The ecological significance of brochosomes on glassy-winged sharpshooter egg masses and parasitism by *G. ashmeadi*

1. The effect of brochosomes on parasitism rates by G. ashmeadi in the laboratory
Twenty female *G. ashmeadi* were offered a choice between two GWSS egg masses either with or without brochosomes in a Petri dish lined with moist filter paper. Parasitoid behavior (resting, grooming, searching container using antennae, searching leaf, searching egg mass, inserting ovipositor into the egg mass, inserting ovipositor into egg mass from the underside of leaf) was recorded for 5 mins. Parasitoids were reared from egg masses in Petri dishes and parasitism rates were compared between treatments. The sequence of behaviors for each treatment were statistically analyzed to determine whether the presence of brochosomes increased grooming and resting behavior and led to lower parasitism behaviors compared with non-brochosome covered egg masses.

2. Determining the ecological significance of brochosome deposition on GWSS egg masses and its effect on parasitism rates by G. ashmeadi under field conditions
This objective sought to determine the effect brochosomes on parasitization efficiency of spring and summer GWSS egg masses under field conditions. In this situation, as opposed to lab studies, foraging parasitoids are not time limited and multiple females can visit egg masses. Work by UCR Ph.D. student Al-Wahaibi (2004) has demonstrated that GWSS egg masses laid in spring are significantly larger than summer egg masses, brochosome coverings are consistently heavier on spring egg masses, foraging *G. ashmeadi* populations are substantially lower than summer populations, and incomplete parasitization of GWSS egg masses by *G. ashmeadi* is significantly higher in spring than summer. When taken together these four factors, larger egg masses, higher brochosome loads, low parasitoid densities, and incomplete exploitation of discovered egg masses may be an escape strategy utilized by GWSS to increase its natural enemy free space each spring.

a) Making Experimental Host Patches: To assess brochosome impact, field collected mated GWSS females bearing white spots on the forewings were caged on potted 'Eureka' lemons, a cultivar readily used for oviposition by GWSS and *G. ashmeadi* (Irvin and Hoddle, 2004). Plants were inspected daily for egg masses and leaves with egg masses were tagged with date of oviposition, thereby providing egg masses of known age for exposure to foraging parasitoids. GWSS eggs 1-3 days of age are most readily used for oviposition by *G. ashmeadi* (Irvin and Hoddle, 2005). Lemon trees with two types of GWSS egg masses: (1) Egg masses with no brochosomes, and (2) egg masses with heavy brochosome coverage, were deployed in the field following the protocol below after ~24-36 hrs of exposure to ovipositing GWSS. Brochosomes can be readily washed off egg masses on leaves with no adverse effect on parasitization by *G. ashmeadi* (Velema et al., 2005).

b). Field Deployment of Experimental Egg Masses. Potted lemon trees were deployed in lemon tree plots at UCR Ag. Ops and were positioned immediately adjacent mature trees on metal staked pot stands 1 m above the ground. Stakes were ringed with tangle-foot to

exclude predatory ants. A minimum of 20 Brochosome-free and 20 brochosome-covered egg masses 24-36 hrs of age were deployed on plants, inspected and watered daily, and left in the field until eggs darkened because of parasitism or until red eyespots of GWSS nymphs were seen indicating egg development beyond that susceptible to parasitism. This exposure period realistically provides adequate time for egg masses to be attacked and does not bias parasitism rates by prematurely removing egg masses from the field. Deployment of plants in this manner was conducted every other week for 6-8 weeks (i.e., 3-4 exposure trials) for both the spring and summer GWSS generations.

c. Assessing Parasitization and Female Visitation Rates: The percentage of eggs within an egg mass and percentage of egg masses parasitized with varying brochosome loads were determined by rearing parasitoids in the lab from harvested leaves. These data were subjected to appropriate transformations and compared using t-tests at the 0.05 level of significance. The number of male *G. ashmeadi* emerging from egg masses were determined and used to estimate the number of females that oviposited in a particular egg mass. In the laboratory, *G. ashmeadi* exhibits precise sex allocation, and numbers of male eggs laid is strongly influenced by the number of females visiting and foraging on GWSS egg masses. Individual females always lay 1-2 male eggs per egg mass when no other conspecific activity is detected. As the number of conspecific females visiting a host patch increases, the number of males produced per egg mass increases significantly as predicted by Local Mate Competition (Irvin and Hoddle, 2006). These data will allow us to determine the effect of varying brochosome loads on parasitism rates of GWSS eggs, and numbers of females (as indicated by number of male offspring that emerge $\leq$ 2 males one female processed the patch > 2 males more than one female oviposited in the patch) needed to successfully parasitize egg masses with varying brochosome loads over the spring and summer GWSS generations. This research is currently being written up for publication.

3. Brochosome degradation in the field

To determine whether brochosomes degrade in the field lemon trees with brochosome-covered egg masses were tagged and placed in the field. Egg masses were photographed at 0, 3, 6, 9 & 12 days (the same time every day) and photographs were visually assessed using a grid to determine percentage brochosome coverage and intensity (3 = fluffy, intense white brochosomes; 1 = dull smooth white brochosome). This was repeated for spring and summer brochosomes since high temperatures in the summer may degrade brochosomes more quickly. 15 replicates of brochosome covered egg masses were also placed in the laboratory at a constant temperature to determine whether brochosomes still degrade without subjection to UV light and environmental extremes found in the field.