Developing an Early-Season Monitoring System for Leaffooted Bug on Almond

Project No.: **14-ENTO14-Tollerup**

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Objectives:

1. Short-term (within 2014-2015 funding period).
   a. Evaluate indicators that provide an early-season mechanism for estimating leaffooted bug (LFB) population densities.
   b. Determine minimum survival threshold temperature of LFB.
2. Long-term (within and beyond the 2014-2015 funding period).
   a. Develop an efficient and effective sampling method for LFB on almond.
   b. Continue work on better understanding the aggregation cues of LFB.

Interpretive Summary:

Studies continue on overwintering thermal death of leaffooted bug Laboratory experiments conducted in temperature cabinets showed that at 26.6°F adult *Leptoglossus zonatus* survival did not significantly differ from the control temperature of 45°F at two, three, or four hours of exposure. Although, when exposed for up to six hours at 26.6°F survival decreased to approximately 27%. At 21.2°F, survival decreased to 50 and 20% when exposed for two, or six hours respectively. In 2015 we plan to evaluate temperatures between 26.6 and 21.2°F in smaller intervals to determine more precisely where survival begins to significantly decrease.

In the spring and summer of 2014, leaffooted bug populations were extremely low, making monitoring of overwintering aggregations and field infestation levels during the season unachievable. The low populations may have resulted from temperatures during a two-week period in mid-December of 2013 that ranged from approximately 28 to 22°F. Our data along with observations from 2014 season support that cold winter temperatures could be used to predict infestation levels of leaffooted bug in the subsequent spring and summer.

Materials and Methods:

<u>Objective 1.</u>
Due to the near absence of *L. zonatus* populations, we were not able to neither monitor overwintering aggregations nor monitor field populations during the growing season.

Objective 1b.

Growth Chamber

We conducted a series of low-temperature growth chamber experiments using adult *L. zonatus*. A single replication consisted of 10 individuals at approximately a 50:50 male / female ratio placed in a 1 pint plastic food container. We evaluated *L. zonatus* survival after being exposed to temperature treatments of 45 (control) 32, 26.6, 21.2, 15.8, or 1.4 °F for periods of 2, 3, 4, or 6 hours. Each treatment was replicated six times. The number of adult *L. zonatus* available, limited the number of temperatures we tested. In studies during 2015 we will evaluate temperatures between 26.6 and 21.2 to more closely determine a survival 50% threshold temperature.

Objective 2.

Improving Sampling

Developing an efficient and effective sampling plan for LFB is a long-term goal of my program. Although low populations prevented us from making field observations of overwintering aggregations and orchard populations, we have made considerable progress toward this goal during the 2014 / 2015 season. We have located large aggregations of *L. zonatus* on pomegranate and have begun planning and designing experiments to evaluate aggregation cues and behavior. My goal is to establish a working relationship with Jocelyn Millar, in the Department of Entomology, University of California, Riverside. To date, however, I have not initiated any projects with Dr. Millar.

Results and Discussion:

A key part of this project, proposed to determine if overwintering LFB populations experience high mortality due to temperatures below freezing. Daane et al. (unpublished data) reported that LFB pressure was low during the season of 2007 which followed an exceptionally cold winter. The winter of 2013 – 2014 was mild except for a two week period in mid-December when low temperatures consistently reached 28 to 22°F. Pest control practitioners, growers, and UC Cooperative Extension Farm Advisors, reported extremely low LFB pressure during the spring and summer of 2014, supporting the hypothesis that populations are adversely affected by cold temperature. We determined that *L. zonatus* survival did not significantly decrease from that of the control at 26.6°F for up to 4 hours of exposure. Although at this temperature, survival fell to about 27% (**Figure 1**). In published work, Daane, et al. (2007) found that at approximately 27°F mortality in overwintering aggregations increased considerably. The temperature threshold experiments that we conducted required approximately 1680 adult *L. zonatus*. Due to the number of LFB required to conduct the experiment, we initially evaluate temperatures over a wide range, 32 to 15.8°F in 5-degree intervals. In subsequent studies, we will reduce the intervals between 26.6 and 15.8°F to establish a 50 and 90% mortality threshold.

A long-term goal of my program is to develop more efficient methods for sampling leaffooted bug. Current UC IPM recommendations for sampling almond, early in the season include examining aborted nuts for gummosis, or oozing on the nut surface (Zalom, et al. 2014). The drawback is that leaffooted bug can enter and leave an orchard relatively quickly and by the time damage of this type is detected, leaffooted bug have likely moved on. Other sampling

methods include using beat trays or a long pole to knock upper-canopy branches to startle adults. Beat trays are useful for monitoring nymphs although not for adults since the adult insects generally startle and fly away prior to being knocked onto the beat tray.

Kent Daane along with Wang, et al. (2000) determined that a pheromone plays a key role in cuing the species to aggregate. Unfortunately they did not identify the precise compound or compounds involved. Once the compound is identified the pheromone, it may be possible to produce it synthetically and placed into a dispenser for use as an early-season monitoring tool.

Other possible lures may exploit plant volatiles. Experiments currently in progress have looked at various oils, such as avocado, peanut, and walnut. To date, the most attractive material tested consisted of whole ground pistachios. The ground pistachios placed in a mesh bag attracts nymphs (**Figure 2**); it's not clear although if a female haphazardly lays eggs near the bag then the nymphs move onto the pistachios to feed or if the female detects a suitable host food, and lays eggs near the bag. The later scenario certainly holds the most promise; if a lure can be developed that attracts females, then early-season movement into orchards could be detected.

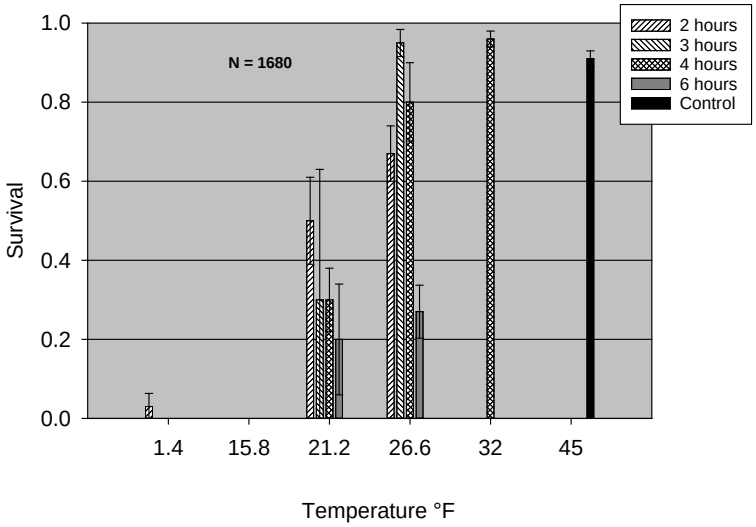

Figure 1. Mean survival of adult leaffooted bug exposed to different temperatures. Each of six replications contained 10 adult (1:1 sex ratio). Six replications were conducted at each temperature.

Figure 2. Leaffooted bug nymphs on whole-ground pistachios placed in a mesh bag.

Research Effort Recent Publications:

No manuscripts have been published or submitted.

References Cited:

Daane, K., et al. 2007. Predicting leaffooted bug outbreaks to improve control, pp. 12. California Pistachio Research Board.

Wang, Q., et al. 2000. Mating behavior and evidence for male-produced sex pheromones in Leptoglossus clypealis (Heteroptera : Coreidae). Annals of the Entomological Society of America 93: 972-976.

Zalom, F., et al. 2014. UC IPM pest management guidelines: almonds, http://www.ipm.ucdavis.edu/PMG/r3300311.html.