

BIOLOGICAL CONTROL OF GLASSY-WINGED SHARPSHOOTER IN CALIFORNIA

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GWSS

As an exotic invader the glassy-winged sharpshooter (GWSS), *Homalodisca coagulata* (Fig. 1), has become extremely pestiferous in southern California where it is thought to have established around 1990. GWSS has also successfully invaded Tahiti, established 1999, and Hawaii, established 2004. Within California (Fig. 1), GWSS has now become established in the counties of Los Angeles, Orange, Riverside, San Bernardino, San Diego, Ventura, and within portions of Butte, Contra Costa, Fresno, Imperial, Kern, Sacramento, Santa Barbara, Santa Clara, and Tulare counties.



Fig. 2

Biological Control of GWSS

Researchers at the University of California at Riverside (UCR), United States Department of Agriculture (USDA-ARS) and Californian Department of Food and Agriculture (CDFA) are pursuing classical biological control strategies to reduce populations of GWSS.

In the southeastern USA and northeastern Mexico, GWSS eggs are parasitized by several species of mymarid and trichogrammatid parasitoids (Fig. 3). *Gonatocerus ashmeadi* (Fig. 4), *G. triguttatus* (Fig. 5), *G. morrilli* (Fig. 6), and *G. fasciatus* (Fig. 7), all Mymaridae, are the most common natural enemies associated with *H. coagulata* eggs in its home range. In an effort to use natural enemies to control GWSS populations in southern California, *G. ashmeadi*, *G. morrilli*, *G. triguttatus*, and *G. fasciatus* have been imported from the home range of GWSS, cleared through quarantine, and introduced into urban and agricultural areas. These four parasitoids join resident populations of *G. ashmeadi* and *G. morrilli*. Over 90 separate recoveries of egg masses parasitized by *G. triguttatus* or *G. fasciatus* have been made in 23 sites over seven counties. This is good evidence that populations of introduced biological control agents are becoming established in southern California. The CDFA has established two facilities based in Riverside and Kern counties to produce, release, and monitor biological control agents.

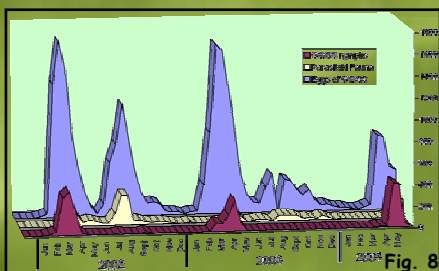


Fig. 8

Non-Target Impact Studies

All species of GWSS biological control agents have been screened for their ability to parasitize closely related non-target species of Homoptera. These include the southeastern species *H. insolita*, *H. liturata*, (both proconiine sharpshooters), three sharpshooters of the cicadellini tribe, *Colladonus montanus*, *Graphocephala atropunctata* and *Xyphon fulgida*, and other species of leafhoppers from a different subfamily *Euscelidius variegatus*, and *Macrostelus fascifrons*.



Fig. 1



Fig. 4



Fig. 5



Fig. 6



Fig. 7

Preliminary observations dealing with a few of the native Californian sharpshooters (from the subfamily Cicadellinae) has revealed the GWSS parasitoids may impact some of their populations. *H. liturata*, a native sharpshooter from the same tribe and genus and most similar to the GWSS in its egg laying and generalist plant feeding habits, is expected to be utilized by the three *Gonatocerus* species as a secondary host. *H. liturata* is implicated in *X. fastidiosa* transmission in agriculture, but exists primarily in desert habitats where mymarid parasitism is rare. The habitats occupied by three other predominant native sharpshooters, however, have less overlap with the GWSS in addition to being from a different tribe. Oviposition preferences may exclude some of the native sharpshooters from parasitization by the GWSS parasitoids. Additional laboratory testing is currently underway to fully explore any possible non-target effects associated with these parasitoids and the native sharpshooters of California.

GWSS & Natural Enemy Phenology in S. California

Phenological data on GWSS and parasitoid populations (*G. ashmeadi*, *G. fasciatus* and *G. triguttatus*) have been collected for two full years in southern California where GWSS exhibits two distinct population peaks (Fig. 8), the first occurring in spring during which an average of 12 % of eggs were parasitized and the second in summer, an average of 19 % of eggs successfully parasitized. This summer figure contrasts with reported parasitism rates of up to 100 % parasitism in some regions. Possible explanations of this discrepancy in the parasitism rates is this kind of data being collected in "snapshots" from any given season. Of the egg masses discovered by *Gonatocerus* spp., 17 % had at least one egg parasitized in spring, compared to 30 % of discovered egg masses utilized in summer.

Parasitoid Biology

The density of searching females has a significant effect on the sex ratio of progeny produced. When female *Gonatocerus* parasitoids fail to encounter other ovipositing females, progeny output is strongly female biased. Laboratory results suggest that local mate competition affects progeny production and more males are produced when females encounter conspecifics who are producing daughters with whom their sons may mate. No-choice laboratory studies showed progeny production for *G. ashmeadi*, *G. triguttatus*, and *G. fasciatus* was greatest from GWSS eggs 3, 4, and 2 days of age, respectively and each parasitoid species was able to utilize a range of egg ages around their most preferred age, these being eggs 1-4, 3-6, and 1-3 days of age.