Establishing the parasitoid wasp, Trissolcus japonicus, (Hymenoptera: Scelionidae) in York State

Trissolcus japonicus

79th Annual New England New York, Canada Fruit Pest Management Workshop
Tuesday-Wednesday, October 24th – 25th , 2017
Bishop Booth Center, Burlington, VT

Peter Jentsch	*Art Agnello*	*Tessa Grasswitz*	*Debbie Breth*
CALS - HVRL	*CALS - NYSAES*	*CCE-LOFT*	*CCE-LOFT Ret.*

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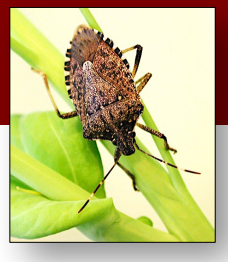


Background

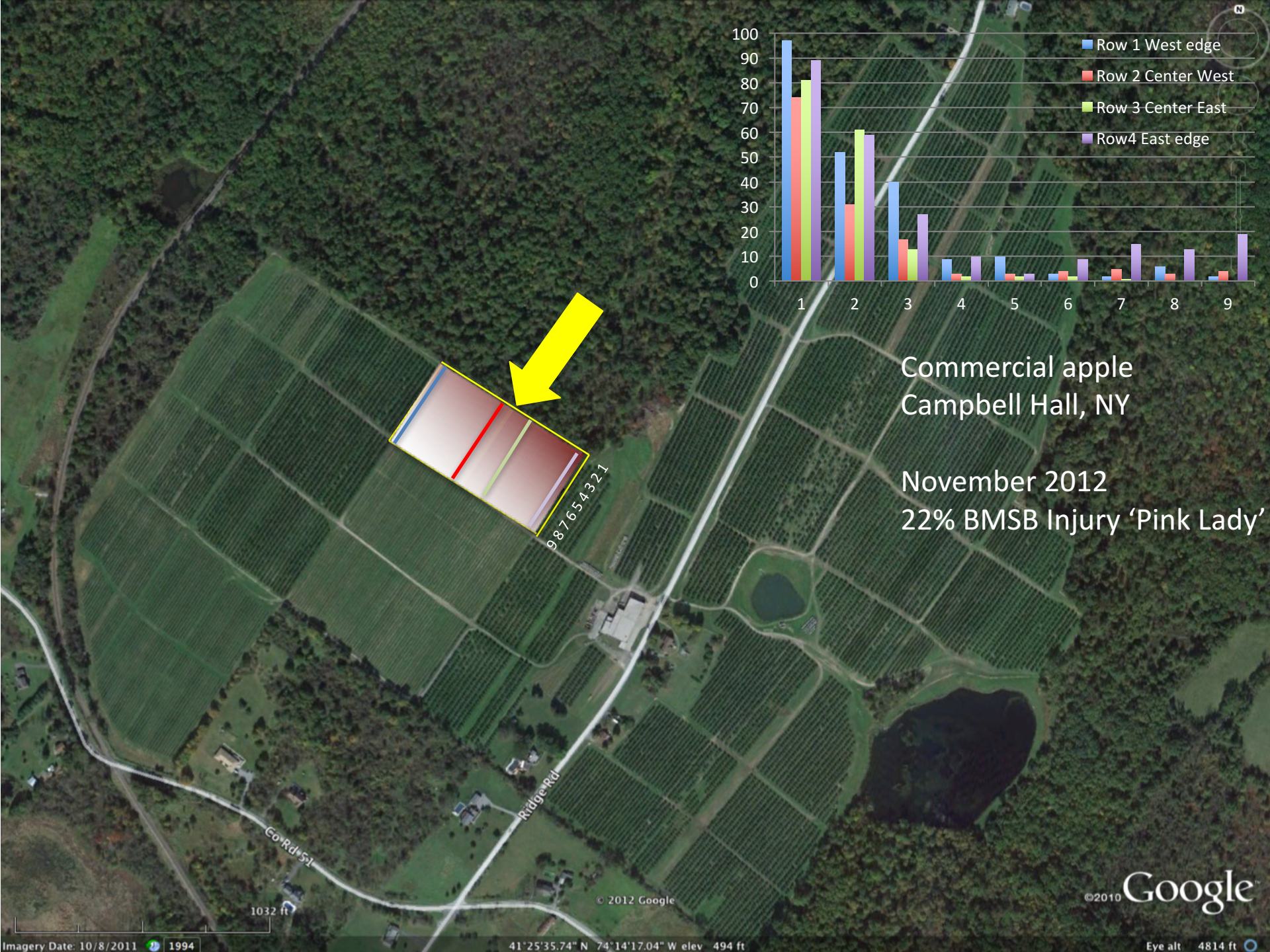
- Brown Marmorated Stink Bug first detected in
  Allentown, PA in 1998, confirmed in 2001 (Hoebeke and Carter 2003)
  Cornell student insect collection in 2007, Hudson Valley in 2008.

- Arboreal insect resides in woodlands, feeds on leaves, stems, nuts, fruit.

- Ag. losses from BMSB occurs during drought, 2nd gen. high populations.

- Moves from woodland & hedgerows to Ag. crop edge.

Pink Lady 2012


100
90
80
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60
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1
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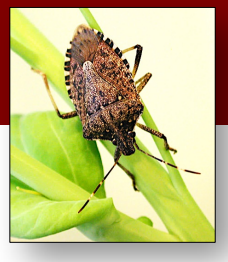
Row 1 West edge
Row 2 Center West
Row 3 Center East
Row4 East edge
987654321
Commercial apple
Campbell Hall, NY
November 2012
22% BMSB Injury 'Pink Lady'
Co Rd 51
Ridge Rd
1032 ft
© 2012 Google
©2010 Google
Imagery Date: 10/8/2011
1994
41°25'35.74" N 74°14'17.04" W elev 494 ft
Eye alt 4814 ft


BMSB in Jalapeño Pepper
Mid-August, 2013, Marlboro, NY
15% feeding injury
Averaging 4 nymphs per plant

Establishing the parasitoid wasp, Trissolcus japonicus, (Hymenoptera: Scelionidae) in York State



Background:

- Brown Marmorated Stink Bug first detected in Allentown, PA in 1998, confirmed in 2001 (Hoebeke and Carter 2003) Cornell student insect collection in 2007, Hudson Valley in 2008.

- Kim Hoelmer, USDA-ARS, Newark DE, Beneficial Insects Introduction Research Lab. In 2007 he surveyed natural enemies of BMSB in Asia, returning with live parasitoid specimens, held in U.S. quarantine facilities.

- *Trissolcus japonicus* found to highly successful with parasitism of *H. halys* eggs reported to be as high as 80% in China (Talamas et al. 2013).

Establishing the parasitoid wasp, Trissolcus japonicus, (Hymenoptera: Scelionidae) in York State

- In choice and non-choice tests of parasitoid wasps species found *Trissolcus japonicus to be* **highly effective,** parasitizing 60-100% of the eggs in BMSB clusters.

- *T. japonicus is* **highly specific** in choice tests, choosing BMSB over other pentatomid eggs. However, in *non-choice* tests *T. japonicus* will oviposit into the eggs of the predatory spined soldier bug, *Podisus maculiventris* (Say).

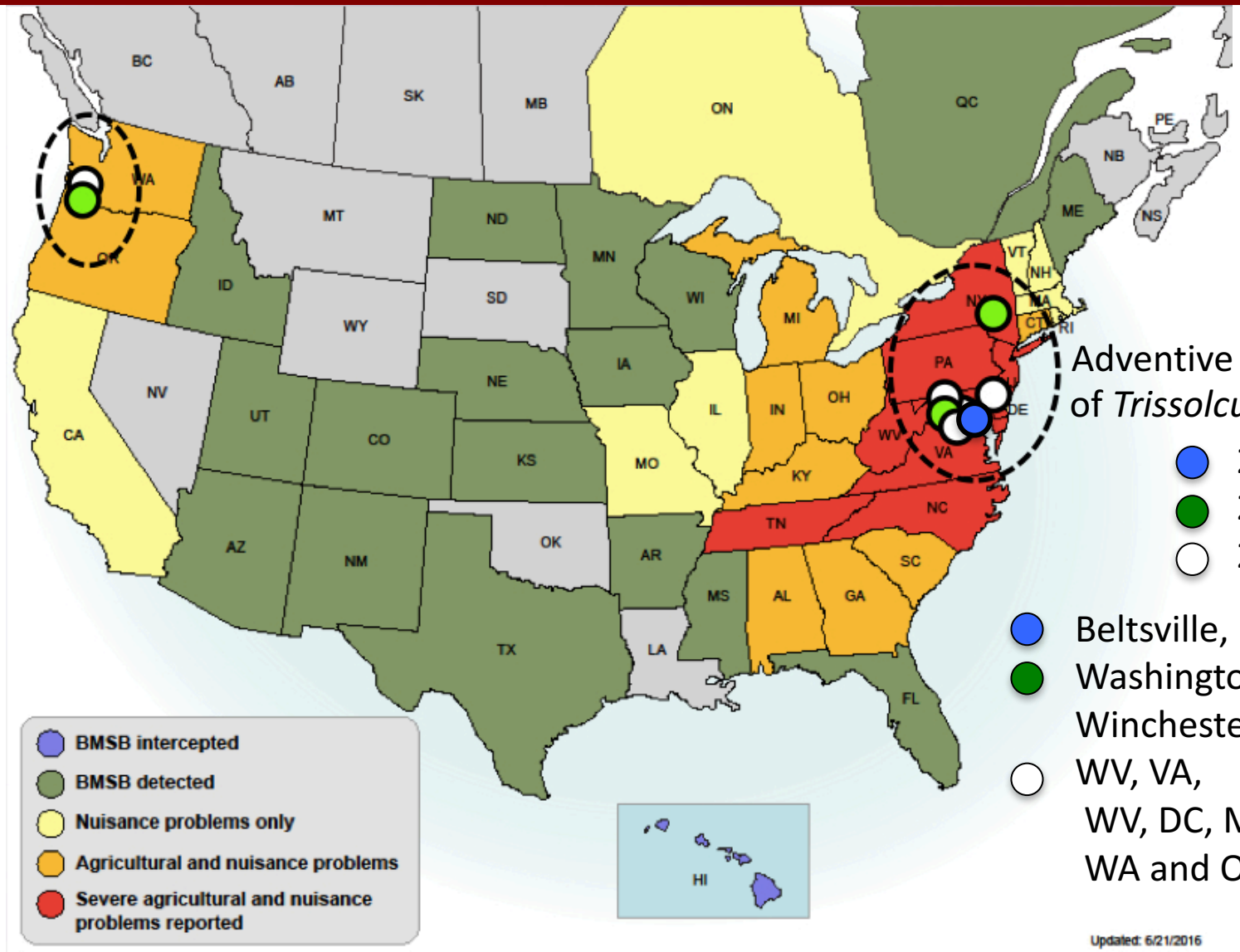
Establishing the parasitoid wasp, Trissolcus japonicus, (Hymenoptera: Scelionidae) in York State

- Using sentinel eggs of BMSB, **adventive** populations of *T. japonicus* were found 2014 in Beltsville, MD.

- The following year *T. japonicus* were also found in Washington, DC and Winchester, VA,.

- In 2016, *T. japonicus was also found* in VA, WV, MD, DE NJ and NY in the East, and WA and OR in the West.

Adventive populations of *Trissolcus japonicus* discovery from Sentinel Egg Mass Survey



Trissolcus japonicus Release Sites of the Brown Marmorated Stink Bug in NY State

* Adventive specimens of *T. japonicus* from the US were sent to Marie-Claude Bon in USDA-ARS European Biological Control Laboratory (Montpellier, France)

* DNA from submitted *T. japonicus* specimens was extracted and characterized using 23 microsatellite gene markers from thirteen different Asian *T. japonicus* populations, including those in quarantine in the U.S. and others collected in Asia in 2012-2013 by Kim Hoelmer's team at the USDA-ARS Beneficial Insects Introduction Research Laboratory (Newark, DE).

* It was determined none of the adventive finds originated from the populations held in quarantine (unpubl.), and thus represented independent introductions of *T. japonicus.*

(E. Beers. PROC. ENTOMOL. SOC. WASH. 118(3), 2016, pp. 466–470)

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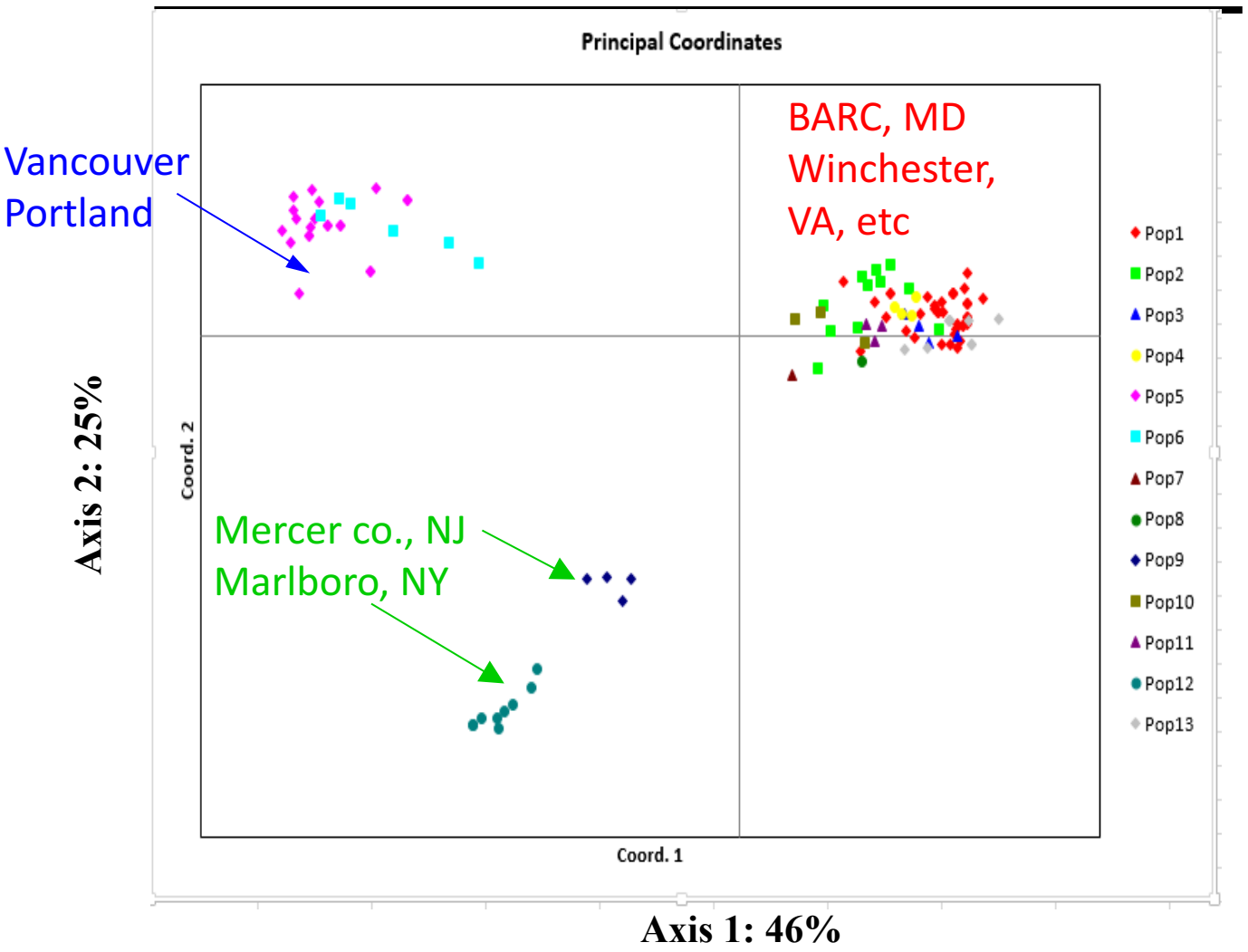
Principale Coordinate Analysis (PCoA)- 115 spécimens recovered in US génotype

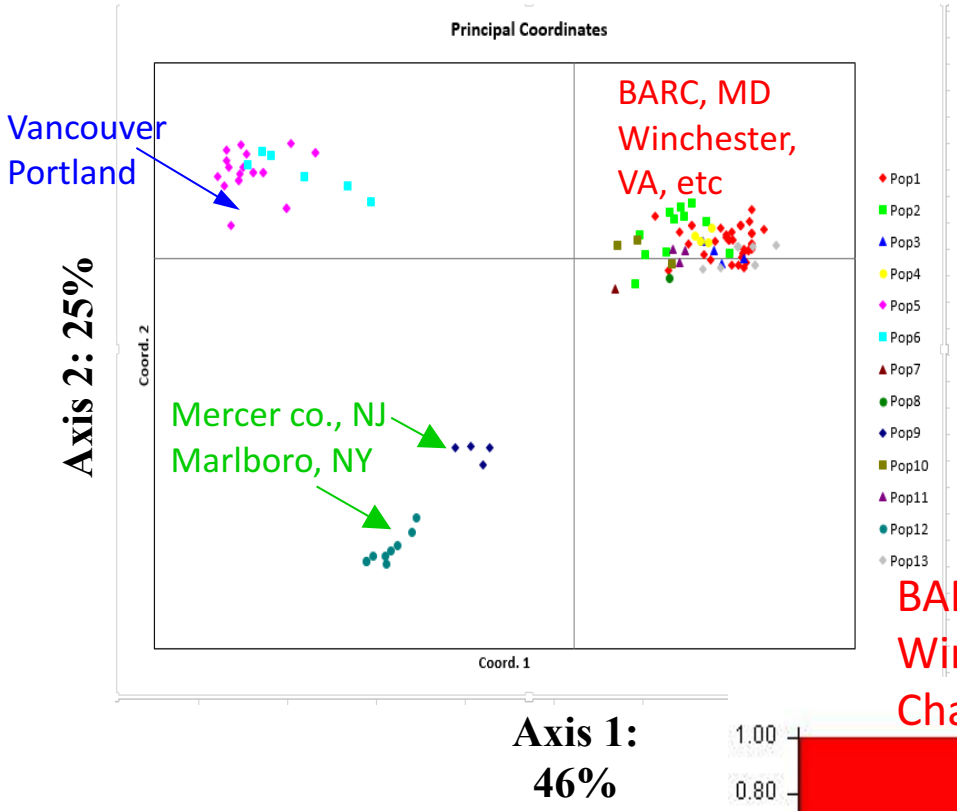


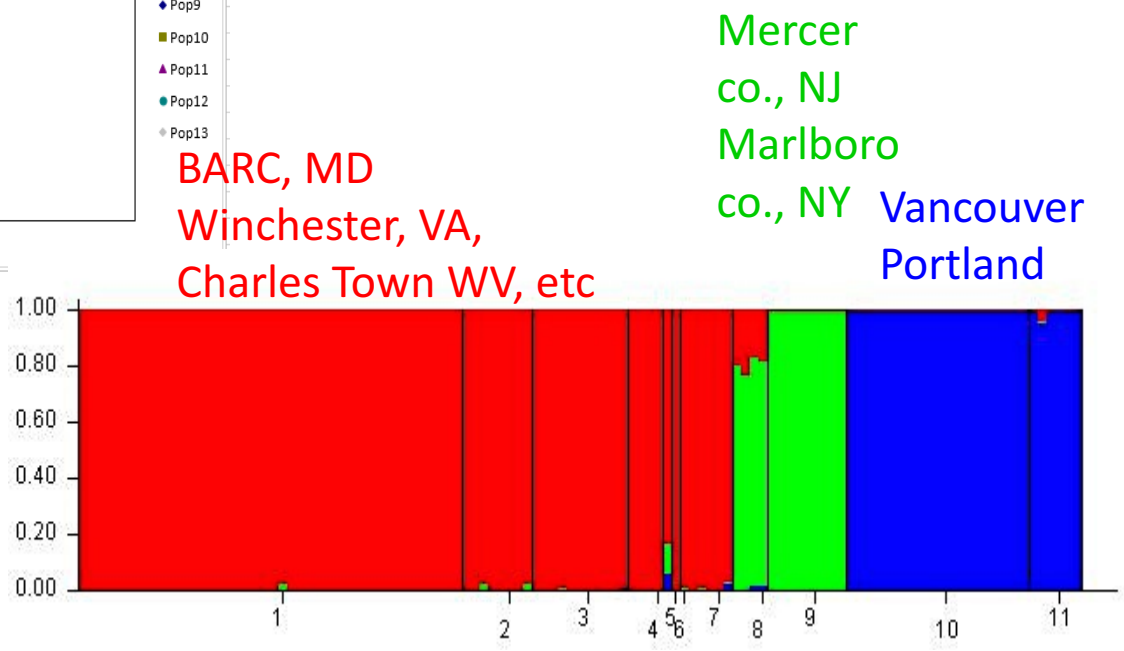
Axis 1: Split between Western and 2 Eastern populations and all the others

Axis 2: Split between Western and the 2 Eastern populations

Dr. Marie-Claude Bon at the USDA-ARS European Biological Control Laboratory (Montpellier, France)
DNA specimen extractions employing 23 microsatellite gene markers to differentiate genotypes .

Bayesian clustering approach

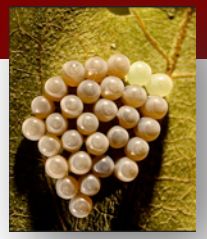




With K=3

Dr. Marie-Claude Bon at the USDA-ARS European Biological Control Laboratory (Montpellier, France)
DNA specimen extractions employing 23 microsatellite gene markers to differentiate genotypes .

Sentinel *H. halys* Egg Production and Deployment



- **Production of BMSB sentinel egg clusters:**
- Maintained a laboratory colony of BMSB to supply egg masses for the sentinel surveys of egg parasitoids.
- BMSB adults were held in a rearing cage at room temperature (21-27 ° C, 60% humidity, 16:8 L:D photoperiod)
- Adults were fed *A. altissima* stems and leaves, Jalapeño pepper plants, stems and leaves, shelled sunflower seeds, green beans changed every 3-4d.
- Egg masses were deposited onto and collected from foliage every 48-72h. frozen (-80 ° C) and kept frozen up to 300d. before deployment.

Field Deployment of Sentinel Egg Masses.

- Seven WNY sentinel sites and 2 ENY sites were selected to survey for parasitoids in 2017.
- Sentinel eggs were attached to hosts of BMSB

NYS DEC Liberation of Wildlife Permit

After in-depth review of applicable provisions of the Environmental Conservation Law (ECL) and Codes, Rules and Regulations of the State of New York (NYCRR), **DEC has concluded that its regulatory authority extends to the issuance of permits for the release of specifically defined species of wildlife and listed endangered, threatened, and/or invasive species.** Wildlife is defined in ECL S 1 1-0103. Endangered and threated species are identified in 6 NYCRR Part 182, and listed **invasive species are identified in 6 NYCRR Part 575.**

DEC has recently concluded that their statutory and regulatory framework around the Liberation of Wildlife Permit regulating release of biologicals such as insects does not generally apply to releasing insects into the wild, so long as the proposed release is not of an insect that is listed on either the endangered or invasive species listings.

Upon review by the DEC, the adventive *T. japonicus population does not require a* license or permit from DEC to undertake the movement and release of the Samurai wasp, as it is not listed within 6 NYCRR 575.

Establish Baseline Survey of Native and Invasive Parasitoids in New York State

Phase 1

Sentinel Egg Survey

- **July 28th – Oct 1st :** Weekly placement of eggs
- Eggs to cooperators using overnight shipping
- Placement in Wayne, Orleans, Ontario, Columbia, Ulster, Dutchess counties
- Re-collection of eggs sent and reared at the HVRL, placed in petri dishes and held in a controlled environment chamber at 25°C after 5-7d
- Eggs were monitored for hatch of stink bugs or emergence of parasitoids, identified by E. Talamas.
- Adults parasitoids reared from sentinel egg masses given a 90% honey-water solution droplets on dish

Placement Sites of *H. halys eggs* in New York State (N=10 Farms, 3-24 clusters/wk.)

Farm	Town	County	PlacHost Plant	Latitude	Longitude
Schutt Orchard	Webster	Monroe	Acer saccharum (*sugar maple)*	43°11'3.78"N	77°26'56.76"W
Windmill Orchard	Ontario	Ontario	Acer saccharum (*sugar maple)*	43°15'50.27"N	77°22'35.32"W
KM Davies	Williamson	Wayne	Acer saccharum (*sugar maple)*	43°14'10.54"N	77°11'23.63"W
Wooded	Holley	Orleans	Juglans nigra (Black Walnut)	43°14'0.42"N	78° 1'10.46"W
Wooded	Lyndonville	Orleans	Malus sp. (crab apple)	43°19'33.63"N	78°22'23.50"W
Wooded	Medina	Orleans	Ailanthus altissima Tree of Heaven	43°12'1.79"N	78°23'36.81"W
Hepworth Farms	Marlboro	Ulster	Robinia pseudoacacia (Black Locust)	41°40'14.72"N	74° 5'11.21"W
Hepworth Farms	Marlboro	Ulster	Ailanthus altissima Tree of Heaven	41°40'14.72"N	74° 5'11.21"W
Crist Orchard	Walden	Orange	Ailanthus altissima Tree of Heaven	41°33'2.64"N	74° 9'50.72"W
Minard Orchard	New Paltz	Ulster	Vitis sp. (wild grape)	41°42'1.47"N	74° 4'24.13"W

Biological Control of the Brown Marmorated Stink Bug in New York State

2017 Sentinel Egg Emergence

Native

Trissolcus euschisti (6/23) (N=1)

Telenomus podisi (6/30) (N=3)

Asian Invasive

Trissolcus japonicus (7/7) in Marlboro, Ulster Co. (N=96)

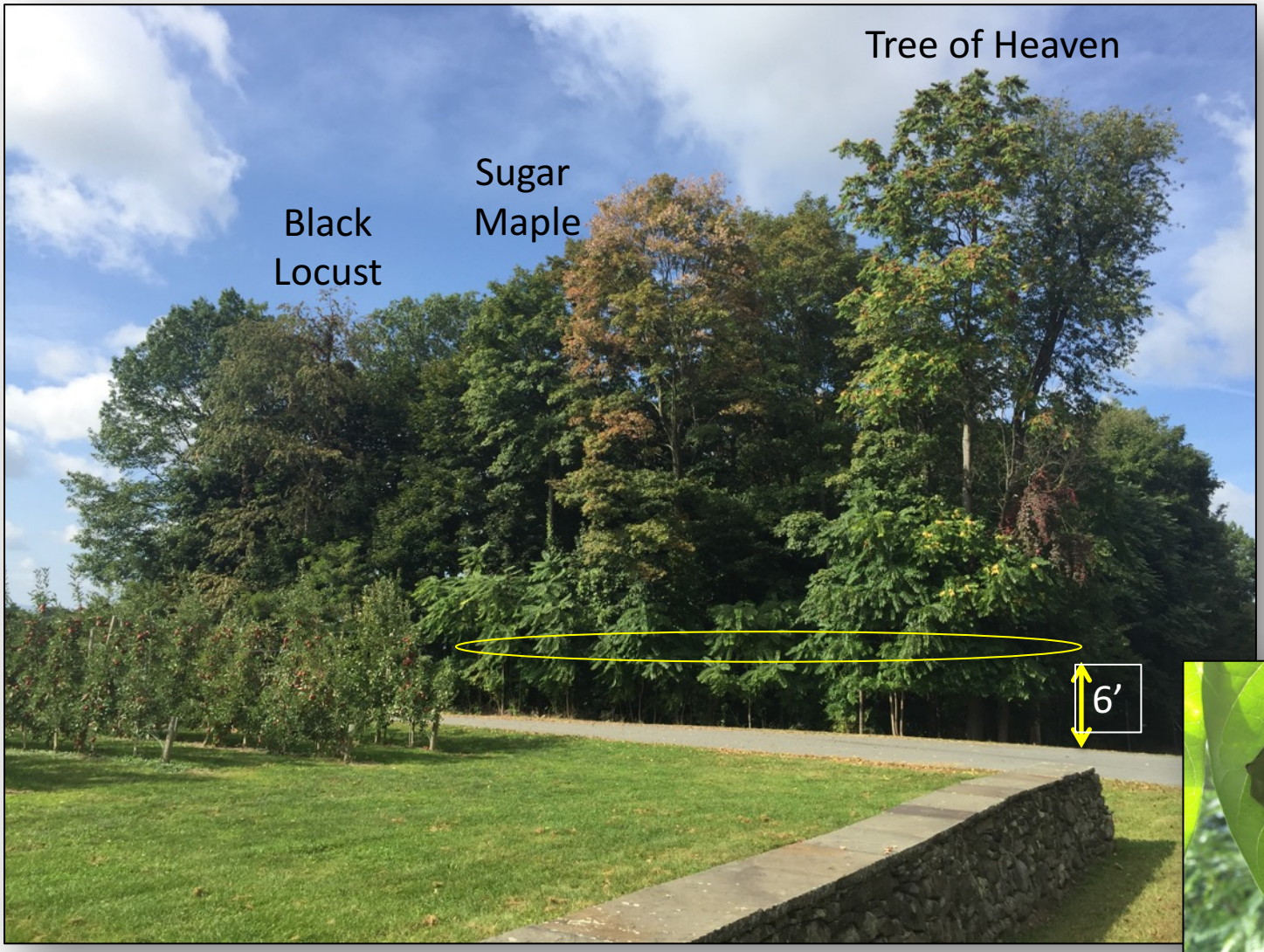
Trissolcus japonicus Release Sites of the Brown Marmorated Stink Bug in New York State

Phase II
Place Parasitized Eggs Parasitoid Release

T. Japonicus Egg Placement

- 1st captured adventive *T. japonicus* from Hepworth Farms in Marlboro, NY on July 7th 2017.
- Wasps reared and used to parasitize frozen BMSB eggs.
- 1st parasitized eggs sent to cooperators beginning on 15th September.
- Parasitized eggs placed onto 32 sites, on 25 farms in 5 NY counties.

Brown Marmorated Stink Bug: Biological Control Release Sites

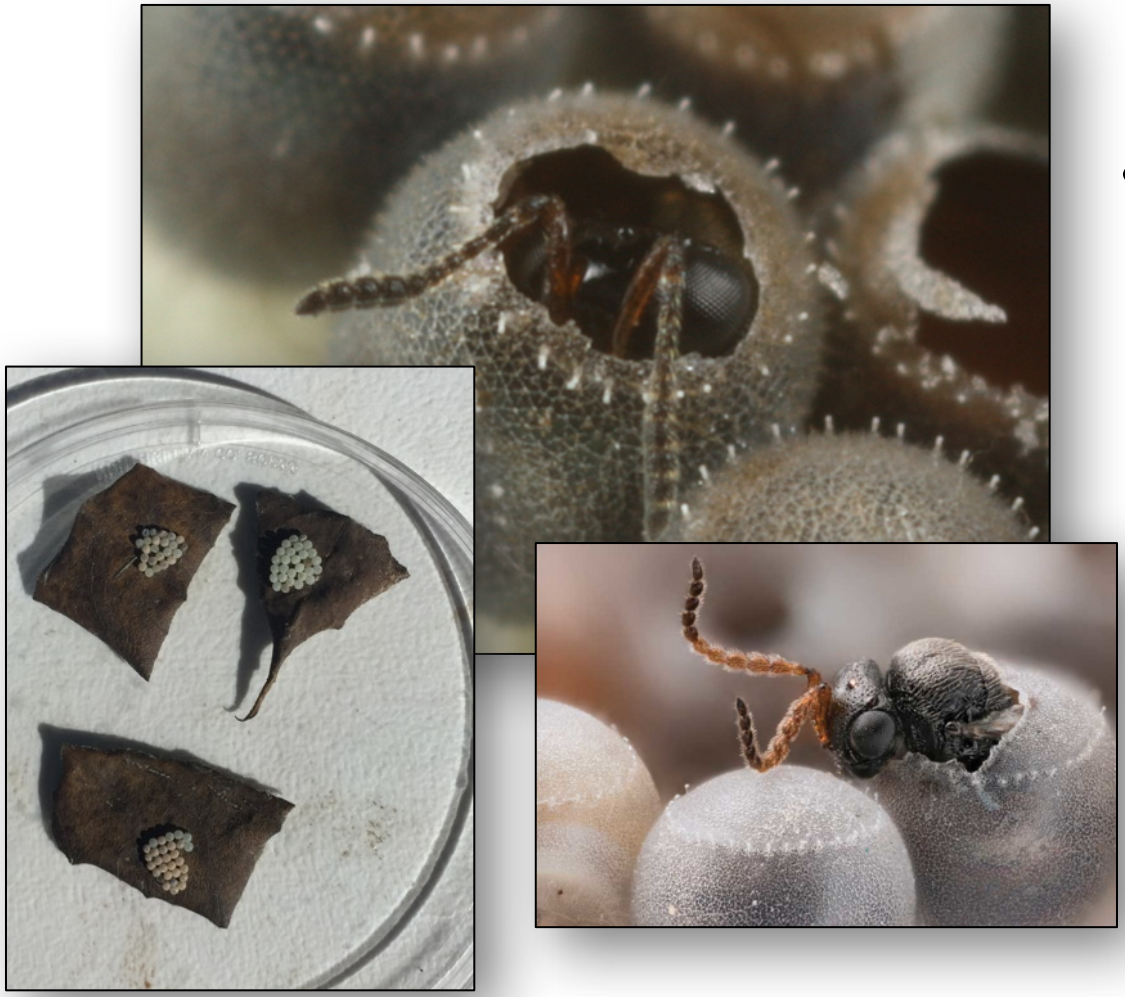


Placement Sites of *T. Japonicus parasitized eggs* in New York State (N=24 Farms, 32 sites, 87 clusters; ≈ 2300 eggs)

Site	Farm	Town	County	Date	Clusters	Eggs	Placement / Host Plant	Latitude	Longitude
1	Schutt Orchard	Webster	Monroe	15-Sep	3	78	Acer saccharum (*sugar maple)*	43°11'3.78"N	77°26'56.76"W
2	Holley	Holley	Orleans	22-Sep	3	84	Bmack Walnut	43°14'0.42"N	78° 1'10.46"W
3	Hurds Orchard	Modena	Ulster	22-Sep	3	89	Vitis riparia (Native grape)	41°41'25.15"N	74° 4'3.51"W
4	Minard Orchard	New Paltz	Ulster	22-Sep	3	76	Vitis riparia (Native grape)	41°42'1.57"N	74° 4'24.22"W
5	Minard Orchard	Clintondale	Ulster	22-Sep	3	72	Acer saccharum (*sugar maple)*	41°41'32.91"N	74° 3'18.67"W
6	Crist Brothers	Walden	Orange	22-Sep	2	54	A. altissima (Tree of Heaven)	41°33'1.34"N	74° 9'36.77"W
7	Hepworth Farms	Gardener	Ulster	23-Sep	3	74	Robinia pseudoacacia (Black Locust)	41°40'14.72"N	74° 5'11.21"W
8	Ochs Orchard	Warwick	Orange	23-Sep	2	56	A. altissima (Tree of Heaven)	41°13'55.83"N	74°22'0.66"W
9	Pennings Orchard	Warwick	Orange	23-Sep	2	56	A. altissima (Tree of Heaven)	41°13'52.59"N	74°23'11.62"W
10	Fishkill Farms	Fishkill	Dutchess	24-Sep	3	73	Robinia pseudoacacia (Black Locust)	41°31'12.02"N	73°49'40.04"W
11	Fix Brothers Orchard	Hudson	Columbia	24-Sep	2	56	Vitis riparia (Native grape)	42°11'6.33"N	73°49'47.25"W
12	Fix Brothers Orchard	Hudson	Columbia	24-Sep	2	54	A. altissima (Tree of Heaven)	42°11'16.36"N	73°49'58.86"W
13	Porpiglia / Weed Orchards	Marlboro	Ulster	24-Sep	2	56	Rhus sp. (Sumac)	41°38'13.67"N	74° 0'24.57"W
14	Crist Brothers	Milton	Ulster	24-Sep	3	78	A. altissima (Tree of Heaven)	41°39'4.29"N	73°59'33.93"W
15	Crist Brothers	Milton	Ulster	24-Sep	3	74	Robinia pseudoacacia (Black Locust)	41°38'43.94"N	73°59'24.84"W
16	L. Clarke Pear Orchard	Modena	Ulster	24-Sep	2	59	A. altissima (Tree of Heaven)	41°40'1.19"N	74° 7'44.19"W
17	Meads Orchard	Red Hook	Dutchess	24-Sep	3	73	A. altissima (Tree of Heaven)	42° 3'14.98"N	73°50'55.49"W
18	Migliorelli Farm	Tivoli	Dutchess	24-Sep	3	72	Robinia pseudoacacia	42° 2'56.09"N	73°52'59.69"W
19	Yonder Farms	Valatia	Columbia	24-Sep	2	59	A. altissima (Tree of Heaven)	42°14'48.18"N	73°43'25.07"W
20	Hudson Valley Fruit Distributers	Milton	Ulster	26-Sep	3	87	Acer saccharum (*Sugar Maple)*	41.6443N	73.9685W
21	Poughkeepsie Farm Project site	Poughkeepsie	Dutchess	28-Sep	3	76	A. altissima (Tree of Heaven)	41°40'40.28"N	73°53'50.91"W
22	Crist, Coy Orchard	Clintondale	Ulster	29-Sep	3	82	Acer saccharum (*Sugar Maple)*	41°40'39.00"N	74° 3'19.43"W
23	Crist, Coy Orchard	Clintondale	Ulster	29-Sep	3	84	Vitis riparia (Native Grape)	41°40'24.16"N	74° 3'30.29"W
24	Gunk House	Highland	Ulster	29-Sep	3	84	A. altissima (Tree of Heaven)	41°41'59.76"N	74° 3'7.90"W
25	Brad Clarke Organic	Modena	Ulster	29-Sep	2	58	Robinia pseudoacacia (Black Locust)	41°40'6.74"N	73°59'39.28"W
26	Dressel's Orchard	New Paltz	Ulster	29-Sep	3	81	Juglans nigra (eastern black walnut)	41°42'43.82"N	74° 6'48.75"W
27	Dressel's Orchard	New Paltz	Ulster	29-Sep	3	86	Juglans nigra (eastern black walnut)	41°41'30.84"N	74° 7'43.96"W
28	Crist Brothers	Campbell Hall	Orange	6-Oct	3	71	Deer Fence	41°25'36.84"N	74°14'21.00"W
29	Sermoneta Orchards	Cuddebackville	Orange	6-Oct	3	71	Corylus avellana (Hazelnut)	41°27'45.22"N	74°36'57.16"W
30	Sermoneta Orchards	Cuddebackville	Orange	6-Oct	3	74	Corylus avellana (Hazelnut)	41°27'41.78"N	74°36'57.28"W
31	Sermoneta Orchards	Cuddebackville	Orange	6-Oct	3	77	Corylus avellana (Hazelnut)	41°27'40.97"N	74°36'52.20"W
32	Warwick Valley Winery & Distillery	Warwick	Orange	6-Oct	3	76	Acer saccharum (*sugar maple)*	41°17'31.47"N	74°26'15.06"W


Sentinel Egg Placement
Samurai Wasp Release Sites
Kingston
Toronto
Lake Ontario
Orleans Co.
Monroe Co.
New York
Columbia Co.
Ulster Co.
Dutchess Co.
Connecticut
Orange Co.
Pennsylvania
Long Island Sound

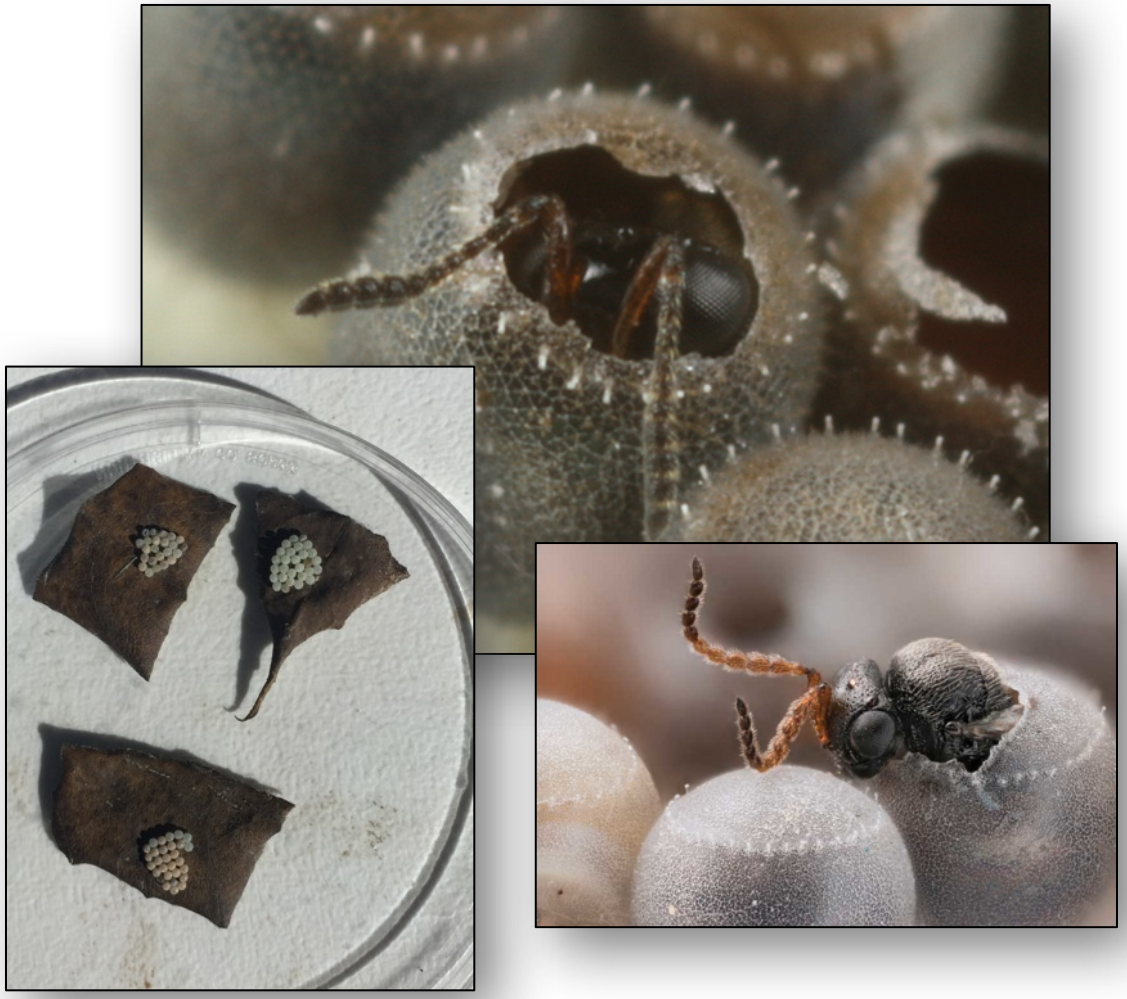
Biological Control of the Brown Marmorated Stink Bug in New York State



2017 Phase III

- Parasitized eggs to be collected in October & November to determine % emergence.

Biological Control of the Brown Marmorated Stink Bug in New York State



2018 Phase III

- Place sentinel eggs weekly in release sites.
- After 7d return to HVRL
- Rear eggs to confirm *T. Japonicus presence* = establishment.

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

Field Research Support Technician	Tim Lampasona
Support Technician Insect Colony	Dana Acimovic
Research Assistant	Christopher Leffelman
Research Assistant	Lucas Canino
Research Assistant	Ben Lee
Research Assistant	Addie Kurchin
Summer Research Intern	Cameron Fuhr
Farm Manager	Albert Woelfersheim
Administrative Assistant	Erica Kane
Administrative Assistant	Christine Kane
HRVL & NEWA Weather Data.....	Christopher Leffelman, Albert Woelfersheim

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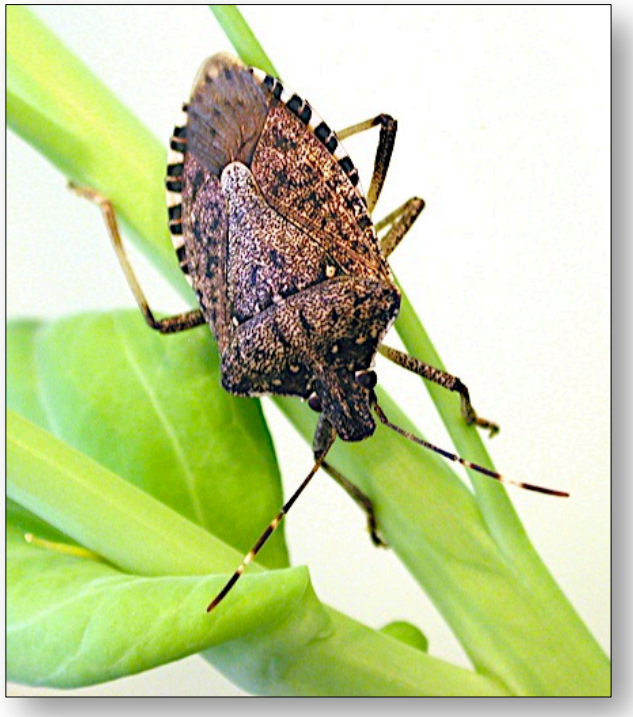
Questions??



The National March Madness
Citizen Science Project
To Find
The Brown Marmorated Stink Bug

Trissolcus japonicus