A Comparison of FUNgi in Randall's Island Urban Forest On-Trail vs. Off-Trail

Monica Nikolova[1], Megan Orsuwan[1], Micaela Ramos[1]
[1]Ethical Culture Fieldston School

Abstract:

Fungi are eukaryotic organisms classified as separate from the plant and animal kingdoms. Randall's Island has a variety of diverse environments, from overgrown forests to vast meadows. This study aims to assess the biological diversity in Randall's Island's urban forest, comparing fungi found on a man-made trail and inside the forest. 28 samples were collected, 15 on trail, and 13 off trail. Gel electrophoresis was run on 18 samples, and yielded 12 results. 4 species were discovered in the man-made urban forest trail, and 2 species were discovered inside the forest.

Introduction:

- Fungi are eukaryotic organisms.
- Fungi live in the soil and on trees and thrive in cooler and drier environments.
- Along with bacteria, fungi play a crucial role in an ecosystem by helping to break down organic matter into essential elements such as carbon, nitrogen, oxygen, and phosphorus.
- Fungi feed on organisms ex. wood, cheese, soil, or flesh, which can be dead or alive.
- Fungi include: yeasts, mushrooms, molds, mildews, and rusts (Alexopoulos et al., n.d., Fungi: Life, n.d.).
- Fungi was collected from Randall's Island Urban forest. The samples were collected on a man-made trail, lined with logs. They were also collected off-trail in a dense, overgrown forest (Randall's Island Park Alliance, n.d.).
- We hypothesized that the biodiversity of fungi would differ on-trail and off-trail because of human contact on-trail and the more hospitable habitat off-trail. We believed that the lack of surrounding plants would isolate the fungi, leaving less room for biodiversity. We expected that the fungi found off-trail would be more biodiverse because of the sample's interactions with other fungi.

Materials and Methods

- Sample collection: 28 fungi samples were collected from the Randall's Island Urban Forest. They were placed with ethanol in 1.5 mL, 5 mL, and 10 mL tubes.
- DNA Extraction: First, the samples of the fungi were ground and placed in tubes with lysis solution. They were then centrifuged, and silica resin, ice-cold wash buffer, and distilled water were added.
- DNA Amplification: ITS fungi primer was used and DNA was amplified through PCR.
- Gel Electrophoresis: 5 μl of the amplified DNA was placed in the gel electrophoresis chamber, and were run.
- Sequences and Analysis of DNA: Cyverse DNA Subway database was used to analyze the sequences and identify the different species.

Results

Figure 1: Randall's Island Park

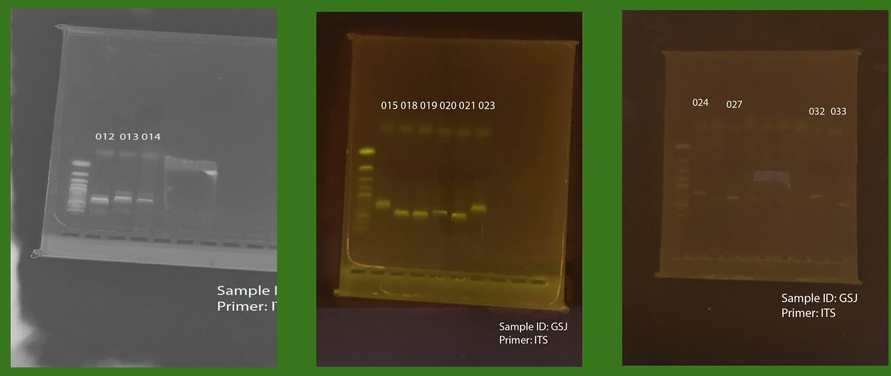

Figure 2a/2b/2c:
Results of all gel electrophoresis tests. Fig. 2a was taken on February 10th, Fig. 2b on March 5th, and Fig. 2c on April 7th

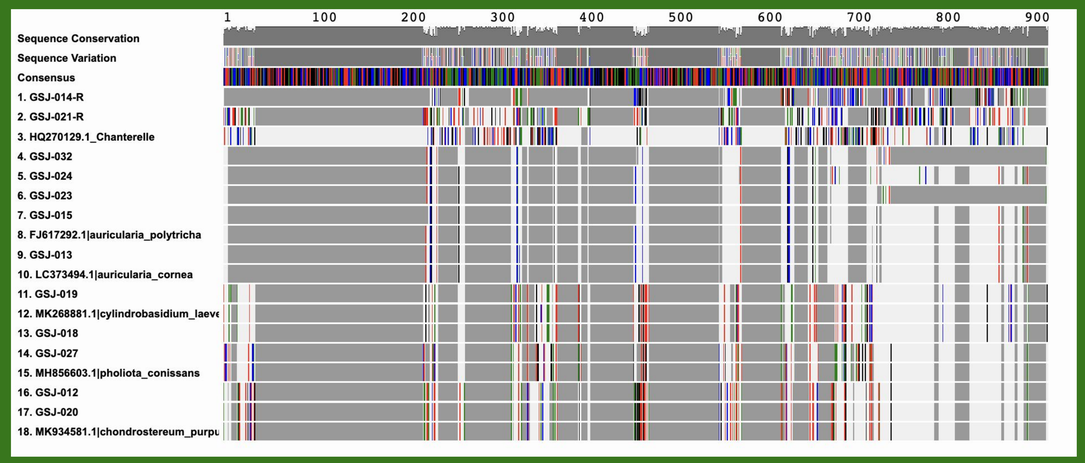

Figure 3: Trimmed Multiple Alignment Created by MUSCLE. These are sequences of results illustrated by the MUSCLE program. This image shows 900 bp of sequence conservation, with the color demonstrating different nucleotides. In both the sequence conservation bar and the sequence variation bar, conservation is represented by gray and variation by white.

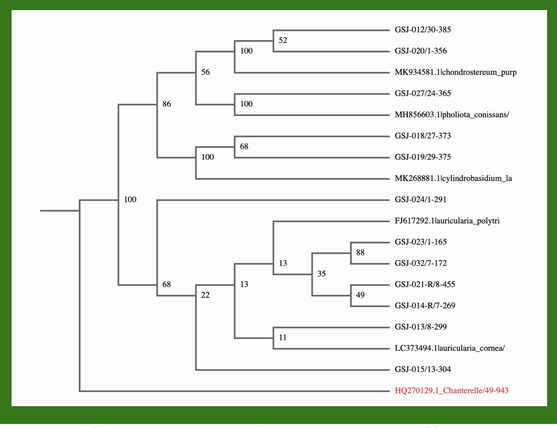

Figure 4: Neighbor Joining phylogenetic tree displaying the evolutionary relationships between the identified species. The species highlighted in red has the least genetic commonalities with the rest of the species.

Discussion

Findings contradicted original hypothesis:
- Two species found off-trail
- Four species found on-trail

Potential errors:
- Distance between samples

MUSCLE:
- depicted the sequences found, showing some similar sequences among the samples
- *Auricularia cornea* and *Auricularia Polytricha* display very similar differences from the consensus in almost identical locations, signifying their genetic similarities.
- *Chondrostereum purpureum, Cylindrobasidium laeve*, and *Pholiota conissans* cultures show similar nucleotide differences in alike locations however not as closely as the *Auricularia cornea* and *Auricularia Polytricha* do

Neighbor Joining Phylogenetic Tree:
- *Auricularia cornea* and *Auricularia polytricha* are closely related.
- *Chondrostereum purpureum, Cylindrobasidium laeve*, and *Pholiota conissans* culture are more genetically similar to each other than to *Auricularia cornea* and *Auricularia Polytricha.*

Why findings do not strongly support a specific conclusion:

Edge effect:
- Created at the boundary between multiple habitats/ecosystems, often resulting from natural transitions or human activity.
- Can lower biodiversity
  - Create more suitable habitats for certain species, creating competition and an imbalance.
  - This is frequently the case when invasive species are favored (Willmer et al., 2022).
- Can increase biodiversity
  - Create ecotones, or transitional zones, where different habitats meet, leading to a greater variety of species.
  - This could be true of the on-trail path through the Randall's Island urban forest.

References

Alexopoulos, J., Moore, D., & Ahmadjian, V. (n.d.). Fungus. *Encyclopaedia Britannica Online Academic Edition*. Retrieved October 22, 2024, from https://www.britannica.com/science/fungus

Center, D. L. (n.d.). Barcoding bioinformatics part III [Video]. YouTube. https://www.youtube.com/live/zLSByi_CrL8

(Additional references on back)

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