# BIOLOGICAL CONTROL OF THE GLASSY-WINGED SHARPSHOOTER IN KERN COUNTY, CALIFORNIA

**Project Leaders:**
Isabelle Lauzière, Matthew A. Ciomperlik, and Lloyd E. Wendel
USDA-APHIS-Plant Protection and Quarantine
Glassy-winged Sharpshooter Program
Edinburg, TX, 78539

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## INTRODUCTION

Throughout 2001, a technique to rear the glassy-winged sharpshooter was developed at the USDA-APHIS, GWSS facility located in Mission, Texas. Series of observations and experiments were carried out, in particular to select suitable host plants for feeding and oviposition and determine optimum environmental conditions. Difficulties experienced during the fall and winter of 2000 related to this insect's development and reproductive behavior were largely overcome and a self-sustaining glassy-winged sharpshooter colony with continuous egg production was finally achieved. We now find ourselves nearly independent of having to perform repeated field collections, with the exception of limited collections intended to increase the genetic diversity of our colony. From March 2001 to present, rearing personnel in Mission have produced 11 consecutive generations of glassy-winged sharpshooters, about 55,000 insects in 2001 and three times that many in 2002. This has allowed us to start rearing and studying several glassy-winged sharpshooter parasitoids during 2002. Since April, 20 generations of 3 parasitoid species, *Gonatocerus ashmeadi, G. triguttatus* and *G. morrilli* (Hymenoptera: Mymaridae) isolated from 7 geographically diverse sites have been produced at our laboratory, with a total production of over 50,000 parasitoids to date. In addition, several cultures of non-target sharpshooter species are being maintained for parasitoid host range studies (*Homalodisca insolita*, *H. lacerta* and *Oncometopia* sp.). Finally, several species of exotic parasitoids from Argentina are maintained within the USDA-APHIS quarantine facility and studied in a collaborative effort with Walker Jones (USDA-ARS).

Concomitantly, the Kern County Glassy-winged Sharpshooter Pilot Project developed several chemical-based management strategies to control this insect pest in an area-wide fashion (see report by L. Wendel and M. Ciomperlik). Initial goals established in this program called for the testing and integration of biological control methods with those chemical control methods that would be shown effective. Information gathered from laboratory observations, field testing and improvements to mass rearing of parasitoids indicate that area-wide integrated pest management for glassy-winged sharpshooter may be feasible in the immediate future. Classical biological control of glassy-winged sharpshooter may ultimately prove successful in the long term; however, augmentative approaches that follow area-wide population control programs, such as those in Bakersfield and Temecula, warrant further study. Large scale field testing in the 3700 acres of citrus in the Kern Pilot Project, comparing the efficacy of 3-4 species of *Gonatocerus* is planned in 2003.

Although very reliable, current rearing techniques must be further improved to where they become highly efficient and economical and allow to produce high numbers of natural enemies for field releases in the biological control and area-wide integrated pest management programs. The challenge: the glassy-winged sharpshooter develops rather slowly to adulthood, its development rate being dependent upon plant quality and host species selected for rearing, exhibits a reproductive diapause under unsuitable natural environmental conditions, a moderate fecundity otherwise, and usually, high mortality rates in captivity. Based on our current knowledge of GWSS insect biology, an experiment was designed to study the effect of rearing densities on the development and reproductive biology of GWSS under greenhouse conditions, using conditions matching as much as possible with its rearing activities.

## OBJECTIVES

1. Study the development and reproductive biology of the glassy-winged sharpshooter under semi-controlled conditions.
2. Determine the effect of increasing the density of glassy-winged sharpshooters per plant on its reproductive potential.
3. Optimize current rearing techniques accordingly. Increase current glassy-winged sharpshooter egg production by a factor of 10-15.
4. Continue studying the biology and behavior of several glassy-winged sharpshooter parasitoid species under laboratory, semi-controlled and field conditions.
5. Evaluate field efficacy of 3-4 *Gonatocerus* species in citrus using parasitoid inoculated plants.
6. Participate in collaborative studies relating to chemical control, classical biological control (exotic parasitoids), DNA analyses, cold storage and development of an artificial diet.

## RESULTS AND CONCLUSIONS

In an ongoing experiment initiated in May 2002, four densities were tested: 50, 100, 150 and 200 first instar nymphs per cage, equivalent to 2, 4, 6 and 8 nymphs per plant, respectively. Each density was replicated 16 times. Glassy-winged sharpshooter nymphs were provided 25 potted pea plants replaced twice a month and nymphs were monitored daily for

development to adulthood. Slightly different methodologies were used to handle the cages to allow for determination of development time (8 replicates), size of resulting adults (4 replicates and partial data), total egg production (12 replicates), nymphal mortality (8 replicates and partial data) and, as precisely as possible, adult mortality over time (12 replicates).

Preliminary observations and analyses showed a significant effect of density on the growth and development of the glassy-winged sharpshooter. At the two lowest densities tested, individuals developed in 34 to 36 days as compared to 38 to 41 days at the highest densities. The size of resulting adults decreased significantly when reared at 200 nymphs per cage. Males were significantly smaller than females at all densities. Nymphal mortality averaged 35% and did not vary significantly with increasing density. Total egg production did not vary significantly with increasing rearing density. This indicates an indirect negative impact of high rearing densities on glassy-winged sharpshooter females' reproductive potential, possibly due to nutritional requirements. In addition, significantly higher premature adult mortality was recorded at the highest densities studied. Females produced an average of 1800 eggs per cage. Finally, it appears that the optimum rearing density is no more than 5-6 glassy-winged sharpshooter per plant, given the type of plants selected for this experiment. Based on these observations, multiple steps are being taken to modify all current production activities in such a way that glassy-winged sharpshooter production per space unit increases consistently.

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