

## **Biology, Distribution, and Management of the BMSB in Soybean**

United Soybean Board Project – 3 year funding of \$272,000, plus smaller grants from state soybean boards.

Co-investigators: Galen Dively, Ames Herbert, Joanne Whalen, and Cerruti Hooks. Total of 16 graduate students at UMD, UDel, and VT, worked on BMSB for their research projects. Five had degree projects directly related to soybean production.

The following is a brief summary of the activities and project results:

**Objective 1** - Determine the infestation density of BMSB nymphs and adults required to cause reductions in seed quality and yield, and delayed senescence ('stay green' effect).

Characterized different impacts of feeding injury and their relationships with soybean growth and yield. Developed treatment thresholds for determining the need for insecticide application.

**Objective 2.** Compare and evaluate the sampling efficiency of visual counts and sweep net sampling and relate each methods to treatment thresholds.

Developed and validated a more efficient visual count method that consists of recording the number of BMSB observed in a 2-minute plant inspection. A visual count of 5 BMSB in a 2-minute search approximates the current action threshold of 5 per 15 sweeps.

**Objective 3** - Quantify the within-field distribution and spatiotemporal dynamics of BMSB populations in corn and soybean, and examine the influence of adjacent managed and natural habitats on the density of stink bugs.

Determined the timing and duration of infestations in corn and soybean, usually occurs first in corn. BMSB exhibits a clear edge effect in both field corn and soybean, which means that scouting is more efficient if efforts are concentrated on field edges bordering wooded habitats. Knowledge of their infestation pattern has led to reductions in the control cost and environmental exposure by applying only perimeter treatments.

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**Objective 4** - Determine the influence of different landscape, environmental, and topographic variables at different spatial scales on BMSB abundance.

Involved large-area network of monitoring 329 soybean fields throughout the mid-Atlantic region. Determined that higher temperature, particular during June and July, altitude, and aspect slope are prominent drivers of large-scale infestation patterns in stink bugs. At a smaller scale, deciduous forest as early-season feeding sites and near-by dwellings for overwintering are determinate factors associated with higher stink bug infestations in soybean. These findings suggest that the coastal plain areas of the mid-

Atlantic region, which are hotter and less topographically diverse, are less likely to experience high BMSB populations.

**Objective 5** - Monitor the expansion of BMSB infestations in soybean in the mid-Atlantic region, with particular focus on production areas at the outer brim of the known distribution.

Conducted extensive surveys of soybean fields and light trapping during each year, starting in 2011. BMSB activity in traps, field infestation levels, and control actions varied widely from year to year. Highest infestations occurred in 2010 and 2011, when 50-70% of the soybean acreage was either perimeter or whole field treated in northern Virginia, and western and central Maryland. The range of economic infestations in soybean has expanded southward into Virginia each year, but overall levels have significantly declined in recent years. Few fields had economic infestations in 2015.

**Objective 6**– Determine if natural enemies of native stink bug species will shift to BMSB and if natural control is significant.

Studies showed that egg mortality due to natural enemies varied significantly among the stink bug species. Found very little parasitism of BMSB eggs in soybean fields by the native parasitoids, but very high levels of mortality due to parasitism of native stink bug eggs. However, predation by predatory insects results in about 50% mortality of the BMSB eggs. These results suggest that the native parasitoids are not shifting to eggs of BMSB but this still needs further investigations.

**Objective 7:** Information delivery of the project results to stakeholders.

Presented project results and information on the biology and management of BMSB at 13 invited out-of-state crop conferences and professional events and at 58 in-state producer meetings.

Six scientific papers on the results of the project are either in the review process or published. Produced an extension field guide that summarizes much of what was accomplished in this project.