



Environment and Natural Resources Trust Fund (ENRTF) M.L. 2014 Work Plan

Date of Report: January 15, 2014
Date of Next Status Update Report: November 15, 2014
Date of Work Plan Approval:
Project Completion Date: June 30, 2017
Does this submission include an amendment request? N

PROJECT TITLE: Brown Marmorated Stink Bug Monitoring and Biocontrol Evaluation

Project Manager: Robert Koch
Organization: Univeristy of Minnesota
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City/State/Zip Code: St. Paul
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Location: St. Paul, Ramsey County, Minnesota

Total ENRTF Project Budget:	ENRTF Appropriation:	\$167,000
	Amount Spent:	\$0
	Balance:	\$167,000

Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 04f-1

Appropriation Language:

\$99,000 the second year is from the trust fund to the commissioner of agriculture and \$167,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to monitor for brown marmorated stink bugs to identify problem areas, target biocontrol efforts, and evaluate the suitability of candidate biological control agents for use in Minnesota. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Brown Marmorated Stink Bug Monitoring and Biocontrol Evaluation

II. PROJECT STATEMENT:

Our project seeks to install a framework for monitoring brown marmorated stink bug (BMSB) (*Halyomorpha halys*) within Minnesota to identify developing problem areas and target implementation of biological control. We also propose to evaluate the suitability of biological control agents identified by USDA for use in Minnesota.

BMSB in Minnesota

BMSB was first discovered in Minnesota in 2010 (St. Paul) and is now in Ramsey, Washington, Anoka, Winona, Hennepin, Chisago, Carver, Dakota and St. Louis counties. BMSB is a generalist plant pest attacking 300+ species of plants in natural, agricultural and horticultural settings, with potential to feed on many native plant species in Minnesota. Due to unpleasant odor, large size and sheer numbers, BMSB is a nuisance home invader worse than Asian lady beetles or box elder bugs in the eastern U.S. As BMSB populations build in Minnesota, indirect impacts to environment and natural resources are likely to occur through increased pesticide use in homes, yards, agricultural fields and orchards to control this pest. For example, when Midwestern soybean was invaded by the soybean aphid (*Aphis glycines*), insecticide use increased 130-fold in that crop. In addition to soybean, BMSB attacks many other field, fruit and vegetable crops. Insecticide use in orchards in the Mid-Atlantic region has already increased fourfold due to BMSB. Direct impacts of BMSB to environment and natural resources are likely due to its broad host range including native plant species and potential for rapid population growth. A Federal risk assessment determined: "Heavy feeding pressure by BMSB could also damage or reduce native plant species and impact biodiversity throughout the United States." The same Federal document also states: "...it is reasonable to expect that BMSB could displace and directly compete with native stink bugs..."

Monitoring for BMSB – MDA Component

Based on experience with BMSB in other areas of the country, we expect BMSB to first become a household nuisance and then become a significant plant pest. We expect these adverse impacts to occur 5-10 years from initial discovery. It has been 3 years since discovery in Minnesota; therefore, it is imperative that a proactive response be implemented now. Monitoring for BMSB at the landscape level should help to predict where problem areas are developing; alerting stakeholders within the area and allowing targeted efforts at biological control to protect natural and agricultural resources. Research on a trap and lure for BMSB is reaching the point where this approach is feasible.

Biological control – UMN Component

Management of this pest in eastern states has relied primarily on insecticide use. Biological control has proven to be an environmentally sound and economical alternative in some systems. It is necessary to evaluate and identify appropriate biological control agents for use against BMSB in Minnesota before populations reach damaging levels. Federal researchers are evaluating 35 populations of 4 species of parasitic wasps (*Trissolcus* spp.) known to attack BMSB eggs in South Korea, Japan and China. This work is aimed to determine the potential efficacy and safety of these species as biological control agents for BMSB. The ability of the candidate biological control agents to survive winter conditions in northern states, such as Minnesota, remains undetermined and will be necessary for advancement to implementation. This project will examine the ability of the most promising candidate biological control agents to survive winter and use modeling techniques to determine the suitability of Minnesota for establishment.

III. PROJECT STATUS UPDATES:

Project Status as of November 15, 2014:

Project Status as of May 15, 2015:

Project Status as of November 15, 2015:

Project Status as of May 15, 2016:

Project Status as of November 15, 2016:

Overall Project Outcomes and Results:

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Monitoring for BMSB

Description:

This activity will be carried out by MDA. See MDA work plan for project description and budget.

Summary Budget Information for Activity 1:

ENRTF Budget: \$0
Amount Spent: \$ 0
Balance: \$

Activity Completion Date:

Outcome	Completion Date	Budget
1. Volunteer BMSB monitoring network	May each year	\$0
2. Collect data at regular intervals and publish in online map	Sept. each year	\$0

Activity Status as of November 15, 2014:

Activity Status as of May 15, 2015:

Activity Status as of November 15, 2015:

Activity Status as of May 15, 2016:

Activity Status as of November 15, 2016:

Final Report Summary:

ACTIVITY 2: Studies on overwintering potential of BMSB control agents in Minnesota

Description:

Biological control is a tactic under exploration for suppressing BMSB populations to reduce their direct and indirect impacts on the environment, economy and people of Minnesota. Several species of tiny parasitic wasps have been identified attacking BMSB in Asia and are under evaluation in USDA laboratories. These stingless wasps lay their eggs in the eggs of BMSB. The larvae of the stingless wasps then feed on and kill the BMSB eggs. The most effective of these stingless wasps in Asia is *Trissolcus japonicus*, which causes up to 70% parasitism in China. However, we are unsure how well any of these species of stingless wasp will survive the cold winter temperatures in Minnesota, and therefore are unsure about their potential impact on BMSB in Minnesota. Minnesota experiences considerably colder winter temperatures than other areas where BMSB is currently established, and where biological control agents may be released. We need to determine proactively which of candidate biological control agents will have a high chance of survival here, so that we can then focus our efforts for developmental of a biological control program against BMSB.

To assess how well these insects will survive Minnesota winters, we will use a series of laboratory studies to determine at what temperature the insects freeze (i.e., supercooling point), at what temperature they die (i.e., lower-lethal temperature) and how soon they die (i.e., lower lethal time). These biological parameters will then be used to predict the ability of these insects to survive MN winters. This work is critical now, because the process of identifying, testing and getting approval to use new biological control agents can take several years.

Summary Budget Information for Activity 2, UMN:

ENRTF Budget: \$167,000
Amount Spent: \$ 0
Balance: \$167,000

Activity Completion Date: 06/30/2017

Outcome	Completion Date	Budget
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1. <i>Measurement of the response to cold temperatures by candidate biological control agents of BMSB</i>	12/31/2016	\$143,398
2. <i>Model for impact of winter temperatures on survival of candidate biological control agents of BMSB</i>	06/30/2017	\$23,602

Activity Status as of November 15, 2014:

Activity Status as of May 15, 2015:

Activity Status as of November 15, 2015:

Activity Status as of May 15, 2016:

Activity Status as of November 15, 2016:

Final Report Summary:

V. DISSEMINATION:

Description:

The primary audience for this work will be producers and hobby growers of fruits and vegetables. Monitoring information for BMSB will help to anticipate problem areas before they develop. In addition to commercial and hobby growers, others will also benefit from this information due to the nuisance behavior of this insect to invade structures in the fall. Identifying areas where this may become problematic and providing that information in advance of the problem may help to avoid negative reactions among residents of these areas. Information will be disseminated to these audiences through direct email communication, web site updates, social media and news releases. The updates on the monitoring network and biological control status will be reported at relevant meetings and conferences throughout the year. We anticipate that this work will also result in an article in a scientific journal as well as presentations at national scientific meetings. However, ENRTF funds will not be used for travel to national meetings.

Status as of November 15, 2014:

Status as of May 15, 2015:

Status as of November 15, 2015:

Status as of May 15, 2016:

Status as of November 15, 2016:

Final Report Summary:

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

University of Minnesota

Budget Category	\$ Amount	Explanation
Personnel:	\$141,615	1 Lab Technician/Student (1.0 FTE): Salary (\$34,506.75 = \$16.55/hr x 2080 hrs) +

	\$6,282	Fringe (\$12,698.48 = 36.8% of salary) * 3 yrs 1 Undergraduate Student (\$12.08/hr x 260 hrs) x 2 yrs
Equipment/Tools/Supplies:	\$4,503	Cages & supplies for maintaining insect populations in lab: \$1,501/yr * 3 yrs
Printing:	\$1,000	Publication fees: 2 scientific articles * \$500 / article
Other:	\$13,600	Fee for use of space in quarantine facility & growth chambers: \$400/mo * 34 months
TOTAL ENRTF BUDGET:	\$167,000	

Explanation of Use of Classified Staff: N.A.

Explanation of Capital Expenditures Greater Than \$5,000: N.A.

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: 3.2

UMN Technician/Student: 1.0 FTE for 3 years

UMN Undergraduate Student Worker: 225 hrs/yr for 2 yrs

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: N.A.

B. Other Funds:

Source of Funds	\$ Amount Proposed	\$ Amount Spent	Use of Other Funds
Non-state			
	\$	\$	
State			
	\$	\$	
TOTAL OTHER FUNDS:	\$	\$	

VII. PROJECT STRATEGY:

A. Project Partners:

Receiving funds: Mark Abrahamson with MDA will lead the monitoring work (**receiving \$99,000**). Dr. Robert Koch with U of MN will lead the work to evaluate potential biological control agents for suitability in Minnesota (**receiving \$167,000**). Both organizations will provide in-kind equipment, facilities, and GIS/technical support.

Not receiving funds: For monitoring, we will draw volunteers from the various groups such as Master Gardeners, First Detectors and Producers. For evaluation of the biological control agents, Dr. Robert Venette with the USDA Forest Service will provide technical guidance on overwintering biology and cold hardiness. Dr. Kim Hoelmer of the USDA ARS will provide biological control agents for this work.

B. Project Impact and Long-term Strategy:

This project will put in place a monitoring network for BMSB that will likely prove useful for years to come and will be a first step towards implementation of biological control for BMSB, which is a critical need for proactively dealing with this pest in an economically and environmentally sustainable manner. This work will aid in selection of biological control agents for use in Minnesota. If one or more biological control agents show a high likelihood for survival in Minnesota, the next step will be work on implementation of a control program after approval for release has been granted.

C. Spending History:

Funding Source	M.L. 2008 or FY09	M.L. 2009 or FY10	M.L. 2010 or FY11	M.L. 2011 or FY12-13	M.L. 2013 or FY14

VIII. ACQUISITION/RESTORATION LIST: N.A.

IX. VISUAL ELEMENT or MAP(S):

See attached visual graphic.

X. ACQUISITION/RESTORATION REQUIREMENTS WORKSHEET:

N.A.

XI. RESEARCH ADDENDUM:

N.A.

XII. REPORTING REQUIREMENTS:

Periodic work plan status update reports will be submitted no later than 11/15/2014, 5/15/2015, 11/15/2015, 5/15/2016 and 11/15/2016. A final report and associated products will be submitted between June 30 and August 15, 2017.

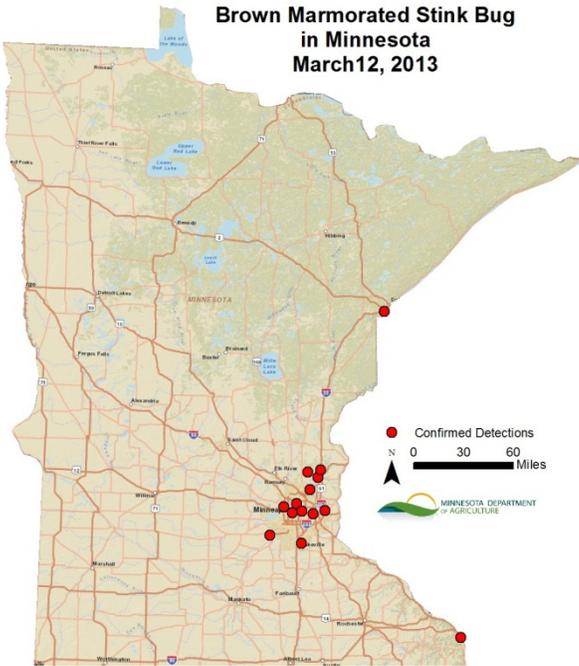


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M.L. 2014 Project Budget								
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Project Manager: <i>Robert Koch</i>								
Organization: <i>University of Minnesota</i>								
M.L. 2014 ENRTF Appropriation: \$167,000								
Project Length and Completion Date: <i>3 Years, June 30, 201</i>								
Date of Report: <i>January 15, 2014</i>								

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	<i>See UMN budget</i>			<i>Studies on overwintering potential of BMSB control agents in Minnesota</i>				
Personnel (Wages and Benefits)				\$147,897		\$147,897	\$147,897	\$147,897
<i>1 Lab Technician/Student (1.0 FTE): Salary (\$34,506.75 = \$16.55/hr x 2080 hrs) + Fringe (\$12,698.48 = 36.8% of salary) * 3 yrs - \$141,614 total</i>								
<i>1 Undergraduate Student (\$12.08/hr x 260 hrs) x 2 yrs - \$6,282 total</i>								
Professional/Technical/Service Contracts								
Equipment/Tools/Supplies								
Cages & supplies for maintaining insect populations in lab: \$1,501/yr * 3 yrs				\$4,503		\$4,503	\$4,503	\$4,503
Capital Expenditures Over \$5,000								
Printing								
Publication fees: 2 scientific articles * \$500 / article				\$1,000		\$1,000	\$1,000	\$1,000
Other								
Fee for use of space in quarantine facility & growth chambers: \$400/mo * 34 months				\$13,600		\$13,600	\$13,600	\$13,600
COLUMN TOTAL				\$167,000	\$0	\$167,000	\$167,000	\$167,000

Brown Marmorated Stink Bug Monitoring and Biocontrol Evaluation

STATUS IN MINNESOTA



Current known distribution of BMSB in Minnesota.

POTENTIAL IMPACTS

Federal risk assessment determined: *“Heavy feeding pressure by BMSB could also damage or reduce native plant species and impact biodiversity throughout the United States.”*



Fall congregation of BMSB on a building (not in MN), photo by Leske, 2010.

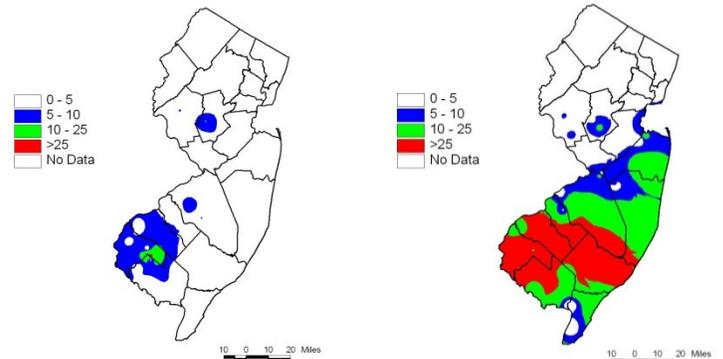
MONITORING NETWORK



Trap used for monitoring BMSB populations.

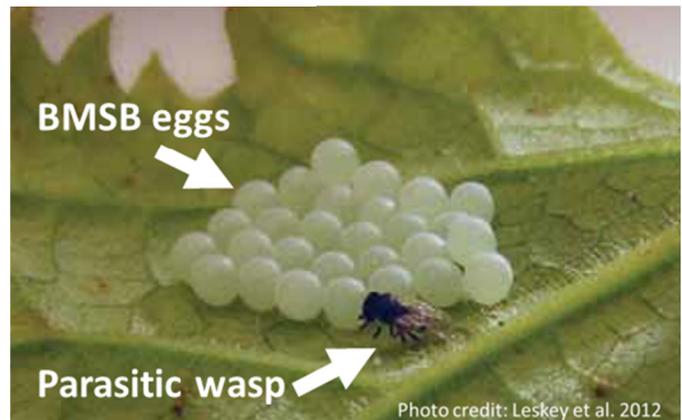
Average Nightly Distribution of Adult BMSB for week ending June 15, 2011

Average Nightly Distribution of Adult BMSB for week ending August 03, 2011



Results from BMSB monitoring network in New Jersey predicting problem area. Maps by Rutgers University.

BIOLOGICAL CONTROL



Potential biocontrol agent attacking BMSB eggs. Wasps are 1-2 mm long and cannot sting humans.