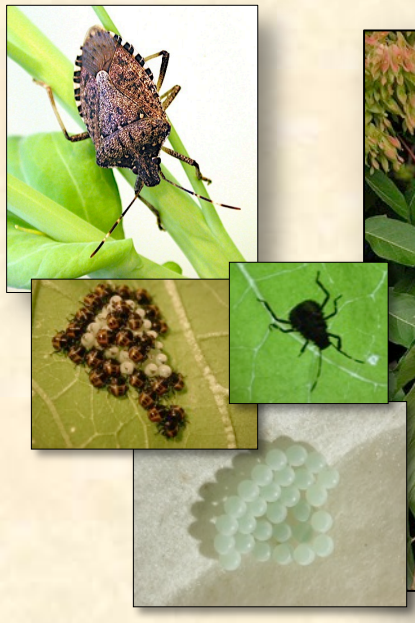
Agriculturally Invasive Insect Pests in NY State: Update on BMSB Management in Vegetable



Brown Marmorated Stink Bug

Tree of Heaven
Ailanthus altissima

Lower Hudson Valley Commercial Vegetable Growers' School
The Falcon, Marlboro, NY
February 24, 2014 – 10:00AM

Peter Jentsch
Senior Extension Associate – Entomology

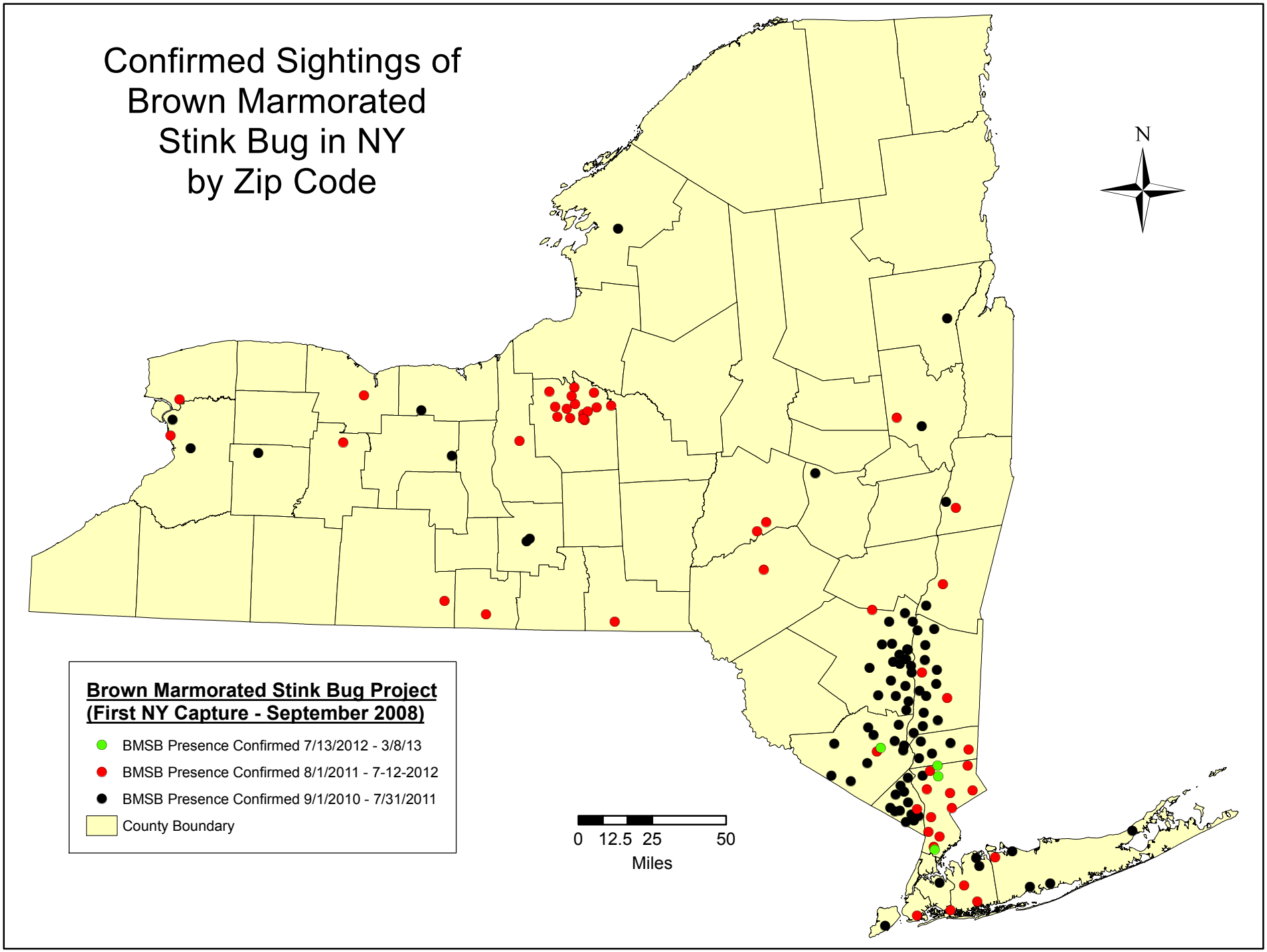
CORNELL'S
Hudson Valley
LABORATORY

Asian Invasive Brown Marmorated Stink Bug Spread in the US

Halyomorpha halys

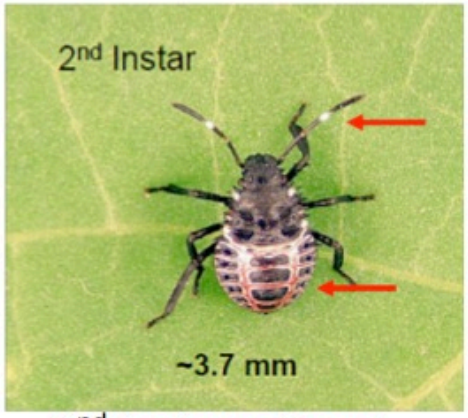
Year Brown Marmorated Stink Bug Detected

1996 | 1999 | 2003 | 2004 | 2005 | 2007 | 2008 | 2009 | 2010 | 2011

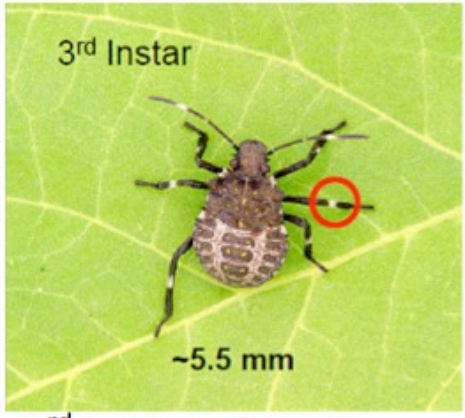

Confirmed Sightings of
Brown Marmorated
Stink Bug in NY
by Zip Code
N
Brown Marmorated Stink Bug Project
(First NY Capture - September 2008)
BMSB Presence Confirmed 7/13/2012 - 3/8/13
BMSB Presence Confirmed 8/1/2011 - 7-12-2012
BMSB Presence Confirmed 9/1/2010 - 7/31/2011
County Boundary
0 12.5 25 50
Miles

Eggs: Average 28/cluster; light green to white

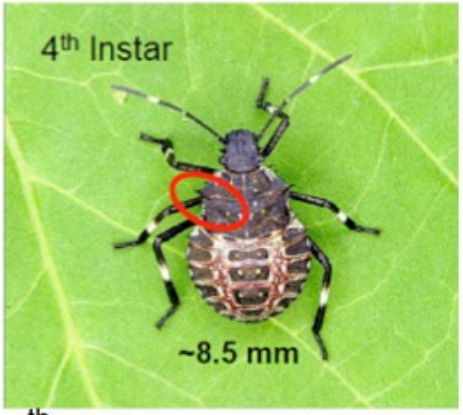
1st instar: black & red; cluster near eggs



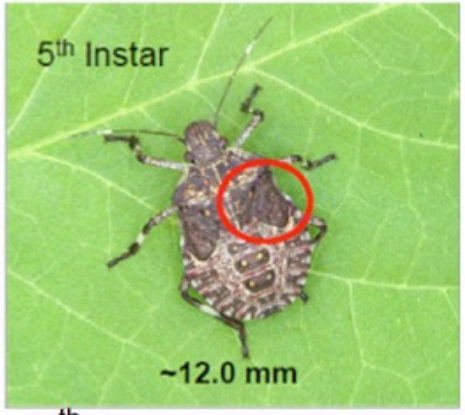
2nd instar: striped antennae



3rd instar: striped antennae and legs



4th instar: thoratic spur striped antennae & legs



5th instar: wing pads striped antennae & legs

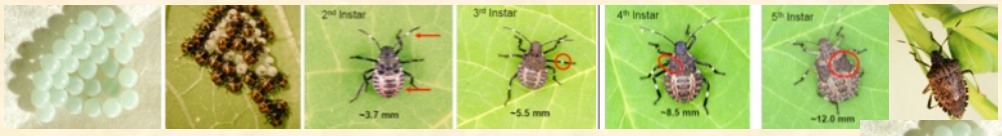
BMSB Adults: red eyes, 4 cream colored dots on shoulders; banding on legs and antenna, smooth blunt shoulders. Banded abdomen; 14 -17 mm in length.

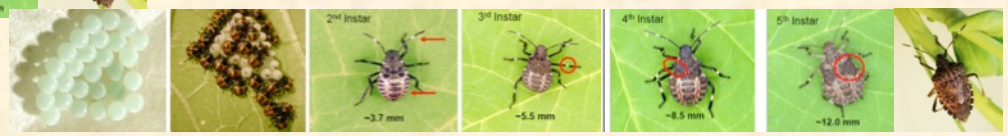
Adult BMSB

2 sets of
4 cream ‘dots’

Along the
anterior edge of
the abdomen
and thorax

BMSB Voltinism
2 generations in the Mid-Hudson Valley of NY





Combined 1st & 2nd Generations

May June July August September Oct.

Presence in Vegetable Intensified Feeding

CORNELL'S Hudson Valley LABORATORY

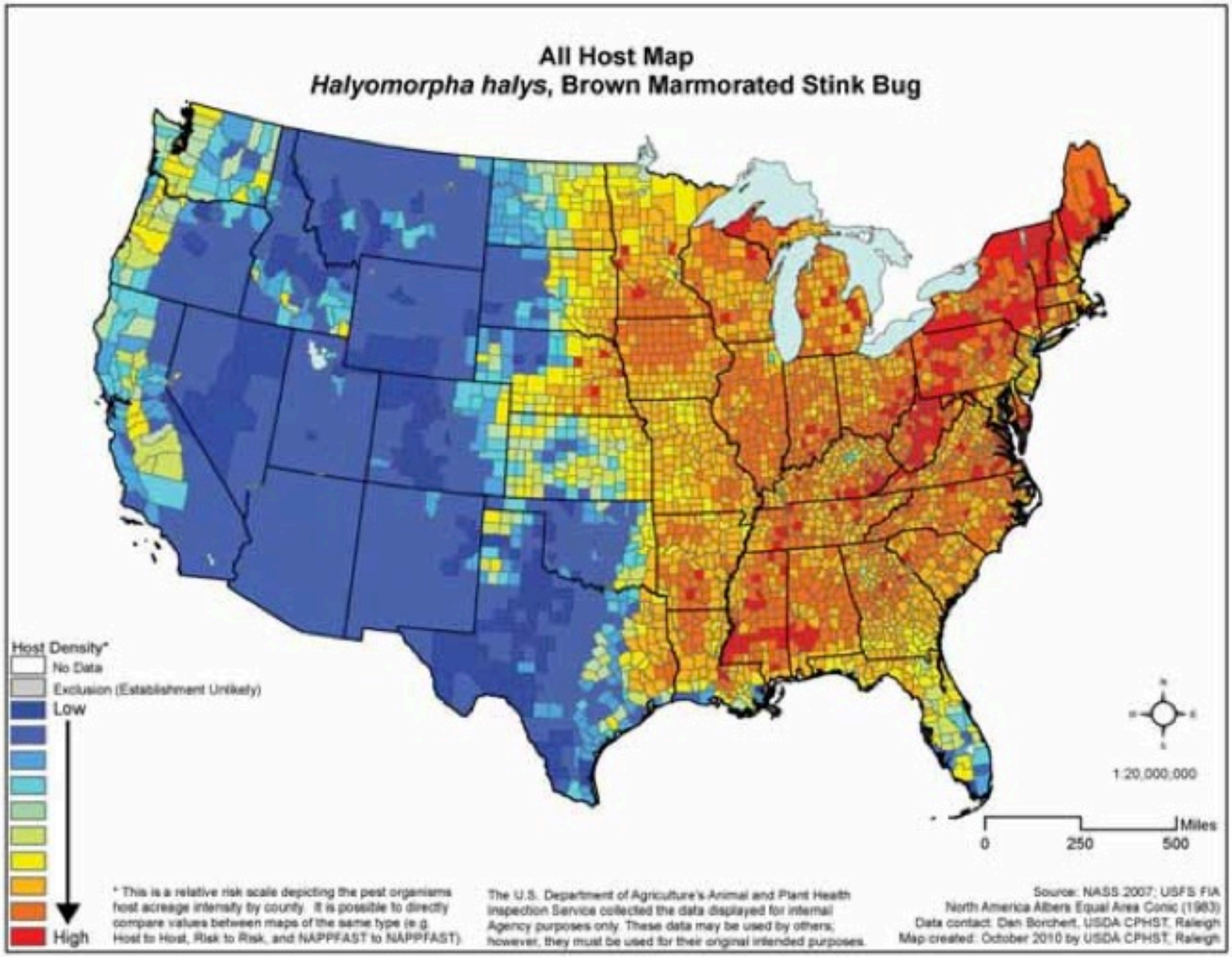


Figure 1: Risk maps displaying the relative density of field, vegetable, and fruit crop hosts plants of BMSB throughout the United States.

Appendix A: BMSB Host List

Table 2: Reported host list for BMSB. This pest's host range is likely larger than what has been reported in the literature and likely includes a wide variety of ornamentals and weeds that have not been specifically documented in the literature. (* indicates hosts used to develop the risk maps in Figure 1 and 2).

Host	Common name	Reference
Abeliea x *grandiflora* (André) Rehd	Glossy abelia	Bernon, 2004
Acer campestre L.	Hedge maple	Bernon, 2004
Acer palmatum Thunb.	Japanese maple	Bernon, 2004
Acer platanoides L.	Norway maple	Bernon, 2004; Hamilton and Shearer, 2003
Acer pseudoplatanus L.		Wermelinger et al., 2008
Acer rubrum L.	Red maple	Bernon, 2004
Acer spp.*	Maple	Hoebeke and Carter, 2003; Wermelinger et al., 2008
Amelanchier spp.	Shadbush	Bernon, 2004; Hoebeke and Carter, 2003
Arctium minus Bernh.	Burdock	Bernon, 2004
Arctium spp.		Wermelinger et al., 2008
Asparagus officinalis L.*	Asparagus	Hamilton and Shearer, 2003
Asparagus spp.		Bernon, 2004; Wermelinger et al., 2008
Basella rubra Linn.	T'ang ts'oi or Climbing spinach	Hoffman, 1931
Beta vulgaris L.	Beat Root	Hua, 2000
Betula spp.	Birch	Bernon, 2004
Buddleja davidii Franch.	Butterfly bush	Bernon, 2004; Wermelinger et al., 2008
Buddleia spp.	Butterfly bush	Hamilton and Shearer, 2003
Camellia oleifera C. Abel	Tea-oil camellia	Hua, 2000
Capsicum annuum L*	Bell pepper	Bernon, 2004; Leskey, 2010a, 2010b
Caragana arborescens Lam.	Siberian pea shrub	Bernon, 2004; Nielsen and Hamilton, 2009
Carya spp.	Pecan	Bernon, 2004
Catalpa spp.*	Catalpa	Bernon, 2004; Hoebeke and Carter, 2003
Celastrus spp.	Bittersweet	Bernon, 2004
Celosia argentea L.	Princess feather or Cock's comb	Hoffman, 1931
Celtis occidentalis L.	Hackberry	Bernon, 2004
Cercis canadensis L.	Redbud	Bernon, 2004
Cleome spp.	Cleome	Bernon, 2004
Citrus spp.*	Citrus	Wermelinger et al., 2008; Hoebeke and Carter, 2003
Cornus racemosa Lam.	Gray dogwood	Bernon, 2004
Cornus sericea L.	Redosier dogwood	Bernon, 2004

Host	Common name	Reference
Tilia americana L.	Linden	Bernon, 2004
Tilia spp.*	Basswood	Hoebeke and Carter, 2003
Triticum aestivum L.	Wheat	Hua, 2000
Tropaeolum majus L.		Wermelinger et al., 2008
Ulmus spp.	Elm	Hua, 2000
Uncultivated hedge		Nielsen and Hamilton, 2009
Viburnum opulus var. *americanum* Ait.	Highbush cranberry	Nielsen and Hamilton, 2009
Viburnum prunifolium L.	Blackhaw viburnum	Bernon, 2004; Nielsen and Hamilton, 2009
Viburnum setigerum Hance	Tea Viburnum	Bernon, 2004
Vibernum spp.	Cranberry bush	Bernon, 2004
Vigna sesquipedalis L.	Chinese long bean	Hoffman, 1931
Vitis spp.*	Grape	Bernon, 2004; Hamilton, 2009
Vitis vinifera L.	Grapevine	Wermelinger et al., 2008
Zea mays L.*	Corn	Leskey, 2010a, 2010b

United States Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine

Qualitative analysis of the pest risk potential of the brown marmorated stink bug (BMSB), *Halyomorpha halys* (Stål), in the United States

October 2010

Rev: Original

Polyphagous insect with an expansive host range

- 133 listed plant species hosts
- Observed on over 300 plants
- Deciduous trees, tree fruit, legume, vegetable

Host	Common name	Reference
Corylus colurna L.	Turkish filbert	Bernon, 2004
Crataegus spp.	Hawthorn	Bernon, 2004
Cryptomeria spp.	Japanese cedar	Wermelinger et al., 2008
Cucumis sativus L.	Cucumber	Bernon, 2004
Cupressus spp.	Cypress	Wermelinger et al., 2008
Decaisnea fargesii Franch.		Wermelinger et al., 2008
Diospyros kaki L.	Persimmon	Hoebeke and Carter, 2003
Diospyros kaki Thunb.	Japanese persimmon	Kawada and Kitamura, 1983
Diospyros spp.*	Persimmon	Bernon, 2004; Hoebeke and Carter, 2003; Wermelinger et al., 2008
Elaeagnus angustifolia L.	Russian olive	Nielsen and Hamilton, 2009
Euonymus alatus (Thunb.) Siebold	Winged Euonymus	Bernon, 2004
Euonymus spp.	Euonymus	Bernon, 2004
Ficus spp.	Fig	Hoebeke and Carter, 2003
Fraxinus americana L.	White ash	Nielsen and Hamilton, 2009
Franxinus spp.	Ash	Bernon, 2004
Glycine max Merrill	Soybean	Bernon, 2004; Hoebeke and Carter, 2003; Wermelinger et al., 2008 Hua, 2000; Son et al., 2000
Gossypium spp.	Cotton	Hua, 2000
Helianthus spp.	Sunflower	Bernon, 2004
Hibiscus rosa-sinensis L	Chinese hibiscus	Hoffman, 1931
Hibiscus spp.		Wermelinger et al., 2008
Ilex opaca Ait.	American holly	Bernon, 2004; Hamilton and Shearer, 2003
Ilex spp.*	Holly	Bernon, 2004
Ilex verticillata (L.) A. Gray	Winterberry holly	Bernon, 2004
Juglans nigra L.*	Walnut	Bernon, 2004
Koelreuteria spp.	Goldenrain Tree	Bernon, 2004
Ligustrum spp.	Privet	Bernon, 2004
Lonicera spp.	Honeysuckle	Bernon, 2004; Hoebeke and Carter, 2003; Wermelinger et al., 2008
Lycopersicon spp.	Tomato	Bernon, 2004
Magnolia stellata (Siebold & Zucc.) Maxim.	Star magnolia	Bernon, 2004
Malus domestica L. (or Brokh)*	Apple	Hua, 2000; Hoebeke and Carter, 2003
Malus spp.	Crabapple	Bernon, 2004; Hamilton and Shearer, 2003; Wermelinger et al., 2008
Morus spp.	Mulberry	Wermelinger et al., 2008; Bernon, 2004; Hoebeke and Carter, 2003
Paulownia spp.	Paulownia	Hoebeke and Carter, 2003
Paulownia tomentosa (Thunb.) Siebold & Zucc. ex Steud.*	Princess Tree or Paulownia	Bernon, 2004; Hoebeke and Carter, 2003; Wermelinger et al., 2008
Phaseolus lunatus Linn.	Lima beans	Hoffman, 1931

Host	Common name	Reference
Phaseolus spp.*	Pole bean, Bush bean	Bernon, 2004
Phaseolus vulgaris L.	String beans	Hamilton and Shearer, 2003; Wermelinger et al., 2008
Pisum sativum L.	Peas	Wermelinger et al., 2008
Platanus occidentalis L.	Sycamore	Bernon, 2004
Prunus armenica L.	Apricot	Bernon, 2004; Wermelinger et al., 2008
Prunus avium L.	Cherry	Wermelinger et al., 2008; Hoebeke and Carter, 2003
Prunus domestica L.	Plum	Bernon, 2004; Wermelinger et al., 2008
Prunus grayana Maxim.	Japanese bird cherry	Funayama, 2007
Prunus mume Sieb. et Zucc	Japanese apricot	Hoebeke and Carter, 2003
Prunus persica Batsch	Japanese peach	Hoebeke and Carter, 2003; Wermelinger et al., 2008; Hua, 2000
Prunus spp.*	Peach,	Bernon, 2004; Leskey, 2010a, 2010b; Wermelinger et al., 2008
Prunus spp.	Ornamental plum, Sour cherry, Black cherry	Bernon, 2004
Pyracantha coccinea M. Roem	Firethorn	Wermelinger et al., 2008
Pyracantha spp.	Firethorn	Bernon, 2004; Hamilton and Shearer, 2003
Pyrus prifolia Nakai	Japanese pear	Hoebeke and Carter, 2003
Pyrus pyrifolia (Burm. f.) Naki	Asian pear	Nielsen and Hamilton, 2009
Pyrus spp.*	Pear	Bernon, 2004; Nielsen and Hamilton, 2009; Hua, 2000;
Rhamnus spp.	Buckthorn	Bernon, 2004
Rhodotypos scandens (Thunb.) Makino	Jetbead	Bernon, 2004
Rhus spp.	Sumac	Bernon, 2004
Rosa rugosa Thunb.	Rugosa rosea	Bernon, 2004; Nielsen and Hamilton, 2009;
Rosa spp.	Rose	Hamilton, 2009
Rubus spp.*	Raspberry	Bernon, 2004; Hamilton and Shearer, 2003; Wermelinger et al., 2008
Salix spp.	Willow	Bernon, 2004; Wermelinger et al., 2008
Sambucus spp.	Elder	Bernon, 2004
Sicyos angulatus L.	Burcucumber	Bernon, 2004
Solanum nigrum L.	Black nightshade	Hoffman, 1931
Solanum spp.	Nightshade	Bernon, 2004
Solanum spp.*	Tomato	Hamilton, 2009; Leskey, 2010a, 2010b
Sorbus spp.	Mountainash	Bernon, 2004
Spiraea spp.	Spirea	Bernon, 2004
Stewartia pseudocamellia Maxim.		Wermelinger et al., 2008
Symphytum spp.	Comfrey	Bernon, 2004
Syringa spp.	Lilac	Bernon, 2004; Wermelinger et al., 2008

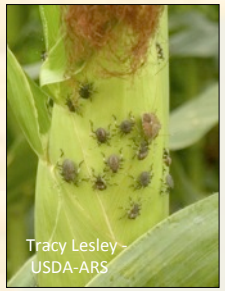
Brown Marmorated Stink Bug on Tree Fruit, Small Fruit & Vegetable

Tree fruit (apple, pear, peaches, cherry)

Small fruit (grape, bramble fruit)

Doug Pfeiffer - Virginia Tech

Vegetables (tomato, pepper, sweet corn, Lima Beans,



Hudson Valley Complex:
SB species of economic importance

Brown Stink Bug, *Euschistus servus* (Say)

Adult Stink bug damage

GT TC P Bloom PF 1C 2C 3C 4C 5C 6C 7C 8C

21 March 21 April 27 April 1 May 14 May 28 May 10 June 25 June 5 July 15 July 1 Aug. 15 Aug. 1 Sept.

Green Stink Bug, *Acrosternum hilare* (Say).

Adult Stink bug damage

GT TC P Bloom PF 1C 2C 3C 4C 5C 6C 7C 8C

21 March 21 April 27 April 1 May 14 May 28 May 10 June 25 June 5 July 15 July 1 Aug. 15 Aug. 1 Sept.

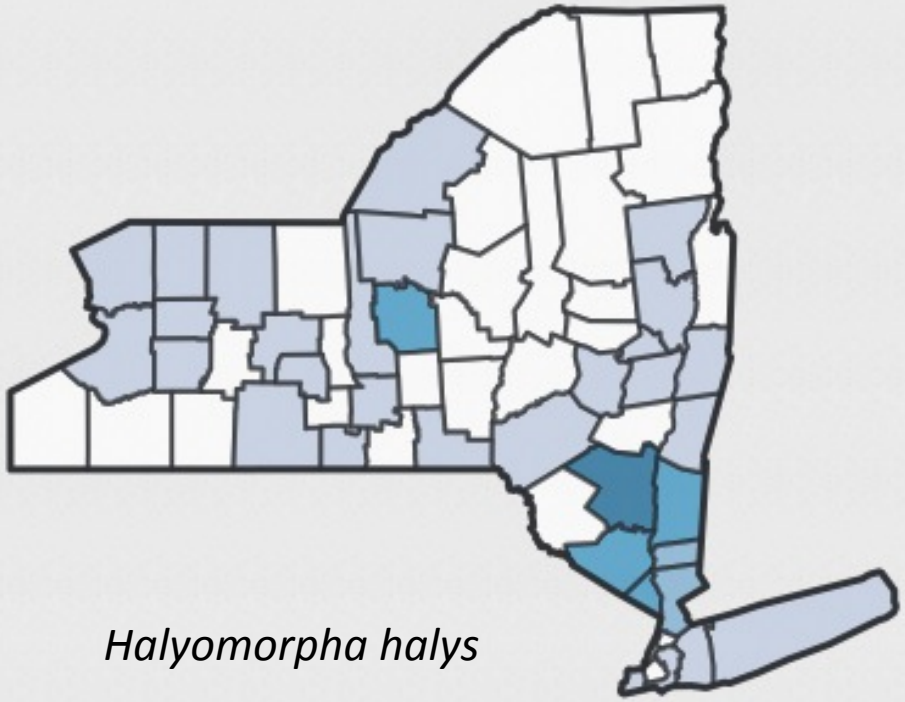
Brown marmorated stink bug, *Halyomorpha halys* (Stål)

Adult SB Presence | Adult & Nymph Stink bug damage

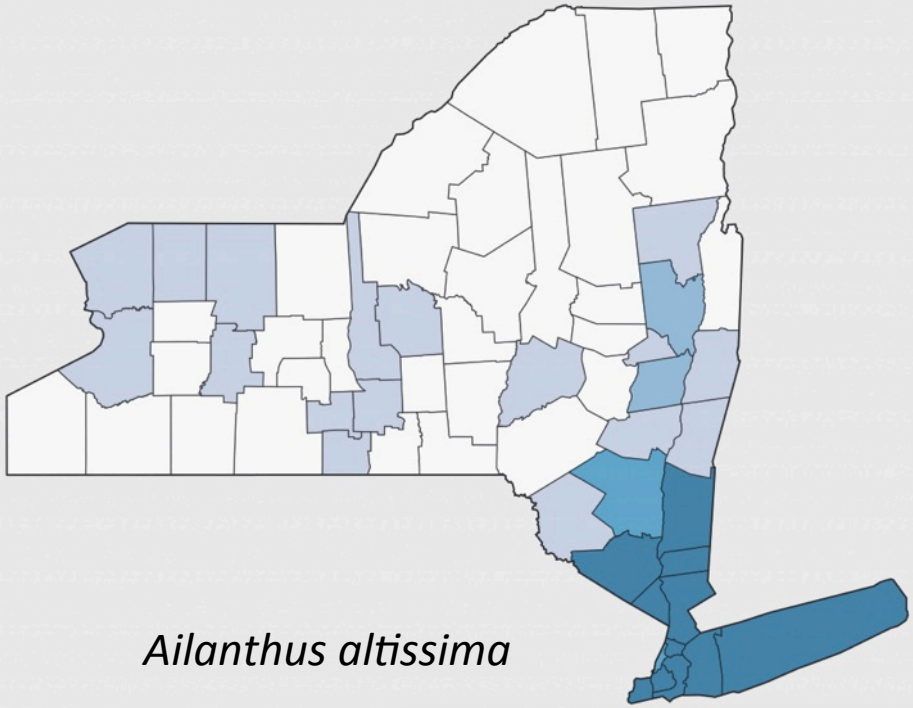
GT TC P Bloom PF 1C 2C 3C 4C 5C 6C 7C 8C

21 March 21 April 27 April 1 May 14 May 28 May 10 June 25 June 5 July 15 July 1 Aug. 15 Aug. 1 Sept.

iMapinvasive
New York Invasive Species Public Map
http://imapinvasives.org/nyimi/map/



Halyomorpha halys



Ailanthus altissima

- Use of invasive species maps help to better understand the ecological niche of newly introduced invasive species
- The BMSB utilizes the Tree of Heaven, *Ailanthus altissima* as an important food and reproductive resource.


Tree of Heaven, *A. altissima*.
Warwick, NY
September, 2012

***Ailanthus altissima* (Mill.) Swingle 'Tree of Heaven'**

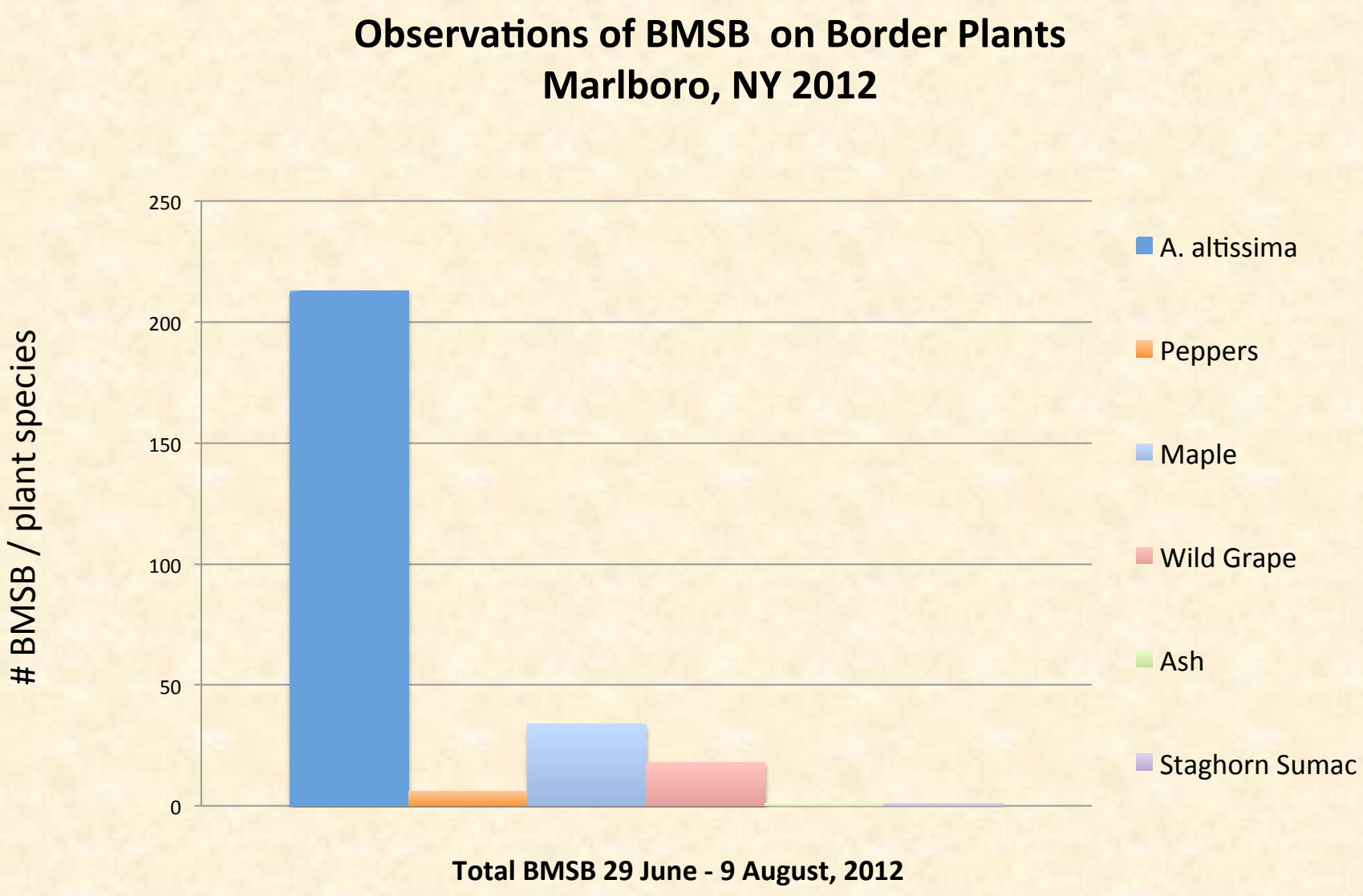
A. altissima has spread through the U.S. including NY.

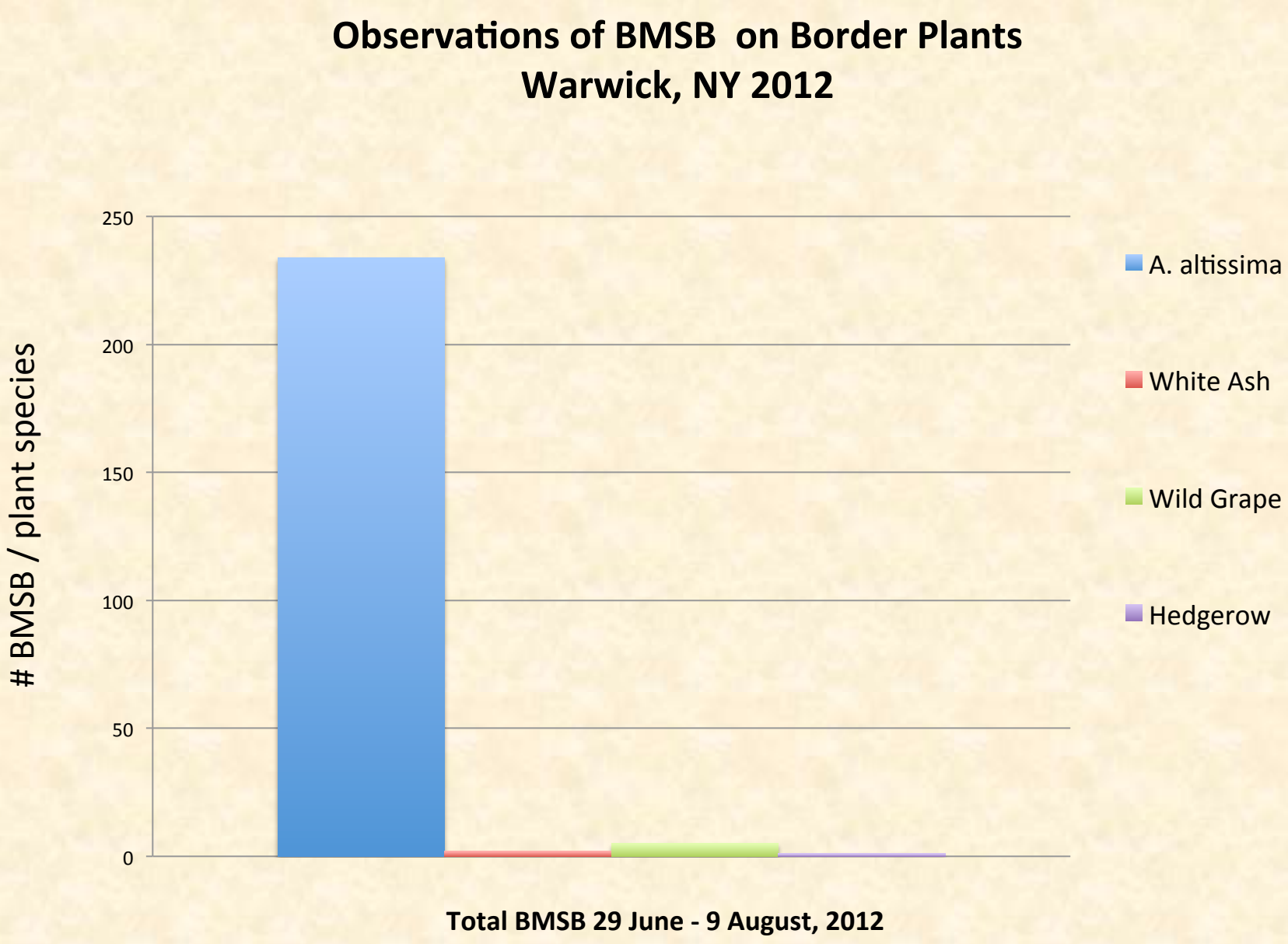
Contributing to the increase of BMSB in this part of NY state?

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.

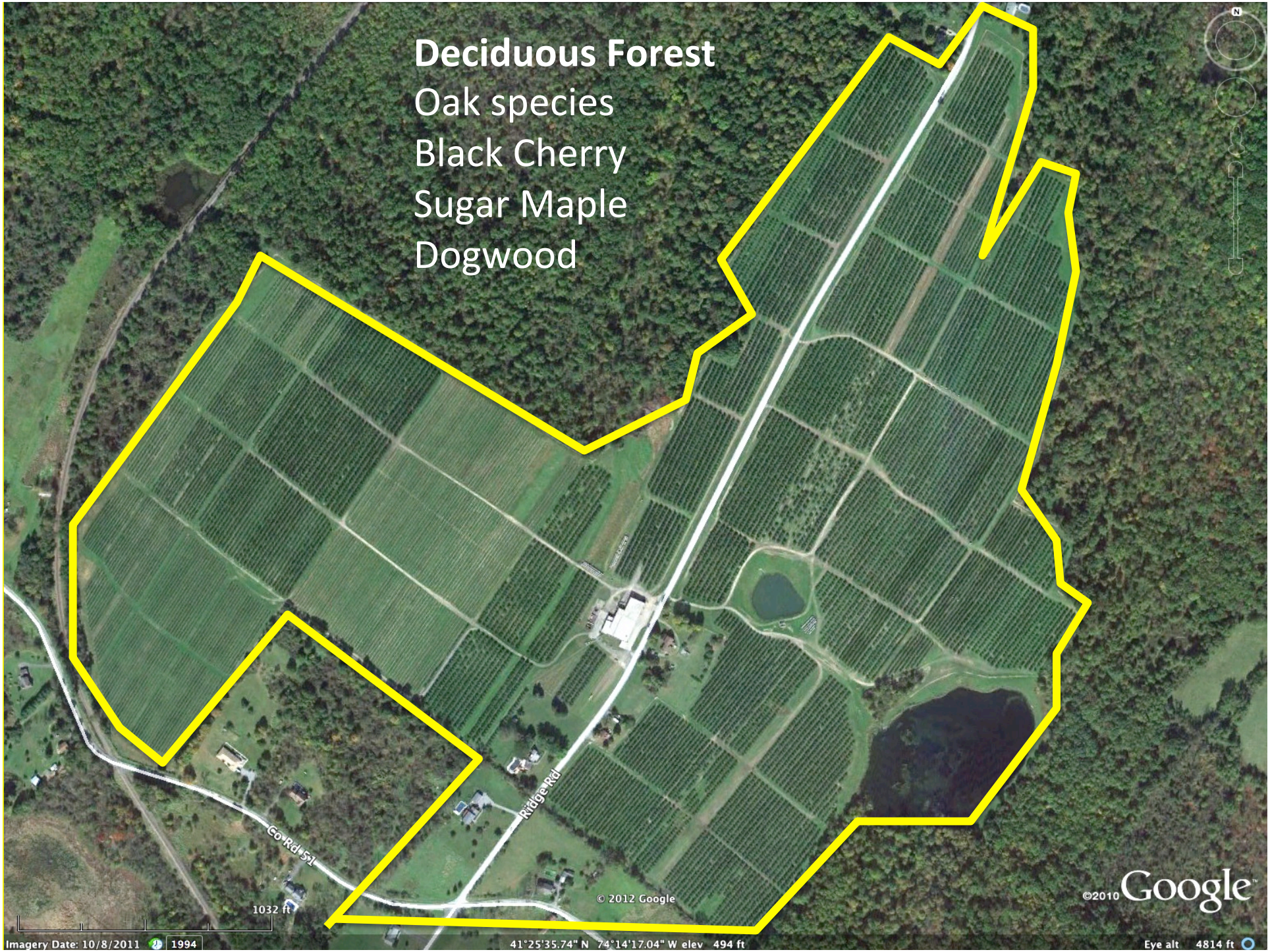
Very present in 'undesirable' urban niches.


Observations of BMSB on Border Plants
Marlboro, NY 2012
BMSB / plant species
250
200
150
100
50
0
A. altissima
Peppers
Maple
Wild Grape
Ash
Staghorn Sumac
Total BMSB 29 June - 9 August, 2012


Observations of BMSB on Border Plants
Warwick, NY 2012
BMSB / plant species
250
200
150
100
50
0
A. altissima
White Ash
Wild Grape
Hedgerow
Total BMSB 29 June - 9 August, 2012

9 October, 2012
Milton, NY

Stink Bug injury to Golden Delicious
5 bins: Range from 38 – 57% damage
9 October, 2012; Milton, NY


Deciduous Forest
Oak species
Black Cherry
Sugar Maple
Dogwood
Ridge Rd
Co Rd 51
1032 ft
© 2012 Google
©2010 Google
Imagery Date: 10/8/2011
1994
41°25'35.74" N 74°14'17.04" W elev 494 ft
Eye alt 4814 ft

Pheromone Tedders Trap Captures of BMSB Using MDT & USDA #10 lures

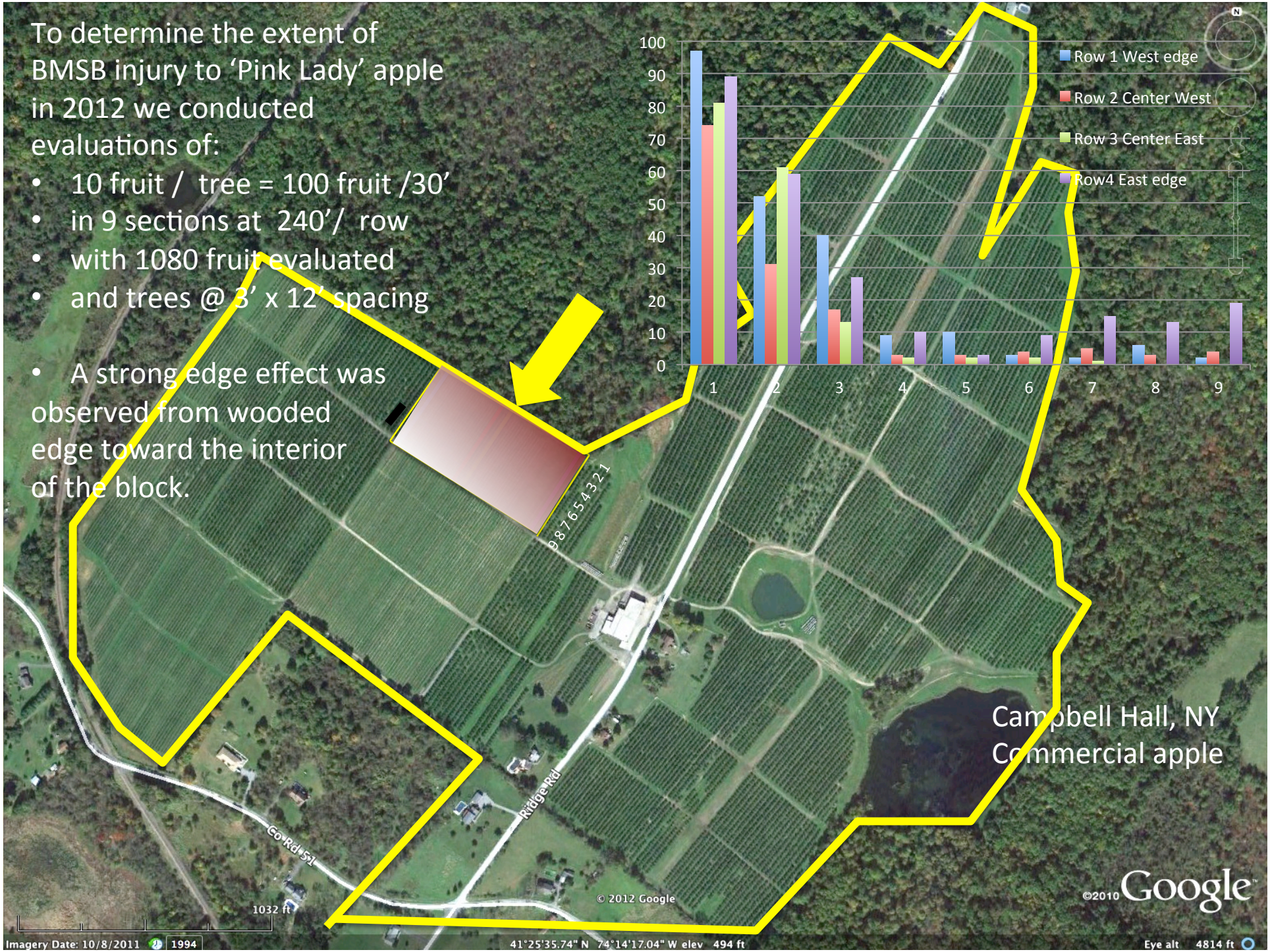
Red Delicious & Rome Apple

Campbell Hall, NY 2012

To determine the extent of BMSB injury to 'Pink Lady' apple in 2012 we conducted evaluations of:

- 10 fruit / tree = 100 fruit /30'
- in 9 sections at 240'/ row
- with 1080 fruit evaluated
- and trees @ 3' x 12' spacing

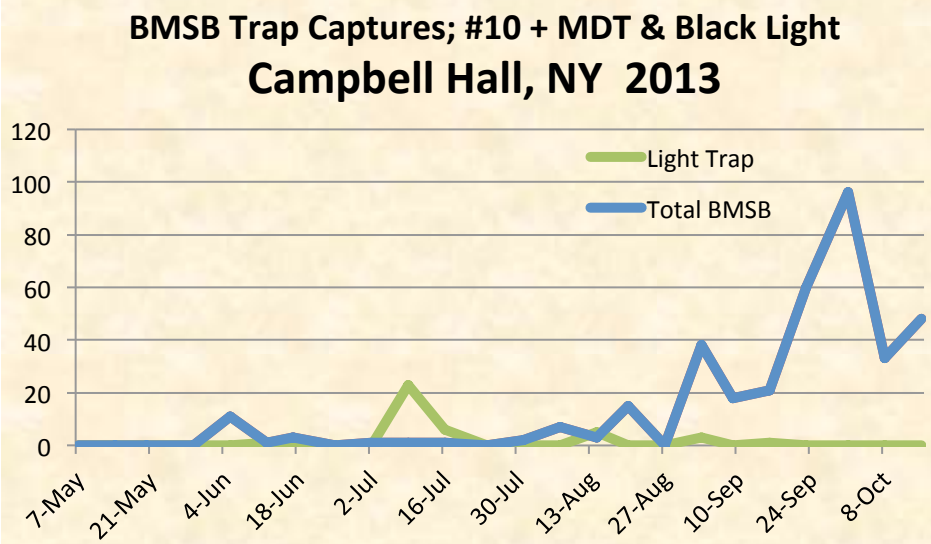
- A strong edge effect was observed from wooded edge toward the interior of the block.

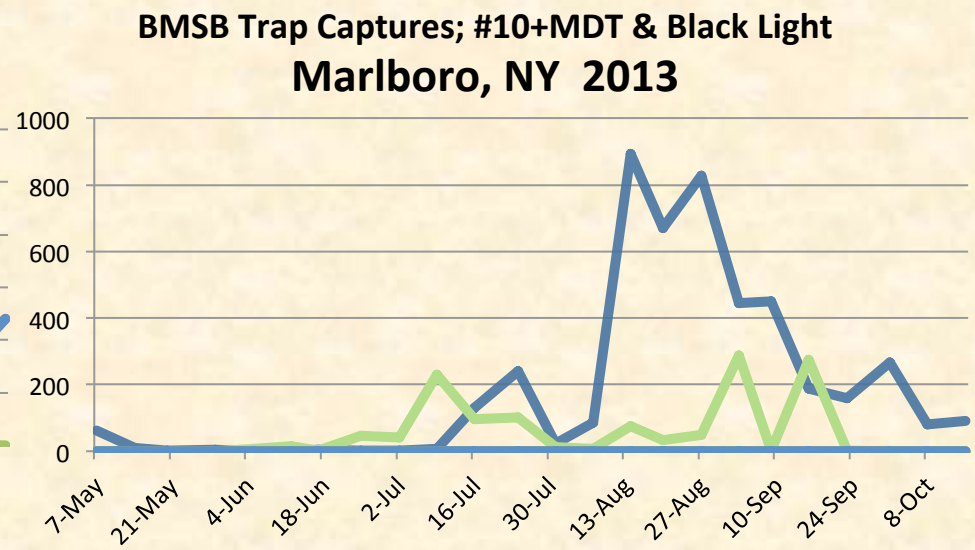


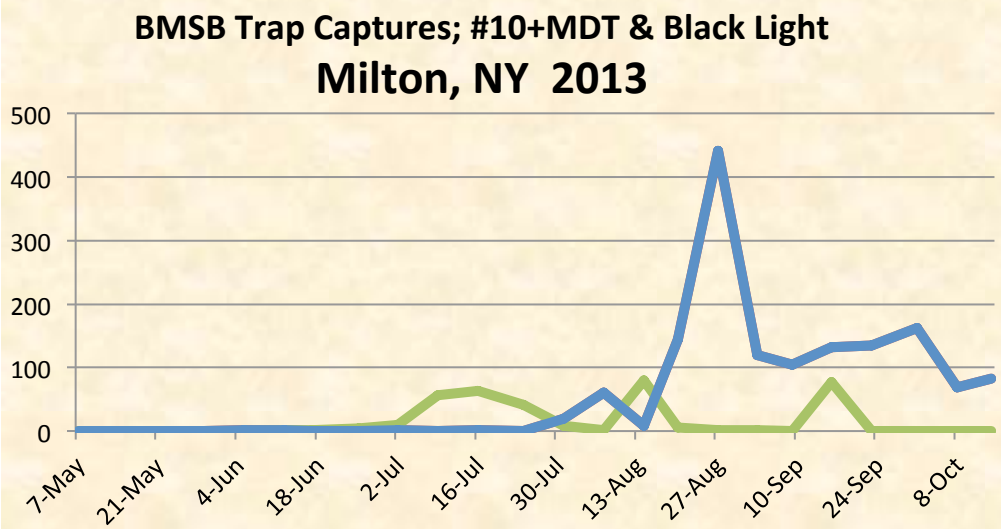
Campbell Hall, NY
Commercial apple

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

- **2013: Early trap captures with the use of #10 + MDT synergist**



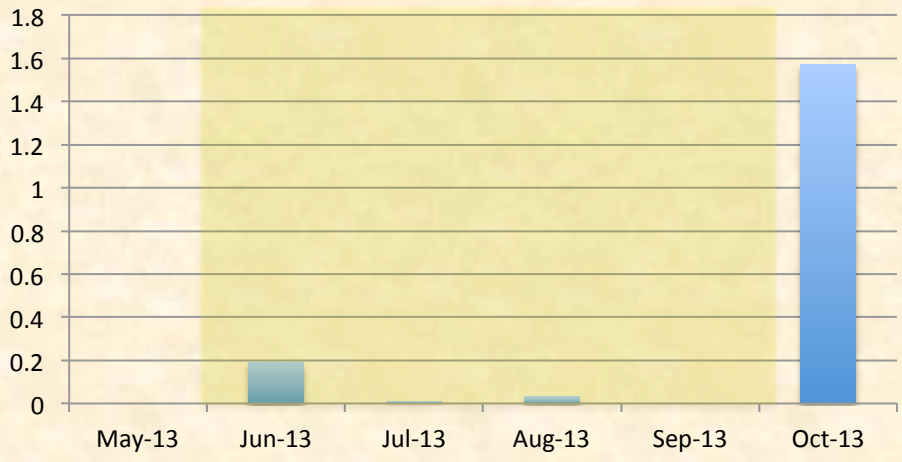




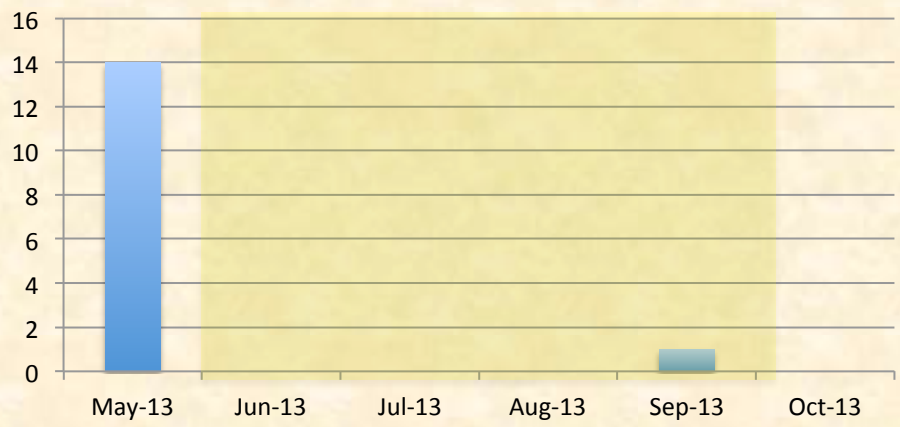
BMSB Studies
Campbell Hall, NY

Injury >20% 2012

Total Rain (1.8 in.)

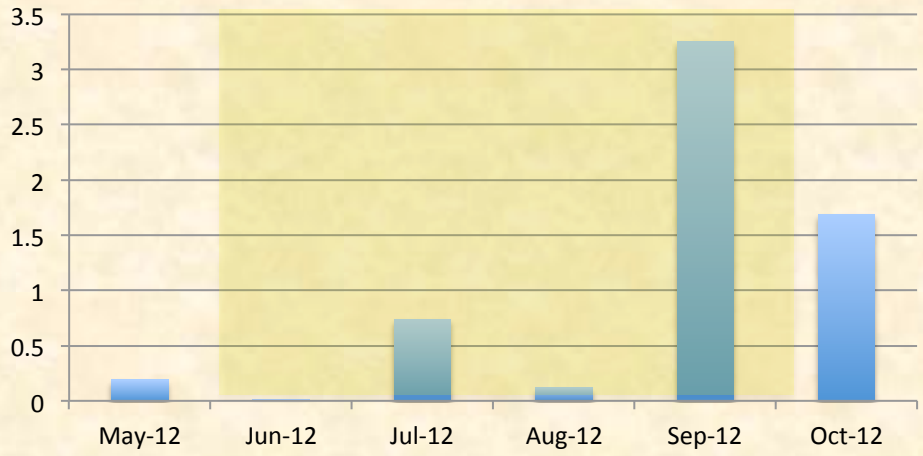


RH Hrs >= 90% (15 hrs.)

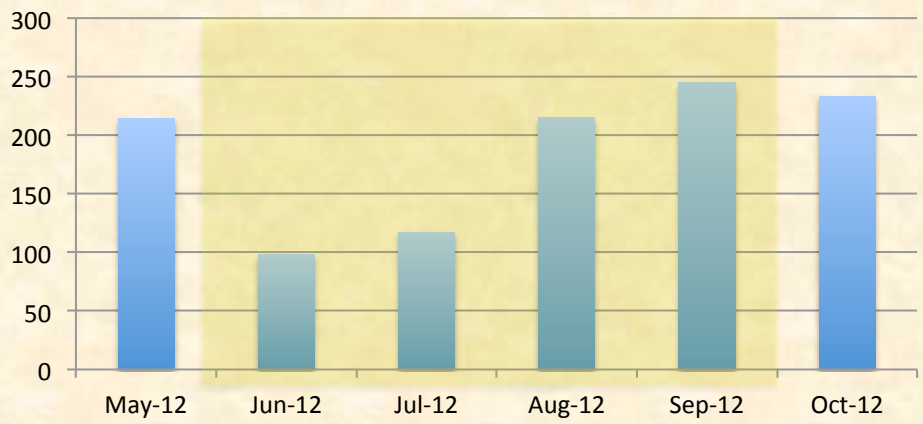


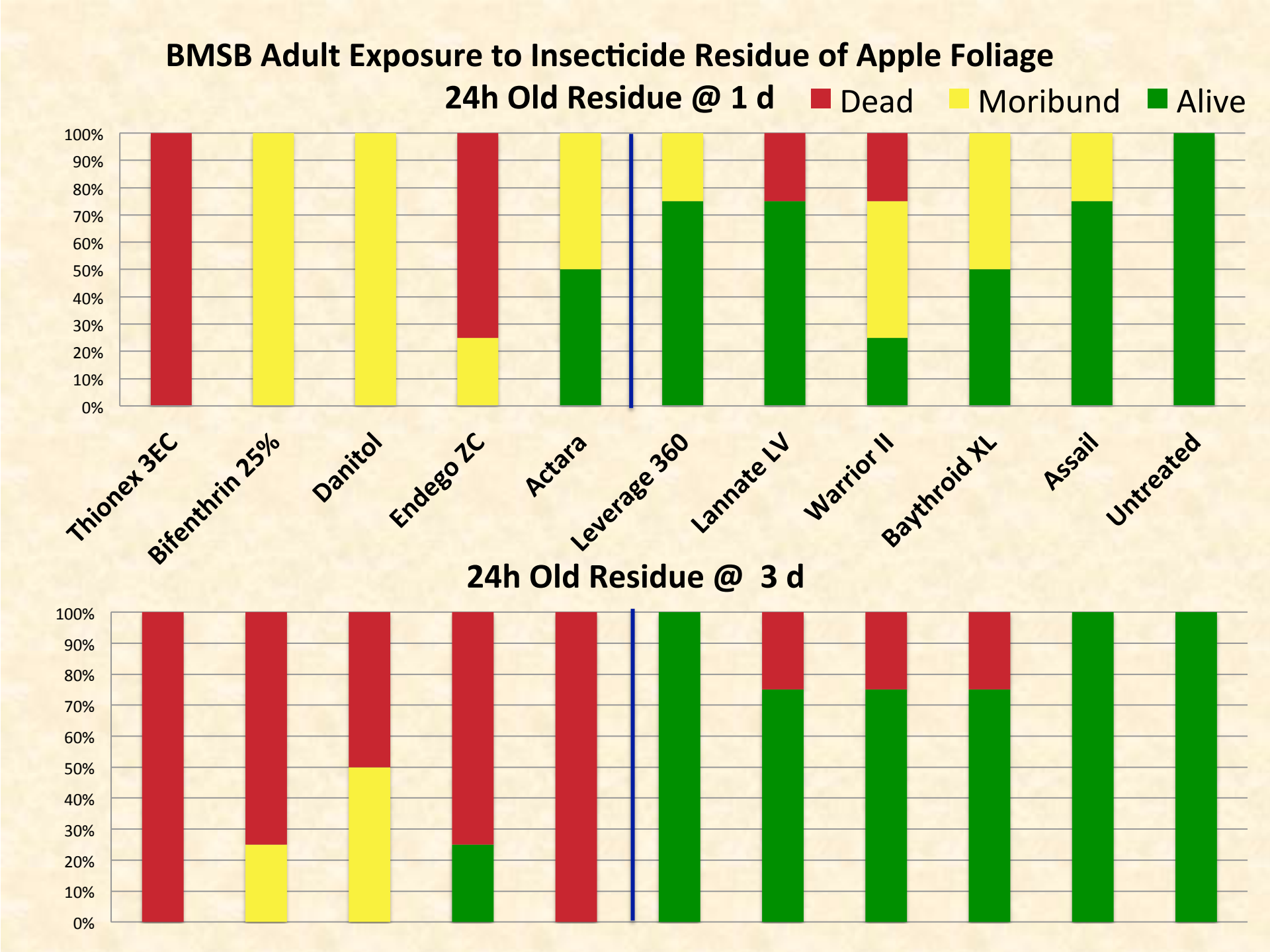
Injury 0.1% 2013

Total Rain (6.0 in.)



RH Hrs >= 90% (1122 hrs.)




BMSB Adult Exposure to Insecticide Residue of Apple Foliage
24h Old Residue @ 1 d
Dead
Moribund
Alive
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Thionex 3EC
Bifenthrin 25%
Danitol
Endego ZC
Actara
Leverage 360
Lannate LV
Warrior II
Baythroid XL
Assail
Untreated
24h Old Residue @ 3 d
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%

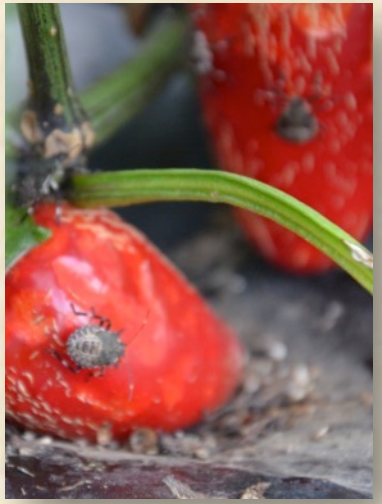
2013 BMSB Injury to Organic Pepper
Marlboro, NY

- On August 12th, 15% injury was observed in a 1 acre organic planting of Jalapeno Pepper.


d Indian Rd
9W

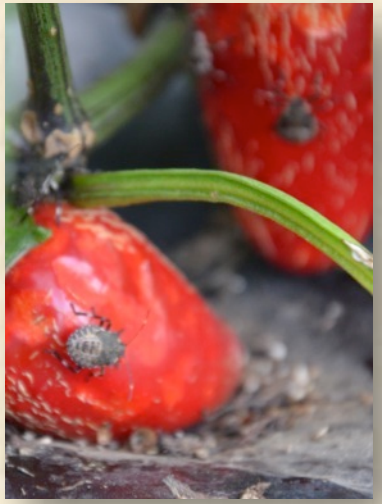

BMSB in Jalapeno Pepper
12th August, Marlboro, NY
15% feeding injury
Averaging 4 nymphs per plant

2013 BMSB Injury to Pepper
Marlboro, NY



- On August 12th, 15% injury was observed in a 1 acre organic planting of Jalapeno Pepper.
- Applications of Mycotrol-O @ 16 oz./A on 14 August, 1 & 14 September.
- Set up integrated pest management approach to reduce BMSB field populations

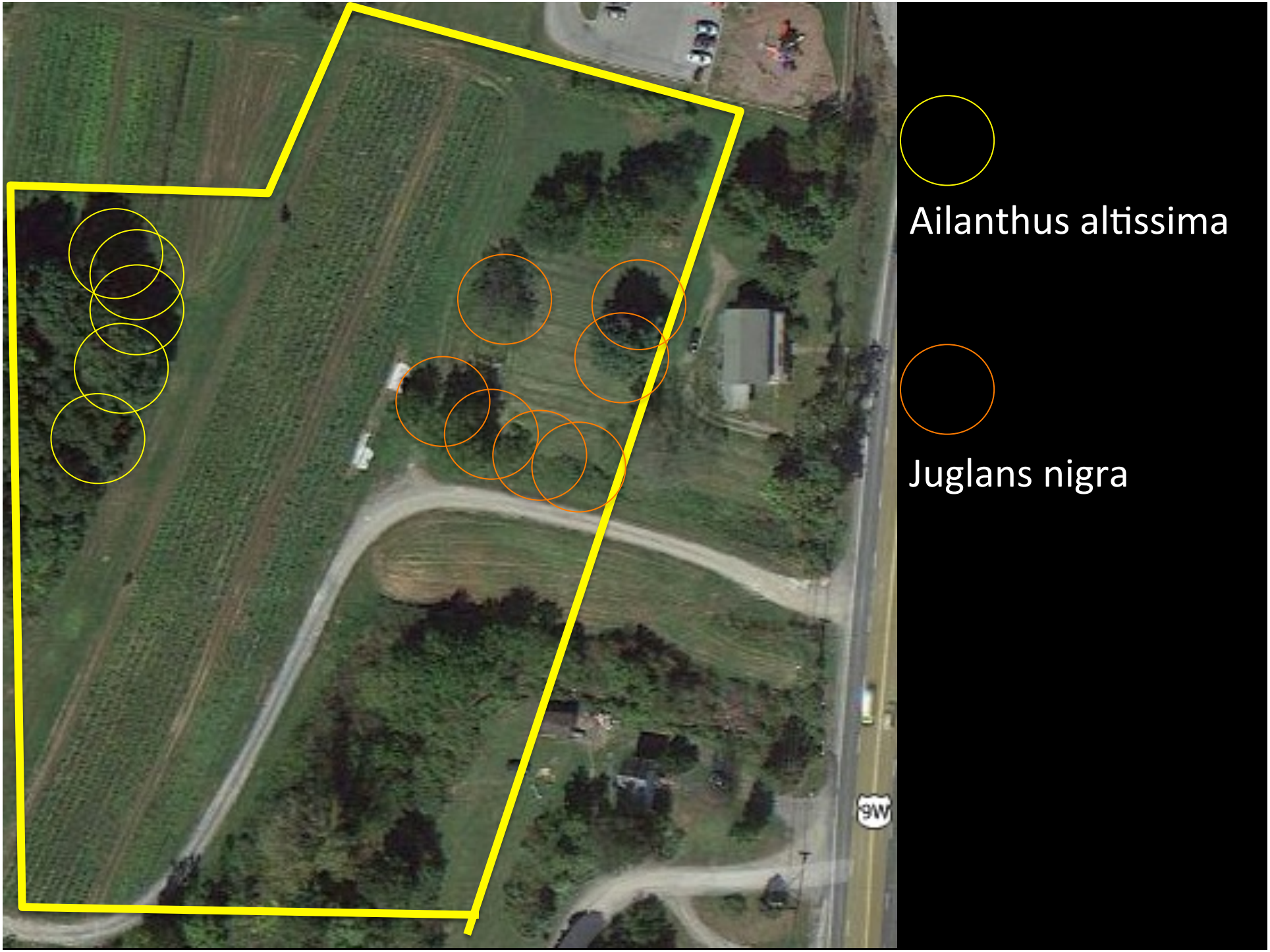
2013 BMSB Injury to Pepper



- Employing pheromone baited insecticide treated netting traps
- High intensity lighting

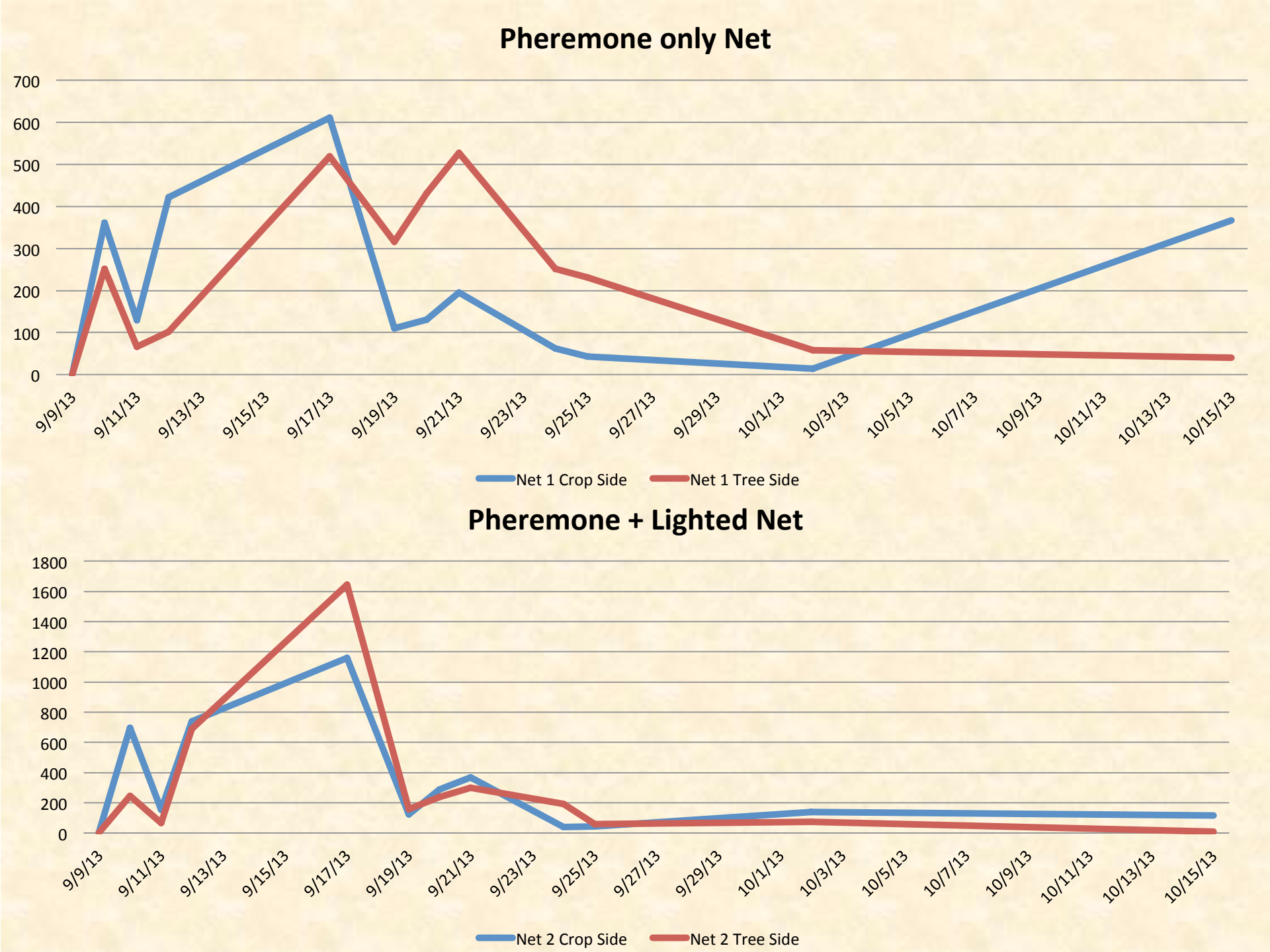

MDT
USDA #10


HONDA
EM650
HONDA
EM650

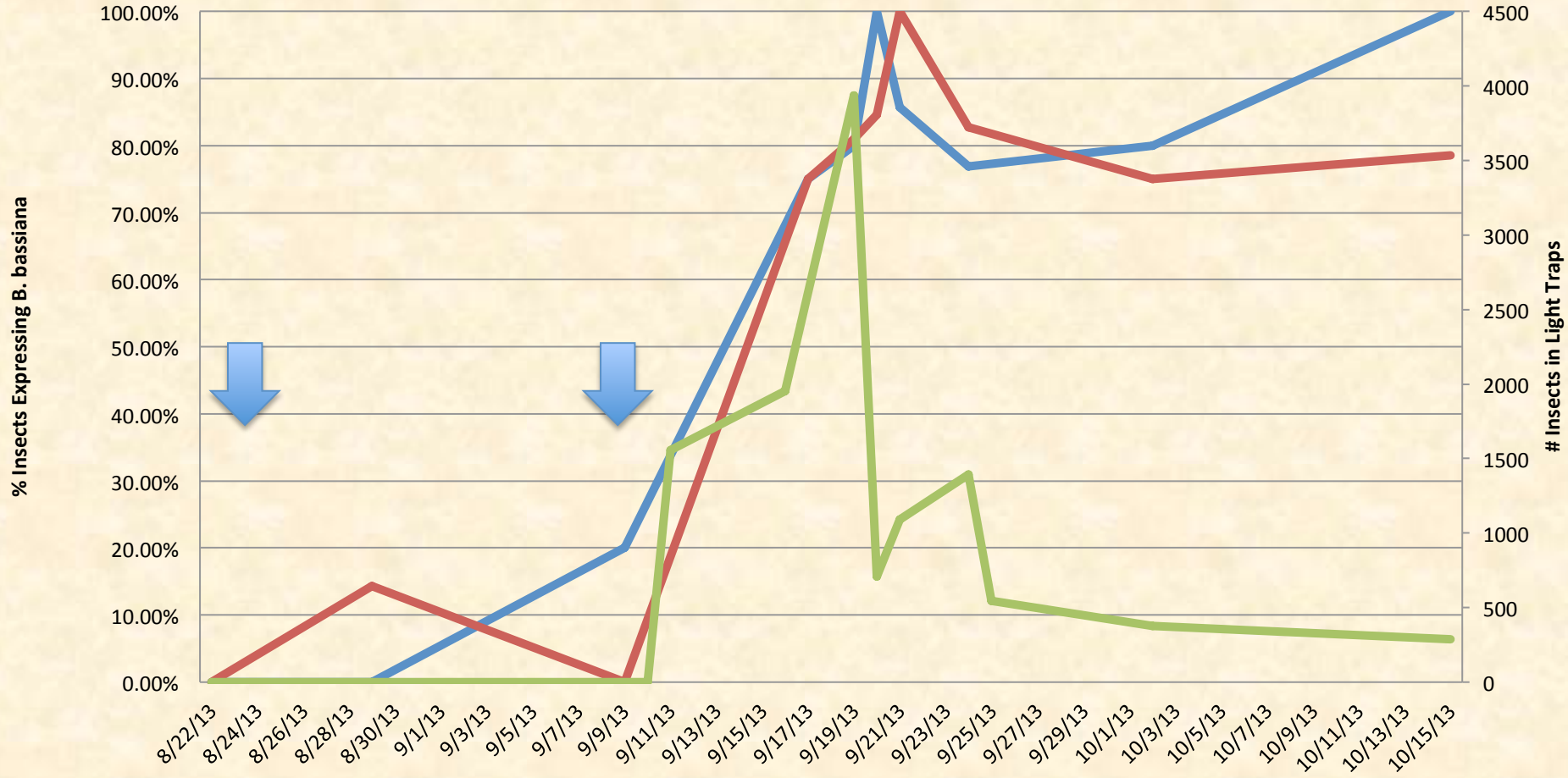

Ailanthus altissima
Juglans nigra
9W

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

CORNELL'S
Hudson Valley
LABORATORY


Pheremone only Net
700
600
500
400
300
200
100
0
9/9/13
9/11/13
9/13/13
9/15/13
9/17/13
9/19/13
9/21/13
9/23/13
9/25/13
9/27/13
9/29/13
10/1/13
10/3/13
10/5/13
10/7/13
10/9/13
10/11/13
10/13/13
10/15/13
Net 1 Crop Side
Net 1 Tree Side
Pheremone + Lighted Net
1800
1600
1400
1200
1000
800
600
400
200
0
9/9/13
9/11/13
9/13/13
9/15/13
9/17/13
9/19/13
9/21/13
9/23/13
9/25/13
9/27/13
9/29/13
10/1/13
10/3/13
10/5/13
10/7/13
10/9/13
10/11/13
10/13/13
10/15/13
Net 2 Crop Side
Net 2 Tree Side

B. bassiana expression over Time



	8/22/13	8/29/13	9/9/13	9/10/13	9/11/13	9/16/13	9/17/13	9/19/13	9/20/13	9/21/13	9/24/13	9/25/13	10/2/13	10/15/13	
Net 1 infection	0.00%	0.00%	20.00%			73.66%		75.00%	80.00%	100.00%	85.71%	76.92%		80.00%	100.00%
Net 2 infection	0.00%	14.29%	0.00%			82.95%		75.00%	80.95%	84.62%	100.00%	82.76%		75.00%	78.57%
Population	0			0	1556	521	1954		3935	708	1090	1392	545	375	287

- *Beauvaria bassiana* strain GHA applications *(Mycotrol-O @ 16 oz./A)*

CORNELL'S Hudson Valley LABORATORY

Key points to remember

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

Strategies for control: Conventional

1. Early trapping **with Tedders trap + #10 and MDT combo lure**
2. **Scouting** crop **at first trap capture**
3. Perimeter applications of field at first observation
4. Maintain perimeter applications alternating with whole field applications if BMSB presence continues

: Organic

5. Applications at 90% rH (48 hrs) Mycotrol-O at 1st BMSB

Insecticide efficacy is critical

- Use materials **with greatest efficacy & longest residual**
- Maintain 'fresh' residue every 4-5 days when needed

Thanks to the staff at the HVL for all their support:

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