Research Update: Invasive Insects in Berry Crops

2015 Hudson Valley Commercial Fruit Growers' School

Best Western Plus

Kingston, NY

February 12th, 2015

Peter Jentsch

Senior Extension Associate – Entomology

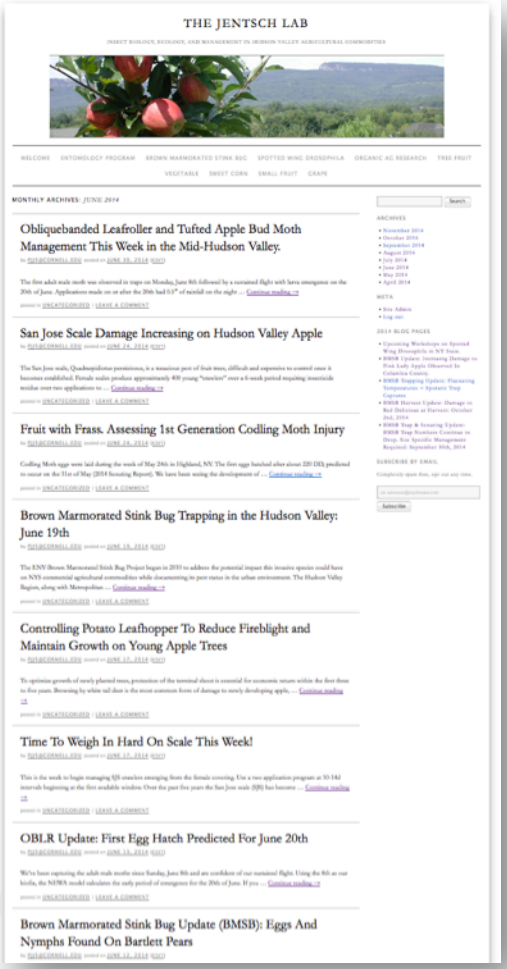
Cornell University
College of Agriculture and Life Sciences

Hudson Valley Research Laboratory

Communication to NY Growers

Jentsch Lab Site: Developed 2014

Insect Alerts & Recommendations
(E-mail Subscription)



Website: http://blogs.cornell.edu/jentsch/

Jentsch Lab Site: Developed 2014

THE JENTSCH LAB

INSECT BIOLOGY, ECOLOGY, AND MANAGEMENT IN HUDSON VALLEY AGRICULTURAL COMMODITIES

WELCOME ENTOMOLOGY PROGRAM BROWN MARMORATED STINK BUG SPOTTED WING DROSOPHILA ORGANIC AG RESEARCH TREE FRUIT VEGETABLE SWEET CORN SMALL FRUIT GRAPE

Welcome to the Jentsch Lab

2014 ENTOMOLOGY FACULTY AND STAFF LEFT TO RIGHT: P.JENTSCH, MICHELLE ROBINSON, DINA TRUNCALI, PAWAN ANGARA, DERRIK SWEHLA, ZACARY COTE, TIM LAMPASONA, KELLYN WILL (ABSENT).

Our research and extension outreach program is directed by Cornell University's Department of Entomology and located at the Hudson Valley Laboratory, in Highland, NY. We are a part of the New York State Agricultural Experiment Station in Geneva, NY, with the laboratory building owned by a non-profit cooperative tree fruit grower organization (HVRL Inc.). This cooperative partnership with the College of Agriculture and Life Science (CALS) and Cornell Cooperative Extension (CCE) has provided agricultural Research and Extension on Tree Fruits and Vegetables in the Hudson Valley since 1923. Research-based information continues to be provided to New York farmers through educational programs organized by Cornell Cooperative Extension and participating associations. Horticultural plant protection programs at the Hudson Valley Lab are especially important to sustaining the viability of agriculture in the Hudson Valley and Northeast as agricultural production is ultimately the best way to preserve open space and economic stability in the rapidly developing corridor between Albany and New York City.

Focus: Stakeholder access to the technical aspects of insect pest management and integrated approaches for reducing crop losses from insect pests is an integral component of our work and the primary purpose of this website. We hope to convey to the agricultural and consumer community that plant protection is a dynamic and an ever changing process, especially 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 economic competitive advantage and promoting national food security, while ultimately, serving the world-wide community of consumers by reducing the negative impact of food production on our environment. At the Hudson Valley Laboratory we strive to provide access of time sensitive information to the agricultural community. This site 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.

Edit

Search

ARCHIVES

- November 2014
- October 2014
- September 2014
- August 2014
- July 2014
- June 2014
- May 2014
- April 2014

META

- Site Admin
- Log out

2014 BLOG PAGES

- Upcoming Workshops on Spotted Wing Drosophila in NY State.
- BMSB Update: Increasing Damage to Pink Lady Apple Observed In Columbia County.
- BMSB Trapping Update: Fluctuating Temperatures = Sporatic Trap Captures
- BMSB Harvest Update: Damage to Red Delicious at Harvest: October 2nd, 2014
- BMSB Trap & Scouting Update: BMSB Trap Numbers Continue to Drop. Site Specific Management Required: September 30th, 2014

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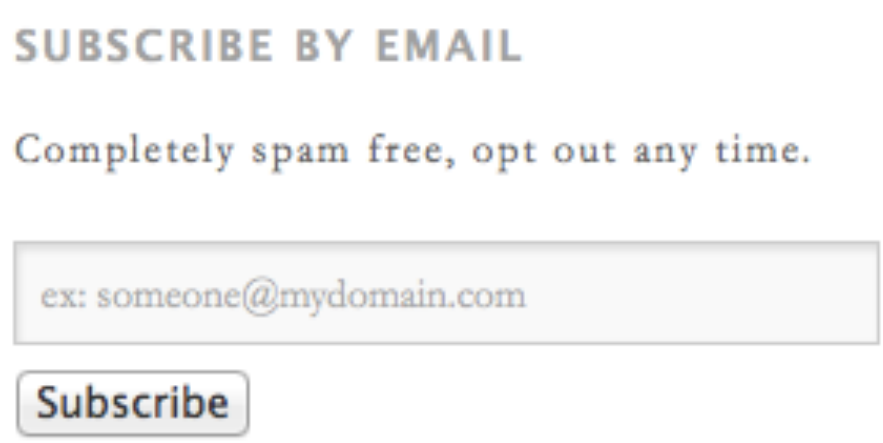

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Historical Invasive Insect Pests Of Fruit In Eastern New York

Apple maggot, *Rhagoletis pomonella* (Wash, 1867)	Tephritidae; Diptera
European red mite, *Panonychus ulmi,*	*Acari*: Tetranychidae
Grape berry moth, *Lobesia botrana* ([Dennis & Schiffermuller])	Tortricidae; Lepidoptera
Japanese beetle, *Popillia japonica* Newman,	Scarabaeidae; Coleoptera
Oriental fruit moth, *Grapholita molesta* (Busck)	Tortricidae; Lepidoptera
Oystershell scale, *Lepidosaphes ulmi* (Linnaeus)	Diaspididae; Hemiptera
Pear psylla, *Cacopsylla pyricola* Foerster,	Homoptera: Psyllidae
Rose leafhopper, *Edwardsiana rosae* (Linnaeus)	Cicadellidae; Homoptera
San Jose scale, *Quadraspidiotus perniciosus* (Comstock)	Diaspididae; Hemiptera

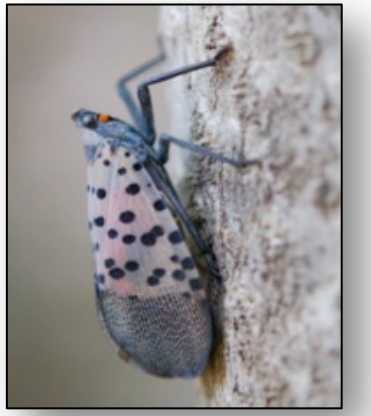
Factors Contributing to Invasive Insect Success

- Size of the **introduced population** (the larger the number, the higher the probability of establishment).
- **Aggressiveness** (how well it out competes native species)
- **Many generations** (producing high populations)
- Rapid dispersal and **overwintering success**
- Ecological niche with **suitable climate** and **available food**
- **Absence of natural enemies** (parasites and predators)

New Pest Update: Spotted Lanterfly. Hemiptera: Fulgoridae

- The **Spotted Lanternfly,** *Lycorma delicatula* (White), is a **planthopper** orinating from China, Korea, India, Vietnam, and parts of eastern Asia.
- **On Sept. 22, 2014, the Pennsylvania Department of Agriculture**, in cooperation with the Pennsylvania Game Commission, confirmed the presence the Spotted Lanternfly in **Berks County, PA.**
- It is an invasive insect in **Korea** where it was introduced in **2006** and since has **attacked 25 plant species** which also grow in Pennsylvania. In the U.S. it has the potential to greatly impact >**70 plant host species including grape, apple, pine and stone fruit**.

- **Adults** appear in July & moves to **Tree of Heaven** (*Ailanthus altissima*)
- Uses Tree of heaven for **egg laying** beginning in October.



Adult SLF

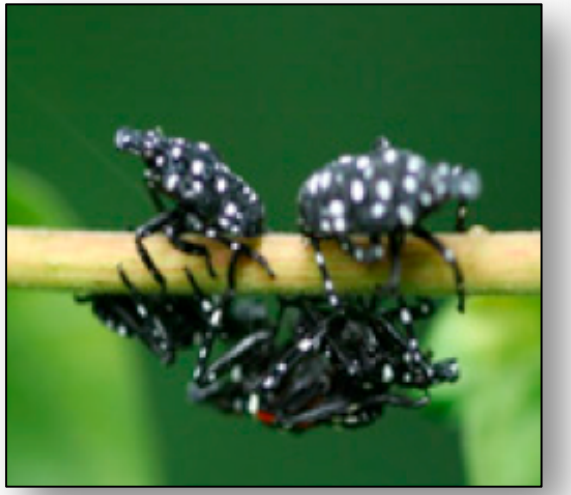
New Pest Update: Spotted Lanterfly. Hemiptera: Fulgoridae

- Nymphs hatch from Late April to early May egg masses laid on smooth bark, stone, and other vertical surfaces. Nymphs **climb, feed and fall** repeatedly onto host plants.

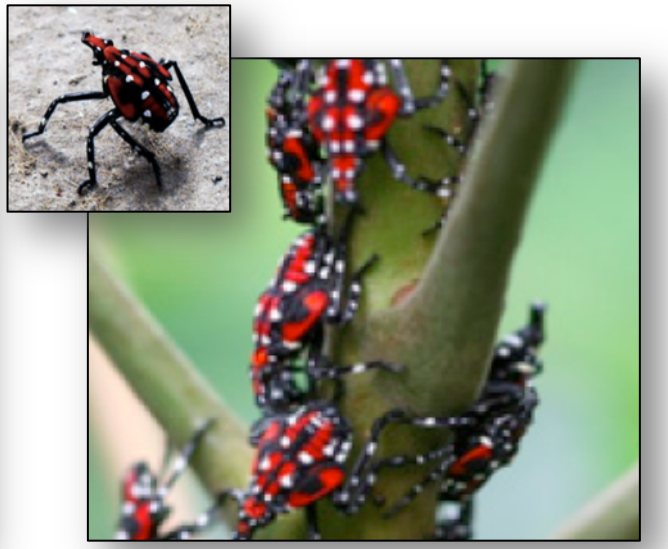
- Nymphs complete **four immature stages**. The first stage is black with white spots and wingless.

- As it grows, the Spotted Lanternfly will start to develop red patches in addition to the white spots. Nymphs spread from the initial site by crawling and feeding on woody and non-woody plants.

Fall/ Winter



Spring

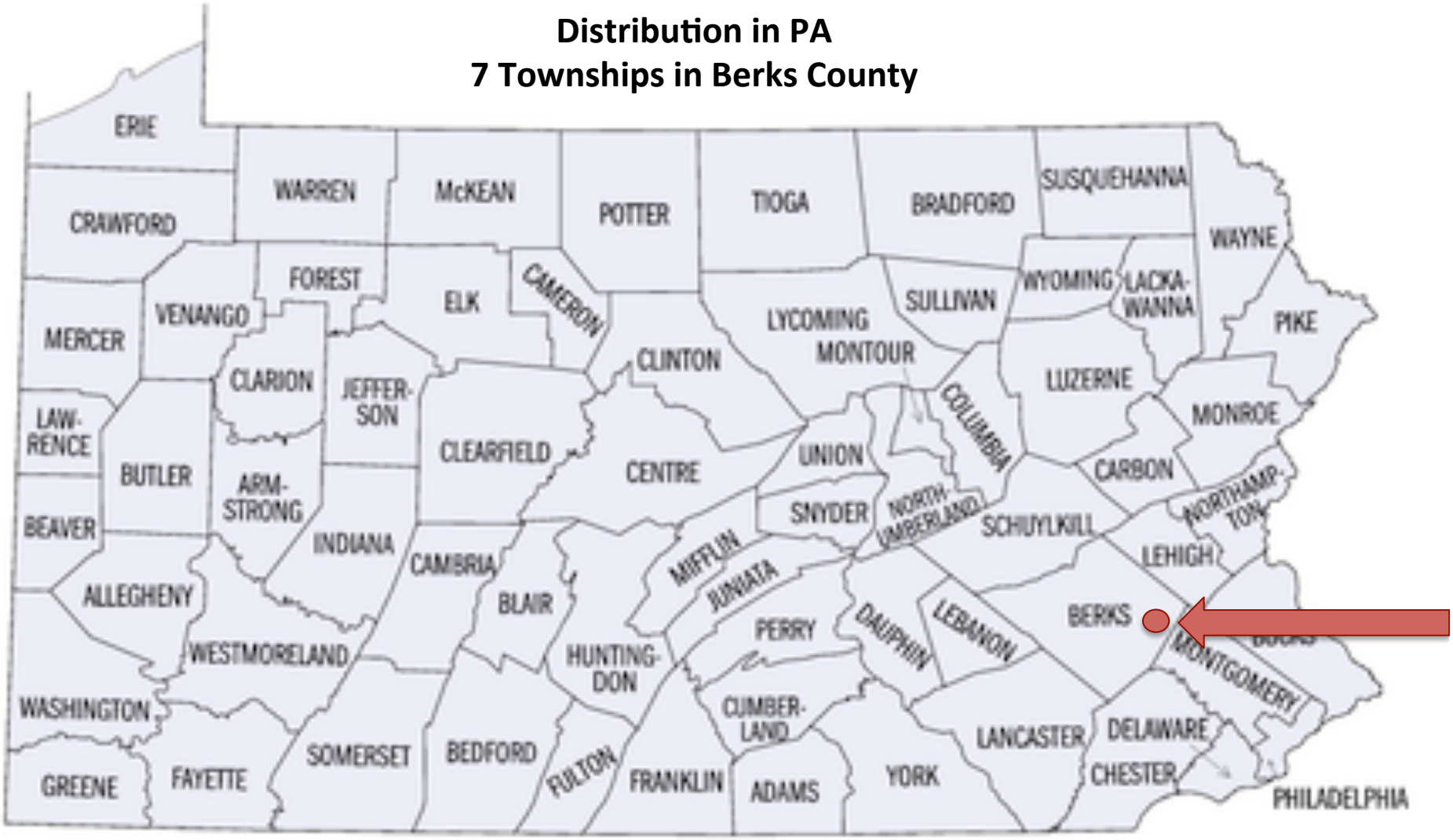


Early Summer

Lycorma Detection Survey

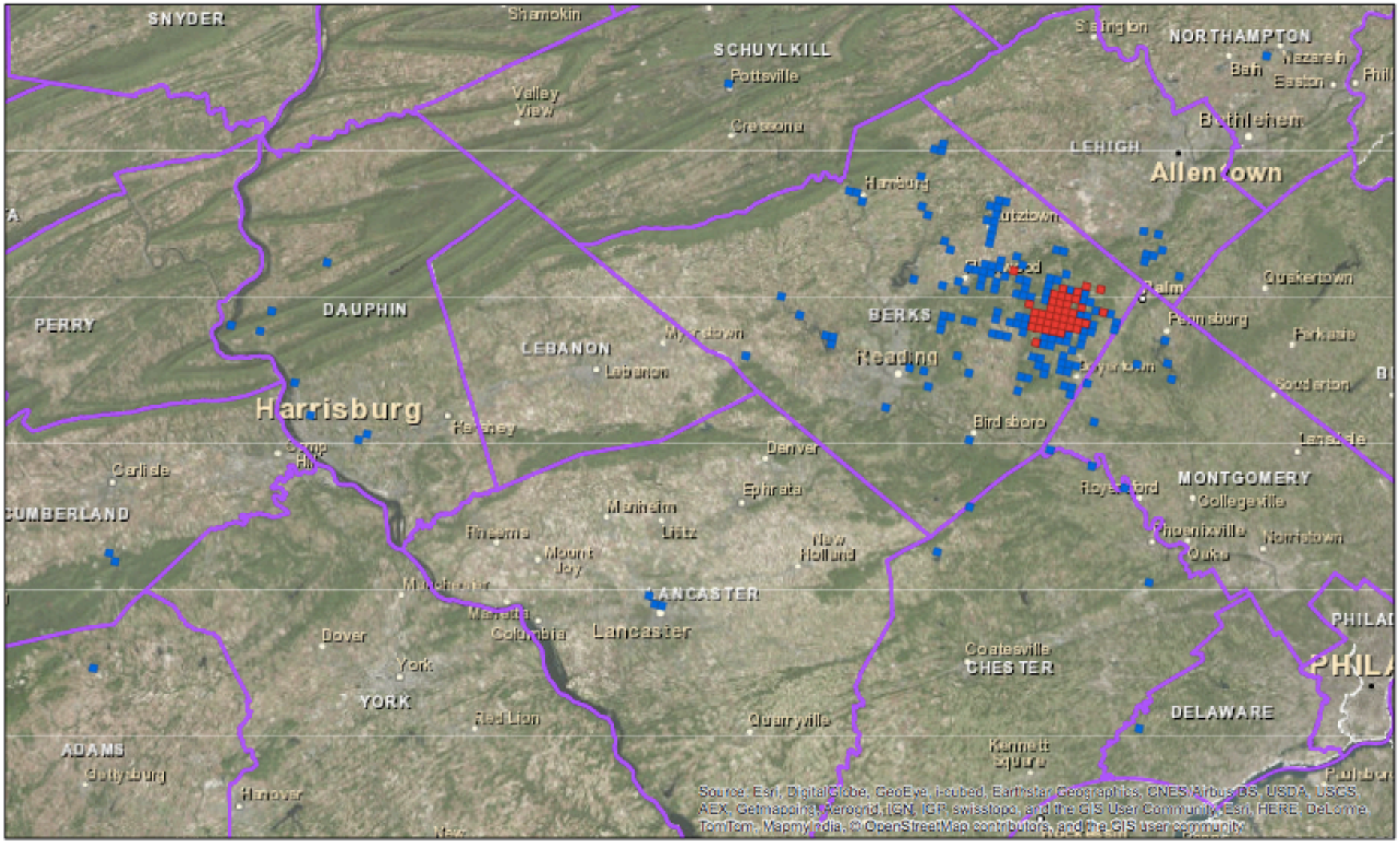
Results Through 15 December 2014

Distribution in PA
7 Townships in Berks County



Lycorma Detection Survey

Results Through 15 December 2014



Survey Grids

- Surveyed - Positive
- Surveyed - Not Found

pennsylvania
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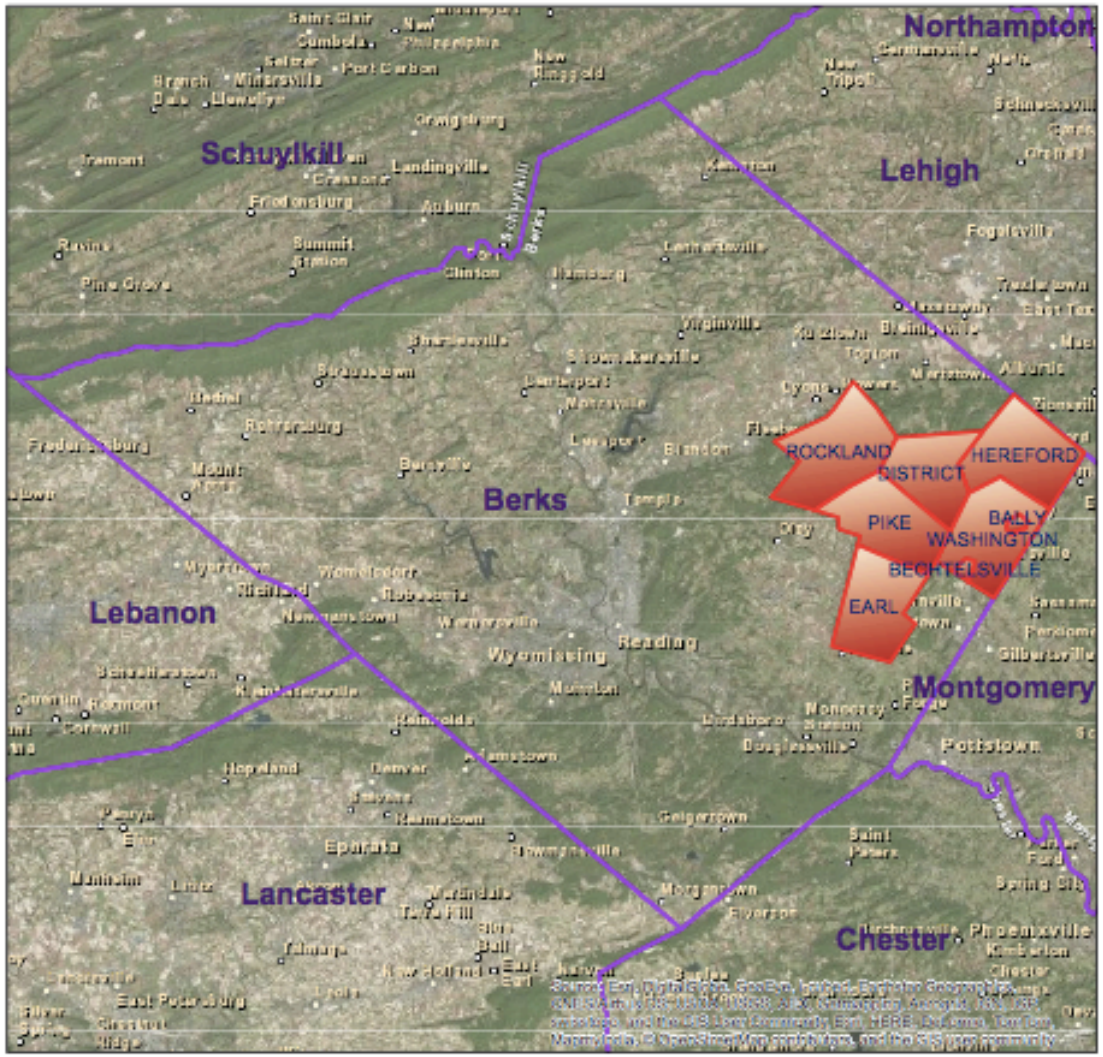
Spotted Lanternfly Quarantine Map

Townships Under Quarantine As of December 13, 2014



Legend

- Township Under PDA Quarantine
- Pennsylvania County Border

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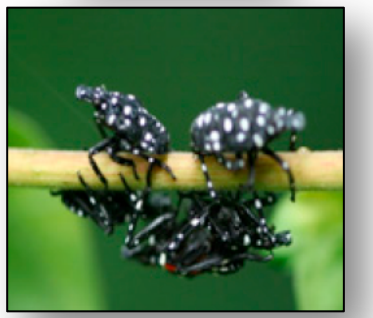
6 Township self assessment for all life stages of SLF using PA Dept of Ag. Form below.

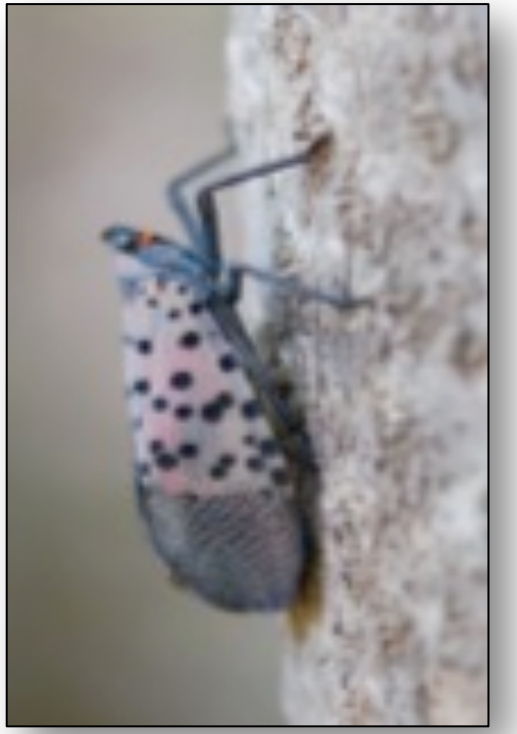


New Pest Update: Spotted Lanterfly: Management

<u>Target adults in mid-late September prior to egg laying & nymphs as they hatch</u>

- Removal of egg masses from bark

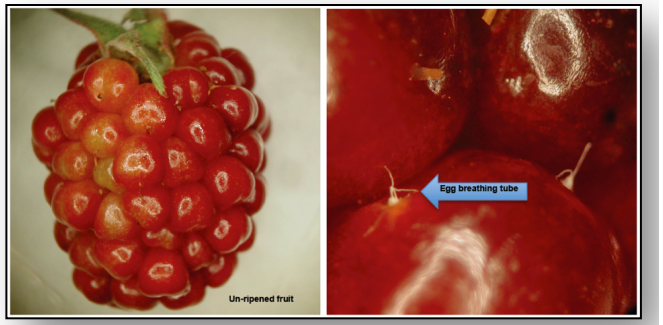
- Trunk applications of Dinotefuran (*Safari, Scorpion*, *Venom)*
  - Systemic insetcicide activity kills insects as they feed on sap



SLF Eggs

Spotted Wing Drosophila

Crops at Highest Risk



- **Raspberries, blackberries, and blueberries**
- **Fall-bearing and late maturing varieties**
- **Day-neutral strawberry varieties**
- **Late season tart and sweet cherries**
- **Thin-skinned grapes (Pinot Noir: Dejon Clones)**
- **Cracked or damaged fruit.**

Life Cycle of the Spotted Wing Drosophila

Drosophila suzukii (Matsumura)

Pupation 4-15 days
Inside or outside of fruit

Adults
20-30 days

Three Larval Instars
5-7 days

Eggs 12-72 hours
350+ eggs in a lifetime

Development Range
10d – 4 weeks

Female Drosophila species

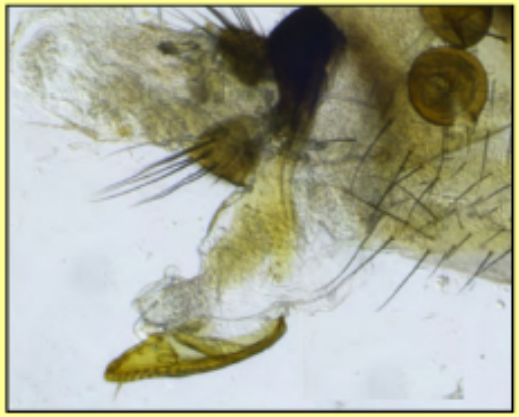
UC Berkeley & UC Cooperative Extension *Photos:* M. Hauser, CDFA

Spotted Wing Drosophila (D. suzukii)

SWD has a large, saw-like, serrated ovipositor with two even rows of teeth that are much darker than rest of ovipositor

Other Drosophila spp.

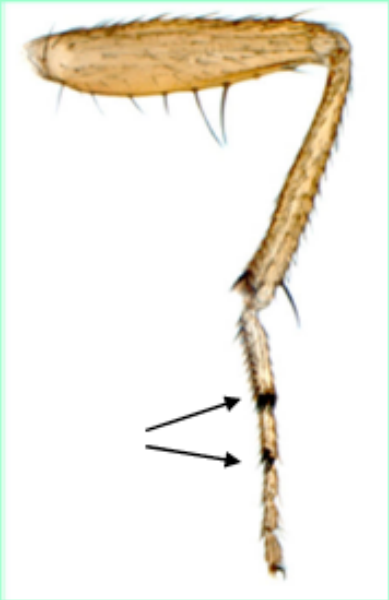
have smaller, more rounded ovipositors, sometimes with irregular, poorly defined teeth



Male Spotted Wing Drosophila (SWD)

UC Berkeley & UC Cooperative Extension

Photos: M. Hauser, CDFA



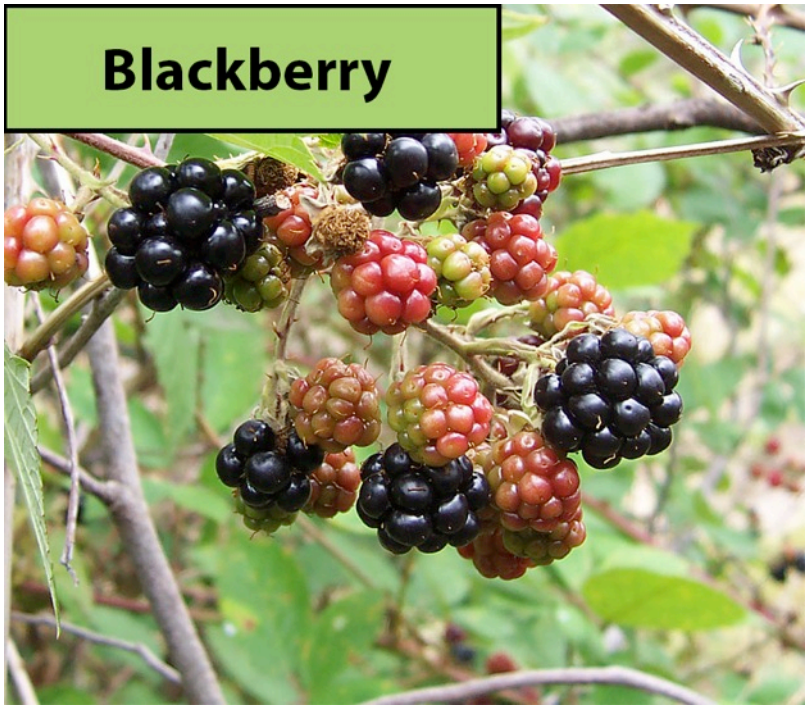
Double stripes on tarsi of front legs

Leading edge of wing has dark spot

Unbroken abdominal bands

Alternate hosts for SWD

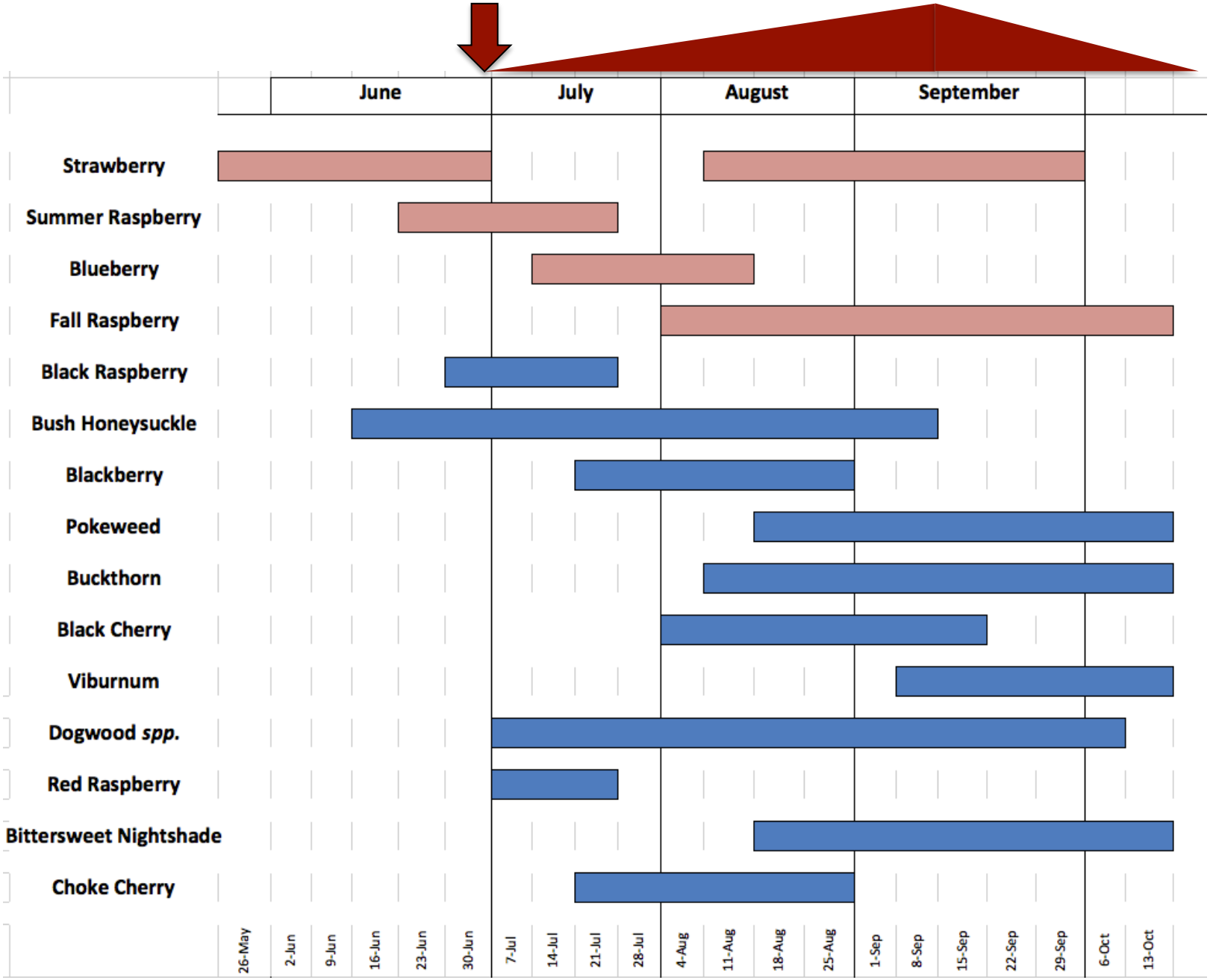
Rubus allegheniensis - Blackberry



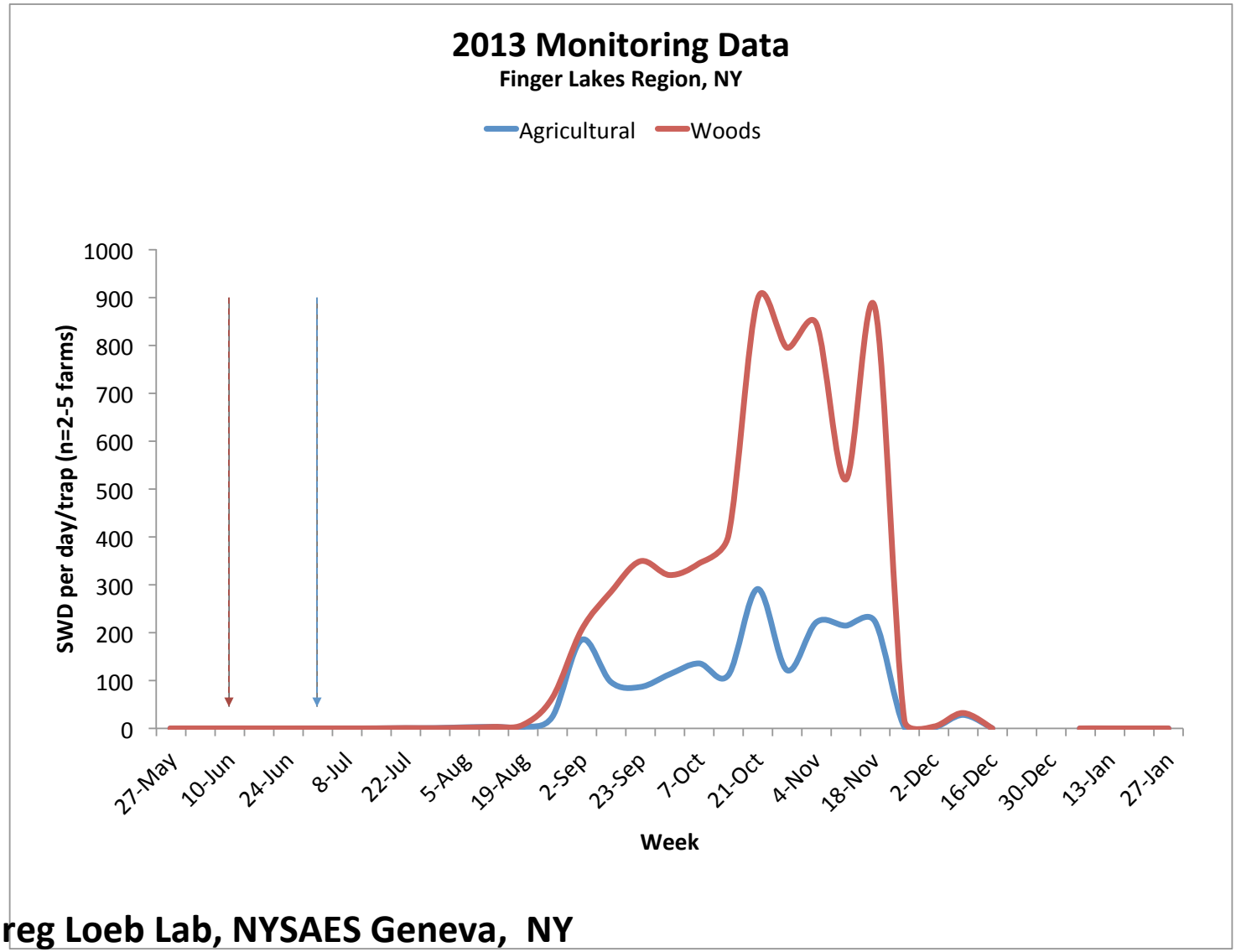
Tartarian Honeysuckle (*Lonicera tatarica*)

An invasive shrub, Tartarian honeysuckle is a native of eastern Asia and was first introduced into North America as an ornamental in 1752. SWD was found to be highly attracted to the fruit, and infestations in *L. tartarica* were noticed before infestation in cultivars.

SEASONAL PHENOLOGY

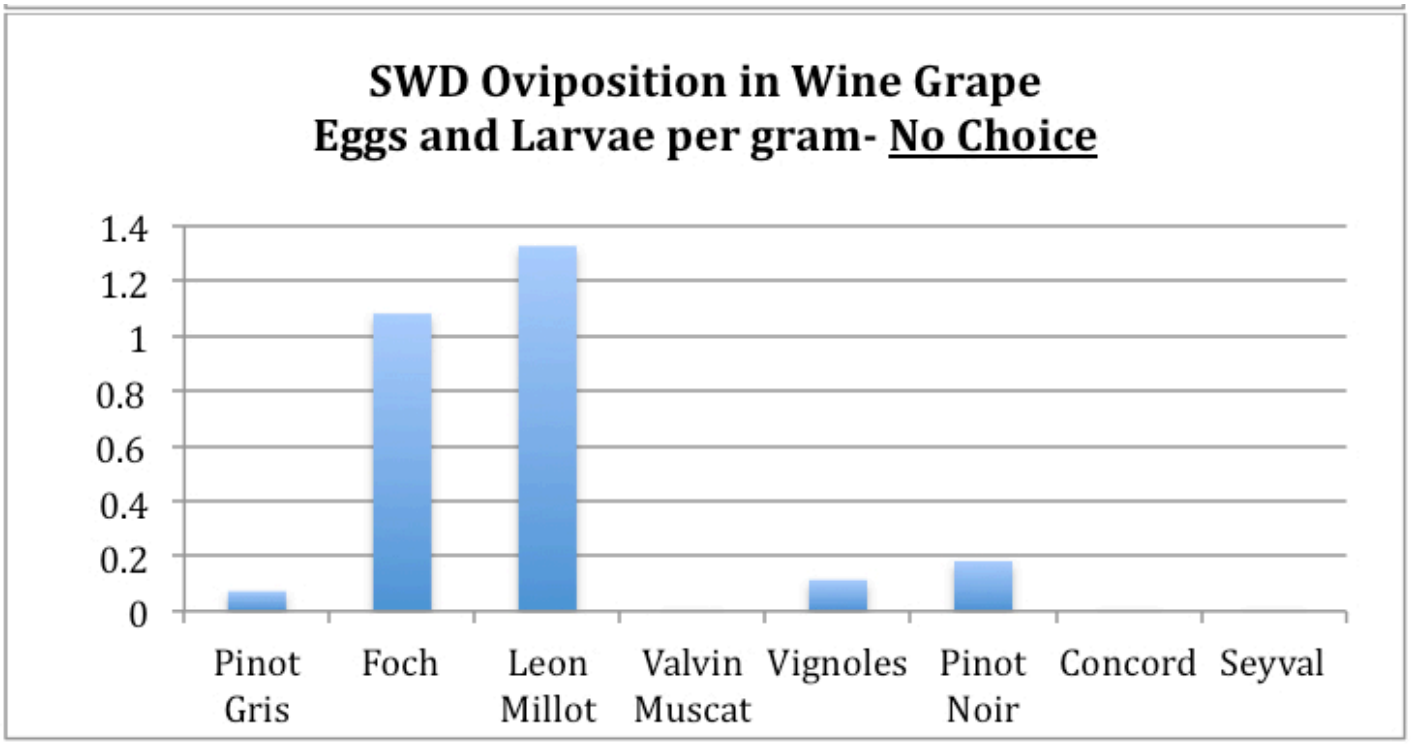


SWD SEASONAL DYNAMICS IN THE NORTHEAST



Credit: Greg Loeb Lab, NYSAES Geneva, NY

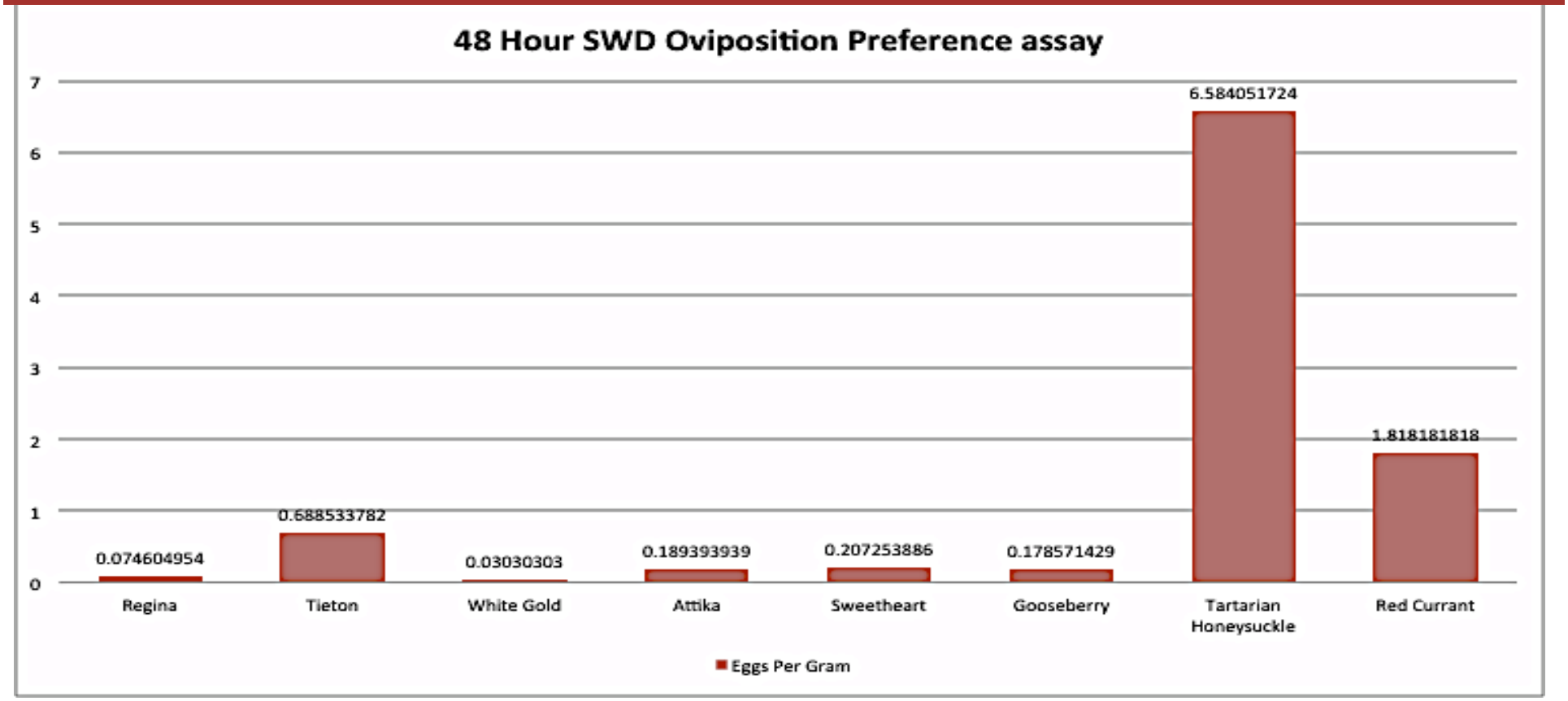
Grape Variety Preference Study: SWD



- Non-Choice Test
- Grapes varieties placed in individual containers.
- 5 female SWD

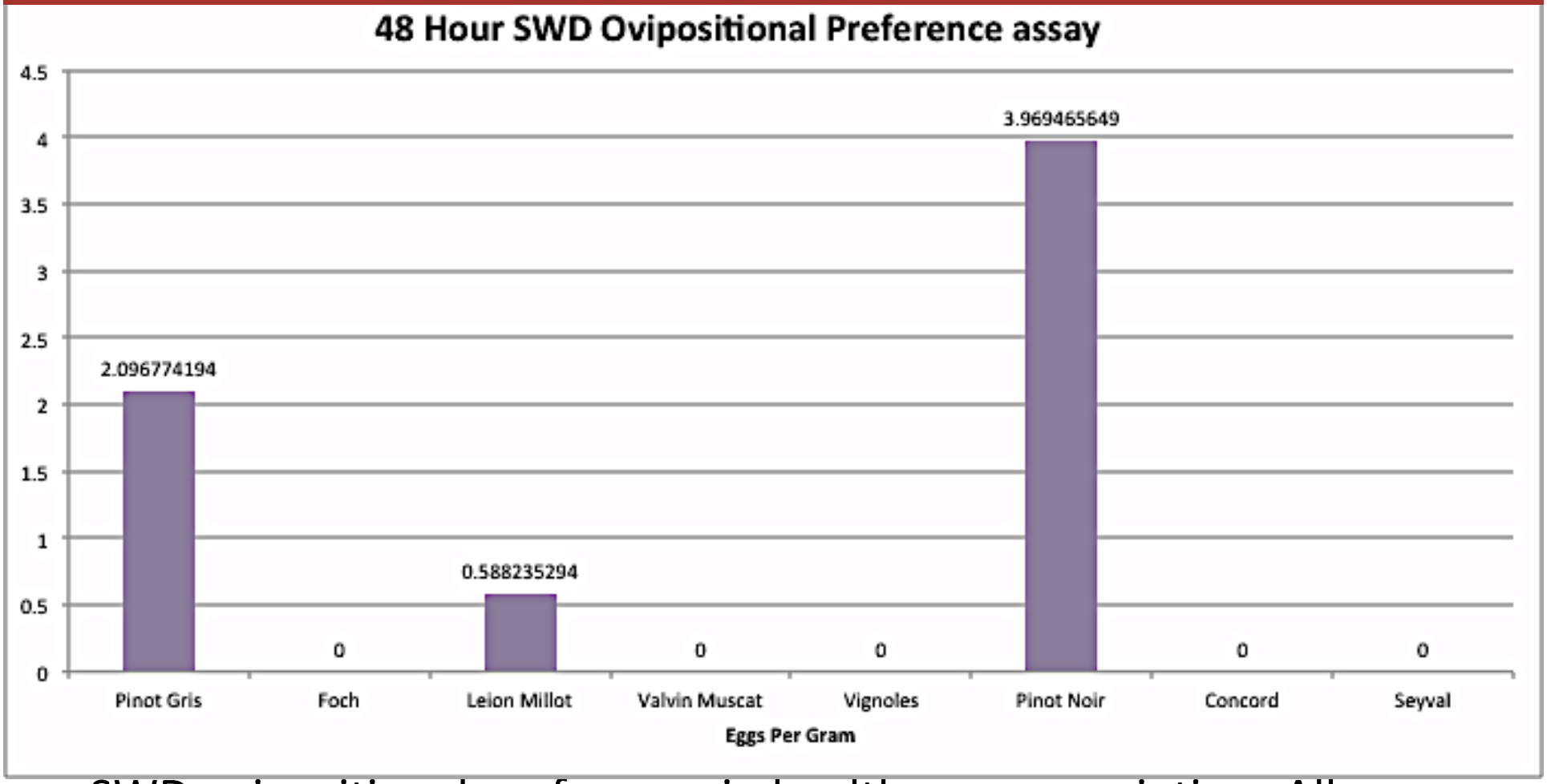
- SWD ovipositional preference in pre-ripened grape varieties.
- Allowed 48 hours to oviposit.

Grape Variety Preference Study: SWD



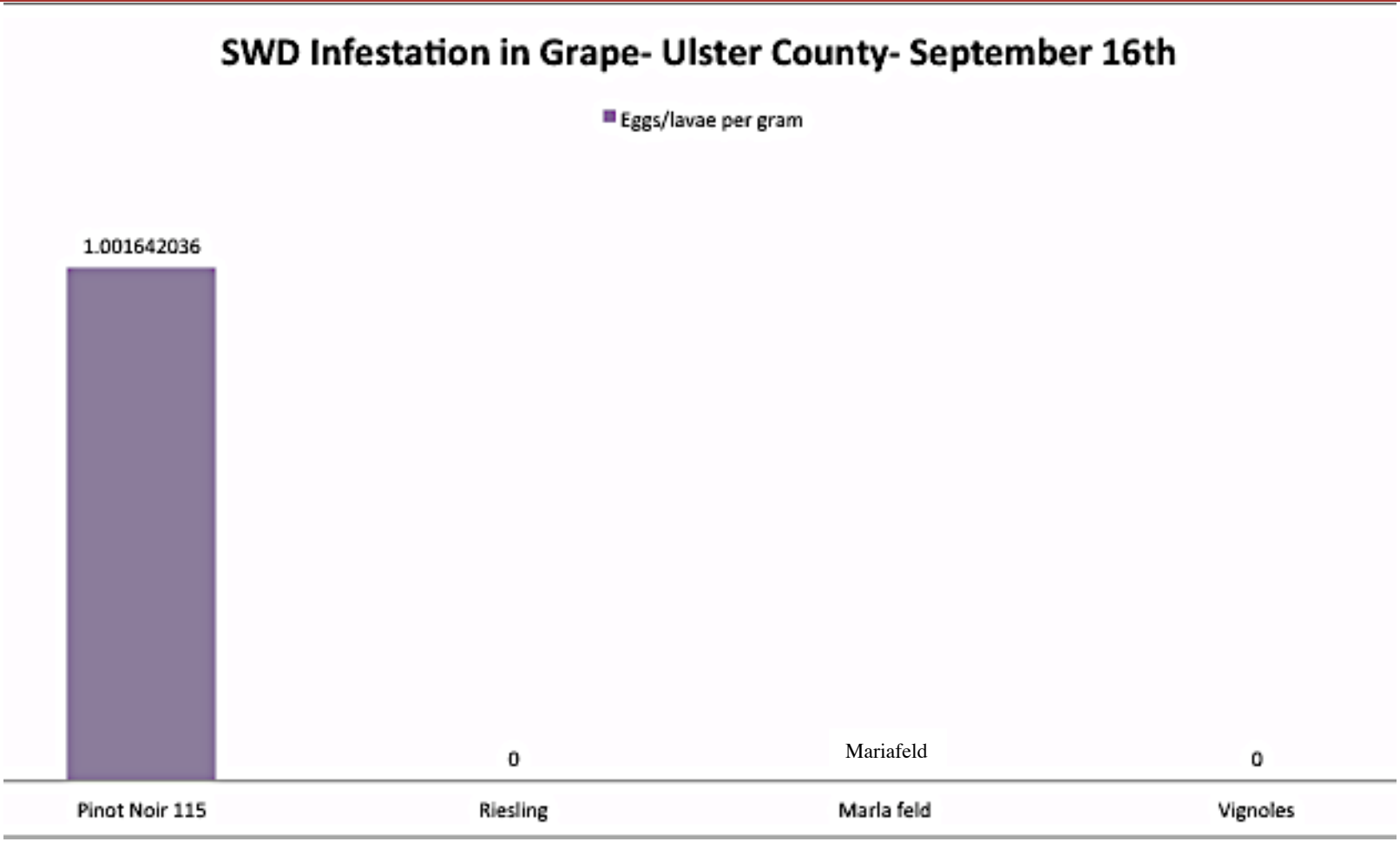
- **Male and Female flies were introduced to fruit, and allowed 48 hours to oviposit before they were removed and eggs were counted.**
- **Each fruit was isolated with 5 male and 5 female SWD adults.**

Grape Variety Preference Study: SWD



- SWD ovipositional preference in healthy grape varieties. All grapes placed in same container. 40 SWD adults introduced and allowed 48 hours to oviposit.

Grape Variety Preference Study: SWD



Grapes collected and analyzed from an Ulster County vineyard indicated that Pinot Noir is indeed at high risk of SWD infestation.

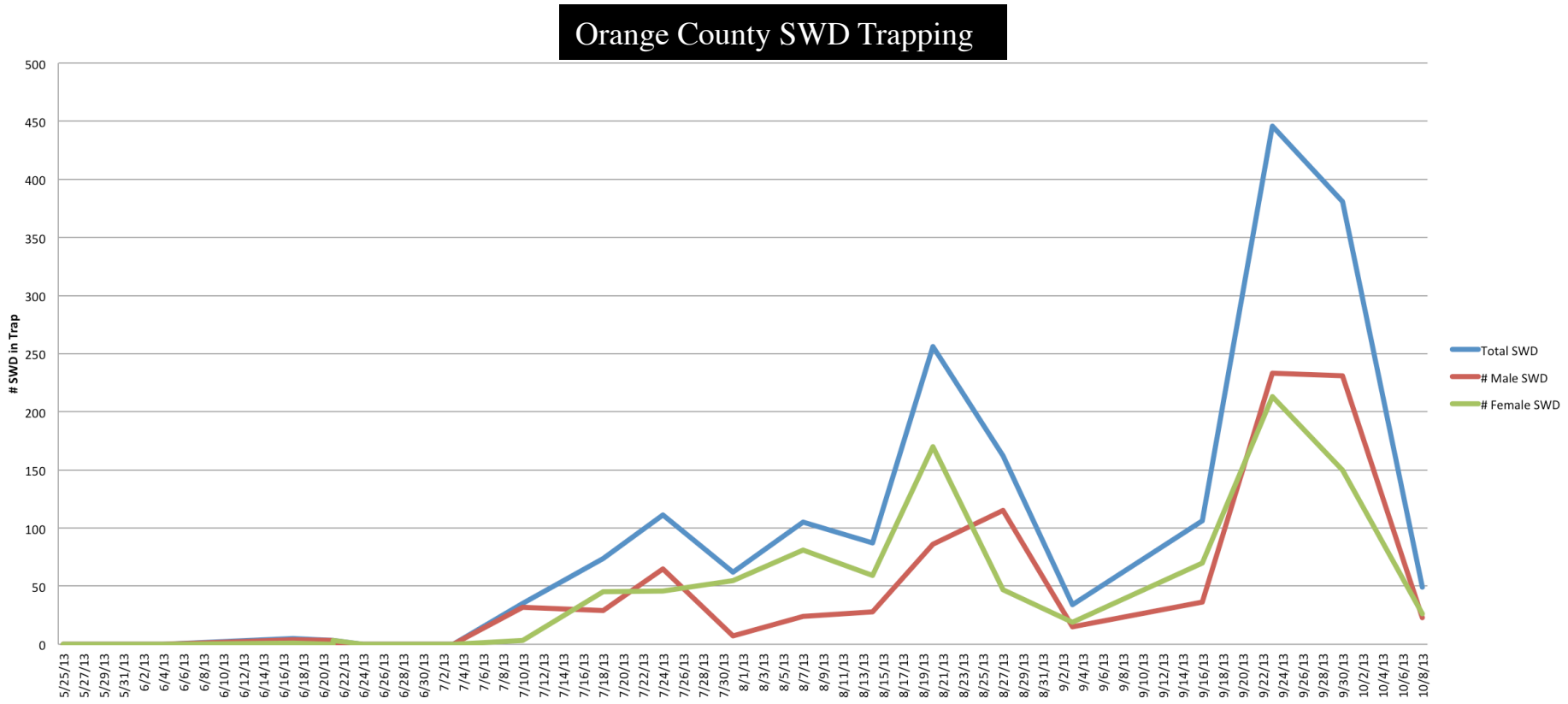
Grape Variety Preference Study: SWD

- Vineyard with P115 with 100% injury of cluster with >90% berry infestation / cluster.

Monitoring

- **Whole wheat bread dough (fermenting bait) -water, sugar, yeast, whole wheat, apple cider vinegar (ACV)**
- **Drowning solution of ACV**

SWD Population over Time: Orange



- First Capture: June 17 (5 SWD, 4 Male, 1 Female)
- Largest Capture: September 23
- (446 SWD, 233 Male, 213 Female)

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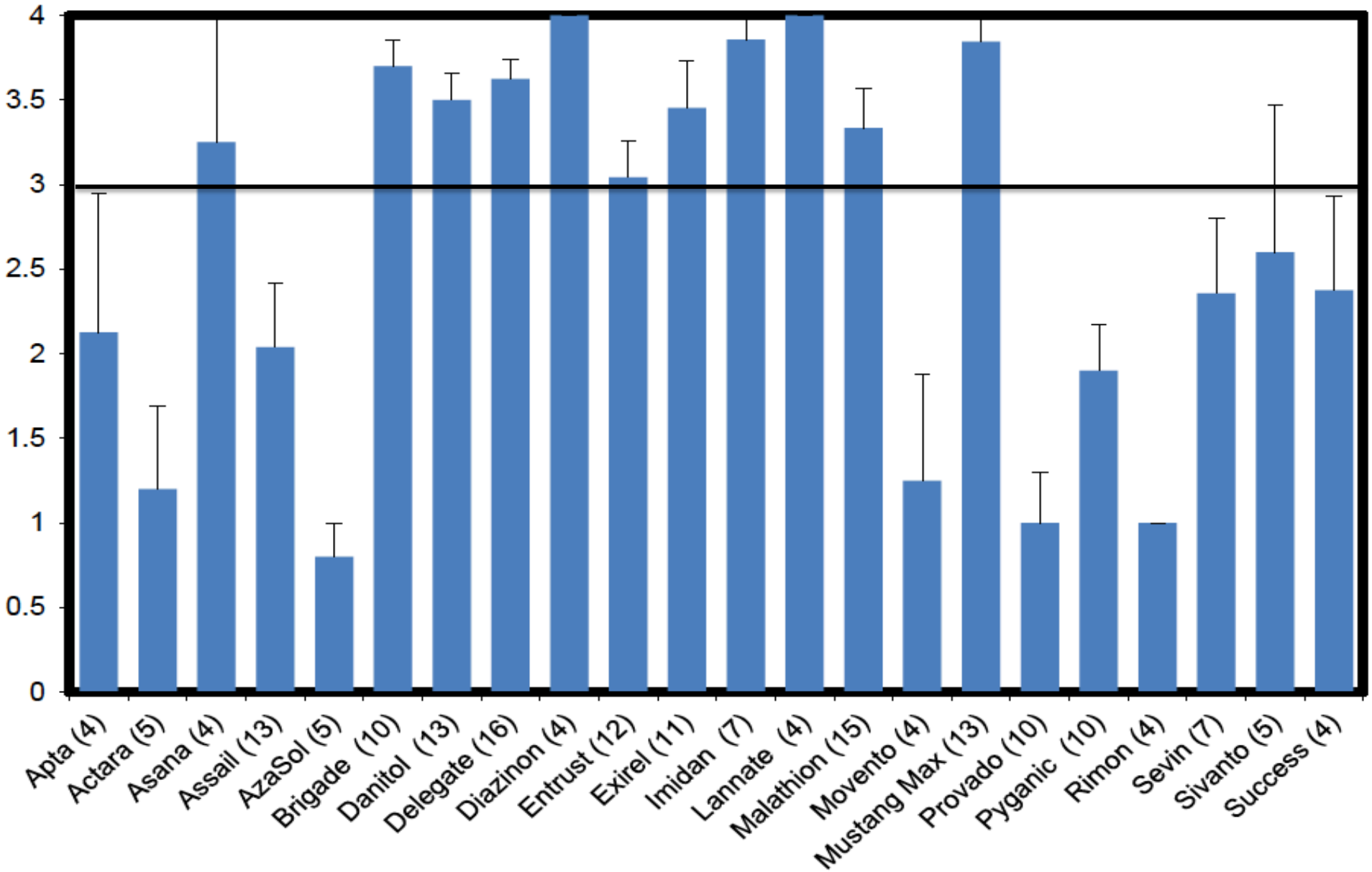
CLASSES OF SWD INSECTICIDES

Class	IRAC Code	Examples	SWD Efficacy
Organophosphates	1B	Malathion	Excellent to good
Pyrethroids	3A	Brigade, Danitol, Mustang Max	Excellent
Spinosyns	5	Delegate, Entrust	Excellent to good
Neonicotinoids	4A	Assail	Good to poor
Carbamates	1A	Sevin	Good to poor
Diamide	28	Exirel*	Excellent to good

***Just received EPA label for blueberries, not raspberries**

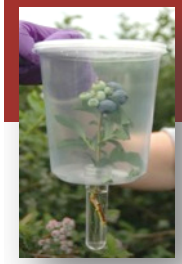
Credit: Greg Loeb Lab, NYSAES Geneva, NY

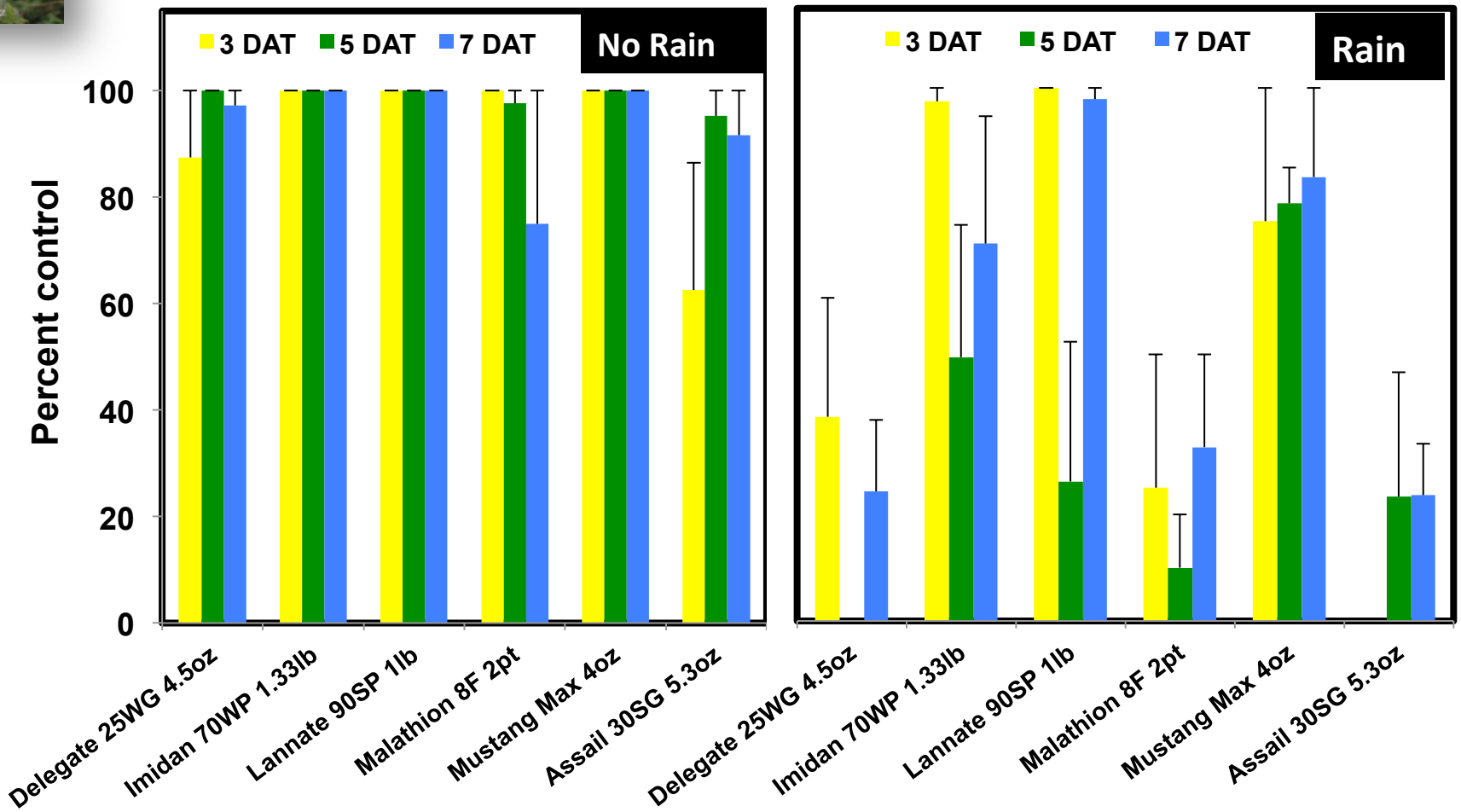
Survey on insecticide efficacy against SWD, collated by Rufus Isaacs, MSU - November, 2013



Effect of Rain on Some Common Insecticides

From Rufus Isaacs, MSU

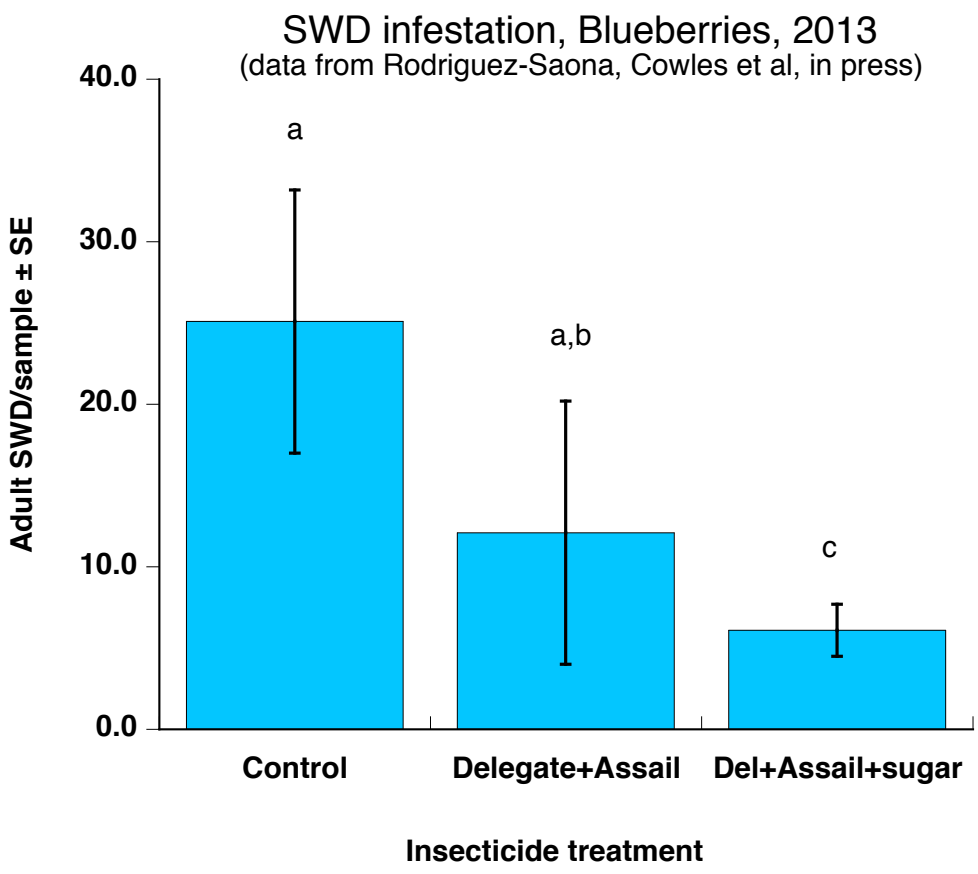




0.8 inches of rain on treated bushes
1 day after application

MICHIGAN STATE UNIVERSITY

Enhancing Mortality with Sugar



Cultivar: 'Bluecrop'

Treatments: 4 wk spray program
- **Alternate Delegate & Assail**
- **Delegate & Assail plus sugar**

Plot size: 2 rows, 32 bushes

Replicates: 4

2 lbs. sugar / 100 gal. water

Credit: Greg Loeb Lab, NYSAES Geneva, NY

African Fig Fly, *Zaprionus indianus* Gupta

African Fig Fly, *Zaprionus indianus* Gupta

- **Introduction:** The fig fruit fly is native to tropical Africa, but has been found in South America, including Brazil in 1999 (Vilela 1999).

- Central Florida on 26 July, 2005, Virginia and Mississippi in 2012.

- In apple cider baited traps *Zaprionus indianus* Gupta were found in Milton, NY on 4 September, 2012 and August 2014.

African Fig Fly, *Zaprionus indianus* Gupta

- **Description:** A striking pair of white stripes from the antennae, dorsally along distinctive red eyes to the end of the thorax with two black lines bordering each white stripe.
- The body is yellow in color approximately 3.5 mm in length
- Development time is approximately 19 days from egg to adult.
- The African fig fruit fly are capable of producing numerous generations in a season.

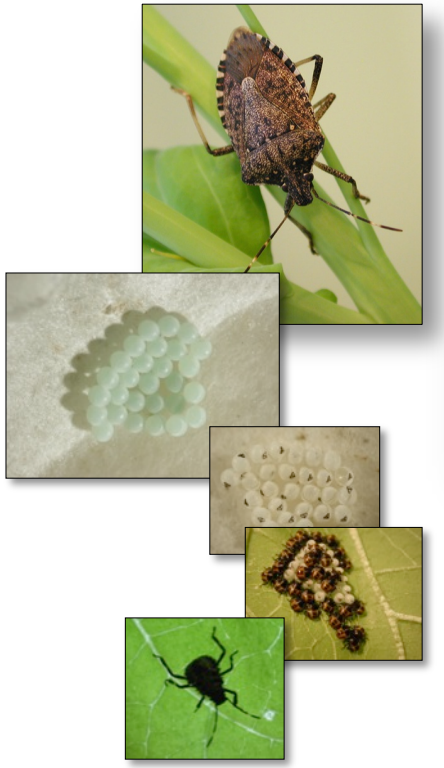
African Fig Fly: Crops at Risk

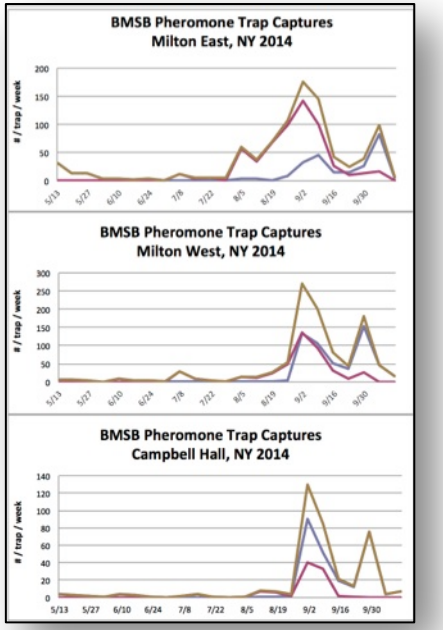
- **Damage: Predominately to citrus and grape**
- **Hudson Valley:**
  - **4 AFF in 2012**
  - **0 AFF in 2013**
  - **3 AFF in 2014**
- **Reports from Rutgers, NJ of wine grape injury independent of SWD injury.**
- **Not yet a threat in NY**

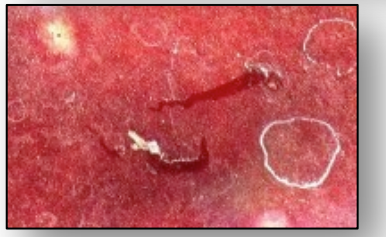
SUMMARY

- Insecticides are presently the primary method of control for SWD
- Consider rotating insecticide IRAC classes every 10-14 days to maintain insecticide susceptibility
- Consider the weather forcasts and insecticide to maintain residual activity
- Sugar may increases efficacy of some insecticides

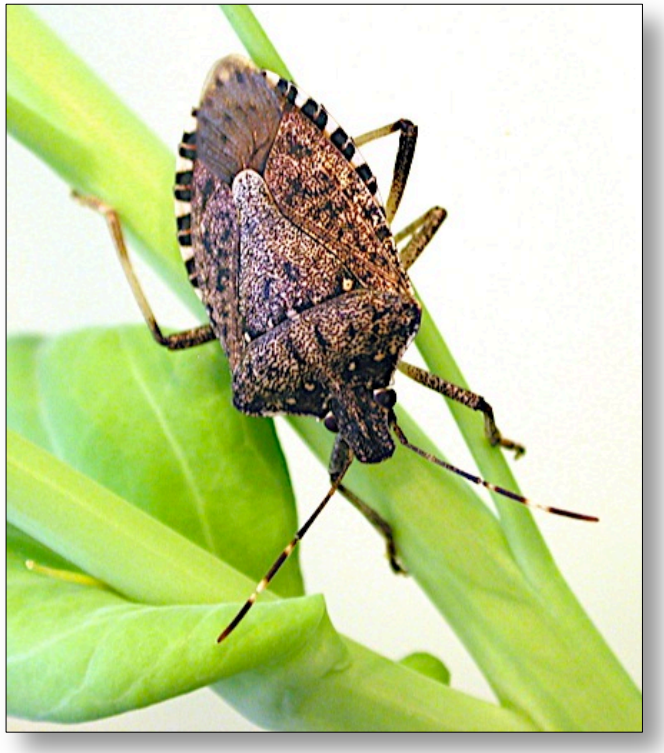
Managing the Brown Marmorated Stink Bug, *Halyomorpha halys* (Stål) in New York State







Brown Marmorated Stink Bug, *Halyomorpha halys* Overview



- Brown Marmorated Stink Bug first detected in Allentown, PA in 1998, confirmed in 2001.

- 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.**

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Brown Marmorated Stink Bug, *Halyomorpha halys* Overview

- Initial observations in 2012 suggest that BMSB presence in wine grapes after harvest does not affect wine taste and scent.

- While there is a distinct taint in freshly crushed juice, the taint does not appear to be stable after the fermentation and bottling process.

- Feeding on berries causes a necrosis and shriveling.

- Adults lay eggs in late spring; population dynamics in vineyards appear to be affected by which hosts are nearby.

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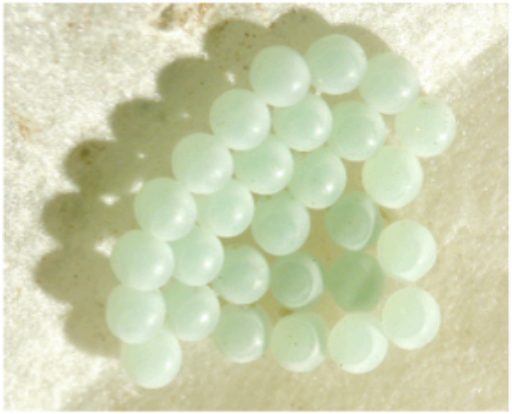
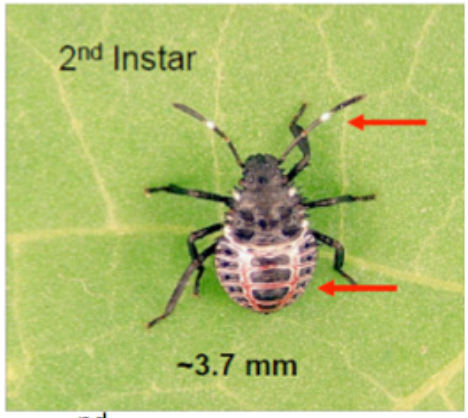
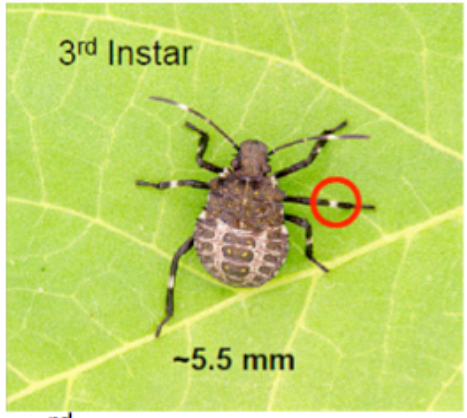


Eggs: Average 28/cluster; light green to white

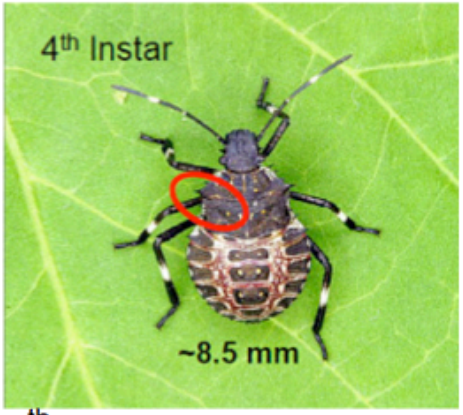
1st instar: black & red; cluster near eggs



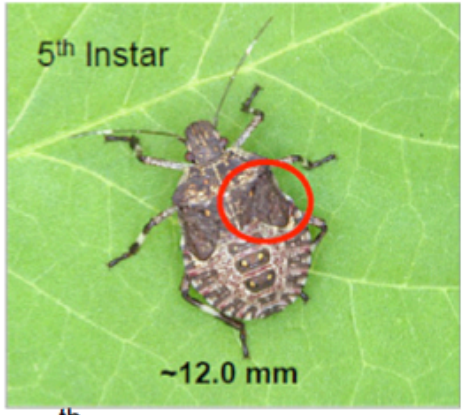
2nd instar: striped antennae



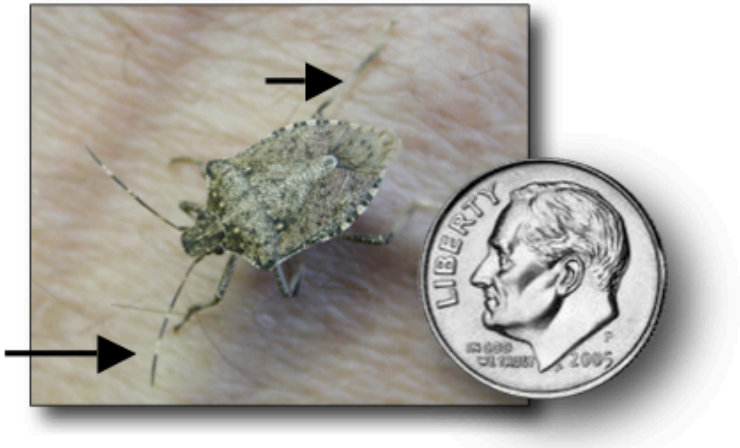
3rd instar: striped antennae and legs



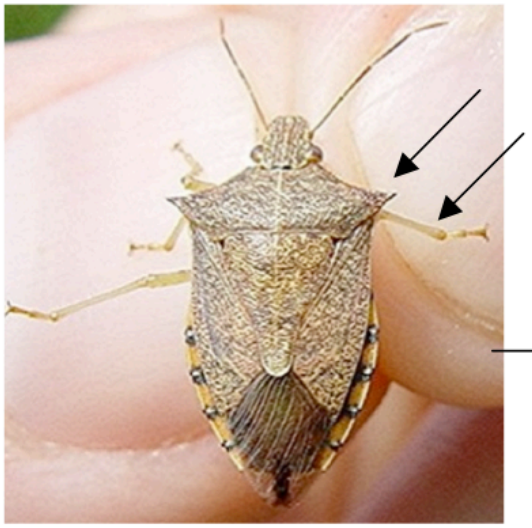
4th instar: thoratic spur striped antennae & legs



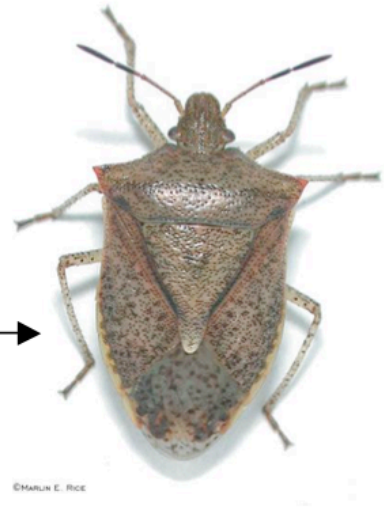
5th instar: wing pads striped antennae & legs



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.

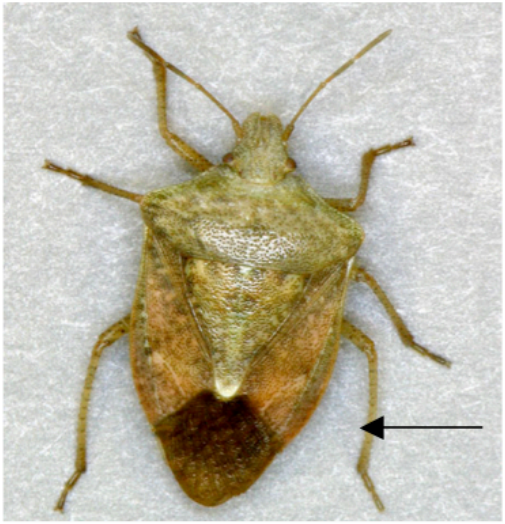


Spined Soldier Bug
Pointed shoulders
No leg stripe

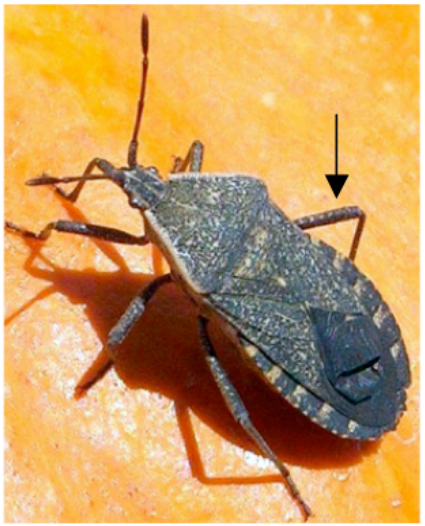


Brown stink bug
No leg stripe

Rough Stink Bug
'Teeth' along shoulders



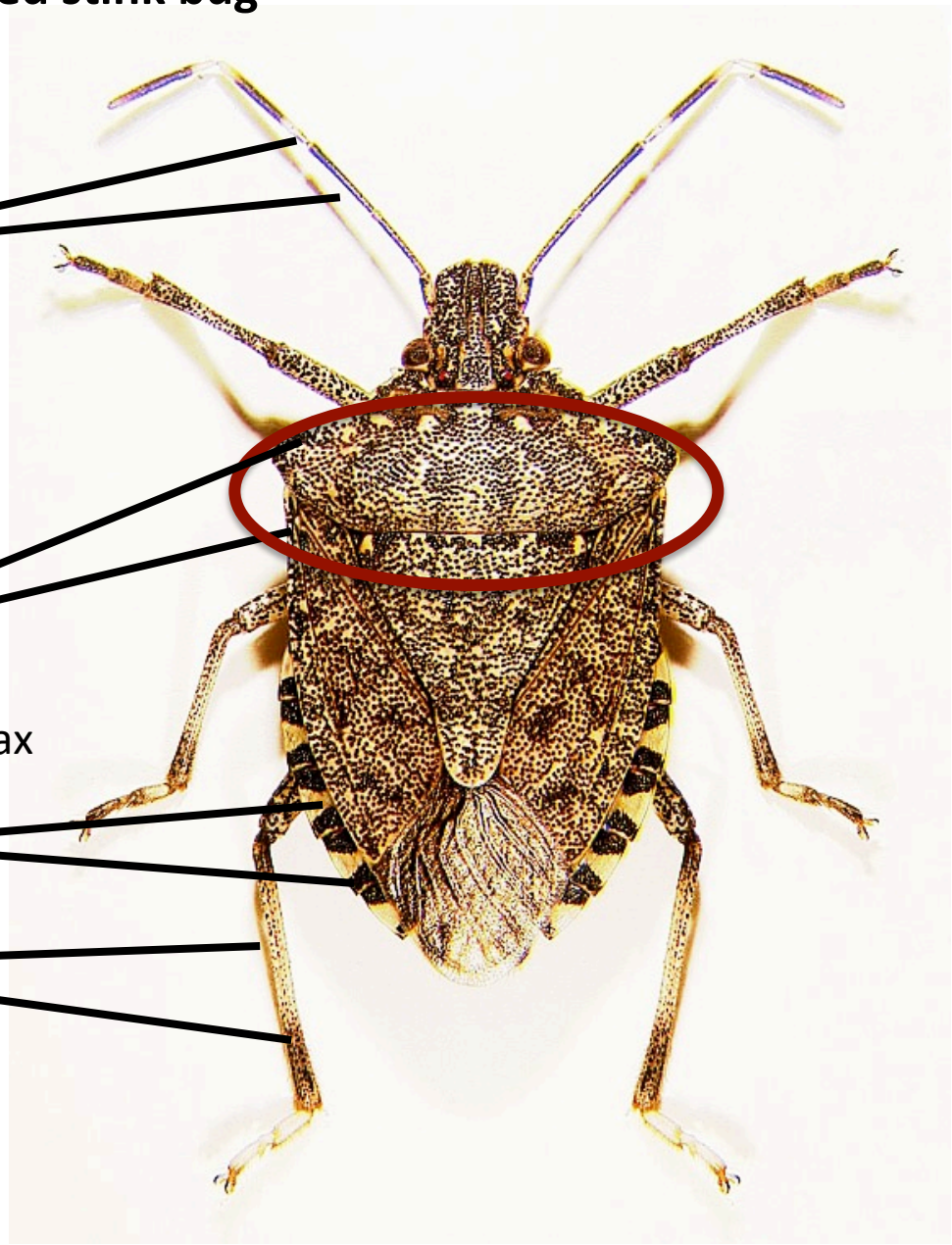
Green Stink Bug
No leg stripe



Squash Bug
No leg stripe

Western conifer seed bug
'leaf footed'

Key features of the brown marmorated stink bug
Halyomorpha halys



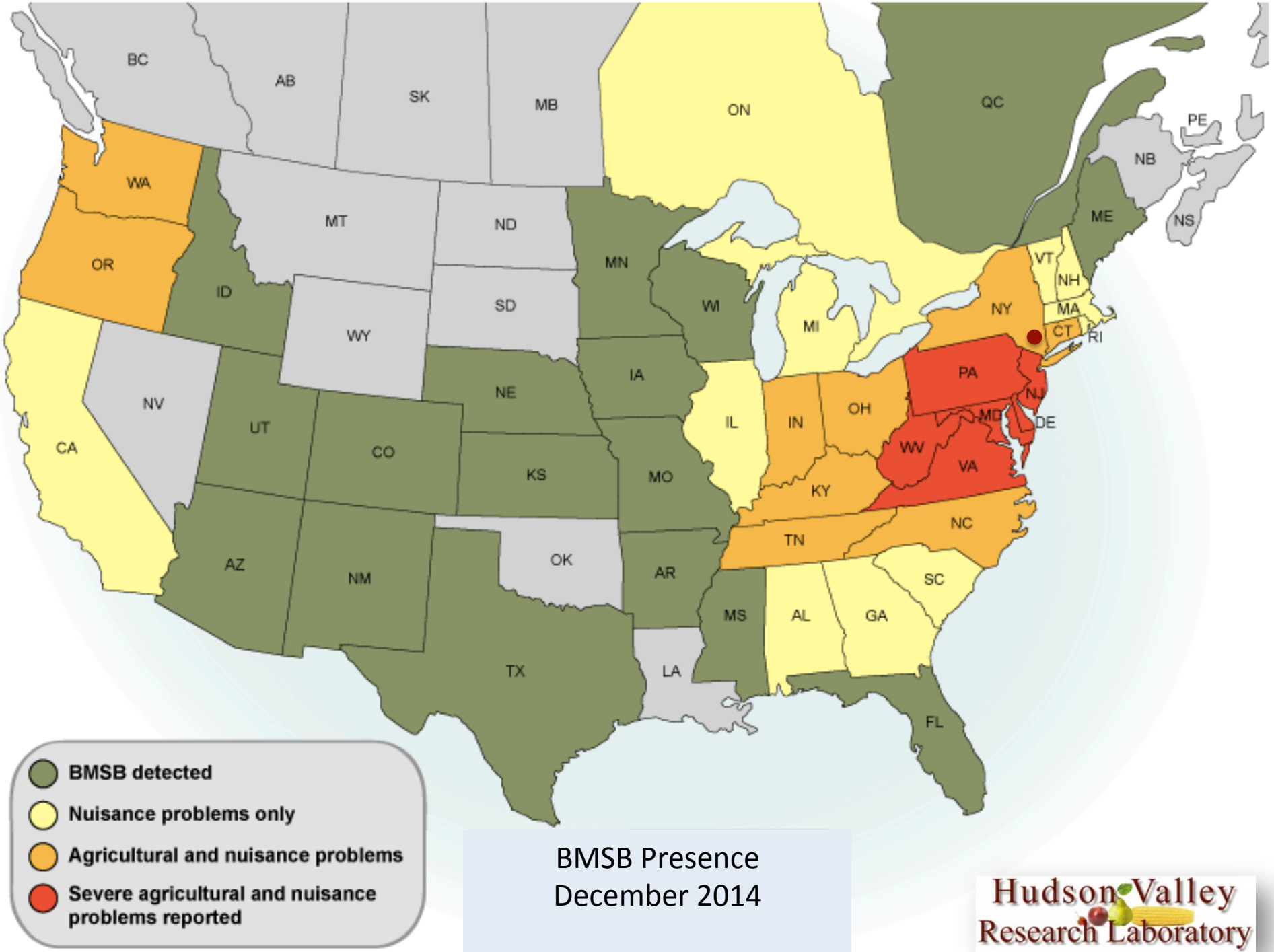
Antenna:
light & dark
banding

2 sets of 4

Cream colored dots on thorax

Wing pads &
Legs:
light & dark banding

Photo by David J. Shetlar
Ohio State University



BMSB Presence
December 2014

Hudson Valley Research Laboratory

Brown Marmorated Stink Bug: Host Plants - Food for Success

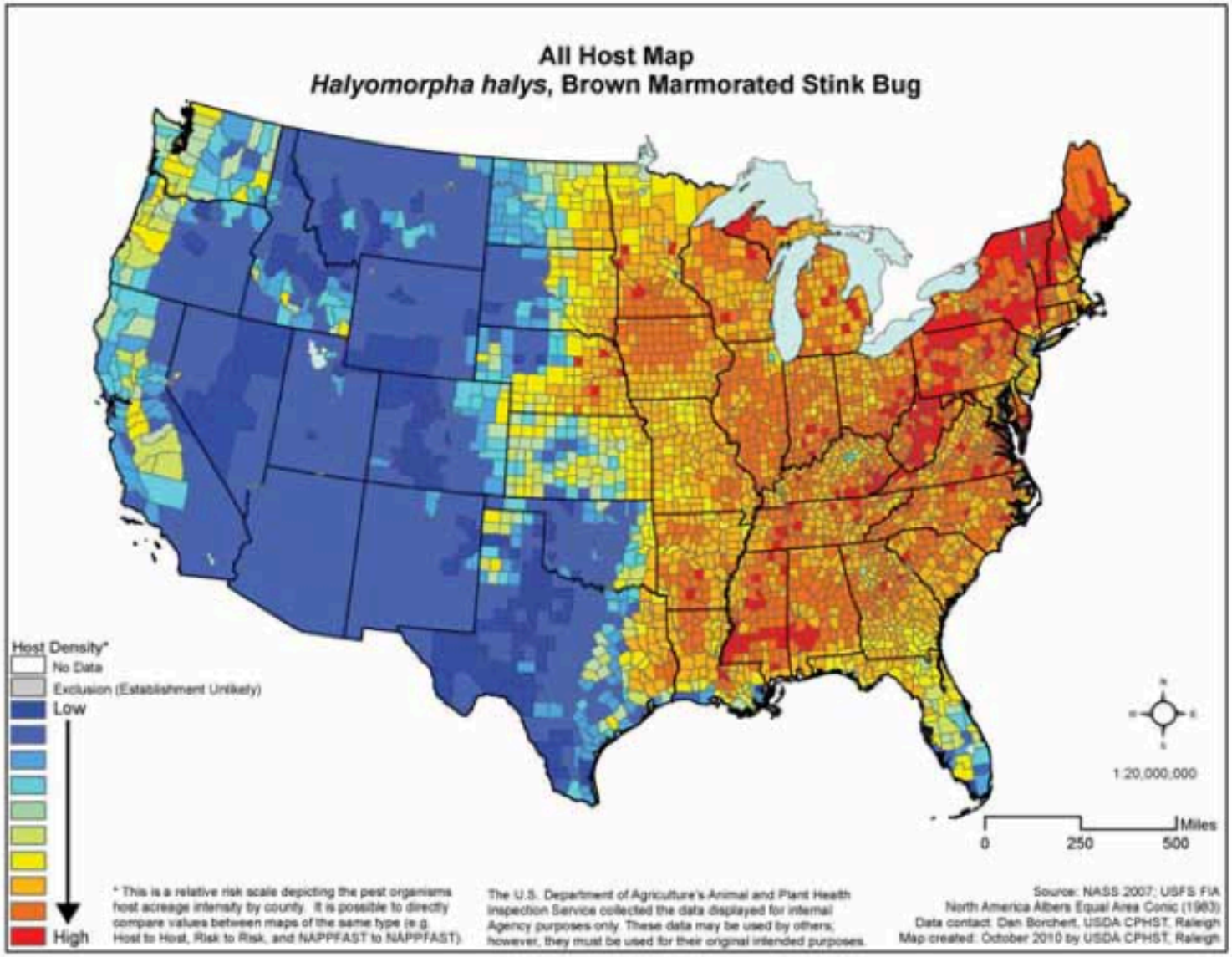
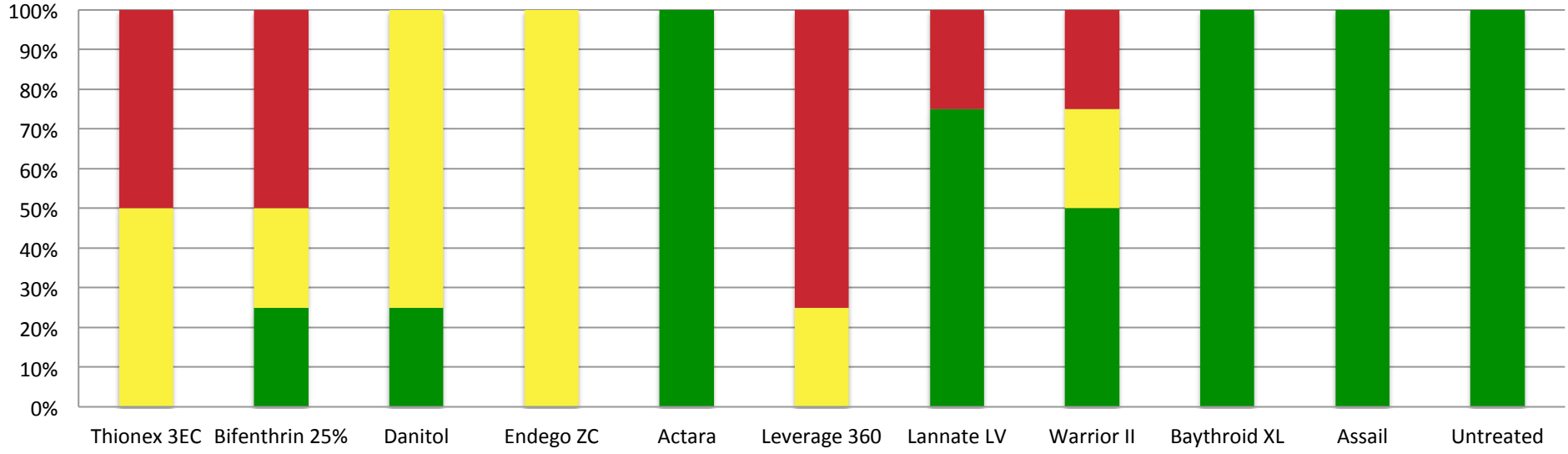
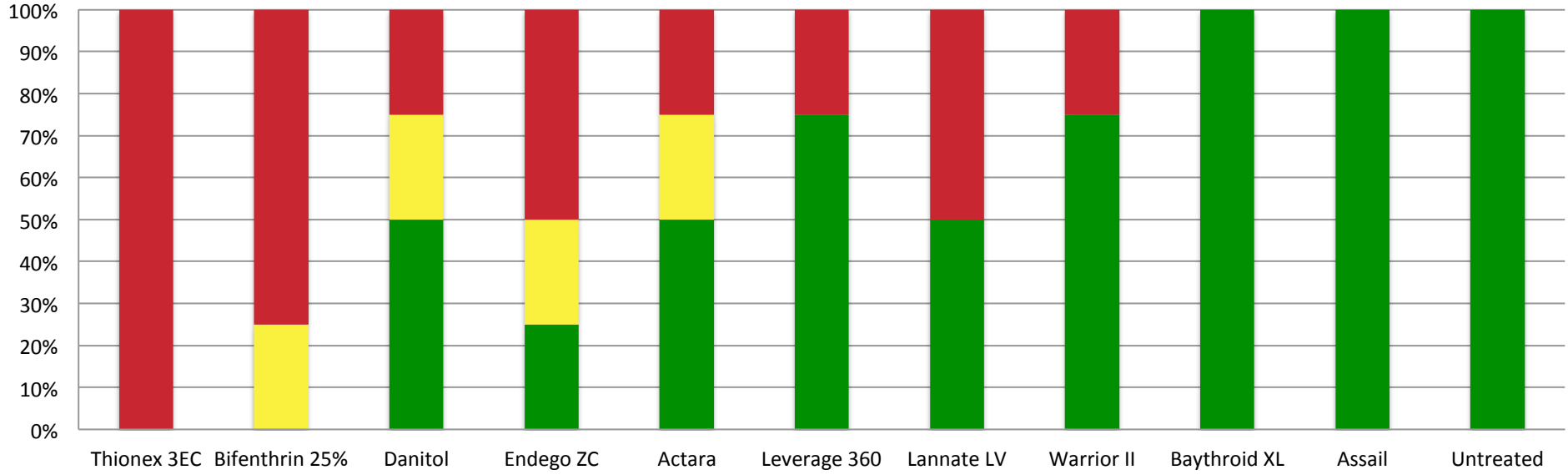


Figure 1: Risk maps displaying the relative density of field, vegetable, and fruit crop hosts plants of BMSB throughout the United States.

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



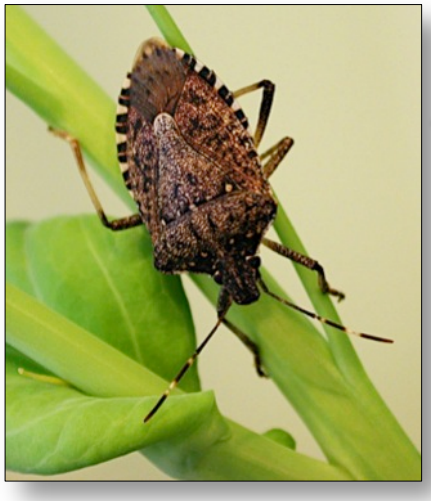
BMSB Adult Exposure to Insecticide Residue of Apple Foliage
72h Old Residue @ 3 d



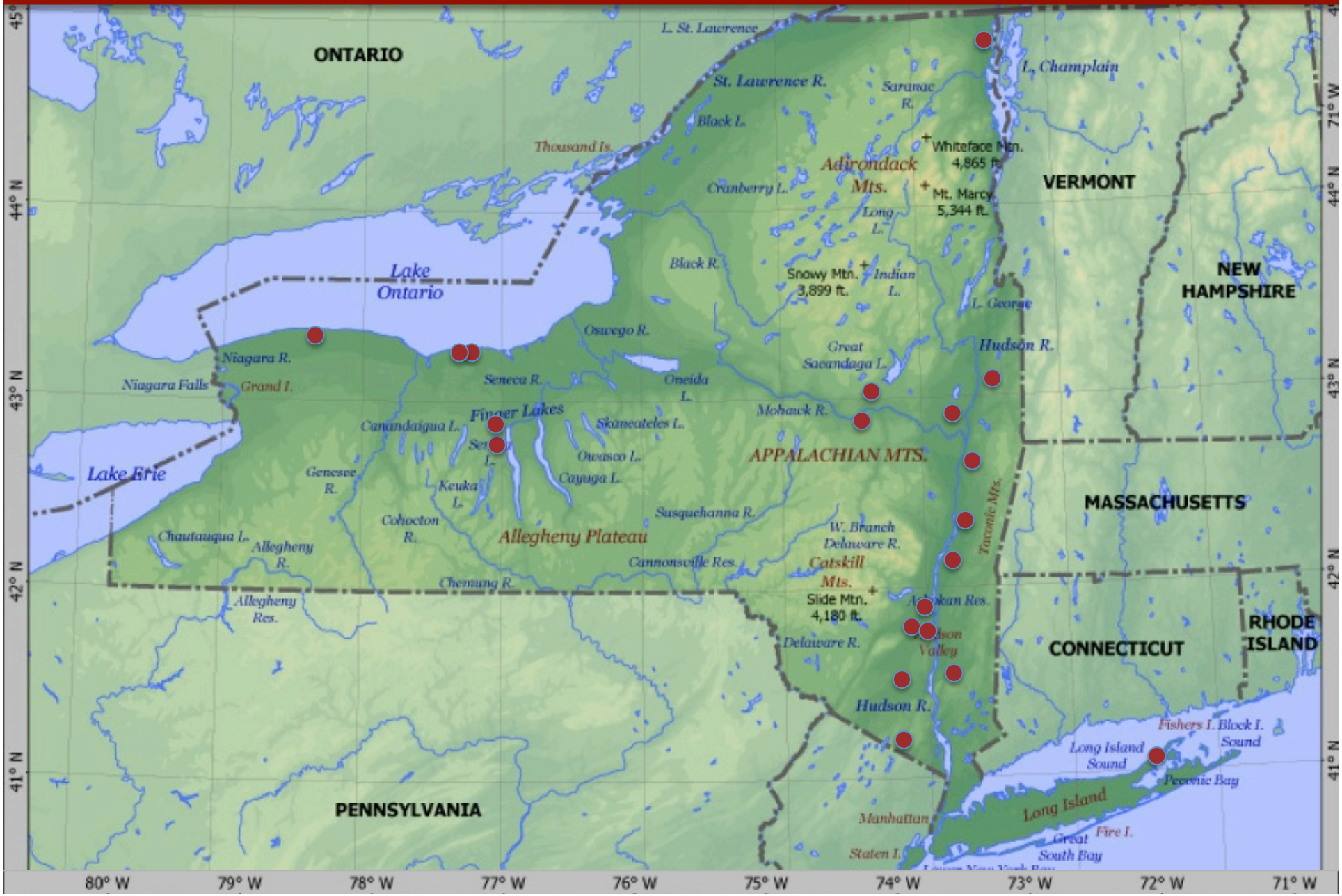
Developing Pest Thresholds for Managing the Invasive Brown Marmorated Stink Bug, *Halyomorpha halys* (Stål): (Pentatomidae) In NY Tree Fruit.

- Conduct State-wide Trap Monitoring of BMSB in NY

- **12 Cooperators**
  - **NYSAES**
  - **WNY LOFT**
  - **ENY Hort.**
  - **HVRL Staff**
- **40 Traps**
- **20 Farms**
- **14 Counties**



NYS BMSB Trap Locations: 2014
Tree Fruit, Vegetable / Sweet Corn, Grape

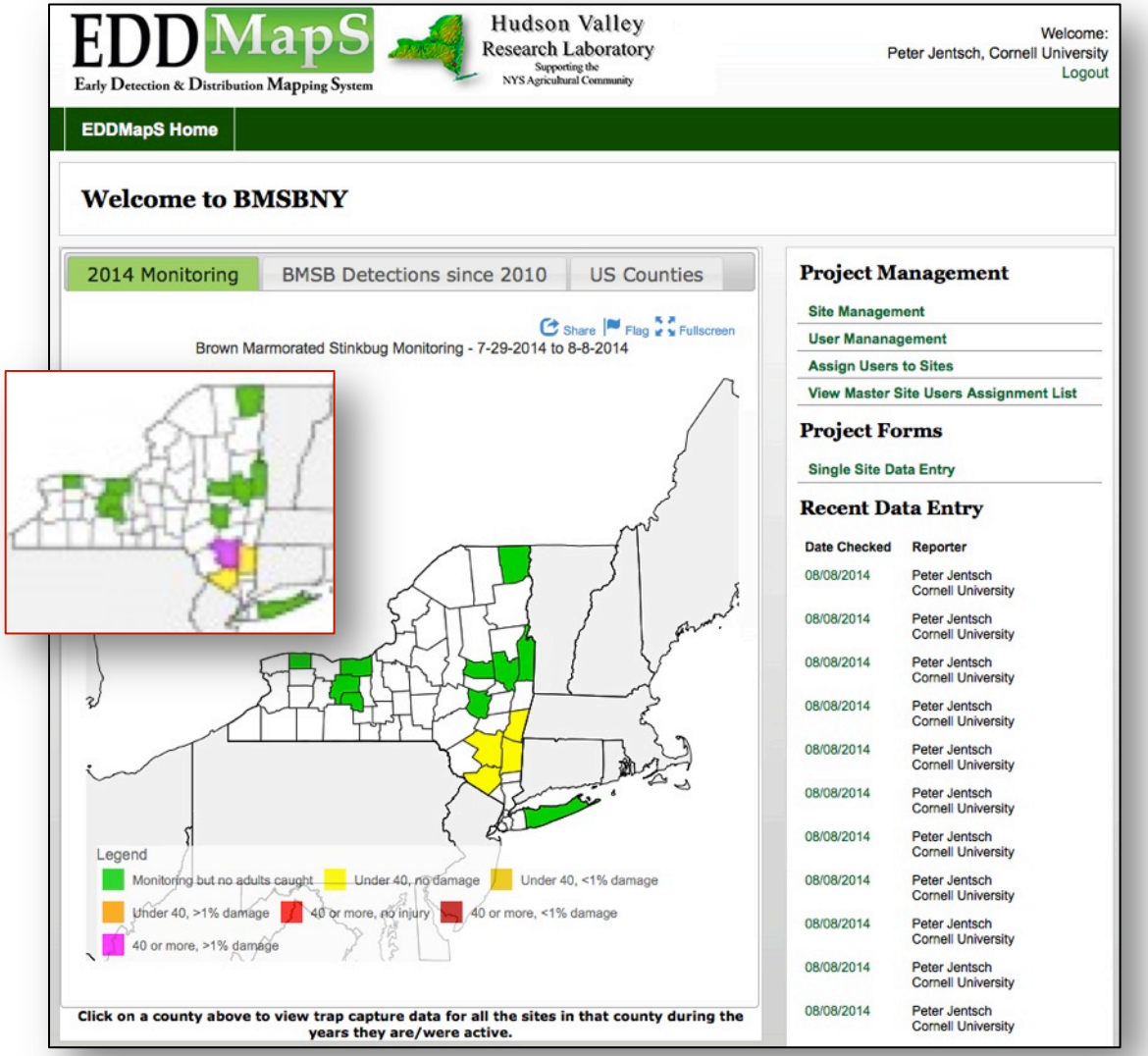


State-wide Trap Monitoring of BMSB in NY

BMSB Trap Site	Lat	Long.	County	Crop	BMSB Total
Bellona-Orchard	42.74786	-77.01583	Yates	Apple	**0**
Campbell Hall - Orchard	41.42821	-74.23972	Orange	Apple	370
Chazy-Orchard	44.90238	-73.43094	Clinton	Apple	0
Columbia-Orchard	42.19387	-73.82546	Columbia	Apple	-
Cutchogue-Peach Orchard	41.01231	-72.48331	Suffolk	Peach	8
Fishkill - Orchard	41.51773	-73.82363	Dutchess	Apple	192
Greenwich-Vegetable	43.0724	-73.5571	Washington	Corn	0
Hudson Valley Lab - Highland	41.74551	-73.96775	Ulster	Apple	510
K M Davies Co	43.23571	-77.18898	Wayne	Apple	**3**
Kinderhook-Orchard	42.39906	-73.70259	Columbia	Apple	0
Milton East - Vegetable	41.63812	-73.96396	Ulster	Organic Pepper	800
Milton West - Orchard	41.65032	-73.9931	Ulster	Apple	962
Montgomery-Veg	43.00424	-74.32636	Fulton	Bean	0
Motts	43.23399	-77.17352	Wayne	Apple	**0**
Orleans-Orchard	43.2575	-78.23857	Orleans	Apple	**0**
Red Jacket-Orchard	42.86137	-77.0256	Ontario	Apple	**2**
Rexford-Orchard	42.81575	-73.83824	Saratoga	Apple	0
Schoharie-Veg	42.75273	-74.45422	Schoharie	Apple	0
Tivoli - Orchard	42.04537	-73.85442	Dutchess	Apple	211
Warwick - Orchard	41.23259	-74.3873	Orange	Apple	227

- 20 Trap Sites in 14 NYS counties
- 7 Sites @ Threshold In 3 NY Counties

BMSB Management Threshold: Communication



Partnered with EEDMaps to extend outreach

- Early Detection & Distribution Mapping of Invasive Insects
- Provide regional and nation invasive species tracking
- Provide customized data outputs for threshold development

By County: Weekly update
Trap data per county
Presence in degrees of risk
Threshold levels

BMSB Management Threshold: Communication

- Employed a 10 Adult / Trap Threshold
- Subscribed growers to receive email Internet based link for BMSB mgt. recommendations weekly
- Worked with CCE to broaden outreach to apple and vegetable growers with threshold recommendations
- Data was entered into a NYS map to disseminate BMSB data using county-wide thresholds

Thank You

Technical staff and assistants

Support: NYS Ag & Mkts, ARDP, NEIPM, EDDMaps, HATCH, Bayer, Dow, Nichino, Syngenta, Gowan