Biology, Monitoring, and Management of Brown Marmorated Stink Bug in Almond Orchards

Jhalendra Rijal[1], Tania Herrera[1], Joanna Fisher[2] and Frank Zalom[2]
[1]University of California Agriculture Cooperative Extension & Statewide IPM Program, Modesto, CA
[2]Dept. of Entomology, University of California, Davis, CA,

Project ID: ENTO23

Abstract

Brown marmorated stink bug (BMSB) has been spreading to almond orchards in the northern San Joaquin Valley and is causing economic damage. Based on feeding study and observation from the field, we concluded that early-season BMSB infestation could cause substantial nut abortion and drop, while mid-to-late season feeding results in unmarketable kernels. Our study also found that BMSB can be present in orchard throughout the season and has the potential to cause damage season-long damage in almonds, although the degree of economic damage is a higher early part of the season.

Introduction

- Brown marmorated stink bug (*Halyomorpha halys*) (BMSB) is an invasive pest from Asia and has spread to over 43 U.S. states.
- In California, reproducing populations of BMSB have been reported in residential areas of 16 counties, most of these counties are in the Central Valley.
- BMSB has a wide host range. Both nymph and adult feed on fruits and seeds by inserting their 'straw-like' mouth. The feeding results in surface gummosis, deformations to internal necrosis on fruits.
- We reported BMSB in almond (in 2017) in Stanislaus County. Between 2017-19, we observed more than 10 almond orchards had BMSB presence with serious economic losses in some orchards (Fig. 1).

Objectives

- Conduct BMSB detection and seasonal monitoring in almond orchards
- Characterize the temporal effect of BMSB feeding on developing almonds using cage studies

Fig. 1 BMSB infestation and damage to developing fruits in commercial almond orchards

Results

BMSB detection monitoring with traps

In 2019, BMSB was detected in 6 of 7 almond orchards monitored (3 orchards high infestation, Fig. 4), and 3 orchards moderate-to-low infestation). The earliest adult capture was in mid-March and continued through October.

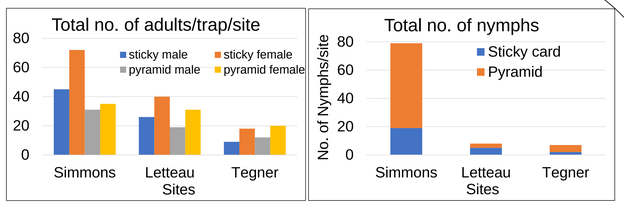

Fig. 4. Cumulative BMSB captures in sticky and pyramid traps in 3 almond orchards, 2019

Season-long feeding damage study

- In cages that were infested with BMSB, we observed substantial nut drop early in the season (March-April) for both Nonpareil, and Monterey varieties.
- Significant nut drop was observed early part of the season (last wk of March - mid April) (Fig. 5)
- Feeding damage on the hull includes external gumming, pinholes, and necrotic lesions. Damage on developing kernel included internal gumming and necrosis.
- At harvest, 3 types of kernel injury observed: 1) gummy kernels, 2) kernels with multiple dark spots, and 3) dimpled/depressed kernels (Fig. 6 & 7). Injury symptoms on hull and shell (Fig. 8)..

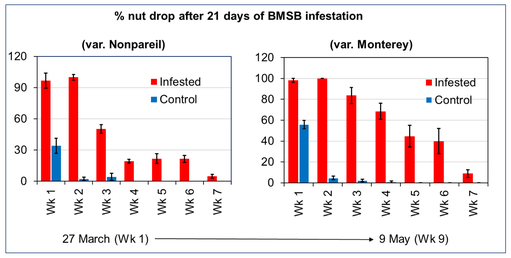

Fig. 5 Percent nut drop due to the BMSB feeding during March-April

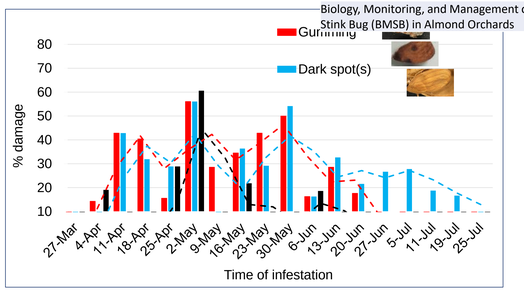

Fig. 6 Damage to the kernels at harvest by BMSB feeding in different times of the year

Fig. 7. Examples of kernel damage by BMSB in different times of the year

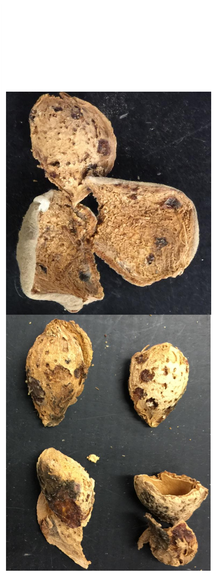

Fig. 8. Manifestation of feeding injuries on the shell and hull of almonds evaluated at harvest

Conclusions

- BMSB has been causing damage to commercial almond orchards in upper San Joaquin Valley since 2017.
- BMSB are capable to do damage to all stages of the fruit development in almonds. Early-season feeding causes nut abortion, resulting in substantial nut drop, while mid-to-late season infestations result in gummy, darken-spot or dimpled kernels.
- BMSB has started causing damage in commercial almond orchards in upper San Joaquin Valley. BMSB are capable to cause some degree of injuries in all stages of nut development in almonds.
- Although we are using two trap types for research purpose, based on previous year's studies, we found that sticky panel trap is equally effective in detecting BMSB adults compared to pyramid trap.
- Sticky trap is much more user-friendly and cheaper than the pyramid trap, and we recommend the sticky trap with BMSB lure for growers and PCAs for monitoring which should start in mid-March.
- It is recommended that growers and pest control advisers (PCAs) pay close attention to BMSB activities in orchards and monitor BMSB population at least in orchards in the area with high risks (i.e. area with known infestation, near to highways; near to other hosts (e.g. tree of heaven).
- Although no variety is immune to BMSB attack, some almond varieties are more susceptible than others. We will report the result of our varietal comparison study in ABC annual report.

Methods

BMSB Detection Monitoring: Weekly monitoring was conducted using two trap types, standard 4'-tall black pyramid and sticky panel traps (Fig 2) baited with BMSB (Trece Inc., Adair, OK) in 7 almond orchards in Stanislaus and Merced Counties. Three traps of each type per site were used.

Season-long feeding damage study: The study was conducted in a small almond orchard at the UC Cooperative Extension, Modesto. Two varieties, Nonpareil and Monterey were used. Nylon mesh cages (20x30 cm) were placed in trees covering 7-15 nuts/cage at the early fruit development stage (March 25) (Fig. 3). Every week, 9 new cages/variety were infested with 3 BMSB adults for 7 days from the last wk. of March (Wk. 1) through harvest..

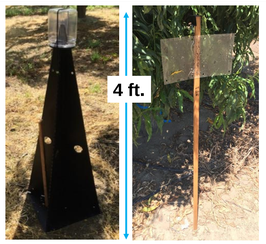

Fig. 2. BMSB traps: Black pyramid (left), sticky panel

Fig. 3 BMSB temporal feeding study set up showing caged fruits with BMSB inside

Acknowledgments: Funded by the Almond Board of California. We thank cooperator growers and PCAs for allowing us to access their orchards. Partial funding from the USDA-SCRI Grant. Thanks to D. Green, C Vue for their help in the project.