Natural Enemies of the Brown Marmorated Stink Bug:
What are the Prospects for Biological Control?

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Photo: J. Wildonger USDA ARS
Pathogens

- No records from BMSB

- *Metarhizium* used with some impact on Sunn pests

- *Ophiocordiceps* spp. reported

* all stages of BMSB potentially vulnerable
Predators
... not yet well studied

of eggs:
ants, earwings, lacewings

of nymphs & adults:
assassin bugs, predatory stink bugs, spiders, birds (starlings, chickens, geese)
Parasitoids of pentatomids

Many species of stink bug egg parasitoids: Scelionids (1º), Chalcidoids (2º)

No parasitoids of nymphs are known

Tachinid flies (1º) and braconids (rarely) attack adults
Parasitoids of adult stink bugs:
Tachinidae (Diptera)

Generally considered to be not very host specific

- however -

• Recent taxonomic studies show considerable cryptic speciation in some tachinids

• Many hosts records likely based on erroneous ID of tachinids

• May be more specific than previously thought
Egg parasitoids: Many are generalists - various chalcidoids (Eupelmidae, Encyrtidae)

*Anastatus* spp. attack eggs of many insect orders; habitat specialists rather than host specialists
Specialist egg parasitoids:  
*Telenomus, Trissolcus, Gryon, Psix*  
(Scelionidae)

*Trissolcus* spp. are typically specific to pentatomids

Photo: UC IPM/JK Clark
Mid Atlantic States Parasitism Survey

- to evaluate the need for a classical biocontrol project for

- Initiated in 2005 and continued through 2010 (summer months)

- 1st conducted in Newark, DE & Allentown, PA

- Sentinel and wild-collected egg masses (N = 300-600 per year) placed in the field for 2 - 3 days

- Parasitoids reared from egg masses and identified

- Tachinid parasitism (egg deposition) measured in Newark samples
Individual eggs in sentinel masses were parasitized at a relatively low overall rate of 3-4% or less.

The proportion of egg masses discovered (with any eggs attacked) was higher, but relatively few individual eggs per mass were attacked (low parasitism efficiency).

The rate of discovery of egg masses has not been increasing with time (2010 data not shown here).
Parasitoids reared from sentinel egg masses & field-collected BMSB egg masses in PA, NJ, & DE include:

3 species of *Anastatus*: *reduvii*, 'near' *pearsalli* and *mirabilis*.

3 native species of *Trissolcus* (*brochymenae*, *edessa*, *euschisti*) occur in lower numbers (1% or less).

*Ooencyrtus* sp. & *Telenomus podisi* (very rare).
Parasitoids of adult BMSB by Tachinidae (Diptera)

- incidence of eggs on adult stink bugs ca. 1.7%

- no tachinid emergence from stink bugs with eggs

- indigenous North American tachinids may not be physiologically adapted to develop in *H. halys*
Percent of BMSB with Tachinid Eggs

- 2005: 7%
- 2006: 9%
- 2007: 2%
- 2008: 2%
- 2009: 1%
- 2010: 1%
Is parasitism greater in some habitats than others?
Parasitoids of BMSB previously reported from Asia

**Scelionidae**
- *Trissolcus itoi, T. mitsukurii, T. plautiae* (Japan)
- *Trissolcus halyomorphae* (China)
- *Trissolcus sp. & Gryon japonicum* (Korea)

**Chalcidoidea**
- occasional generalist chalcidoids (found in low numbers)

**Tachinidae**
- *Bogosia sp. reported to attack adult BMSB* (Japan)
Locations explored for natural enemies of BMSB in Asia (2005 to date)
Tachinid attacking BMSB in Korea: *Pentatomophaga latifascia*

Biology is not well known; most specimens collected fail to develop to emergence.
Parasitoid cultures at ARS BIIR in Newark maintained for host range and efficacy evaluations:

- 12+ populations representing at least 4 species of *Trissolcus*

**Japan:**  
*T. mitsukurii* (Tskuba 2007)  
*T. plautiae* (Tskuba 2007)  
*T. flavipes* (Tskuba 2007)

**China:**  
*T. halyomorphae*  
(Beijing 2007, Beijing 2008, Nanjing 2009)

**S. Korea:**  
*T. plautiae* (Seoul 2009, 2010)
Species Characterization

Morphology

Molecular characterization

Cross-mating studies
The Japanese *Trissolcus* spp. from BMSB are known to attack other Asian pentatomid pests, including the species shown above, indicating they are not absolutely host specific. The full extent of their host range in Asia is unknown.
HOST RANGE TESTING

Attack & Development

No Choice  Choice
Physiological Selectivity
• Complete development
• Successful emergence
• Sex ratio of progeny
• Fitness of progeny (size, fecundity)

Behavioral Selectivity
• Egg recognition
• Length of time probing
• Oviposition time
• Patch residence time

Ecological Selectivity
• Residence time
• Searching behavior
**PEST SPECIES**

- *Euschistus servus*
- *Piezodorus guildinii*
- *Acrosternum hilare*

**BENEFICIAL SPECIES**

- *Stiretrus anchorago*
- *Podisus maculiventris*
- *Brochymena spp.*
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