Leaffooted Bugs in Almonds

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Introduction

Leaffooted bug has a history of being an infrequent pest in Almond orchards throughout the San Joaquin Valley. In Kern County it was first found causing damage to the Sonora variety in the Delano area in 1986. After that it went relatively unnoticed until 2000 when it caused yield reductions in several isolated locations in the San Joaquin Valley. This year where there have been widespread reports of damage to almonds and pistachios from Fresno down through Kern County. Reports on damage range from insignificant to severe, with a leaffooted bug densities ranging from non-existant to high, even sometimes among different orchards within the same general vicinity.

Identification

Adult leaffooted bugs are relatively large brown insects, up to 1 inch in length, that have a long proboscis extending nearly the length of the body. They also have a white stripe across the abdomen and flattened leaf-like structures on their hind legs for which they are named.

Immature leaffooted plant bugs have the same general shape as the adults, but can look quite different. Small immatures have an orange body, brown legs, a brown head, and brown wingpads. They can easily be mistaken for assassin bugs, but differ in that they have a long, backwards-facing proboscis compared to a relatively short downward or forward-facing proboscis on an assassin bug. As leaffooted bugs mature the body gradually becomes more brown and the wingpads enlarge. Generally speaking, the last larval stage and the adult look the same except for the presence or absence of fully developed wings.

Life Cycle

In general, leaffooted bugs are considered to have two generations per year. They overwinter as adult females both within and outside the orchard. Some preferred sites are under brush, inside wood piles, and in other concealed locations. During the spring in late April and May the adult females, which are good flyers, migrate into orchards such as almonds and pistachios. Once in the orchard they begin to feed and reproduce. Adult females lay eggs in chains of about 8 to 10 rectangular brown eggs. Adult females are thought to live anywhere from four to six months, and will continue to lay chains of eggs during that period. Immature leaffooted bugs that emerge from eggs by the overwintering females feed and become adults anywhere from July through fall. As temperatures cool and daylength shortens the leaffooted bugs, which are now all in the adult stage, migrate to a site to overwinter. Details about overwintering sites and how they are selected are still relatively unknown.

Damage

Nymphs and adults feed by inserting their proboscis into plant tissues and sucking out fluids. During late April through May, feeding on the nut hull can be 'superficial" or it can be deep into the endosperm (kernel). If the feeding takes place in the endosperm, the embryo dies, the nut turns yellow and drops to the ground.

The first evidence of nut damage by the leaffooted bugs is clear gumming oozing from the nut surface. A cut underneath the gumming area will reveal a sting that may stop at the endocarp where a gum pocket may form. In some nuts the sting may continue all the way to the seed cavity where lesions can be found in the endocarp (shell) and seed coat (pellicle).

The damage is not uniform throughout the orchard or even within a tree. Some areas and some trees will be more affected than others. Oftentimes the damage occurs in clusters such that if one nut is affected, three or more nearby nuts will also be affected. This is likely caused by the same bug feeding on multiple nuts.

Leaffooted bugs can cause significant nut loss within an orchard. A cage study conducted by Daane et al (2002 report to Almond Board of California) showed that one adult female during a 7 day period on 10-12 caged nuts was able to cause 20% nut drop and 20% nut damage at harvest. That is a total of 40% loss of 10-12 nuts during one week of feeding.

Leaffootted bugs also have varietal feeding preferences. In Kern County on June 10, 2000, Mario Viveros collected data on the damage of leaffooted bugs in Nonpareil, Sonora and Fritz trees. Ten 30-nut samples were taken from each of these varieties. Data were collected on gumming of the hull (surface and inside) and endosperm or kernel lesions. The results (Table 1) show that Sonora was the most damaged and Nonpareil the least with Fritz in the middle. They also show that gumming on the outside of the kernel does not necessarily mean that the kernel has lesions.

Table 1. Evaluation of leaffooted bug damage on three almond varieties, Kern Co., 2000

Variety	Gumming of Hulls (%)		Kernel with Lesions (%)
	Outside	Inside	
Nonpareil	2.3	0.0	0.0
Sonora	22.5	20.0	13.3
Fritz	8.0	14.0	2.5

Daane et al (2002 Almond Board of California Report) showed similar results by using cage studies. Whereas the Viveros data showed that bugs prefer to feed on one variety over another (i.e., one possibly tastes better than the other), the Daane data (Table 2) shows that there are actual differences in the susceptibilities of the varieties to damage. Differences occurred even when the same number of bugs were caged on the same number of nuts of different varieties. As was previously noted, Non-Pareil appears to be less susceptible than other varieties such as Fritz, Carmel, and Butte.

Table 2. Evaluations of leaffooted bug damage to nuts in cage studies, April 2002

	Percentage of Damaged Nuts				
	Non-Pareil	Fritz	Carmel	Butte	Mission
Dropped Nuts	2.1	10.7	20.2	10.5	5.6
External Damage at Harvest	8.0	12.3	17.5	6.5	0.0
Internal Damage at Harvest	5.0	6.9	1.2	3.3	0.0

Leaffooted bugs can also damage almonds later in the season. They are capable of drilling all the way through the shell and into the meat. This causes black spots or wrinkled, misshapen nutmeats.

Control

In most years leaffooted bug is controlled by an egg parasitoid, *Gryon pennsylvanicum*. Later in the season it is not uncommon to find over 80% parasitism of leaffooted bug eggs. These parasitoids have been seen this spring, but cannot be relied on for control during this very sensitive period in the crop.

Control is currently based on the use of the Lorsban®, permethrin/pyrethroids or Sevin®. The biggest concern with these products is the potential to flare mites later in the season. Growers using these products should watch their mite populations closely and follow treatment guidelines available for mites.

Unfortunately there are no official monitoring programs or treatment thresholds available for leaffooted bug. Each individual grower and PCA will need to make their own decision on whether or not a spray is needed. This decision should be based on the number of bugs seen in the orchard, their known longevity in the field (adults are around for a long time), the amount of gumming seen on the nuts, and the tolerance for damage in the crop. PCAs basing treatments on gummosis and nut drop should also recognize that there is a lag time between when feeding takes place, gummosis occurs, and the nuts drop and that not all nuts with gummosis will end up being damaged.