Developing and Early Monitoring System for Leaffooted Bug on Almond

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Introduction

Over the past several years, hemipteran insects have become a serious economic pest in almond. The principle hemipteran pests, commonly referred to as large bugs, include three species in the Family Pentatomidae, redshouldered stink bug, Uhler's stink bug, and green stink bug; and two leaffooted (LFB) species in the Family Coreidae, (Daane, et al. 2003). An additional group of, small bug hemiteran pests on almond include several species in the Family Miridae and Rhopalidae. The group of large bugs, however, pose a greater economic threat due to having mouthparts capable of feeding on developing nuts longer in the season than their small bug counter parts (Daane, et al. 2008a).

In almond leaffooted bug has up to three generations per season with a partial fourth (Daane, et al. 2010). In September to October, adults begin moving out of almond and pistachio orchards to sheltered sites to form aggregations of 5 to 500 individuals (Daane, et al. 2008b). Typically aggregations form under the bark of eucalyptus, in olive and pomegranate orchards, on the underside of palm fronds, and in Cyprus and juniper trees. Although the existence of a male pheromone associated with mating and aggregation have been supported (Want, et al. 2000), we do not fully understand the cues that initiate these behaviors. As early as February LFB begin dispersing from aggregations; the occurrence of warm temperatures likely plays a major role).

The University of California Statewide IPM program recommends monitoring for LFB by visually inspecting for gummosis on nuts during May through July. In November – February, aggregations can be monitored, although they are difficult to locate unless populations are previously known from September – October. They mostly form on the sunny side of trees and move very little.

In March the adults begin to disperse into almond just as nuts have reached the "pea-sized" stage. At this time, monitoring using beating trays can be conducted, although they do not work well due to the tendency of LFB to move away from the sampler. Alternatively, shaking upper branches using a long pole disturbs LFBs causing them to fly and thus becoming very visible against the sky backdrop. The most efficient method of sampling in March is the appearance of damage i.e. dropped nuts. The drawback to this method, although results from the difficulty in distinguishing damaged nuts for natural nut drop (Daane, et al. 2007).

Objectives

1. Short-term (within 2014-2015 funding period).
    a. Determine indicators that provide an early-season mechanism for estimating LFB population densities.
        i. 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 and stink bugs on almond.
        i. Continue work on better understanding the aggregation cues of LFB.
        ii. Develop monitoring traps that can be employed at early-season

Fig. 1. Top clockwise: LFB feeding damage on almond, monitoring for LFB using a pole, aggregation on pomegranate, and adult LFB,

Procedure

Short-term Goal: Minimum Temperature Threshold

A single replication consisted of an aggregation of 10 individuals at approximately a 50:50 male / female ration placed in plastic cup with a single green bean. We evaluated LFB mortality after being exposed to temperature treatments of 7 (control) 0, -3, -6, -9 and -17 °C (45 (control), 32, 27, 21, 15, and 1.4 °F) for periods of 2, 4, and 6 hours. For at least two hours prior to the cold treatments, bugs were kept at a control temperature of 7 °C. After each cold treatment replicates were placed back in the control temperature and mortality evaluated after 24 h. Each treatment was replicated at least six times.

Long-term Goal: Improving Sampling

Developing an efficient and effecting sampling plan of LFB and the other large bug pest is a long-term goal. I am making field observations in order to develop a better understanding of large bugs. During winter and spring 2015, work will be conducted to determine the effectiveness of passive trapping at the orchard edge. Also, during winter and spring of 2015, we will begin experiments to find aggregation cues and behavior. For example, we will evaluate visual and volatile components of pomegranate as aggregation cues.

Results and Discussion

Due to the experiment being initiated too late in the 2013/2014 winter, we were not able to locate overwintering LFB aggregations for field observations and collection for winter/spring laboratory experiments. During the fall of 2014, a large number of LFB were collected from pomegranate in Kern Co and minimum survival threshold temperature experiments were conducted. Leaffooted bug survival was 96% when held for 4 h at 32 °F. When held for 2, 3, 4, or 6 h, at 27 °F, survival remained relatively high at 67, 95, 80, and 73% respectively. A sharp decrease in survival occurred at 21 °F. When held at 2 h survival reached 50%, followed by 30 (3h), 30 (4h), and 20% (6h). At or below 16 °F, essentially no LFB survived (Fig. 2). These results indicate that low temperatures, typically experienced in California during a freeze event, may not severely affect populations of overwintering LFB.

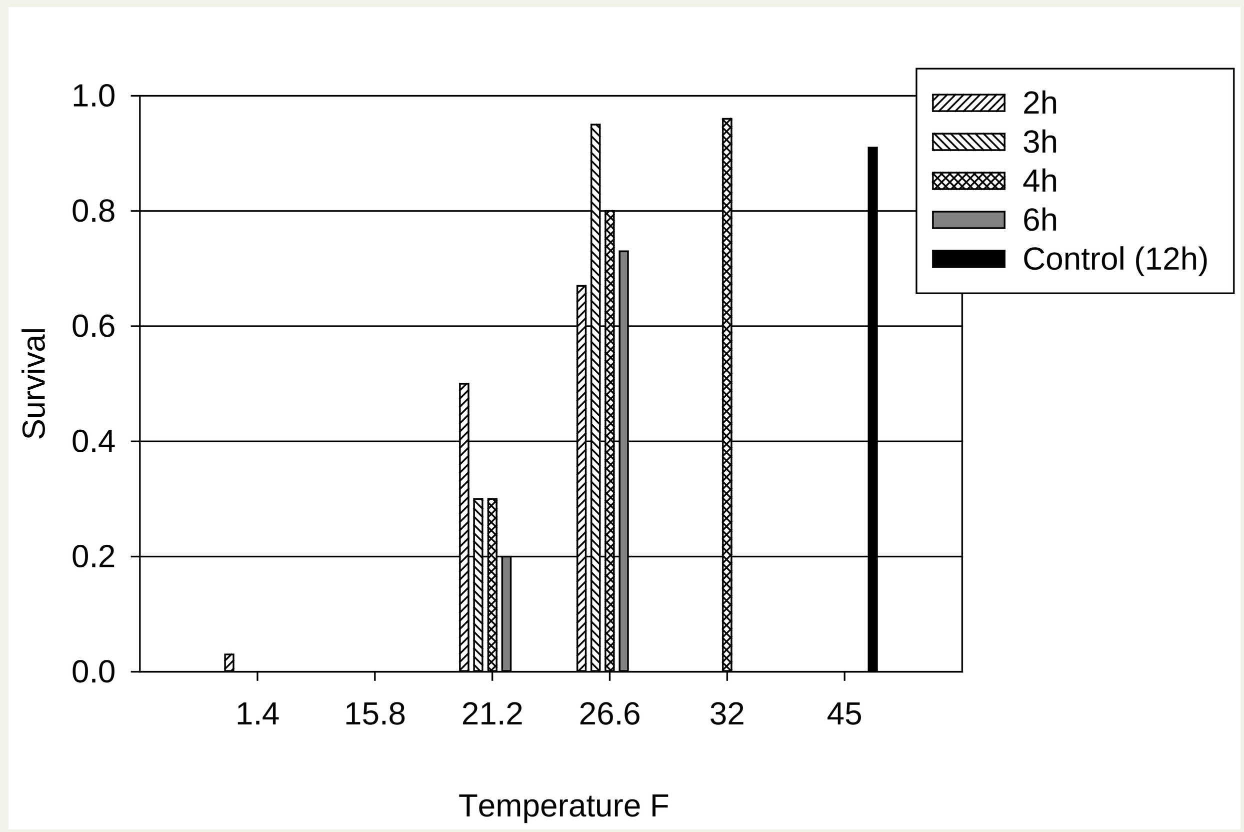

Fig. 2. Survival of leaffooted bug adults subjected to five temperatures for 2,3, 4, or 6 hours .

References

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