Biodiversity of Millipedes in Central Park

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Abstract

Millipedes of several species were collected from majority shaded or sunny leaf litter in Central Park to determine biodiversity in each of these microenvironments. We isolated the DNA using chelex, amplified the DNA by PCR, and confirmed the results through gel electrophoresis. Once confirmed, we sent our PCR to Azenta for sequencing and used BLAST to identify the different species of millipedes. Since millipedes require a moist habitat, and sunlight dries out the environment, we hypothesized that less sun exposure in an area will lead to greater biodiversity of millipede species within this region. Our results supported our hypothesis as there was more biodiversity of millipedes in the shaded areas.

Introduction

- Millipedes typically thrive in environments that are rich in organic matter[1]
  - Found indoors and outdoors, mostly under leaves, near rotting wood, and in mulch[1]
  - Decompose vegetation and cycle nutrients into soil[1]
- Millipedes require a high-humidity environment, and are most active at night[1]
- There are over 7,000 species of millipedes in the world, and 1,400 of these occur in North America[1]
- Millipedes and centipedes are arthropods, but Millipedes belong to the class Diplopoda, while centipedes belong to Chilopoda[2]
- They are invertebrates, with two pairs of legs on each body segment, and a hard external skeleton[2]
  - Amount of legs can range from 40 to 400
- When attacked by other organisms, they curl themselves into a tight spiral shape, and use defense glands to discharge liquid that drives off predators[2]
- Central Park is 840 acres is in a humid subtropical climate zone[3], contains several bodies of water, and is a home to many different organisms[4]
- Biodiversity is the variety of all life on Earth, and the kinds are genetic diversity, species diversity, and biogeographic diversity[5]
- We hypothesized that there would be more species diversity for millipedes in shadier areas, as areas with less sunlight contain more moisture
- Our hypothesis was supported, as 5 different species were found in moist, shady areas, whereas only 2 species were found in the sunny, dry areas

Results

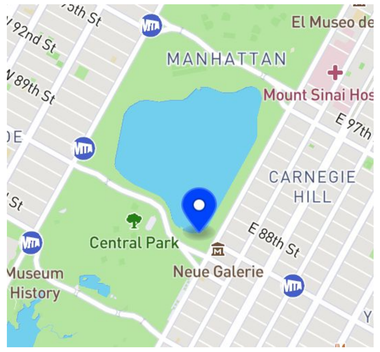

Figure 1. Sample Location on Bridle Path in Central Park. This is a map of Central Park and the surrounding area, indicating the location of the collected samples. The samples were collected at different locations on or near the Bridle Path in Central Park.

Sample	Species (identified via BLAST) - Scientific Name	Species - Common name	Habitat Collected
Sample 1	*Hyloniscus riparius*	Woodlice	Shaded/Moist
Sample 2	*Hyloniscus riparius*	Woodlice	Shaded/Moist
Sample 3	*Lumbricus castaneus*	Chestnut worm	Shaded/Moist
Sample 4	*Lithobius microps*	Stone centipede	Shaded/Moist
Sample 5	*Lithobius melanops*	Brown centipede	Shaded/Moist
Sample 6	*Oxidus gracilis*	Greenhouse millipede	Shaded/Moist
Sample 7	*Eisenia andrei*	Tiger worm	Sunny/Dry
Sample 8	*Oxidus gracilis*	Greenhouse millipede	Sunny/Dry
Sample 9	*Oxidus gracilis*	Greenhouse millipede	Sunny/Dry
Sample 10	*Oxidus gracilis*	Greenhouse millipede	Sunny/Dry
Sample 11	*Oxidus gracilis*	Greenhouse millipede	Sunny/Dry

Table 1. Species Identification of Samples Collected. Invertebrate samples were collected on or near the Central Park Bridle Path. DNA was extracted, sequenced, and species were identified by BLAST. The samples were either collected in a sunny, dry area or in a shaded, moist area

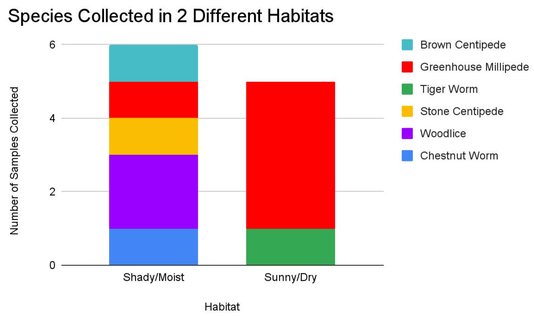

Figure 3. Species Collected in Different Habitats. Invertebrate samples were collected and their species were identified by BLAST. This figure demonstrates the number of different species that were collected in a sunny, dry area in comparison to those collected in a shaded, moist area. Each color in the chart represents a different species. Five different species were collected in shady areas and two species were collected in sunny areas.

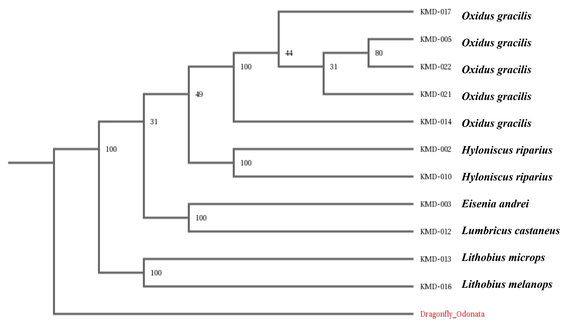

Figure 2. Neighborhood Joining Phylogenetic Tree. This figure shows the neighborhood joining phylogenetic tree, showing the evolutionary relationships between the species. The species written in red is the outgroup with the least genetic affiliation with the rest of the species.

Location of Samples	Sunny Areas	Shaded Areas
Simpson's Biodiversity Measure (1/D)	1.5	4.5

Table 2. Simpson's Biodiversity Measure in Different Habitats. Simpson's biodiversity measure (1/D) was used to determine the biodiversity in each habitat, sunny or shady.

Materials and Methods

- 30 sample specimens were collected from sunny or shady areas along the Central Park Bridle Path
- Isolation of DNA: ground tissue from the samples into tubes filled with chelex solution
- DNA amplification: performed PCR with invertebrate COI primers
  - Gel electrophoresis to verify
- Sequencing: sent PCR to Azenta for sequencing and then analyzed and identified the species using BLAST.

Discussion

- We hypothesized that there would be a greater biodiversity of millipede species in areas with less sun exposure.
- There was more biodiversity in the species collected from the shaded areas, and that most of the samples collected from sunny areas were a species of millipede, identified as *Oxidus Gracilis*, while the species collected from shaded areas varied
- As shown in Table 1, we collected 6 samples from shaded and moist areas, typically the habitat of a millipede, and 5 samples from a sunny and dry area, to compare the biodiversity of millipedes in the areas
- We used Simpson's Biodiversity measure (1/D) to determine the biodiversity in each habitat that we collected samples from
- As shown in Table 2, the biodiversity level was higher in the shaded areas (4.5), and lower in the sunny areas (1.5)
- In the future, increasing the number of samples would improve the reliability of the data of the biodiversity of millipedes
- Although the Bridle Path in Central Park is home to several species, our results do not speak for all millipede species in the area
- One of the limitations of our research was that we did not have that many samples to draw conclusions, and in the future, we suggest collecting more samples to draw more accurate conclusions
- Another limitation is that we only collected from one area in Central Park, and taking samples from a wider variety of locations could also tell us more about the biodiversity of millipedes
- This information could be valuable to the Central Park Conservatory as they could create areas in parks to keep leaf litter to create more shady moist areas, allowing biodiversity to flourish.

References

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