A NOVEL METHOD TO INDUCE OVIPOSITION IN THE GLASSY-WINGED SHARPSHOOTER

Project Leader:
Chris Tipping
University of Florida, NFREC
Quincy, FL 32351

Project Directors:
Russell F. Mizell, III and Peter C. Andersen
University of Florida, NFREC
Quincy, FL 32351

Cooperators:
Brent Brodbeck
University of Florida, NFREC
Quincy, FL 32351

Wayne Hunter
U.S. Hort. Research Lab.
Ft. Pierce, FL 34945

Rolando Lopez
Clemson University
Charleston, SC 29414

Reporting period: The results reported here are from work conducted from June 2003 to June 2004.

ABSTRACT
Gravid *Homalodisca coagulata* females were induced into ovipositing a significantly greater proportion of their eggs 24h after desiccation treatment with a directed flow of warm air (40°C, 5.0 meters per second for 15 m) compared to untreated females. Treated and untreated females oviposited 54.5% and 28.2% of their eggs, respectively, regardless of host plant.

INTRODUCTION
Accidental introductions of *H. coagulata* into regions of California have prompted researchers to begin a classical biological control program using egg parasitoids in the genus *Gonatocerus* (Jones 2001). Initiation and maintenance of large cultures of *H. coagulata* for egg production for culture of *Gonatocerus* parasitoids is difficult and time consuming because few host species adequately support all life stages of *H. coagulata* (Brodbeck et al. 2004). Currently, augmented releases of *Gonatocerus* parasites are an important component of long-term management of *H. coagulata* in California.

The phenomenon of death stress oviposition was first reported by DeCoursey and Webster (1952) who indicated that a variety of chemical agents, including pesticides, could produced various levels of stress to gravid female mosquitoes *Ochlerotatus sollicitans* (Walker) and gravid Angoumois grain moth, *Sitotroga cerealella* (Oliver). Individuals that were stressed deposited a greater amount of eggs than untreated controls.

One of the objectives of our research project is to determine the behavioral and physiological mechanisms associated with the overwintering of *Gonatocerus* eggs parasitoids, an important natural enemy of *H. coagulata*. Efficient acquisition of even-aged cohorts of *H. coagulata* eggs is crucial to this project. For nearly 20 years, our research group has been involved in the study of many life history characteristics of *H. coagulata*, including oviposition behavior.

OBJECTIVES
The main objective of this study was to determine and manipulate the environmental conditions conducive to inducing oviposition of gravid *H. coagulata* females.

RESULTS
Twenty gravid females were field-collected from crape myrtle, *Lagerstroemia indica* L. by sweep net. Ten females were placed immediately into a cage that was provisioned with either one three-week old cotton plant, (*Gossypium hirsutum* (L.) 'Deltapine 88'), or one glabrous soybean plant, (*Glycine max* (L.) 'D90-9216'). Ten females were stressed with a direct flow of warm air (40°C, 5.0 meters per second) for 15m (Fig 1). After airflow treatment, females were placed into a cage with a plant as described previously. Plants were examined for egg masses the next morning. Females were dissected and numbers of mature, chorionated oocytes in the lateral and median oviducts were counted. Tests with each host plant were replicated three times. Host plant effects on oviposition were analyzed by ANOVA (SAS 1990). We defined the experimental unit as total eggs per plant, as we could not accurately quantify eggs per female. Paired comparison t-tests were used to compare the differences between the total eggs, number of eggs oviposited, and of mature chorionated oocytes not oviposited between treated and control females.

Host plant had no effect on oviposition of stressed ($F = 0.84$; $df = 1, 4$ $P < 0.42$) or unstressed females ($F = 0.03$; $df = 1, 4$ $P < 0.88$). Data from the six replications were then combined for t-test analysis. Field-collected gravid *H. coagulata* oviposited a significantly higher proportion of their eggs following stress treatment compared to unstressed controls (Table 1.). Targeted dissections indicated that stressed females had fewer chorionated oocytes within reproductive structures than females that were not stressed.

Figure 1. Airflow apparatus used to induce desiccation stress in gravid female *H. coagulata*.

Table 1. Means (±SE) of number of eggs oviposited and or retained by stressed and unstressed gravid *H. coagulata*. Values across rows followed by different letters are significantly different; P<0.05.

	Stressed	Unstressed	Pr> |t|
Mean±SE[a]			
Proportion of eggs oviposited	54.4±4.4a	28.2±5.3b	0.002
Eggs oviposited per female	13.7±2.3a	5.9±1.2b	0.015
Total oviposited + mature oocytes	194±18.9a	187.2±17.1a	0.696

[a]*n*=six replications

CONCLUSIONS

A broad ovipostional host range may not necessarily be disadvantageous to the neonates of *H. coagulata*, as we have recently documented adaptations that allow the immature stages to efficiently relocate to suitable hosts (Tipping et al. 2004). Stress-induced oviposition thus appears consistent with both the reproductive physiology and the nutritional ecology of *H. coagulata* due to the inability of females to reabsorb oocytes and the high vagility of immatures.

The phenomenon of death stress oviposition, or induced oviposition, in *H. coagulata* can be a valuable tool for researchers who require large numbers of uniform aged eggs essential for nymphal development studies. Additionally, this technique can be useful for maintaining cultures of *Gonatocerus* parasitoids. Finally, collection of many egg masses in a short period of time may also be instrumental in the creation or augmentation of existing cultures of *H. coagulata*.

REFERENCES

Brodbeck, B. V., P. C. Andersen, R. F. Mizell III and S. Oden. 2004. Comparative nutrition and developmental biology of xylem-feeding leafhoppers reared on four genotypes of *Glycine max*. Environ. Entomol. 33: 165-173.

De Coursey, J. D. and A. P. Webster. 1952. Effect of insecticides and other substances on oviposition by *Aedes sollicitans*. J. Econ. Entomol. 45: 1030-1034.

Jones, W. A. 2001. Classical biocontrol of the glassy-winged sharpshooter, pp. 50-51. *In* Proceedings of the Pierce's Disease Research Symposium, December 5-7, 2001, Coronado Island Mariott Resort, San Diego, California. California Department of Food and Agriculture, Copeland Printing, Sacramento, California, 141 pp.

SAS Institute Inc. 1990. SAS/STAT User's Guide. SAS Institute, Inc, Cary, NC.

Tipping, C., R. F. Mizell III and P. C. Andersen. 2004. Dispersal adaptations of immature stages of three species of leafhopper (Hemiptera: Auchenorrhyncha: Cicadellidae). Florida Entomol. In Press.

FUNDING AGENCIES

Funding for this project was provided by the CDFA Pierce's Disease and Glassy-winged Sharpshooter Board.