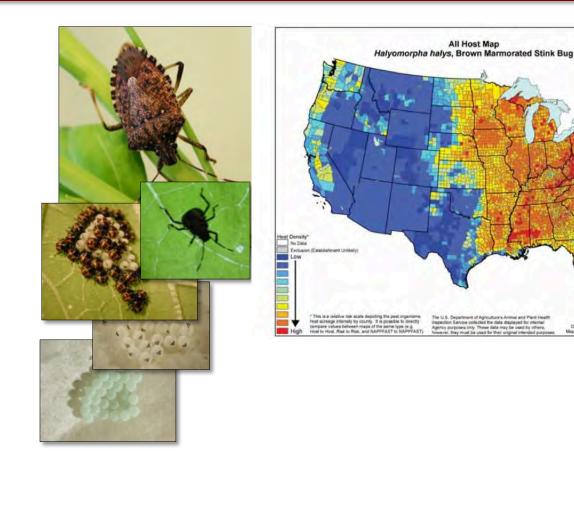
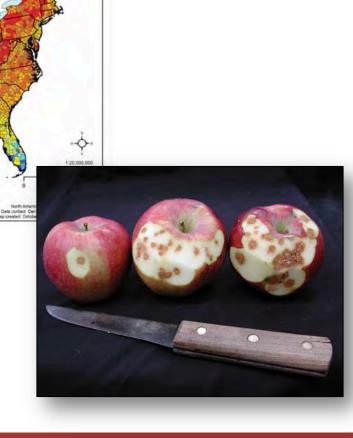
Brown Marmorated Stink Bug, *Halyomorpha halys* (Stål): What Can We Expect in WNY Tree Fruit in 2016.







Golden Delicious Apple With BMSB Feeding Injury, Campbell Hall, NY October - 2012



5 bins: Range from 38 – 57% damage



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Pink Lady Apple With BMSB Feeding Injury, Campbell Hall, NY November - 2012





Cornell University

BMSB Feeding Injury Assessment, Hudson Valley Research Lab, NY 2012





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BMSB in Western New York?

Biology



Overwintering Success

Monitoring

Management





BMSB Establishment in the US

- First BMSB specimen in 1998 from Allentown, PA
- NYC boroughs in 2007 (Hoebeke. R)
- Hudson Valley urban structures in 2008
- Citizen Science project began in Sept 2010
- >800 submissions received as of Sept. 2015.
- Participant surveys suggest increasing populations in urban environment.

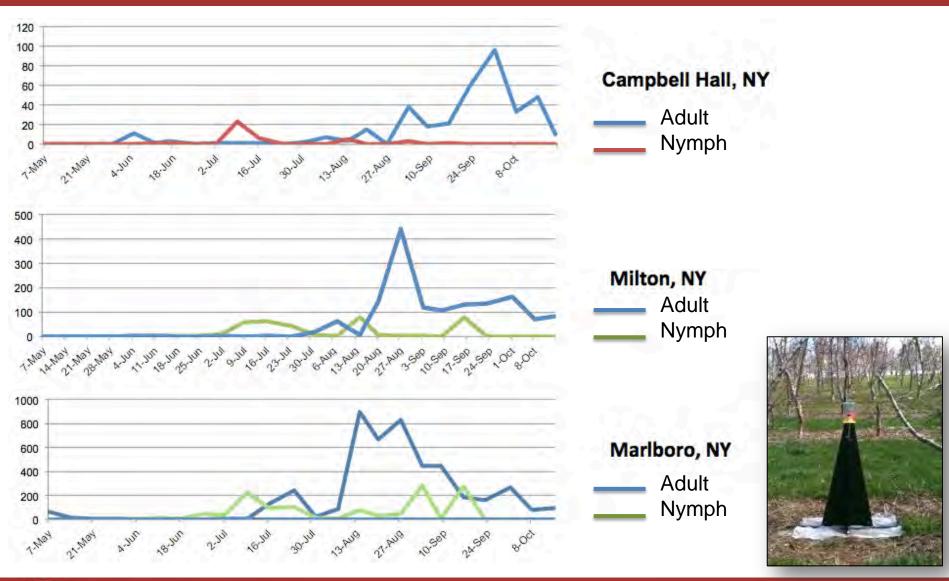


BMSB Establishment in the US

- BMSB is a arboreal insect pest: Primarily deciduous trees
- Overwinters primarily in forest, also man made structures
- Highest numbers observed on Tree of Heaven in summer
- Can succeed on Catalpa, Black Walnut, Sugar Maple, Oak, Cherry, Ash, Elm, Sycamore
- Isolated pockets throughout the Hudson Valley
- Dramatic regional differences in population density



BMSB Monitoring: 3 Diverse NY Orchards, 2013





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BMSB Establishment in the US

- BMSB is a arboreal insect pest: Primarily deciduous trees
- Highest numbers observed on Tree of Heaven, Catalpa, Black Walnut
- Can succeed on Sugar Maple, Oak, Cherry, Ash, Elm, Sycamore
- Isolated pockets throughout the Hudson Valley
- Dramatic regional differences in population density
- Edge trap captures only indicate presence and <u>POTENTIAL</u> fruit injury
- High BMSB populations along the orchard edge have not consistently proved to require management.



Factors Contributing to Invasive Insect Success

- Introduced population (the larger the number, the higher the probability of establishment).
- Aggressiveness (how well it out competes native species)
- **Rapid dispersal** (adult flight, immature crawling)
- Ecological niche: Suitable climate; Available Hosts for Food, Shelter
- Absence of natural enemies (parasites and predators)

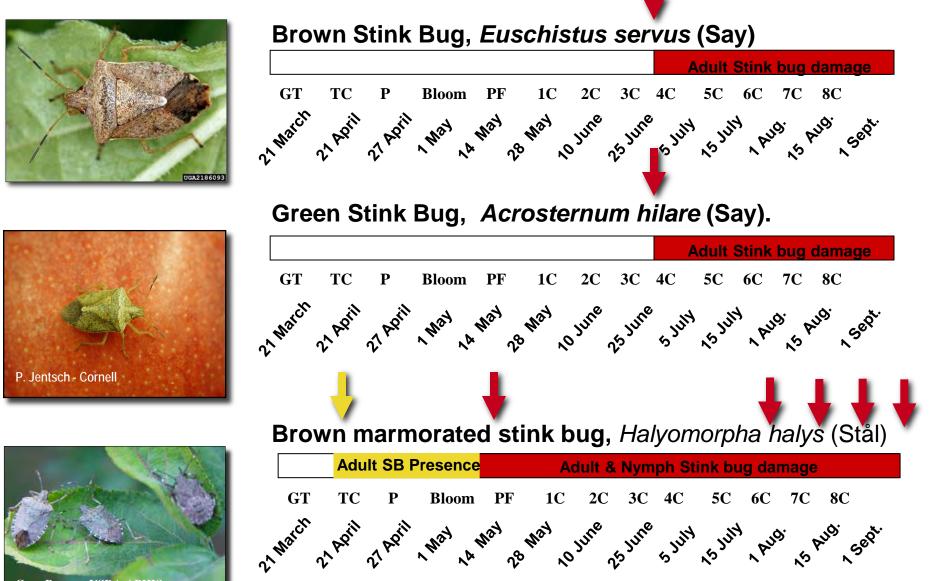


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- Rapid dispersal (adult flight, immature crawling)
- Ecological niche: Suitable climate; Available Hosts for Food, Shelter
- Absence of natural enemies (parasites and predators)
- Many generations (can produce high populations)
- **Overwintering Success** (potential for early season damage)



Hudson Valley Stink Bug Complex species of economic importance



Gary Bern on USDA-APHIS

BMSB: Insect Biology





Eggs: Average 28/cluster; 1st instar: black & red; light green to white

cluster near eggs



2nd instar: striped antennae



3rd instar: striped antennae and legs



instar: thoratic spur 4^m striped antennae & legs



5th instar: wing pads striped antennae & legs

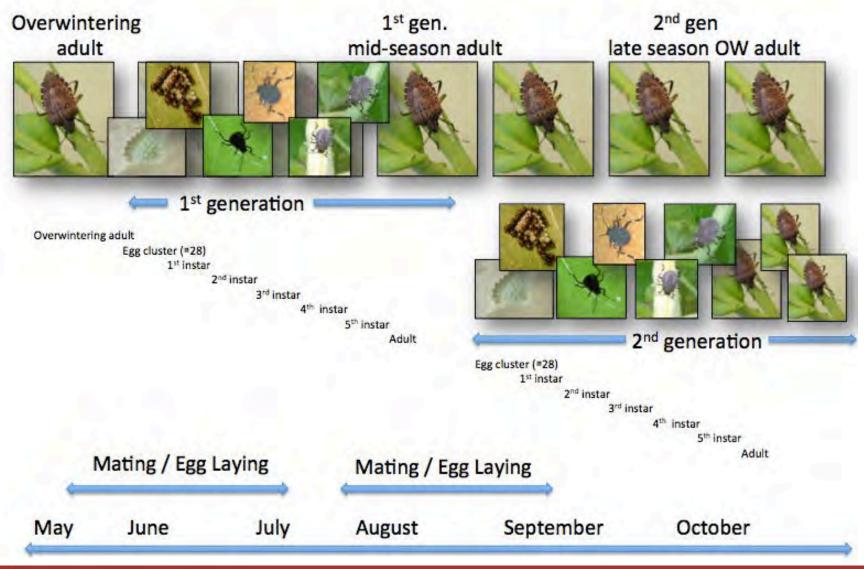


BMSB Adults: red eyes, 4 cream colored dots on shoulders; banding on legs and antenna, smooth blunt shoulders. Banded abdomen; 14 -17 mm in length.



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BMSB Biology: 2 Generations in the HV in 2012





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- Sunlight / Day length (BMSB adult mating)
 - 13-14h day length for mating and egg laying to begin
 - Geneva, NY April 29th Aug 13th
 - \circ HVRL Highland May 1st Aug. 11th



- Degree Day Accumulations
 - It requires 538 degree days (DD based 50°F) to develop from egg to adult.
 - An additional 148 DD are required for female maturation at 77°F.
 - Total of **686 DD**₅₀ for 1 generation;
 - **1224** DD₅₀ for a **2nd complete the adult OW population**



- Degree Day Accumulations
 - \circ 686 DD₅₀ for 1 generation; **1224DD₅₀ for a 2nd complete OW gen.**
 - Highland (from May $1 Aug. 11^{th}$)
 - 2012: 1990.9 DD₅₀* (severe damage in Sept-Nov 15th)
 - o 2014: 1821.9 DD₅₀
 - 2015: 1949.6 DD₅₀



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 - 2015: 1949.6 DD₅₀

Geneva
 2015: 1759.6 DD₅₀





- Early Degree Day Accumulations
 - \circ 686 DD₅₀ for 1 generation
 - Geneva, NY: 2015
 - \circ 408.4 DD₅₀ (from Jan. to May 1)
 - **853.2** DD_{50} (from May 1 June. 30th)
 - Highland, NY: 2015
 - \circ 476.4 DD₅₀ (from Jan. to May 1)
 - **982.9** DD_{50} (from May 1 June. 30th)
 - Biglerville, PA: 2015
 - \circ 549.0 DD₅₀ (from Jan. to May 1)
 - **1147.0** DD_{50} (from May 1 June. 30th)

- Early Degree Day Accumulations
 - \circ 686 DD₅₀ for 1 generation
 - Geneva, NY: 2015 Slow start for BMSB development
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- Degree Day Accumulations
 - Early low Degree Day accumulations likely inhibit the start of the development of BMSB
 - Requiring longer periods of time to reach maturation for 1st generation development
 - Late season sunlight requirements then become the limiting factor for 2nd generation in Northern climates
 - In northern regions, BMSB will likely have one generation / yr.



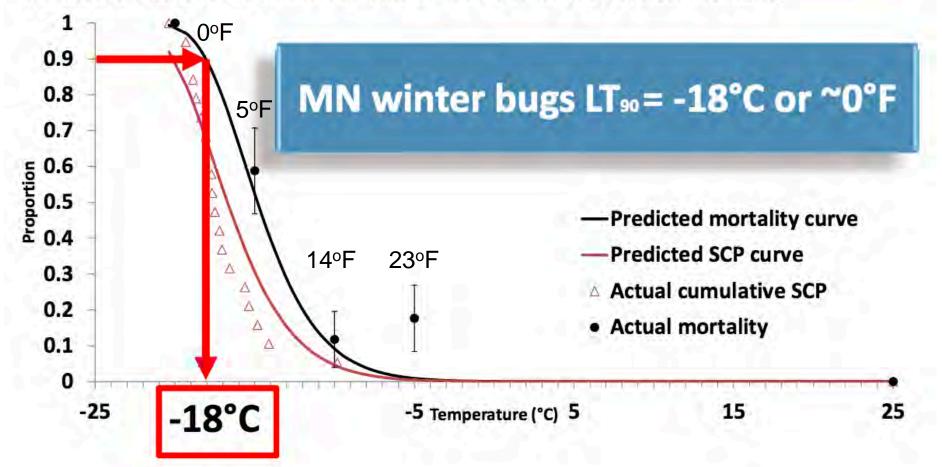
• Overwintering habitat

- A smaller percent of the population will aggregate in buildings where temperature extremes allow for survival in northern climates
- In woodland habitat, temperatures below -18°C or -0.4°F will kill 90% of the population (Kuhar, T. 2016)

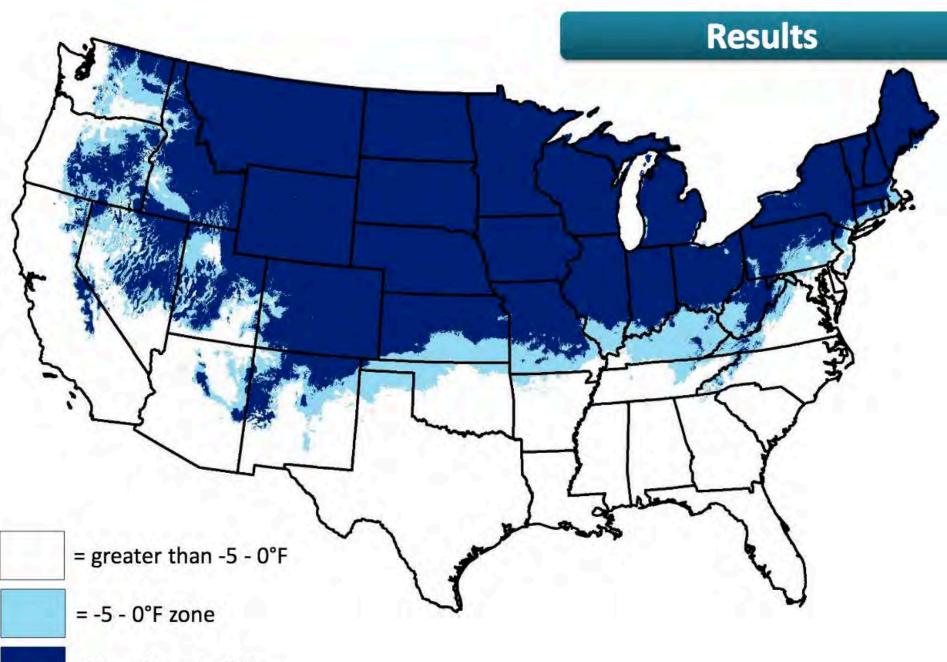


Factors for BMSB Success: Overwintering

Predicted and observed BMSB: Cumulative SCP & proportion mortality

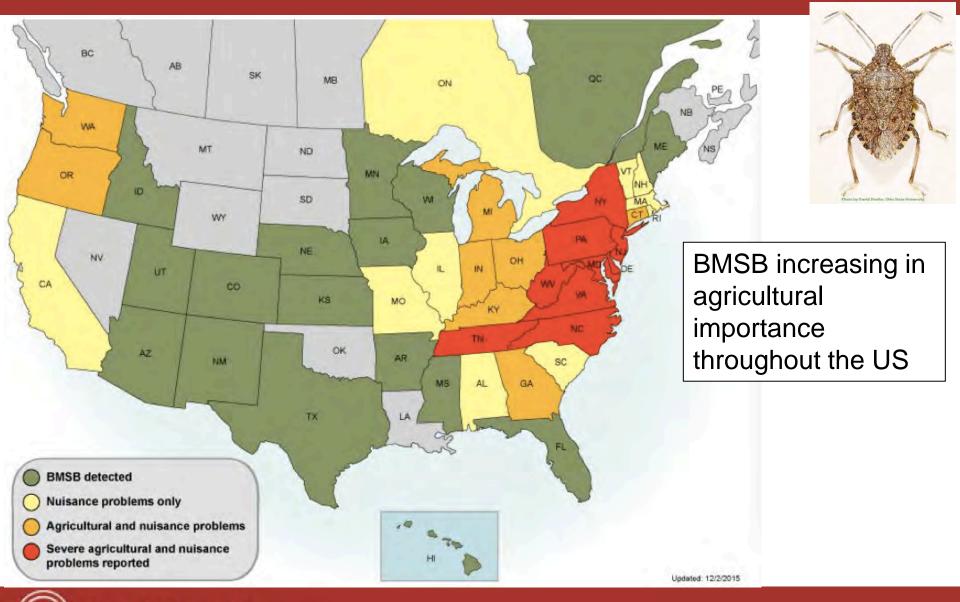


SCP: n=19 bugs Mortality: n=17 bugs/each temp (mean \pm 95% confidence interval) Regression curves fitted with a Weibull distribution



= less than -5 - 0°F

BMSB Establishment in the US



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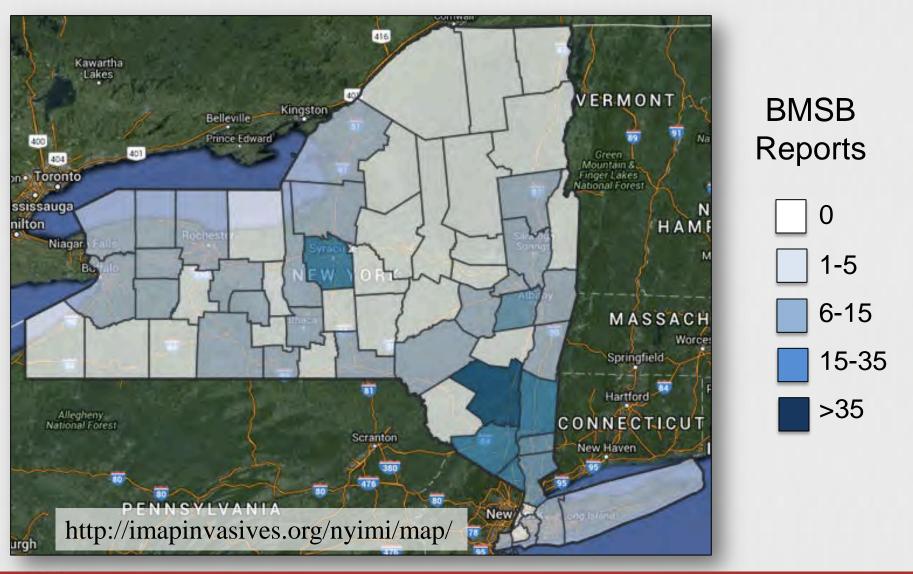
New York Invasive Species Public Map BMSB Distribution in NYS





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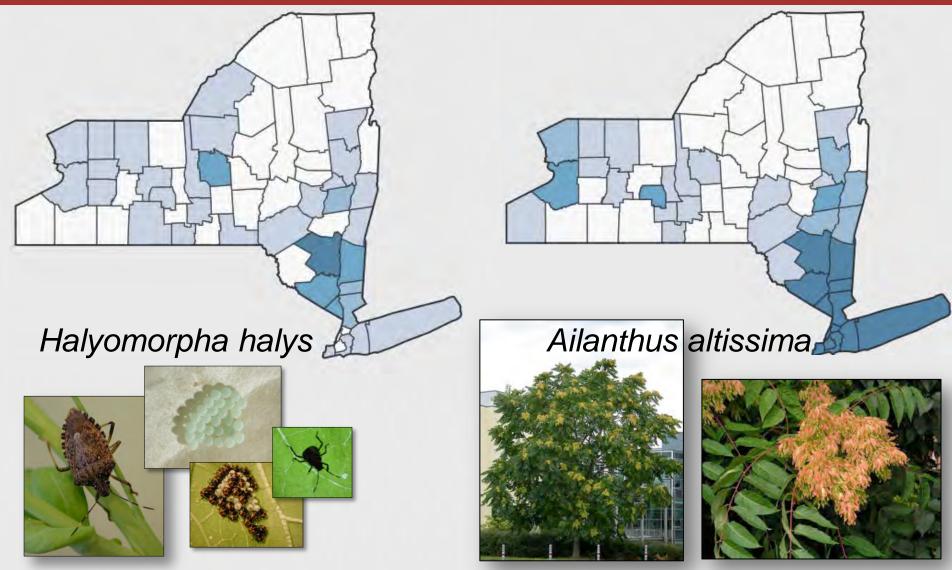
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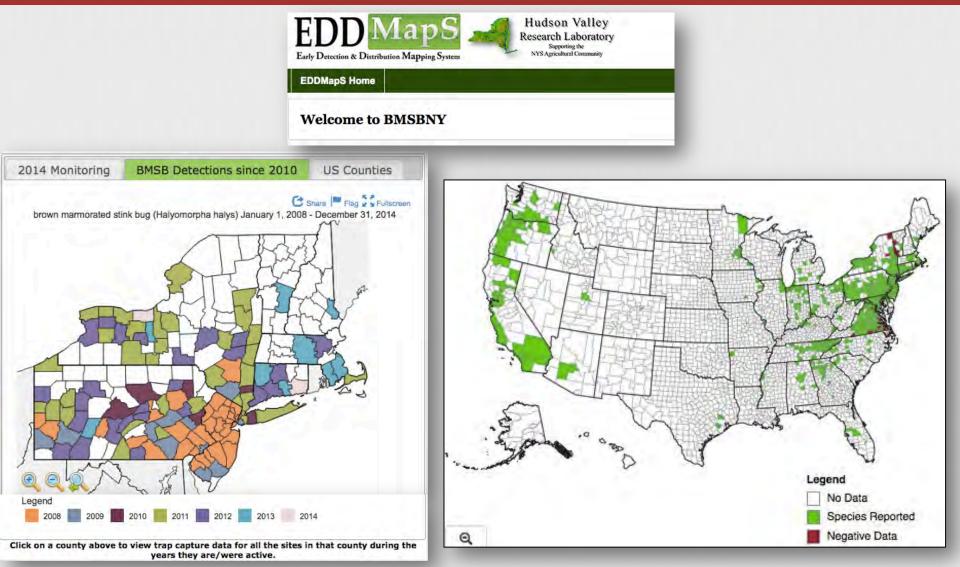
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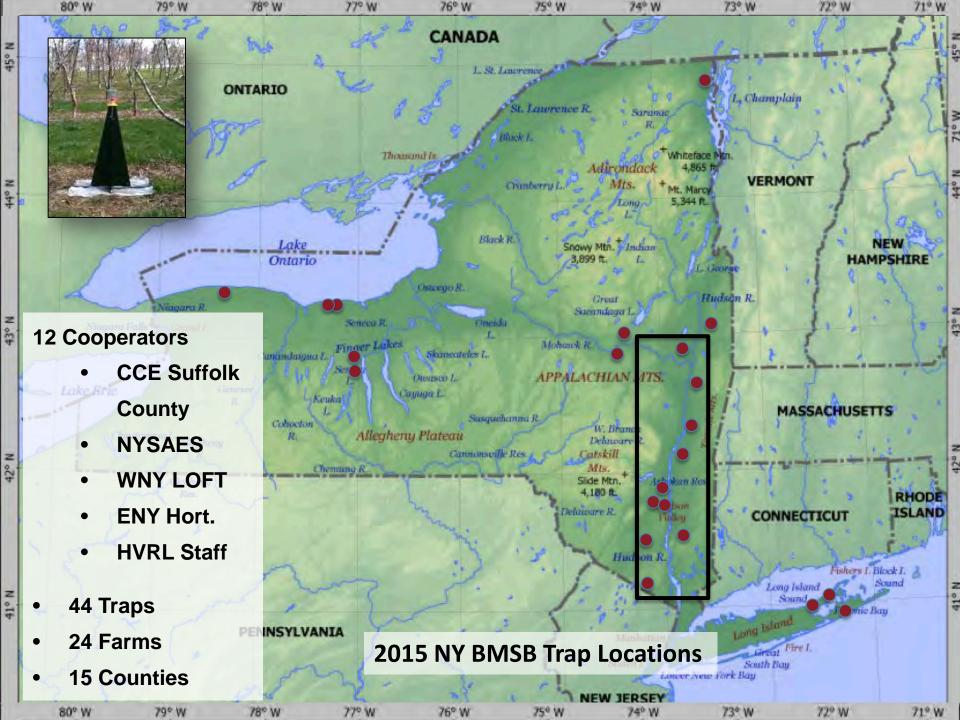


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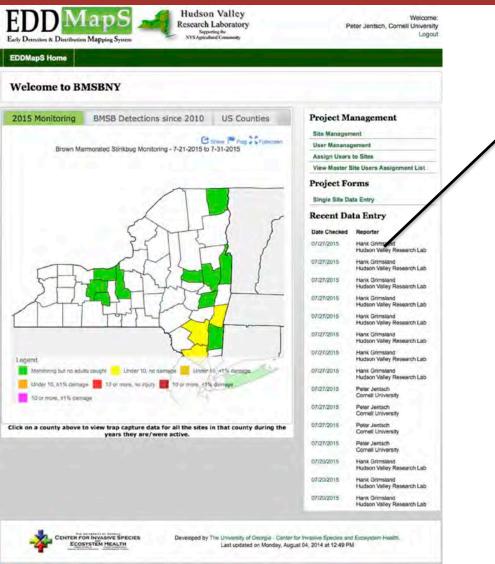
EDDMaps.org/bmsbny/ BMSB Distribution in NYS Tree Fruit Orchards







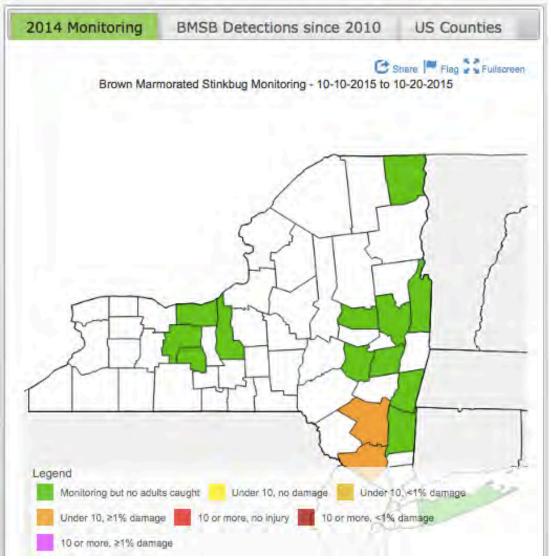
EDDMaps.org/bmsbny/ BMSB Distribution in NYS Tree Fruit Orchards



Presence / absence data O Individual site access

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EDDMaps.org/bmsbny/ BMSB Distribution in NYS Tree Fruit Orchards



- Presence / absence
- Population Threshold

+ Damage Levels by county



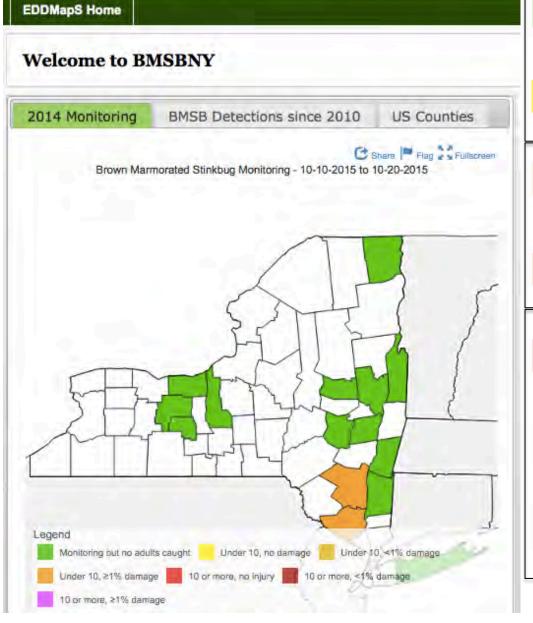
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Hudson Valley Research Laboratory Supporting the NYS Agricultural Community

15 NYS counties / 44 Sites

- Absence (Green)
 Monitoring but no adults caught
- Presence (Yellow) Under 10, no damage
- Presence + Damage Levels Under 10, <1% damage
- Presence + Damage Levels
 Under 10, ≥1% damage
- BMSB Threshold + Damage Levels
 10 or more, no injury
- BMSB Threshold + Damage Levels
 10 or more, <1% damage
- BMSB Threshold + Damage Levels
 10 or more, ≥1% damage



- 2015: Employed a 10 Adult / Trap Threshold
- Disseminate recommendations using ENY CCE Hort News; Scaffolds Newsletter; HVRL Lab Blog Site
- Growers suscribe to receive email Internet based link for BMSB mgt. recommendations as BMSB traps and damage levels are assessed
- Hudson Valley Research Lab: Blog site
- <u>https://blogs.cornell.edu/jentsch/</u>



Email link to BlogSite





WELCOME ENTOMOLOGY PROGRAM SROWN MARMORATED STINK BUC SPOTTED WING DEDSUPHILA. DECANIC AG RESEARCH. THEE FEDIT VEGETABLE SWEET CORN SMALL FRUIT GRAFE.

Welcome to the Jentsch Lab



2034 ENTOMOLOGY FACULTY AND STAFF LEFT TO RIGHT, P.IENTSCH, MICHELLE ROSINSON, BINA TRUNEALL PAWAN ANGARA DERRIK SWEHLA, JACARY COTE TIM LAMPASONA RELEVA WILL-LARSENTI

Albany and New York City.

Focuse Stakeholder access to the technical aspects of insect pest management and integrated approaches for reducing crop lower from meet pents is an integral component of our work and the premary purpose of this website. We hope to convey to the articultural and consumer community that plant protection is a dynamic and an over changing process, expendity as resistance diminishes the effectiveness of pest management tools and newly invasive pests overwhelm the integrity of the regions agricultural commodities. Our efforts in applied entomology are formulated to benefit agricultural producers in sustaining the highest quality yield, maintaining coonomic competitive advantage and promoting national food security, while ultimately, serving the world-wide community of consumers by reducing the negative impact of fixed production on our enveronment. At the Hudson Valley Laboratory we strive to provide access of tinte sensitive information to the agricultural community. This vite is one of many on-demand sources of plant protection information available from Cornell University.

To search for specific topics and project, begin by selecting a commodity tab above.

THE JENTSCH LAB

Edit

Search Our research and extension outreach program is directed by <u>Cornell</u> University's Department of Entomology and located at the Hudson Valley Laboratory, in Highland, NY. We are a part of the New York State tural Experiment Station in Geneva, NY, with the laboratory suikling owned by a non-profit cooperative tree fruit grower · Aprel 2014 organization (HVRI, Inc.). This ecoperative partnership with the College META of Agriculture and Life Seamer (CALS) and Cornell Cooperative Extension (CCE) has provided agricultural Research and Extension on · Site Admin · Log-out Tree Fruits and Vezetables in the Hudson Valley unce 1923. Research-based information continues to be provided to New York 2014 BLOG PAGES farmers through educational programs organized by Cornell Cooperative · Upcoming Workshop Extension and participating associations. Horticultural plant protection Wing Drosophila in NY St programs at the Hudson Valley Lab are especially important to · BMSB Updatt: Increasing L Pink Lady Apple Observed In sustaining the stability of agriculture in the Hudson Valley and Northeast Columbia County. as agricultural production is ultimately the best way to preserve open · BMSB Trapping Updater Plu space and aconomic atability in the rapidly developing corridor between Temperatures - Sporace Trap · SMSB Harvess Update: Damage to Red Differous at Hasyest: October 2nd, 2014 · SMSB Trap & Senaring Update: BM58 Trap Numbers Continue to Drop Son Sperific Management Required: September 36th, 2614 SUBSCRIBE BY EMAIL Combined or state from one wat aby him Subscribe

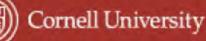
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Insect Alerts & Recommendations

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San Jose Scale Damage Increasing on Hudson Valley Apple	rene of the second seco
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Brown Marmorated Stink Bug Trapping in the Hudson Valley. June 19th	-
- And the set of the set of the prime later of the prime later is provide reported reported reported and and the set of the prime later and the set of	
Controlling Porato Leafhopper To Reduce Fireblight and Maintain Growth on Young Apple Trees	
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Time To Weigh In Hard On Scale This Week!	
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and the state of t	
OBLR Update: First Egg Hatch Predicted For June 20th	
We is have expressing the addressing south source bandles, just 20 and are considered in the same and fights. Using the Self-score,	

Nymphs Found On Bartlett Pears





Brown Marmorated Stink Bug: August 15th Update

Brown Marmorated Stink Bug (BMSB) numbers last week show continued increase of late instar nymph movement to pheromone baited Tedders traps. The late start to the season may have pushed forward the emergence of the

BMSB Update: August 20. Confirmed Late Season Feeding to Apple, Peach and Pepper Extensive damage from BMSB Observed On Peach in Highland, NY: August 25th

by PIJ5@CORNELL.EDU posted on AUGUST 25, 2014

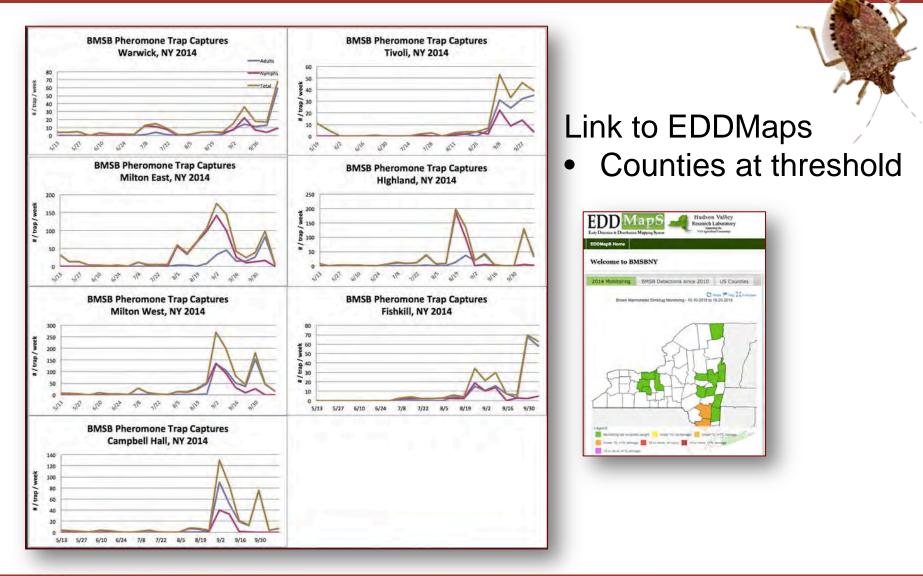


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Recommend NYS Registered InsecticidesWhole orchard, ARM, Border applications

Product	Active ingredient	Rate / A	REI Hrs.	PHI Days	Efficacy (USDA)	Max. per crop / season	App. Interval
Actara 25WDG	Thiamethoxam	2.0-5.5 oz/A	12	35	+++	16.5 oz./A (0.258 lb. a.i./A)	10d
Asana XL 0.66EC	Esfenvalerate	4.8-14.5 fl oz/A	12	21	++	101 fl oz/A (0.525 lb AI/A).	NA
Baythroid XL 1EC	Beta-Cyfluthrin	1.4-2.8 fl oz/A	12	7	++	2.8 fl oz/A (0.022 lb AI/A).	14d
Bifenture EC	Bifenthrin	5.2-12.8 fl oz/A	12	14	++++	32 fl ozs (0.50 lbs ai)	30d
Bifenture 10DF	Bifenthrin	12.8-32.0 oz/A	12	14	++++	80 ozs (0.50 lbs ai)	30d
Brigade WSB	Bifenthrin	12.8-32.0 oz/A	12	14	++++	80 ozs (0.50 lbs ai)	30d
Danitol 2.4EC	Fenpropathrin	10.66-21.33 fl oz/A	24	14	+++	42.56 fl ozs (0.80 lbs ai)	10d
Endigo ZC	Thiamethoxam / Lambda-cyhalothrin	5-6 fl fl oz/A	24	35	++++	19 fl oz./A (0.172 lb ai) NY	10d
Lan nate 2.4LV*	Methomyl	2.25 pt/A	72	14	++++	240 ozs (0.50 lbs ai)	7d
Lan nate 90SP*	Methomyl	8-16 oz/A	72	14	++++	5.0 lbs	7d
Leverage 360	Beta-Cyfluthrin / Imidacloprid	2.4-2.8 fl oz/A	12	7	+++	2.8 fl oz/A	14d
Surround 95WP	Kaolin	25-50 lb/A	4	0	+	NA	Od
Thionex 50WP	Endosulfan	Max. 5 lb/A	20 days	21	++++	6.0 lbs	NA
Thionex EC	Endosulfan	1.33-2.67 qts./A	7 days	21	++++	2-2/3 qts (2.0 lbs ai)	NA
Voliam Xpress EC	Chlorantraniliprole / Lambda-cyhalothrin	6-12 fl oz/A	24	21	+++	31.0 fl oz/A	10d
Vydate 2L*	Oxamyl	4-8 pt/A	48	14	++	281 fl oz/A (128 oz AI/A).	7d
Warrior 1CS	Lambda-cyhalothrin	2.56-5.12 fl oz/A	24	21	++	20.48 fl. oz. (0.28 lb. a.i.)**	5d
Warrior II 2.08CS	Lambda-cyhalo thrin	1.28-2.56 fl oz/A	24	21	++	10.24 fl. oz. (0.28 lb. a.i.)**	5d

* Although these materials have excellent topical ratings in lab bioassay studies, field efficacy studies have shown economic fruit injury from BMSB feeding, suggesting low residual levels.

** Post bloom applications

(+) low to (++++) high efficacy



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A strong edge effect observed from wooded edge toward the interior of the block in Pink Lady harvested in early November.

Row 1 West edge Row 2 Center West Row 3 Center East Row4 East edge 20

100

90

80

70

60

50

40 30

10

Along 30' of border fruit 74-98% injury was assessed.

>21% injury was documented at packout.



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Campbell Hall, NY **Commercial apple**

• BMSB nymphs and adults are very mobile.



- Movement from tree to tree and flight in and out of the orchard has been observed.
- Attract and kill options can be employed using pheromone lures in 'baited trees' or netting along the orchard perimeter to aggregate populations for directed applications.

Application options include:

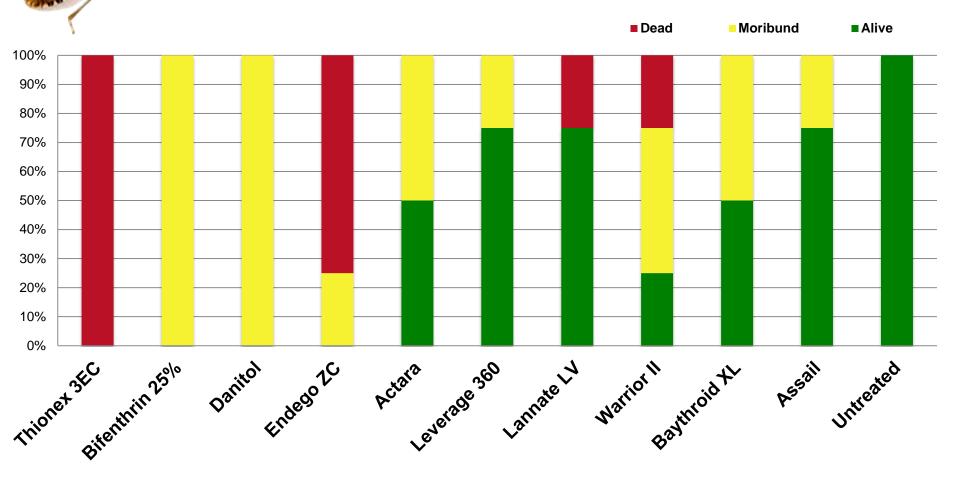
- Whole orchard applications upon 1st infestation
- Alternate row middle applications at 7d intervals
- Border row applications at 7d intervals

Insecticide Group	Product	Active Ingredient %	Adult BMSB Mortality ¹
Pyrethroid	Bifenture	bifenthrin	100
	Danitol	fenpropathrin	95
	Warrior II	lambda-cyhalothrin	73
Carbmate	Lannate	methomyl	92
	Vydate	oxymyl	68
Neonicotinoid	Actara	thiamethoxam	92
	Assail	acetamiprid	87
	Calypso	thiacloprid	58
Pre-mix	Leverage 360	imidacloprid and bifenthrin	95
	Endigo	lambda-cyhalothrin and thiamet	hoxam 98
	Voliam Flexi	chlorantraniliprole and thiamethe	oxam 98

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.



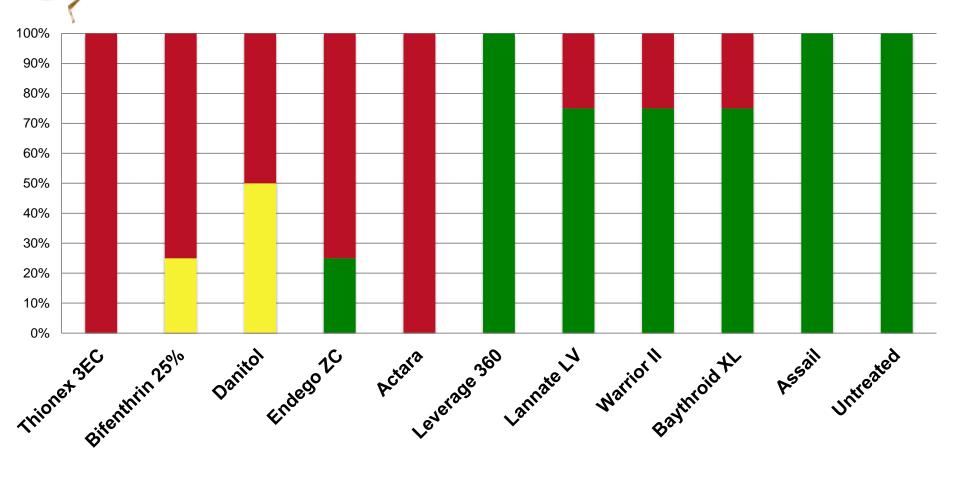
BMSB Adult Exposure to Insecticide Residue of Apple Foliage 24h Old Residue @ 1 d





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BMSB Adult Exposure to Insecticide Residue of Apple Foliage 24h Old Residue @ 3 d





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Conclusion

- Cold Winter Temperature, low Degree Day Accumulations in spring and sunlight constraints reduce the success of BMSB in northern regions including WNY.
- Constraints will likely limit BMSB to a single generation / year.
- A single generation of BMSB will likely result in low levels of tree fruit injury depending on seasonal survival, host resource availability, moisture requirements in periods of drought.
- Consider ARM and Border Applications under low-moderate populations levels using the most effective insecticide.



Thank You



Support from the Tree Fruit and Agrichemical Industry NYSAES, CCE, Technical staff and field assistants



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