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Biodiversity of Centipedes on the Fieldston Campus

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Abstract

The goal of this experiment was to measure the relative biodiversity of centipede species collected from various locations around the Ethical Culture Fieldston School Bronx campus. The DNA of twelve samples was collected, extracted, and analyzed to determine species biodiversity.

The DNA was extracted using the Chelex method. We discovered three species on the Bronx campus.

Introduction

Centipedes (Chilopoda) are small, nocturnal arthropods

- Elongated, multi-segmented body structure
- Found most commonly in tropical/subtropical areas, but have been identified in all six continents (except Antarctica)

They are very diverse, with an estimated 8,000 species across the world

- Vary greatly in size, shape, color, and segmentation
- Life cycle lasts up to six years in some species

These predatory insects hunt insects, annelids, mollusks, other centipedes, and sometimes small vertebrates

- They use a pincerlike modified set of front legs (forcipules) to inject poison into prey
- Will sometimes consume leaf litter

Due to the extreme diversity in Chilopoda, the effects of selection pressure created by man-made environments can be observed clearly and over a short period of time.

Results

Table 1: Results of DNA Sequencing

ID	Species	ID	Species
001	<i>Lithobius forficatus</i>	006	<i>Mecistocephalus multidentatus</i> *
002	<i>Mecistocephalus multidentatus</i> *	007	Unsuccessful
003	<i>Mecistocephalus multidentatus</i> *	008	Unsuccessful
004	<i>Lithobius forficatus</i>	009	Unsuccessful
005	<i>Cryptops hortensis</i>	010	Unsuccessful

Table 1. These centipede species were collected at and around the Ethical Culture Fieldston School campus and identified by sequencing. *Lithobius forficatus* was identified twice and *Mecistocephalus multidentatus* was identified three times. Species marked with a * indicate 120 or more mismatches from the genetic database.

Figure 4: Phylogenetic Tree of Sequencing Results

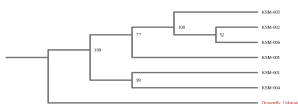


Figure 4. Maximum likelihood phylogenetic tree displaying the evolutionary relationships between the identified species. It is important to note that both samples KSM-001 and KSM-004 were identified as *Lithobius forficatus*, and that samples KSM-002, KSM-003, and KSM-006 were identified as *Mecistocephalus multidentatus*. The species highlighted in red has the least genetic commonalities with the rest of the species.

Materials and Methods

- 12 centipede samples were collected
 - DNA from the samples was isolated and amplified using PCR
- PCR products were analyzed using gel electrophoresis and 10 samples were sequenced
 - 6 were successfully sequenced for DNA

Figure 1: Sample Collection Location

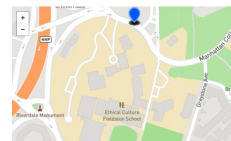


Figure 1. Ethical Culture Fieldston School campus.

Figure 3: Untrimmed Multiple Alignment Created By MUSCLE

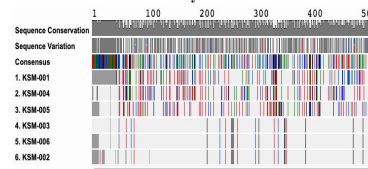


Figure 3. Sequencing results illustrated by the MUSCLE program. This image shows 500 bp of sequence conservation, with the colors representing different nucleotides. In both the sequence conservation bar and the sequence variation bar, conservation is represented by gray and variation by white.

References

- Centipedes. (n.d.). ScienceDirect. Retrieved November 19, 2020, from <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/centipede#:~:text=Background,-Centipedes%20are%20nocturnal%20mit isegmented%20elongated%20arthropods%20known%20for%20the%20distinct,to%20inject%20venom%20into%20prey>
- Using DNA barcodes to identify and classify living things. (n.d.). DNA Barcoding 101. Retrieved November 19, 2020, from <https://dnabarcoding101.org/files/using-dna-barcodes.pdf>

Discussion

- The aim of this experiment was to determine the biodiversity of Centipede species across the Ethical Culture Fieldston School Campus.
 - Although more than one species was identified, there were only three species found from our limited sample size (6 samples).
- Because of small the sample size, assumptions about the Biodiversity across the entire campus can not be made, especially because most of the samples that were successful were taken from one spot on the campus.
- Of the species determined through DNA sequencing, *Mecistocephalus multidentatus* was found to be three of our centipede samples. It is important to note that when the DNA of these samples was sequenced and put into the database, the best match had over 120 mismatches. And when sequenced by MUSCLE, the mismatches lined up perfectly for each of the three samples. This most likely means that the DNA of all three of these samples was degraded and the database did its best to match them to a possible species, but in a much less likely scenario, this could mean a new species was discovered because of the homogeneity of small clusters of a new species.
- In the future, increasing the number of samples would improve the reliability of the data of the biodiversity across the Fieldston campus. It would be informative to not only collect more samples from different spots across the campus but to also collect more samples within each location.

Acknowledgements

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