



**Brown Marmorated Stink Bug
Stakeholder Advisory Panel Meeting
USDA/ARS
Appalachian Fruit Research Station
2217 Wiltshire Road
Kearneysville, WV 25430
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Submitted by:

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Brown Marmorated Stink Bug Stakeholder Advisory Panel Participants

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Introductions and Overview of 2015 Progress

Presented by: Tracy Leskey, USDA/ARS/AFRS

- Introductions of each person in attendance.
- Information for attendees regarding the contents of program packet provided.
- Presentation by Tracy on SCRI and Stakeholder Advisory Panel purposes, objectives, funding, and accomplishments to date.

Oral Presentation Summaries

Objective 1: Establish biology and phenology of BMSB in specialty crops

1.1.1 Voltinism

Presented by: Shelby Fleischer, Oregon State University

Summary:

- Semi-field cage work completed on numbers of generation. Moving onto defining timing of generations, defining adult physiological states and impacts of abiotic conditions.

1.1.2 Movement to and from overwintering sites and overwintering survivorship

Presented by: Chris Bergh, Virginia Tech

Summary:

- Tracking emergence from overwintering shelters during winters of 2013 and 2014.
- Peaks of emergence in early to mid April and late May to early June.
- First and second peaks of emergence perhaps triggered by degree days and photoperiod, respectively.

Objective 3: Establish effective management programs for BMSB in specialty crops

1.2., 1.3., 3.1., & 3.2. Orchard Crops

Presented by: Chris Bergh, Virginia Tech

Summary:

- Transect sampling of BMSB from woods to orchard showed that more bugs were found on edges of both hosts.
- Highest captures in traps were recorded from woods borders.

- Injury to apples was highest near baited traps and on orchard edges bordered by field crops.
- First record of BMSB commercial injury to hazelnut in 2014 in Oregon.

1.2., 1.3., 3.1., & 3.2. Vegetables

Presented by: Tom Kuhar, Virginia Tech

Summary:

- Suspected that a density of 1 BMSB/sweet corn ear can result in economic loss.
- Report on preferred and less preferred vegetables for BMSB feeding.
- Tomato seems to be unsuitable for BMSB development but still incurs injury in late August.
- Reported high levels of green peach aphid on peppers after 4 weekly pyrethroid sprays to control BMSB.

First Discussion

- In the trap-based treatment threshold studies, where were the traps placed, how many traps should be used per acre and what lure was used?
 - Traps were placed on the border and interior of the apple orchards. More research needed to determine the number of traps per acre. The experimental #10 BMSB aggregation pheromone (10 mg) + MDT (66 mg) was used.
- Which insecticides were used for management in treatment threshold studies?
 - A list of specific insecticides was not reported, but primarily focused on pyrethroids and neonicotinoids for effective control. These included the most efficacious materials for BMSB.
- Potential for border row sprays for BMSB management?
 - Anne Nielsen has recorded data over 3 field seasons. Results showed similar levels of injury between perimeter-only and ARM sprays. Similar levels of injury were reported in apple orchards based on one season of data.
- BMSB found in leaf litter? George Behling said he has found them overwintering in leaf litter.
- Possibility of reduced vigor of asparagus in years following damage?

- Yes, needs to be addressed.
- Discussions on how BMSB tucked in trees perceive change in photoperiod as a cue to leave overwintering sites. Additionally, emergence from diapause was suggested to occur around 13.5 h of daylight.
- Discussions on potential impact of snow cover on BMSB overwintering mortality.
 - Suggested that snow cover may not negatively impact overwintering mortality.

1.2., 1.3., 3.1., & 3.2. Small Fruit

Presented by: Vaughn Walton, Oregon State University

Summary:

- Low populations of BMSB observed in NJ blueberry and presence recorded in Oregon small fruit.
- Reported study showing that blackberry weight was decreased when exposed to 5 BMSB/cluster. Increased necrosis was observed at 2 and 5 BMSB/cluster
- 10 BMSB/cluster reduced blueberry weight on Duke but not Aurora cultivars. Also reported more necrosis in Duke
- Higher injury rates reported in Oregon than in NJ, which may be temperature related given optimal feeding/probing temperature of 17C.

1.2., 1.3., 3.1., & 3.2. Grape

Presented by: Anne Nielsen, Rutgers University

Summary:

- Populations started to increase late August and peaked in late September.
- Many nymphs were observed in NJ grapes.
- Low populations seen in Erie, but higher populations reported 45 miles away.
- More injury observed in white grape varieties.

1.2., 1.3., 3.1., & 3.2. Ornamentals

Presented by: Paula Shrewsbury, University of Maryland

Summary:

- More BMSB found in 2014 in Corvallis nurseries in Oregon than in 2013.

- Found BMSB on 82% of 259 cultivars surveyed.

1.4. Landscape and Temporal Risk

Presented by: George Hamilton, Rutgers

Summary:

- Significant impact of wood border on trap captures and injury to tomatoes.
- Mean patch edge increased BMSB injury and number of patches decreased it

Second Discussion

- Web report movement across state may be influenced by novelty reports where others have become desensitized.
- Has anyone measured relative sugar level at which BMSB becomes attracted?
 - Anne Nielsen reported increases in BMSB populations at veraison when sugars are increasing, although this time also coincides with highest general populations.
 - Similar patterns to Anne's report have been observed in ornamentals and vegetables
- Anyone looked at tensile strength that can be penetrated by BMSB proboscis?
 - Can feed through nuts, tree bark and etc...so not likely a mechanism for preventing injury.
 - Suggestion for research on defining the composition of the woods rather than just reporting woods as important factor in BMSB populations. Angel will talk about this in her presentation
- Phyophthora observed in 50 feet surrounding baited Rescue trap which may be related to increased BMSB.
- Trans-2-decanal and do decanal found in both red and white wines.
- Potential relationship between temperature of woods and optimal feeding temperature.

OREI Update

Presented by: Anne Nielsen, Rutgers

Summary:

- Higher density of natural enemies in trap crops than in pepper cash crop.

- Similar levels of injury to pepper cash crop in control and trap crop-protected peppers
- Reported nymphal dispersal capacity and host plant preferences by plant phenology
- Reported relative levels of predation and parasitism on sentinel BMSB egg masses
- Videos of predators on BMSB eggs. Most predation occurred at night.
- Egg consumption by predators increased with presence of flowering plants (even when plant was not actively flowering).

1.5. Genetic Studies – Transcriptome/RNAi Project
Presented by: Leslie Pick, University of Maryland

Summary:

- First goal was to identify all genes expressed by BMSB
- Second goal was to establish techniques to visualize gene expression
- Third goal to identify genes useful for basic and applied studies -- still in progress.
- BMSB is susceptible to RNAi, but effective delivery method still needed.

1.7. BMSB and Gut Symbionts
Presented by: Chris Taylor, University of Maryland

Summary:

- BMSB symbiont species identified as "*Pantoea carbekii*."
- Survivorship of 3rd – 5th instar nymphs and 1st and 2nd generation adults was reduced by sterilizing egg masses.
- Reported lower fecundity and a protracted pre-oviposition period in females from sterilized egg masses.
- Hope to test antimicrobials effects on symbionts for control of BMSB.

1.8. Diet Optimization/Physiological Status
Presented by: Angel Acebes, Virginia Tech

Summary:

- Most abundant tree species on perimeter of wood lines neighboring orchards in VA and WV: tree of heaven, hackberry, sassafras, spicebush, and black locust.

- Most abundant tree species in interior of woods lines neighboring orchards in VA and WV: hackberry, green ash, black cherry, spice bush, and eastern redbud.
- Peach was suitable as a single diet for BMSB development/survivorship in the early and late season. Mixed diets (variety of foods) increased survivorship compared with a single diet of apple, catalpa or tree of heaven. Tree of heaven suitable as a single host late in the season.
- Adult size was highest on single diet of tree of heaven and mixed diets of other hosts.

Objective 2: Develop monitoring and management tools for BMSB

2.1.1. and 2.1.2. Monitoring Tools and

2.2.3. Attract and Kill

Presented by: Tracy Leskey, USDA

Summary:

- There was a synergistic effect of aggregation pheromone and MDT.
- Trece lure was the only commercial lure that outperformed the experimental standard.
- Trap can be refined to make them more “grower-friendly” given the attractiveness of the aggregate pheromone with synergist.
- In a comparison of different trap types, the highest season-long captures were recorded in coroplast pyramids. Small limb- and ground-deployed traps performed reasonably well. The Rescue trap did not perform as well.
- The area of arrestment around the aggregation pheromone deployed in an apple tree appears to be limited to the baited tree. Baited apple trees will retain BMSB for >20 h.

2.2.5. Asian Natural Enemies and

2.2.6. Native Natural Enemies

Presented by: Christine Dieckhoff, USDA

Summary:

- Four *Trissolcus* in quarantine and being tested for host specificity.
- *Podisus maculiventris* attacked in both choice and no-choice tests.
- Presented list of native predators and parasitoids reported thus far...excluding katydids as reported by Anne Nielsen
- Reported very low rates of parasitism in Delaware from native parasitoids

Third Discussion

- Explanation for variation in trap captures in trap comparison study?
 - This is still being investigated.
- Will marketplace accept RNAi technology?
 - Variable opinions: If it can be shown to work efficiently, then it should be accepted as it can be made to be very specific. Would require a lot of education to growers and public, but a lot of fear likely to persist in the public.
- Are companies ready to sell lures without a mechanism of deployment?
 - Yes, we are working with them to help with that but they want to take advantage of market share.

Objective 4: Integrate stakeholder input and research findings to form and deliver practical outcomes

4.1. Economics

Presented by: Jayson Harper, Penn State University

Summary:

- Evaluating economic impact of BMSB
- Evaluating economics of control strategies against BMSB
- Increased costs of insecticides against BMSB in apple more pronounced than on peaches

4.1., 4.2., 4.3., and 4.5. Outreach (including Grower Survey)

Presented by: Chris Gonzales, NEIPM

Summary:

- Results of online and paper surveys given to growers, farm managers and workers were discussed.
- Growers reported the need for scouting, spraying, trapping and biology/behavior information.
- Updates about StopBMSB.org site traffic were given and kits were handed out.

2.2.1. Insecticides & Management

Presented by: Greg Krawczyk, Penn State University

Summary:

- Organic insecticide data were presented.
- "New" insecticide's efficacy was presented.
- Potential for relating number of nymphs captured per trap to management decisions.

2.2.2. Fungal Pathogens

Presented by: Tom Pike, University of Maryland

Summary:

- Minimal efficacy against BMSB observed with the use of wild-type fungal pathogens alone or in conjunction with diatomaceous earth or horticultural oil.
- Also, minimal efficacy observed with transgenic fungal strains.
- 100% fungal inhibition observed in the presence of 100% trans-2-octenal and trans-2-decenal (purported BMSB defense compounds).

2.2.4. Repellents

Presented by: Aijun Zhang, USDA

Summary:

- Reported that the major repellent secretion by BMSB is tridecane.
- Other repellent components include (*E*)-2-decenal and isolongifolenone (repellent for mosquitoes and ticks).
- Surround seems to have no deterrence effect on BMSB feeding on tomato (which is likely the case for other crops).
- Peppermint oil still to be tested as a possible repellent.

Final Discussions

- Stink bug ID guide to be available in Spanish?
 - Some resources on stopbmsb.org are in Spanish. Considering a Spanish version of the guide.
- Effect of 3-5 years of increased insecticides on ecology of orchards?

- Reports of increases in woolly apple aphid, scales, and mites, but many growers are backing-off on early season pyrethroid use to counter this effect. Some use of secondary pest insecticides prophylactically later in the growing season.
- Some off-label applications of materials have been noted, but do not appear to be rampant.
- Suggestion was made for growers to present at a future working group meeting which practices have been adopted as a result of the SCRI project and what information is still needed.
 - Discussion regarding making commodity-based management programs.
- What are the chemical companies doing in relation to this group?
 - Release of commercial lures.
 - Development of traps.
 - Funding of research to evaluate their products, including biopesticides.
 - Testing of evolving chemistries against Hemiptera/pentatomids.
- Is there a border effect in vegetables?
 - Yes.
- Why aren't BMSB a problem on eastern shore of VA?
 - Perhaps a function of composition of woodlands, or fewer wooded areas?
- Will EPA label for border sprays?
 - Suspect not as it is cannot be monitored in the same way. Labels do not exclude border sprays so perhaps no reason to add it in.