Biological Control of the Brown Marmorated Stink Bug: Prospects and Procedures

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The Brown Marmorated Stink Bug
*Halyomorpha halys*

White bands on antennae

‘checkerboard’ pattern on connexivias

Photo: B. Cutting
BMSB Life Cycle
In 2010 BMSB was responsible for an estimated $37 million in losses to mid-Atlantic growers of apples alone.
Estimated potential range of BMSB

Zhu et al. 2012
How is BMSB moving?
How is BMSB moving?

• Response to senescence or harvest of crops?
• Fattening up for winter?
• Feeding on trunks of trees

Images by M. Raupp, UMD
Brazen Bugs?

Photo: Sean Wiles, USDA-ARS
How to fight stink bugs?
How to fight stink bugs?
Natural biological control

Pathogens

Metarhizium spp.
Ophiocordiceps spp.

Parasitoids

Egg parasitoids
Parasitoids of adults

Predators

Lacewings, predatory stink bugs, spiders, ants, birds etc.
Search for native parasitoids

Search for tachinid fly eggs

Sentinel egg masses for egg parasitoids
Parasitism of adult BMSB: Proportion with tachinid eggs

- % BMSB found with tachinid eggs
- Overwinter sites
- Summer feeders

<table>
<thead>
<tr>
<th>Year</th>
<th>Overwinter Sites</th>
<th>Summer Feeders</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>34</td>
<td>48</td>
</tr>
<tr>
<td>2006</td>
<td>10</td>
<td>24</td>
</tr>
<tr>
<td>2007</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2008</td>
<td>437</td>
<td>70</td>
</tr>
<tr>
<td>2009</td>
<td>337</td>
<td>120</td>
</tr>
<tr>
<td>2010</td>
<td>662</td>
<td>479</td>
</tr>
<tr>
<td>2011</td>
<td>2466</td>
<td>1606</td>
</tr>
</tbody>
</table>

N examined = 6,372
N parasitized = 112
N emerged tachinid = 1
BMSB egg parasitism

Less than 4% of eggs in Newark were parasitized.

The rate of discovery of egg masses has not significantly increased over time.
Classical biological control is the best hope for sustainable management of BMSB.
Foreign Exploration
Trissolcus mitsukurii

Photo: Steve Valley, Oregon Dept. of Agriculture
Safeguards in Quarantine:

- Red light appears as dark
- UV insect traps
- Multiple secure doors
- White suits
- Cool temperatures
- Extensive training
Trissolcus flavipes

Trissolcus mitsukurii

Trissolcus plautiae

Trissolcus halyomorphae

14 Colonies in total
Jon O • 26 days ago

Nice... get rid of the stink bugs (completely harmless) by introducing Asian wasps (I'm betting they're not harmless). After that, they'll be introducing king cobras to eat the wasps.

> 1 Reply

SuperG • 27 days ago

So importing the wasps that are the enemy of stinkbugs doesn't sound like a great idea. Once here, what if they find one of our beneficial insects an easier prey? We've done that in the past and have ended up with 2 pests.

> 24 Replies

The brown marmorated stink bug has inundated the mid-Atlantic, taking its toll on crops across the region. Researchers are investigating whether a type of parasitic wasp can bring down stink bug numbers.

April 26, 2011 from WAMU

Home is where the heart is. It's also probably where a lot of stink bugs are right now, crawling out from cracks and crevices. They were introduced into Allentown, Pa., from Asia in the 1990s and have been making themselves at home.
Host specificity of Asian *Trissolcus*

Photos: Chris Hedstrom, B. Cutting
Host-specificity of parasitoids

A successful egg parasitoid must:

• Overlap with host habitat
• Overlap with time of host activity
• Locate and recognize host (chemical, visual cues)
• Have morphological compatibility (able to sting)
• Have developmental compatibility (chemical, nutritional, temporal)
Host specificity of Asian *Trissolcus*

- All egg parasitoids
- All parasitoids of pentatomid bugs
- Test degree of specificity (to BMSB)

Photo: Steve Valley
Host range testing
Attack & Development

No Choice

Choice

native
non-target

BMSB
target

native
non-target
Host Range Evaluation

- Banasa calva
- Banasa dimiata
- Banasa euchlora
- Brochymena quadripustulata
- Chinavia hilaris
- Chlorochroa saucia
- Chlorochroa sayi
- Chlorochroa senilis
- Cosmopepla lintneriana
- Edesssa florida
- Euschistus servus
- Euschistus servus
- Euschistus tristigmus
- Euschistus variolarius
- Euschistus variolarius
- Holcostethus limbolorius
- Hymenarcys nervosa
- Menecles insertus
- Mormidea lugens
- Murgantia histrionica
- Oebalus pugnax
- Perillus bioculatus
- Podisus maculiventris
- Stiretrus anchorago
- Thyanta custator
- Thyanta custator accerra
- Thyanta custator accerra
- Trichopepla semivittata
Host specificity of Asian *Trissolcus*

Photos: Chris Hedstrom, B. Cutting
Additional BMSB related work

- Competition between native and Asian parasitoids
- Parasitism rates of egg masses field
- ID of parasitoids and behavioral evaluation
The Hoelmer Lab

Photos: Daria Tatman (USDA), Megan Krol (the Review), B. Cutting
Thank you!