

CURTAILING OVIPOSITION BY THE GLASSY-WINGED SHARPSHOOTER ON NURSERY PLANTS

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ABSTRACT

The containerized ornamental nursery industry in California has been implicated as the most likely source of new outbreaks of the glassy-winged sharpshooter (GWSS) *Homolodisca vitripennis* (formerly *H. coagulata*) in areas of the state that are not infested. For nurseries in GWSS-infested areas, rigorous quarantine requirements mandate GWSS monitoring, thorough plant inspections at shipping and receiving locations, and insecticide treatments. These requirements assume that one GWSS adult, or one egg mass can initiate a stable population. Thus, plant shipments are frequently rejected at the receiving location on the basis of an egg mass that was not detected and removed during the shipping site inspection. The costs associated with quarantine requirements and shipment rejection has become an important economic problem. Many nurseries in infested areas do not ship their product to areas that are not infested with GWSS, resulting in multi-million dollar losses.

In this study, we examine the impact of selected insecticides on GWSS oviposition on containerized nursery plants. The insecticides we selected for study are currently being used by the nursery industry in California to suppress insect populations. In two trials, examining 4 different plant species and 8 insecticides applied as foliar sprays or soil drenches, we found no suppressive impact on GWSS oviposition.

INTRODUCTION

The glassy-winged sharpshooter (GWSS) *Homolodisca vitripennis* (formerly *H. coagulata*) has arguably become the most important invasive species in California due to its propensity to spread diseases induced by *Xylella fastidiosa*, the most important being Pierce's disease of grapevines (Blua et al 1999). First identified in 1990 from collections in Orange and Ventura counties (Sorensen and Gill 1996), GWSS has spread throughout southern California from San Diego to Santa Barbara counties along the coast, and inland to San Bernardino and Riverside counties. More recently it has become established in Kern County. Over the past several years, local outbreaks of GWSS have been found in central and northern California counties where eradication efforts are underway.

Although no data are available that identify the source of these emerging populations, the ornamental nursery industry of California has taken the brunt of the responsibility on the basis of a most likely scenario involving the movement of the insect on containerized nursery material throughout the state. Additionally, it is widely accepted without evidence that the original establishment of GWSS in southern California occurred by dispersal on commercial nursery stock from the southeastern portion of the U.S. to California. (Sorensen and Gill 1996).

Currently, strict regulations have been imposed on the nursery industry to curtail movement of GWSS via containerized ornamentals transported from infested to non-infested counties. These regulations require thorough inspection by the office of county agricultural commissioners at both the origin of plants destined for transport and their destination. Additionally, local disinfestation protocols require repeated insecticide applications at the majority of nurseries shipping materials out of a quarantine area. Upon detection of GWSS at a destination nursery, costly insecticide treatments of the surrounding area are required as well as destruction of the infested material. Inspections and treatments are labor-intensive, time consuming, and result in substantial extra costs to growers, counties, and ultimately the state. It is important to note that nursery shipments can be rejected, leading to a spraying of the destination location and crop destruction, based on the simple presence of egg masses. In many cases the presence of an old egg mass (i.e. an egg-mass scar on the foliage) has been sufficient to trigger crop destruction, pesticide applications, and additional costly monitoring and surveillance. A determination of the viability of the masses is rarely if ever made. The assumption is that any egg mass detected is viable and capable of establishing a population.

The ornamental nursery industry needs new, cost-effective, solutions to the problem of transporting GWSS, especially as eggs, on nursery stock to non-infested areas of California. We believe that effective solutions can be immediately integrated

into current production systems on the basis of understanding the degree to which registered insecticides curtail oviposition, and knowing the relative susceptibility of various nursery plants to oviposition by GWSS.

OBJECTIVES

1. Determine the impact of selected foliar-applied insecticides applied to drip-irrigated potted plants on GWSS oviposition.
2. Determine the impact of selected soil-applied insecticides applied to overhead sprinkler-irrigated potted plants on GWSS oviposition.

RESULTS

Objective 1

We conducted a randomized block experiment in which *Lagerstroemia indica* and *Tristiana conferta* in 5 gal pots were sprayed to run-off with label rates of Safari 20SG (dinotefuran, 8oz/100gal), Marathon II (imidacloprid, 1.7flob/100gal), Tristar 70 WSP (acetamiprid, 1.2oz/100gal), Tempo SC Ultra (beta-cyfluthrin, 5.4flob/100gal), Deltagard T&O 5SC (deltamethrin, 8flob/100gal), and Sevin SL (carbaryl, 32flob/100gal). An untreated control was the seventh treatment. Plants were exposed to a natural *H. vitripennis* population at the University of California, Riverside, CA, and numbers of GWSS egg masses were counted weekly beginning one week after treatment over a three-week period.

Analysis of variance did not detect significant differences among treatments in the number of GWSS egg masses produced on plants for any of the three weekly counts for both *L. indica* ($F \leq 1.331$, $P \leq 0.269$) and *T. conferta* ($F \leq 0.871$, $P \leq 0.526$) (Figure 1).

Objective 2

We conducted a second randomized block experiment in a greenhouse. In this experiment, *Escalonia fradesii* and *Tecomaria compensis* in 1 gal pots were treated with drench applications of Safari 20 SG (dinotefuran, 4flob of a 24oz/100gal base solution) and Marathon II (imidacloprid, 4flob of a 9.2flob/100gal base solution). An untreated control was the third treatment. Over a 3-week period, 200 *H. vitripennis* adults were released into the greenhouse twice weekly, and egg masses were counted weekly beginning one week after treatment.

Analysis of variance did not detect significant differences among treatments in the number of GWSS egg masses produced on plants for any of the three weekly counts for both *E. fradesii* ($F \leq 1.331$, $P \leq 0.269$) and *T. compensis* ($F \leq 0.871$, $P \leq 0.526$) (Fig. 1). Out of 30 GWSS adults caged on experimental *E. fradesii* for 24 h, 30 survived on control plants, while 0 and 1, respectively, survived on plants treated with Safari and Marathon II three weeks after treatment.

CONCLUSIONS

Thus far, none of the insecticides commonly used in the ornamental nursery industry that we examined has made a direct impact on oviposition by GWSS. However, their indirect impact on oviposition is substantial due to population reduction alone. The need for a means of reducing GWSS oviposition remains strong due to the “0-tolerance” position assumed by current quarantine regulations. Determining a minimum viable population size for GWSS would allow us to refine existing quarantine protocols that mitigate the costs of inspection, monitoring and eradication efforts.

Other than examining additional insecticides and insect repellents, our further research will focus on documenting GWSS behavior to find points that can be exploited to interrupt oviposition.

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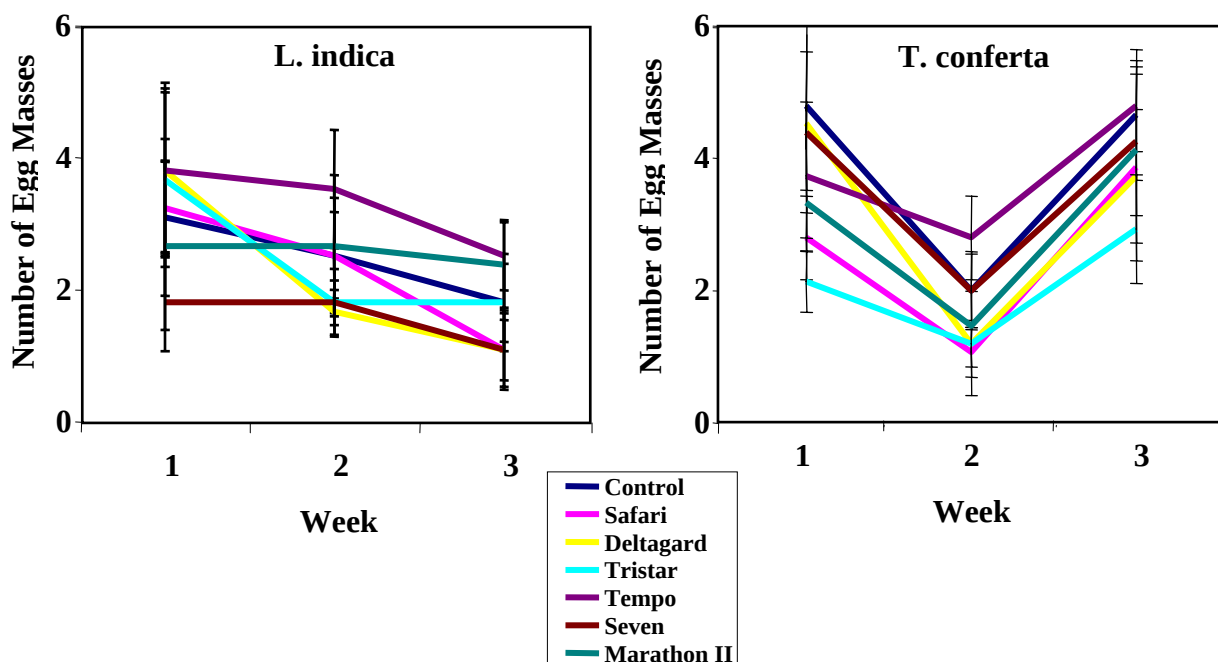


Figure 1. Number of GWSS egg masses on potted *Lagerstroemia indica* and *Tristiana conferta* treated with selected foliar-applied insecticides, and non-treated controls. Insecticides were applied one week before the first week count.

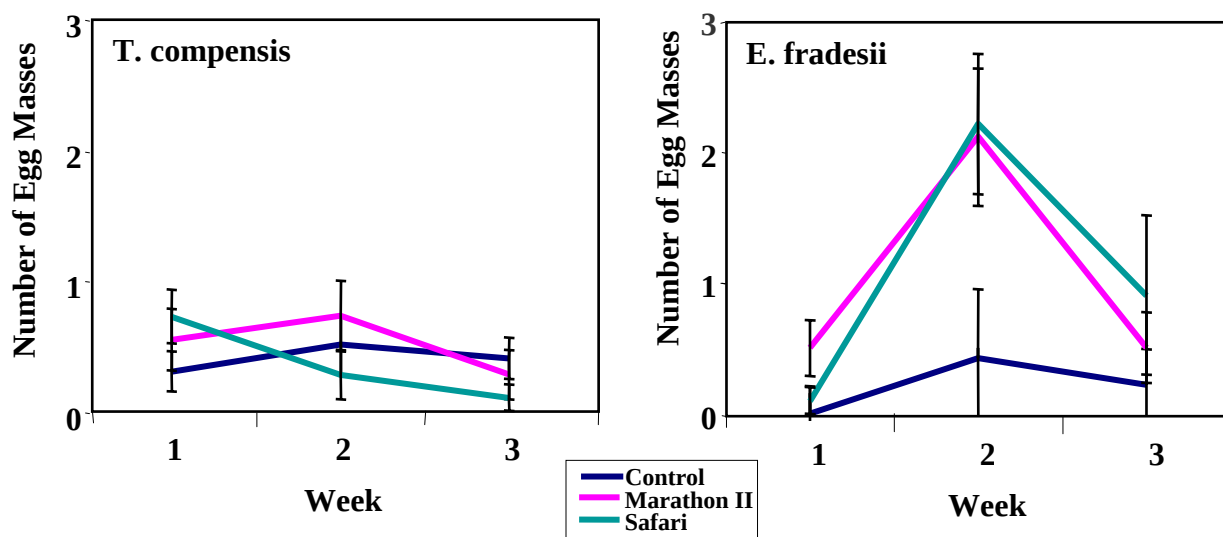


Figure 2. Number of GWSS egg masses on potted *Tecomaria compensis* and *Escalonia fradesii* treated with selected soil-applied insecticides, and non-treated controls. Insecticides were applied one week before the first week count.

POTENTIAL ISOLATES OF THE ENTOMOPATHOGENIC FUNGUS *BEAUVERIA BASSIANA* FOR GLASSY-WINGED SHARPSHOOTER CONTROL

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ABSTRACT

Two California isolates and a Texas isolate of the entomopathogenic fungus, *Beauveria bassiana* (Balsamo) Vuillemin, demonstrated their potential as effective pathogens of the glassy-winged sharpshooter (GWSS), *Homalodisca vitripennis* (formerly *H. coagulata*). Virulence of these isolates evaluated in the laboratory assays at different conidial concentrations and in small caged tests was similar. Adult GWSS feeding on plants sprayed with fungal inoculum were infected and killed by the fungus in the caged tests. When conidia were exposed to sun light and assessed for their viability, the two California isolates appeared to be more tolerant of solar radiation.

INTRODUCTION

A collaborative project between UC Davis and USDA-ARS is aimed at identifying suitable entomopathogenic fungi for the control of the glassy-winged sharpshooter (GWSS), *Homalodisca vitripennis* (formerly *H. coagulata*), a pest that threatens the grape industry in California as a vector of the Pierce's disease causing bacterium, *Xylella fastidiosa*. Entomopathogenic fungi, which enter the host through the cuticle, are ideal candidates for insects like GWSS with piercing and sucking mouthparts. Entomopathogenic fungi were isolated from GWSS in the Southeast US (Mizell and Boucias 2002, Kanga et al. 2004). But no fungal pathogen has so far been reported in California GWSS populations. However, we recovered several isolates of two generalist fungi, *Beauveria bassiana* (Balsamo) Vuillemin and *Metarhizium anisopliae* (Metschnikoff) Sorokin, from GWSS habitats in California and tested them against GWSS (Dara et al. In Press, Kaya et al. 2004, 2005). We also isolated *B. bassiana* from California harvester ant, *Pogonomyrmex californicus* (Buckley), three-cornered alfalfa hopper, *Spissistilus festinus* (Say) and a darkling beetle from Kern, Fresno and Riverside counties, respectively. These isolates were evaluated, along with a Texas isolate and the commercial isolate, for their virulence to adult GWSS and ability to grow at different temperatures (Dara et al. In Press). Based on the results, two California isolates – recovered from the three-cornered alfalfa hopper and a soil sample from a citrus orchard in Riverside Co – and the Texas isolate were further evaluated for their virulence at different concentrations and efficacy to infect GWSS when sprayed on the plants. Viability of these isolates following exposure to solar radiation and pathogenicity to selected natural enemies were also evaluated.

OBJECTIVES

1. Conduct surveys to find fungal infections in GWSS populations or insects closely related to GWSS.
2. Culture and isolate the fungi and evaluate their pathogenicity against GWSS.
3. Assess environmental effects like temperature and sunlight on conidial survival and germination, fungal growth, and infectivity.
4. Evaluate the host range of fungi that infect GWSS.
5. Conduct small-scale caged tests to evaluate selected pathogens against GWSS.

RESULTS

Natural infections in GWSS populations

We continue to search for natural infections in GWSS populations in southern California. GWSS adults were periodically collected in the urban areas around Bakersfield on Chinese photinia, prostrate acacia, oleander and crepe myrtle. These insects were maintained in the laboratory for the bioassays. No entomopathogenic fungi have been found in these insects.

Virulence of entomopathogenic fungi to GWSS:

Beauveria bassiana

Laboratory-reared GWSS adults supplied by CDFA, Riverside were used for the bioassays. The two California isolates and the Texas isolate of *B. bassiana* were evaluated against adult GWSS at three fungal concentrations - 105, 107 and 109 conidia/ml. GWSS were anesthetized by exposing them to CO₂ for 20 sec and then inoculated by rolling them in a 10 µl drop of conidial suspension. Controls were treated with 0.01% of Silwet, an adjuvant used to prepare conidial suspensions. GWSS were incubated on potted cowpea plants covered with cylindrical cages and their mortality was recorded daily for two weeks. Cadavers were surface sterilized in 3% sodium hypochlorite solution and incubated on water agar for fungal emergence. These assays were repeated twice. There were significant differences ($P < 0.05$) in the infections caused at different concentrations within each isolate (Figs. 1 and 2). But there was no significant difference among the isolates.