PennState
College of Agricultural Sciences

# PROPOSAL TRANSMITTAL

**Date:** 12/14/2018 **PSU Ref. No: 205928**

**Title:** Utilization of Insecticide Treated Nets as an Alternative Method to Monitor and Manage Brown Marmorated Stink Bug

**Submitted to:** Patti Keller

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**Proposed Project** **4/1/2019 - 3/31/2020** **Total Project Request: $28,777**

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**Please reference PSU Ref. Number in all correspondence.**

**TITLE:** Utilization of Insecticide Treated Nets as an Alternative Method to Monitor and Manage Brown Marmorated Stink Bug.

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**PROJECT DURATION:** Two Years, 2nd year project funding request

**JUSTIFICATION:** The current recommendations to manage brown marmorated stink bug (BMSB) *Halyomorpha halys* (Stäl) (Hemiptera - Pentatomidae) continue to rely mostly on the judicious use of insecticide applications. Although, due to continuous improvement in our understanding of BMSB biology and behavior, we are a long way from the initial recommendations of multiple, the calendar' based applications, broad spectrum insecticides still remain the only reliable and economical tool to control BMSB. Improved BMSB monitoring practices help to better understand the movement of the bugs into orchards and assess the relative abundance so the insecticide treatments are used only when they are really needed.

Biological control of BMSB in its native range in Asia is very effective and basically eliminates the need for the use of any insecticides against this particular species of stink bug. Our multi-year attempts to evaluate the complex of beneficial insects influencing the BMSB population around orchards provided a better understanding of this issue in our area. Generalist predators such as spiders, praying mantis, lacewings, assassin bugs, damsel bugs or even lady bugs are fully capable to prey on various BMSB instars, however, by their nature, their practical impact is limited and they are not capable to keep the BMSB population in orchards below levels warranting chemical intervention. The generally more effective group of biological control agents, such as native parasitoid wasps usually feed on eggs and are quite reliable in keeping the population of native stink bugs in check. The orchards observations by Hillary Peterson, my graduate student, identified some native parasitic wasps such as species from genera *Anastatus* spp., *Telenomus* spp., and *Trissolcus* spp. attempting to attack BMSB eggs, but their success ratio in parasitizing BMSB eggs is still very low. The recent discovery of samurai wasp, *Trissolcus japonicus* (Ashmead), a BMSB specific parasitoid in one of Pennsylvania orchards provides a much better chance for successful biological control of this pest.

During last few seasons our research activities concentrated mostly on the development and validation of effective BMSB monitoring systems and effective management strategies. Although broad spectrum insecticides are still the basis for an effective BMSB management program, utilization of BMSB monitoring practices and use for the treatment threshold the presence of BMSB nymphs allowed us to significantly reduce the number of insecticide applications targeting BMSB. Also, the utilization of "ghost traps "and Attract and Kill (A&K) strategy proved very promising in reducing the reliance on pesticides to reduce fruit injury caused by BMSB. During the 2016 and 2017 seasons we started to evaluate the new ZeroFly®

nets (Vestergaard, Lausanne, Switzerland) baited with regular BMSB attractants as a potential tool for use in the A&K program. Insecticide treated nets placed between the orchard and the source of invading BMSB (e.g., woods) were very effective in capturing adults and nymphs BMSB.

During our studies conducted in 2018, the nets were placed in and around various commercial apple orchards. Each net was placed on about 8 ft tall shepherd hook and baited with three BMSB monitoring lures (Trece, Inc. Adair, OK). To monitor the number of potentially affected bugs, all nets had 6 ft diameter plastic tarp placed under the trap. Although the numbers of collected BMSB adults during the 2018 were up to 3x lower in the most affected orchard than during the 2017 season, the number of dead adults and nymphs under the ghost traps were much higher than in any monitoring trap placed around the orchards. In separate studies, we also evaluated the potential field longevity of the nets and the optimal number of lures per net. The lure number study indicates the direct relationship between the number of lures per trap and the number of collected bugs. Increasing the number of lures per net increases the number of collected bugs. Studies are still needed to establish the economical equilibrium between the number of lures per trap, number of traps per block and the real value in relation to fruit quality. The net longevity studies generated unexpected results: the traps with new nets deployed for the first time in 2018 season collected lower numbers of BMSB than nest utilized in the field for two seasons. We are still continuing this part of the project in the laboratory setting, re-evaluating the nets under artificial lab conditions. With the expected US EPA registration of the insecticide treated nets more detailed studies are necessary to provide practical recommendation for their use in the field.

During this second year of the project we plan to continue our evaluations and validation of the best options for the practical use of insecticide treated nets for the monitoring and potential control of brown marmorated stink bug. With insecticides still representing the most effective BMSB management option, the research emphasis will be placed on validating the most effective and economical ways to incorporate insecticide treated nets into practical management strategies. Re-introduction of CM/OFM effective management practices (i.e., mating disruption) combined with alternative BMSB treatments should also reduce the outbreaks of secondary pests. The ultimate rational and cost effective management of BMSB needs to be fully interwoven within other established effective IPM practices.

**OBJECTIVES:**

1. Continue to evaluate the practical field effectiveness of insecticide treated net “ghost traps” as an alternative to the spray based BMSB monitoring/management options within the whole-orchard pest management program.

2. Evaluate the most effective, practical and cost-effective options for utilizing nets in BMSB monitoring and management practices.

3. Evaluate the impact of alternate BMSB management program on IPM related balance and its effect on management of traditional fruit pests including secondary pests.

4. Educate the grower community on results and possible constrains of using this alternative BMSB management option.

**WORK STATEMENT:**

1. *Evaluate the practical field effectiveness of "ghost traps' …*- the "ghost traps" strategy including ZeroFly nets be evaluated in commercial orchards settings. The "ghost traps" will be placed outside of the orchard, close to potential sources of BMSB influx with the goal to not only to arrest the movement of BMSB toward orchard but also to attract BMSB from the orchard. The "mark and recapture" experiment will be conducted around the "ghost traps" to precisely evaluate the attractiveness and arrestment ability of ghost traps toward BMSB. Standard BMSB monitoring traps deployed inside the evaluated blocks as well as visual timed observations will be conducted to monitor the resident BMSB population present in orchard. Fruit injury levels will also be assessed periodically on the same trees as used for visual BMSB counts.

2. *Evaluate the most effective, practical and cost-effective options for …* The preliminary study with insecticide treated nets conducted during the 2017-18 seasons utilized predetermined number of lures used per net as well as set distance between nets. During the 2019 we will continue the validations of the most economical options for the practical use of the ghost traps (e.g., number of lures, comparison of various lures, traps locations, etc.). Additionally, we will evaluate the most optimal placement of the ghost traps in relation to orchard border and the border of potential source of stink bugs (e.g., woods). Another aspect of this objective will include the evaluation of usefulness of deer fences already present in some orchards.

3. *Evaluate the impact of alternate BMSB management program on IPM related balance …*- Comprehensive seasonal IPM based BMSB pest management programs based on *in-situ* pest monitoring and economic thresholds (when available) will be established and evaluated for their efficacy in controlling BMSB. Additionally, where possible, mating disruption against CM/OFM complex will be incorporated into the system. For validation and comparison of results, pest management programs with standard insecticide applications directed against BMSB will be used as a control. Fruit evaluations conducted at monthly intervals and timed visual monitoring of BMSB presence in the orchard will be used to evaluate the field efficacy of various BMSB management programs.

4. *Educate the grower community…* - All information resulting from this research project will be disseminated to the general grower community using Cooperative Extension educational program methods such as newsletter articles, web-based information resources, summer field days, and winter grower meetings. The results of the on-going programs will be presented to all fruit growers and industry personnel through winter educational meetings.

**BUDGET – Year 2:**

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|---|---|
| *Technician salary 0.5 FTE* (data collections, colonies maintenance, etc. …) | *$ 15,023* |
| *Fringe benefit* (@ 38.97% | *$ 5,854* |
| *Travel* (3 months fleet operation vehicle lease @ $748/month) | *$ 3,900* |
| *Supplies* (Trapping supplies, insect colonies, greenhouse fees at FREC, etc.) | *$ 4,000* |
| **TOTAL for the 2nd year of the project:** | **$ 28,777** |

**DURATION OF PROJECT: 2018 - 2020**

**Year 2:** April 1, 2019 – March 31, 2020 $28,777

**SUBMITTED BY:**

Greg Krawczyk, Ph.D.
Principal Investigator

**Other support:** Researcher salary and some clerical support are provided by The Pennsylvania State University College of Agricultural Sciences.