Analyzing Ant Activities in Autumnal Ambients

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Abstract

Ants were collected along the Bridle Path in Central Park in order to analyze the biodiversity of ants in microenvironments in Central Park. Once the samples were collected, DNA was extracted using Chelex, amplified by PCR, and analyzed by gel electrophoresis. Next, the DNA was sequenced in order to identify the different ant species. We hypothesized that we would find less biodiversity of ants in the collection areas that are subject to more human disruption and pollution. Our data did not support our hypothesis as we found that areas with less human disruption were more likely to be dominated by a single ant species. Although human disruption decreases the total number of ants in an area, the disruption may foster ant biodiversity by preventing a single species from dominating a given location.

Introduction

- Ants, or *Formicidae*, are invertebrates belonging to the order *Hymenoptera*, a group of specialized insects that undergo a complete cycle of metamorphosis and often associate in large colonies with complex social organization (1)
  - 0.2 to 2.5 centimeters in size (1)
  - Lifespan from several weeks to several years (1)
  - Over 10,000 species worldwide; 42 in Manhattan (4)
- Native ants can live in a variety of habitats, including deserts, beaches, walls, and abandoned plumbing, however, queen ants often prefer to build their nests in soil or abandoned trees (1).
  - Colonies play crucial roles in their environments, providing seed dispersal, pollination, and soil enrichment (4).
- Central Park encompasses 843 acres with open lawns, aquatic ecosystems, and wooded areas, making it home to a large portion of New York City's biodiversity (2)
  - Originally the land was cared for by the Lenape people as part of "Manahattan"
  - Opened to public use in 1859, after the destruction of Seneca Village, becoming the first landscaped public park in the United States (2)
- Overcrowding rates in New York City are around 11%, which results in increased construction initiatives and human activity (3).
  - Result is greenhouse gas emissions and pollution
  - Pollutants can damage trees and soil

Results

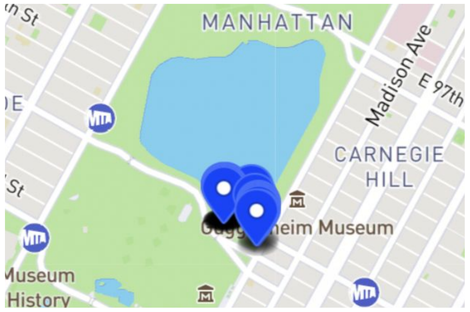

Figure 1. Sample Collection Locations in Central Park. Shown a map of Central Park with the locations where samples were collected on or near the Bridle Path and under Bridge 24. The farthest east location pin represents the samples taken from near Bridge 24, in dry leaves near trees, while the cluster of pins represents samples taken from the southeast side of the Bridle Path.

	NW Side of Bridge 24	West Side of Bridge 24	East Bridle Path
Species	*Bledius gallicus (2)* *Lasius psammophilus (11)* *Nylanderia (3)* *Bradysia tilicola (1)* *Lasius claviger (1)*	*Nylanderia (1)* *Emblyna (1)*	*Lasius claviger (2)* *Lasius psammophilus (3)* *Prenolepis imparis (1)* *Nylanderia (1)* *Ponera pennsylvanica (1)*
Simpson's Biodiversity (1/D)	2.4	2.0	4.0

Table 2. Species and Biodiversity Identified in Locations Sampled. Ant samples were collected in three areas of Central Park with varying levels of human activity. Simpson's Biodiversity (1/D) was used to calculate the biodiversity of ants in more and less populated areas.

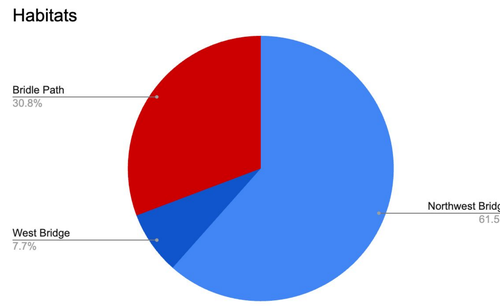

Figure 3. Ant Samples Collected from the Bridle Path and from Bridge 24. This pie chart demonstrates that the majority of ants (69.2%) collected in Central Park were from the area around Bridge 24, an area with less human traffic and pollution than the Bridle Path.

Materials and Methods

- 30 samples from Central Park were collected
  - 8 samples from Bridle Path
  - 18 samples from Northwest Side of Bridge 24
  - 4 samples from West Side of Bridge
- DNA was extracted and amplified using PCR
- PCR products were analyzed using gel electrophoresis
- 28 samples were sequenced and species were identified using BLAST

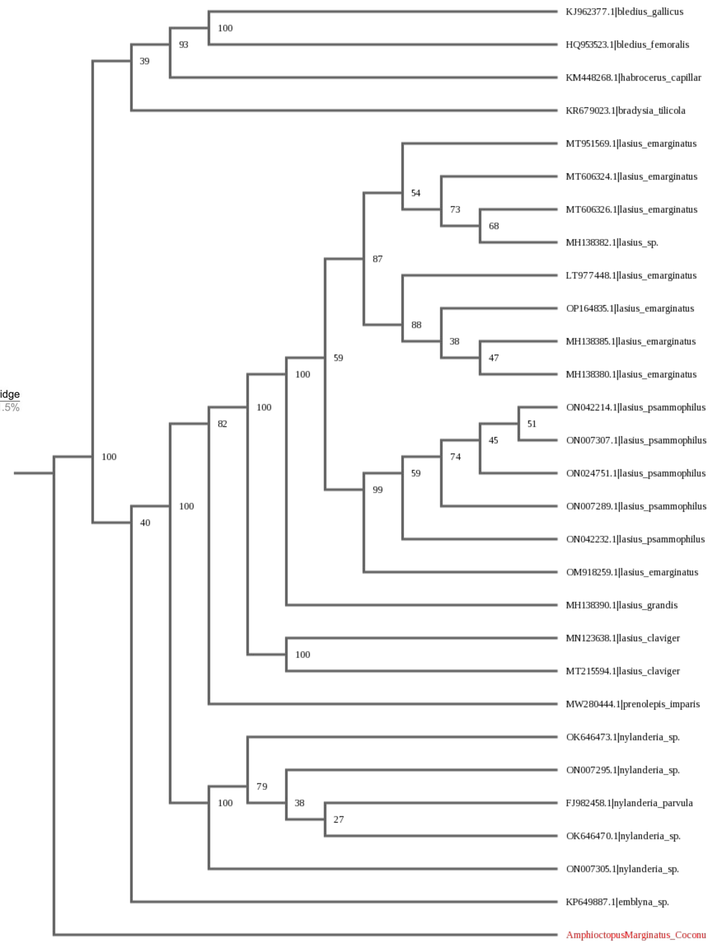

Figure 4. Neighborhood Joining Phylogenetic Tree. The phylogenetic tree depicts the evolutionary relationship between the various species that were identified. The species that is in red is the outgroup, the coconut octopus, the species that has the least genetic similarity to the other species listed.

Discussion

- We collected ant samples in three areas of Central Park, along the Bridle Path and around Bridge 24, with varying levels of human activity.
- The majority of ants collected in Central Park, 69.2%, were from the area around Bridge 24, an area with less human traffic and pollution than the Bridle Path.
- The locations, the northwest and west sides of Bridge 24, that were less populated, fostered less biodiversity as shown by the Simpson's Biodiversity (1/D) scores of 2.4 and 2.0, as compared to 4.0.
- Our results do not support our hypothesis that less human disruption will lead to greater ant biodiversity. Although more ants were collected from areas with less human disruption, they tended to all be the same species.
- It is possible that human activity and pollution disturbs the ants' environments, preventing one species from dominating in a given area.
- Other factors that may have impacted the biodiversity of the ant population that we studied include weather, soil differences, season, and time of day.
- Future directions may include collecting more samples from more diverse habitats, including areas outside of the city, in addition to measuring the amount of common soil pollutants in the areas where the ants are collected.

References

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