
2014 Onion School
Middletown, NY

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Plant Protection Presentations

Recent presentations:

Cornell Cooperative Extension Eastern NY Commercial Vegetable Program
Invasive Insects: BMSB Management in Vegetable.

Cornell Cooperative Extension Eastern NY Commercial Fruit Program
Upper Hudson / Champlain Commercial Tree Fruit School
Insect Pest Management Overview

Empire Expo, On-Center, Syracuse, NY Jan. 21, 2014:
Status of BMSB and SWD in NY
Late Season SWD Management.

http://blogs.cornell.edu/jentsch/
Onion Bulb Mite

- Its wide host range includes onion, garlic, lily, gladiolus, cereals and many other crops. It also feeds on organic matter in the soil.

- The first published record of *R. robini* as a pest of onion in the United States dates back to 1955, when it was briefly reported as a pest of commercial onion in New York.

- Since 1995, it has recurred sporadically in that state and has caused significant degrees of economic damage.
Onion Bulb Mite

- Most damage caused by bulb mite occurs at the **roots** and in the basal plate.

- Onion bulb mites have been found in **pockets within the growing bulb** tissue of otherwise healthy plants.
Onion Bulb Mite

- The above-ground symptoms of damage are quite similar to those of onion maggot, most serious to seedling onions.

- Heavily damaged plants eventually lose their roots and topple.
Onion Bulb Mite

- Damage is also manifest in *infection* from bacterial and fungal pathogens that may enter through *mite-created wounds*.

- The bulb mite is extremely well adapted to its soil habitat: it prefers to feed on fresh tissue, but can *survive on many organic materials* including dead plants, dead insects and manure;

- It can survive up to five weeks submerged under water; *escapes* drought and extreme cold by moving deeper into the soil.
Onion Bulb Mite

- The second nymphal stage, or hypopus, may use its specialized sucker plate to attach itself to flying and crawling animals or to equipment, and thus be dispersed to new locations.

- Populations of the bulb mite can increase rapidly

- Females can live up to 40 days and produce 700 eggs;

- A generation can be completed in approximately 4 weeks, producing multiple generations leading to a high resistance potential
Predatory Mite: *Gaeolaelaps aculeifer*

- **Bulb Mites** *(Rhizoglyphus robini)*
- **Predatory Mites** *(Gaeolaelaps sp.)*
- **Pot worm**
- **Springtails** *(Friekea sp.)*
Onion Bulb Mite: HVL Studies

• Overwinters in the soil with all three life stages (adult, egg & nymph) found throughout the year.

• Very abundant OW on volunteer field onion and cull piles
OBM on volunteer onion
Onion Bulb Mite: HVL Studies

- Found in cover crop seed coat (barley) feeding on fungi.
- Can maintain OW populations on barley cover crops.
Hull and Naked Barley Seed Cover Crop
Plumule withdrawn from between cotyledons by epicotyl

Epicotyl elongates

Testa splits

Cotyledon

Radicle emerges

a) 2nd day after soaking
b) 5th day
c) 7th day
d) 9th day
Efficacy Against Bulb Mite of Seed Treatments on Standard and Naked Barley Planted as a Winter Cover Crop

<table>
<thead>
<tr>
<th>Treatment/Rate</th>
<th>% infested plants (n=60)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9/30</td>
</tr>
<tr>
<td></td>
<td>10/8</td>
</tr>
<tr>
<td>UNTR, Naked</td>
<td>58.3</td>
</tr>
<tr>
<td>Standard</td>
<td>66.7</td>
</tr>
<tr>
<td>Carzol Naked @ 10g</td>
<td>13.3</td>
</tr>
<tr>
<td>Naked @ 20g</td>
<td>13.3</td>
</tr>
<tr>
<td>Stand. @ 10g</td>
<td>28.3</td>
</tr>
<tr>
<td>Vydate Naked @ 5g</td>
<td>33.3</td>
</tr>
<tr>
<td>Naked @ 10g</td>
<td>63.3</td>
</tr>
<tr>
<td>Stand. @ 5g</td>
<td>45.0</td>
</tr>
<tr>
<td>Icon Naked @ 10g</td>
<td>25.0</td>
</tr>
<tr>
<td>Naked @ 20g</td>
<td>35.0</td>
</tr>
<tr>
<td>Stand. @ 10g</td>
<td>61.7</td>
</tr>
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</table>
Efficacy of insecticide treated barley seed (naked vs standard) Pine Island, NY - 2002

% INFESTED PLANTS
Efficacy against OBM of insecticide treated barley seed (1X rate vs. 2X rate).

Pine Island, NY - 2002
Evaluation of onion bulb mite on Vydate treated barley plants.
Hudson Valley Lab - 2003

- OBM Nymph
- OBM Adult
- Dead OBM

No. OBM per plant

- Untreated
- Vydate 1 gal./A
- Vydate 2 gal./A

<table>
<thead>
<tr>
<th>Ranked treatment</th>
<th>% infested plants</th>
<th>No. mites/plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Oat</td>
<td>90.8</td>
<td>11.5</td>
</tr>
<tr>
<td>2. Soybean</td>
<td>65.8</td>
<td>10.1</td>
</tr>
<tr>
<td>3. Wheat</td>
<td>59.5</td>
<td>27.2</td>
</tr>
<tr>
<td>4. Barley</td>
<td>56.0</td>
<td>17.5</td>
</tr>
<tr>
<td>5. Annual rye</td>
<td>53.3</td>
<td>8.7</td>
</tr>
<tr>
<td>6. Proso millet</td>
<td>47.0</td>
<td>4.5</td>
</tr>
<tr>
<td>7. Pearl millet</td>
<td>44.0</td>
<td>10.6</td>
</tr>
<tr>
<td>8. Siberian millet</td>
<td>3.0</td>
<td>0.4</td>
</tr>
</tbody>
</table>
Onion Bulb Mite: HVL Studies

- Survives well in cold temperature.

LT50 OBM Adult ♀ = 17°F
LT50 OBM Egg = 10°F

Under ideal conditions OBM increase in number to feed on developing onion in early spring to reduce stand count.

OBM on barley

OBM on volunteer onion
SUMMER AIR AND SOIL TEMPERATURES IN PINE ISLAND, NY - 2002

TEMPERATURE (F)

AIR
Soil 1"
### Impact of Seed Treatments on Onion Bulb Mite

**Onion Seed-Treatments Efficacy against OMB**  
**Cornell’s Hudson Valley Lab, Highland NY, 1999.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
<th>20 DAP roots</th>
<th>20 DAP bulb</th>
<th>30 DAP bulb</th>
<th>40 DAP bulb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carzol</td>
<td>50g/kg</td>
<td>0.5b</td>
<td>0.2a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vydate</td>
<td>50g/kg</td>
<td>0.2ab</td>
<td>&lt;0.1a</td>
<td>0.5a</td>
<td>5.8b</td>
</tr>
<tr>
<td>Fipronil</td>
<td>30g/kg</td>
<td>&lt;0.1ab</td>
<td>&lt;0.1a</td>
<td>0.0a</td>
<td>0.0a</td>
</tr>
<tr>
<td>+Carzol</td>
<td>50g/kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fipronil</td>
<td>30g/kg</td>
<td>0.0a</td>
<td>0.0a</td>
<td>0.0a</td>
<td>0.0a</td>
</tr>
<tr>
<td>+Vydate</td>
<td>50g/kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fipronil</td>
<td>30g/kg</td>
<td>0.0a</td>
<td>0.0a</td>
<td>0.4a</td>
<td>0.2a</td>
</tr>
<tr>
<td>Untreated</td>
<td>-</td>
<td>3.4c</td>
<td>3.1b</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Establishment and survival in greenhouse bioassays.
Summary of Insecticide Effects on Onion Bulb Mite

• Insecticide drenches of some value (?
  ~ Carzol > (fipronil ?) > Vydate

• Seed treatments of onion
  ~ Carzol > fipronil > Vydate

• Seed treatments of ‘standard’ barley
  ~ somewhat effective
  ~ seed coat protection of OBM populations

• Seed treatments of ‘naked’ barley
  ~ Carzol (86%) > fipronil (75%) > Vydate (21%)

• Foliar Vydate treatments of barley seedlings
  ~ 2 gal (64%) > 1 gal (40%)
Agriculturally Invasive Insect Pests in NY State: Update on BMSB Management in Vegetable

Brown Marmorated Stink Bug

Tree of Heaven
*Ailanthus altissima*
Asian Invasive Brown Marmorated Stink Bug Spread in the US

*Halyomorpha halys*
Eggs: Average 28/cluster; light green to white

1<sup>st</sup> instar: black & red; cluster near eggs

2<sup>nd</sup> instar: striped antennae

3<sup>rd</sup> instar: striped antennae and legs

4<sup>th</sup> instar: thoracic spur; striped antennae & legs

5<sup>th</sup> 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 Voltinism
2 generations in the Mid-Hudson Valley of NY

May      June      July      August      September     Oct.

Presence in Vegetable         Intensified Feeding

Combined 1\textsuperscript{st} & 2\textsuperscript{nd} Generations
Figure 1: Risk maps displaying the relative density of field, vegetable, and fruit crop hosts plants of BMSB throughout the United States.
Polyphagous insect with an expansive host range
• 133 listed plant species hosts
• Observed on over 300 plants
• Deciduous trees, tree fruit, legume, vegetable
Brown Marmorated Stink Bug on
Tree Fruit, Small Fruit & Vegetable

**Tree fruit** (apple, pear, peaches, cherries)

**Small fruit** (grape, bramble fruit)

**Vegetables** (tomato, pepper, sweet corn, Lima beans, soybean)

Gary Bern on, USDA-APHIS

Deepak Magadha, Rutgers University

Tracy Lesley - USDA-ARS

Doug Pfeiffer - Virginia Tech
Hudson Valley Complex:
SB species of economic importance

Brown Stink Bug, *Euschistus servus* (Say)

Green Stink Bug, *Acrosternum hilare* (Say).

Brown marmorated stink bug, *Halyomorpha halys* (Stål)

Adult Stink bug damage

Adult SB Presence

Adult & Nymph Stink bug damage
iMapinvasive
New York Invasive Species Public Map
http://imapinvasives.org/nyimi/map/

• Use of invasive species maps help to better understand the ecological niche of newly introduced invasive species

• The BMSB utilizes the Tree of Heaven, *Ailanthus altissima* as an important food and reproductive resource.
Tree of Heaven, *A. altissima*.

Warwick, NY

September, 2012
Ailanthus altissima (Mill.) Swingle ‘Tree of Heaven’

A. altissima has spread through the U.S. including NY.

Contributing to the increase of BMSB in this part of NY state?

The ‘Tree of Heaven’ is a primary food source for BMSB.

Feeding occurs on foliage and seed while it also acts as a site for reproduction of 2 BMSB generations in NY.

Very present in ‘undesirable’ urban niches.
Observations of BMSB on Border Plants
Warwick, NY 2012

Total BMSB 29 June - 9 August, 2012
Stink Bug injury to Golden Delicious
5 bins: Range from 38 – 57% damage
9 October, 2012; Milton, NY
Deciduous Forest
Oak species
Black Cherry
Sugar Maple
Dogwood
Pheromone Tedders Trap Captures of BMSB Using
MDT & USDA #10 lures
Red Delicious & Rome Apple
Campbell Hall, NY 2012
To determine the extent of BMSB injury to ‘Pink Lady’ apple in 2012 we conducted evaluations of:
• 10 fruit / tree = 100 fruit /30’
• in 9 sections at 240'/row
• with 1080 fruit evaluated
• and trees @ 3’ x 12’ spacing
• A strong edge effect was observed from wooded edge toward the interior of the block.
Studies of the Brown Marmorated Stink Bug, *Halyomorpha halys* (Stål), in New York State

- **2013: Early trap captures with the use of #10 + MDT synergist**

![Graphs showing BMSB Trap Captures; #10 + MDT & Black Light, Campbell Hall, NY 2013, Marlboro, NY 2013, Milton, NY 2013](image)
Injury BMSB Studies
>20% Campbell Hall, NY
2012

Total Rain (1.8 in.)

2013

Total Rain (6.0 in.)

Injury 0.1%

RH Hrs >= 90% (15 hrs.)

RH Hrs >= 90% (1122 hrs.)
BMSB Adult Exposure to Insecticide Residue of Apple Foliage

24h Old Residue @ 1 d

24h Old Residue @ 3 d
2013 BMSB Injury to Organic Pepper Marlboro, NY

• On August 12\textsuperscript{th}, 15\% injury was observed in a 1 acre organic planting of Jalapeno Pepper.
BMSB in Jalapeno Pepper
12th August, Marlboro, NY
15% feeding injury
Averaging 4 nymphs per plant
2013 BMSB Injury to Pepper
Marlboro, NY

• On August 12\textsuperscript{th}, 15\% injury was observed in a 1 acre organic planting of Jalapeno Pepper.

• Applications of Mycotrol-O @ 16 oz./A on 14 August, 1 & 14 September.

• Set up integrated pest management approach to reduce BMSB field populations
2013 BMSB Injury to Pepper

• Employing pheromone baited insecticide treated netting traps
• High intensity lighting
MDT

USDA #10
Studies of the Brown Marmorated Stink Bug, *Halyomorpha halys* (Stål), in New York State
- *Beauvaria bassiana* strain GHA applications

(Mycotrol-O @ 16 oz./A)
Key points to remember
• BMSB is arboreal, forest pest, very mobile to and out of agricultural crops
• Fruit damage takes 2-3 weeks for expression mid-late season.
• Low populations can equate to high feeding injury levels

Strategies for control: Conventional
  1. Early trapping with Tedders trap + #10 and MDT combo lure
  2. Scouting crop at first trap capture
  3. Perimeter applications of field at first observation
  4. Maintain perimeter applications alternating with whole field applications if BMSB presence continues

: Organic
  5. Applications at 90% rH (48 hrs) Mycotrol-O at 1\textsuperscript{st} BMSB

Insecticide efficacy is critical
• Use materials with greatest efficacy & longest residual
• Maintain ‘fresh’ residue every 4-5 days when needed
Thanks to the staff at the HVL for all their support:

Summer Research Assistant ............................................. Tim Lamposona
Summer Research Assistant ............................................. Taylor Truncali
PT Summer Research Assistant ................................. Henry Grimsland
Summer Research Assistant ............................................. Susan Weibman
Summer Research Intern (CCE BMSB)......................... Kaitlyn Kelder
Summer Intern ................................................................. Brianna Flonc

Farm Manager .................................................................. Albert Woelfersheim
Administrative Assistant .................................................. Donna Clark
HVL & NEWA Weather Data .............................................. Anne Rugh, Joe Whalon