**PROJECT TITLE: Bee Minnesota - Protect our Native Bumblebees**

**I. PROJECT STATEMENT**

Our goal is to protect native pollinators from risk of disease transmission and population declines. ***By screening and neutralizing bee pathogens we wish to promote best management practices to maintain honey bee health and prevent pathogen spill-over into native bee populations.*** Native bumblebees, *Bombus* spp., are important pollinators of wild flowering plants and crops such as tomatoes and berries, and are appreciated for their beauty. Unfortunately, five of our twenty-three species of native bumblebees in Minnesota are considered vulnerable, endangered, or critically endangered by the International Union for Conservation of Nature. The rusty patched bumblebee, *Bombus affinis* Cresson, was the first bumblebee to be listed as federally endangered in the U.S. Rusty patched bumble bee populations in Minnesota are crucial to recovery as over 35% of all observed individuals in 2018 were in Minnesota.

The global decline in bee populations has been attributed to habitat loss, pesticides, parasites, and ***pathogens***. For some bumblebee species, a leading problem may be infectious diseases. For example, the spread of the bumblebee pathogen, *Nosema bombi*, exacerbated through commercial rearing and distribution of *Bombus impatiens* across the U.S., was associated with declining bumblebee species. Another emerging threat is viral pathogen transmission among pollinator species as they forage on common flowers. For example, there is evidence that Deformed wing virus (DWV), may be transmitted from honey bees to bumblebees if diseased honey bees deposit viruses on flower parts (spillover) and other bees subsequently pick them up when visiting the same flowers. Very little is known about pathogen prevalence in bumblebees in the U.S. and in Minnesota. To first understand and then mitigate further declines in these important pollinators, it is critical to collect baseline data on archetypal pathogens in our local populations of honey bees and bumblebees.

We propose to use cutting edge technology to rapidly screen for DWV and *Nosema* presence in three common bumblebees: *Bombus impatiens, B. bimaculatus,* and *B. griseocollis* (accounting for ~80% of bumblebee individuals in this region of Minnesota) in three locations near honey bee colonies*.* Finding a solution or even a cure to bee pathogens is a high priority for our assembled team; therefore, we propose to run an innovative pilot study in an attempt to neutralize DWV. Finally, we will protect our native pollinators by educating beekeepers about the critical “public health” need to keep managed bees as healthy as possible. Beekeepers within 2 miles of the three sampling locations will be engaged in monitoring their colonies for DWV, *Varroa* mite parasites that vector DWV, and other health concerns.

**II. PROJECT ACTIVITIES AND OUTCOMES**

**Activity 1 Title: Screen for DWV and *Nosema* in bumblebees and quantify potential for virus transmission between honey bees and bumblebees.**

**Description:**There is potential for pathogens to be transmitted from honey bees to bumblebees while foraging on flowers, but the extent of this transmission in nature has not been explored. In three locations where we manage honey bee colonies (8 colonies per location: Minneapolis, the MSP airport, and in Rochester), we will use a new sequencing assay, first developed in the Schroeder Lab, to quantify the prevalence and abundance of DWV and *Nosema* in three species of bumblebees collected while foraging. We also will monitor pathogen load in honey bees foraging on the same species of flowers during early, mid, and late summer and throughout the year in our managed honey bee colonies. Furthermore, we will also set out pathogen-free *B. impatiens* colonies (reared from wild-caught queens) in the same locations to monitor possible infection over the season, and how the infection affects their health and reproduction. **ENRTF BUDGET: $505,000**

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| **Outcome** | **Completion Date** |
| *1.* Screen for presence of DWV and *Nosema* in three common bumblebee species and surrounding honey bee colonies | *October 2022* |
| *2.* Monitor potential for virus transmission into *B. impatiens* colonies placed near honey bee colonies, and if pathogen is found, quantify effects on bumblebee colony health | *December 2022* |

**Activity 2 Title: Explore potential to neutralize DWV in bees.**

**Description:**Run laboratory-based cage and cell culture assays to determine if DWV can be neutralized in honey bees and bumblebees. It was recently reported that an effective treatment for a related virus of DWV, namely Sacbrood virus, was discovered. This treatment is based on a specific antibody raised from egg yolk against the virus which was used to immunize honey bee pupae. This work will be repeated here to determine whether DWV can be neutralized in both honey bees and bumblebees. Antibody synthesis, formulation, and production will be carried out in collaboration with Dr Ben Hause (vaccine production specialist). **ENRTF BUDGET: $101,500**

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| **Outcome** | **Completion Date** |
| *1.* Preparation, synthesis, formulation, and testing of DWV specific antibodies in honey bee and bumblebee tissues | *July 2021* |
| *2.* Application of DWV antibodies in caged honey bees and bumblebees  | *May 2022* |

**Activity 3 Title: Beekeeper and community “public health” education about native and non-native bees in Minnesota.**

**Description:**Minnesota’s bee diversity boasts over 450 species and includes both native and non-native, managed and wild species. While we recognize the important role of managed honey bees in Minnesota, it is critical to provide outreach regarding the importance of our native bee pollinators and how unmindful bee management might negatively impact native bee health. We propose an educational campaign (Bee Minnesota) that increases understanding of the roles of native and managed bees in Minnesota. Additionally, we will engage backyard beekeepers in the cities of Minneapolis andRochester to participate as beekeeper citizen scientists via pathogen and pest sampling in their honey bee colonies. Everyone will be kept updated as to progress made throughout the project by means of a well-managed and curated website. **ENRTF BUDGET: $86,500**

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| **Outcome** | **Completion Date** |
| *1. Provide education via a bee public health campaign to promote practices and policies that support wild, native bees* | *April 2023* |
| *2. Establish and disseminate updated beekeeping best management practices to protect wild, native bees in Minnesota* | *June 2023* |

**III. PROJECT PARTNERS AND COLLABORATORS:** Dr Declan Schroeder (Pathogen detection & surveillance Associate Professor, U of M) is the project leader. Project partners are with Dr Marla Spivak (Distinguished McKnight Professor Apiculture / Social Insects, U of M), Dr Rebecca Masterman (Assistant Extension Professor and Bee Squad Program Director, U of M), and Dr Elaine Evans (Assistant Extension Professor, Bee Researcher, U of M). Project Collaborator is Dr Ben Hause (Tallgrass Biologics LLC).

**IV. LONG-TERM IMPLEMENTATION AND FUNDING:** The Bee Lab at the University of Minnesota has an active Extension and Outreach program run by Dr. Rebecca Masterman (honey bees) and Dr. Elaine Evans (native bees, especially bumblebees) who will continue to disseminate results after project completion. Drs. Schroeder and Spivak will publish research findings and present to scientific communities. Funds from this project will build on federal resources being used to pursue these goals, greatly expanding the scope of our efforts.

**V. SEE ADDITIONAL PROPOSAL COMPONENTS: A. Proposal Budget Spreadsheet; B. Visual Component or Map & F. Project Manager Qualifications and Organization Description**