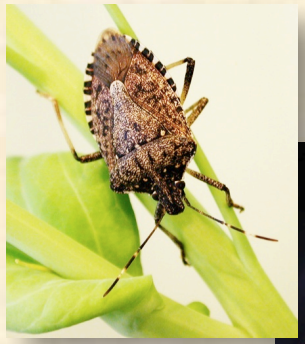
Status of Brown Marmorated Stink Bug and Spotted Wing Drosophila in NY.



Empire Producers Expo

January 21, 2014

Oncenter Convention Center

800 South State St. Syracuse, NY

Peter Jentsch

Senior Extension Associate – Entomology

CORNELL'S Hudson Valley LABORATORY

THE JENTSCH LAB

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

Invasive Species

Our work specifically addressing the impact of important invasive insect pest species across the major commodities grown in the Northeast, specifically those impacting the Hudson Valley, has been conducted since 2010. Monitoring invasive insects is our primary concern to determine early emergence, presence and development. Intensive scouting is then conducted to validate the presence in agricultural crops. From these data we hope to construct developmental models to initiate management and keep the agricultural community appraised of county distribution, management timing and economic injury levels throughout the region.

The insects of greatest concern include:
Spotted Wing Drosophila, Drosophila suzukii in small fruit, stone fruit and grape;
2013 Hudson Valley Spotted Wing Drosophila Pest Alert

Brown Marmorated Stink Bug, Halyomorpha halys, causing economic injury to Hudson Valley tree fruit and pepper;
Brown Marmorated Stink Bug Grower Alert
Managing BMSB Using an Integrated Approach: Pheromone based mass trapping, treated netting, high intensity lighting, and Beauveria bassiana (Mycotrol-O GHA strain)

African Fig Fly, Zapeionus indiana, in grape; causing injury to grape in New jersey

HUDSON VALLEY LAB IMAGE

Cornell University's Hudson Valley Laboratory located in Highland, NY

Agricultural Invasive Insect Pests[1]

Native / invasive insects destroy about 13% of potential crop production yearly.

Represents $33 billion in U.S. crops (USBC, 2001).

- Approximately 40% of pests were introduced (Pimentel, 1993)
- **$1.2 billion in pesticides** are applied for all insect control yearly (Pimentel, 1997).
- Approximately **$500 million/year** applied against invasive insects
- **Invasive insect pest cost: approx. $13.5 billion / year in the U.S.**

1. Update on the environmental and economic costs associated with alien-invasive species in the United States. David Pimentel, Rodolfo Zuniga, Doug Morrison. 29 Dec. 2004 College of Agriculture and Life Sciences, Cornell University, Ithaca, NY 14850-0901, USA

Agricultural Invasive Insect Pests Present

Invasive Agricultural Pest (Accidental)

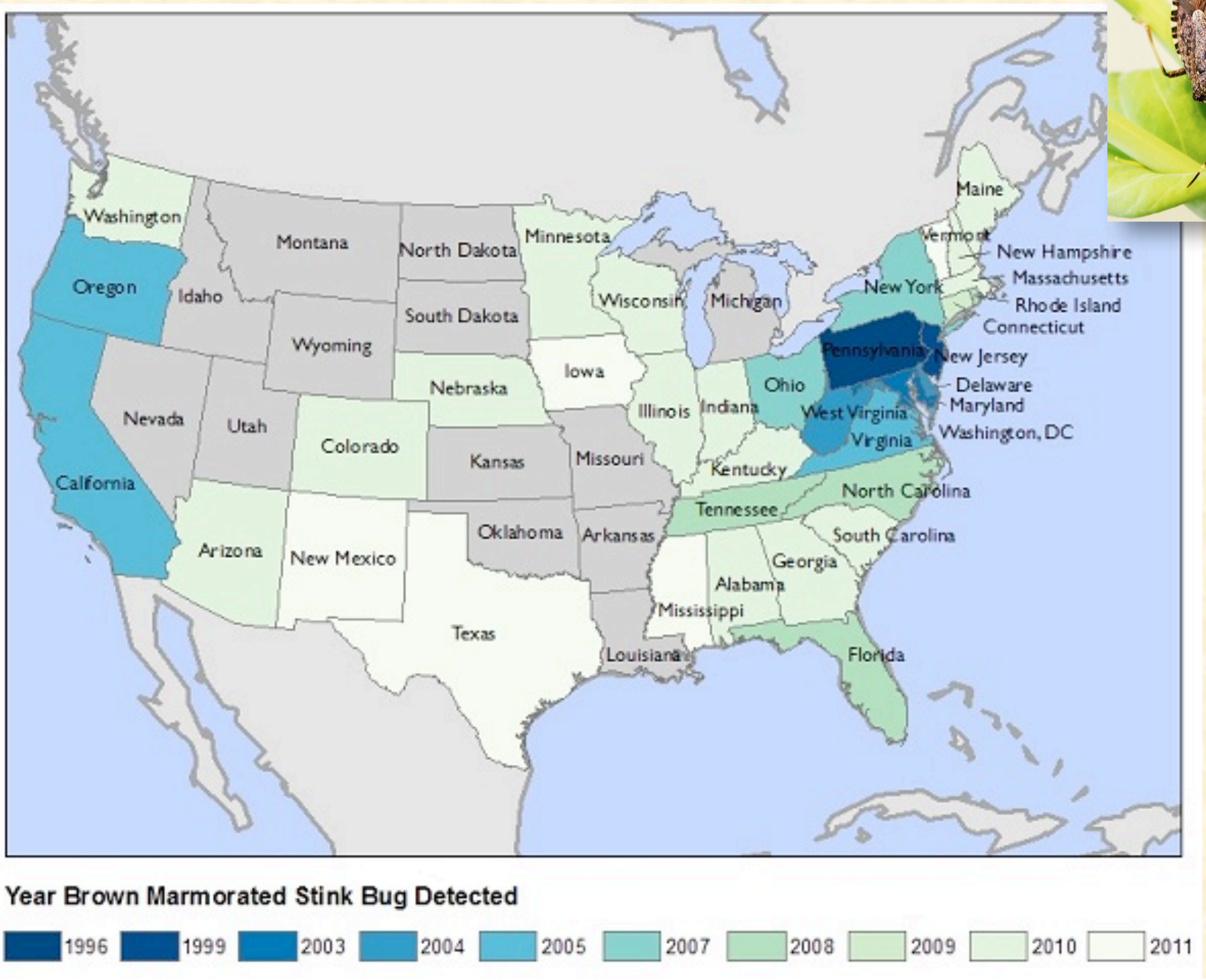
Cydia pomonella	codling moth 1800 NY
Quadraspidiotus perniciosus	San Jose scale – 1870 CA
Cacopsylla pyricola	pear psylla – 1832 CT
Grapholita molesta	oriental fruit moth 1913 VA
Ostrinia nubilalis	European corn borer – 1917 MA
Halyomorpha halys	brown marmorated stink bug – 1996 PA
Drosophila suzukii	spotted wing drosophila – 2008 CA

Brown Marmorated Stink Bug (BMSB)

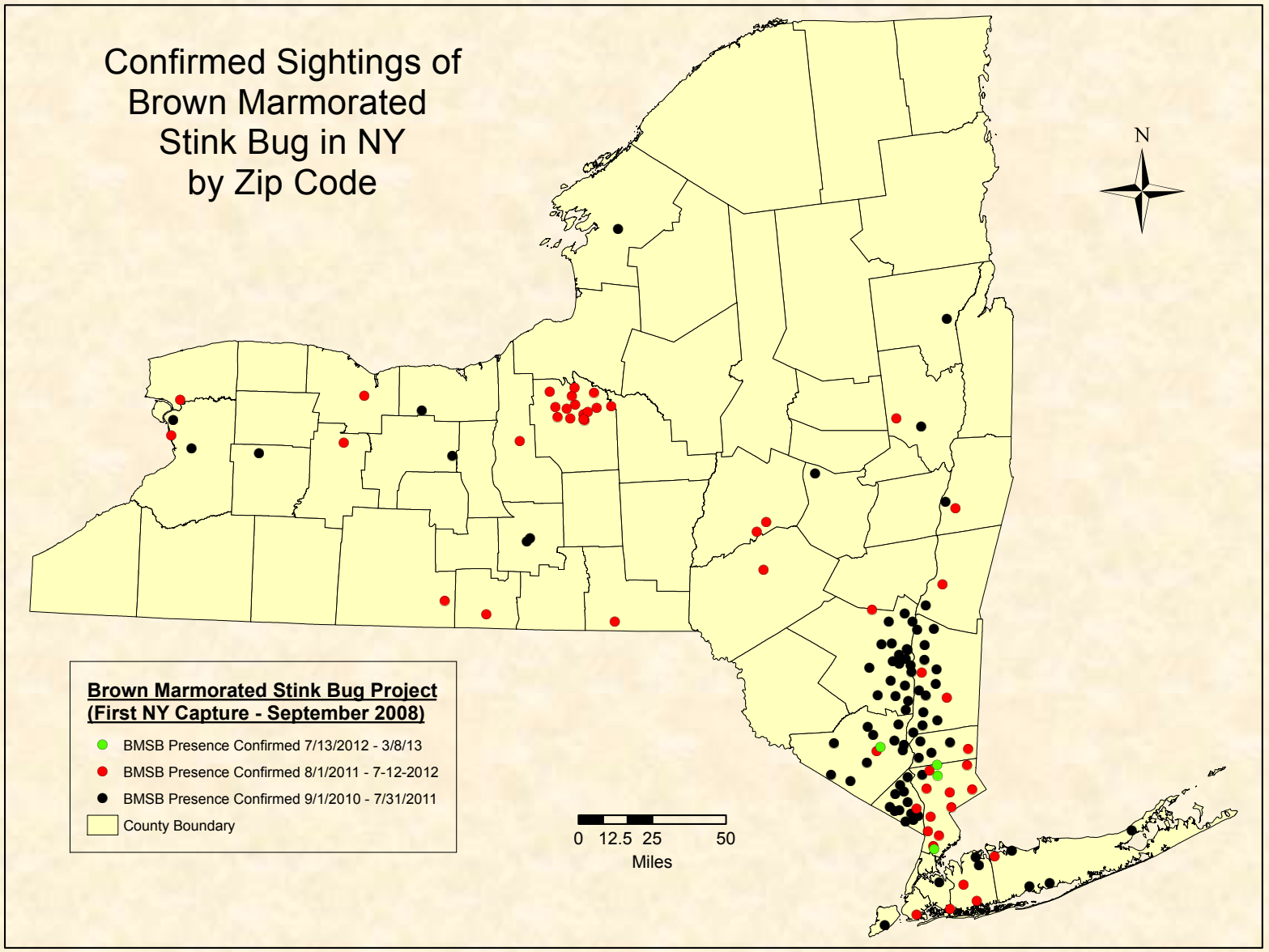
Spotted Wing Drosophila (SWD)

Asian Invasive Brown Marmorated Stink Bug Spread in the US

Halyomorpha halys



Urban mapping of BMSB (from Citizen Science submissions) showing population concentrations in 33 Counties of New York.



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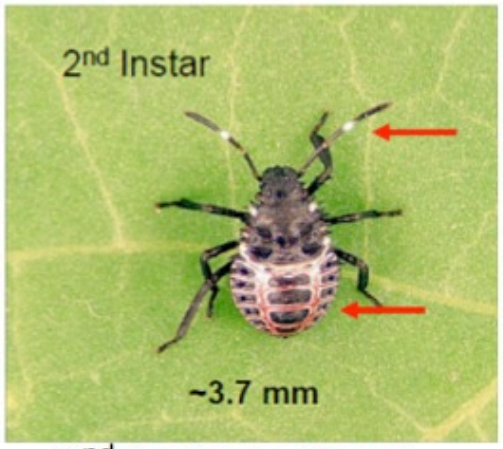
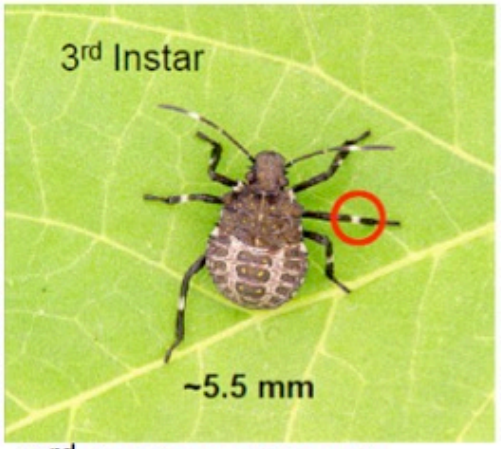
Eggs: Average 28/cluster; light green to white

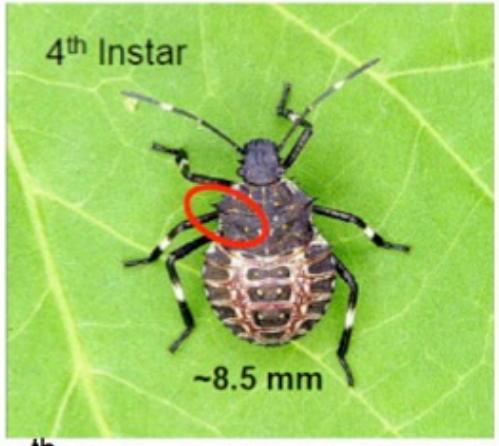
1st instar: black & red; cluster near eggs



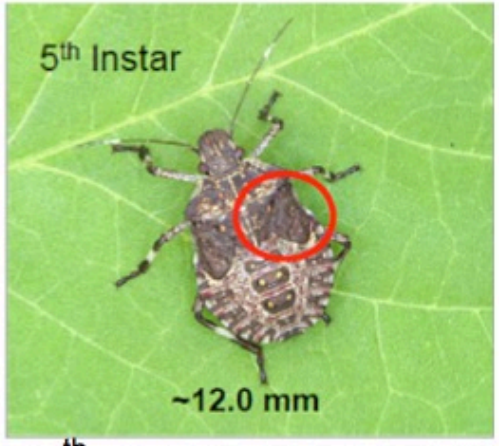
2nd instar: striped antennae



3rd instar: striped antennae and legs



4th instar: thoratic spur striped antennae & legs



5th instar: wing pads striped antennae & legs

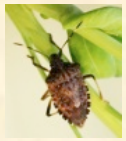
BMSB Adults: red eyes, 4 cream colored dots on shoulders; banding on legs and antenna, smooth blunt shoulders. Banded abdomen; 14 -17 mm in length.

Adult BMSB

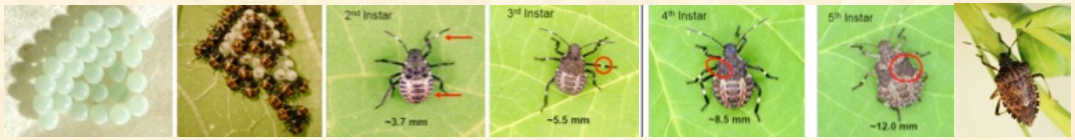
2 sets of
4 cream ‘dots’

Along the anterior edge of the abdomen and thorax

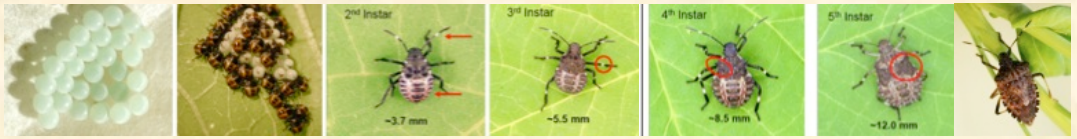
BMSB Bi-Voltinism
2 generations in the Mid-Hudson Valley of NY



Overwintering adult
28 eggs / cluster weekly; 200 / female



1st Generation



Combined 1st & 2nd Generations

May June July August September Oct.

Presence Intensified Feeding

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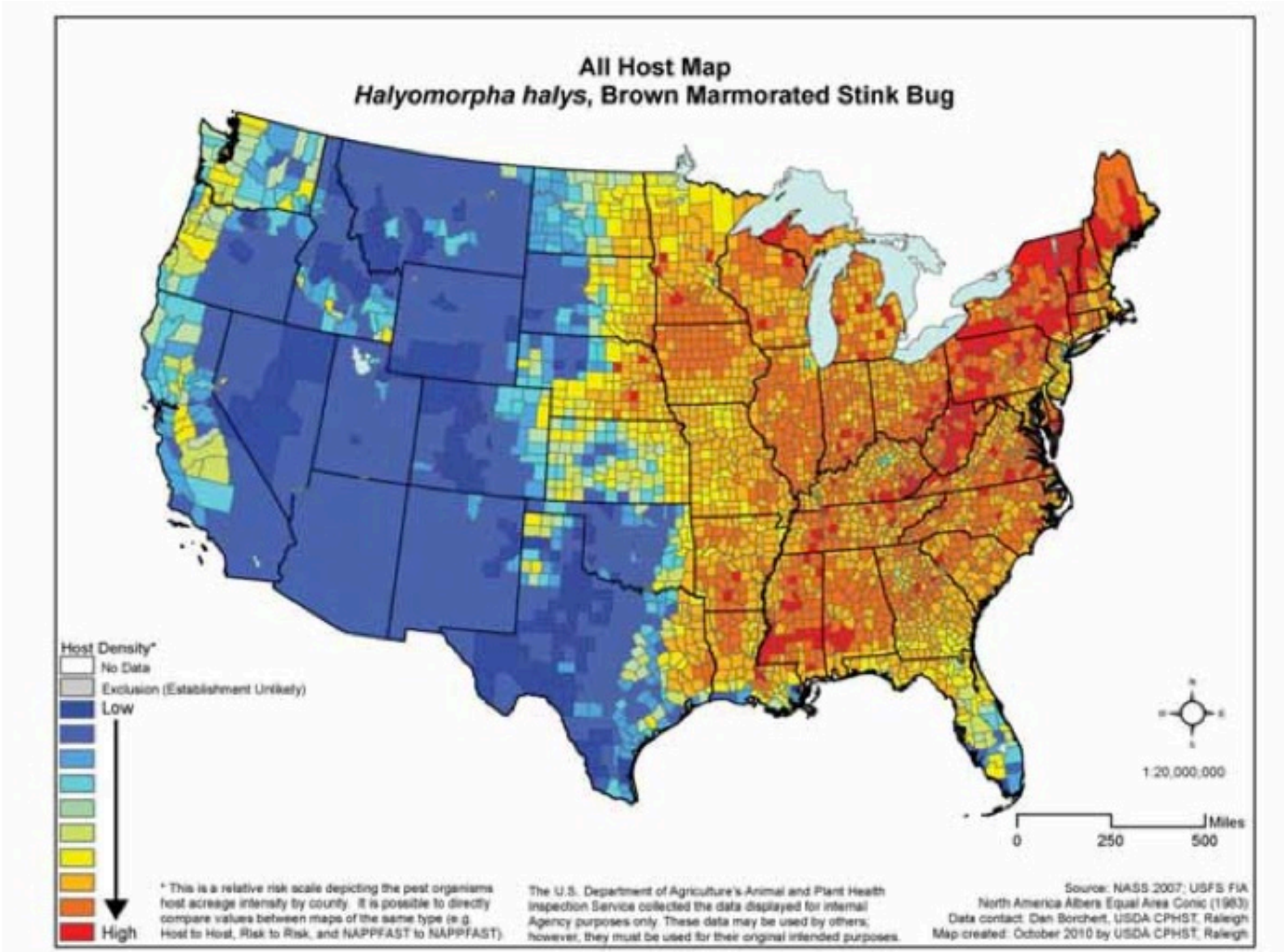
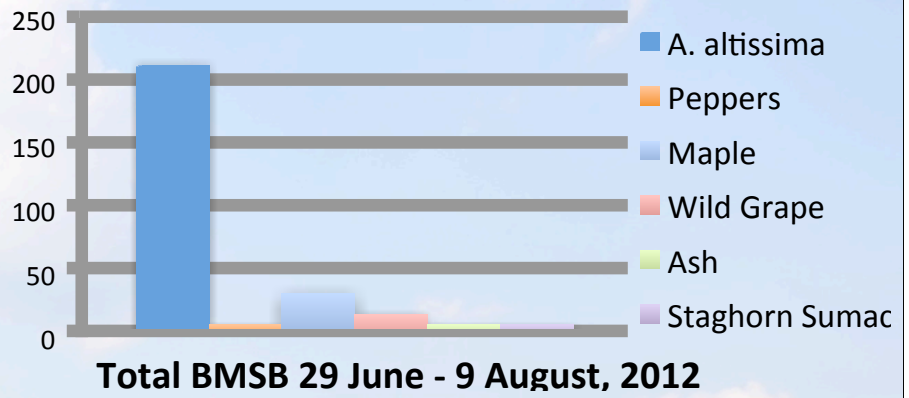


Figure 1: Risk maps displaying the relative density of field, vegetable, and fruit crop hosts plants of BMSB throughout the United States.

Tree of Heaven, *A. altissima*.

Warwick, NY
September, 2012

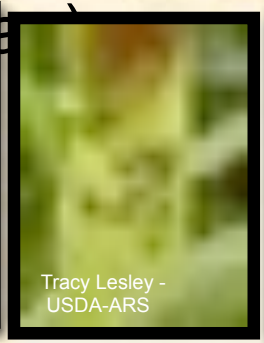


Ag. Hosts of the Brown Marmorated Stink Bug

Tree fruit (apple, pear, peaches, cherry)

Small fruit (grape, bramble fruit)

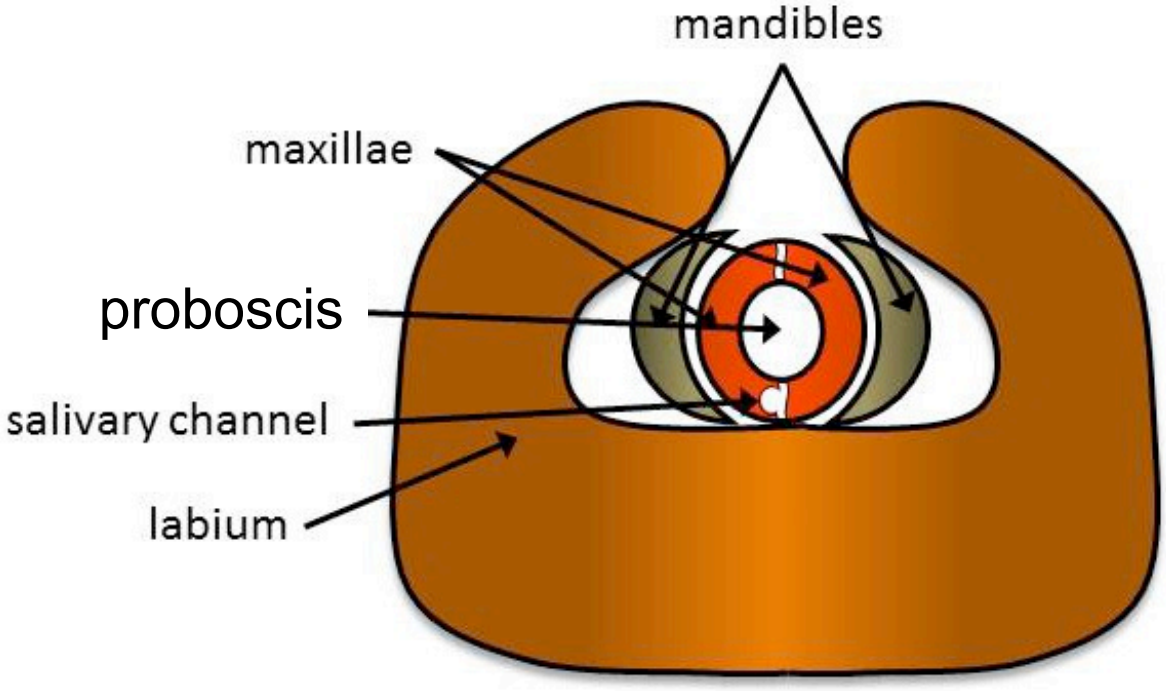
Vegetables (tomato, pepper, sweet corn, Lima

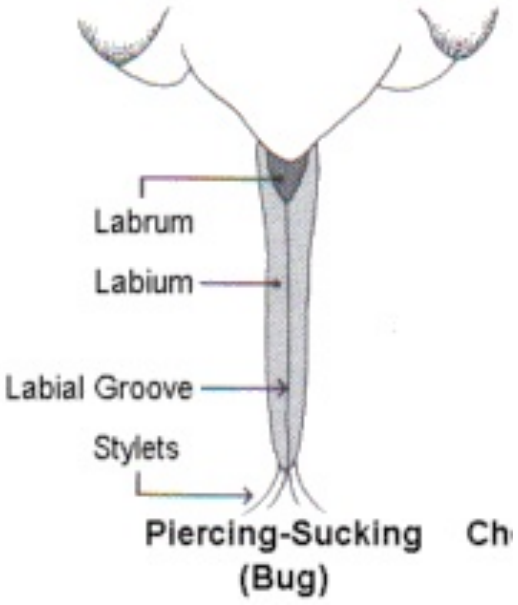


The Stink Bug Complex In NYS Tree Fruit
Mouthparts

- Stink bug species are both herbivorous and insectivorous.

- Mouthparts modified into a proboscis, sheathed within a modified labium, which is capable of piercing plant tissue and insect cuticle to remove liquids from their host.





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The Brown Marmorated Stink Bug Complex In NYS Tree Fruit Feeding Injury

- The adult and nymph feed on tree fruit, vegetable, small fruit, grape and ornamental trees.
- Greatest tendency is to feed on developing seed of broadleaf plants, arboreal tree hosts
- Stink bug feeding pierces the fruit skin leaving behind a feeding ‘hole’ in the center of a depression and at times a ‘feeding sheath’.

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The Stink Bug Complex In NYS Tree Fruit
SB Feeding Injury

- Leaving behind dry cell walls that appear as corking when peeled.

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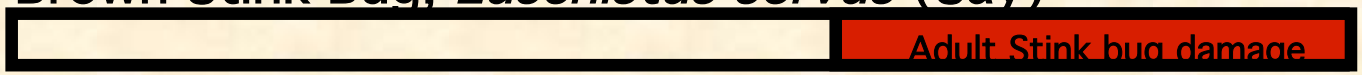
Hudson Valley Complex:

SB species of economic importance

Brown Stink Bug, *Euschistus servus* (Say)



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).

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)

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.

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 collection jar
- USDA #10 + MDT (*methyl* (E,E,Z)-2,4,6-*decatrienoate)*
- Killing strip
- Weed free base

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The BMSB Presence in New York: Agriculture

- 2011: **70 Sites**
- MDT Lure baited set out in NYS major agricultural regions
  - BMSB captured only in Marlboro, NY (Hudson Valley).

- 2012: **8 Sties**
- USDA #10 lure + MDT Lure
  - BMSB in all lower and Mid-Hudson Valley trap Sites
  - 60+ / week one orchard site.
  - Severe tree fruit injury observed (>20%)

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The BMSB Presence in New York: Agriculture

- 2013: 14 NYS Counties (≈40 traps)
- #10 lure +MDT Tedders traps captured *higher numbers of adults earlier* and in new areas of NYS:
  - 900+ / week in Marlboro, NY
  - **New Ag. Sites Captures:**
  - Western NY plus HV (May 7);
  - Long Island (May 15);
  - Capital District (Aug 19).

BMSB injury noted early in tree fruit in 2013, However, no economic injury was observed.

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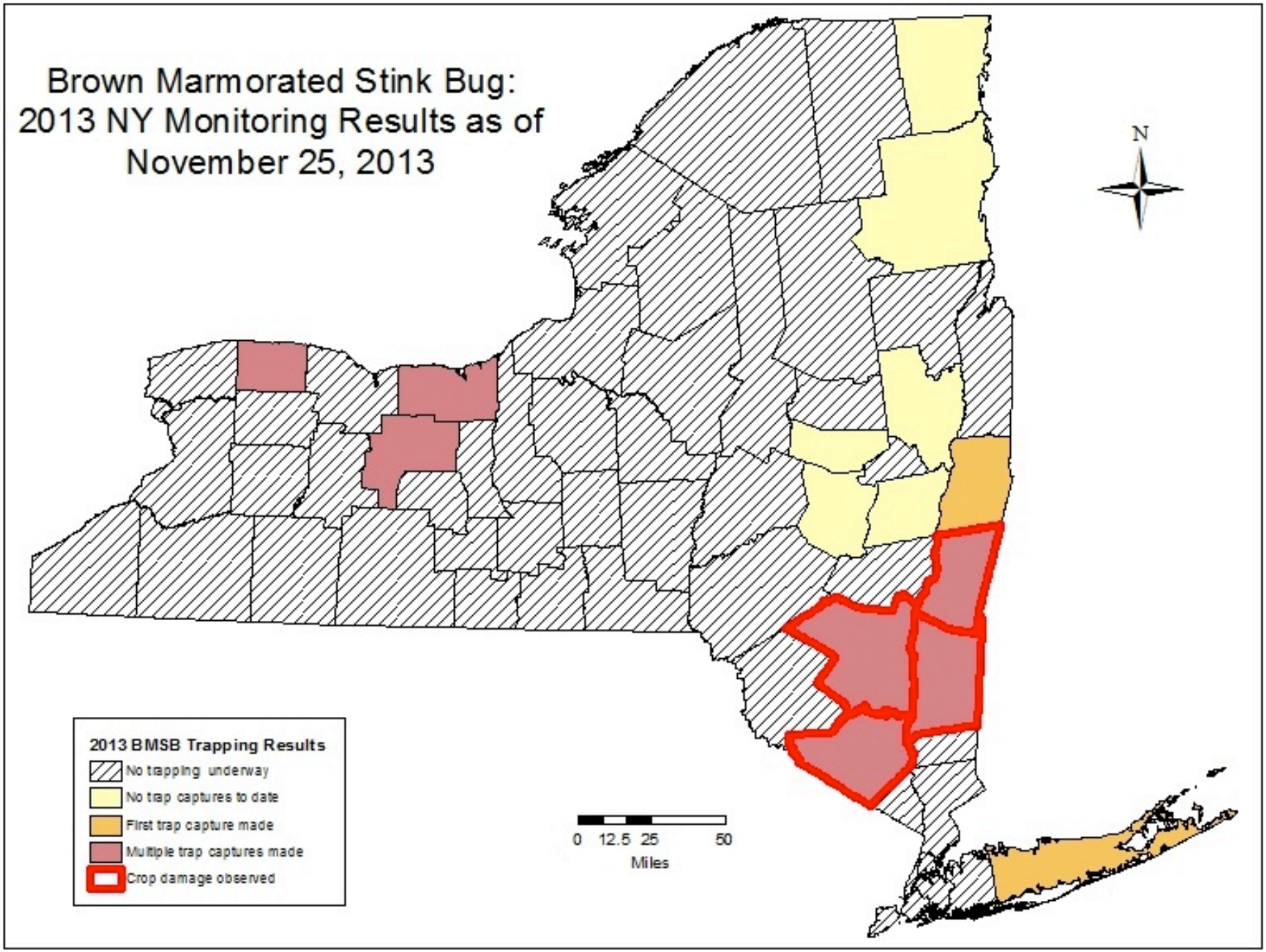
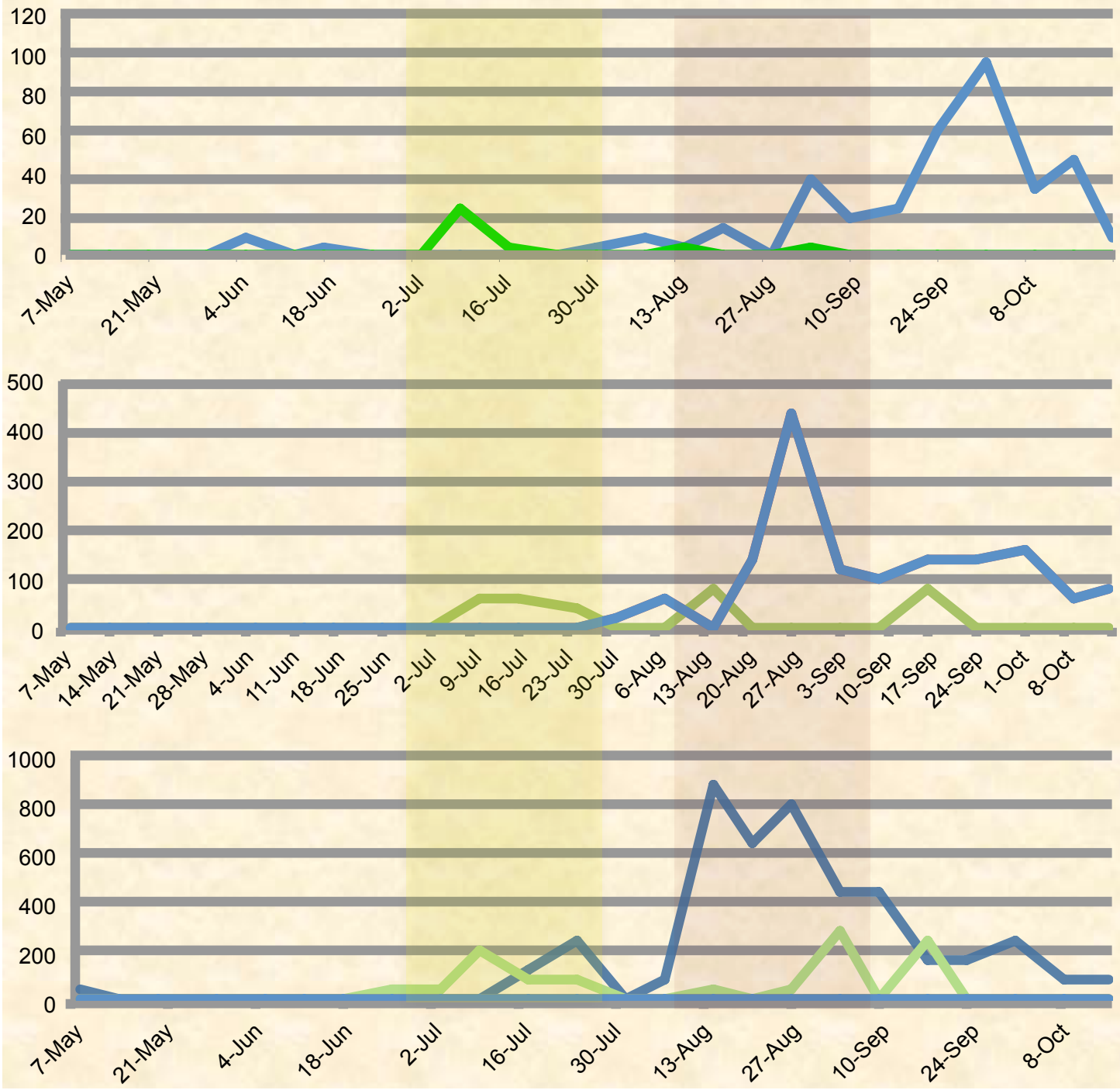
Results from #10 lure +MDT Tedders traps in agricultural sites.
BMSB observed in 7 of 15 NY counties during the 2013 growing season.



BMSB Monitoring of 3 NY Orchards, 2013



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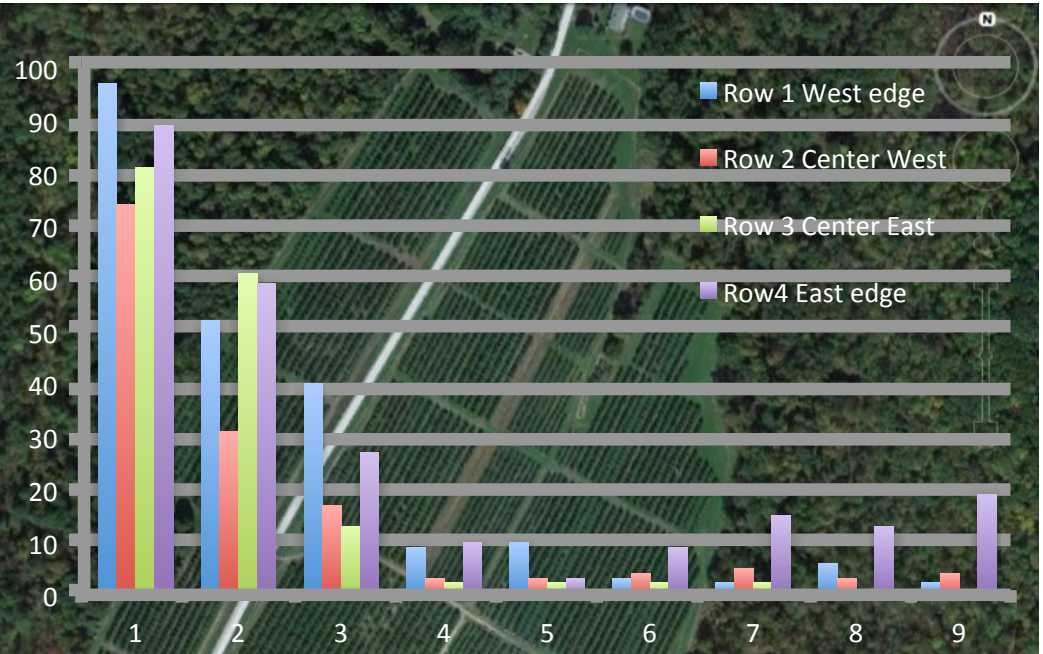
A strong edge effect was observed from wooded edge toward the interior of the block in Pink Lady harvested in early November.



Evaluation of 3600 fruit.

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

>21% injury was documented at packout.

Campbell Hall, NY
Commercial apple

Infestation occurrences in Ag. Commodities

9 October, 2012

Milton, NY

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

What are the factors influencing the movement of BMSB to Ag Commodities in NYS

- **Population density** leading to reduced host viability
  - High overwintering and 1st generation BMSB can reduce host viability
  - 2nd generation move out of deciduous forest trees for lack of food resources
- **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 trap captures, rainfall & RH as predictors for BMSB movement to crops?

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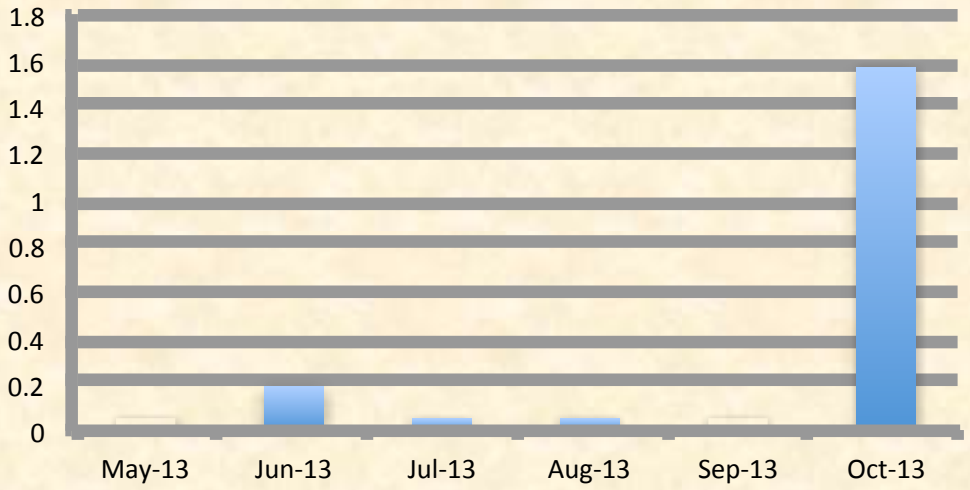
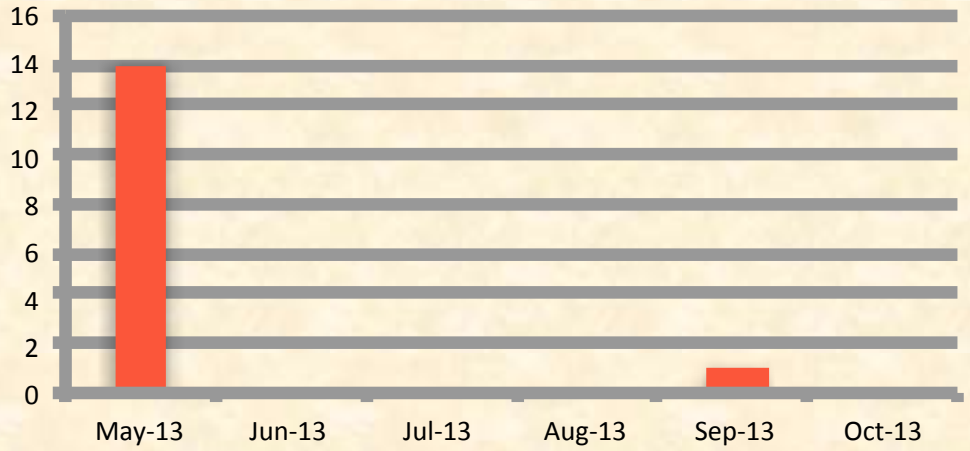
Factors Influencing BMSB Fruit Feeding
Rainfall & RH, Campbell Hall, NY

>21% Fruit Injury (N=3600)
2012

Total Rain (1.8 in.)

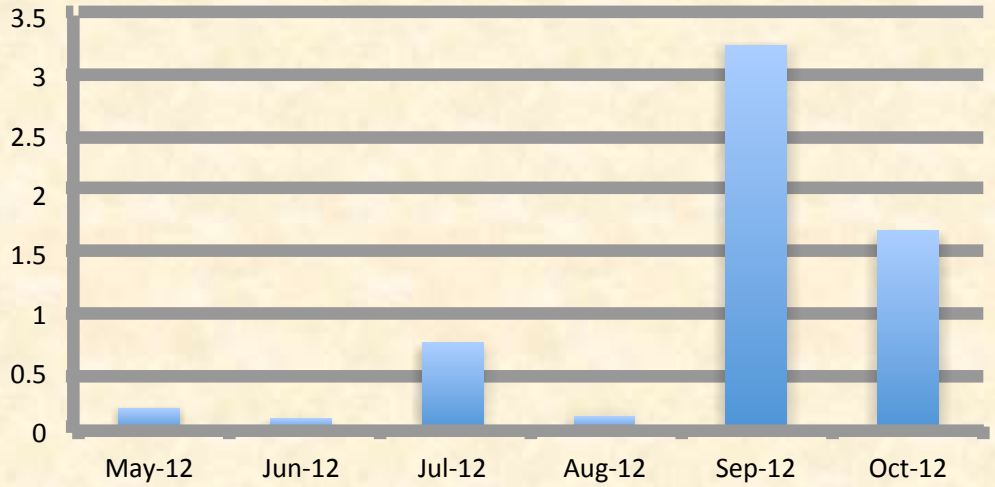


RH Hrs >= 90% (15 hrs.)

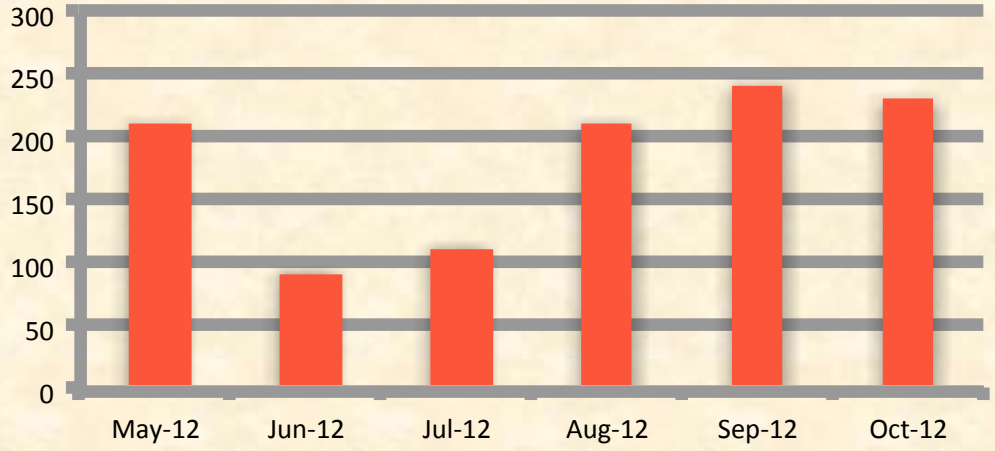


0.1% Fruit Injury (N=12,000)
2013

Total Rain (6.0 in.)



RH Hrs >= 90% (1122 hrs.)

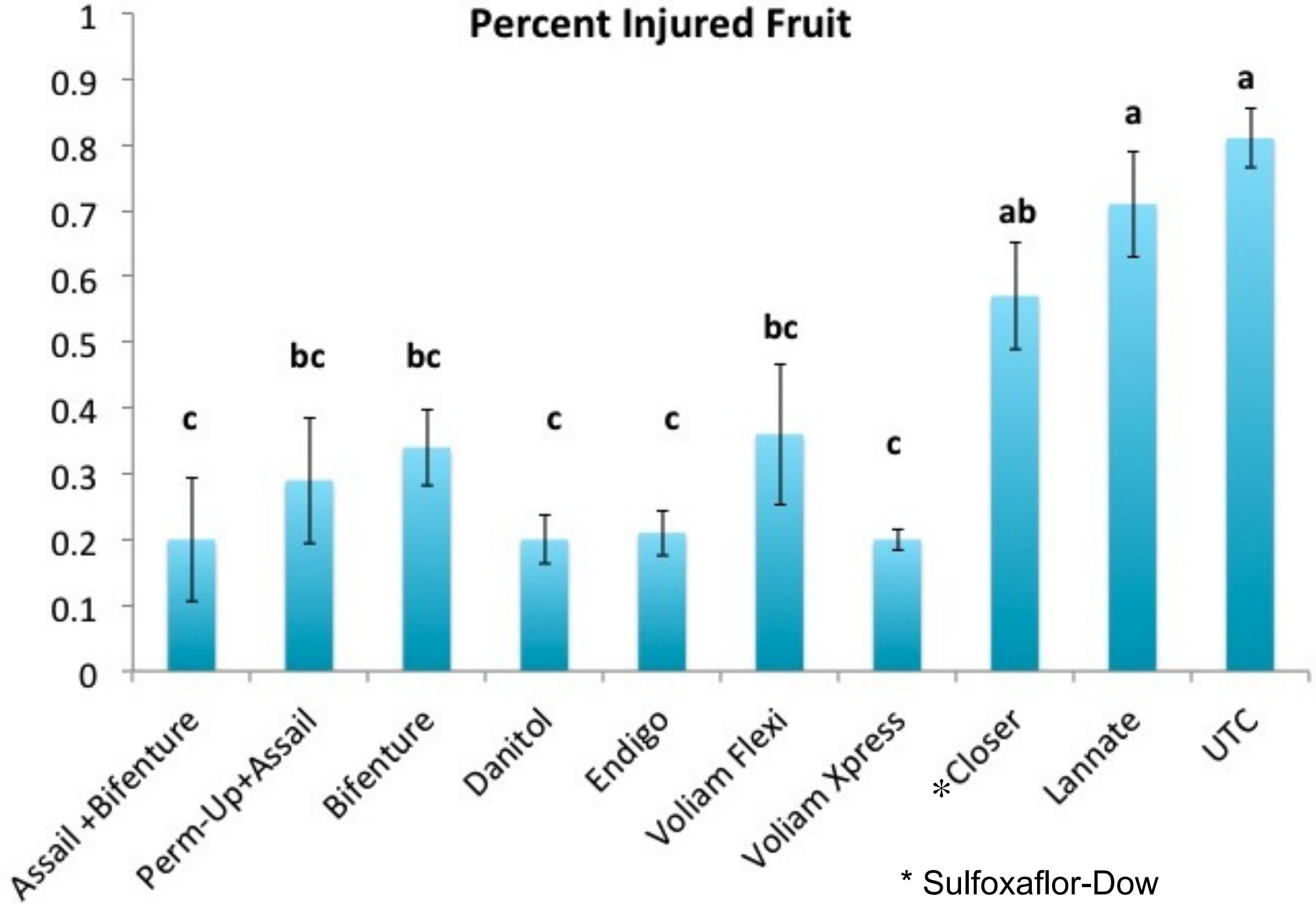


Insecticide Use

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 β-cyfluthrin	95
	Endigo	lambda-cyhalothrin and thiamethoxam	98
	Voliam Flexi	chlorantraniliprole and thiamethoxam	98

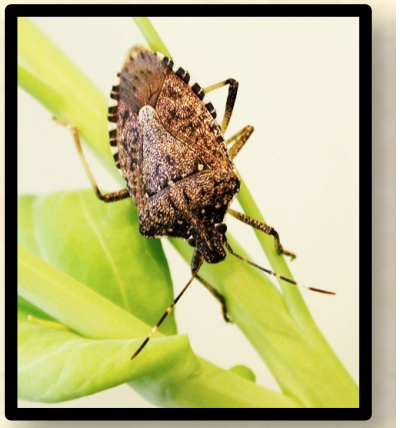
1. Direct contact activity of insecticides against BMSB adults in a lab setting may be very high, yet the activity of field-aged residue may, over time, quickly becomes ineffective at preventing feeding injury.

BMSB Mgt. in Peaches at 10 d Intervals: Rutgers



* Sulfoxaflor-Dow

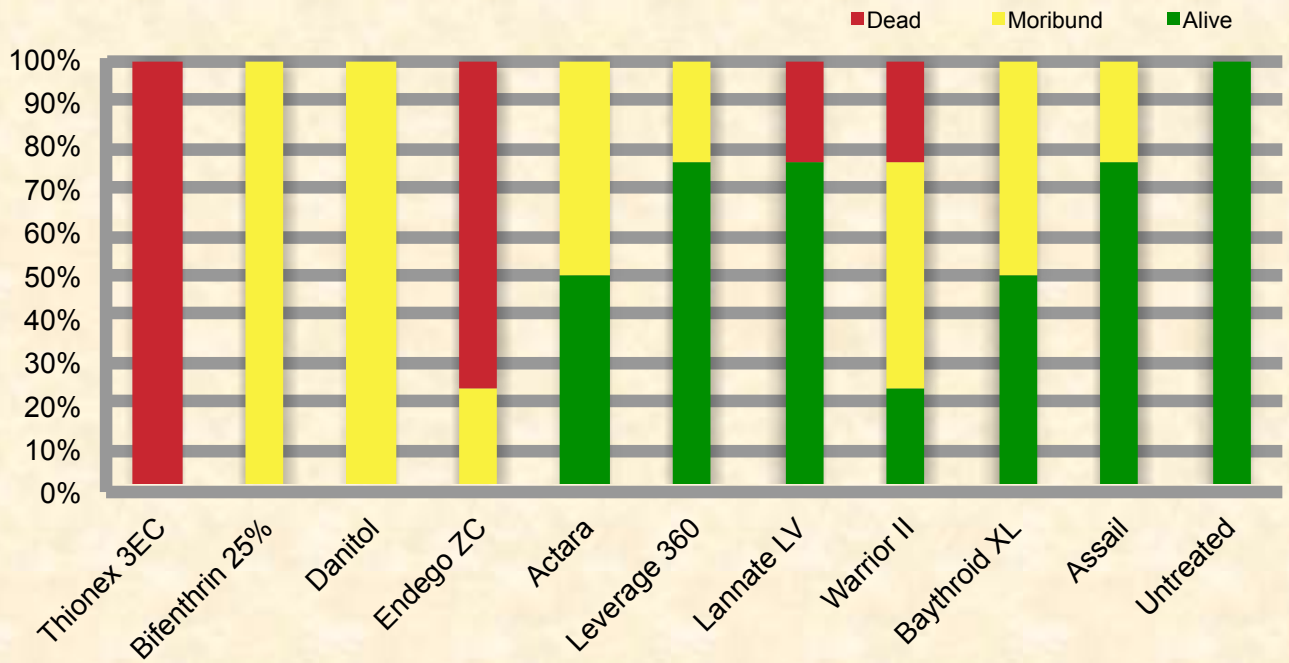
Studies of the Brown Marmorated Stink Bug, *Halyomorpha halys* (Stål), in New York State



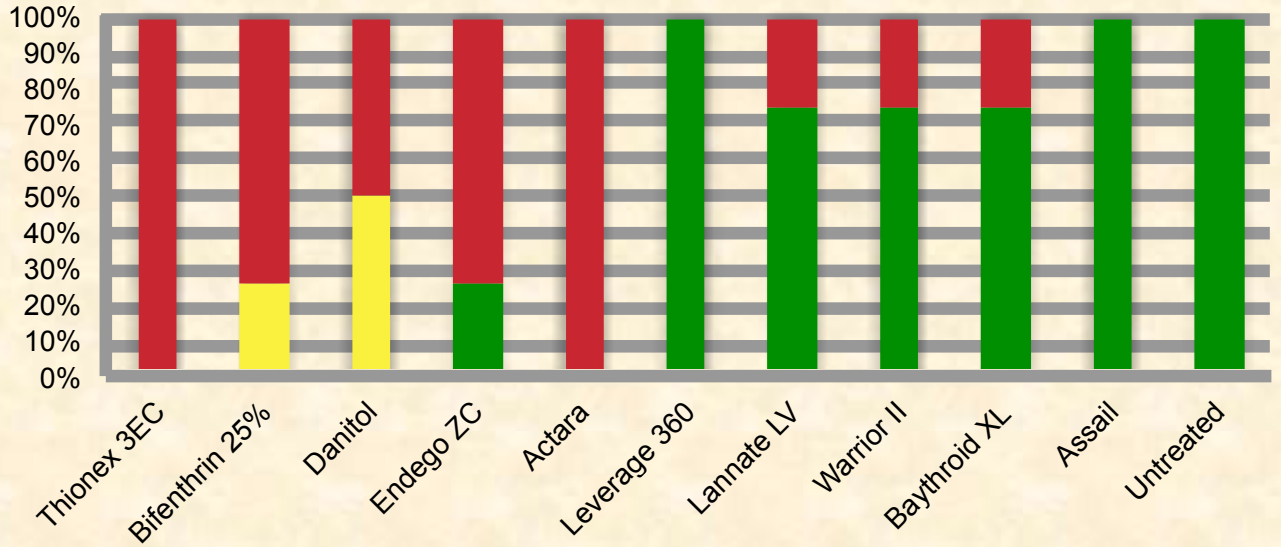
Residual field bioassay of adult BMSB on treated foliage:

- **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.
- 1st 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
24h Old Residue @ 1 d



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



BMSB Monitoring, Threshold and Application Strategy

- **Monitoring:**
- **Trap: Tedders + pheromones to detect BMSB along the orchard perimeter**
- **Scout: If BMSB is captured in traps then scout perimeter orchard rows**
- **Threshold: 1 BMSB observed within 100' of perimeter scouting**
- **Application Strategy: Perimeter orchard application using effective**

- **Scouting: Repeat scouting after 4d, using 1 BMSB threshold along perimeter orchard rows as a trigger for subsequent application.**
- **Application Strategies: Alternate row middle applications (ARM) at 7d**

- **Monitoring: Repeat perimeter scouting using 1 BMSB threshold**
- **Application Strategies: Use whole orchard application. Repeat sequence.**

Spotted Wing Drosophila
Drosophila suzukii

- An invasive insect in the vinegar fly family. (Drosophilidae)
- Introduced to Western US in 2008.
- It was observed In 2011 in the Midwest, East Coast and northern Hudson Valley with **economic losses** in raspberry.
- In 2012 we **observed high levels of small fruit infestation across the Hudson Valley.**
- In 2013, **earlier emergence** and increasing range of fruit infestation.
- Raspberry & blackberry 100% loss.

Male

Female

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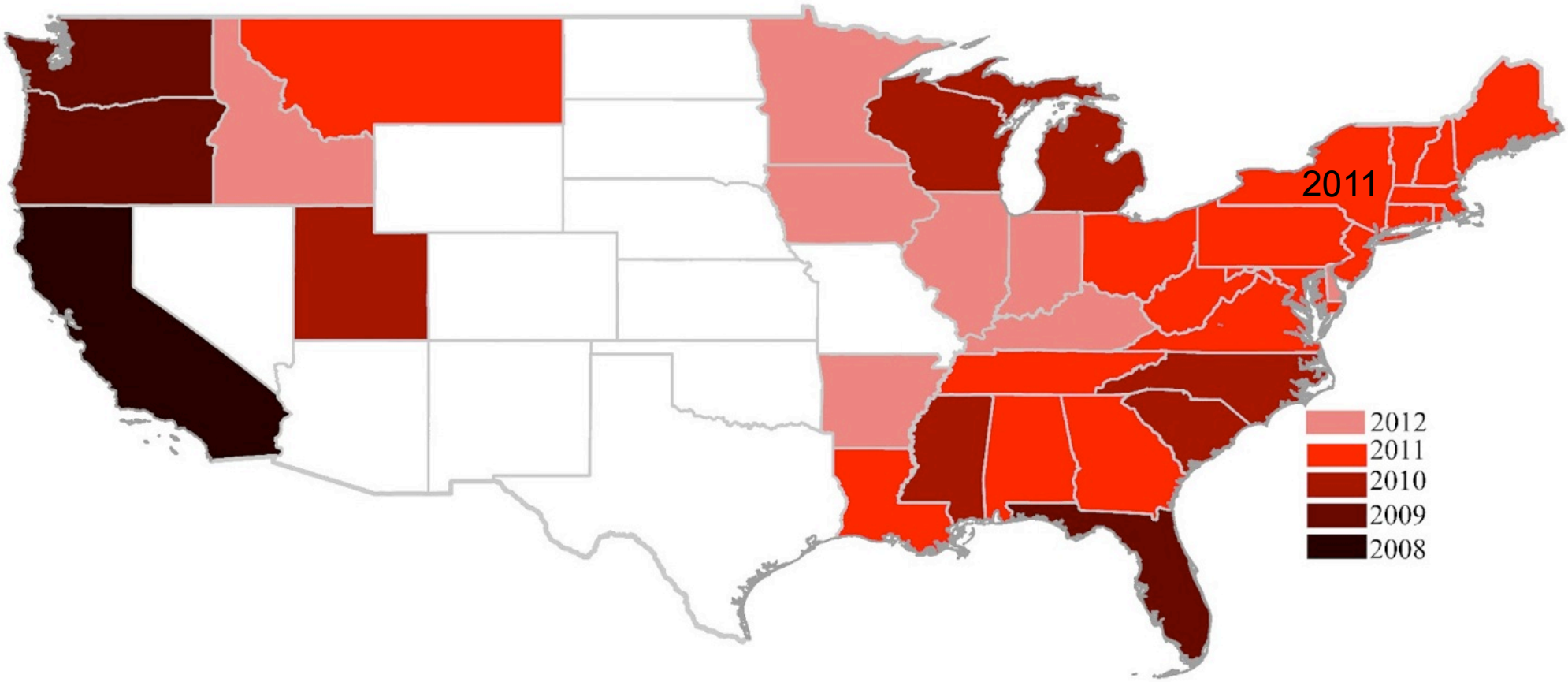
Current state level spotted wing drosophila in the United States.

Burrack, et al. 2012. Journal of Integrated Pest Management.



Spotted wing Drosophila: 2012 NY Monitoring Results as of September 14, 2012

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Drosophila suzukii spotted wing Drosophila

- Known Ag hosts include: **blackberries, raspberries**, **blueberries, strawberries**, figs, cherries, thin skin grapes, peaches, apples, pears, nectarines, plums.

- California represents the largest acreage of these fruits nationwide.

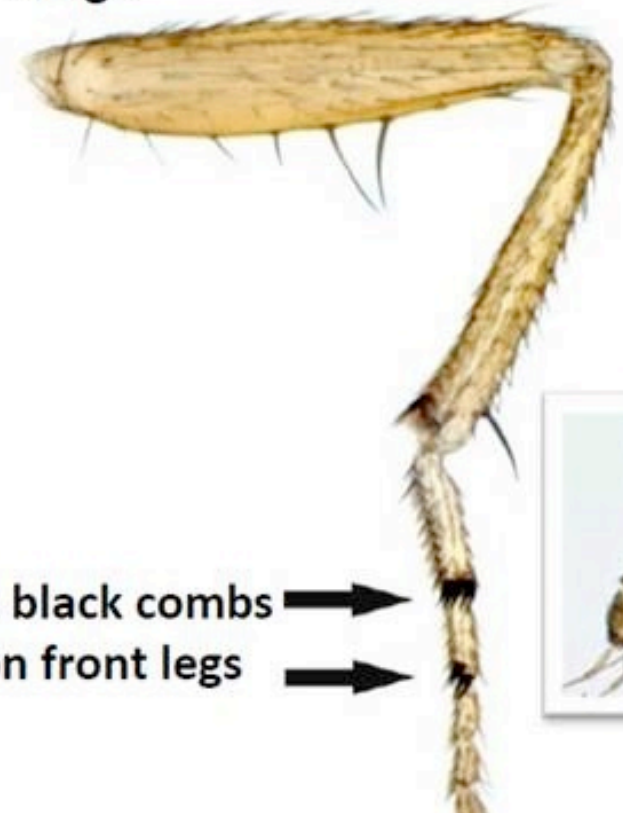
- SWD was responsible for an average of 20% crop loss in CA, although near total infestations are possible.

- Range of fruit injury from egg laying and larval infestation in the Hudson Valley of NY by mid-August: 17%-100% injury

SWD – Key Characteristics

Male

Black spot
on wings

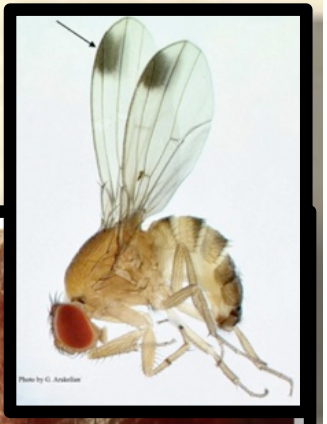


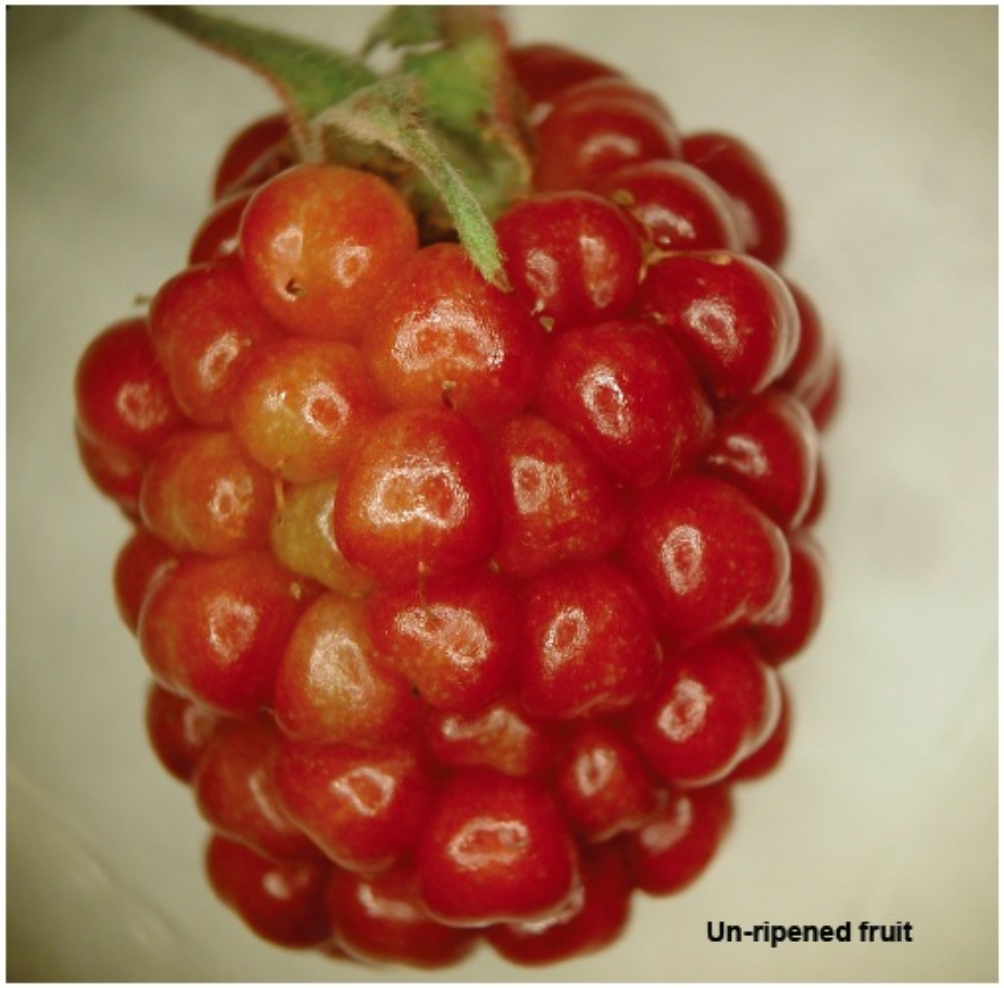
2 black combs
on front legs

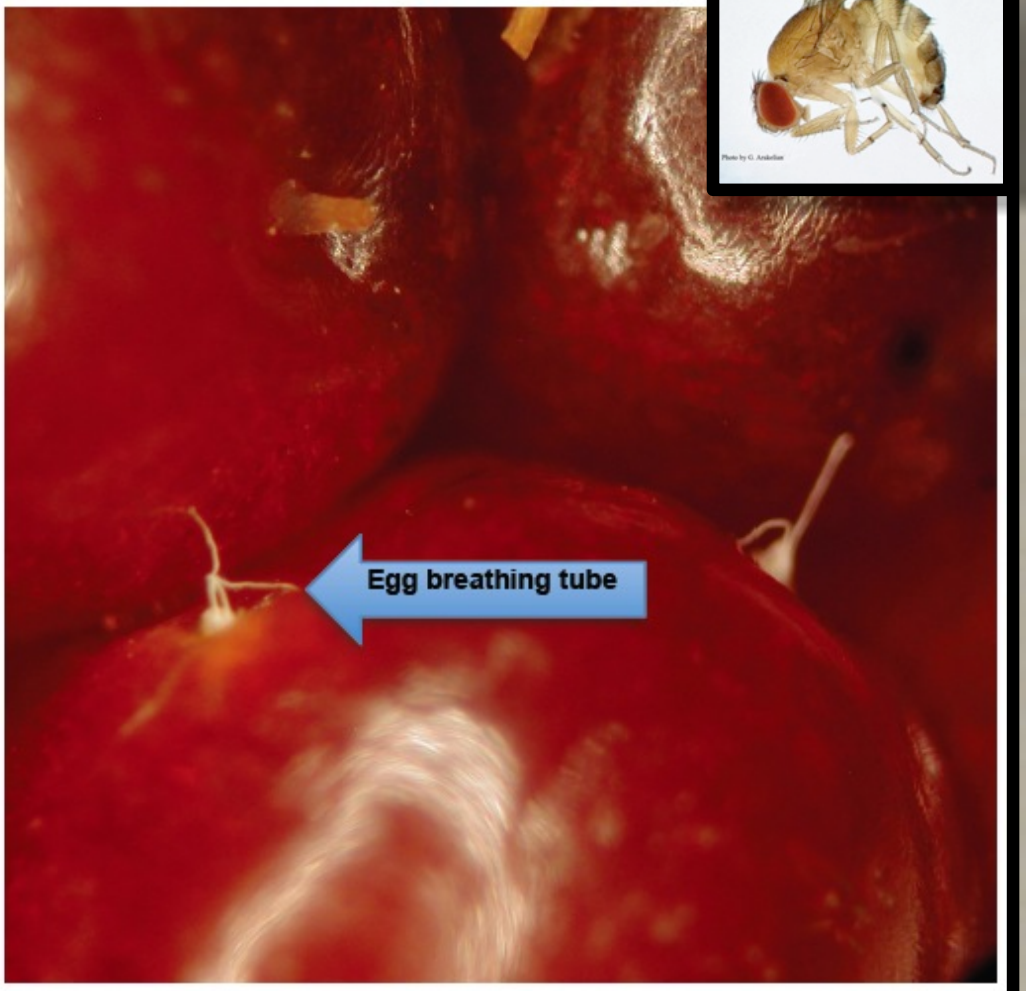
Female

She inserts saw-like device (ovipositor) into fruits and lays eggs

Un-ripened blackberry infested with SWD eggs 2012







Key problem: SWD oviposits into pre-ripened fruit

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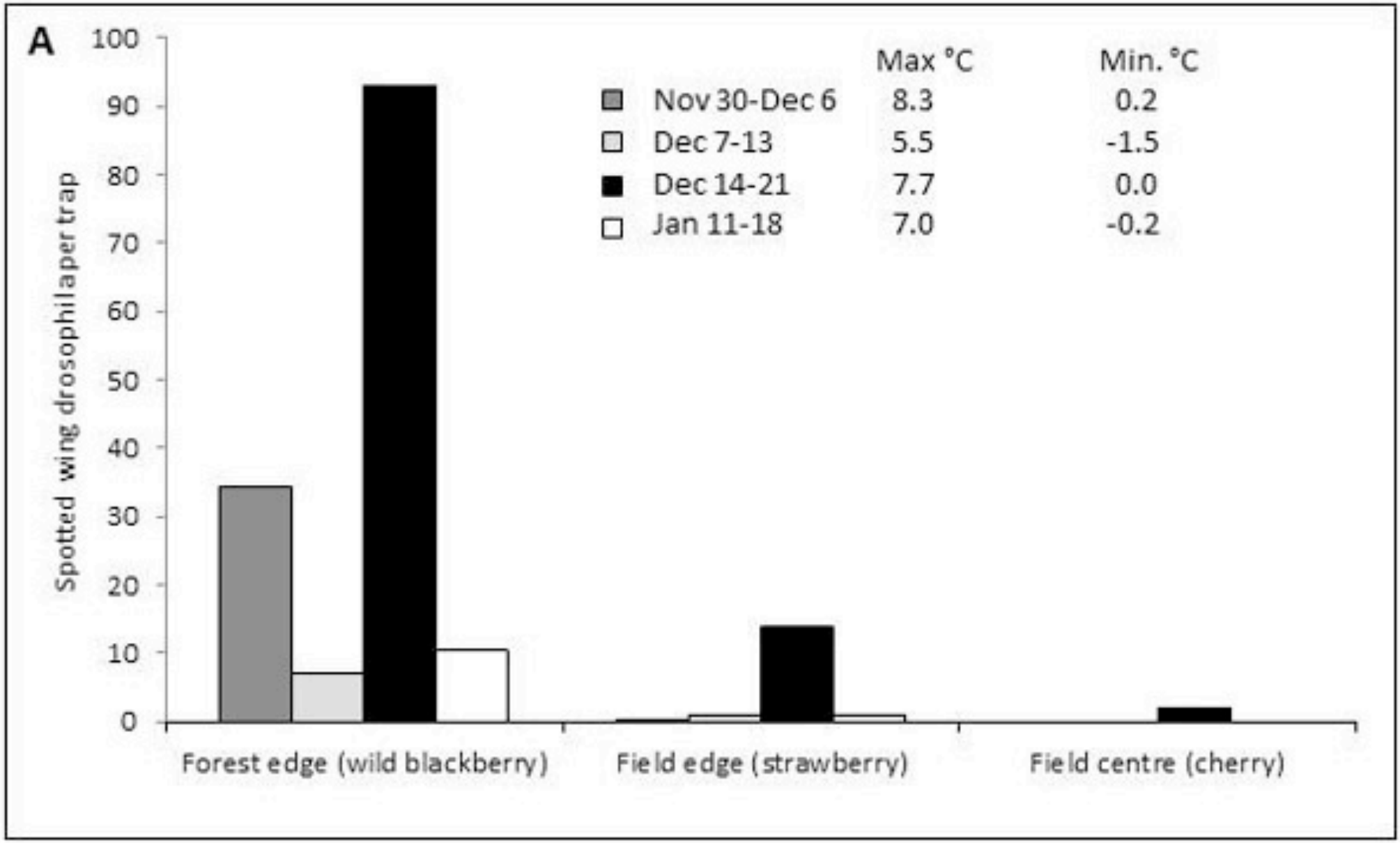
Spotted Wing Drosophila – Overwintering



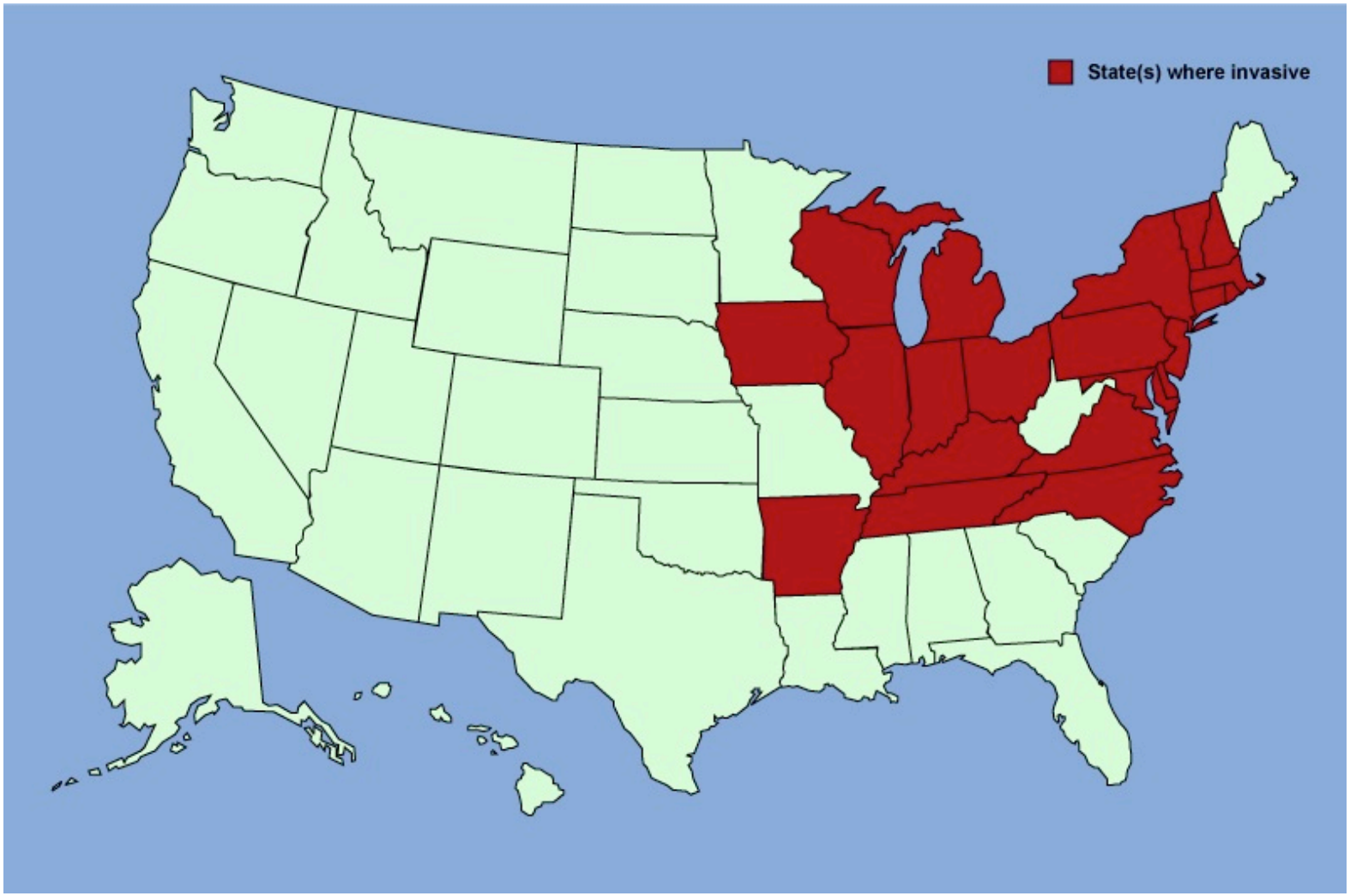
SWD trap captures in Vineland, Ontario

- Highest numbers move toward the forest in the winter

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.

CORNELL'S Hudson Valley LABORATORY



Tartarian Honeysuckle (*Lonicera tatarica*)

CORNELL'S
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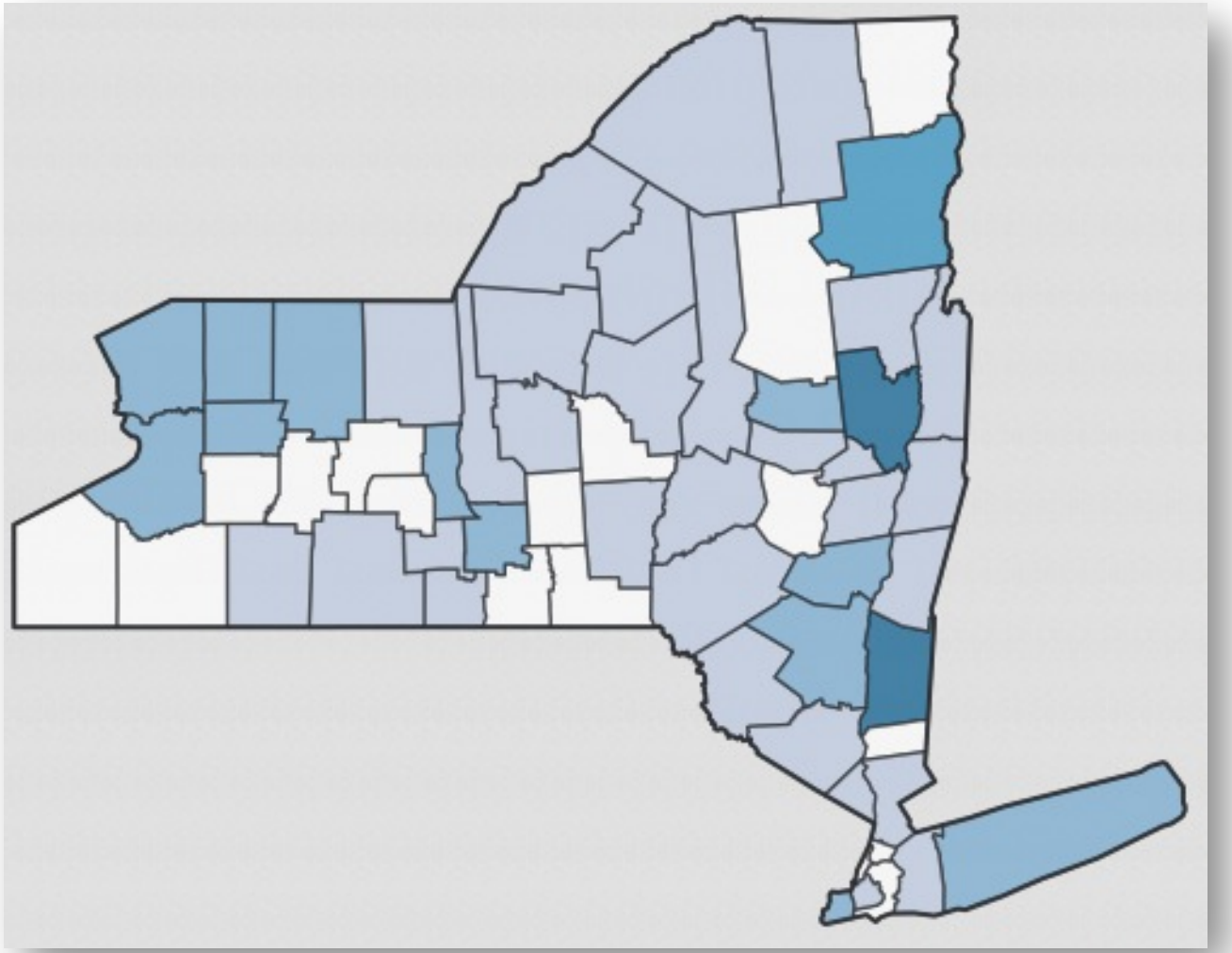
LABORATORY



Tartarian Honeysuckle (*Lonicera tatarica*)

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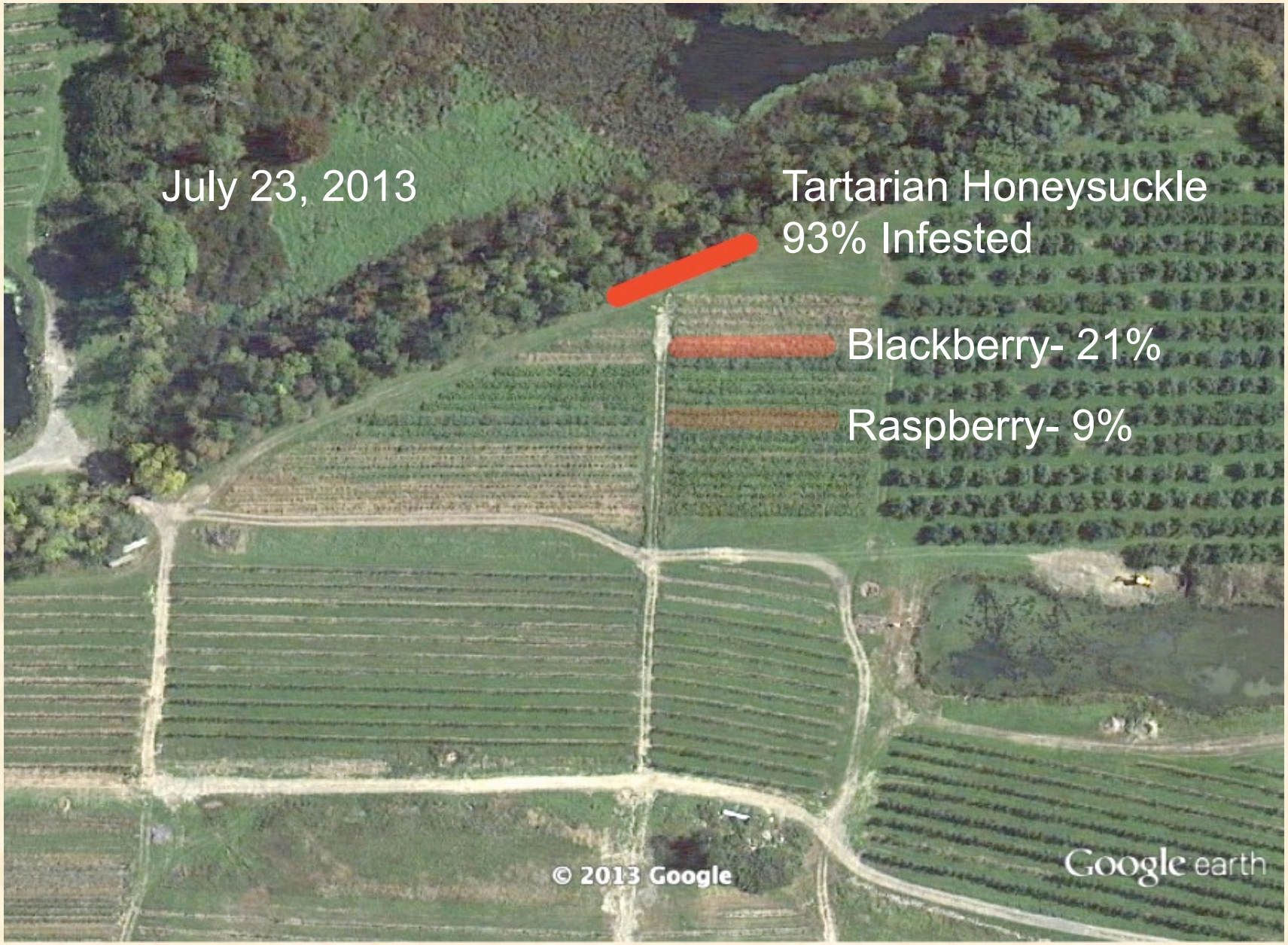

Fruit Infestation levels by location. Opacity of line indicates level of infestation.

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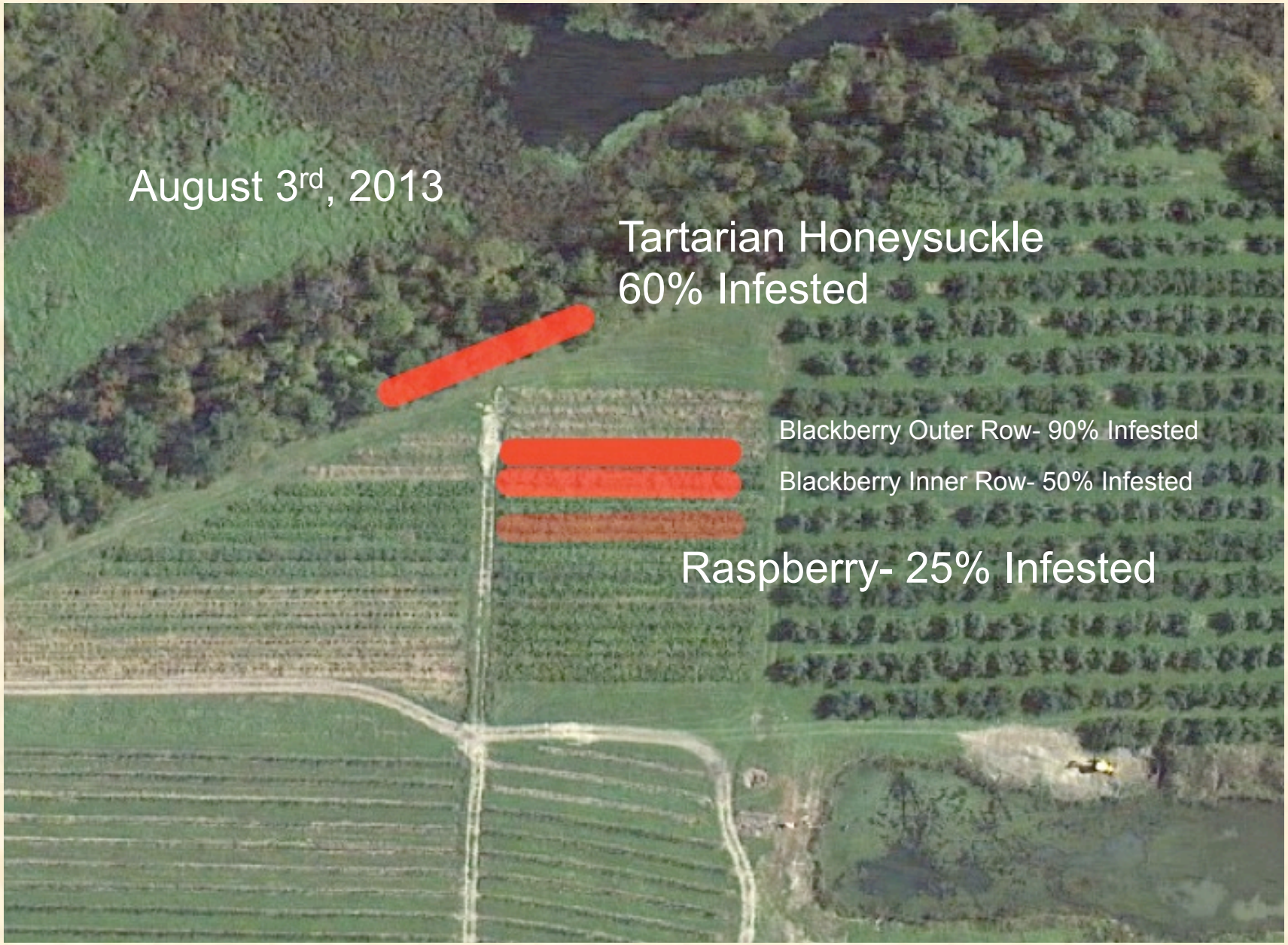

As Tartarian Honeysuckle loses fruit, infestation increases in cultivars closest to forest edge.

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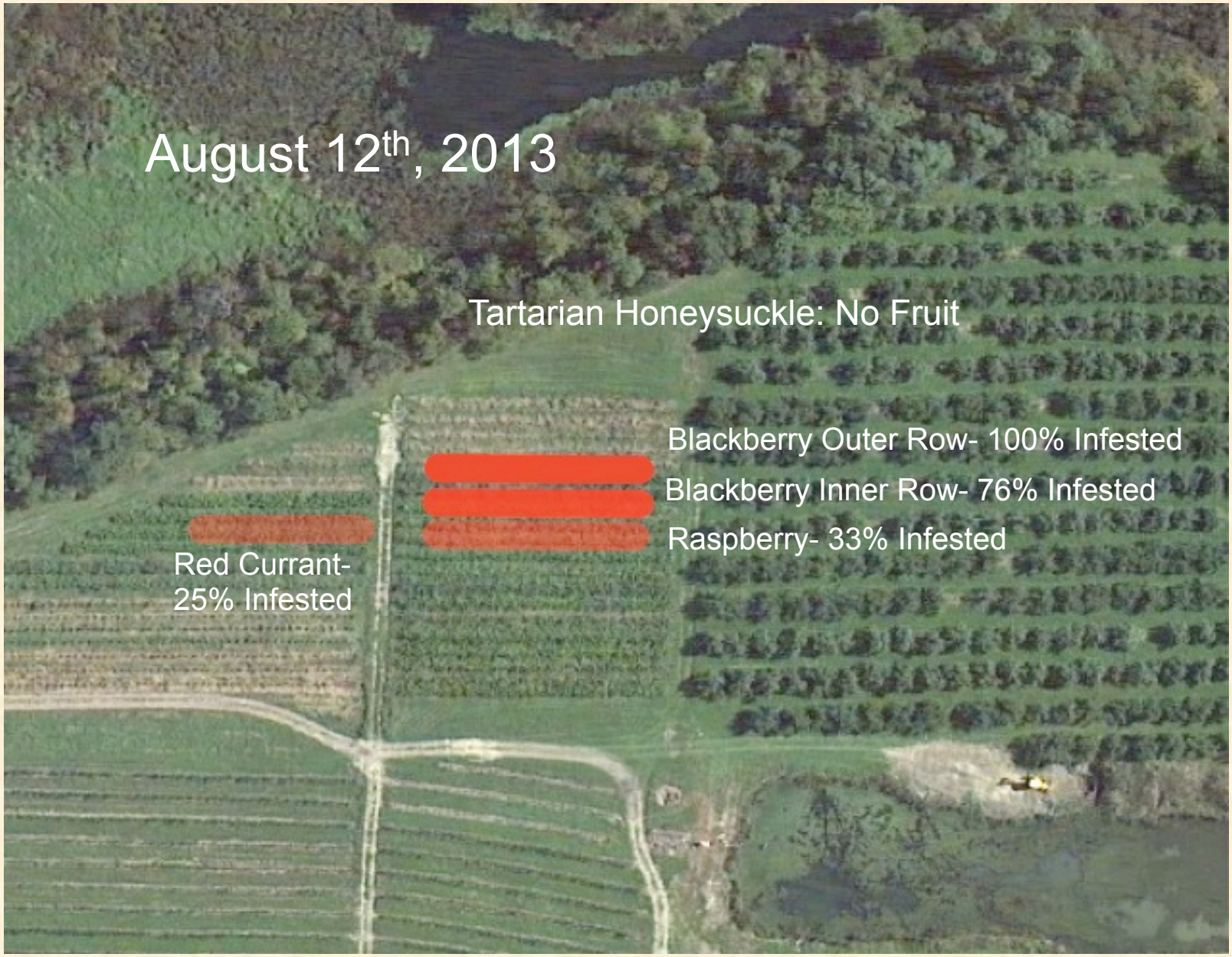

As Tartarian Honeysuckle loses all fruit, Infestation in cultivars reaches higher levels.

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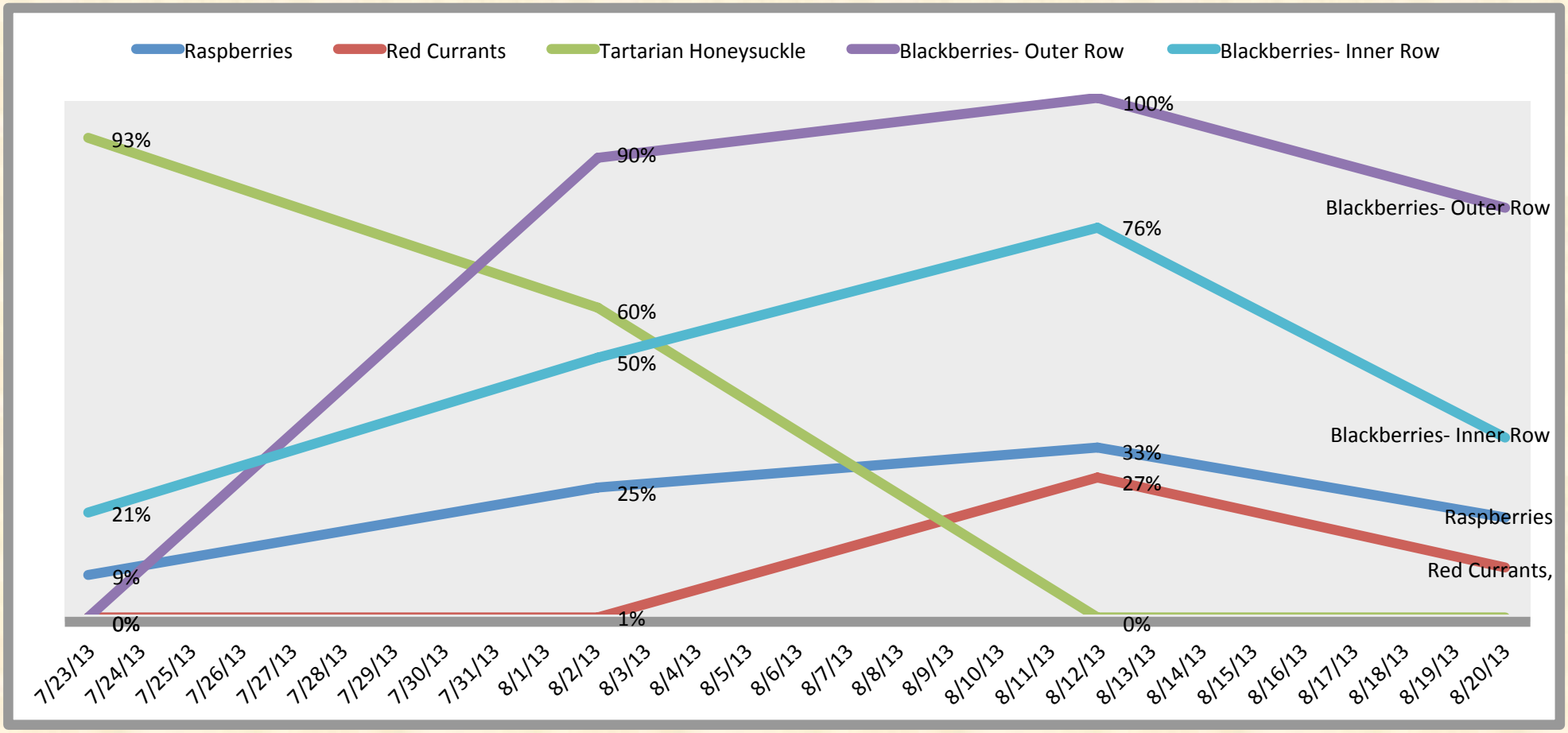
Fruit Infestation levels in wild hosts and small fruit: Ulster Co.



- Tartarian Honeysuckle berries maintained high levels of infestation until August 12, when the plants bordering the orchard no longer had fruit.
- Infestation in the domestic cultivars increased as wild hosts disappeared.

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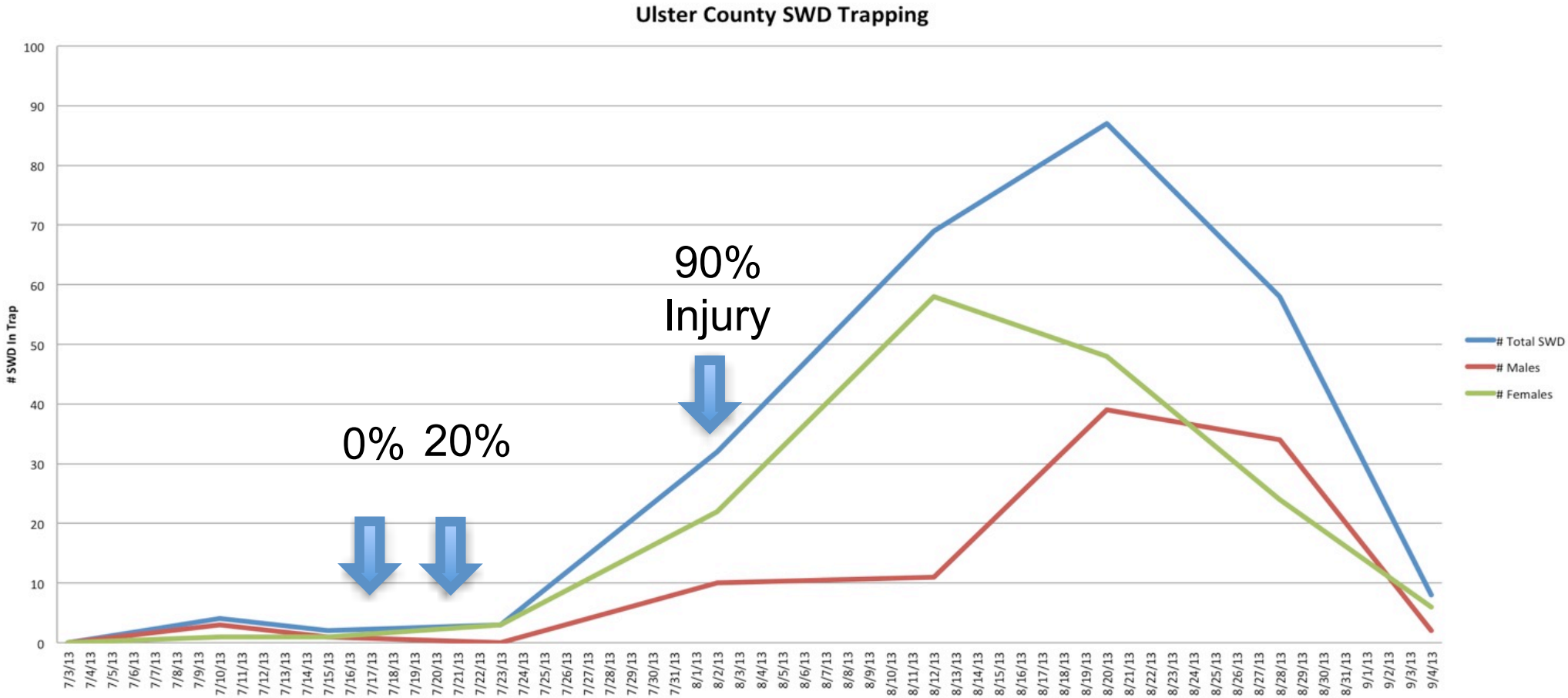
SWD Population over Time: Blackberry, Ulster Co. 2013



Injury in blackberry crop:

- Clean crop up to mid-July
- 20% injury on 21 July
- 90% injury on 1 August

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SWD Management

Adult Trapping: Yeast mixture, sugar, apple cider vinegar
Adult captures provide early warning
Begin management at 1st adult SWD ?

Crop Monitoring: Assessment of fruit for eggs & larva

Cultural management of crop: Clean pick & removal of injured fruit

Maintain harvested fruit at 33F: ASAP

Insecticide frequency: 3-4 day program using best materials
Alternate row middle vs full row

Insecticide class rotation: Resistance management 10d to 2 wks

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SWD Management after 0.8” of Rainfall (R. Issacs, Univ. Mich)

Material	Rate	% Control	% Control 0.8” rainfall
Mustang Max	4.0 oz./A	100	70-100
Assail 30SG	5.3 oz./A	60-100	20-45
Delegate 25WDG	4.5 oz./A	88-100	20-60
Malathion 8F	2.0 pts./A	70-100	8-45

Loss of SWD efficacy 1-3 days after rain

24 hrs post application rain event.

Stresses the need for retreatment of most insecticides.

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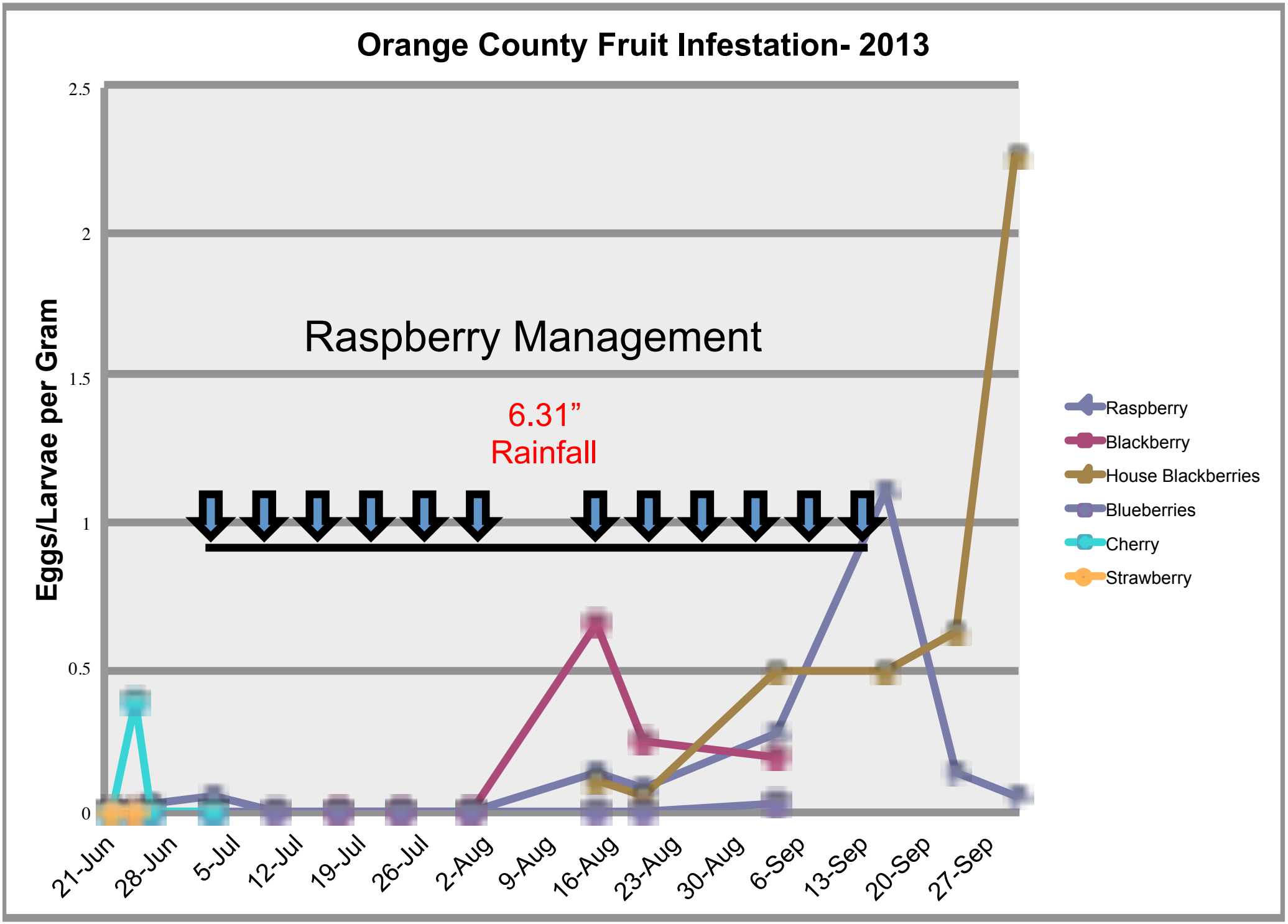
SWD Control in Mixed Small Fruit; Orange Co.

Date	Material	Rate	Commodity
27 June	Malathion 57	2 pts./A	Raspberry
1 July	Assail 30SG	5 oz./A	Raspberry
5 July	Malathion 57	2 pts./A	Raspberry
12 July	Delegate 25WDG	3 oz./A	Raspberry
14 July	Brigade	8 oz./A	Raspberry
19 July	Assail 30SG	5 oz./A	Raspberry
22 July	Danitol	16 oz./A	Raspberry
27 July	Mustang Max	4 oz./A	Raspberry
30 July	Assail 30SG	5 oz./A	Raspberry
	6.31” Rainfall; 6 day application interval		
5 August	Delegate 25WDG	3 oz./A	Raspberry
19 August	Brigade	8 oz./A	Raspberry


Orange County Fruit Infestation- 2013
Eggs/Larvae per Gram
2.5
2
1.5
1
0.5
0
Raspberry Management
6.31”
Rainfall
21-Jun
28-Jun
5-Jul
12-Jul
19-Jul
26-Jul
2-Aug
9-Aug
16-Aug
23-Aug
30-Aug
6-Sep
13-Sep
20-Sep
27-Sep
Raspberry
Blackberry
House Blackberries
Blueberries
Cherry
Strawberry

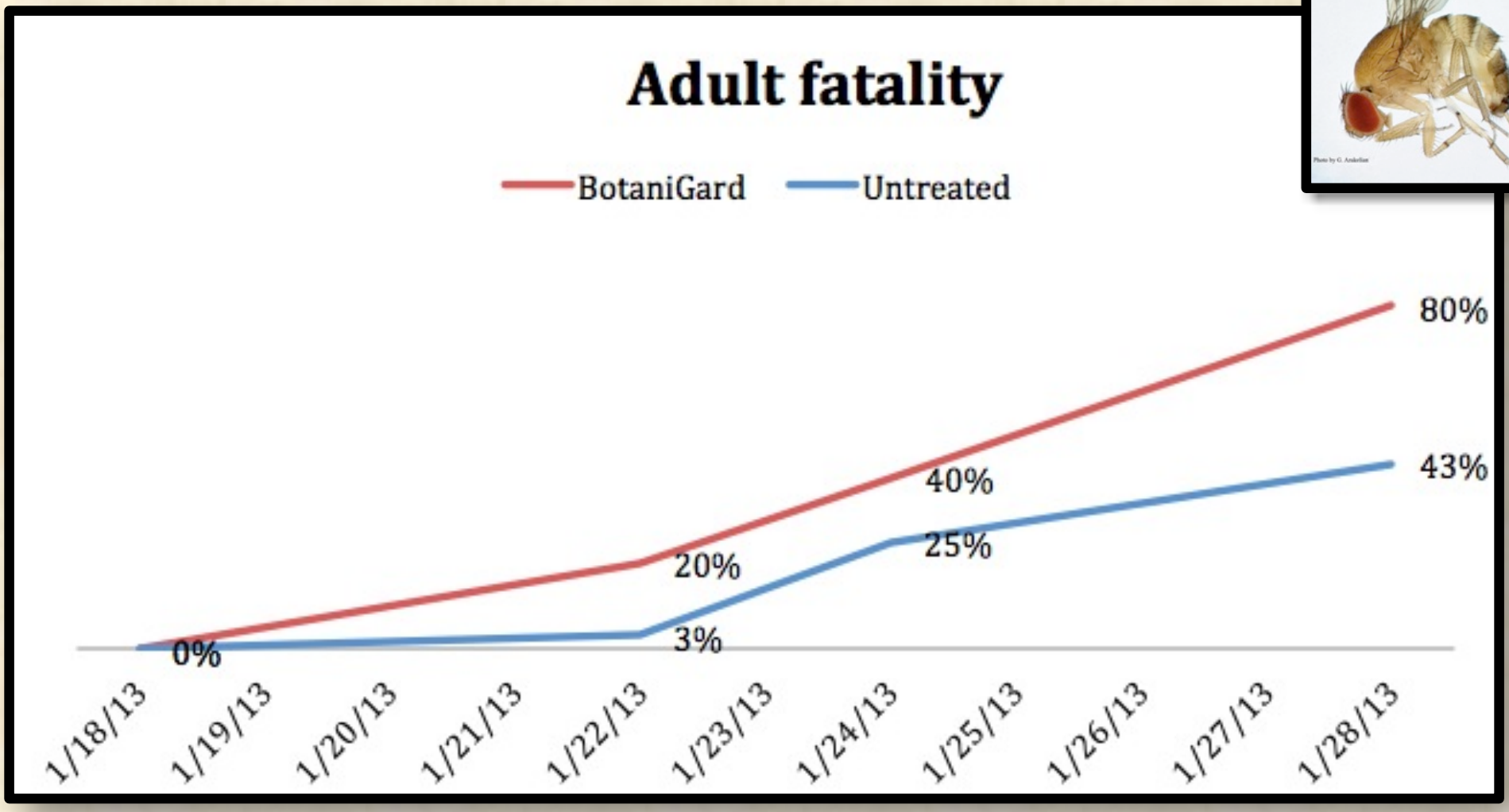
Alternative Approaches to Conventional IPM

Mycotrol-O is a mycopesticide, employing a fungal pathogen (*Beauveria bassiana)* as a method of controlling *D. suzukii.*

- ***OMRI approved***
- Strain GHA at a concentration of 10.9% or 2 x 1010 viable spores per gram of active ingredient.

In laboratory studies, BotaniGard was applied to surface of blueberries in closed bioassay (one adult fly per berry, 10 replicates), adult fatality measured daily.

Mycotrol-O mycopesticide. (*Beauveria bassiana)* to control *D. suzukii.*



BotaniGard applied to surface of blueberries in closed bioassay (one adult fly per berry, 10 replicates). Adult mortality measured daily.

Mycotrol-O mycopesticide. (*Beauveria bassiana*) to control *D. suzukii.*

Advanced stage of fungal growth (~10 days of exposure).

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

Technical Assistant.....	Tim Lamposona
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