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

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

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

Background


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

• Ag. losses from BMSB occurs during drought, 2\textsuperscript{nd} gen. high populations.

• Moves from woodland & hedgerows to Ag. crop edge.
Commercial apple
Campbell Hall, NY
November 2012
22% BMSB Injury ‘Pink Lady’
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:**


- 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

Beltsville, MD
Washington, DC, Winchester, VA
WV, VA,
WV, DC, MD, DE, NY
WA and OR

Updated: 5/21/2016
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)
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
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 § 1 1-0103. Endangered and threatened 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
<table>
<thead>
<tr>
<th>Farm</th>
<th>Town</th>
<th>County</th>
<th>PlacHost Plant</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schutt Orchard</td>
<td>Webster</td>
<td>Monroe</td>
<td><em>Acer saccharum</em> <em>(sugar maple)</em></td>
<td>43°11'3.78&quot;N</td>
<td>77°26'56.76&quot;W</td>
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<tr>
<td>Windmill Orchard</td>
<td>Ontario</td>
<td>Ontario</td>
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<td>43°15'50.27&quot;N</td>
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<td>KM Davies</td>
<td>Williamson</td>
<td>Wayne</td>
<td><em>Acer saccharum</em> <em>(sugar maple)</em></td>
<td>43°14'10.54&quot;N</td>
<td>77°11'23.63&quot;W</td>
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<tr>
<td>Wooded</td>
<td>Holley</td>
<td>Orleans</td>
<td><em>Juglans nigra</em> <em>(Black Walnut)</em></td>
<td>43°14'0.42&quot;N</td>
<td>78°1'10.46&quot;W</td>
</tr>
<tr>
<td>Wooded</td>
<td>Lyndonville</td>
<td>Orleans</td>
<td><em>Malus sp.</em> <em>(crab apple)</em></td>
<td>43°19'33.63&quot;N</td>
<td>78°22'23.50&quot;W</td>
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<tr>
<td>Wooded</td>
<td>Medina</td>
<td>Orleans</td>
<td><em>Ailanthus altissima</em> <em>(Tree of Heaven)</em></td>
<td>43°12'1.79&quot;N</td>
<td>78°23'36.81&quot;W</td>
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<tr>
<td>Hepworth Farms</td>
<td>Marlboro</td>
<td>Ulster</td>
<td><em>Robinia pseudoacacia</em> <em>(Black Locust)</em></td>
<td>41°40'14.72&quot;N</td>
<td>74°5'11.21&quot;W</td>
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<tr>
<td>Hepworth Farms</td>
<td>Marlboro</td>
<td>Ulster</td>
<td><em>Ailanthus altissima</em> <em>(Tree of Heaven)</em></td>
<td>41°40'14.72&quot;N</td>
<td>74°5'11.21&quot;W</td>
</tr>
<tr>
<td>Crist Orchard</td>
<td>Walden</td>
<td>Orange</td>
<td><em>Ailanthus altissima</em> <em>(Tree of Heaven)</em></td>
<td>41°33'2.64&quot;N</td>
<td>74°9'50.72&quot;W</td>
</tr>
<tr>
<td>Minard Orchard</td>
<td>New Paltz</td>
<td>Ulster</td>
<td><em>Vitis sp.</em> <em>(wild grape)</em></td>
<td>41°42'1.47&quot;N</td>
<td>74°4'24.13&quot;W</td>
</tr>
</tbody>
</table>
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

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

<table>
<thead>
<tr>
<th>Site</th>
<th>Farm</th>
<th>Town</th>
<th>County</th>
<th>Date</th>
<th>Clusters</th>
<th>Eggs</th>
<th>Placement / Host Plant</th>
<th>Latitude</th>
<th>Longitude</th>
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<tbody>
<tr>
<td>1</td>
<td>Schutt Orchard</td>
<td>Webster</td>
<td>Monroe</td>
<td>15-Sep</td>
<td>3</td>
<td>78</td>
<td>Acer saccharum (<em>sugar maple</em>)</td>
<td>43°11’3.78&quot;N</td>
<td>77° 26'56.76&quot;W</td>
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<tr>
<td>2</td>
<td>Holley</td>
<td>Holley</td>
<td>Orange</td>
<td>22-Sep</td>
<td>3</td>
<td>84</td>
<td>Bmack Walnut</td>
<td>43°14’0.42&quot;N</td>
<td>78° 1’10.46&quot;W</td>
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<tr>
<td>3</td>
<td>Hurds Orchard</td>
<td>Modena</td>
<td>Ulster</td>
<td>22-Sep</td>
<td>3</td>
<td>89</td>
<td>Vitis riparia (Native grape)</td>
<td>41°4’25.15&quot;N</td>
<td>74° 4’3.51&quot;W</td>
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<tr>
<td>4</td>
<td>Minard Orchard</td>
<td>New Paltz</td>
<td>Ulster</td>
<td>22-Sep</td>
<td>3</td>
<td>76</td>
<td>Vitis riparia (Native grape)</td>
<td>41°2’1.57&quot;N</td>
<td>74° 4’24.22&quot;W</td>
</tr>
<tr>
<td>5</td>
<td>Minard Orchard</td>
<td>Clintondale</td>
<td>Ulster</td>
<td>22-Sep</td>
<td>3</td>
<td>72</td>
<td>Acer saccharum (<em>sugar maple</em>)</td>
<td>41°41’3.91&quot;N</td>
<td>74° 3’18.67&quot;W</td>
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<tr>
<td>6</td>
<td>Crist Brothers</td>
<td>Walden</td>
<td>Orange</td>
<td>22-Sep</td>
<td>2</td>
<td>54</td>
<td>A. altissima (Tree of Heaven)</td>
<td>41°33’1.34&quot;N</td>
<td>74° 9’36.77&quot;W</td>
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<td>7</td>
<td>Hepworth Farms</td>
<td>Gardener</td>
<td>Ulster</td>
<td>23-Sep</td>
<td>3</td>
<td>74</td>
<td>Robinia pseudoacacia (Black Locust)</td>
<td>41°40’14.72&quot;N</td>
<td>74° 5’11.21&quot;W</td>
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<td>8</td>
<td>Ochs Orchard</td>
<td>Warwick</td>
<td>Orange</td>
<td>23-Sep</td>
<td>2</td>
<td>56</td>
<td>A. altissima (Tree of Heaven)</td>
<td>41°13’55.83&quot;N</td>
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<td>Pennings Orchard</td>
<td>Warwick</td>
<td>Orange</td>
<td>23-Sep</td>
<td>2</td>
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<td>A. altissima (Tree of Heaven)</td>
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<td>74°23’11.62&quot;W</td>
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<td>10</td>
<td>Fishkill Farms</td>
<td>Fishkill</td>
<td>Dutchess</td>
<td>24-Sep</td>
<td>3</td>
<td>73</td>
<td>Robinia pseudoacacia (Black Locust)</td>
<td>41°31’12.02&quot;N</td>
<td>73°49’40.04&quot;W</td>
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<td>11</td>
<td>Fix Brothers Orchard</td>
<td>Hudson</td>
<td>Columbia</td>
<td>24-Sep</td>
<td>2</td>
<td>56</td>
<td>Vitis riparia (Native grape)</td>
<td>42°11’6.33&quot;N</td>
<td>73°49’47.25&quot;W</td>
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<tr>
<td>12</td>
<td>Fix Brothers Orchard</td>
<td>Hudson</td>
<td>Columbia</td>
<td>24-Sep</td>
<td>2</td>
<td>54</td>
<td>A. altissima (Tree of Heaven)</td>
<td>42°11’16.36&quot;N</td>
<td>73°49’58.86&quot;W</td>
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<td>13</td>
<td>Porpiglia / Weed orchards</td>
<td>Marlboro</td>
<td>Ulster</td>
<td>24-Sep</td>
<td>2</td>
<td>56</td>
<td>Rhus sp. (Sumac)</td>
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<td>Crist Brothers</td>
<td>Milton</td>
<td>Ulster</td>
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<td>3</td>
<td>78</td>
<td>A. altissima (Tree of Heaven)</td>
<td>41°39’4.29&quot;N</td>
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<tr>
<td>15</td>
<td>Crist Brothers</td>
<td>Milton</td>
<td>Ulster</td>
<td>24-Sep</td>
<td>3</td>
<td>74</td>
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<td>Modena</td>
<td>Ulster</td>
<td>24-Sep</td>
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<td>3</td>
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<td>Columbia</td>
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<td>26-Sep</td>
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<td>87</td>
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<td>41.6443N</td>
<td>73.9685W</td>
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<td>28-Sep</td>
<td>3</td>
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<td>Ulster</td>
<td>29-Sep</td>
<td>3</td>
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<td>Crist, Coy Orchard</td>
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<td>Ulster</td>
<td>29-Sep</td>
<td>3</td>
<td>84</td>
<td>Vitis riparia (Native Grape)</td>
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<td>Gunk House</td>
<td>Highland</td>
<td>Ulster</td>
<td>29-Sep</td>
<td>3</td>
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<td>29-Sep</td>
<td>3</td>
<td>81</td>
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<td>74° 6’84.75&quot;W</td>
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<td>29-Sep</td>
<td>3</td>
<td>86</td>
<td>Juglans nigra (eastern black walnut)</td>
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<td>28</td>
<td>Crist Brothers</td>
<td>Campbell Hall</td>
<td>Orange</td>
<td>6-Oct</td>
<td>3</td>
<td>71</td>
<td>Deer Fence</td>
<td>41°25’36.84&quot;N</td>
<td>74°14’21.00&quot;W</td>
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<td>Sermoneta Orchards</td>
<td>Cuddebackville</td>
<td>Orange</td>
<td>6-Oct</td>
<td>3</td>
<td>71</td>
<td>Corylus avellana (HazelNut)</td>
<td>41°27’45.22&quot;N</td>
<td>74°36’57.16&quot;W</td>
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<td>Orange</td>
<td>6-Oct</td>
<td>3</td>
<td>74</td>
<td>Corylus avellana (HazelNut)</td>
<td>41°27’41.78&quot;N</td>
<td>74°36’57.28&quot;W</td>
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<td>31</td>
<td>Sermoneta Orchards</td>
<td>Cuddebackville</td>
<td>Orange</td>
<td>6-Oct</td>
<td>3</td>
<td>77</td>
<td>Corylus avellana (HazelNut)</td>
<td>41°27’40.97&quot;N</td>
<td>74°36’52.20&quot;W</td>
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<td>32</td>
<td>Warwick Valley Winery &amp; Distillery</td>
<td>Warwick</td>
<td>Orange</td>
<td>6-Oct</td>
<td>3</td>
<td>76</td>
<td>Acer saccharum (<em>sugar maple</em>)</td>
<td>41°17’31.47&quot;N</td>
<td>74°26’15.06&quot;W</td>
</tr>
</tbody>
</table>
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