Population Increase, Movement and Impact of the Brown Marmorated Stink Bug, Halyomorpha halys (Stål) into New York State

Agr.Assistance Winter Fruit Grower Meeting
Lyons, NY
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Peter Jentsch
Senior Extension Associate – Entomology
Brown Marmorated Stink Bug, *Halyomorpha halys*

Overview


• First NY BMSB confirmed in 2007, Hudson Valley in **December of 2008**.

• Economic injury caused by BMSB in the mid-Atlantic occurred in commercial apple in 2009; extensive injury in 2010 causing 37 million dollars in pome fruit damage.

• Economic damage to apple on three Hudson Valley Farms in Ulster and Orange Counties in 2012.
Eggs: Average 28/cluster; light green to white
1st instar: black & red; cluster near eggs
2nd instar: striped antennae
3rd instar: striped antennae and legs

4th instar: thoracic spur; striped antennae & legs
5th instar: wing pads; striped antennae & legs

BMSB Adults: red eyes, 4 cream colored dots on shoulders; banding on legs and antenna, smooth blunt shoulders. Banded abdomen; 14-17 mm in length.
Key features of the brown marmorated stink bug
*Halyomorpha halys*

**Antenna:**
- light & dark banding

**2 sets of 4**
- Cream colored dots on thorax

**Wing pads & Legs:**
- light & dark banding

Photo by David J. Shetlar
Ohio State University
US BMSB Presence by November 2012
Citizen Science & Ag BMSB Presence, PA. 2011
Urban mapping of BMSB (from Citizen Science submissions) showing population concentrations in 33 Counties of New York.

Confirmed Sightings of Brown Marmorated Stink Bug in NY by Zip Code

Brown Marmorated Stink Bug Project (First NY Capture - September 2008)
- BMSB Presence Confirmed 7/13/2012 - 3/8/13
- BMSB Presence Confirmed 8/1/2011 - 7-12-2012
- BMSB Presence Confirmed 9/1/2010 - 7/31/2011
- County Boundary
Brown Mamorated Stink Bug 2012; N=64
Figure 1: Risk maps displaying the relative density of field, vegetable, and fruit crop hosts plants of BMSB throughout the United States.
Polyphagous insect with an expansive host range
- Observed on over 300 plants; arboreal
- Deciduous trees, tree fruit, legumes
Tree of Heaven, *A. altissima.*

Warwick, NY
September, 2012
Ailanthus altissima (Mill.) Swingle ‘Tree of Heaven’

A. altissima has spread through the U.S. including NY.

Contributing to the increase of BMSB in this part of NY state?

The ‘Tree of Heaven’ is a primary food source for BMSB.

Feeding occurs on foliage and seed while it also acts as a site for reproduction of 2 BMSB generations in NY.

Very present in ‘undesirable’ urban niches.
Ailanthus altissima (Mill. ) Swingle; ‘Tree of Heaven’ in NY
Observations of BMSB on Border Plants
Marlboro, NY

Total BMSB 29 June - 9 August, 2012
Observations of BMSB on Border Plants
Warwick, NY

Total BMSB 29 June - 9 August, 2012
2012 Trap and Kill Project

- Injection of Acephate into cambium of *A. altissima*

1. To reduce BMSB
2. To maintain tree attractiveness
3. Act as a trap and kill
Brown Marmorated Stink Bug on Tree Fruit, Small Fruit & Vegetable

**Tree fruit** (apple, pear, peaches, cherry)

**Small fruit** (grape, bramble fruit)

**Vegetables** (tomato, pepper, sweet corn, Lima Beans, soybean).
Hudson Valley Complex: SB species of economic importance

Brown Stink Bug, *Euschistus servus* (Say)

1st & 2nd Generation

Green Stink Bug, *Acrosternum hilare* (Say)

1st Generation

Brown marmorated stink bug, *Halyomorpha halys* (Stål)

1st & 2nd Generation
Establishing Brown Marmorated Stink Bug Presence In NYS: Agriculture Environment

- Standard use of Tedders trap and pheromone lures to determine presence / absence of BMSB
  - Black Tedders triangular station with cone trap and clear plastic jar
  - USDA #10 + MDT (methyl (E,E,Z)-2,4,6-decatrienoate)
  - Killing strip
  - Weed free base
# Lure Comparison Study to Monitor BMSB
Columbia, Dutchess & Orange Co., NY 2013

7 Orchard locations using #10 + MDT standard lures & Black Light

<table>
<thead>
<tr>
<th>Monitoring Site/ Orchard</th>
<th>BMSB Pheromone Type</th>
<th>Lat.</th>
<th>Long.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warwick, NY (Orange County)</td>
<td>#10 + MDT SCRI Monitoring Site</td>
<td>41°13'59.16&quot;N</td>
<td>74°23'15.12&quot;W</td>
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<tr>
<td>Warwick, NY (Orange County)</td>
<td>Lure Comparison</td>
<td>41°13'48.35&quot;N</td>
<td>74°23'9.33&quot;W</td>
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<tr>
<td>Campbell Hall, NY (Orange County)</td>
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<td>41°25'36.46&quot;N</td>
<td>74°14'18.91&quot;W</td>
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<tr>
<td>Campbell Hall, NY (Orange County)</td>
<td>Lure Comparison</td>
<td>41°25'43.37&quot;N</td>
<td>74°14'11.79&quot;W</td>
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<tr>
<td>Marlboro, NY (Orange County)</td>
<td>#10 + MDT SCRI Monitoring Site</td>
<td>41°38'8.77&quot;N</td>
<td>73°58'5.19&quot;W</td>
</tr>
<tr>
<td>Hudson, NY (Columbia, Co.)</td>
<td>#10 + MDT SCRI Monitoring Site</td>
<td>42°11'50.31&quot;N</td>
<td>73°49'34.59&quot;W</td>
</tr>
<tr>
<td>Tivoli, NY (Dutchess Co)</td>
<td>#10 + MDT SCRI Monitoring Site</td>
<td>42° 2'43.32&quot;N</td>
<td>73°51'15.90&quot;W</td>
</tr>
</tbody>
</table>
BMSB Monitoring of 3 NY Orchards, 2013

Campbell Hall, NY

Milton, NY

Marlboro, NY

Tedder / pheomone
Black Light
Lure Comparison Study to Monitor BMSB
Warwick, NY  2013

20 Aug.  27 Aug.  3 Sept.  9 Sept.

Lure Formulation
Brown Marmorated Stink Bug: 2013 NY Monitoring Results as of September 6, 2013
Campbell Hall, NY 2012
Commercial apple

Scouting: 1\textsuperscript{st} BMSB on 27\textsuperscript{th} Aug.
Fruit damage survey
>15% SB Injury in Red Delicious
September 10, 2012
Stink Bug Survey: What species of stink bug is causing fruit injury?
Stink Bug Survey: #4  
100 acre Orchard;  
5 acre block; Pink Lady  
Fruit damage survey  
September 10, 2012

Evaluation of var. ‘Pink Lady’  
Trees @ 3’ x 12’ spacing

- 10 fruit / tree = 100 fruit /30’
- 9 sections; 240’ row
Stink Bug Survey: #4
100 acre Orchard;
5 acre block; Pink Lady
Fruit damage survey
September 10, 2012

Evaluation of var. ‘Pink Lady’
Trees @ 3’ x 12’ spacing

- 10 fruit / tree = 100 fruit /30’
- 9 sections; 240’ row
Stink bug injury to Pink Lady apple on 4 September, 2012
Determination of Stink Bug Injury

- Bitter pit lesions clustered
- Corking beneath skin surface with separation

- Stink bug feeding site always visible
- Corking up to skin surface

Bitter Pit

Stink Bug Injury
Elongate depression with two feeding punctures
Hail Injury
Studies of the Brown Marmorated Stink Bug, *Halyomorpha halys* (Stål), in New York State

2013:

I. Established trap captures with the use of #10 + MDT synergist

![Graphs showing BMSB Trap Captures; #10 + MDT & Black Light for different locations in New York State]
Studies of the Brown Marmorated Stink Bug, *Halyomorpha halys* (Stål), in New York State

2013:

I. Early trap captures with the use of #10 + MDT synergist

II. Monitored BMSB adults on trees: observed on pome & stone fruit in isolated orchards

III. Recommendations:

- Initiate trapping to detect BMSB along the orchard perimeter
- If BMSB is captured in traps then scout perimeter orchard rows
- 1 BMSB observed within 100’ of scouting = orchard perimeter application using efficacious insecticides (bioassay results).
- Repeat scouting after 4d, using observations of 1 BMSB along perimeter orchard rows as a trigger for subsequent perimeter application.
- Following applications would employ alternate row at 7d followed by whole orchard application as observance of BMSB becomes evident.
- Repeating scouting and perimeter spray sequence.
Studies of the Brown Marmorated Stink Bug, *Halyomorpha halys* (Stål), in New York State

2013:

IV. Employed ‘active’ and ‘passive’ traps using fix netting over canopy (Campbell Hall, NY)
   - Both traps sprayed with Bifenthrin 10 DF (3.0 oz./quart).
   - Active trap pheromone baited using #10 + MDT, bi-weekly charge.
Active baited trap (left)

Passive trap (right)
Active Pheromone Baited Trap & Halogen Lighting
Insecticide Treated Netting
Active Pheromone Baited Trap

Rescue Lure
MDT

USDA
#10
Infestation occurrences in Ag. Commodities: >20% Loss in Organic Jalapeno Pepper in 2013
- BMSB populations were observed on Black Walnut and Tree of Heaven, which may have acted as intermediate hosts, fostering migrations to pepper in high numbers.

- BMSB locations on netting traps with pheromone were equally dispersed on the field and forested sides of net.

- Nights when lights were on, BMSB were heavily concentrated on the field side in front of the light with higher numbers observed.
Studies of the Brown Marmorated Stink Bug, *Halyomorpha halys* (Stål), in New York State

*Combined Seasonal Trap Captures Using Pheromone and Pheromone + Light

*Over 13,000 BMSB captured*
- **Beauvaria bassiana** strain GHA applications (*Mycotrol-O @ 16 oz./A*)
BMSB Infested With 
*Beauveria bassiana* strain GHA 
(*Mycotrol-O @ 16 oz./A*)
What are the factors influencing the movement of BMSB to Ag Commodities in NYS

- Population density leading to reduced host viability
  - High overwintering and 1\textsuperscript{st} generation BMSB can reduce the viability of seed and foliage for the 2\textsuperscript{nd} generation in deciduous forest trees

- Climatic conditions
  - Under drought conditions
    - Seed and plant tissue becomes stressed with reduced moisture
    - Seed of deciduous trees reduce moisture stores
    - BMSB will move from deciduous trees to crops as seed viability is reduced

- Can we use rainfall & RH as predictors for BMSB movement to crops?
Factors Influencing BMSB Fruit Feeding
Mid-Atlantic, Allentown, PA 2009 & 2010

2009 Total Rain (37.88 in.)

2010 Total Rain (28.85 in.)

RH Hrs >= 90% (1345 hrs.)

RH Hrs >= 90% (886 hrs.)
Factors Influencing BMSB Fruit Feeding
Rainfall & RH, Campbell Hall, NY

>21% Fruit Injury (N=3600) 2012

Total Rain (1.8 in.)

0.1% Fruit Injury (N=12,000) 2013

Total Rain (6.0 in.)

RH Hrs >= 90% (15 hrs.)

RH Hrs >= 90% (1122 hrs.)
BMSB Monitoring, Threshold and Application Strategy

- **Recommendations:** Tiered monitoring & sequenced applications

- **Monitoring:** Initiate monitoring using Tedders + pheromones to detect BMSB along the orchard perimeter

- If BMSB is captured in traps then scout perimeter orchard rows

- **Threshold:** 1 BMSB observed within 100’ of perimeter scouting

- **Application Strategy:** Use 1 perimeter orchard application using effective insecticides.

- **Monitoring:** Repeat scouting after 4d, using 1 BMSB threshold along perimeter orchard rows as a trigger for subsequent application.

- **Application Strategies:** Use alternate row middle applications (ARM) at 7d

- **Monitoring:** Repeat perimeter scouting using 1 BMSB threshold

- **Application Strategies:** Use whole orchard application. Repeat sequence.
## Insecticide Use

<table>
<thead>
<tr>
<th>Insecticide Group</th>
<th>Product</th>
<th>Active Ingredient</th>
<th>% Adult BMSB Mortality¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrethroid</td>
<td>Bifenture</td>
<td>bifenthrin</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Danitol</td>
<td>fenpropathrin</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>Warrior II</td>
<td>lambda-cyhalothrin</td>
<td>73</td>
</tr>
<tr>
<td>Carbamate</td>
<td>Lannate</td>
<td>methomyl</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>Vydate</td>
<td>oxymyl</td>
<td>68</td>
</tr>
<tr>
<td>Neonicotinoid</td>
<td>Actara</td>
<td>thiamethoxam</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>Assail</td>
<td>acetamiprid</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>Calypso</td>
<td>thiacloprid</td>
<td>58</td>
</tr>
<tr>
<td>Pre-mix</td>
<td>Leverage 360</td>
<td>imidacloprid and bifenthrin</td>
<td>95</td>
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<tr>
<td></td>
<td>Endigo</td>
<td>lambda-cyhalothrin and thiamethoxam</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>Voliam Flexi</td>
<td>chlorantraniliprole and thiamethoxam</td>
<td>98</td>
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</table>

¹ Direct contact activity of insecticides against BMSB adults in a lab setting may be very high, yet the activity of field-aged residue may, over time, quickly becomes ineffective at preventing feeding injury.
BMSB Mgt. in Peaches at 10 d Intervals: Rutgers

* Sulfoxaflor-Dow
Studies of the Brown Marmorated Stink Bug, *Halyomorpha halys* (Stål), in New York State

Residual field bioassay of adult BMSB on treated foliage:

- **Four tree plots, 4 replicates** treated with the highest labeled rate of insecticides using tractor mounted airblast sprayer

- Foliage collected 24, 48 and 72 hours after application.

- 1<sup>st</sup> generation adults placed on portions of 4 leaves wrapped on the inside of a 1 oz. enclosed container.

- Adults were observed at 1 and 3 day intervals and evaluated as live, morabund or dead, held at 70°F.
BMSB Adult Exposure to Insecticide Residue of Apple Foliage
48h Old Residue @ 1 d

BMSB Adult Exposure to Insecticide Residue of Apple Foliage
48h Old Residue @ 3 d
BMSB Adult Exposure to Insecticide Residue of Apple Foliage
72h Old Residue @ 1 d

BMSB Adult Exposure to Insecticide Residue of Apple Foliage
72h Old Residue @ 3 d
<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>Restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lorsban(NL) chlorpyrifos</td>
<td>1 pre-bloom appl./season</td>
</tr>
<tr>
<td>Pounce(NL) permethrin</td>
<td>2 pre-bloom (0.5 lb. a.i./A)</td>
</tr>
<tr>
<td>Carzol(L) formetanate hydrochloride</td>
<td>1 PF appl./season</td>
</tr>
<tr>
<td>Actara(NL) thiamethoxam</td>
<td>11.0 oz./ season (0.258 lb. a.i./A)</td>
</tr>
<tr>
<td>Active ingredient</td>
<td>Restrictions</td>
</tr>
<tr>
<td>-------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Endigo (L)</td>
<td>19.0 fl.oz./ season</td>
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<tr>
<td>lambda-cyhalothrin</td>
<td>(0.16 lb. a.i./A )</td>
</tr>
<tr>
<td>Thiamethoxam</td>
<td>(0.172 lb. a.i./A )</td>
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<tr>
<td>Danitol (L)</td>
<td>2 pre-bloom</td>
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<tr>
<td>fenpropathrin</td>
<td>(0.5 lb. a.i./A)</td>
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<tr>
<td>Lannate 90SP (NL)</td>
<td>5.0 lb./season &amp;</td>
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<tr>
<td>methomyl</td>
<td>5 appl./season</td>
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<tr>
<td></td>
<td>7d min interval</td>
</tr>
<tr>
<td>Thionex 3EC (2ee)</td>
<td>≤ 3 appl./season</td>
</tr>
<tr>
<td>endosulfan</td>
<td>≤ 2 appl. to fruit</td>
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Stop use date for BMSB 2(ee): 7/31/2014

Stop use date for apple: 7/31/2015
<table>
<thead>
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<th>Formulation/(Labeled)</th>
<th>Active ingredient</th>
<th>Restrictions</th>
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<tbody>
<tr>
<td>Leverage (L)</td>
<td>2.8 fl.oz./season</td>
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<tr>
<td>Imidacloprid</td>
<td>(0.044 lb. a.i./A)</td>
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<td>8-cyfluthrin</td>
<td>(0.022 lb. a.i./A)</td>
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<tr>
<td>Assail (NL)</td>
<td>32.0 fl.oz./season</td>
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<tr>
<td>acetamiprid</td>
<td>(0.6 lb. a.i./A)</td>
<td>≤ 4 appl./season</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥ 12d interval</td>
</tr>
<tr>
<td>Danitol (L)</td>
<td>16.0 fl.oz./appl.</td>
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<tr>
<td>fenpropathrin</td>
<td>(0.3 lb. a.i./appl.)</td>
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<tr>
<td></td>
<td>(0.6 lb. a.i./A)</td>
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<td></td>
<td>14d PHI</td>
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<tr>
<td>Lannate 90SP (NL)</td>
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<tr>
<td>methomyl</td>
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<td>7d min interval</td>
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<td>Brigade 2EC (L)</td>
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<td>Bifenture 10DF (L)</td>
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<tr>
<td>bifenthrin</td>
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</table>
Key points to remember

• BMSB is arboreal, forest pest, very mobile to and out of agricultural crops.
• Large deciduous forests likely have high BMSB populations.
• Fruit damage takes 2-3 weeks for expression mid-late season.
• Low populations can equate to high feeding injury levels.

Strategies for control

1. Early trapping with Tedders trap + #10 and MDT combo lure
2. Scouting pome and stone fruit at first trap capture
3. Border applications at first observation along border
4. Maintain border applications if BMSB presence continues
5. Alternate row applications at 4-7 days as BMSB enter orchard

Insecticide efficacy is critical

• Use materials with greatest efficacy & longest residual
• Maintain ‘fresh’ residue every 4-5 days when needed employing alternate row middle (ARM) applications.
Thanks to the staff at the HVL for all their support:

Technical Assistant ................................................................. Allen Clayton
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Administrative Assistant ............................................... Donna Clark
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