWSS was identified in the Coachella Valley in the early 1990's. Population increases of this insect in Coachella Valley in the last three years have increased the danger of PD occurrence in this area, as has occurred in similar situations in the Temecula and San Joaquin Valleys. In July 2002, the occurrence of *Xylella fastidiosa (Xf),* the PD bacterium, was found in 13 vines from two adjacent vineyards in the southeastern part of the Coachella Valley. With this discovery, and the increasing GWSS populations, there was and is a real need to continue an area-wide GWSS/PD management program, to prevent an economic disaster to the work forces and connect small businesses of Mecca, Thermal, Coachella, Indio, etc. that depend upon the vineyards for a big portion of their incomes. Only a continuation of an area wide GWSS/PD management program will keep the vineyards viable in Coachella. At present there are no apparent biological or climatological factors that will limit the spread of GWSS or PD. GWSS has the potential to develop high population densities in citrus. Insecticide treatments in citrus groves preceded and followed by trapping and visual inspections to determine the effectiveness of these treatments are needed to manage this devastating insect vector and bacterium. Approximately 1,750 acres of citrus in Riverside County were treated for GWSS in February through July of 2006 between a cooperative agreement with USDA-APHIS and the Riverside Agricultural Commissioner's Office under the "Area-Wide Management of the Glassy-Winged Sharpshooter in the Coachella and Temecula Valleys." The cost of the 2006 Riverside County GWSS treatments was close to $700,000. This is down from the 5,200 acres treated in 2005 at a cost of $1,000,000.

OBJECTIVES
1. Delineate the areas to be targeted for follow-up treatments to suppress GWSS populations in the Temecula and Coachella Valleys for 2006.
2. Determine the impact of the 2005 GWSS area-wide treatments to suppress GWSS populations in citrus groves and adjacent vineyards.

RESULTS AND CONCLUSIONS

The programs in Coachella and Temecula were dependent upon growers, pest management consultants and citrus and vineyard manager participation. The areas encompass approximately 28,000 acres. Representatives of various agencies were involved in the program, they were as follows: USDA-ARS, USDA-APHIS, CDFA, Riverside County Agricultural Commissioner, University of California, Riverside (UCR), University of California, Cooperative Extension, and grower consultants. Representatives of these agencies meet to review the program. Newsletters are sent to growers, managers, wineries, and agencies with information on GWSS populations and insecticide treatments via e-mail. The information from Temecula is sent weekly, while information from Coachella goes to the various parties monthly.

The GWSS/PD citrus groves and vineyards within the GWSS/PD management areas were monitored weekly to determine the need and effect of insecticide treatments on GWSS populations. Yellow sticky panel traps (7 x 9 inches) were used to help determine GWSS population densities and dispersal/movement within groves and into vineyards (Figures 1 and 2). A total of 986 GWSS yellow sticky panel traps are monitored weekly. Based on trap counts and visual inspection, approximately 1,500 and 250 acres of citrus were treated in Coachella and Temecula, respectively, for GWSS control in 2006. In Temecula and Coachella Valley treatments for GWSS in citrus were initiated when at least one to two GWSS adults were found at the same trap location for two consecutive weeks. In Temecula Valley, only the citrus where the GWSS were found was treated. In Coachella Valley, all citrus located within a 0.5 mile radius from the trap finds were treated as a preventive measure to protect surrounding groves. The decision to treat more area from GWSS finds in Coachella than what was treated in Temecula differed because of terrain, urban development and the history of GWSS blow-ups in Kern County and Temecula Valley the fourth year after GWSS area-wide programs were initiated. Approximately 91% of the citrus was treated with a single application of Alias (imidacloprid) at 36 ounces per acre. Organically grown citrus (9%) was treated with PyGanic (1.4% Pyerthrins) at 7 pints per acre. In most areas where PyGanic was used to manage GWSS, follow up treatments of PyGanic were applied one month after the first application for two consecutive months.

For a successful area-wide GWSS management program with large acreages of citrus, a management program has to be initiated. Organic insecticides are not as effective as the neonicotinoid insecticides, such as imidacloprid, for controlling GWSS. Therefore, organic insecticides will have to be applied more frequently than their synthetic counterparts. In our Riverside County GWSS area-wide program, organic citrus groves pose challenges to area-wide GWSS management programs (Figure 3).

FUNDING AGENCIES

Funding for this project was provided by the USDA Animal and Plant Health Inspection Service, and the California Department of Food and Agriculture.

Additional note: We would like to especially thank Ben Drake of Drake Enterprises for his input and counsel and the grape and citrus growers, managers and pest control advisors for their needed cooperation to make the Riverside County GWSS area-wide management program successful. We want to thank Heavenly Clegg for her development of the Temecula GWSS newsletter and Gevin Kenny for managing the Temecula GWSS monitoring and data analysis. We would especially like to thank CDFA's Rosie Yacoub for bar-coding of the GWSS yellow sticky panel traps, which resulted in simplifying our data input and mapping of GWSS populations in Temecula and Coachella Valleys.

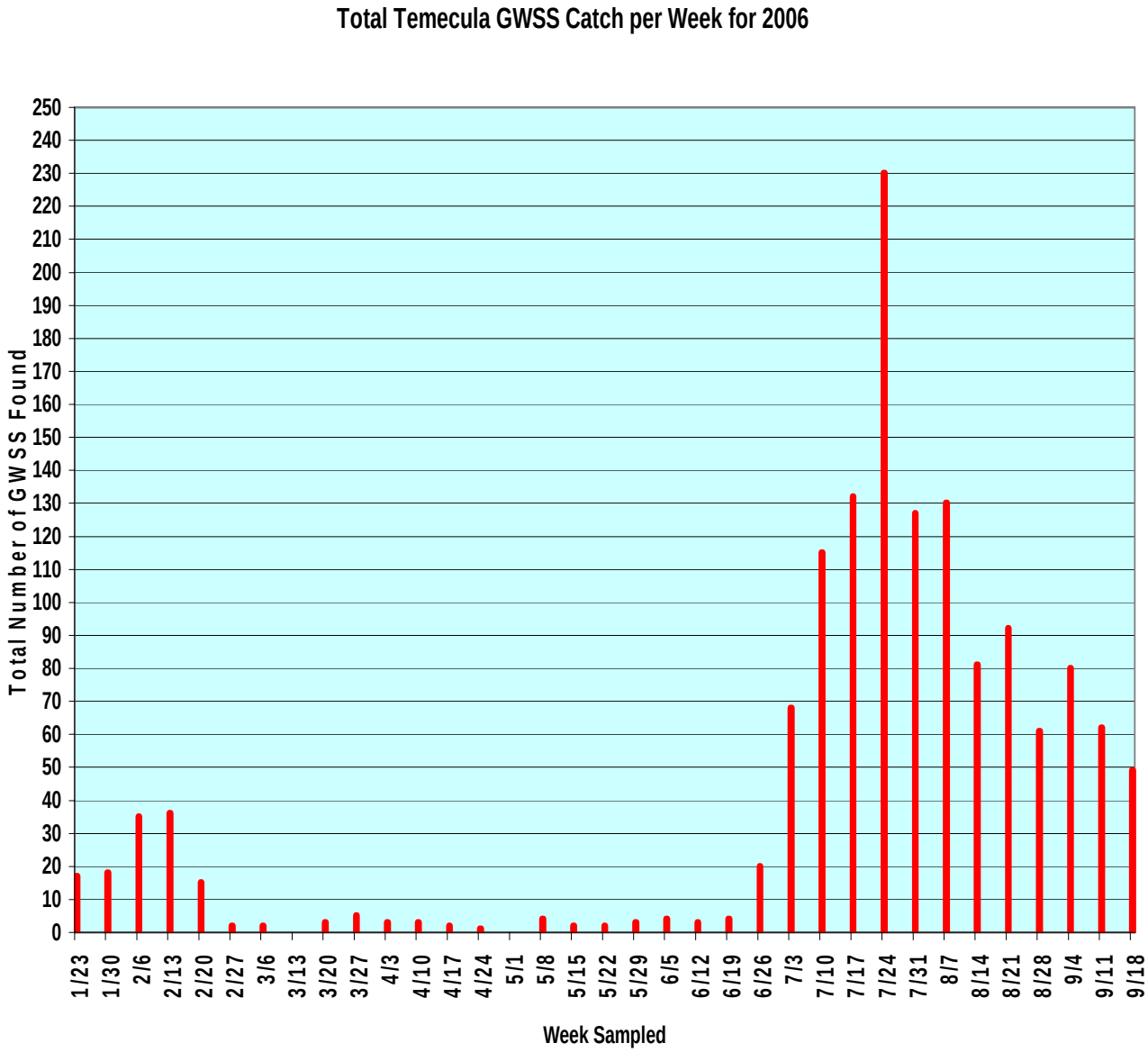

Figure 1. In 2006, high numbers of adult GWSS were caught on the yellow sticky panel traps in Temecula, with populations peaking in July, reaching a total of 230 trapped.

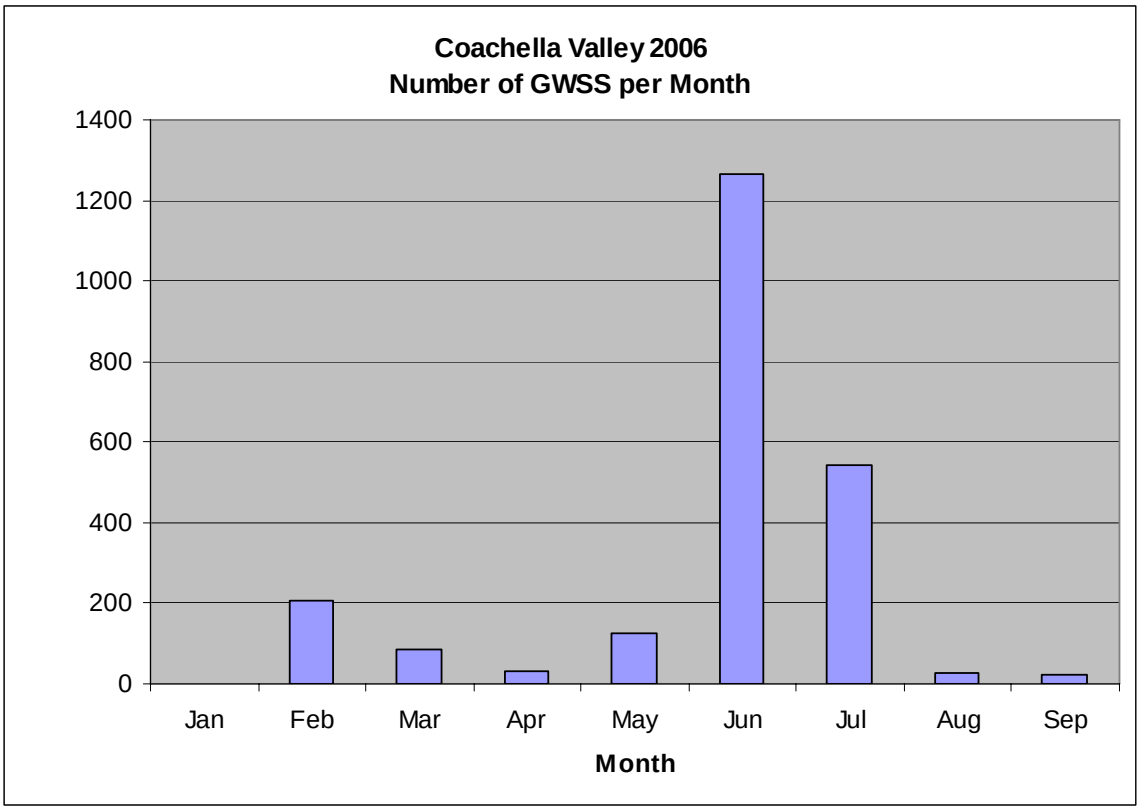

Figure 2. GWSS populations in Coachella Valley peaked in June 2006 with a high of 1,266 trapped.

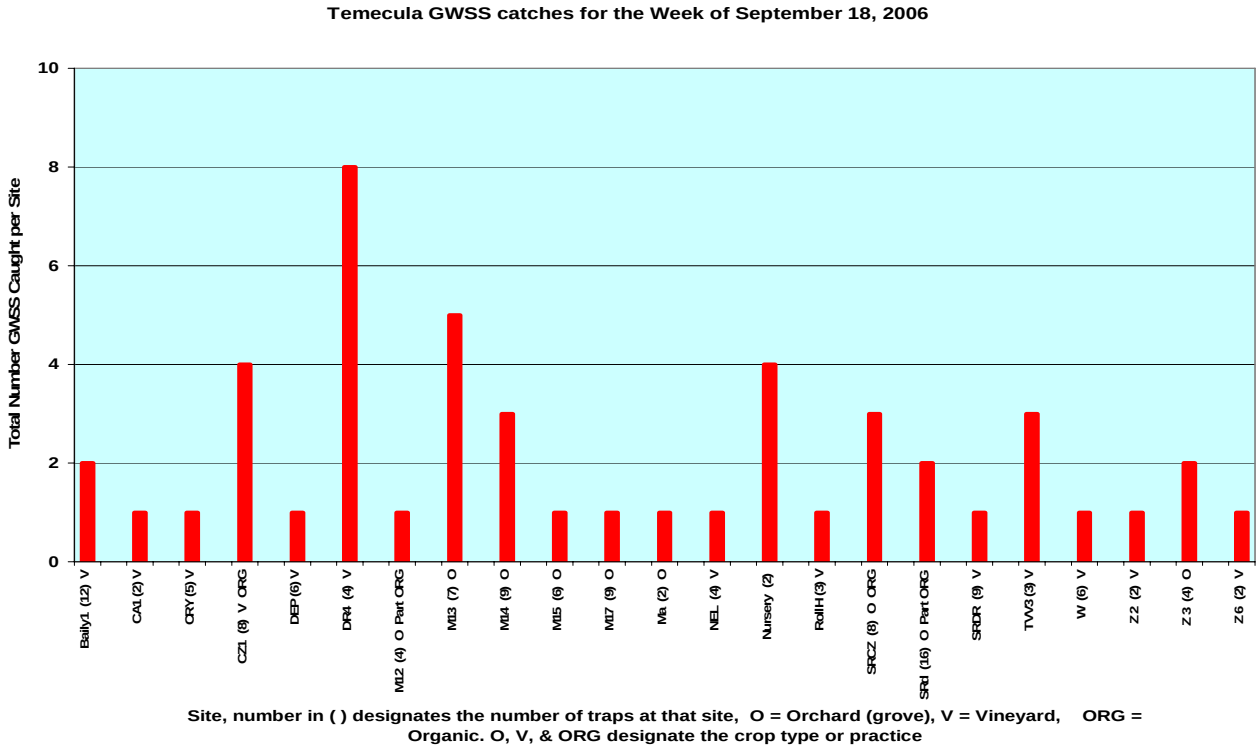

Figure 3. Temecula GWSS adults caught for the week of September 18, 2006.

COMPATIBILITY OF SELECT INSECTICIDES WITH NATURAL ENEMIES OF THE GLASSY-WINGED SHARPSHOOTER AND OTHER PESTS

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Reporting Period: The results reported here are from work conducted November 2005 to September 2006.

ABSTRACT

To evaluate the compatibility of insecticides that have both a broad and limited spectrum of activity against biological control agents, laboratory studies were carried out to compare the relative susceptibilities of seven foliar and two systemic insecticides against four common species of beneficial insects: *Aphytis melinus* Debach, *Gonatocerus ashmeadi* Girault, *Eretmocerus eremicus* Rose & Zolnerowich, and *Encarsia formosa* Gahan. Evaluations with systemic insecticides also included two species of predators, *Geocoris punctipes* Say and *Orius insidiosus* Say. Foliar insecticides were evaluated by a petri dish technique across a range of concentrations to measure their effect on direct mortality of the parasitoids. A systemic uptake bioassay technique was used to determine the toxicity of systemics against the six species of beneficials. Insecticides tested are used against citrus and agricultural pests, and included acetamiprid, imidacloprid, thiamethoxam (all 3 are neonicotinoids); chlorpyrifos, (organophosphate); bifenthrin, cyfluthrin, fenpropathrin (all 3 are pyrethroids); and buprofezin and pyriproxyfen (two insect growth regulators = IGRs). Chlorpyrifos, a conventional organophosphate insecticide with broad-spectrum activity, was consistently the most toxic pesticide to all four species of beneficial insects tested. Among the pyrethroids, fenpropathrin demonstrated lower toxicity to parasitoids compared with bifenthrin or cyfluthrin. Acetamiprid, although efficacious against GWSS, exhibited fairly selective toxic characteristics to *G. ashmeadi* and *E. eremicus* until four days post-treatment while being toxic to *A. melinus* within 24 h after treatment. *Aphytis melinus* was the most susceptible hymenopterous parasitoid to all test insecticides. Buprofezin and pyriproxyfen, with a relatively narrow spectrum of activity, were less toxic to the parasitoids. Imidacloprid has been considered to be relatively selective, with limited impact on parasitoids because of its systemic activity. However, results from this laboratory study suggest that both systemics, imidacloprid and thiamethoxam, may not be as selective against parasitoids as was expected. To understand the bioassay results with the two systemics, quantification of imidacloprid and thiamethoxam in both the parasitoids and the test citrus leaves was evaluated using ELISA kits. Additional studies are underway in the laboratory to determine how the parasitoids are exposed to these two systemic materials through various routes of exposure. Selectivity of these two compounds to natural enemies is also being examined under field conditions. The results presented here will provide pest managers with specific information on the degree to which the tested insecticides are likely to be compatible with various natural enemies.

INTRODUCTION

The current management plan for glassy-winged sharpshooter, (GWSS), *Homalodisca vitripennis*, includes the use of a number of insecticides that are quite effective (Akey et al. 2001, Bethke et al. 2001, Prabhaker et al. 2006). However, if selected insecticides are effective against GWSS while showing minimal impacts on beneficial insects, biological control can be maximized. There has been little information available on the long-term impact that different control measures are having on GWSS populations and its natural enemies on citrus and grapes. Although biological control has been the foundation of citrus IPM in California for many years, it is now threatened by the arrival of several new pests and greater use of non-selective insecticides to control these new species. In particular, the recent registration of new insecticides for use on citrus is creating uncertainty over the long-term impact they may have on established IPM programs (Grafton-Cardwell and Gu 2003). Therefore, there is a need for accurate assessment of the impact of agrochemicals on both GWSS and nontarget insects, including parasitoids and predators. Such information is essential to attain greater understanding of the various control options for GWSS in citrus and how they can be best integrated with existing, successful management programs. The overall objective of this research project is to help determine IPM compatible management tactics by focusing on chemical controls being used against GWSS and evaluating their impact upon several important biological control agents. To address this goal, the impact of selected insecticides including those that are used against GWSS and other pests on citrus was assessed against a number of common beneficial parasitoids including *G. ashmeadi* (an egg parasitoid of GWSS), *A. melinus* (an endoparasitoid of armored scale insects on citrus), *E. eremicus* and *E. formosa* (two whitefly parasitoids), and two predators, *G. punctipes* and *O. insidiosus*. The relative selectivity of insecticides was determined in the laboratory using two bioassay techniques, a petri dish bioassay for foliar insecticides and a systemic uptake bioassay for systemic insecticides