Tracking Brown Marmorated Stink Bug in Utah's Urban-agricultural Landscapes

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Abstract

Since detection of brown marmorated stink bug (BMSB; *Halyomorpha halys* (Stål)) in Salt Lake City in 2012, urbanized landscapes in northern Utah have supported the establishment and spread of this invasive insect. In the Intermountain West, where high elevation mountains border the human-dominated valleys, urbanized landscapes with human-built structures have served as initiation points for BMSB spread into agricultural settings. Economic agricultural crop injury was detected in 2017, five years after introduction. To track this expanding BMSB population, host plant surveys and trap efficacy trials were conducted in 15 urban/suburban locations from May to October in 2017 and 2018. Host plant surveys implemented visual inspection and beat sheet sampling, revealing 62 species and 24 families of host plants, with *Catalpa speciosa* being the most commonly encountered host species. Trap efficacy trials utilized three trap types: dual funnel trap, clear sticky trap (Trécé Inc.), and Dead-Inn pyramid trap (AgBio Inc.). The pyramid trap was found to be the most effective of the three. All traps contained the Pherocon® BMSB Dual Lure (Trécé Inc.). From these data, we have characterized and mapped BMSB distribution, host plant preferences, and phenology. Phenology data taken from host plant surveys and trapping trials were compared with controlled voltinism field experiments in 2018, to verify the presence or absence of a suspected second adult generation. Voltinism experimentation confirmed only one successful adult generation, but oviposition by the adult (F1) generation did occur, resulting in a lone third instar nymph surviving into late September.

Introduction

Urban host plant surveys have highlighted which plant species harbor BMSB in Utah and compliment host plant data found in surveys already conducted in other regions of North America (Bergmann et al. 2016). Nielsen and Hamilton (2009) have shown that host plant surveys also serve as a platform for collecting seasonal phenological data. Understanding the phenology (seasonal development, number of generations, and other population dynamics) of BMSB has been further investigated with controlled season-long weekly observations of wild caught BMSB populations and the use of pheromone baited traps to monitor wild urban populations along the Wasatch Front of northern Utah (Weber et al. 2014). This multi-faceted approach to monitoring BMSB in the urban landscape will provide valuable data to future growers should BMSB become a more severe agricultural pest in Utah.

Objectives

I. Document BMSB host plants in Utah
II. Determine voltinism of BMSB in Utah
III. Compare performance of three BMSB trap types in urban landscapes

Materials and Methods

Host Plant Surveys

- Host plants had at least one of the three major BMSB life stages (egg, nymph, or adult) present
- 15 sites in northern Utah (Fig. 3) were sampled May through September in both 2017 and 2018
- Each site contained 20 plants randomly selected from a 40 x 200 meter transect
- Plants were assessed for BMSB using beat sheet sampling and visual observation

Beat sheet

Voltinism

- To assess whether BMSB is univoltine or bivoltine in Utah, a total of 70 wild caught adult BMSB were observed June to October 2018
- 40 adults were placed on tart cherry (*Prunus cerasus*) and 30 were placed on catalpa (*Catalpa speciosa*)
- Mesh bags were used to isolate BMSB to tree branches, each with 10 wild adults (7:3 female to male ratio on tart cherry; 8:2 on catalpa)
- Surviving BMSB and their respective life stages were recorded once a week
- Egg masses were transferred out of adult bags into similar cohorts
- BMSB had access to leaves, flowers, or fruiting bodies at all times

Mesh bag on tart cherry

Trapping

- Included three commercial BMSB stink bug traps all baited with Pherocon® BMSB Dual Lure by Trécé Inc.
- Each of the 15 host plant survey sites contained one of the following trap types: Pherocon® Dual Funnel Tube Trap by Trécé Inc., Dea Inn Pyramid Trap by AgBio Inc., and Pherocon® Dual Panel Clear Sticky Trap by Trécé Inc.
- Trap data was collected May through September 2017 and 2018

Sticky Pyramid Dual Funnel

Results

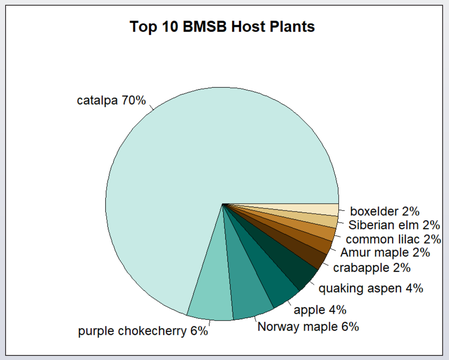


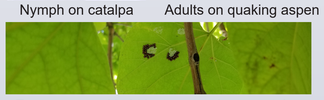
Figure 1.Percentages of the top ten most commonly observed host plants in 2017 and 2018.

Host Plant Surveys

- 62 species and 24 families of host plants
- Catalpa was the most frequently observed host

Nymph on catalpa

Adults on quaking aspen



Egg masses with 1st instar nymphs on catalpa

- Most host plants had large fruiting bodies or flowering structures
- Top ten host plants consisted of 6 familes
- Most host plants harbored BMSB for a significant portion of the season
- Fewer BMSB observed in 2018 than 2017
- Salt Lake Valley and Utah Valley sites had high numbers of BMSB both years

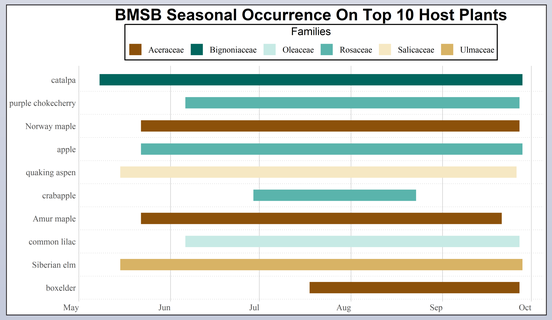


Figure 2. Seasonal timeline of BMSB on top ten most commonly documented hosts. Plant families are grouped by color.

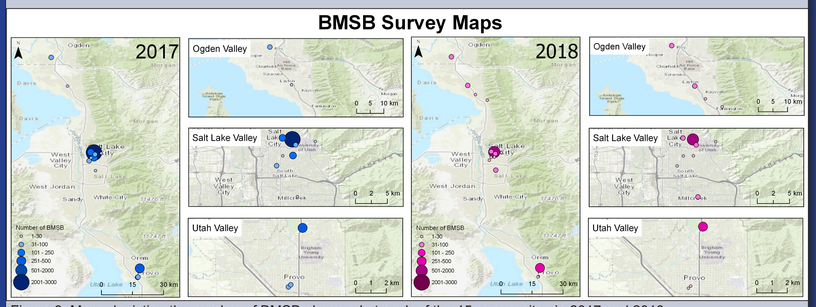


Figure 3. Maps depicting the number of BMSB observed at each of the 15 survey sites in 2017 and 2018.

Egg mass

1st instar nymphs on egg mass

Adult

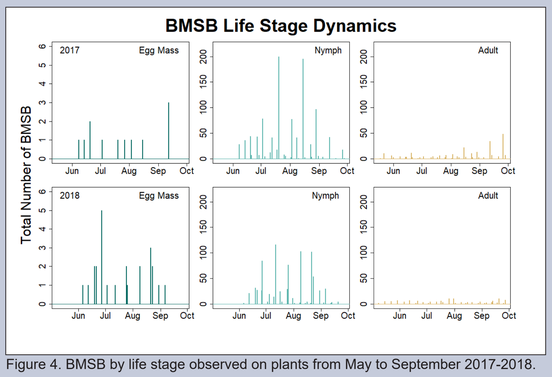


Figure 4. BMSB by life stage observed on plants from May to September 2017-2018.

- Egg masses appear in early June
- Few egg masses observed
- Peak number of nymphs in July and August
- Adults found consistently throughout the season but in fewer numbers when compared to nymphs
- Slight spike in adult numbers late September 2017 marks initiation of fall aggregation

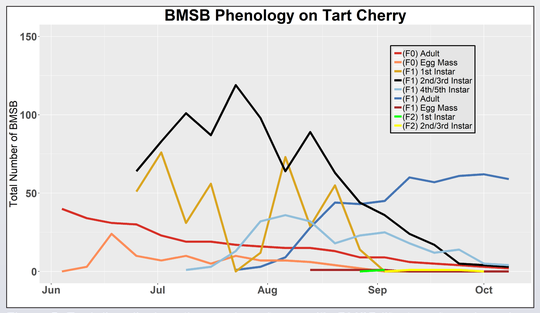


Figure 5. Each line displays the number of a specific BMSB lifestage from June 4 through October 8, 2018. Spring emerged adults (F0), *n*=40.

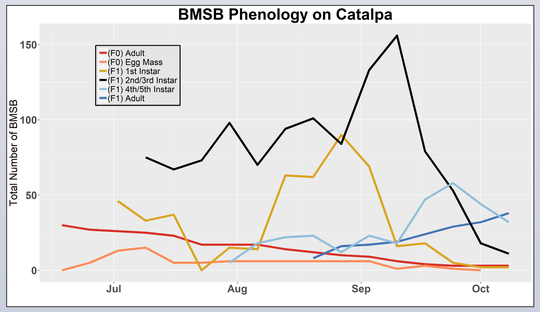
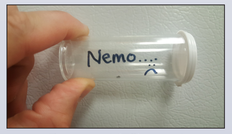


Figure 6. Each line displays the number of a specific BMSB lifestage from June 18 through October 8, 2018. Spring emerged adults (F0), *n*=30.

Voltinism

- (F0) adults laid eggs June through September
- (F0) egg production was highest in June and early July
- Late season peak in early instar nymphs on catalpa
- (F1) Adults developed on both tart cherry and catalpa
- (F1) adults on tart cherry laid four egg masses
- A single (F2) nymph emerged and survived to 3rd instar



Deceased (F2) nymph

Field crew counting BMSB

Trapping

- Pyramid trap performed better than the sticky and dual funnel traps
- Total number of BMSB was much lower in 2018 when compared to 2017
- Utah Valley experienced a dramatic decrease in trap catch in 2018

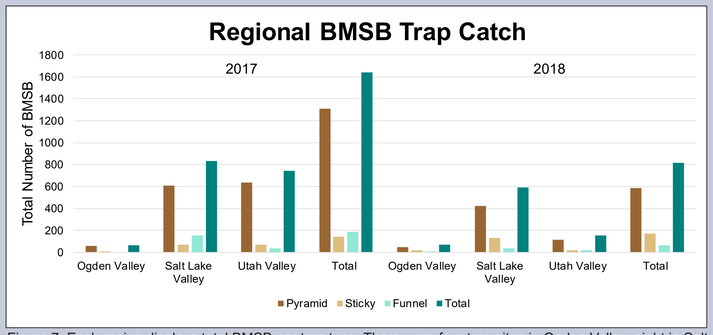


Figure 7. Each region displays total BMSB per trap type. There were four trap sites in Ogden Valley, eight in Salt Lake Valley, and three in Utah Valley. These regions are oriented north to south as they are left to right.

Conclusions

- BMSB inhabits a wide range of ornamental hosts in Utah, principally catalpa.
- BMSB populations decreased between 2017 and 2018, likely due to extreme heat and less precipitation in 2018.
- BMSB appears to be univoltine in the Intermountain West based on current results. To confirm these findings, we will repeat voltinism experimentation in 2019, starting in May and using a larger sample size of (F0) adult BMSB. Starting sooner may enable earlier detection of (F0) oviposition, allowing more time for the (F2) nymphs to develop into adults.
- The Dead Inn Pyramid trap has proven a more effective trap than both the Pherocon® Dual Funnel Tube trap and Dual Panel Clear Sticky trap in urban landscapes of Utah.

References

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Maps were created using ArcGIS® software by Esri.

Acknowledgments

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