## INTERSPECIFIC COMPETITION BETWEEN *GONATOCERUS ASHMEADI* AND *G. TRIGUTTATUS* FOR GLASSY-WINGED SHARPSHOOTER EGG MASSES

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### INTRODUCTION

We are currently studying the competitive behavior of two GWSS egg parasitoids, *Gonatocerus ashmeadi* Girault and *G. triguttatus* Girault (both Hymenoptera: Mymaridae), to determine which one shows the most potential as a classical biological control agent for GWSS. A better understanding of the interactions between these two parasitoids may provide an insight into predicting and interpreting field outcomes following the establishment and proliferation of *G. triguttatus* in California as it competes with the precinctive *G. ashmeadi*. Therefore, the following investigations were conducted to investigate which parasitoid species is most competitive using two different experimental designs representing high and low GWSS egg mass densities.

### OBJECTIVES

1. To investigate interspecific competition between *G. ashmeadi* and *G. triguttatus* for GWSS egg masses.

### MATERIALS AND METHODS

Two experimental designs were used to represent low and high GWSS egg mass densities. The first involved exposing approximately 45 GWSS eggs (egg masses were 1, 3 and 5 days of age) to one mated female *G. ashmeadi* and *G. triguttatus* (~24 hrs of age) for 24 hours in a 3 inch ventilated vial cage at 25$^{o}$C. The second involved exposing one egg mass (4-8 eggs) to both species (see previous description) for one hour in a 2 inch Petri-dish lined with moist filter paper at 25$^{o}$C. Visual observations for aggressive behavior were made every 5 minutes during the second experiment and both experiments were replicated 20 times. The number of *G. ashmeadi* and *G. triguttatus* offspring produced per vial or egg mass was recorded.

### RESULTS AND CONCLUSIONS

Exposing approximately 45 GWSS eggs (high density situation) to one mated female *G. ashmeadi* and *G. triguttatus* simultaneously produced 45% more *G. ashmeadi* offspring compared to *G. triguttatus* (Figure 1). This may suggest that *G. ashmeadi* is more 'aggressive' than *G. triguttatus* and therefore shows more potential as a biological control agent for GWSS. It also may indicate that *G. ashmeadi* could out compete *G. triguttatus* in the field and prevent its successful establishment and dispersal in California. However, exposing one GWSS egg mass to one mated female *G. ashmeadi* and *G. triguttatus* simultaneously produced 53% more *G. triguttatus* compared to *G. ashmeadi* (Figure 2). The result from the low egg mass density experiment apparently contradicts previous results. This might be due to the differences in GWSS densities between studies and may indicate that *G. ashmeadi* is more efficient at parasitising at high GWSS egg mass densities, whereas when resources are scarce *G. triguttatus* becomes more efficient at excluding competitors. In fact, two observations of *G. triguttatus* aggressively chasing *G. ashmeadi* off the egg mass were recorded during the second study. Furthermore, Lauziere et al. (1999) has shown that at low host densities oogenesis in the parasitoid *Cephalonomia stephanoderis* Betrem (Bethylidae) was delayed and the pre-oviposition phase was extended. Therefore, the lower numbers of *G. ashmeadi* offspring produced in the second study where GWSS egg mass density was low, may be due to *G. ashmeadi* females requiring a longer pre-oviposition period compared to *G. triguttatus* under these conditions.

Alternatively, the difference between results may be a factor of parasitoid age. The first study exposed egg masses to parasitoids that were ~ 24 hrs of age for 24 hours, whereas the second study involved similarly aged parasitoids being exposed to egg masses for just one hour. Therefore, parasitoids were respectively, 48 hours and 25 hours old by the conclusion of the experiments. This may account for differences in competitive behavior between studies because both species may have different pre- oviposition periods or may vary in their response to host interaction and oviposition experience. This may occur because female *G. ashmeadi* and *G. triguttatus* may emerge with complements of undeveloped eggs and, the pre-oviposition period post-emergence during which oocytes develop may differ between these two species. For example, *G. triguttatus* may have a shorter pre-oviposition period allowing superiority at low GWSS density studies; however, it may have a more limiting daily fecundity than *G. ashmeadi*, therefore limiting its efficiency at higher density studies. *Gonatocerus ashmeadi* may require a higher degree of host interaction and oviposition experience compared to *G. triguttatus* to maximize its parasitization efficiency. This would enable *G. ashmeadi* to out compete *G. triguttatus* in the first study because it involved high GWSS densities, a longer exposure time, and a greater potential for host encounters, and subsequent experience. However, to accurately hypothesize about the mechanisms behind why results were contradictory in these two studies, and to determine which species shows more potential as a biological control agent for GWSS, trials investigating parasitoid pre-oviposition periods, longevity, daily and lifetime fecundity, and field-based competition studies are required.

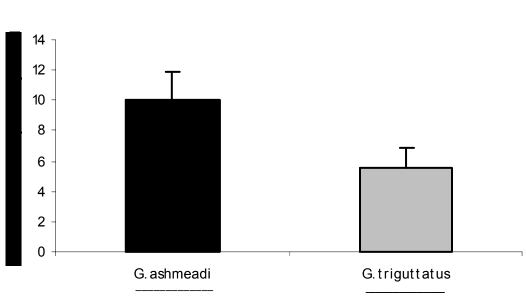


**Figure 1.**: Mean number of *G. ashmeadi* and *G. triguttatus* offspring produced from exposing 100 GWSS eggs in a vial to one mated female of both species

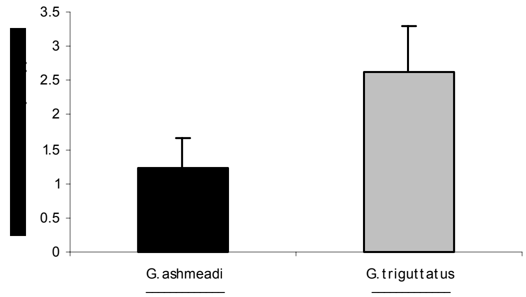


**Figure 2.**: Mean number of *G. ashmeadi* and *G. triguttatus* offspring produced from exposing one GWSS egg mass to one mated female of both species

Funding for developing mass rearing techniques for biological control programs is limited and results presented here raise the important question: how do we decide which parasitoid species shows the most potential as a biological control agent? Depending on the experimental design used, results can favor a different parasitoid species. It may be beneficial to determine which design is more realistic of a field situation. The first study may be representative of high GWSS egg densities that occur in summer; whereas the second study may be representative of low densities that occur in spring, or could occur year round as a result of a successful biological control program against GWSS. Therefore, experimental designs that simulate low GWSS densities may be more realistic at determining which parasitoid species shows the greatest over all potential for suppressing GWSS population recruitment from the egg stage. Results presented here suggest that as GWSS biological control progresses in California there may be a shift in species dominance from *G. ashmeadi* to *G. triguttatus* as GWSS populations diminish.

## REFERENCES


Lauziere, I.,G. Perez-Lacharud and J. Brodeur. 1999. Influence of host density on the reproductive strategy of *Cephalonomia stephanoderis*, a parasitoid of the coffee berry borer. Ent. Exp. Appl. 92:1, 21-28.


## FUNDING AGENCIES


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