Leaffooted plant bugs, *Leptoglossus* spp. (Hemiptera: Coreidae) in Almond Orchards

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OBJECTIVES

Objectives for the current year:

- *Determine the species composition of Leaffooted plant bugs on almonds and alternate host plants*
- *Establish a colony of Leaffooted plant bugs for ongoing field and lab work*
- *Conduct a mechanical damage study to simulate bug feeding on almonds, to explore the relationship between almond age and nut drop, nut damage and the gummosis response*

INTRODUCTION

Leaffooted plant bugs (LFPBs) and stink bugs feed on developing almonds, which results in nut drop and damage to developing kernels. LFPBs are difficult to detect in the field prior to observing symptoms of feeding (gummosis) or nut drop (3,4,5). Currently, there is no trap or lure for monitoring LFPBs. Since leaffooted bugs are larger than most stinkbugs, they can feed on and damage developing nuts later in the growing season. **A long-term goal for leaffooted bug management is to develop an early detection monitoring system.** This will contribute to an IPM program for LFPBs. One of our goals is to determine which species or host plant strains of LFPBs are abundant. Species identification is important, as attractants such as pheromones can be species specific (1,6,10). Both *Leptoglossus clypealis* (Fig. 1a) and *L. occidentalis* (Fig. 1b) are reported on almonds, pistachios and pomegranates (UC IPM,8).

Figure 1. Leaffooted plant bugs. 1a. *Leptoglossus clypealis* has a distinctive spine-like tylus on the distal end of head, (1b) *L. occidentalis* has reduced white wing bands and no tylus, (1c) *L. zonatus* has yellow spots on prothorax (photos by UCIPM, Wikipedia, and R. Buss)(2,7).

INTRODUCTION-damage

Fig. 2. Gummosis, the sap exuding from the punctures on the top of the almond.

After LFPBs feed on almonds, sap exudes and this condition is known as **gummosis**. Pest control advisors and managers use the gummosis response to make control decisions.

However, the age of the almond and the variety of the almond may affect when the gummosis response appears. In addition, LFPBs have often dispersed from the orchard by the time the gummosis response is observed. An early detection system for LFPBs would improve management of these bugs.

OBJECTIVE 1

- *Determine the species composition of Leaffooted plant bugs on almonds and alternate host plants*

Leaffooted plant bugs and stinkbugs have been collected from almonds, pistachios and pomegranates in the central valley. DNA is being used to determine the number of species or plant strains/biotypes of LFPBs collected this year. Collections will continue next year and molecular work will expand to include stinkbugs.

METHODS

- LFPBs were collected on almonds, pistachios and pomegranates in the central valley. Collaborators helped to send samples from additional field sites. LFPBs were identified tentatively to species and prepared for DNA/molecular work. We have extracted DNA from a subset of samples.

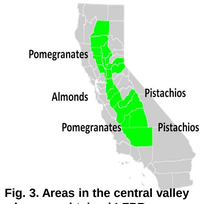
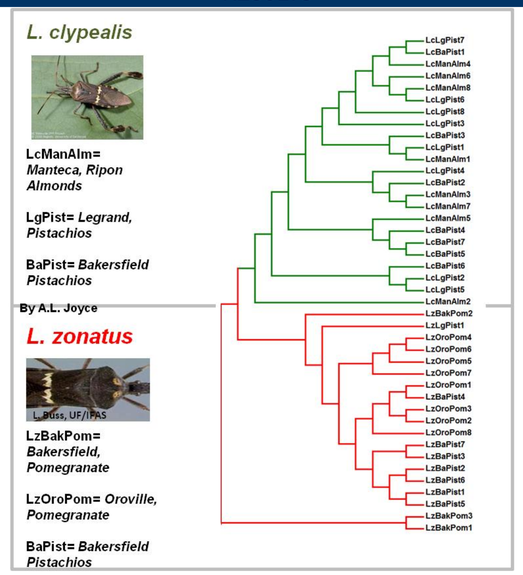


Fig. 3. Areas in the central valley where we obtained LFPBs on several host plants.

- DNA was extracted from the thorax of male LFPBs using the Qiagen DNeasy Blood and Tissue Kit.
- Amplified fragment length polymorphisms (AFLPs) were developed (9). One primer combination has been used so far (M-CAT, E-ACT) ; several more will be included in the study. Samples were run on a 3730 Genetic Analyzer.
- Genemapper 3.9 software determined presence or absence of each allele. Nei's genetic distance was calculated and used to generate a neighbor joining tree using Phylip (Fig. 4).

RESULTS



- Fig. 4. A neighbor joining tree with preliminary AFLP data from 42 *Leptoglossus* males from almond, pistachio and pomegranate, producing 167 bands/alleles. *L. clypealis* were collected on almond and pistachio, *L. zonatus* from pistachio and pomegranate.
- More individuals and primers will be used to complete the study.

OBJECTIVE 2

- *Establish a colony of Leaffooted plant bugs for ongoing field and lab work*

METHODS

- *L. clypealis* LFPB adults, nymphs and eggs collected from almonds were used to start a colony, which has been maintained in the laboratory successfully for several generations.

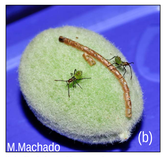


Fig. 5. (a) Cage used for rearing LFPBs, (b) field-collected eggs, nymphs and adults were used to start the colony.

- LFPBs are being fed a diet of green beans, corn, and a seed mixture of unroasted nuts. Arborvitae plants are provided for habitat and serve as an oviposition substrate.
- Adult LFPBs from the colony will be used in Objective 3. We will compare natural feeding damage by LFPBs with mechanical damage. Adults will also be used for future behavioral bioassays. In order to develop an early detection/monitoring system for LFPBs, we will investigate attraction of adults to male and female odors/pheromones, host plant volatiles, and combinations of these odors.

OBJECTIVE 3

- *Conduct a mechanical damage study to simulate LFPB feeding on almonds, and to explore the relationship between almond age and nut drop, kernel damage and the gummosis response*

METHODS

- The mechanical damage preliminary study was setup in Merced, California on two almond varieties, Monterey and Sonora. We wanted to compare the level of nut drop, nut damage and the response time from puncture until the almond would exhibit gummosis.
- Trials began in May when almonds were mid-sized, since this was the first year of the study. Each week, a control and treatment branch were setup. The control branch had 15 almonds that were not punctured, and the treatment branch had 15 almonds which were mechanically damaged. Each almond was punctured 6 times with a #2 insect pin to a depth of ~1 cm.
- Almonds were observed weekly until near harvest to determine %nut drop and whether gum remained on the nuts. Just before harvest, remaining nuts were removed to determine % damage.

OBJECTIVE 3 (Results)

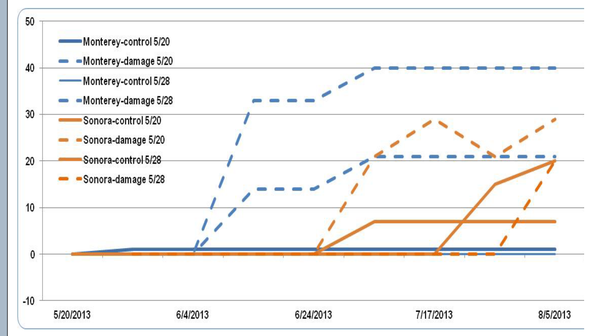
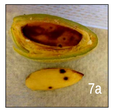


Fig. 6. The cumulative % nut drop over the growing season for Monterey and Sonora almonds, in damaged and control treatments.

- The almond shell was too tough to mechanically puncture by mid-June.
- Nut drop began several weeks after nuts were punctured, and was higher for mechanically damaged Monterey than Sonora nuts. However, Sonora controls had nut drop while Monterey did not.



All the mechanically punctured nuts which remained on the branch were damaged (Fig. 7a) while controls were not (Fig.7b).

- All the punctured/damaged almonds exhibited the gummosis response rapidly and the dried gum remained on the nuts for the growing season.
- Next spring.. (1) almonds will be observed through the entire growing season, (2) a penetrometer will determine shell 'hardness' as a proxy for almond age, (3) we will include more almond varieties, and (4) compare damage by caged live LFPB feeding to mechanical damage.

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