UNIVERSITY OF WISCONSIN - LA CROSSE
COLLEGE OF SCIENCE AND HEALTH

TRAVEL & SUPPLIES GRANTS
For Student Researchers

Date: 2/18/2024 **Total funds requested** $500

Term for which funds are requested: 20 Fall
20 24 Spring
20 Summer

Type of Grant:
Type A: Supplies Type A
Type B: Travel

Project Title Local solitary ground-nesting bees' pollination habits

Conference Title (Travel Grants):

Destination/Dates of travel:

Principle Student Author:

Print/type name: Ian McGuigan Student ID: REDACTED
Local address: REDACTED Local phone: REDACTED
Signature: [redacted] E-mail: REDACTED

Other Student Authors:

Print/type name: Student ID:
Local address: Local phone:
Signature: E-mail:

Print/type name: Student ID:
Local address: Local phone:
Signature: E-mail:

Faculty mentor 1:

Name: Barrett Klein Department: Biology
Signature: Barrett Klein Digitally signed by Barrett Klein Date: 2024.02.19 11:51:47 -06'00' E-mail address bklein@uwlax.edu

Faculty mentor 2:

Name: Department:
Signature: E-mail address

(For office use only)

Eligibility check for students:	1	2	3
Enrolled?			
SAH major			
GPA > 2.5			
Previous reports on file			

Committee action: Approval: Denial: Date: Amount:

Dean's action: Approval: Denial: Date:

Abstract

Bees play a pivotal role in the pollination of native crops and plants. Many of these bees are solitary ground-nesting bees, but their role as pollinators is much less understood than social honeybees or bumblebees. Determining which plant species the native ground-nesting bees pollinate is of utmost importance to conservation efforts of both the bees and the plants. Using a high-throughput DNA sequencing technique on pollen samples collected from bees, we will determine the floral origins. We aim to identify the ecological importance of native ground-nesting bees by determining which plant species they pollinate in the driftless region. This study aims to provide the rudimentary knowledge used to aid in monitoring ground-nesting bee populations and the overall abundance and diversity of the plants they pollinate.

Background and Significance

Native bees play a crucial role in many ecosystem functions (Danforth et al., 2006; Klein et al., 2007). They are prominent pollinators of native plants throughout the United States and important for the pollination of cultivated plants (Kopec et al., 2017), providing an estimated $3251/hectare in revenue (Khalifa et al., 2021). 85% of these bees are solitary (Batra, 1984) and approximately 75% of them excavate their nests in the ground (Antoine et al., 2021), yet relatively little is known about their pollination habits. Solitary ground-nesting bees are often overshadowed in the field of public opinion and among the biological community by the more visible bumblebees or European honeybees. This has led to a lack of research and a lack of understanding of these species and their contributions to pollination.

Due to this gap in knowledge, the ramifications of habitat loss on the bees are entirely left to speculation. Without a more comprehensive understanding of the effects of human interference and land development on the organisms we will not understand if the populations can be sustained in urban environments. Additionally, we cannot truly understand the consequences of ground-nesting bee declines without understanding which native flora the bees predominantly pollinate. Investigating this knowledge gap will assist in local conservation efforts in urban and non-urban habitats.

Similar to elsewhere in the ground-nesting bee range, little is known in La Crosse about these bees. This knowledge lapse could have negative implications for the success of the populations and the larger ecological community. Today, habitat loss, climate change, pesticide use, and parasitism (Kopec et al., 2017) have been the major driving forces behind the decline

in bee populations. If we do not understand the behavior and habits of these organisms, we cannot truly understand the degree to which our actions have negative consequences.

Two of the common, native ground-nesting bees found in La Crosse are the genera *Colletes* (Plasterer bees) and *Andrena* (Miner bees). Both genera are some of the first pollinators to emerge in spring, making them essential for the pollination of early blooming flora. Identifying which plant species are pollinated by these bees will inform conservation efforts for both lineages of organisms. For example, in the driftless region, if the bees pollinate native spring blooming endangered plants like the Carolina anemone (*Anemone caroliniana*) or the ground plum (*Astragalus crassicarpus*), the success of both the plant and the bees could be linked. Once these pollination preferences are known, the conservation efforts can be combined to create a healthier ecosystem in local natural areas.

Objectives

Determine which plants solitary ground-nesting bees are pollinating in the driftless region.

Genetically sequencing pollen samples collected from native ground-nesting bees will allow us to determine which plant species the bees are pollinating during the spring bloom in the driftless region. Pollen collected from bees will be identified by high - throughput DNA sequencing to determine floral origins.

Methodology

Pollen samples were collected by Danielle Hudson, a graduate student in Dr. Barrett Kleins Pupating Lab this past spring. During collection, pollen was brushed from specimens collected at each site, a method that has been used by prior students in the Pupating Lab with success. Sites that were sampled included a variety of habitats: prairie, riparian, forested, and urban. Microscopic pollen identification is slow and has a low taxonomic resolution (Bell et al., 2016). Therefore, we will collaborate with the Osmundson lab (UWL) to use high-throughput DNA sequencing (Illumina NovaSeq platform) to identify the floral origins of the pollen sample (Bell et al., 2016). The DNA barcoding gene for plant species identification, ribulose-bisphosphate carboxylase (rbcL) (Nurhasanah et al., 2019), will be amplified using primers developed by Dr. Osmundson, incorporating Illumina sequencing adapters and sample-specific sequence tags. The resulting DNA will then be shipped to the University of Wisconsin Biotechnology Center at UW Madison to be sequenced on an Illumina NovaSeq 6000 instrument. Floral preferences will be identified by comparing with databases, such as GenBank and BOLD (Barcode of Life).

Dissemination

We plan to share the data with Mississippi Valley Conservancy, the Wisconsin Department of Natural Resources, and the Research and Creativity symposium at the University of Wisconsin La - Crosse. The research will ultimately be published in a peer-reviewed biology journal.

References

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UW-L CSH
TRAVEL AND SUPPLIES GRANTS FOR STUDENTS

SUPPLIES GRANT APPLICATION

Budget Form

Name: Ian McGuigan

Project Title: Local solitary ground-nesting bees' pollination habits

Advisor: Barrett Klein

Department: Biology

Itemized list of required supplies :

Item	Quantity		Unit Cost		Total Cost
Qiagen DNeasy mericon Food Kit	2	x	225	=	$450
Qiagen kit delivery	1	x	40	=	$40
		x		=	$
		x		=	$
		x		=	$
		x		=	$
		x		=	$
		x		=	$
		x		=	$
		x		=	$
		x		=	$
		x		=	$

Total Cost: $490

Please explain any unusual costs or circumstances. If the total cost is greater than $500, indicate where the balance of the funding will come from (your host department, advisor, yourself, etc.).