Final Report
Southern Region Small Fruit Consortium and IR-4 Southern Region

Title: Alternative management tactics for green June beetles in grape

Grant Code: SRSFC Research Project 2010-11

Final Report

Grant Code SRSFC Project: 2010-11

Research Proposal

Name, Mailing and Email Address of Principal Investigator(s): Principal Investigator:
Dr. Donn T. Johnson
University of Arkansas
Fayetteville, AR 72701
E-mail: dtjohnso@uark.edu

Objectives: The overall objective is to develop a management tactic that prevents green June beetles from damaging fruit. The specific objective is:
1) To evaluate field efficacy of insecticides and biopesticides against the green June beetle for potential use in an attract-and-kill tactic.

Justification: The green June beetle (GJB), *Cotinis nitida* (L.), causes significant fruit damage to small fruits and tree fruits in the southeastern US. The GJB is native to the southeastern US from Kansas to Connecticut and south to Texas and northern Florida. Over the past 60 years, the size of the poultry and livestock industry in this region increased, resulting in more acreage receiving applications of manure which decomposed into food to support an ever increasing local populations of GJB grubs. After adults emerge, mate and egg lay for about a week; they search, find and feed as a group on ripe fruit. These feeding aggregations promote a complex of yeast species on the fruit that release fermentations volatiles very attractive to other GJBs. In the past, GJB adults caused significant feeding damage to ripening fruit throughout the SE region. Respondents to my survey conducted in 2006 emphasized the need for an alternative tactic such as mass trapping and to identify effective insecticides and/or biopesticides against GJB with a preharvest interval less than 3 days (8).

A major shortcoming of using synthetic insecticides against GJBs is that most have a pre-harvest interval (PHI) > 7 days on fruit crops. Most organophosphate (OP) insecticides including Malathion (45% kill of GJB) were considered too slow in killing GJB adults. However, Lindane, a cancelled chlorinated hydrocarbon, killed 100% of GJBs in 6 hrs. Currently, Sevin is the only effective insecticide registered against the GJB but its use against GJB is restricted to caneberries and grapes and takes 8 hrs to stop feeding and a day to kill. It is reported that Sevin, Provado (imidacloprid) and the biopesticide Neemix (azadirachtin) significantly reduced grape foliar damage by Japanese beetle (JB) and should do the same for GJBs, whereas Naturalis L

(*Beauvaria bassiana*) and Spinosad had little effect. In comparison, most biopesticide formulations registered for fruit have a PHI < 1d. However, we were uncertain which biopesticides would kill or repel or adequately suppress GJB adult fruit feeding. Some of the formulations in Table 1 were tested for efficacy against GJB adults in July 2007 and 2008 (Johnson and Lewis 2008, 2009). It was found that most insecticides worked better against GJB adults when applied topically than via feeding on treated fruit. Sevin killed 95% of GJB adults when sprayed topically compared to 45% kill of GJB adults fed insecticide-dipped grapes.

In 2010, the USDA-NIFA-Small Business Innovation Research (SBIR) Phase I program funded Darek Czokajlo (Alpha Scents Inc.), Maciej Pszczolkowski and I to develop an inexpensive lure and trap, and develop killing stations for monitoring and control of GJBs. The goal is to minimize insecticide use against GJBs. To date, we have noted that traps with a strip of white, orange or blue, baited with a cotton-wicked bottle dispensing 50 % concentration of isopropanol or greater, and set at 1 or 1.5 m height captured the most GJBs of both sexes and may function as mass trapping stations. From this research, we will be making several presentations about managing GJBs at the entomology and fruit grower meetings.

Our current goal was to determine the efficacy of several insecticide and biopesticide formulations with different modes of action and submit data on effective compounds to EPA for registration against GJBs on fruit.

Methodologies: Several thousand live adult GJBs were collected from trap lines sampled in the USDA-NIFA-SBIR project noted above. These GJBs were removed from trap lines daily, placed in screen cages and provided ripe fruit until treated in the bioassays. Topical bioassays were conducted on 20 July 2010 in Fayetteville, AR inside a screened insectary. Five treatment replicates per treatment each consisted of a screen cage envelope measuring 20 cm x 15 cm. Ten field-collected GJBs and a slice of ripe peach were placed in each treatment screen cage and the envelope stapled shut. Each envelope was dipped in a gallon of one of the treatment solutions listed in Table 1. Each treated cage was hung from a clothes line inside an insectary. Percentage mortality was assessed at 24, 48, and 72 hours. Treatment means of arcsine square root transformed data were analyzed using ANOVA and means separation by Waller-Duncan k-ratio t test at $P > 0.05$.

Results: All insecticide treatments caused 100% mortality of green June beetle adults by 48 hrs after treatment, except Avaunt that killed significantly less (60.9%) after 72 hrs (Table 1). In contrast, the biopesticides, Azera and Ecotrol, caused significantly less mortality of green June beetle adults by 72 hrs (≤ 40%) than did all the insecticides (Table 1). It was observed that Ecotrol greatly agitated the green June beetles and caused them to try to escape the screen cages.

Table 1. Percentage mortality of green June beetle adults restrained in screen cages and dipped in either an insecticide or biopesticide in Fayetteville, AR on 20 July 2010

Treatment/ Formulation	Rate Amt. product/acre	GJB % Mortality[a] 24hr	48hr	72hr
Insecticides				
Actara 25 WG	1.5 oz (0.425 g/gal)	98.0 a	100.0 a	100.0 a
Actara 25WG	3 oz (0.85g/gal)	98.0 a	100.0 a	100.0a
Battalion 0.2 EC	7 fl oz (2 ml/gal)	100.0 a	100.0 a	100.0 a
Clutch 50 WDG	3 oz (0.85 g/gal)	98.0 a	100.0 a	100.0 a
Danitol 2.4 EC	10-2/3 oz (3.15 ml/gal)	100.0 a	100.0a	100.0 a
NIA 2302 (tolfenpyrad)	24 fl oz (7.1 ml/gal) + 0.25% NIS v/v	100.0 a	100.0a	100.0 a
Voliam flexi WG	6 fl oz (1.77 g/gal)	100.0 a	100.0 a	100.0 a
Avaunt 30WG	3 oz (1.7 g/gal)	6.2 b	28.7 b	60.9 b
Biopesticides				
Ecotrol	3 qt (28.4 ml/gal)	18.6 b	27.4 b	40.3 c
Azera	1 qt (9.5 ml/gal)	10.0 b	24.0 b	34.0 c
Check	water	0 d	4.0	6.0 d

Means followed by the same letter do not differ significantly ($P > 0.05$, Waller-Duncan k-ratio t test)

[a] ANOVA performed on arcsine square-root transformed data of the proportion killed; presented as actual percentage mortality

Conclusions: All the synthetic insecticides evaluated killed 100% of adult GJBs, except Avaunt. These data will be submitted to the respective company for submission to EPA for label registration against adult GJBs. The two biopesticides did not kill more than 40% of adult GJBs in 72 hrs.

Impact Statement: This project has demonstrated the effectiveness of several synthetic insecticides with different modes of action (Actara, Battalion, Clutch, tolfenpyrad, and Voliam flexi) against green June beetle adults feeding on fruit. In conjunction with a USDA-NIFA-SBIR grant, we have developed inexpensive traps that dispense 50 % isopropanol to either monitor for green June beetle flight to aid timing of insecticide sprays or other protective tactics or to mass trap and lower local populations of green June beetles over time.

Citation(s) for any publications arising from the project or webinar:

Johnson, D.T., Lewis, B.A., Bryant, R.J., Liyanage, R., Lay, J.O., Pszczolkowski, M.A. 2009. Attractants for the green June beetle (Coleoptera: Scarabaeidae). J. Econ. Entomol. 102:2224-2232.

Vincent, C., M.E. Garcia, D.T. Johnson, and C.R. Rom. 2010. Broad mite on primocane-fruiting blackberry in organic production in Arkansas. HortTech. 20(4): 718-723.

Johnson, D.T., B. Lewis, A. Knutson, and F. Pontasch. 2010. Management of green June beetles and Japanese beetles in fruit. Proceedings OK & AR Horticulture Industries Show 29:73-77.
Johnson, D., C. Vincent and E. Garcia. 2010. Broad mites damaging blackberries in Arkansas. The Southern Small Fruit Small Fruit News October 10(4):1-2.
Johnson, D.T. and B. Lewis. 2009. Efficacy of insecticides against green June beetle, 2008. ESA Arthropod Management Tests 34:C13.
Johnson, D.T. and B. Lewis. 2008. Efficacy of feeding on insecticides and dosage response of contact insecticides against green June beetle, 2007. ESA Arthropod Management Tests 33:C10.
Johnson, D. 2010. Bramble insects. Invited online presentation via the NE IPM Bramble Webinar on 17 February. Online at: http://www.fruit.cornell.edu/Berries/webcastarchive.htm