Brown Marmorated Stink Bug Working Group Meeting

Appalachian Fruit Research Station
2217 Wiltshire Road
Kearneysville, WV 25430-2771

June 15-16, 2010

Submitted by:

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Executive Summary

Recently, the brown marmorated stink bug (BMSB), *Halyomorpha halys* (Stål) was introduced from Asia into the mid-Atlantic region. This infestation is believed to have originated in Allentown, PA in the mid 1990s. Since then, BMSB has spread to New Jersey, Maryland, Delaware, West Virginia, and Virginia. Limited populations also have been detected in Mississippi, Ohio, Oregon, and California. BMSB is a polyphagous pest whose host range includes high-value crops such as tree fruit, ornamentals, hardwood trees and cultivated crops such as soybean. In the region encompassing western Maryland and the eastern panhandle of West Virginia, populations have steadily increased annually since first detection in 2003 and 2004, respectively. During the 2009 growing season, serious economic injury to peach, apple, and Asian pear due to large BMSB populations was commonly detected in commercial and experimental orchards late in the season. Some commercial growers have used increasing numbers of pyrethroid applications, a class of insecticides found to be effective against BMSB in an attempt to control BMSB and mitigate economic injury, while other growers were unaware of the extent of BMSB injury until harvest. Although development of a trap-based monitoring system for BMSB is being pursued, there is no established monitoring method or treatment threshold for this pest. Further, BMSB biology within orchards has only recently come under study, and the potential scale of the economic threat is unknown.

In addition to the agricultural threat posed by BMSB, this invasive species also is emerging as a serious nuisance pest for homeowners and business. In the fall, BMSB adults move from host plants and seek overwintering sites, particularly in homes and other buildings. During this behavioral shift, profound numbers of adults will move toward and aggregate on the outside of structures and eventually seek entry within. In 2009, several schools in the eastern panhandle of WV were forced to cancel recess because of the large numbers of BMSBs orienting toward buildings and interfering with the student activities. In addition, many local newspapers and television stations in MD, WV, PA, NJ, VA, and DE have reported on this fall aggregation behavior, highlighting the problems for homeowners. After entry into overwintering sites, BMSB will often be found aggregating in large numbers in small confined spaces such as behind bookshelves, beneath mattresses, inside filters of window-mounted AC units within homes or between layers of stacked building materials in garages. At businesses such as hotels, owners have been forced to display signs explaining the presence of BMSB within their facilities. These observations highlight the societal impact imposed by the presence of this pest within the region and the need to address homeowner and business owner concerns.

In October 2009, an informal meeting was held at the Appalachian Fruit Research Station (AFRS), Kearneysville, WV to discuss BMSB research. Participants included scientists from AFRS, USDA-ARS personnel from Beltsville, MD and Newark, DE, Virginia Tech, and West Virginia University. Based on this initial meeting, participants agreed that a next logical step would be to organize a larger, regional meeting to discuss the current state of BMSB research, identify key questions for research, and establish research, extension, and regulatory priorities.

On June 15-16, 2010, a formal BMSB working group meeting was held at the Appalachian Fruit Research Station in Kearneysville, WV. Meeting participants included key

research and extension personnel from USDA-ARS, Rutgers University, Penn State University, University of Delaware, University of Maryland, and Virginia Tech. Stakeholders included tree fruit growers from VA and WV, an organic vegetable grower from WV, a hotel manager from the eastern panhandle of WV, and the owner of a pest control company in NJ. In total, thirty participants attended the working group meeting.

The meeting was held over the course of two days. On Day 1, participants delivered relevant presentations encompassing BMSB research, field observations, stakeholder concerns, or other critical information. On Day 2, the group convened to establish research, extension, and regulatory priorities for BMSB. The group first generated a comprehensive list of research, extension, and regulatory priorities, and subsequently each meeting participant ranked them within each category. Those results were tallied and presented to the group. An overall list of priorities was then generated based on inclusion and rank assigned by each working group participant. The meeting ended with a discussion of collaborations, grants, and future endeavors.

Overall Priorities

1	**Research**	Studies of basic BMSB behavior (host preferences, movement, and responses to cues)
2	**Research**	Standardized sampling methods (traps, lures, placement, timing)
3	**Research**	Studies of basic BMSB biology (physiology, generations)
4	**Research**	Identification of the true BMSB pheromone
5	**Extension**	Development of education programs for growers and general public (including movement, threat)
6	**Research**	Mapping and assessment of BMSB distribution
7	**Regulatory**	APHIS position statement about BMSB
8	**Extension**	Creation of a unified web-based location as a repository for BMSB information
9	**Research**	Development of IPM-friendly management tactics
10	**Research**	Toxicity screening of known insecticides
11	**Extension**	Education of professionals to identify BMSB and its damage
12	**Research**	Impact of landscape/habitat on population density
13	**Research**	Identification of biocontrol agents-parasitoids, fungal pathogens, predators (native and foreign exploration)
14	**Extension**	Development of a public awareness campaign--posters, public service announcements, educational materials, etc
15	**Regulatory**	Product testing and labeling for new products

Research Priorities

1 Studies of basic BMSB behavior (host preferences, movement, and responses to cues)
2 Studies of basic BMSB biology (physiology, generations)
3 Standardized sampling methods (traps, lures, placement, timing)
4 Establish the identity of susceptible crops and their susceptibility periods
5 Mapping and assessment of BMSB distribution
6 Identification of the true BMSB pheromone
7 Development of monitoring strategies for urban areas and in agricultural settings
8 Determination of host utilization and preference and range
9 Impact of landscape/habitat on population density
10 Development of IPM-friendly management tactics
11 Define damage diagnostics and economics injury
12 Toxicity screening of known insecticides
13 Assessment of economic impact in urban environment
14 Examination of cross attractancy of brown marmorated and green stink bugs to olfactory cues
15 Investigation of host plant volatiles as attractants
16 Identification of potential repellents
17 Identification of biocontrol agents-parasitoids, fungal pathogens, predators (native and foreign exploration)
18 Examination of potential of combining BMSB and *Euschistus* pheromones for monitoring
19 Synopsis of research to date from Japan
20 Assessment of displacement of native stink bugs

Extension Priorities

1 Development of education programs for growers and general public (including movement, threat)
2 Education of professionals to identify BMSB and its damage
3 Creation of a unified web-based location as a repository for BMSB information
4 Development of revised and unified management plants
5 Development of treatment recommendations and guidelines for both urban areas and agricultural settings
6 Raise awareness of importance of BMSB with APHIS, local congressmen and others
7 Development of educational programs for structural and landscape industries
8 Coordinate efforts among extension programs
9 Development of a public awareness campaign--posters, public service announcements, educational materials, etc.
10 Development of an eXtension community of practice
11 Focus on urban entomology
12 Creation of extension groups
13 Direct homeowners to contact local politicians with complaints

Regulatory Priorities

1 APHIS position statement about BMSB
2 Expansion of uses of existing registered products
3 Product testing and labeling for new products
4 Definition of the threat posed by BMSB
5 Prevention of movement (including in vehicles)
6 Interagency coordination and interdisciplinary funding
7 Anticipation of quarantines for nurseries

Oral Presentations Summaries

The Brown Marmorated Stink Bug in Pennsylvania—Then and Now
Karen Bernhard
Penn State University, Lehigh County Cooperative Extension

Questions addressed:

- Are populations of stink bugs down?
- Are growers, especially commercial growers, noticing damage to crops?
- Is it that the damage to fruits and vegetables isn't happening (or isn't serious enough), or is it that folks aren't seeing it?
- Should we be making more attempts to raise awareness of this pest and the damage it can cause?

Summary:

- Poll of Master Gardeners…"Since 2003, I believe Brown Marmorated Stink Bug activity in my home or outbuildings has":
    - Increased—36 (64.3%)
    - Stayed the same—8 (14.3%)
    - Decreased—12 (21.4%)
- Observation of aggregations of BMSB at birdwatching areas on and around Hawk Mountain (North Outlook) by photographers. Lasts roughly two weeks per year.

Spread and Seasonal Occurrence of Brown Marmorated Stink Bug
George Hamilton
Rutgers University
Department of Entomology

Summary:

- Data is collected from blacklight traps and information submitted on the Rutgers University website.
- Brown Marmorated Stink Bug presence is confirmed in MD, PA, NJ, DE, WV, VA, OR, CA, OH, NY, MS, TN, and FL.
- Research shows there is only one generation of adults per year in New Jersey.
- Numbers of adults on crops peaks in August and September.

Assessing the Feeding Injury and Economic Impact of the Brown Marmorated Stink Bug on Soybean
Galen Dively
University of Maryland
Department of Entomology

Summary:

- Brown marmorated stink bugs are spreading in Maryland and feeding on soybeans.
- Infestations are highest in western Maryland, particularly Washington Co.
- Plant injury symptoms are evident, particularly around the edges of soybean fields.
- Cage studies conducted late in the season showed no effects of brown marmorated stink bug feeding on pod numbers and seed weight.
- Green and brown marmorated stink bug feeding significantly affected seed quality, but it is unclear whether that impact will reduce the value of the soybean crop.
- BMSB saliva appears to alter the hormonal system in soybeans; BMSB-damaged plants do not senesce as rapidly as undamaged plants.

Brown Marmorated Stink Bug Programs in the Tree Fruit Industry in Virginia
Bill Mackintosh
Crop Production Services
Winchester, VA

Summary:

- Edge effect of BMSB damage, particularly near woods.
- Before targeting BMSB, roughly 30% fruit injury in commercial orchards. Since paying more attention and targeting BMSB specifically, damage reduced to ~5%.
- Relying on mid- to late-season pyrethroid applications for control.
- Not sure if the pyrethroid treatments are creating a treadmill effect.
- Summary ideal situation:
  In an ideal situation we would be able to monitor stink bug populations, understand when each apple variety is susceptible to injury and have control options that do not cause an imbalance of beneficials within the orchard.

Brown Marmorated Stink Bug in a Tree Fruit Orchard and Vegetable Farm in West Virginia
Mark Orr
George S. Orr & Sons, Inc.
Orr's Farm Market

Summary:

- It is very difficult for growers to identify BMSB presence and injury as it is occurring. Most injury already exists when treatments are applied.
- Brown marmorated stink bugs are the number one insect problem in the orchard causing significant economic loss since 2008.
- His solution to prevent damage is to use pyrethroids earlier in the season even though doing so may disrupt the rest of the IPM program.
- 45,000 bushels of apples from one plot were redirected from fresh market to processing due to BMSB injury.

- There is tremendous injury in Asian pear, and BMSB damage raspberries as well.
- BMSB appear to move around a lot within the farm (from host to host), but without an easily detectable pattern.

Brown Marmorated Stink Bug Injury to Organically Grown Vegetables on a Farm in West Virginia
Clarissa Mathews
Redbud Organic Farm
Inwood, WV

Summary:

- Most types of vegetables show damage from BMSB resulting in significant economic loss, with snap peas exhibiting the most damage.
- Damage documented on snap peas, green beans, heirloom and hybrid tomatoes, squash, sweet peppers, and raspberries.
- Very little damage on hot peppers, wax beans, okra, cabbage, wineberries, and cut flowers.
- First infestation noted in the field in June, very heavy by mid-September (5/plant).
- Enormous transition from field to nearby house and outbuilding.
- Possible tomato blight vector?

Status of Brown Marmorated Stink Bug in Delaware
Joanne Whalen
University of Delaware
Entomology and Wildlife Ecology

Summary:

- Currently a nuisance pest in New Castle County with increasing numbers reported.
- Stink bug damage has been seen in peaches and plums.
- Stink bugs have the potential to cause serious damage in corn, soybeans, and lima beans, which are economically important crops for Delaware.
- DE is #2 producer of baby lima beans in US.

Brown Marmorated Stink Bug in Central Virginia
Eric Day
Virginia Tech
Department of Entomology

Summary:

- The first specimens of Brown Marmorated Stink Bug were found in a student insect collection from central Virginia in 2004.

- First report of BMSB damage by backyard grower.
- To date, the bug is found principally in apple-growing regions of the state (following the Blue Ridge Parkway?).

Brown Marmorated Stink Bug Potential in Virginia
Tom Kuhar
Virginia Tech
Eastern Shore AREC

Summary:

- Brown marmorated stink bugs are difficult to control with pesticides and other traditional methods.
- Current research is being done on native parasitoids.
- Research is underway to see if weather cues can predict brown marmorated stink bug prevalence for the following season.

Brown Marmorated Stink Bug Impacts on Homeowners, Probable Methods of Dispersal and Interest in Web Information
Steve Jacobs
Penn State University
Department of Entomology

Summary:

- Brown marmorated stink bugs have a serious impact on homeowners.
- They are likely dispersed through vehicles, especially via tractor trailers.
- The best place to reach homeowners is probably through a central website, but it has to be easily accessible.
- Penn State's BMSB website (fact sheet) was visited 152,000 times last year.
- BMSB fact sheet is the 3rd most active page on the Penn State College of Agriculture server, behind the College home page and the Extension home page.

Brown Marmorated Stink Bug and Problems for the Hospitality Industry
Brandon Marks
Rooms Director
Clarion Hotel and Conference Center

Summary:

- First seen in the hotel in fall of 2007.
- Entry through each room's AC system is very hard to control.
- Created tent cards for each room notifying guests of the presence of BMSB.

- Online reviews mention stink bugs…not a beneficial circumstance; many guests request discounted/free rooms.
- The abundance of brown marmorated stink bugs is a serious problem for the hospitality industry, causing economic losses due to dissatisfied customers.

Brown Marmorated Stink Bug in the Urban Setting: Overwintering Pest in Residential and Commercial Buildings
Rick Cooper
Technical Director
Cooper Pest Solutions

Summary:

- Currently, commercial efforts to control BMSB are not effective, given lack of understanding in biology, behavior, toxicology, etc.
- BMSB are active throughout the winter in structures and very active at night (responding to lights).
- Create bad relationships between tenants, property owners, and pest control services.
- Very difficult to control in sensitive environments (hospitals, food service, pharmaceuticals).
- Brown marmorated stink bugs create a serious problem for pest control technicians because they are very difficult to treat.
- The industry usually responds with repeated indoor treatment, which results in unnecessary exposure to pesticides with little benefit.
- His company is trying to use an IPM approach; the major component is trying to eliminate ways for brown marmorated stink bugs to enter the buildings.
- A study using targeted treatments of the trees outside commercial buildings significantly reduced the number of pests inside the building.
- BMSB treatments of homes/business in NJ by this particular company: 2006=0, 2007=31; 2008=268; 2009=425.

Natural Enemies of Brown Marmorated Stink Bug: Prospects for Biological Control
Phillip Taylor and Kathy Tatman
USDA-ARS
Beneficial Insects Introduction Research Unit

Summary:

- Natural enemies of pentatomids include parasitoids (supported by substantial research), predators, and pathogens.
- In experiments, individual eggs in sentinel masses were parasitized at a relatively low overall rate, meaning low parasitism efficiency.
- Searches for parasitoids from the original habitat of brown marmorated stink bugs have been mostly in eastern China and Japan.

- Further research questions include whether parasitoids are more active (with higher parasitism efficiency) on some host plants, or in some habitats, than others.

Trapping Brown Marmorated Stink Bug with methyl 2,4,6-decatrienoates
Ashot Khrimian
USDA-ARS
Plant Sciences Institute

Summary:

- Brown marmorated stink bug is attracted to multiple isomers of methyl 2,4,6-decatrienoate.
- Photochemical instability of the chemical did not seem to hamper field attraction of the stink bugs.
- Capture of immature *Halyomorpha halys* and both sexes of adults suggests that methyl 2,4,6-decatrienoates serve as aggregation kairomones.
- Future work will focus on further evaluation of 2E,4E,6Z-10:COOMe in monitoring and possibly mass trapping of *H. halys*.

Semiochemically-based Monitoring of the native Green stink bug, and the Invasion of the Brown Marmorated Stink Bug in Maryland
Jeffrey Aldrich
USDA-ARS
Plant Sciences Institute

Summary:

- Insects, including *Halyomorpha halys* and *Acrosternum hilare* exhibit cross-pheromone attraction, which is probably related to finding food.
- While some pheromones used to trap brown marmorated stink bugs are successful due to cross-pheromone attraction, the true pheromone of the brown marmorated stink bug has not been identified.

Temperature Dependent Growth Rate Studies and Early Season Fruit Injury
Mark Brown
USDA-ARS
Appalachian Fruit Research Station

Summary:

- The population in West Virginia has the same growth response as the population in New Jersey. This suggests parameters documented in New Jersey can be used throughout the mid-Atlantic.

- Arrival of brown marmorated stink bug has increased the level of early season stink bug injury to fruit.
- Current levels of injury are very high and will likely make the brown marmorated stink bug the most significant insect pest for tree fruit in areas where it is found.

Visual Ecology of the Brown Marmorated Stink Bug: Preliminary Results

Tracy Leskey
USDA-ARS
Appalachian Fruit Research Station

Summary:

- Thousands of BMSB captured in brief trapping study. Peak capture of ~200 in one day in a single trap (black pyramid trap baited with 45mg *P. stali* lure)
- During the late season (September and October), brown marmorated stink bugs do not appear to be orienting to visual cues/colors associated with host plants.
- A dark silhouette against a bright background (such as the black traps) may be similar to the dark shape of a potential overwintering site.
- Research is needed to understand season-long responses to visual stimuli.

Outcomes

Group Recommendations

- Continue to meet as a working group. The likely spread of this pest and its increasing importance in agricultural and urban environments necessitates the need for multi-state, multi-institution, and cross-disciplinary efforts.

- Seek funding sources to maintain the working group. Tentative plan will be to meet on November 17, 2010 in Winchester, VA prior to the Cumberland-Shenandoah Fruit Workers Conference.

- Seek funding sources to establish a regional and/or national team to conduct basic and applied research and fulfill extension/outreach missions based on formalized priorities. A proposal has been submitted to the NIFA Critical and Emerging Issues Program.

Meeting Evaluations

- **Did this meeting effectively provide you with current information regarding Brown Marmorated Stink Bug pest problems?** 100% participants strongly agreed.

- **Did this meeting increase your awareness of problems associated with Brown Marmorated Stink Bug?** 88.2% participants strongly agreed, and 11.8 % somewhat agreed.

- **Did this meeting provide you with timely information regarding Brown Marmorated Stink Bug research, extension, and/or regulatory efforts?** 88.2% participants strongly agreed, and 11.8 % somewhat agreed.

- **Has this meeting changed your perception of the pest status of Brown Marmorated Stink Bug?** 47.1% participants strongly agreed, and 52.9 % somewhat agreed.

- **Has this meeting changed or modified any of your original priorities related to Brown Marmorated Stink Bug?** 41.2% participants strongly agreed, 52.9% somewhat agreed, and 5.9% disagreed.

- **Has this meeting strengthened existing collaborations related to Brown Marmorated Stink Bug?** 57.1% participants strongly agreed, and 42.9 % somewhat agreed.

- **Has this meeting led to new collaborations related to Brown Marmorated Stink Bug?** 42.9% participants strongly agreed, 50.0% somewhat agreed, and 7.1% disagreed.

- **Overall, did you find the meeting location and facilities to be adequate?** 86.6% participants strongly agreed, 6.6% somewhat agreed, and 6.6% disagreed.

- **Overall, did you find this meeting to be a useful endeavor?** 100% participants strongly agreed