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Biodiversity in Millipedes at the Fieldston School



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Abstract

Millipedes, which act as decomposers, are essential to the ecosystem in order for it to “end” and “start.” The goal of collecting DNA samples of millipedes in different areas of the Fieldston campus was to determine what different species live on the Fieldston campus, as well as how the species differ in the different areas. 30 samples of the millipedes were collected and used to determine their DNA sequence by using the Chelex extraction method. The product of the Chelex extraction method was put through PCR and then through gel electrophoresis to see how much DNA was effectively recovered.

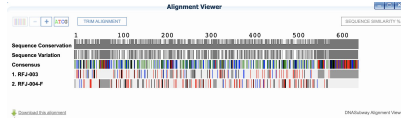
Introduction

- Millipedes are Diplopods
 - Typically found in moist, dark environments
 - play role of scavenger
 - majority are detritivores
 - Millipedes have four legs per segment
- Millipedes populations
 - the ecosystem makes a large impact on the biodiversity of the millipedes
- We measured the biodiversity of the millipedes in order to determine how different ecosystems within the Fieldston campus impact the DNA of the millipedes

Results



Figure 1. Sample Locations in Fieldston Campus. Map of the Fieldston Campus. The millipedes were collected from behind the Lower Field as well as the back parking lot.



| | | |
|-------|------------|---|
| 1(1). | HM180488.1 | <i>Calosilpha brunnicollis</i> - <i>Calosilpha brunneicollis</i> voucher NSMKG:IN-000740 cytochrome oxidase subunit 1 (COI) gene, partial cds |
| 3(3). | MF752269.1 | <i>Cylindroiulus caeruleocinctus</i> - <i>Cylindroiulus caeruleocinctus</i> voucher BIOUG12814-A08 cytochrome oxidase subunit 1 (COI) gene, partial cds |

Figure 3. Species Found at Locations in Fieldston Campus. These species were found on the Fieldston Campus. The *Calosilpha brunnicollis* unfortunately turned out to be a type of beetle and not a millipede. The *Cylindroiulus caeruleocinctus* fortunately did turn out to be a millipede.

Figure 4. Untrimmed Multiple Alignment Created by MUSCLE. Above are sequencing results made by the MUSCLE program. The image displays 600 bp of sequence conservation, the different colors represent different nucleotides. In the sequence conservation and sequence variation bars there are two colors: gray and white. The gray spaces represent conservation and the white spaces represent variation.

Materials and Methods

- Twenty millipede samples were collected
- Found in areas around the Ethical Culture Fieldston School campus
- Chelex protocol was used to extract DNA from the millipedes
- DNA from the samples was isolated and amplified using PCR
- PCR products were analyzed using gel electrophoresis and two samples were sequenced

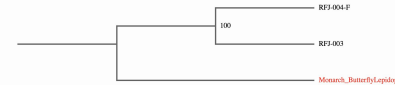


Figure 5. Phylogenetic Tree of Sequencing Results. This phylogenetic tree shows the evolutionary relationships between the two species found. According to the algorithm, the Monarch Butterfly Lepidoptera is the least closely related, which is a mistake.

Discussion

- The amount of millipedes in an area indicates the conditions of the environment.
 - A good environment is one that is damp/moist
- There were many millipedes found on the Fieldston campus, but only two were successfully amplified
 - One was not even a millipede (it was a larval beetle)
- In order to improve the results, a larger variety of samples from different locations could be collected
 - In order to increase the diversity
- Due to the lack of results produced by our data, it is difficult to come to any specific conclusions regarding the biodiversity of millipedes on the Fieldston campus
 - Additional research is necessary

References

- NYC Urban Barcode Project. (2016). Retrieved from <http://www.nycurbanbarcodeproject.org/>
- Smith, Thomas. "Types of Millipedes: Beetles." Retrieved, 2 Mar. 2019. <http://www.typesofbeetles.com/typesofbeetles-484833.html>
- "Millipede." Wikipedia. (2020). In *Encyclopedia Britannica*. Retrieved from <https://www.britannica.com/science/arthropod/Millipede>
- "Millipede." *The "What Is Millipede" List*. (2016). Retrieved from <http://www.101things.com/what-is-millipede/what-is-millipede.com/~millipede/pedia-to-the-million-and-billions-of-genes-change>
- "Millipede." *Millipede*. (2020). Retrieved from <https://www.encyclopedia.com/animals/mammals/arthropods/millipede>
- "Millipede." *Encyclopedia Britannica*. Retrieved from <https://www.britannica.com/science/arthropod/Millipede>

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