



Environment and Natural Resources Trust Fund

2021 Request for Proposal

General Information

Proposal ID: 2021-164

Proposal Title: Biocontrol of Bee Lawns and Parklands

Project Manager Information

Name: Vera Krischik

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

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Project Basic Information

Project Summary: The proposed research and outreach program is to establish a biocontrol program to manage the invasive, exotic Japanese beetle, which will reduce insecticide use in bee lawns and restorations.

Funds Requested: \$500,000

Proposed Project Completion: 2024-06-30

LCCMR Funding Category: Aquatic and Terrestrial Invasive Species (D)

Project Location

What is the best scale for describing where your work will take place?

Statewide

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Narrative

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

The MN Department of Agriculture and the MN Department of Natural Resources list Japanese beetle (JB, *Popillia japonica*) as a highly destructive, invasive exotic pest (USDA 2017, CAB 2005). Since introduced from Japan in 1916, JB has been defoliating over 300 species of plants

JB damages flowers, fruits, and foliage which results in fewer flowers and less food for bees, as well as less fruits for wildlife. However, the spraying of insecticides on bee lawns for JB grubs and on plants and flowers for adults, probably results in the most deaths to pollinators. Fortunately, JB has a natural biocontrol agent that was discovered in 1988 in Connecticut killing JB grubs (Hanula and Andreadis 1988) that needs to be introduced into MN. The microsporidian (fungal) pathogen called *Ovavesicula popilliae* was studied at Michigan State University (MSU) (Perry et al. 2013, Smitley 2011) and released in four states. For the long-term, research is needed to survey greater MN for the presence of JB and the pathogen, which so far was found in one local in MN. Research is needed to identify, culture, and disseminate the biocontrol pathogen. For the short-term, IPM programs need to be developed that conserve pollinators and kill JB.

What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.

The purpose of this research is to develop new management tactics to reduce economic and environmental damage caused by the exotic JB with the use of pathogens and JB traps to spread the pathogens. The outcome is to reduce JB numbers locally and to slow its spread around the state of MN. Current insecticides used to control JB grubs in pollinator bee lawns and in restorations have negative effects on pollinators. The research and outreach programs will be used to establish short- term and long- term management of the exotic pest. In the short- term, current EPA registered microbial insecticides will be tested in the lab and field for efficacy of killing JB adults and grubs. Outreach and educational demonstration projects at parks will promote the IPM programs. The long- term outcome is to establish an endemic pathogen to kill JB. *Ovavesicula popilliae* was first described in Connecticut and infects JB malpighian tubules and spreads systemically (Andreadis and Hanula 1987). It has since been found infecting JB in Michigan (Cappaert and Smitley 2002), Kentucky (Redmond and Potter 2010), and Arkansas (Petty et al. 2012). Research show that the fungus kills 25 to 50 percent of the JB grubs.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

The long-term outcomes of the project are to develop a biocontrol program for an exotic, invasive JB for which the most insecticide applications are used in urban areas, especially bee lawns and restorations. In the short-term, the goal is to use EPA registered microbial insecticides and other bee friendly insecticides, that conserve pollinators, to control JB. We developed an advisory board from MN Department of Agriculture, Lawn to Legumes program, Golf Course Superintendents Association, Michigan State University researchers, MN Nursery and Landscape Association, Minneapolis Park and Recreation Board, that have offered park sites for research and outreach.

Activities and Milestones

Activity 1: Biocontrol in bee lawns and parklands

Activity Budget: \$250,000

Activity Description:

For long- term management, the presence of a microsporidian called *Ovavesicula popilliae* will be surveyed statewide in MN. In preliminary small scale surveys from 2017 to 2019, JB adults were collected in traps and the frozen beetles were shipped to Michigan State University (MSU). Using molecular techniques the pathogen was found in MN beetles at one of four sites. MSU researchers are interested in continuing their collaboration with the University of Minnesota. MSU has already helped Colorado, Kentucky, Arkansas, and Kansas to release the pathogen. We will learn the methods that are needed to culture, release, and determine efficacy of the pathogen. For pathogen dissemination, JB beetle traps will be researched as a novel method to increase pathogen numbers and spread. For the short- term we will evaluate the best EPA insecticides that can control JB and not harm pollinators and beneficial insects. Reducing insecticide use will conserve other biocontrol agents, such as the parasitoids that were released in MN to control emerald ash borer. Demonstration projects at parks will educate people and increase IPM adoption.

Activity Milestones:

Description	Completion Date
Survey Greater MN to understand JB and pathogen distribution.	2022-12-31
Understand the efficacy of the pathogen in lab and field trials.	2022-12-31
Determine the pathogens establishment and spread in areas that the pathogen was introduced.	2024-06-30

Activity 2: Biocontrol in bee lawns and parklands

Activity Budget: \$250,000

Activity Description:

For short- term management, the efficacy of new EPA approved microbial insecticides and new conventional insecticides for killing JB will be researched. Also, It will be determined if these insecticides are friendly to bees and butterflies when used for JB grub control on bee lawns and JB adult control on flowers. New EPA registered microbial insecticides, such as GrubGone (*Bacillus thuringiensis galleriae*), a soil applied fungus *Beauveria bassiana*, parasitic nematodes and a bee-friendly insecticide chlorantraniliprole will be studied. Commercially available JB traps will be researched as a tool to disseminate the pathogen. It is an economic importance to MN to manage JB as it is a quarantine pest in the western US which requires the MSP airport and nurseries to adhere to strict quarantine guidelines and demonstrate that plants are JB free when shipped. IPM protocols and research news will be posted on the CUES website, cues.cfans.umn.edu/, which already offers many resources on IPM. The advisory board consists of members from MN Department of Agriculture, Lawn to Legumes program, Golf Course Superintendents Association, Michigan State University, MN Nursery and Landscape Association, and Minneapolis Parks and Rec. These participants already volunteered sites for research and outreach demonstration projects.

Activity Milestones:

Description	Completion Date
Understand the efficacy of bee friendly EPA registered insecticides on JB grubs and adults.	2024-06-30
Determine if the EPA registered microbial pathogens and bee friendly insecticides conserve pollinators.	2024-06-30
Install demonstration education programs at key parks to promote the IPM and biocontrol program.	2024-06-30

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this be funded?

The research and outreach program will help mitigate decline of native bees and beneficial insects that control pest insects. New IPM programs will be implemented that employ microbial insecticides, such as BT galleriae (specific to grubs in soil as Japanese beetle, JB), *Ovavesicula* (fungus specific to JB grubs in soil), and chlorantraniliprole, (Acelepryn insecticide friendly to bees). The USFWS identified insecticides in bee habitat as a major factor behind the decline of the urban dwelling rusty-patched bumblebee. MN efforts to increase restorations and bee lawns also needs site specific IPM programs to control pests in these restorations.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Promoting Conservation Biocontrol of Beneficial Insects	M.L. 2017, Chp. 96, Sec. 2, Subd. 08b	\$400,000
Understanding Systemic Insecticides as Protection Strategy for Bees	M.L. 2014, Chp. 226, Sec. 2, Subd. 06b	\$326,000

Project Manager and Organization Qualifications

Project Manager Name: Vera Krischik

Job Title: Associate Professor

Provide description of the project manager's qualifications to manage the proposed project.

The project manager is a University of Minnesota professor and IPM specialist with 34 years of experience promoting Integrated Pest Management (IPM), biocontrol, and compatible insecticides to protect pollinators and other good bugs in greenhouses, nurseries, lawns, urban forests, parks, and restorations. Our lab's research identifies the best ways to manage pests thru IPM to reduce non-target effects on native pollinators and biocontrol insects, such as parasitoids, lady beetles, native butterflies, and native bees, such as rusty patched bumblebee, *Bombus affinis*, and blue orchard bee, *Osmia lignaria*. Data from our site specific IPM and biocontrol program is promoted by sharing our expertise at national, state, and local research and outreach meetings. Our lab was requested to be on a technical committee to help the Minneapolis Park Rec Board to develop IPM programs for their parks. We are members of two national committees on IPM for landscapes, two national committee on monarch and rusty patched bumblebee, USDA grant panels that review proposals associated with pollinators, and local efforts by businesses and municipalities to develop IPM programs. Every year we train pesticide applicators on how to correctly use pesticides in nine MDA, MNLA, UM workshops. We provide over 20 talks yearly to growers, commodity groups, and citizens on IPM and pollinators. We have an online training course on IPM and pesticides with the green industry group MNLA. We maintain an IPM website with technical information about pesticides and pollinators and an online 300 page IPM manual to identify pests and develop proper IPM, <http://cues.cfans.umn.edu> . We have another website devoted to IPM of pollinators, with information on pollinator identification, proper host plants, and IPM management of restorations, <https://ncipmhort.dl.umn.edu>, cues.cfans.umn.edu . Yearly we publish papers for commodity journals, research, and outreach.

Organization: U of MN - College of Food, Agriculture and Natural Resource Sciences

Organization Description:

The University of Minnesota's College of Food and Natural Resources Science (CFANS) supports programs that promote agriculture, natural resource protection, agricultural commodity economics, and human needs related to agriculture. Through CFANS Agricultural Experiment Station research lands are provided and maintained to help develop research data and outreach programs to promote and solve issues related to agriculture and natural resource management throughout the state. Through the research, expertise is provided to local, county, and state government on ways to develop and support MN resources.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Project investigator		Perform research, outreach, and financial administration.			0%	3		-
Research associate 1		Direct and perform research and outreach programs			31.8%	3		\$219,400
Research associate 2		Perform research and outreach programs			31.8%	3		\$156,600
Undergraduate research associate		Help with research and outreach programs			0%	2		\$30,000
							Sub Total	\$406,000
Contracts and Services								
							Sub Total	-
Equipment, Tools, and Supplies								
	Tools and Supplies	Lab equipment to identify the pathogens, field equipment to release and survey the pathogens. Lab and field equipment to test the efficacy of the 4 EPA registered insecticides for research and in demonstration projects.	Establish and maintain the pathogen <i>Ovavesicula</i> and perform research in the lab and field on efficacy and establishment.					\$60,000
							Sub Total	\$60,000
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-

Travel In Minnesota								
	Miles/ Meals/ Lodging	Travel for research and outreach to field sites, research plots, outreach meetings, and demonstration sites.	Mileage, renting UM car					\$18,000
							Sub Total	\$18,000
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
	Printing	Costs associated with demonstration site signage, posters, and handouts	Educational program for consumers and professional landscape managers to use pollinator friendly management programs for JB.					\$10,000
	Publication	Page costs associated with publishing research in peer reviewed publications.	Fees associated with publishing in professional journals.					\$6,000
							Sub Total	\$16,000
Other Expenses								
							Sub Total	-
							Grand Total	\$500,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
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Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
			Non State Sub Total	-
			Funds Total	-

Attachments

Required Attachments

Visual Component

File: [9f60d5d0-a76.pdf](#)

Alternate Text for Visual Component

Research, outreach education, and demonstration projects to conserve pollinators by using biocontrol with a native fungus to control the exotic Japanese beetle in bee lawns, parks, and restorations.

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Does your project have patent, royalties, or revenue potential?

No

Does your project include research?

Yes

Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration



UNIVERSITY
OF MINNESOTA
Driven to Discover®

2021-2024 LCCMR, Biocontrol in bee lawns and parklands
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Activity 1: For long-term management and biocontrol of exotic Japanese beetle, *Popillia japonica*, a host specific and native fungal pathogen called *Ovavesicula popilliae* needs to be cultured and released. Beetles collected in MN were studied by Michigan State University and the pathogen was found in low numbers in MN. Surveys will reveal the pathogens presence statewide in MN. The pathogen will be cultured, distributed, and its efficacy evaluated through research.



First introduced to the US from Japan in 1916, Japanese beetle was commonly found in MN by the 1990's. Adult feeding by Japanese beetles result in damage to foliage and fruits and reduction in food for bees and wildlife.

Japanese beetles feed on pollen and ovaries of flowers depriving bees of food. Flowers that are damaged will not make fruits, such as berries, for wildlife.

The long term research outcome is to establish an endemic pathogen to kill Japanese beetle. The pathogen *Ovavesicula popilliae* was first described in CT and was introduced by researchers into MI, KY, AR, and KS.

Results shows that infected grubs are between 25 to 50 % less likely to survive winter. Populations of beetles decrease by 60 % in 5 years. The pathogen has been found in MN thru collaboration with Michigan State University.

Activity 2: For short-term management, research on the efficacy of new EPA approved microbial products, GrubGone (*Bacillus thuringiensis galleriae*), soil applied fungus *Beauveria bassiana*, parasitic nematodes, and bee-friendly insecticide chlorantranilprole will be studied. The outcome will be site specific IPM protocols, demonstration projects in parks, and educational programs for outreach to increase implementation.



Bee lawns have been established in MN in state and local programs to help provide habitat and flower resources to native bees, butterflies, and endangered rusty patched bumblebee.

The most common exotic pest of bee lawns is Japanese beetle. The highest use of insecticides in urban areas is to control Japanese beetle as adults on plants and grubs in the soil under grass.

Research on IPM and biocontrol to manage Japanese beetle and protect pollinators is needed. Demonstration projects in parks will help with IPM adoption.

Outcomes are to provide IPM management that protects pollinators in established bee lawns and restorations using biocontrol to reduce non-target effects from insecticides for native pollinators and beneficial insects.