

## Brown Marmorated Stink Bug Invasion, Biology, Monitoring and Management

Anne L. Nielsen, Rutgers University

February 19, 2013

[http://www.extension.org/organic\\_production](http://www.extension.org/organic_production)




---

---

---

---

---

---

---

---



Anne Nielsen, Rutgers University




---

---

---

---

---

---

---

---



## *Brown Marmorated Stink Bug* Invasion, Biology, Monitoring and Management

Anne L. Nielsen, PhD

Rutgers University, Dept. of Entomology

Contributions from: Tracy Leskey (USDA ARS)

Yong-Lak Park (WVU)

Clarissa Mathews (Shepherd Univ.)




---

---

---

---

---

---

---

---

## Brown Marmorated Stink Bug

### *Halyomorpha halys* (Stål)

- Native to Japan, South Korea, China
  - Agricultural pest
  - Homeowner nuisance
- Introduced ~1996 into Allentown, PA
- Seasonality, damage and control methods were unknown
- Introduced without predators
- Single introduction




---

---

---

---

---

---

---

---

## The problem in the early years (2003-2005)

- Stink bugs were primarily a secondary pest in Mid-Atlantic region
- Lacked management recommendations for stink bugs
- Populations in Allentown, PA were reported by Karen Bernhard of PSU Cooperative Extension
- BMSB was abundant on numerous host plants and causing damage
  - Population was significantly higher than endemic species
  - Large number of host plants including ornamental and specialty crops
- Was it going to become a pest?

---

---

---

---

---

---

---

---

## Early response to BMSB

- Gary Bernon of APHIS predicted BMSB would be the next "Japanese Beetle"
  - Not placed under quarantine
  - USDA-ARS (J. Aldrich, A. Khirman, A. Zhang) on pheromone identification
    - Plautia stali pheromone, a kairomone for BMSB
    - Late season attraction by nymphs and adults
  - Rutgers University (G. Hamilton, P. Shearer, A. Nielsen) studied biology, trapping, and spread
    - BMSB caused severe injury in tree fruit in NJ and PA in 2006
    - Current management was ineffective
    - Populations found in high numbers in soybean and ornamentals
- 2010-2012: In conventional systems, insecticide application has increased up to 4x




---

---

---

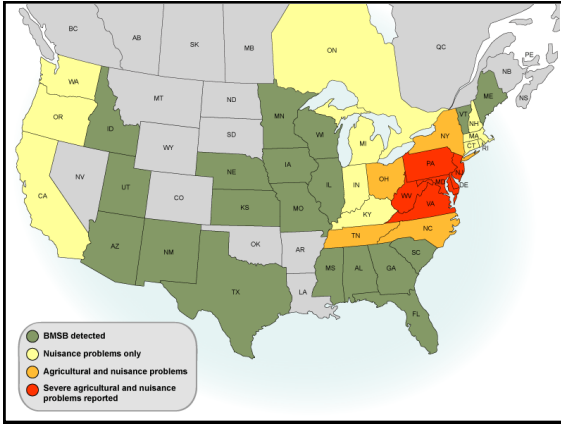
---

---

---

---

---




---

---

---

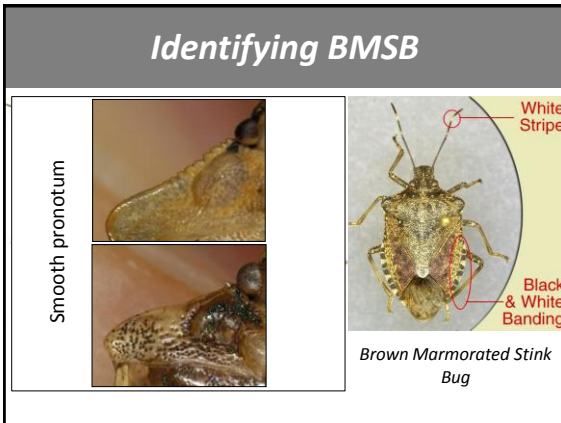
---

---

---

---

---




---

---

---

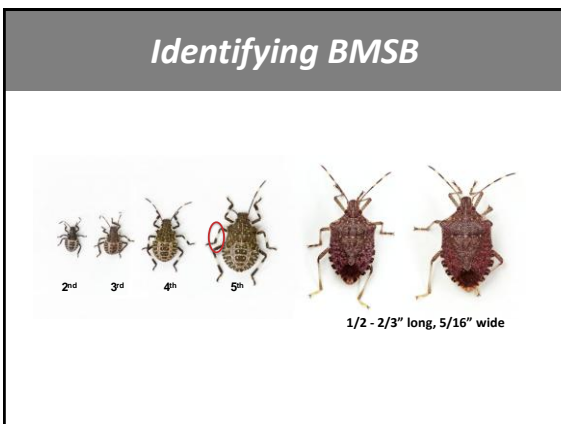
---

---

---

---

---




---

---

---

---

---

---

---

---




---

---

---

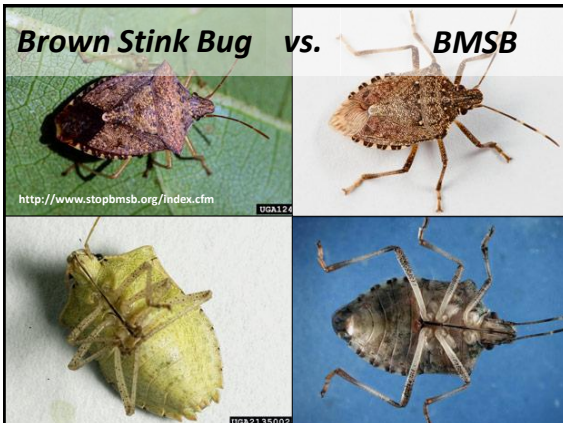
---

---

---

---

---




---

---

---

---

---

---

---

---




---

---

---

---

---

---

---

---

### Survey Response

- How many participants are farmers?
- How many participants have seen BMSB before?

---

---

---

---

---

---

---

### BMSB Overview

1. Biology
1. Monitoring
1. Preliminary data in organic systems




---

---

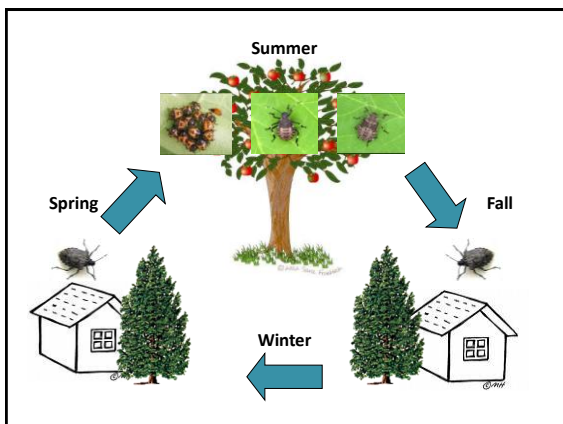
---

---

---

---

---




---

---

---

---

---

---

---

## BMSB Biology

- **Highly polyphagous**
  - Season long pest of peach and sweet corn
  - Late season pest of apple, vegetables, soybean and hardwood trees
  - Nymphs can develop on tree fruit and cause injury
- **Highly mobile**
  - Nymphs are mobile
  - Move between host plants depending on phenology
  - Adults have capacity to fly over 2 km (Lee & Wiman unpub.)
  - Some flight over 50 km

Nielsen and Hamilton Ann. ESA 2009; Nielsen et al. *Env. Entomol.* 2011; Leskey et al., *Psyche* 2012

---

---

---

---

---

---

---

---

## BMSB Biology

- Eggs are laid on the underside of leaves
- Development from egg to adult ~35 days  
— 538 DD (base 14°C)
- A female can lay 4-10 egg masses in her lifetime each with 28 eggs  
— Lag in reproduction for 80-196 DD
- 1-2 generations per year

Nielsen et al., 2008 *Env. Entomol.*




---

---

---

---

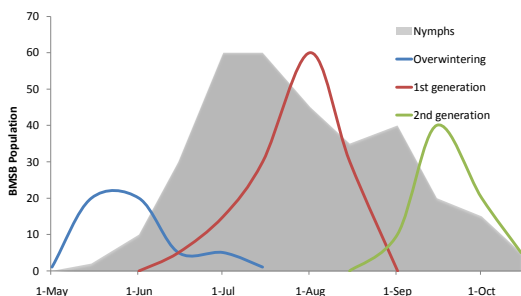
---

---

---

---

## Sample BMSB Multi-Voltine Population




---

---

---

---

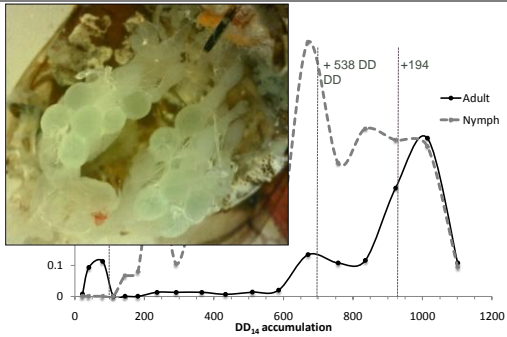
---

---

---

---

### Phenological model - 2012




---

---

---

---

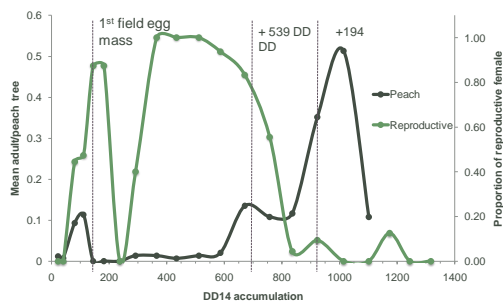
---

---

---

---

### Phenological model - 2012




---

---

---

---

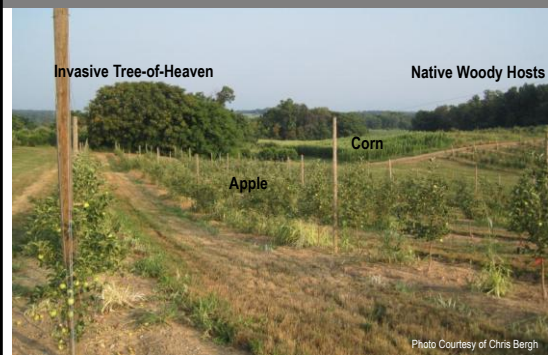
---

---

---

---

### Landscape Level Threat to Crops




---

---

---

---

---

---

---

---





---

---

---

---

---

---

---



---

---

---

---

---

---

---



---

---

---

---

---

---

---





---

---

---

---

---

---

---



---

---

---

---

---

---

---



---

---

---

---

---

---

---




---

---

---

---

---

---

---




---

---

---

---

---

---

---

### *Why is BMSB a Severe Pest?*

- Exploit the ag/urban interface
- Lots of agriculturally important host plants
- Highly mobile
- Perimeter driven pest
- Lack of natural enemies
- Different susceptibility to insecticides than native species
- Short residual of many insecticides




---

---

---

---

---

---

---

## Overview of BMSB

### 1. Biology

- Mobile polyphagous pest with overlapping generations
- Have a degree-day model
- Causes significant injury to host plant

### 2. Monitoring

#### 1. Preliminary data in organic systems




---

---

---

---

---

---

---

---

## Overview of BMSB

### 1. Biology

### 1. Monitoring

#### 1. Preliminary data in organic systems




---

---

---

---

---

---

---

---

## Monitoring Methods

### 1. Landscape

- No sex pheromone identified
- Polyphagous
- Citizen Science; [www.njaes.rutgers.edu/stinkbug](http://www.njaes.rutgers.edu/stinkbug)
- Black light traps

### 2. On-farm

- Direct plant counts
- Aggregation pheromone

---

---

---

---

---

---

---

---

### Monitoring Through the Landscape- NJ

- Black light traps
- Non-specific monitoring tool
- Landscape-level
- Monitor populations during spread and establishment
- Documented attractiveness to pentatomids and BMSB
  - 45-70 traps throughout NJ
  - Monitored May – October for key pests




---

---

---

---

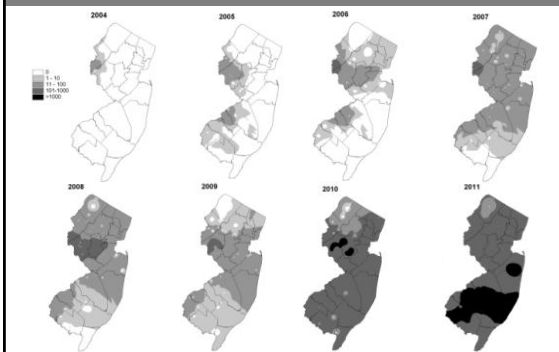
---

---

---

---

### State-wide BMSB Population




---

---

---

---

---

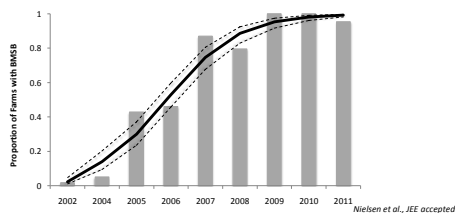
---

---

---

### State-wide BMSB Population

- Since 2004 the BMSB population in NJ increased at a 75% rate
- Spread to 2.8 new farms per year




---

---

---

---

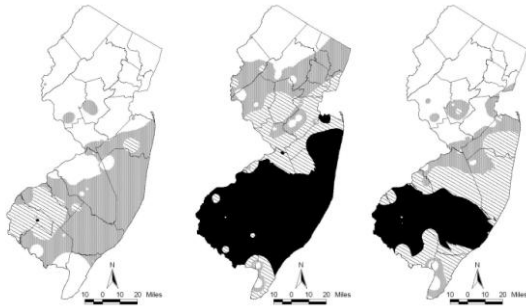
---

---

---

---

## Providing Information to Growers



<http://plant-pest-advisory.rutgers.edu>

---

---

---

---

---

---

---

---

## Monitoring Methods

1. Landscape
  - No sex pheromone
  - Polyphagous
  - Black light traps
2. On-farm
  - Direct plant counts
    - 3 min visual counts
    - Sweep nets
  - Aggregation pheromone




---

---

---

---

---

---

---

---



## Trap Based Monitoring Tools – Leskey

- True pheromone has been identified (#10)
- Dose response studies being conducted
- Purity of compound is not a concern
- When combined with compound “A” there is a synergy for attraction
- Plans for commercial release in 2013




---

---

---

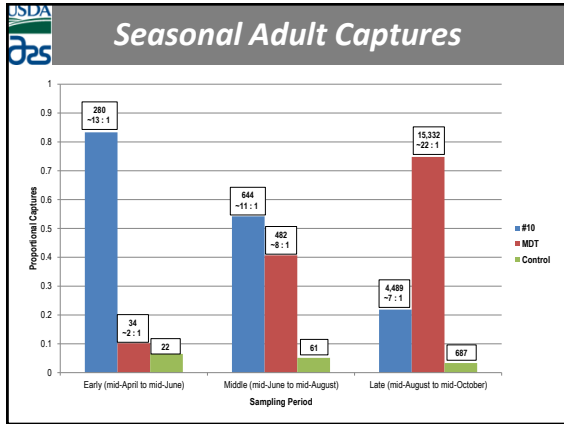
---

---

---

---

---




---

---

---

---

---


---

---

---

**BMSB Overview**

1. ~~Biology~~
1. Monitoring
  - BLT for landscape
  - On-plant counts can be variable
  - Aggregation pheromone identified
2. Preliminary data in organic systems




---

---

---

---

---


---

---

---

**BMSB Overview**

1. ~~Biology~~
1. ~~Monitoring~~
1. Preliminary data in organic systems




---

---

---

---

---

---

---

---

### USDA OREI Funding for Organic Management of BMSB Using a Whole-Farm Approach

- Investigate dispersal behavior within the farmscape and integrate with core organic pest management strategies
  - *Conservation biological control*
  - *Habitat manipulation*
  - *Trap Crops*
  - *Barriers*
- Identify integrated management tactics that could be employed by organic farmers for BMSB and endemic species
- Investigate management of BMSB and native SB at different "invasion" levels
- Extension through eOrganic, field days, social media

---

---

---

---

---

---

---

---

### Preliminary Data in Organic Systems

#### Movement Patterns



Trap Crops



Biological Control  
Organic Insecticides

#### Aggregation Traps




---

---

---

---

---

---

---

---



### Movement Patterns - Park

- Why is a whole-farm approach needed?
  - BMSB has a wide host range
  - BMSB is highly mobile
- Understanding the movement patterns throughout the season
  - Sequence of host plants
  - Track movement of the population
  - Identify or predict hot/cold spots

---

---

---

---

---

---

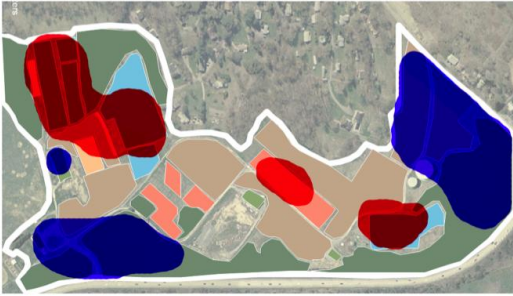
---

---





### Movement Patterns - Park




---

---

---

---

---

---

---



### Movement Patterns - Park

- Hot spots moved during the growing season  
– Building – Berry – Tomato/Apple – Field crop
- Holds true regardless of pest pressure
- Preference to sweeter varieties (3 years)  
Tomatoes and peppers

---

---

---

---

---

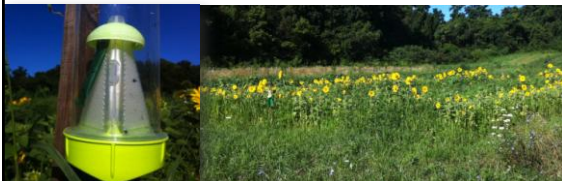
---

---



### Trap Crops - Mathews

- Potential Trap Crops - Green amaranth (*Amaranthus spp.*) and sunflower
- Trap crops baited with Rescue® trap surrounding cash crop
- Sampled weekly for stink bugs and natural enemies




---

---

---

---

---

---

---




---

---

---

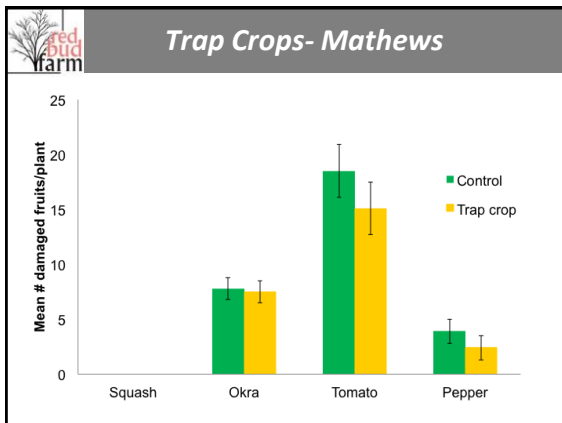
---

---

---

---

---




---

---

---

---

---

---

---

---

**Biological Control**  
Hoelmer, Hooks, Dively, Park

- Egg parasitism is low
- Predation primarily by big-eyed bug and spined soldier bug
  - Up to 60% predation by sucking bugs

---

---

---

---

---

---

---

---




---

---

---

---

---

---

---

### ***Organic Insecticide Trials***

Nielsen, Dively, Park

- Evaluated biopesticide or organic compounds against nymphs
- Azera, Venerate, M-Pede showed laboratory efficacy and reduction in feeding injury against early season fruit
- Pyganic has knock down activity of adults
- Also cause mortality of spined soldier bug
- Surround has been effective at slowing dispersal into orchards




---

---

---

---

---

---

---

### ***Steps Towards Management!***

- Predation is increasing
- Aggregation pheromone identified
- Have a phenological model
- Limited organic insecticides available
- Behavior, landscape movement, host plant selection, sustainable control are still unknown




---

---

---

---

---

---

---




---

---

---

---

---

---

---

---

Find the slides and recording of this presentation at  
<http://www.extension.org/pages/67200>

Register for upcoming webinars and view recorded  
 eOrganic webinars at  
<http://www.extension.org/pages/25242>

Additional organic farming questions? Ask them at  
<https://ask.extension.org/groups/1668>

We need your feedback! Please fill out our follow-up  
 email survey!





---

---

---

---

---

---

---

---