Ants Species Biodiversity and Soil Type in Different NJ Habitats in Tenafly, NJ

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Abstract

This experiment is composed of choosing three different habitats in Tenafly, New Jersey to analyze the different ant species present and, to determine how the differences in soil impact these species. Three distinctly different habitats with different soil types were chosen in order to observe if this affects the different species of ants present. After the ants were collected, their DNA was analyzed in a lab to identify what species are present. The species found in each sample from each location were then compared to each other. After analysis, it was determined that each ant species was the prenolepis imparis.

Introduction

Ants:

- The formicidae family of insects has 12,000 different ant species
  - carpenter ants (*Camponotus*)
  - odorous house ants (*Tapinoma sessile*)
  - pavement ants (*Tetramorium caespitum*)
  - fire ants (*Solenopsis*)
  - ghost ants (*Tapinoma melanocephlaum*)

Types of Habitats:

- Urban- close proximity (~100 yards) to dense traffic and structures
- Suburban- near residential housing
- Wooded- densely packed trees

Types of Soil:

- Dunellen complex soil is found in suburban habitats
  - Well drained soil, brown granular structure
- Udorthents soil is found in urban habitats
  - Human altered, coarse, contain gravel
- Boonton soil is found in wooded areas
  - Moderately drained, high in minerals, rock outcrop

Figure 1. a) *Prenolepis imparis* ant species (http://www.alexanderwild.com/Ants/Taxonomic-List-of-Ant-Genera/Prenolepis/)

b) : *Camponotus* ant species (http://www.antwiki.org/wiki/Camponotus_ligniperda)

Goal

Our hypothesis for this experiment was that ant biodiversity will differ from one sampling location to another sampling location, and similar species of ants will be present in the same type of habitat.

Methods

Sampling

- Three locations that were assessed were divided into square meter quadrats
- Two quadrats were randomly selected for sampling
- If a quadrat didn't yield ants, another quadrat was chosen
- Bait traps were used consisting of Keebler's pecan sandies which have been used in ant sampling to measure biodiversity since 1990
- An hour and a half was spent at each location collecting ants, forceps then were used to place the ants in Eppendorf tubes to be stored in a freezer until analysis.

Table 1. The location and soil type at each sampling location.

Location	Coordinates of Location	Soil Code Name	Soil Name	Properties of Soil
54 Bliss Avenue (Suburban)	40.907794, -73.960538	DuuC	Dunellen-urban land complex	Well drained soil, formed in acid stratified material, brown, granular/block structure
313 Hudson Avenue (Tenafly Nature Center) (Wooded)	40.924638, -73.944983	BorC	Boonton	Moderately drained, rock outcrop, high in minerals, loamy soils with fragipans, steeply sloping
Tenafly Middle School (Urban)	40.929881, -73.967837	UdwB	Udorthents	Human-altered, contain gravel, coarse texture, rugged,

DNA EXTRACTION

- Sample size for analysis: 10-20 mg
- 300 µL of lysis solution added to ant sample in new Eppendorf tubes and mixed thoroughly for 15 min
- The solution was then incubated at 65 degrees for 10 min, then centrifuged for 1 min
- 150 µL of supernatant containing DNA was transferred to new Eppendorf tube
- 3 µL of silica resin were added, incubated for 10 min at 57 degrees Celsius, and centrifuged again to remove supernatant
- 500 µL of wash buffer was added, mixed, centrifuged, and the supernatant dumped. This process was repeated twice
- 100 µL of distilled water was added to DNA pellet to disconnect the silica from the DNA and centrifuged.
- 50 µL of supernatant (containing DNA) were taken out

PCR AND GEL ELECTROPHORESIS

- 2 µL of DNA were added per PCR tube
- 12.5 µL of Taq mix and 10.5 µL of the primer were used
- Using 2% agarose gel for gel electrophoresis, it was verified that PCR was successful
- Sequencing was done by Gene Wiz
- After the sequences were downloaded, the species were determined by using a BLAST search and the DNA Subway platform.

Results

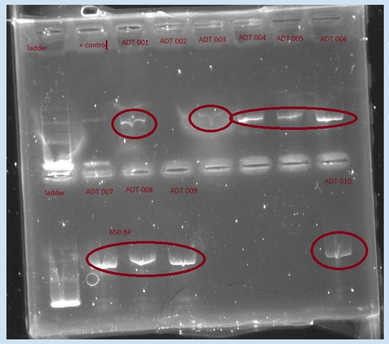

Figure 2: Gel electrophoresis results after PCR using COI primer (650 BP)

- Sample 2 was not able to be amplified
- All other samples were amplified
- The results from the amplified samples were sent to DNA subway

Table 2. Location of samples analyzed with the greatest degree of matching DNA.

Location	Samples	Species with greatest DNA match
54 Bliss Avenue Dunellen	ADT- 01	*Prenolepis imparis*
	ADT-03	*Prenolepis imparis*
	ADT-04	*Prenolepis imparis*
	ADT-05	*Prenolepis imparis*
	ADT-06	*Prenolepis imparis*
Tenafly Middle School Udorthents	ADT-07	*Prenolepis imparis*
	ADT-08	*Prenolepis imparis*
	ADT-09	*Prenolepis imparis*
	ADT- 10	*Prenolepis imparis*
Tenafly Nature Center Boonton	Not Applicable	Not Applicable

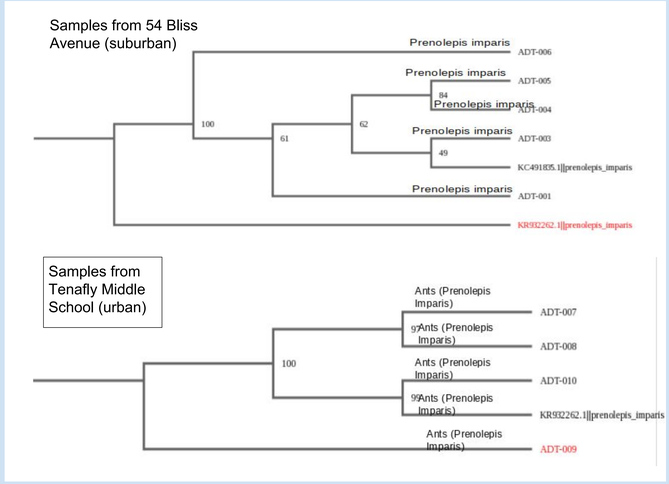

Figure 3: Phylogenetic trees of samples amplified

Results (continued)

Figure 4: Prenolepis Imparis species (https://www.google.com/search?q=prenolepis+imparis&safe=strict&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjZsZut0qPZAhWmxFkKHQ0ZBvIQ_AUICigB&biw=1440&bih=708#imgrc=A9eNiFqv0OMFEM)

- The primer used targeted a segment of the COI gene of invertebrate. The DNA most closely matched with the Prenolepis Imparis for all species analyzed.
- However, no samples were able to be obtained from the Tenafly Nature Center (wooded habitat). This may be due to the cold weather or the condition of soil in this area.

Discussion

- After receiving our results we were able to come to the conclusion that the Prenolepis imparis species is commonly found in urban and suburban habitats in Northern New Jersey.

Future Research

- We collected samples in November, however, we believe that if we sampled in warmer months, a greater quantity of ants would have been found. In warmer months, we feel we could of had better success sampling in the wooded habitat.
- If we sampled in a warmer time, more ants may have been collected, leading to a better conclusion on the biodiversity of ants in all habitats.

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