

**AGRICULTURAL RESEARCH FOUNDATION
FINAL REPORT
FUNDING CYCLE 2013 – 2015**

TITLE: Environmental adaptation and competition between the imported parasitoid, *Trissolcus japonicus* and the native *Trissolcus* parasitoids attacking eggs of *Halyomorpha halys*, the brown marmorated stinkbug

RESEARCH LEADER:

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COOPERATORS: (if any)

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SUMMARY: The invasive crop pest brown marmorated stink bug (BMSB, *Halyomorpha halys* (Stål)) is an increasing threat to specialty crop production in Oregon. A national effort is underway to screen egg parasitoids, and particularly *Trissolcus japonicus* (formerly *halyomorphae*), which has been imported to US quarantine facilities including the OSU facility in Richardson Hall, from the native range of BMSB for potential release in the US against BMSB. Simultaneously, researchers at OSU and elsewhere are surveying the complex of native parasitoids that attack BMSB egg masses. These native parasitoids, which represent the *Trissolcus* and *Anastatus* genera, attack the egg masses of native stink bugs (Hemiptera: Pentatomidae), of which there are more than 50 species in Oregon. Native stink bugs and BMSB often occupy similar habitats and it is likely that there will be competitive interactions between native parasitoids and the exotic parasitoid should it meet USDA-APHIS-PPQ standards for release. Most of the testing on the candidate exotic parasitoid is for host specificity, but environmental adaptation will also be an important factor determining the success of the *T. japonicus* in controlling populations of BMSB in the field. This is particularly true in Oregon, where populations of BMSB are now established on both sides of the Cascade Mountains where environmental conditions are widely divergent.

OBJECTIVES:

- Collect and rear native parasitoids attacking BMSB egg masses in Oregon.
- Evaluate competitive interactions between native parasitoids and *Trissolcus japonicus* on egg masses of BMSB over a spectrum of temperatures using a thermogradient.

PROCEDURES:

Collection and rearing of native parasitoids:

- Sentinel egg masses: Frozen and fresh egg masses were placed in the field during the growing season. BMSB eggs were removed from the colony and mounted onto filter paper strips. Some of the egg masses were frozen at -80°C. Paper strips were mounted on the underside of BMSB host plants in the Willamette Valley and left in place for one week. After collection, egg masses were then brought to the lab to rear out the parasitoids.

- Wild egg masses: Wild egg masses were opportunistically collected from host plants from diverse locations across Oregon.
- We attempted to bring any emergent parasitoids into culture by providing them with honey water and frozen BMSB egg masses. Several species were successfully reared in culture, but only one native parasitoid species has been consistently maintained in the lab (*Trissolcus utahensis*).

Evaluating competitive interactions on a thermogradient:

- Available thermogradient systems are too bulky to fit in the quarantine facility, thus production of a custom thermogradient system has been developed.
- The system utilizes open-source microcontroller technology (Arduino) with Peltier plates and thermometer feedback to create a spectrum of temperatures across a U-shaped steel bar. An LCD screen allows the temperature to be set at the cold and warm sides of the bar. The bar houses glass bottles that serve as the arenas to house BMSB egg masses and parasitoids. Placement of bottles along the bar will allow simultaneous evaluation of competitive interactions between parasitoids on BMSB egg masses across a spectrum of temperatures. The system is portable and will fit in the quarantine facility, and this will allow us to examine interactions between *Trissolcus utahensis* and *Trissolcus japonicus* across different temperatures.

SIGNIFICANT ACCOMPLISHMENTS:

- Diversity of native parasitoid species and impacts of native parasitoids have been determined over three field seasons.
- Cultures of *Trissolcus utahensis* are in culture in the laboratory on BMSB eggs.
- A novel thermogradient system has been designed and partially built.

BENEFITS & IMPACT:

- Significant information about native parasitoid assemblages attacking BMSB eggs has been gained. Ultimately, these data will be published in a refereed journal article.
- Native parasitoid assemblage data will be key ecological background information should any imported egg parasitoid such as *Trissolcus japonicus* be released against BMSB.
- The design for the thermogradient instrument will be published, as this could be a widely applicable tool for various biological sciences (entomology, seed germination, etc.).

ADDITIONAL FUNDING RECEIVED:

- Planning grant for BMSB in western states: USDA-NIFA-SCRI # 2014-51181-22514 to Wiman.

FUTURE FUNDING:

- Once the thermogradient is fully operational, further funding opportunities will be pursued to keep this work going and to complete the objectives of the original ARF proposal.