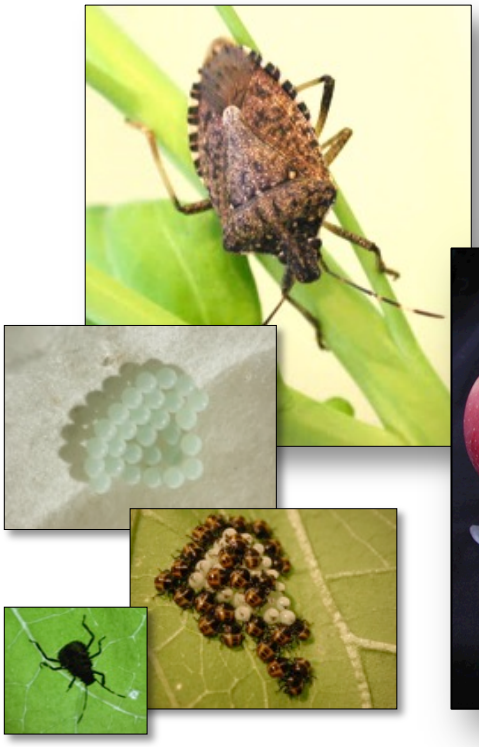
Biological Control of Brown Marmorated Stink Bug, *Halyomorpha halys* Stål (Hemiptera: Pentatomidae) in NYS



Photograph: Elijah J. Talamas, ARS USDA.

Photograph: **Christopher Hedstrom** USDA-APHIS Quarantine Facility, Corvallis, Oregon

Peter Jentsch
CALS – HVRL

Art Agnello
CALS - AgriTech

Elizabeth Tee
CCE-LOFT

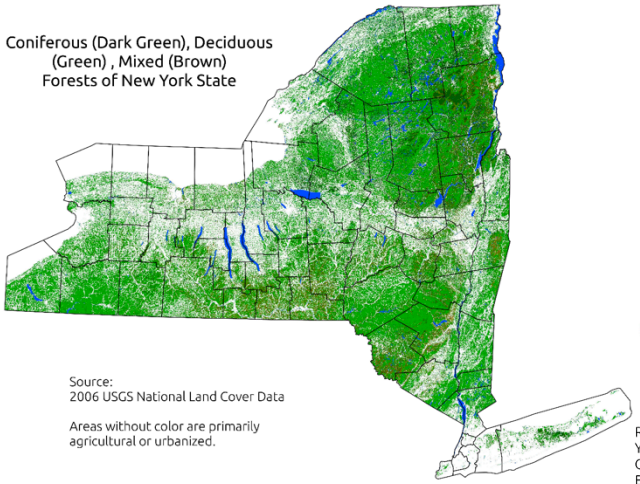
Dana Acimovic
CALS – HVRL

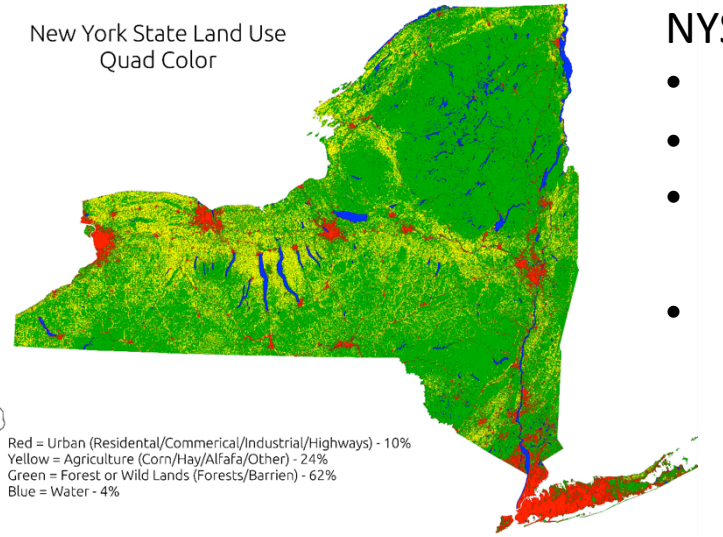
Lydia Brown
CALS – HVRL

Stink Bug Management

- An Ag & Urban Pest
- 1-2 Generations / season
- Economic Injury to High Value Crops
- Late Season Ag. Presence
- Arboreal Perimeter Pest
- Elusive & Unpredictable
- Apple: Mid-August to EOS
- >MRL's During Drought
- Limited Mgt. DTH <7d
- Injury visible after 10d
- Requires late season mgt.
- Overwinter in manmade structures & woodland

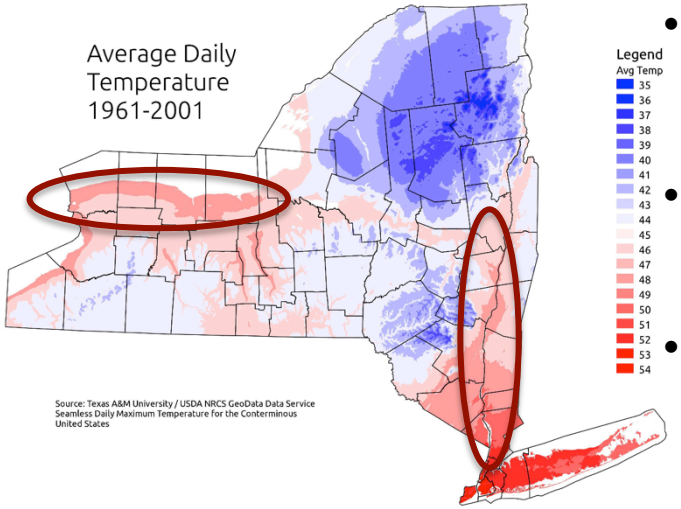
Stink Bug Management
Arboreal (BMSB) Habitat / Urban Overwinter





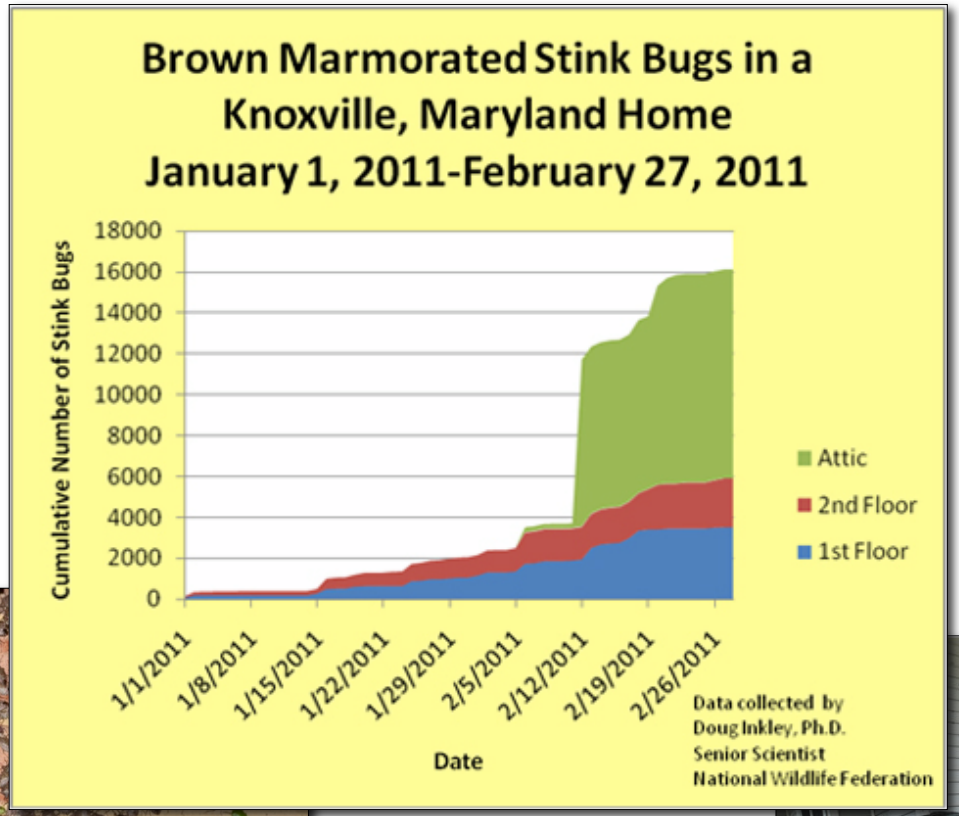
NYS: 30 million total acres.

- 63% forested
- 18.9 million acres
- **Maple**/beech/birch (comprise 53% of forests)
- Sugar Maple, White Ash, Black Locust, Tree of Heaven are reproductive hosts of BMSB



- BMSB can fly continuously on average 2 miles, ranging up to 20 to 75 miles in a single flight.
- In woodland habitat, temperatures below -18°C or -0.4°F will kill 90% of the **adult BMSB** (Kuhar, T. 2016)
- BMSB in urban overwintering sites have higher success rates then woodland OW sites, easily flying long distance to obtain food resources.

Urban Overwintering Sites of BMSB
Do They Provide a Biological Benefit?

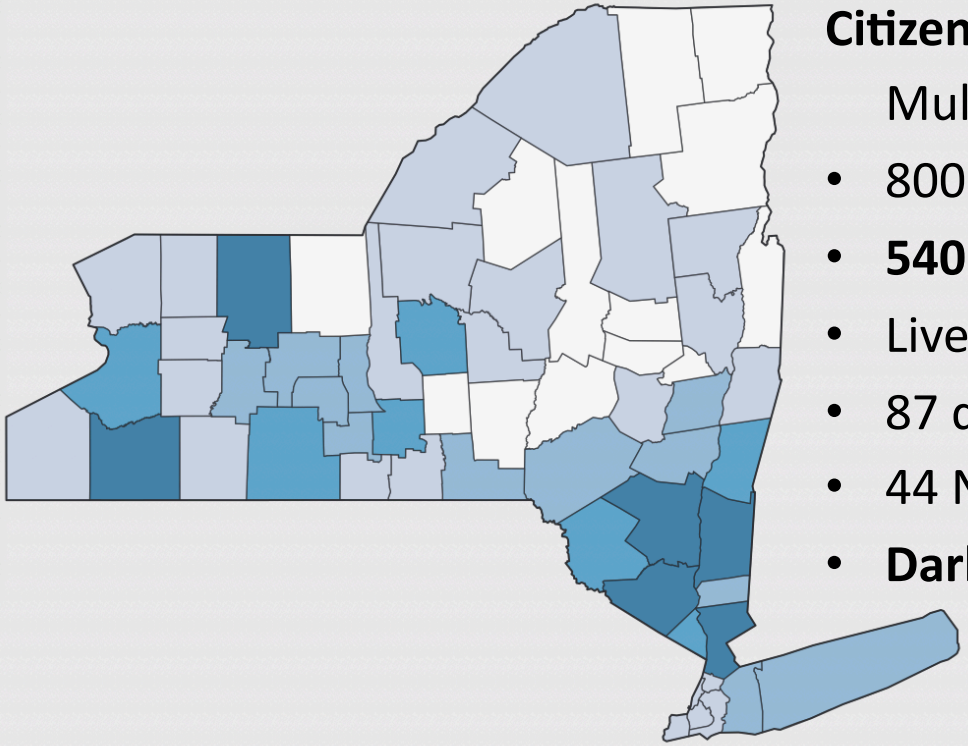


2011

Doug Inkley, NWF
Senior Scientist

>26,000 BMSB in
his Maryland home

Brown Marmorated Stink Bug *Halyomorpha halys*
Citizen Science Project



Citizen Science Project 2011-2015

Multiple sources; HVRL + Individual CS input

- 800 specimens received
- **540 BMSB verified by University**
- Live and digital submissions
- 87 distinct zip code locations
- 44 NYS counties
- **Darker counties = higher BMSB densities**

iMapinvasive

New York Invasive Species Public Map

http://imapinvasives.org/nyimi/map/

Brown Marmorated Stink Bug / Samurai Wasp Citizen Science Project Outreach

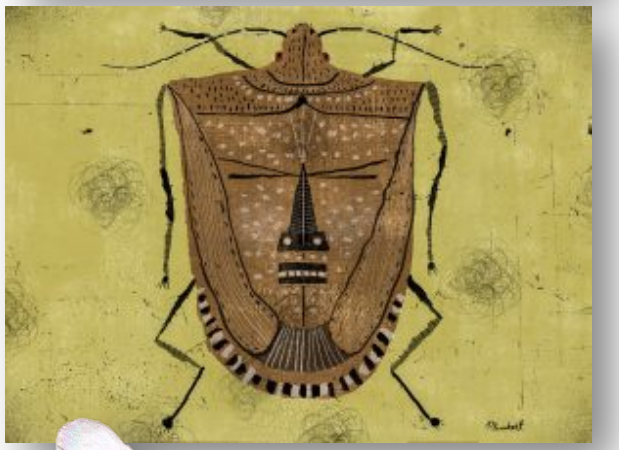
THE NEW YORKER

ANNALS OF ECOLOGY MARCH 12, 2018 ISSUE

WHEN TWENTY-SIX THOUSAND STINKBUGS INVADE YOUR HOME

These uniquely versatile bugs are decimating crops and infiltrating houses all across the country. Will we ever be able to get rid of them?

By Kathryn Schulz March 5, 2018



USA TODAY

NATION NOW

Tiny wasps set to wreak 'Alien'-like havoc on stink bugs

John Ferro Poughkeepsie (N.Y.) Journal

Published 6:05 p.m. ET Mar. 7, 2017

Stink bugs feed on a nectarine. The brown spots show previous places where the hungry bugs have injured the fruit. *Ralph Scorza, U.S. Department Of Agriculture*

HIGHLAND, N.Y. — Scientists are getting ready to escalate a life-and-death battle between two invasive insects: a stink bug that damages a wide variety of crops and a tiny wasp that just might become the hero in this drama.

If all goes according to plan, homeowners and farmers in as many as eight states will see fewer brown marmorated stink bugs infesting their houses and sucking the life from their fruits and vegetables.

Patch Your town or ZIP code **New City, NY**

39°F | Nearby | Local News | Neighbor Posts | Classifieds

Home & Garden

Get Rid Of Stink Bugs: National Citizen Scientist Project

They've discovered how to eradicate the Brown Marmorated Stink Bug, so scientists are trying to map the invasive insect across the USA.

By Lanning Taliaferro, Patch Staff
Mar 10, 2017 8:44 am ET | Updated Mar 10, 2017 11:43 am ET

Like 14 Share Reply

You know those awful brown bugs that stink if you crush them (which you do without realizing it when one crawls on you), the ones that appeared a few years ago all over your house in the spring and fall? Scientists have a plan to fight them, and they want your help.

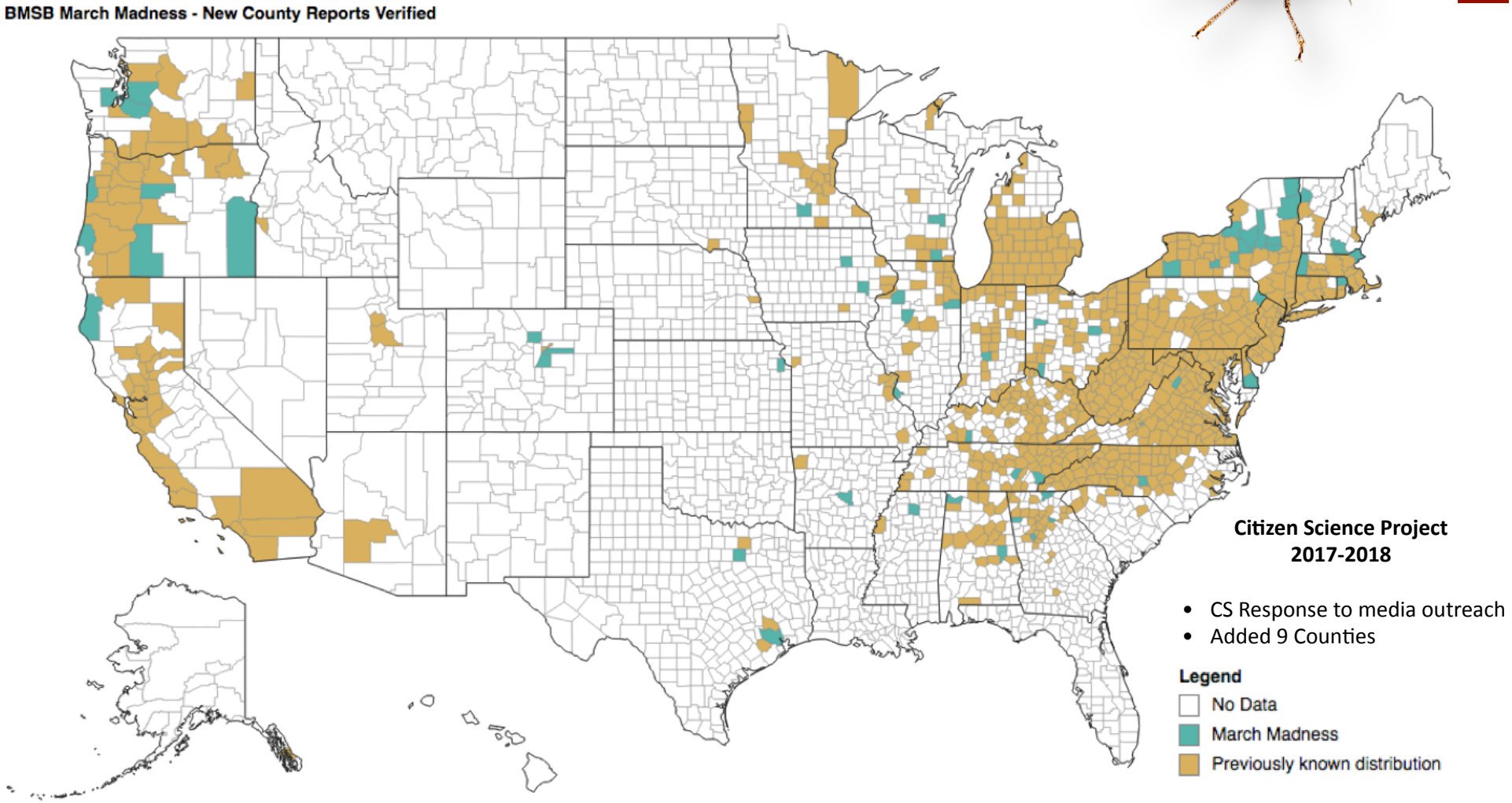
The Brown Marmorated Stink Bug invaded the United States in the mid-1990s from Asia. BMSBs not only gross everyone out, they also are wreaking havoc on the country's fruit and vegetable crops.

But now scientists at Cornell University in New York have discovered a tiny wasp that likes to lay its eggs in Brown Marmorated Stink Bug eggs. So university and USDA scientists are collaborating on a project

New York State Citizen Scientists

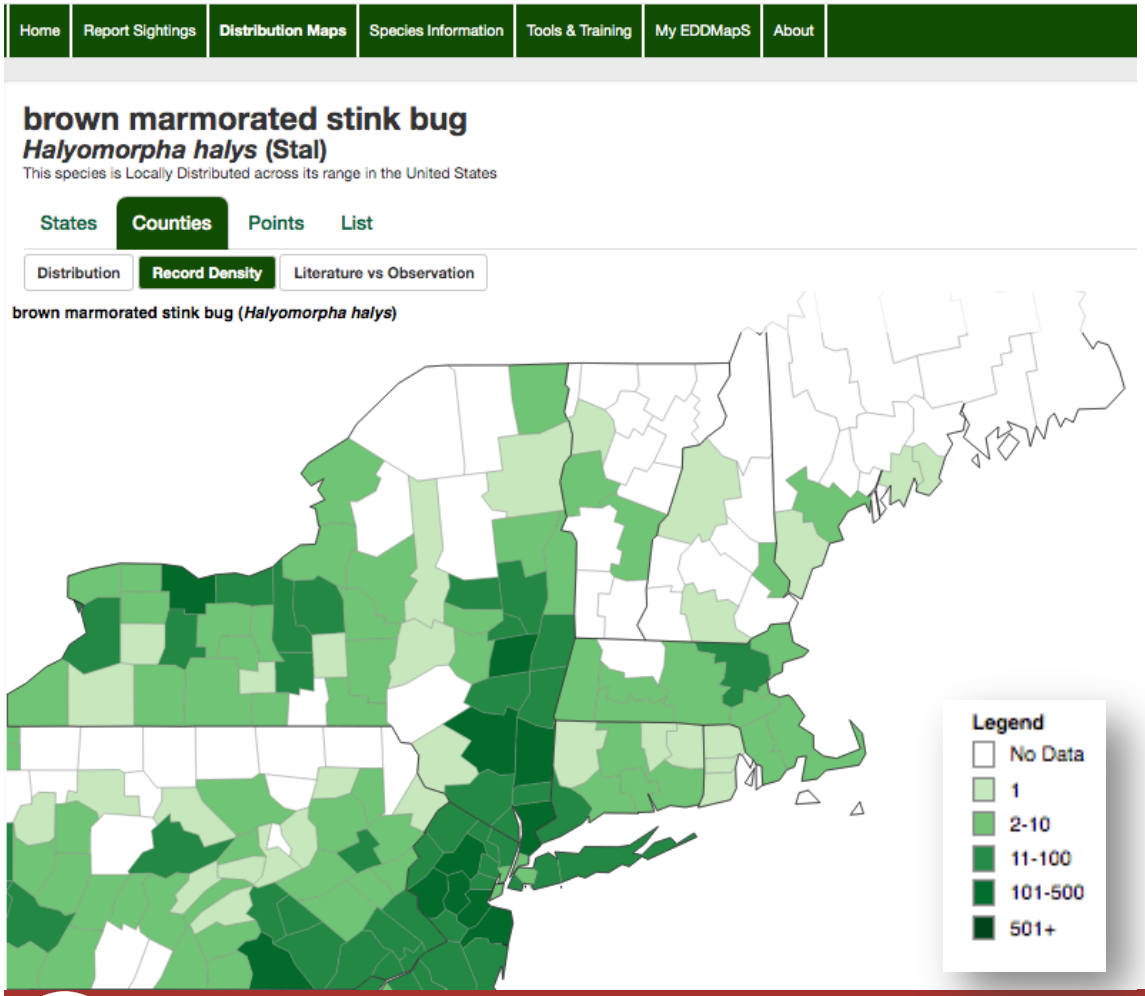
- Provide digital images for NYS BMSB mapping efforts (BMSB density)
- Provide monetary support for Samurai Wasp Redistribution Project
- Provide research data in geographical context of T. j. egg emergence & egg predation

Brown Marmorated Stink Bug
National Citizen Science Project



Brown Marmorated Stink Bug Citizen Science Project

EDDMapS
Early Detection & Distribution Mapping System



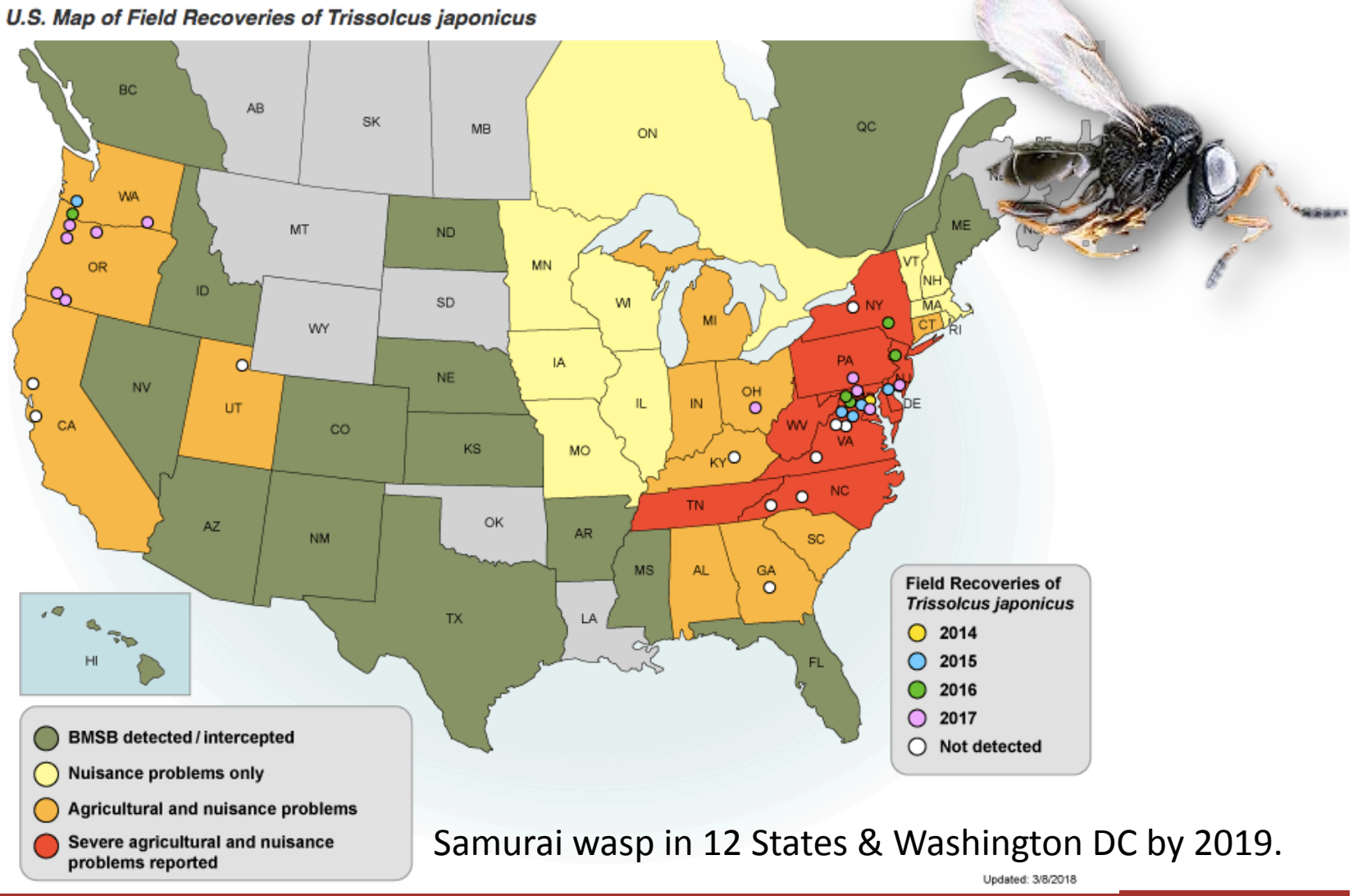
Citizen Science Project 2019

- BMSB density in rural, urban and suburban homes bordering woodlands and agricultural crops
- Provides justification for site selection for Samurai wasp redistribution

Samurai Wasp, Trissolcus japonicus (Ashmead) In NYS

- Samurai wasp, *Trissolcus japonicus*, is an egg parasitoid of BMSB, 2mm in length
- Lays 1 egg into each BMSB egg (42/female)
- Wasp larva feed on BMSB nymph
- Adult wasp emerges from each BMSB egg
- Can have 5 generations / year
- Live in clustered woodland & edges of Ag.
- Overwinter in woodlands, flaked bark
- Parasitizes 60-90% of BMSB eggs in Asia.
- High probability of success in the US.
- Success = Reduced Ag & Urban pest management

Adventive Populations of *Trissolcus japonicus* Field Recovery and Redistribution Sites in the US

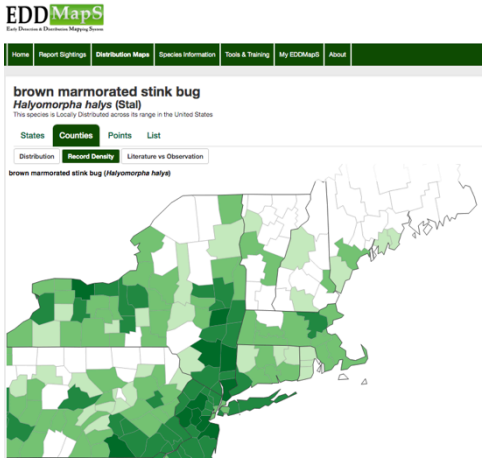


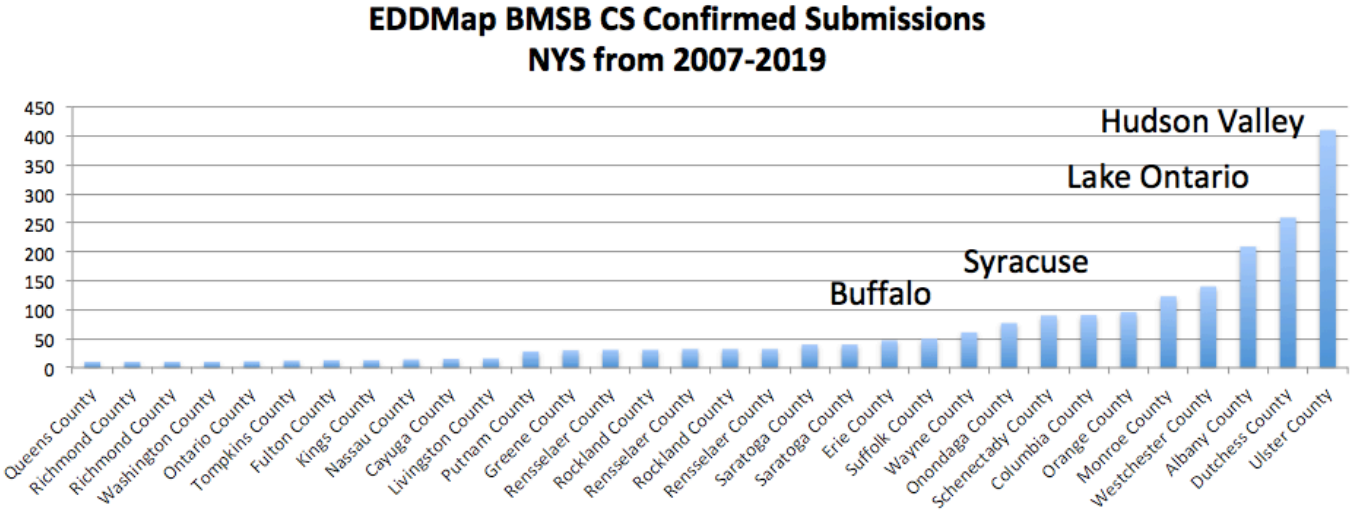
Samurai wasp in 12 States & Washington DC by 2019.

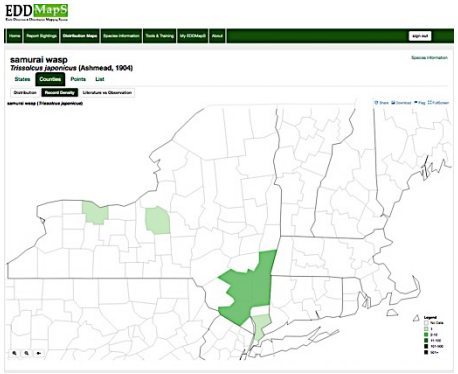
2017-2019 Parasitized Egg Parasitoid Release 'Redistribution'

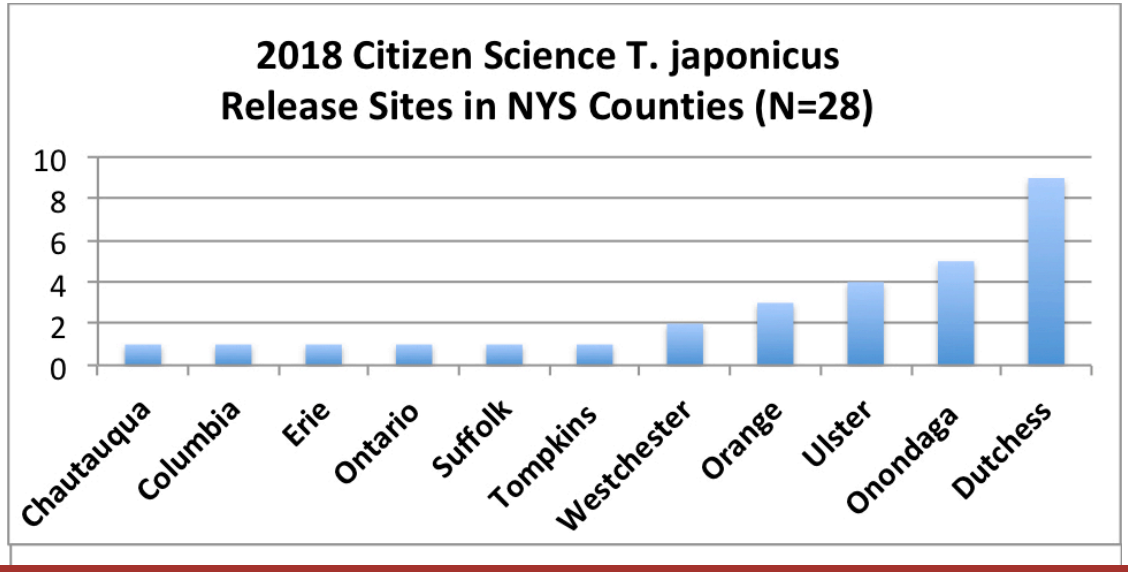
- 'Marlboro' *T. japonicus* used to develop colony and parasitize -80°C stored BMSB eggs.
- Fixed parasitized eggs to petri dish lid added zip tie for send and return mail to determine % emergence.
- Parasitized eggs sent to CS and Ag. cooperators.
- Parasitized eggs placed throughout NYS (11 Counties).

Brown Marmorated Stink Bug & Samurai Wasp Citizen Science Projects









Expanding the Range of the Parasitoid Wasp, Trissolcus japonicus, (Hymenoptera: Scelionidae) in NYS.

Normal, hatched BMSB egg mass.

BMSB eggs showing damage from sucking predators.

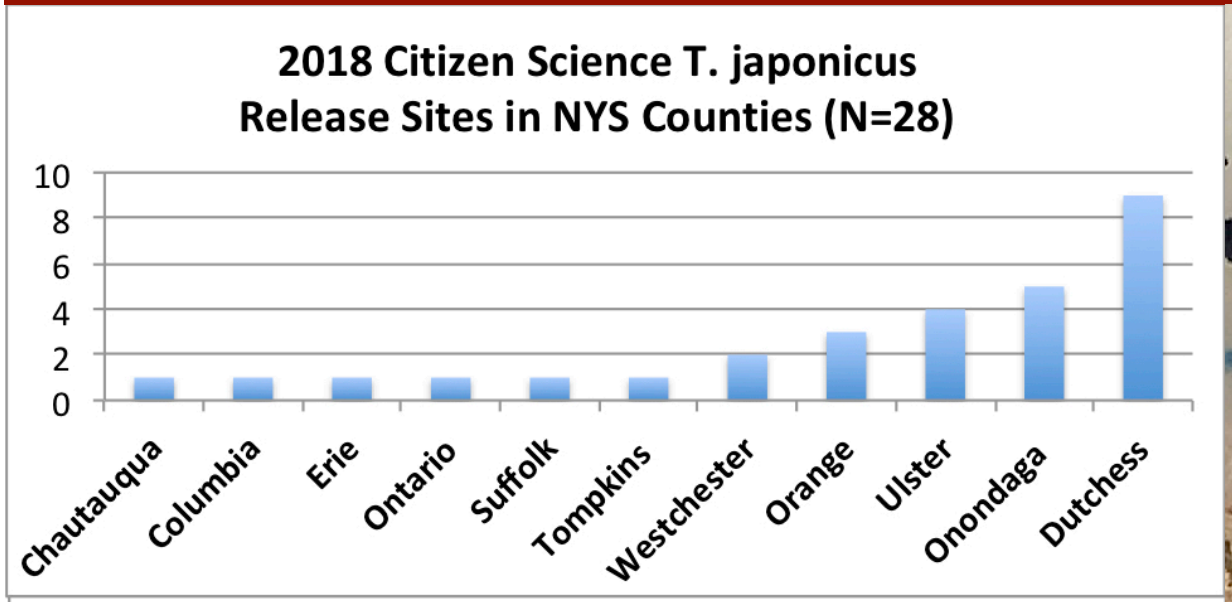
Native Predatory feeding and Parasitism

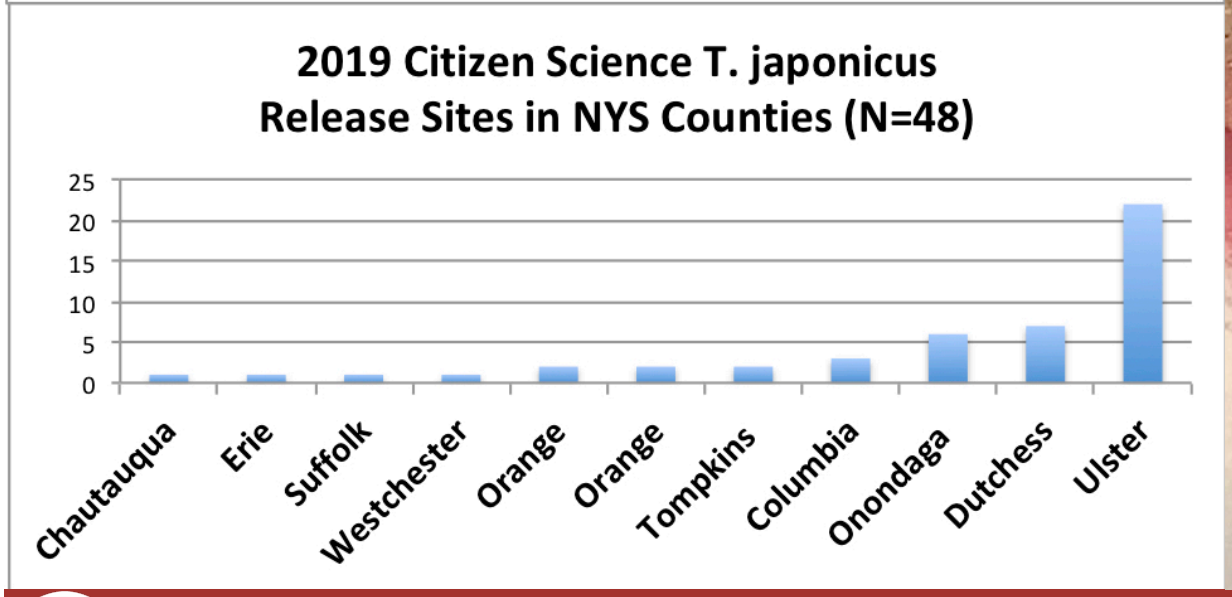
- Predatory feeding accounts for >20% reduction of BMSB egg loss.

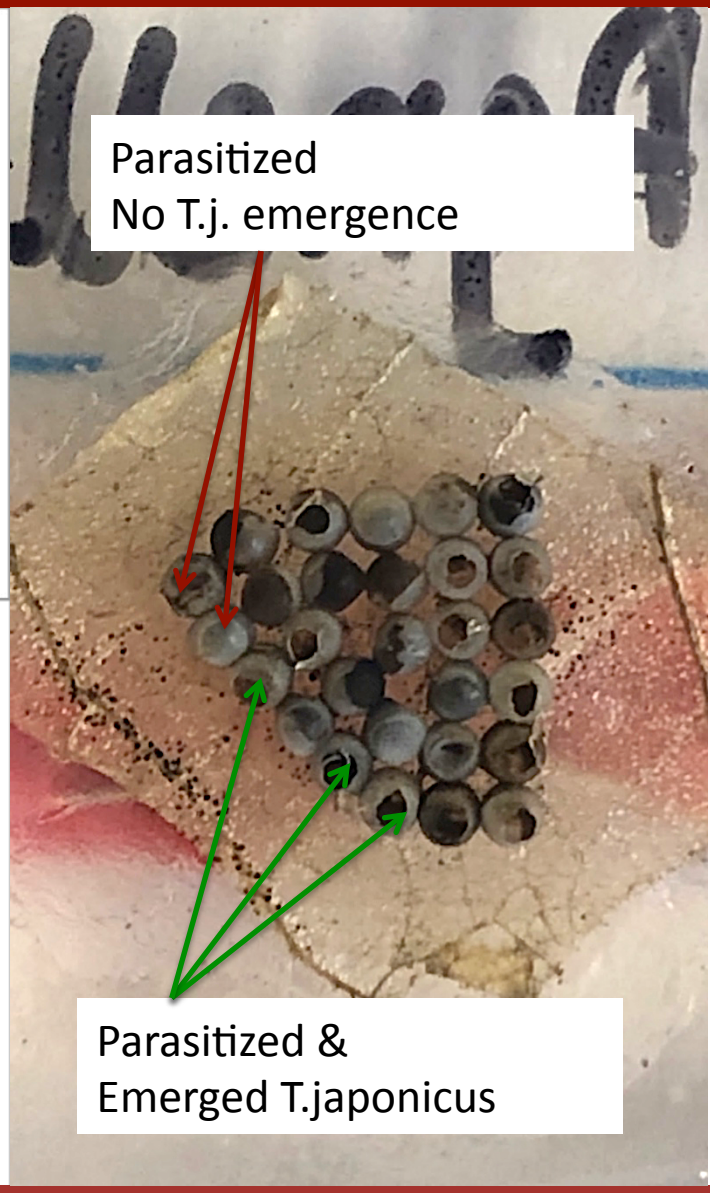
BMSB eggs showing damage from chewing predators.

Spined soldier bug Podisus maculiventris

Citizen Science Release Sites of *Trissolcus japonicus*

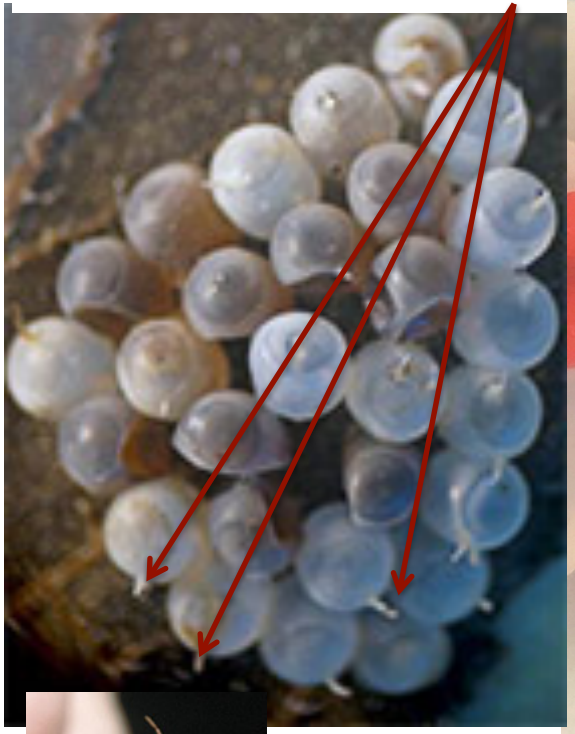


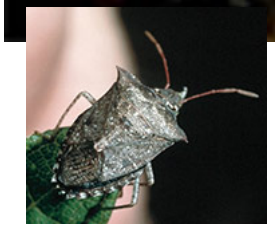




Citizen Science Release Sites of *Trissolcus japonicus*

Stink Bug Feeding
Sheath on BMSB eggs:





Spined soldier bug
Podisus maculiventris

Predatory Feeding
of BMSB eggs:

Tettigoniidae
Grasshopper, Crickets

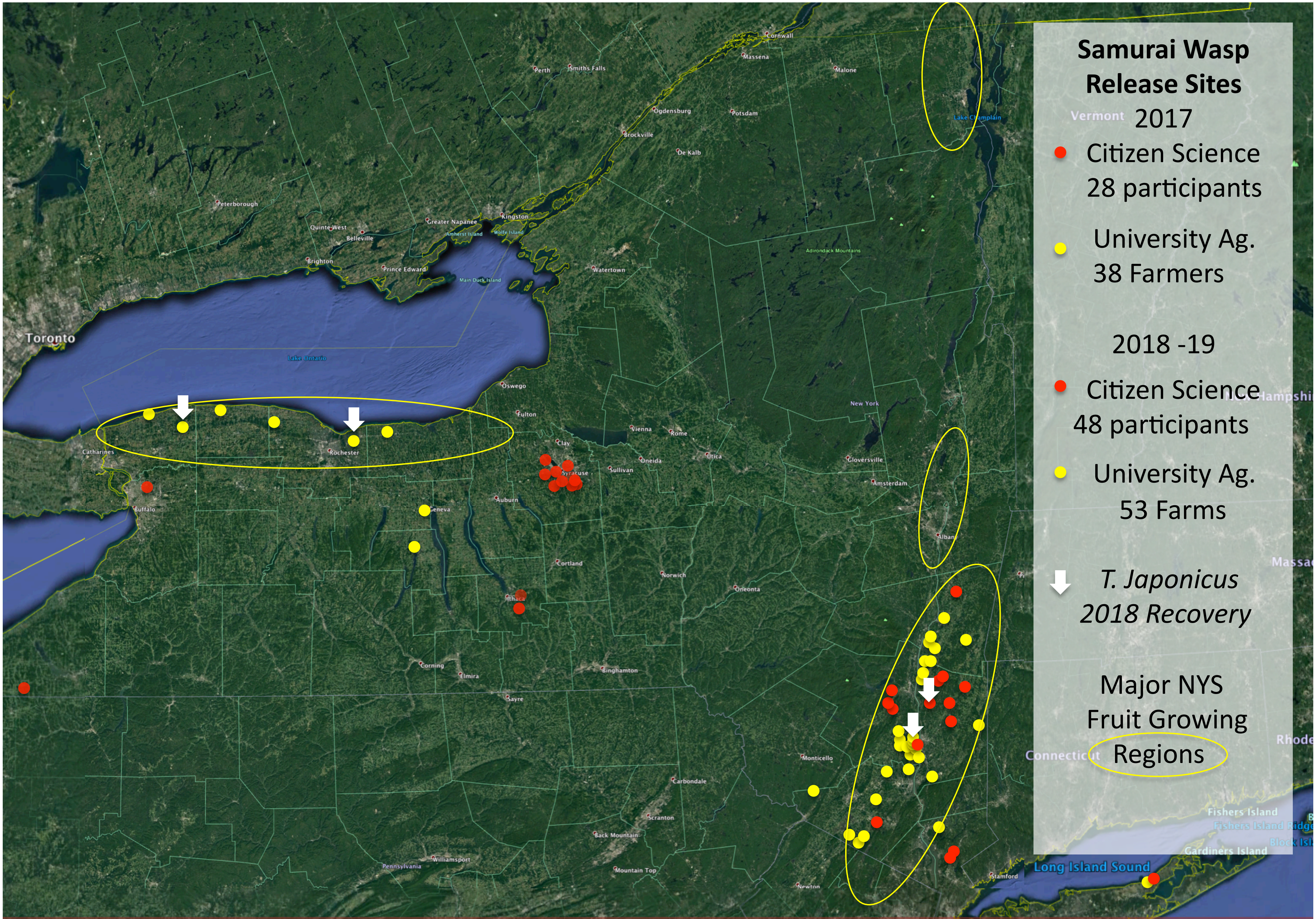
Parasitized
No T. j. emergence

Parasitized &
Emerged T. japonicus

Ag Site Release Site
BMSB Egg Status of *Trissolcus japonicus*

T.j. release Site	Plate #	Rearing dates oviposition	Field Release Dates	# of Clusters	# eggs	# emerged	% emerged	Predator Activity?
Morgan (Agnello)	11	7/21-8/1	8/6-8/20	1	22	2	9.09%	N
Schutt (Agnello)	6	7/21-8/1	8/6-8/20	1	28	11	39.29%	N
KM Davies (Agnello)	6	7/21-8/1	8/6-8/20	1	27	15	55.56%	N
Red Jacket (Agnello)	6	7/21-8/1	8/6-8/20	1	26	0	?	Y

KM Davis



Samurai Wasp Release Sites

2017

Citizen Science 28 participants

University Ag. 38 Farmers

2018 -19

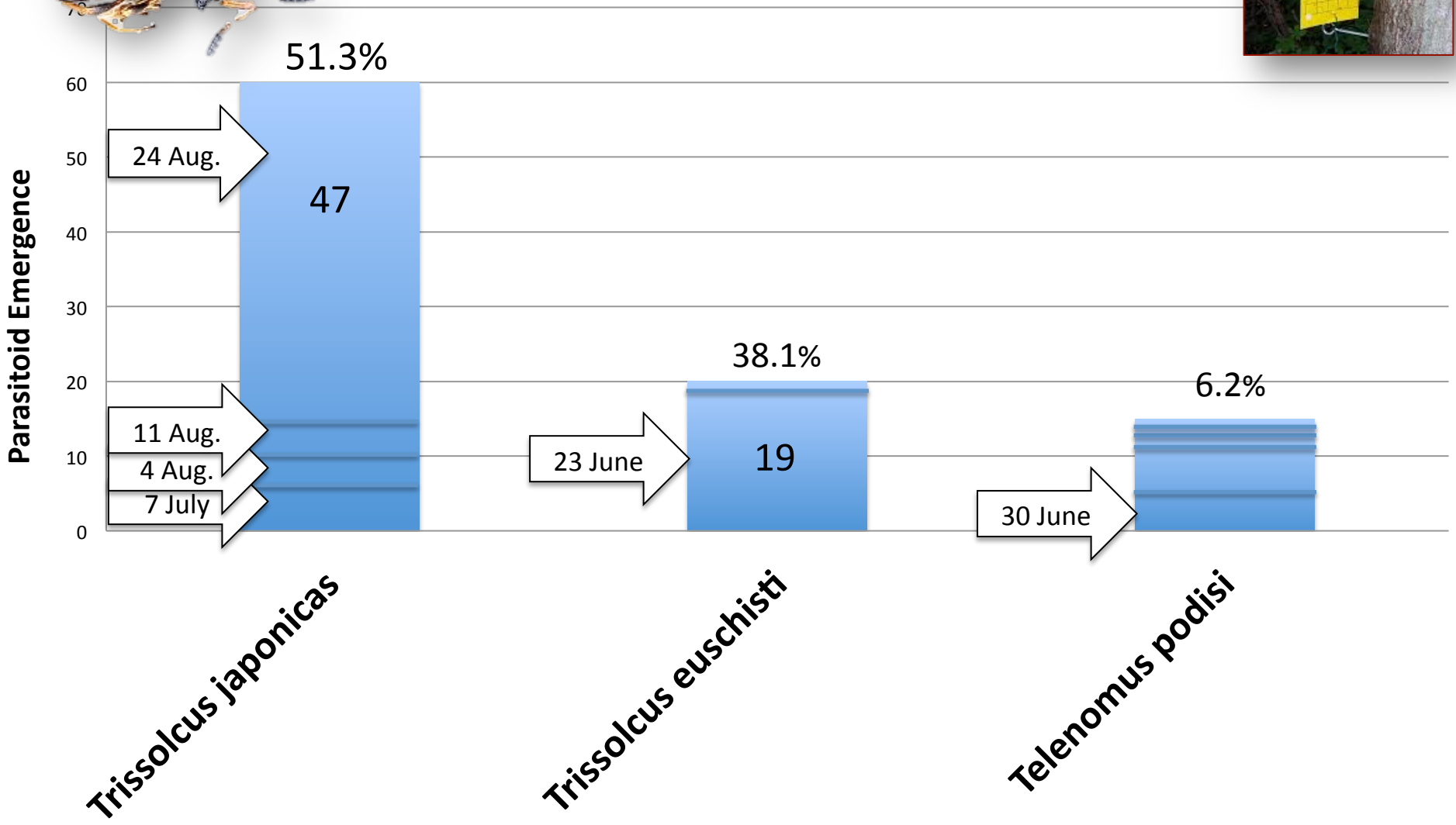
Citizen Science 48 participants

University Ag. 53 Farms

T. Japonicus 2018 Recovery

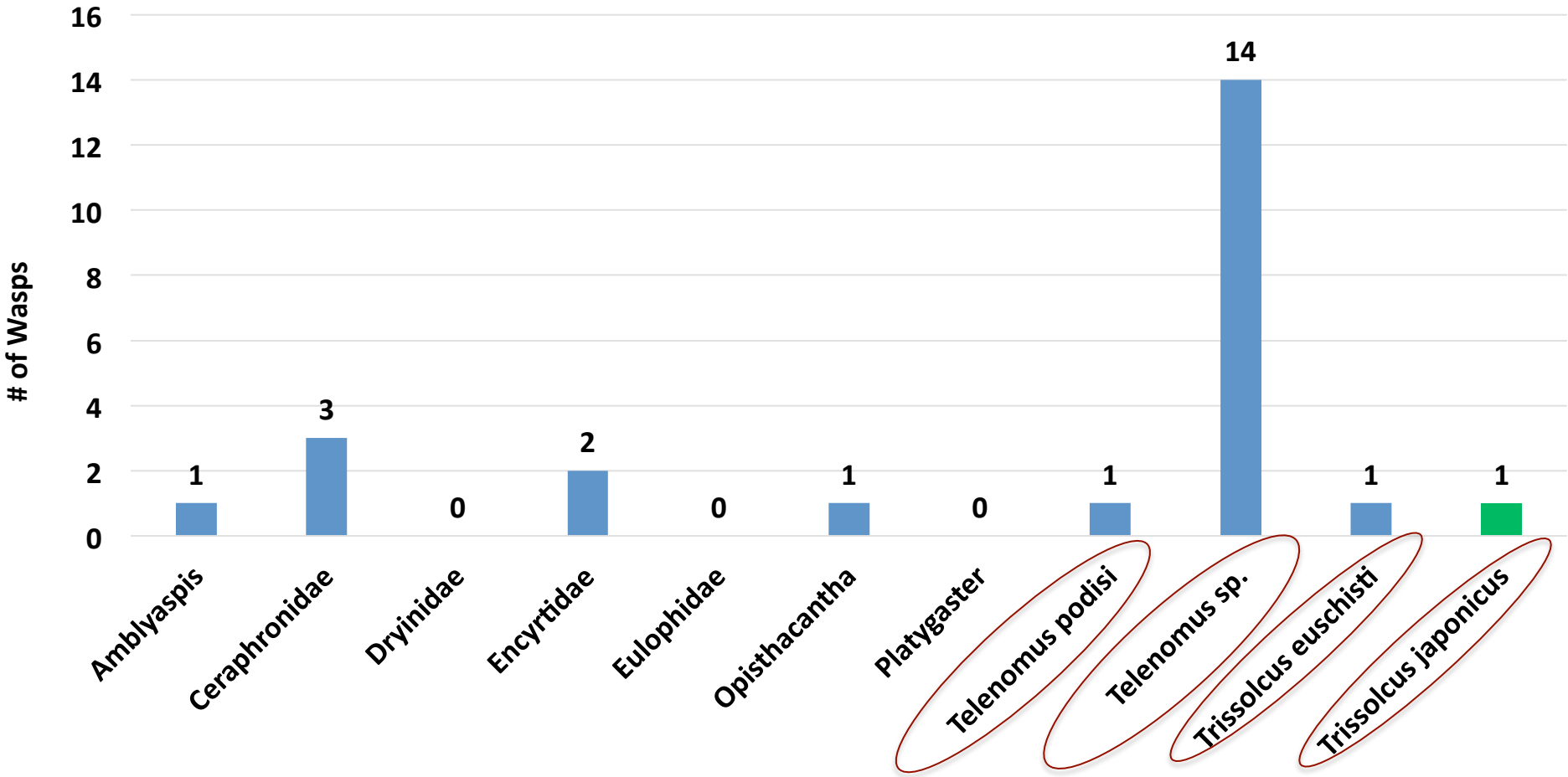
Major NYS Fruit Growing Regions

Parasitoid Survey:
Seasonal Emergence from BMSB -80°C Frozen Eggs
23rd June - Aug. 24th Marlboro, NY 2017



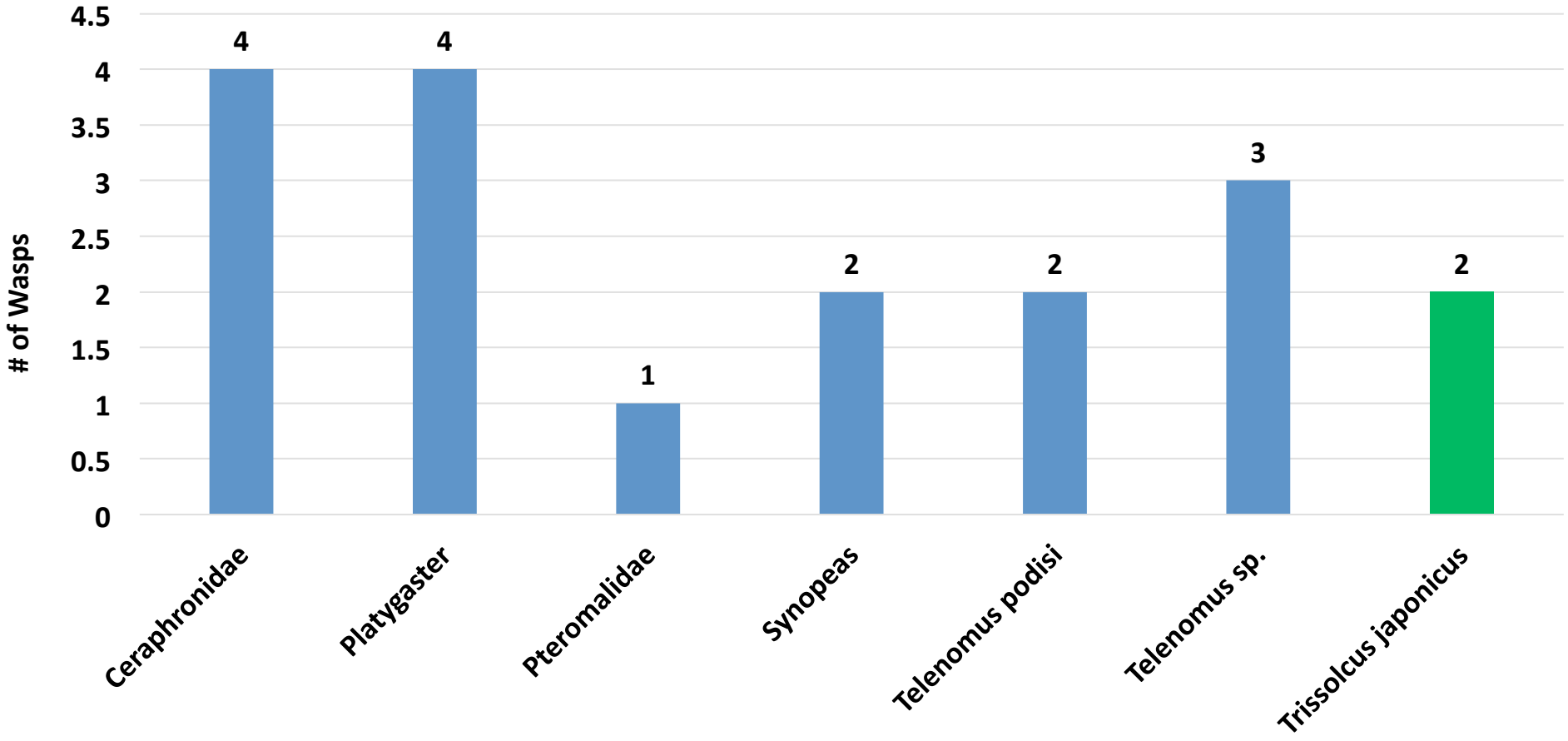
Parasitoid Survey – Western NY
Using Alpha Scent Cards

KM Davies Site 1 Williamson NY
7/3 - 10/3 2018



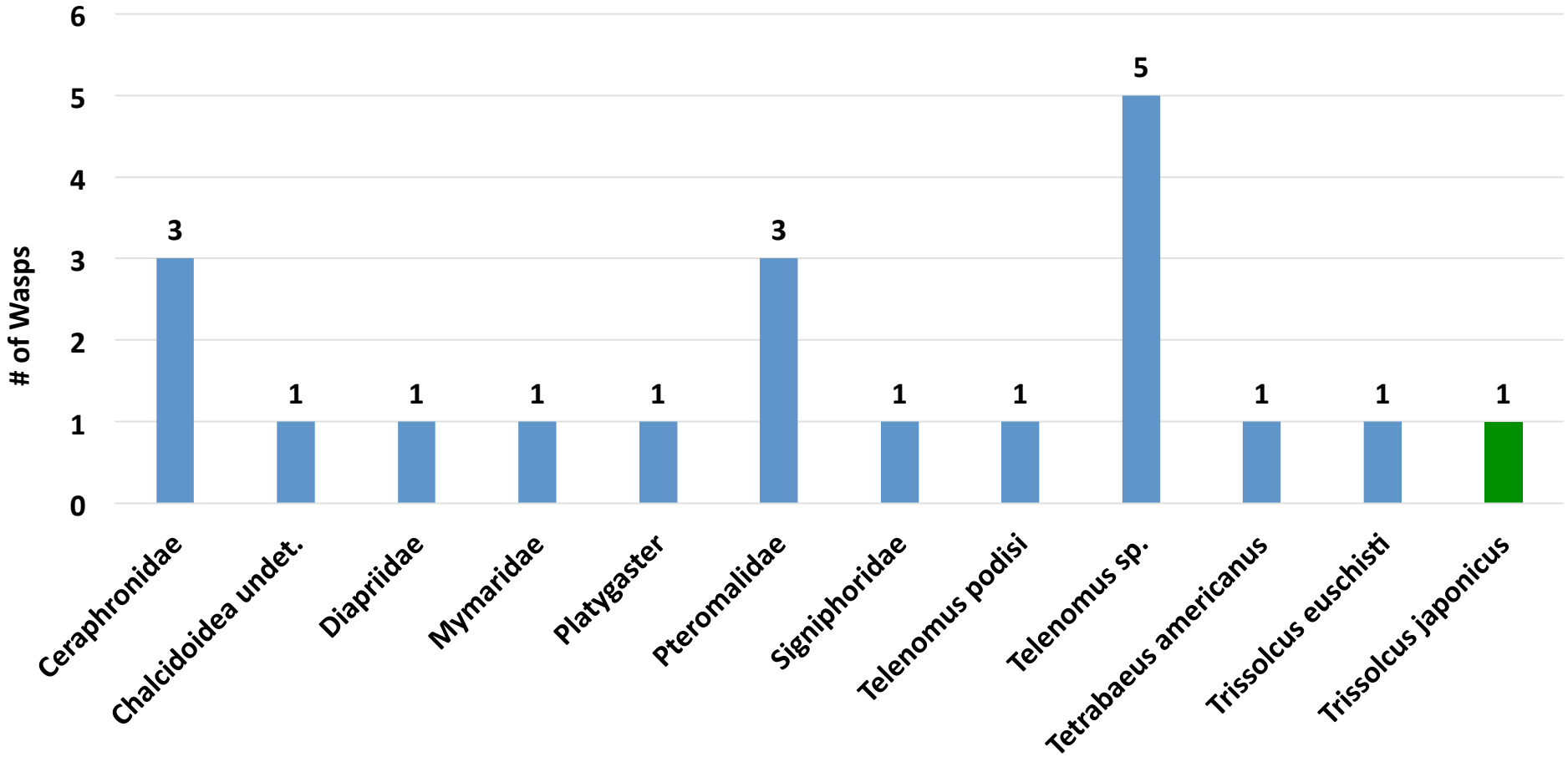
Parasitoid Survey – Eastern NY
Using Alpha Scent Cards

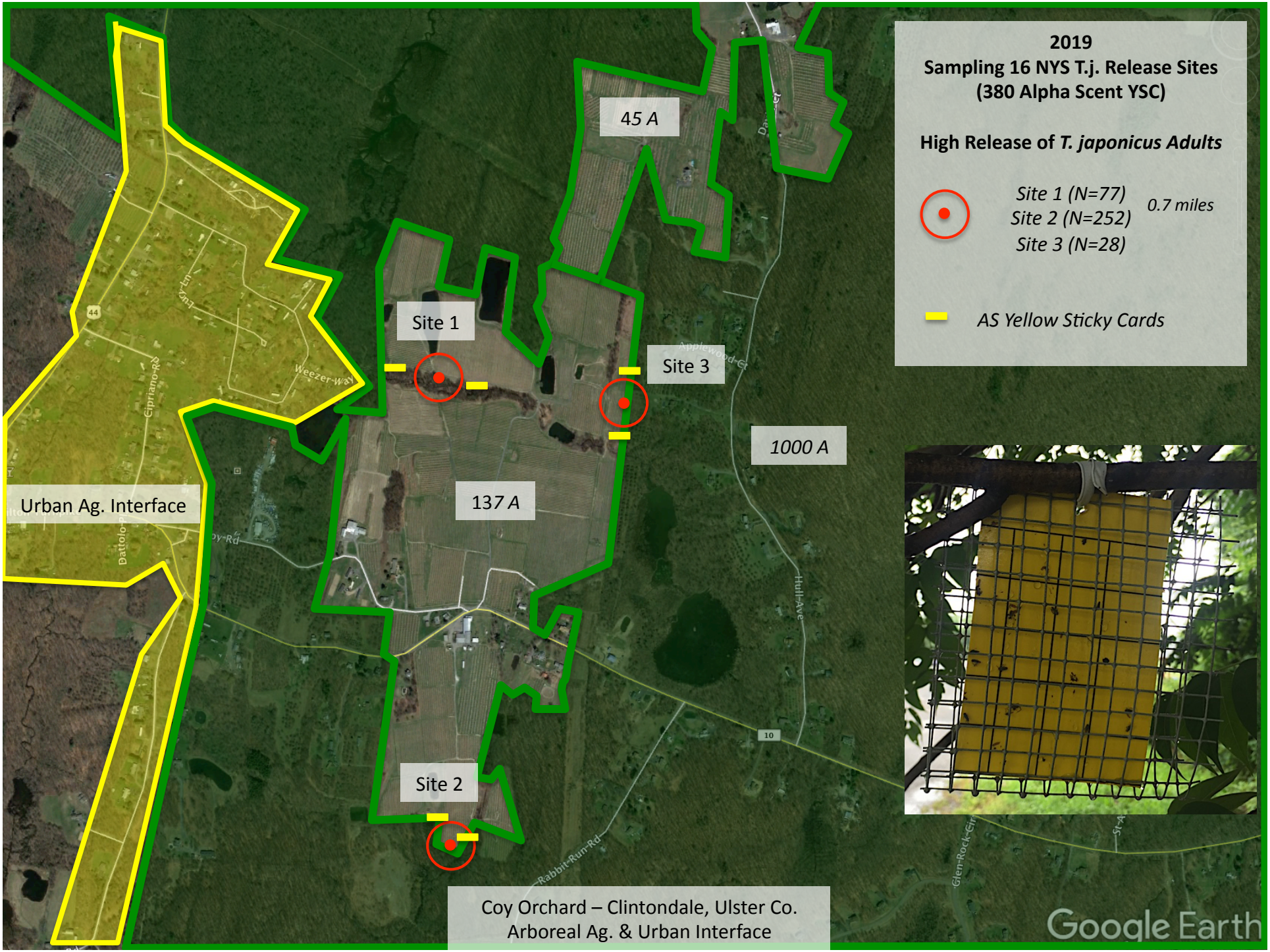
Minard Thruway High New Paltz NY
5/7 - 10/18 2018

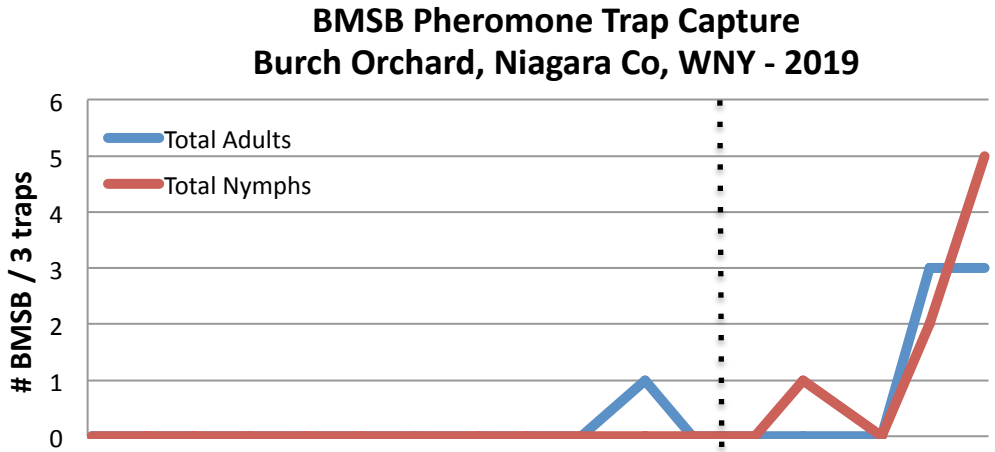


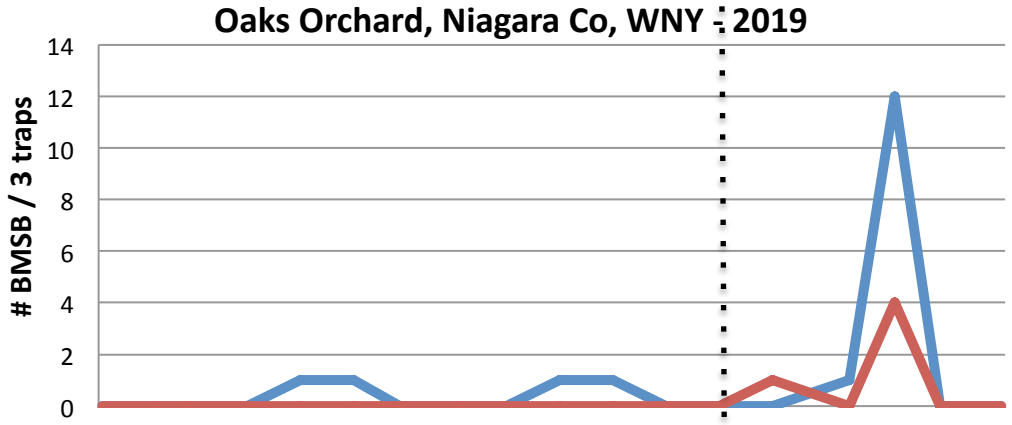
Parasitoid Survey – Eastern NY
Using Alpha Scent Cards

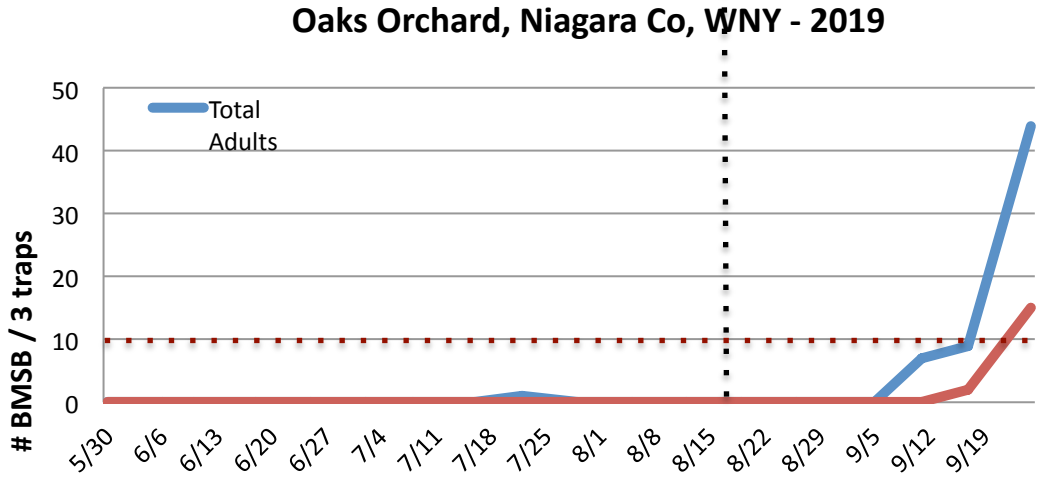
Poughkeepsie Farm Project
7/6 - 8/27 2018

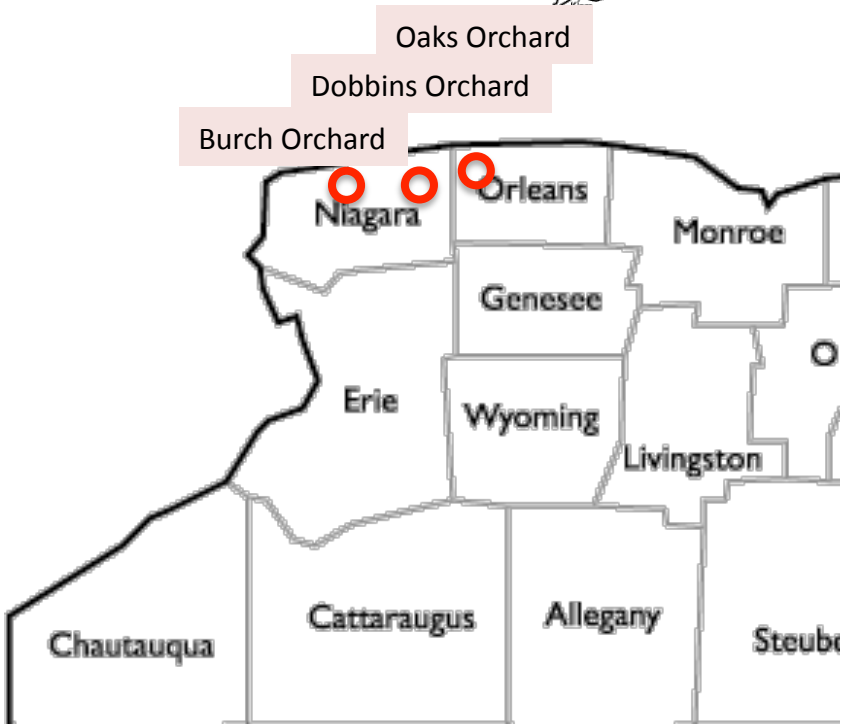



2019
Sampling 16 NYS T.j. Release Sites
(380 Alpha Scent YSC)
High Release of T. japonicus Adults
Site 1 (N=77)
Site 2 (N=252)
Site 3 (N=28)
0.7 miles
AS Yellow Sticky Cards
45 A
Site 1
Site 3
1000 A
137 A
Urban Ag. Interface
Site 2
Coy Orchard – Clintondale, Ulster Co.
Arboreal Ag. & Urban Interface
Google Earth

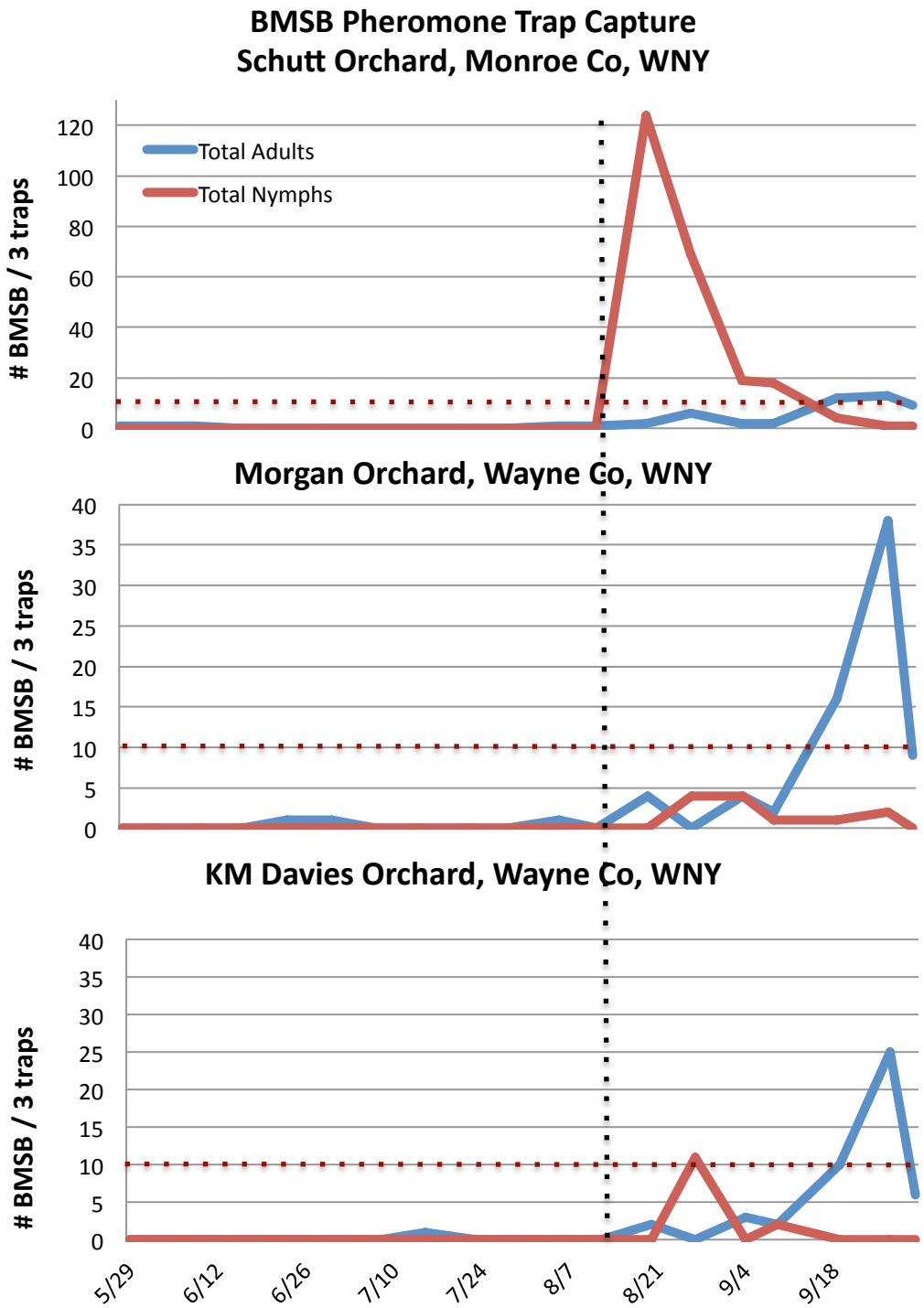


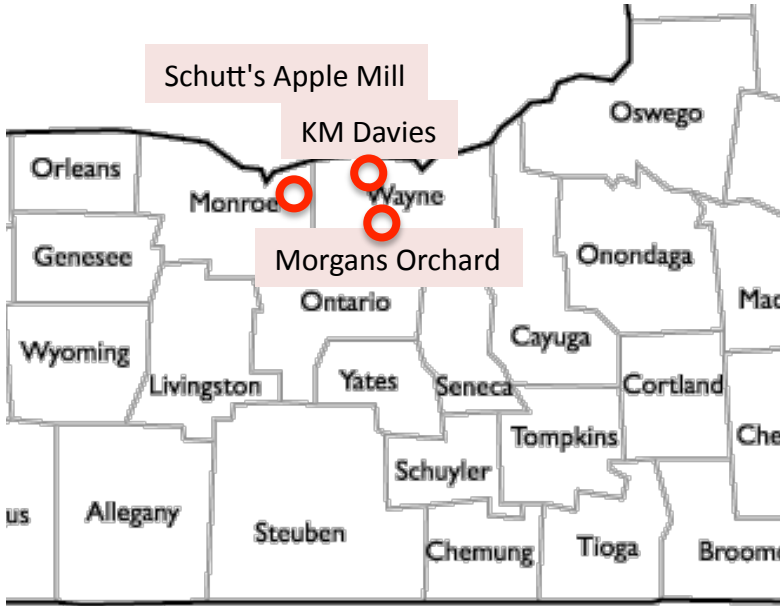




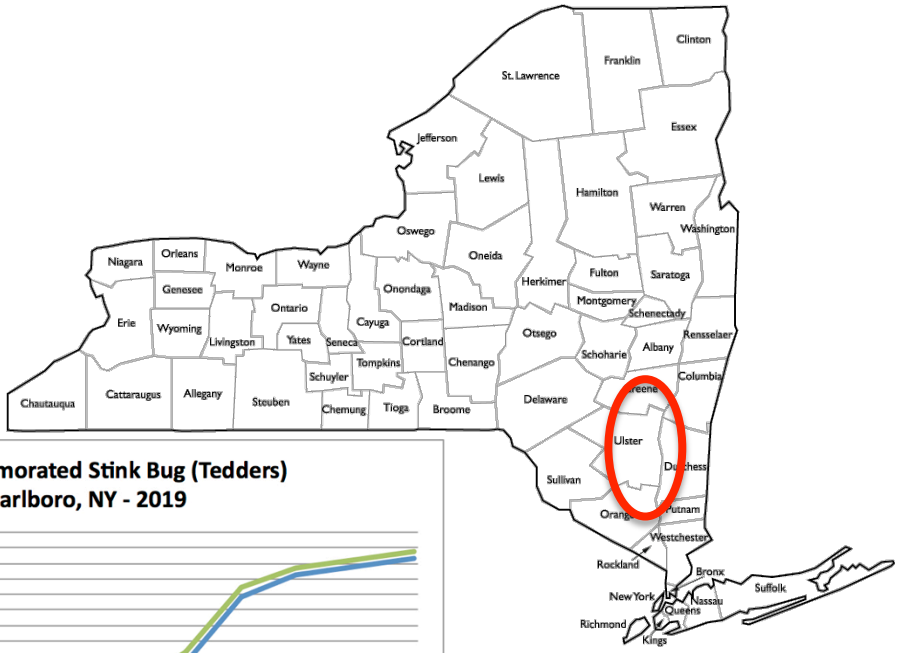


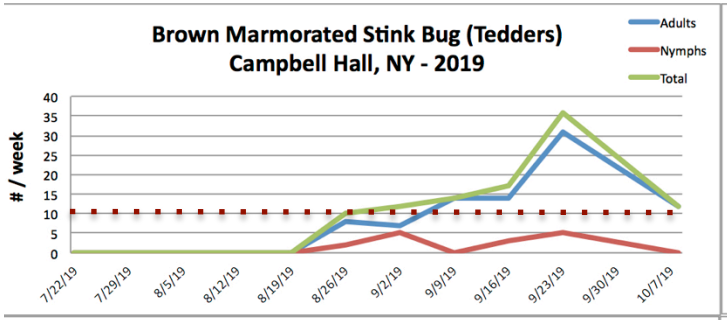
Elizabeth Tee – CCE LOFT

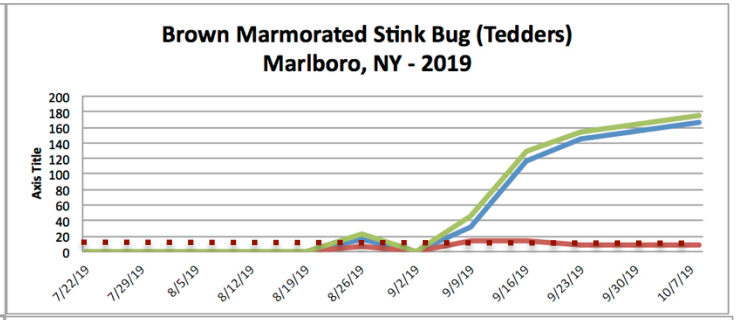


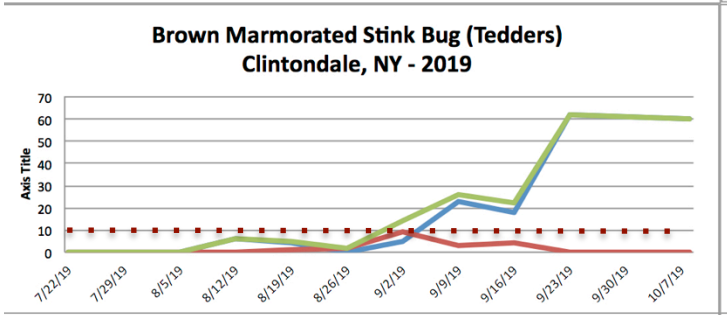


Art Agnello – Cornell AgriTech


St. Lawrence
Franklin
Clinton
Essex
Jefferson
Lewis
Hamilton
Warren
Washington
Oswego
Oneida
Herkimer
Fulton
Saratoga
Niagara
Orleans
Monroe
Wayne
Onondaga
Madison
Montgomery
Schenectady
Genesee
Ontario
Cayuga
Otsego
Rensselaer
Erie
Wyoming
Livingston
Yates
Seneca
Cortland
Schoharie
Albany
Tompkins
Chenango
Columbia
Schuyler
Greene
Chautauqua
Cattaraugus
Allegany
Steuben
Chemung
Tioga
Broome
Delaware
Ulster
Sullivan
Dutchess
Orange
Putnam
Westchester
Rockland
Bronx
Suffolk
New York
Nassau
Queens
Richmond
Kings


Brown Marmorated Stink Bug (Tedders)
Campbell Hall, NY - 2019
Adults
Nymphs
Total
/ week
7/22/19
7/29/19
8/5/19
8/12/19
8/19/19
8/26/19
9/2/19
9/9/19
9/16/19
9/23/19
9/30/19
10/7/19


Brown Marmorated Stink Bug (Tedders)
Marlboro, NY - 2019
Axis Title
7/22/19
7/29/19
8/5/19
8/12/19
8/19/19
8/26/19
9/2/19
9/9/19
9/16/19
9/23/19
9/30/19
10/7/19


Brown Marmorated Stink Bug (Tedders)
Clintondale, NY - 2019
Axis Title
7/22/19
7/29/19
8/5/19
8/12/19
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8/26/19
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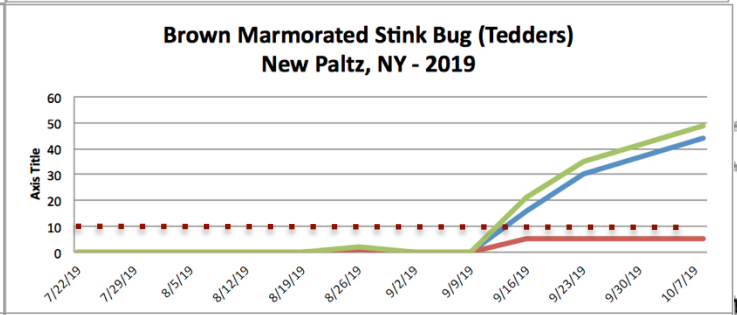
9/16/19
9/23/19
9/30/19
10/7/19


Brown Marmorated Stink Bug (Tedders)
New Paltz, NY - 2019
Axis Title
7/22/19
7/29/19
8/5/19
8/12/19
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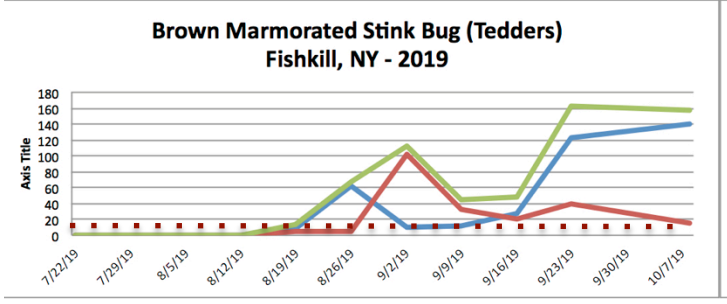
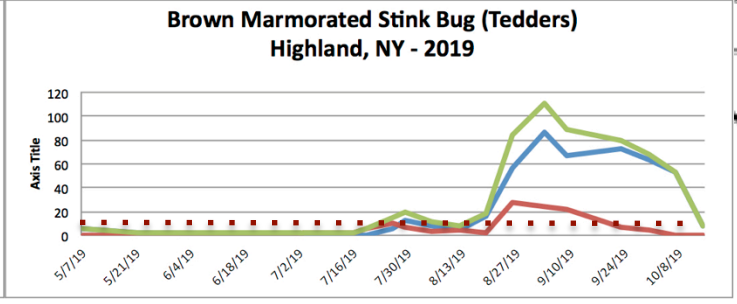
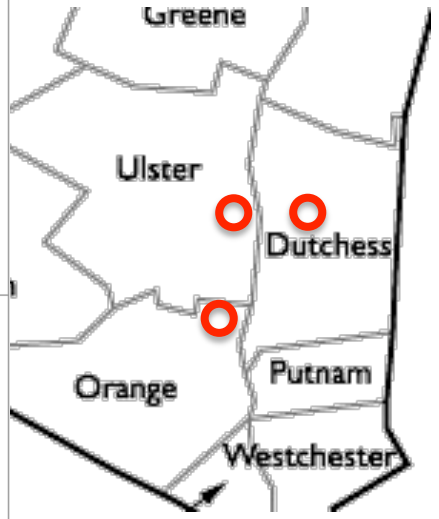
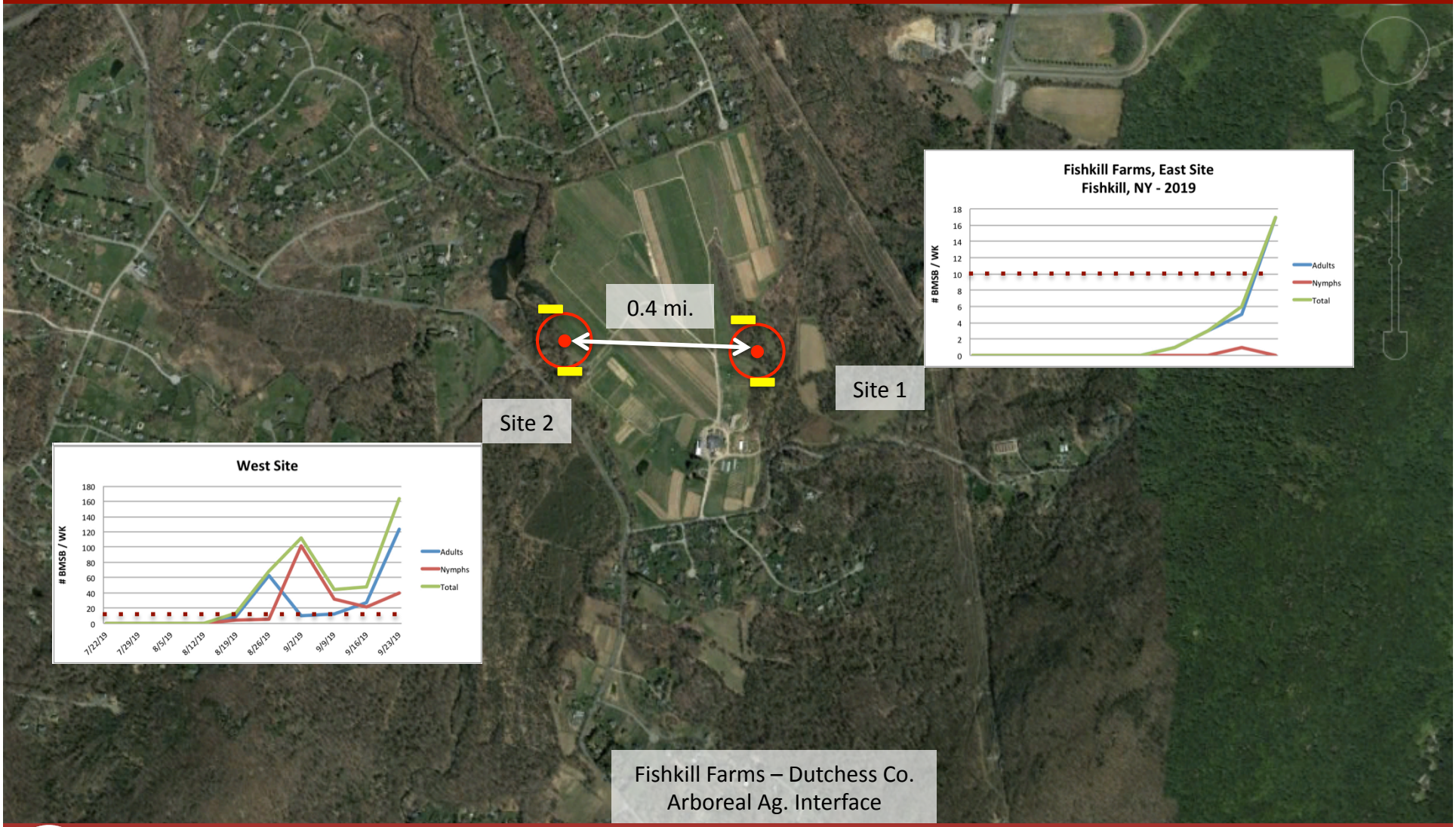
9/16/19
9/23/19
9/30/19
10/7/19


Brown Marmorated Stink Bug (Tedders)
Fishkill, NY - 2019
Axis Title
7/22/19
7/29/19
8/5/19
8/12/19
8/19/19
8/26/19
9/2/19
9/9/19
9/16/19
9/23/19
9/30/19
10/7/19


Brown Marmorated Stink Bug (Tedders)
Highland, NY - 2019
Axis Title
5/7/19
5/21/19
6/4/19
6/18/19
7/2/19
7/16/19
7/30/19
8/13/19
8/27/19
9/10/19
9/24/19
10/8/19


Greene
Ulster
Dutchess
Orange
Putnam
Westchester

Ag. Release Sites of *Trissolcus japonicus* 2017-19 Exceeding BMSB Action Threshold in Hudson Valley Orcahrds



Green & Brown Marmorated Stink Bug: Monitoring

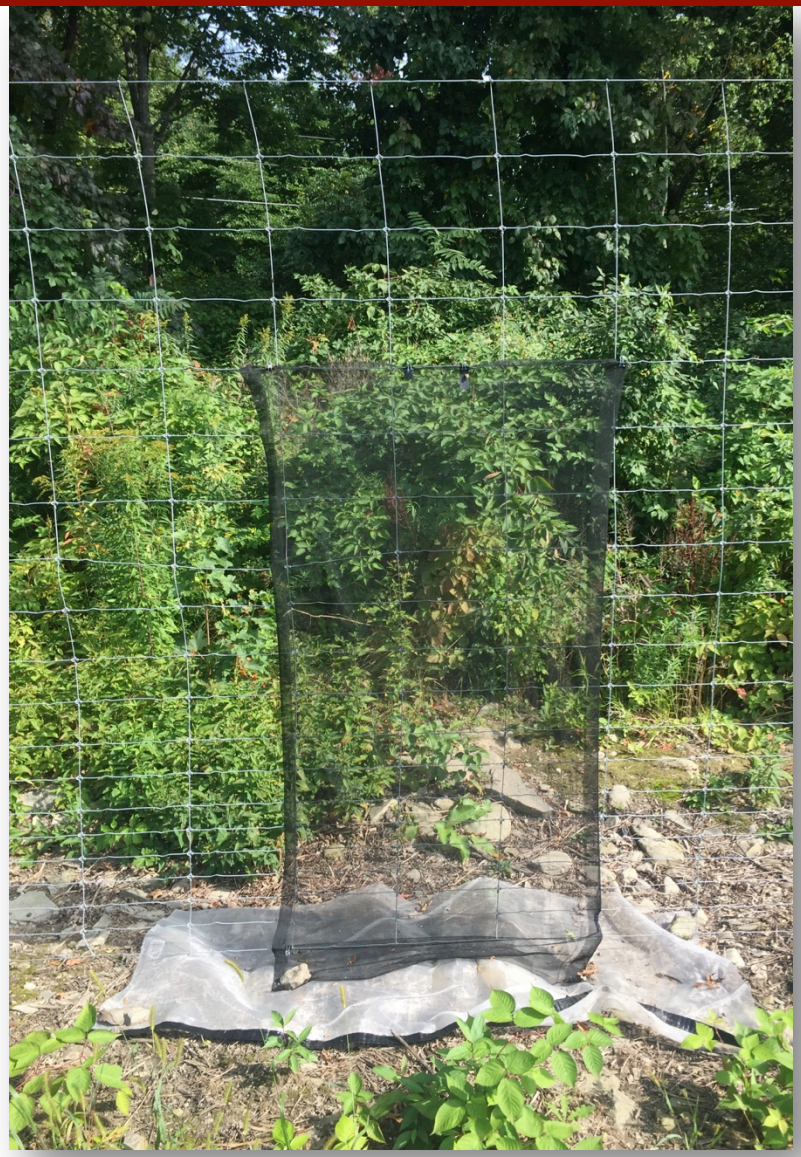
Sticky Card Trap
+ duel pheromone

Tedders Trap
+ duel pheromone

AtK Trap (Vestergaard) impregnated
piperonyl butoxide & deltamethrin
+ duel pheromone

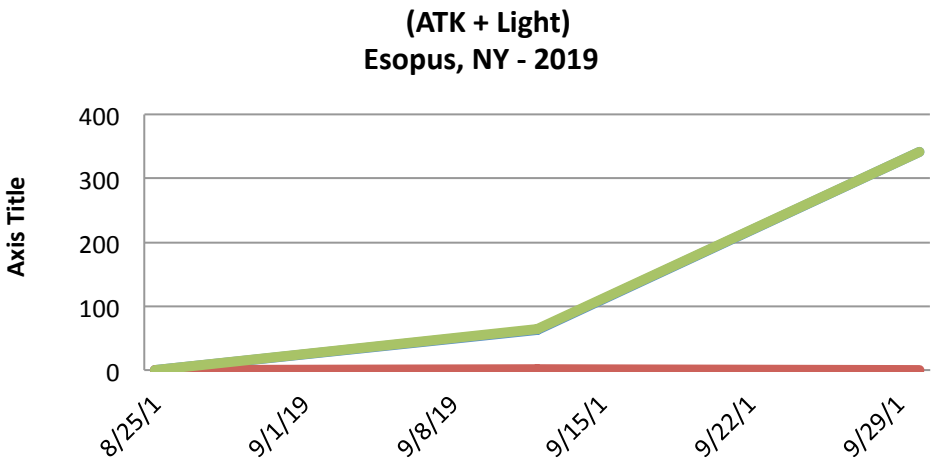
Threshold: 10 adults / trap / week

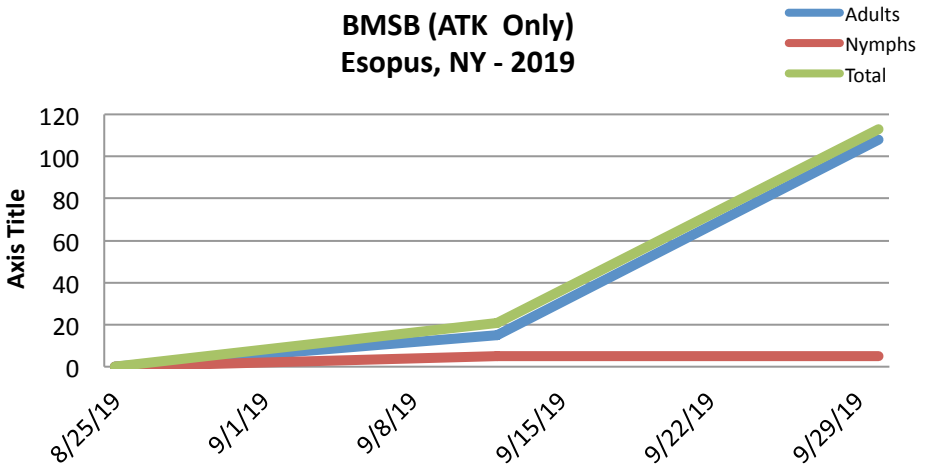
Green & Brown Marmorated Stink Bug: Monitoring

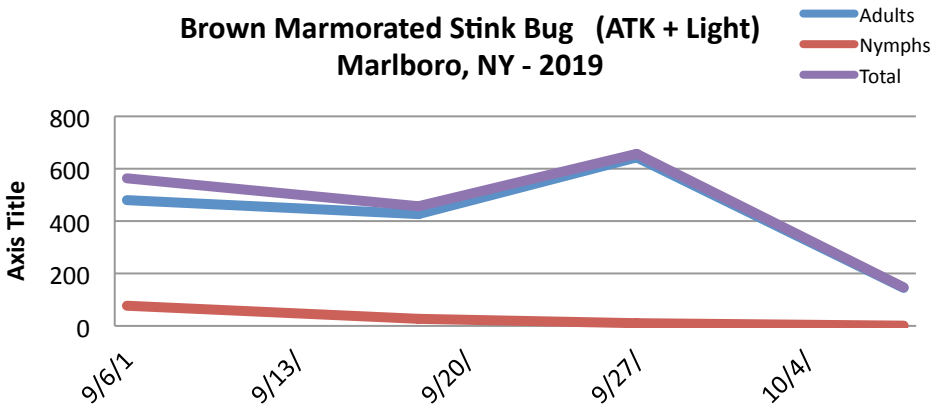


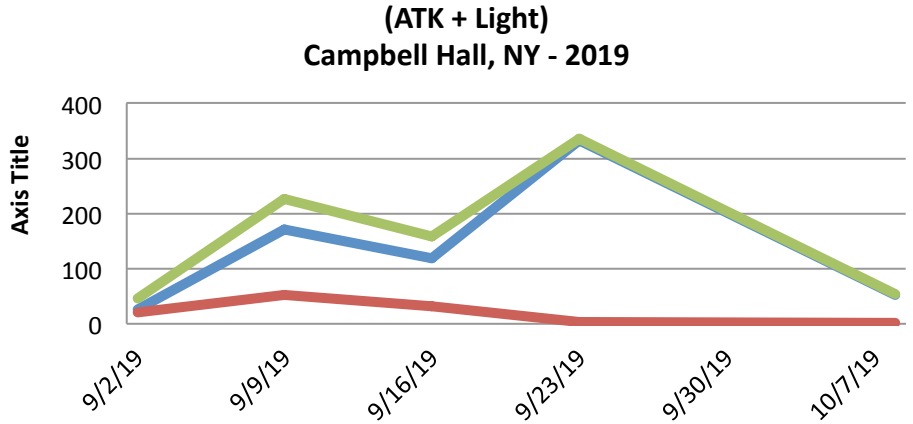
Green & Brown Marmorated Stink Bug: Monitoring

Monitoring the Stink Bug Complex
Free Standing Solar LED ATK + Phermone


(ATK + Light)
Esopus, NY - 2019
Axis Title
400
300
200
100
0
8/25/1
9/1/19
9/8/19
9/15/1
9/22/1
9/29/1


BMSB (ATK Only)
Esopus, NY - 2019
Adults
Nymphs
Total
Axis Title
120
100
80
60
40
20
0
8/25/19
9/1/19
9/8/19
9/15/19
9/22/19
9/29/19


Brown Marmorated Stink Bug (ATK + Light)
Marlboro, NY - 2019
Adults
Nymphs
Total
Axis Title
800
600
400
200
0
9/6/1
9/13/
9/20/
9/27/
10/4/


(ATK + Light)
Campbell Hall, NY - 2019
Axis Title
400
300
200
100
0
9/2/19
9/9/19
9/16/19
9/23/19
9/30/19
10/7/19

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