Soil Type and Monocotyledon Species in Northern New Jersey

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Abstract

This experiment involved the obtaining of twelve different monocotyledon samples, from three different locations. These samples were used in order to evaluate the correlation between monocotyledon species and soil type from which it grows. Once the samples were taken and stored properly, they were be analyzed in a laboratory using DNA isolation methods and PCR amplification. This process made it possible to identify the species of the monocots. The species types were compared both to each other and to the soil they grew from in order to understand the association between the two factors. It was found that there was, in fact, no correlation between a soil type and the monocotyledon that grew from it. In addition, the monocotyledon species did not correlate to their location. The most commonly found species was *Lilium rigidum.*

Introduction

- **Soil Types** - the properties of soil relating to parent material characteristics and severity/type of weathering endured
- **Monocotyledon** - a classification of angiosperms (flowering plants)
  - Have one cotyledon (leaf in seed-bearing plants)
  - Leaves have parallel veins
- The correlation between soil type and monocotyledon species in New Jersey has not been heavily studied

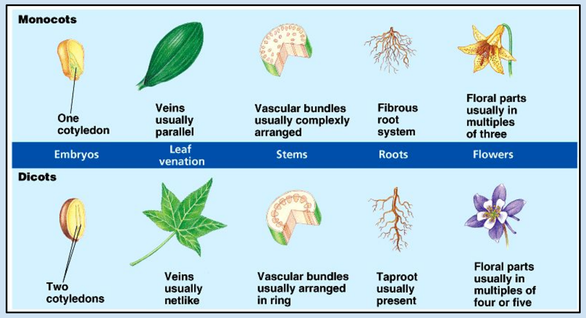

Figure 1. Description of monocotyledons in comparison to dicotyledons

Research Goals

- Identify the species of monocotyledon samples in three different locations in Northern NJ
- Assess the correlation between the monocotyledon species and the soil which they grow from within the three locations

Methods

Sampling:

- Twelve monocotyledon samples were taken overall
  - Four samples from three locations
  - Two 0.25 m x 0.25 m quadrats in each location
- Each sample was preserved in separate paper bags and stored in a refrigerador
- Photographic evidence was taken of each sample

Table 1. Sampling locations and their soil types

Location	Latitude and longitude	Soil type	Soil description
60 Edgewood Street, Tenafly (suburban)	Latitude: 40.915201, Longitude: -73.955603	DuuC (Dunellen-Urban land complex)	Elevation: 50-150 feet Landform: outwash plains Parent material: coarse-loamy outwash derived from sandstone Natural drainage class: well drained
313 Hudson Avenue, Tenafly (Nature Center, wooded)	Latitude: 40.92474, Longitude: -73.94512,	BorC (Boonton moderately well drained-rock outcrop complex)	Elevation: 50-500 feet Landform: ground moraines Parent material: coarse-loamy till derived from basalt Natural drainage class: moderately well drained
407 East Clinton Avenue, Tenafly (wooded)	Latitude: 40.911871, Longitude: -73.946807	BouC (Boonton-urban land complex)	Elevation: 50-500 feet Landform: ground moraines Parent material: coarse-loamy basal till derived from basalt Natural drainage class: well drained

DNA Extraction

- 300 µl of lysis solution was added to 15 mg of our sample in order to break apart the cell membrane, incubated for 10 mins at 65° C, and centrifuged for 1 min
- 3 µl of silica resin was added to 150 µl of the sample (to bind to the DNA), incubated for 10 min at 57°C, centrifuged for 30 seconds, and the supernatant removed
- 500 µl of wash buffer was added, centrifuged for 30 s, and the supernatant removed
- Distilled water was added to remove silica, mixed and incubated for 5 min, centrifuged for 30s.
- The supernatant with the DNA was transferred to a new tube.

Polymerase Chain Reaction (PCR)

- 12.5 µl of Taq mix was added to 10.5 µl of ribulose bisphosphate carboxylase large chain primer mix with 2 µl of isolated DNA is added to this mixture
- After amplification with the thermocycler, 5 µl of each sample, a DNA ladder, and a positive control were mixed with 2 µl of loading dye and placed in 2% agarose gel for gel electrophoresis

Data Analysis

- The DNA Subway bioinformatics platform was used. Sequences were trimmed, consensus paired and uploaded to GenBank. A nucleotide BLAST was run on GenBank to identify species with its matching DNA
- Phylogenetic trees were made

Results

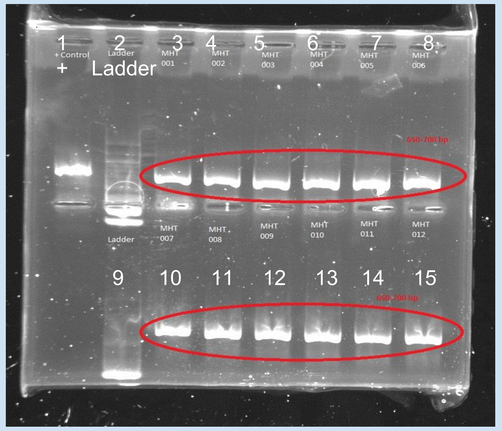

Figure 2 Gel Electrophoresis showing successful PCR amplification of the rbcL gene in all 12 samples (Wells 3-8 and 10-16), in 650-700 BP.

Table 2. Location of samples and species with greatest degree of DNA matching

Location	Samples	Species with greatest degree of DNA matching
407 East Clinton Avenue, Tenafly	MHT-001	*Festuca idahoensis*
	MHT-002	*Festuca Idahoensis*
	MHT-003	*Poa Palustris*
	MHT-004	*Poa Palustris*
60 Edgewood Street, Tenafly	MHT-005	*Festuca Rubra*
	MHT-006	*Lolium Rigidum*
	MHT-007	*Lolium Rigidum*
	MHT-008	*Lolium Rigidum*
Tenafly Nature Center	MHT-009	*Lolium Rigidum*
	MHT-010	*Lolium Rigidum*
	MHT-011	*Poa Palustris*
	MHT-012	*Lolium Rigidum*

Results (continued)

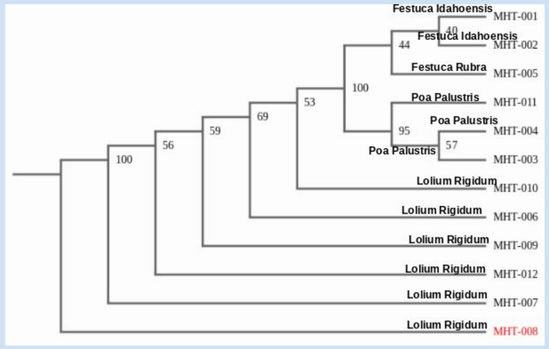

Figure 3. Phylogenetic trees for the DNA samples with their matching DNA

- The rbcL primer, which is specific to plant invertebrates, was able to match the DNA of our samples to several different species of monocots
- However, the biodiversity of the samples did not directly correlate with the location from which they were taken, meaning they did not correlate with the different soil types

Discussion/Conclusion

- Our results suggest a diverse community of organisms inhabiting the Northern New Jersey area
- However, although monocots are diverse throughout this region, they do not directly correlate with the soil types which they grow from

FUTURE RESEARCH

- Samples were taken in late November. If sampling is taken place during warmer months, the quality and quantity of DNA could be increased
- Possible future research would include improving collection time, collecting samples from locations which are farther apart, and using a more recent soil survey

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