

Using Fungi as a Bioindicator for Long Island Forests

Regional Data

Samples	Location
<i>Stereaceae</i>	Chopped log
<i>Trichaptum</i>	Fallen branch
<i>Psathyrellaceae</i>	Fallen tree
<i>Ganoderma curtisii</i>	Pile of leaves
<i>Tyromyces galactinus</i>	Fallen branch
<i>Ganodermataceae</i>	Cut & rotting stump
<i>Bondarzewia berkeleyi</i>	Chopped log
<i>Scleroderma cepa</i>	Swamp area
<i>Juglans cinerea</i>	Rotting fallen tree
<i>Climacodon septentrionalis</i>	Fallen tree
<i>Ganoderma curtisii</i>	Rotting roots of cut tree
<i>Polyporaceae</i>	Side of tree
<i>Resupinate fungus</i>	Fallen tree
<i>Ganodermataceae</i>	Piece of rotting tree
<i>Stereum</i>	Cut tree

Figure 1. Sample and habitat descriptions for DZM 001-015

Abstract

Fungi are often found on decaying matter, such as trees. Knowing of some local areas with diseased and dying trees, it was pondered if fungi could be used to accurately determine the health of a tree. It was hypothesized that if specific species of fungi sprouts on trees with a certain disease or ailment, a correlation can be made that these fungi are positively related to arboreal necrosis.

Fungi on trees with visible symptoms of necrosis along with samples from nearby trees harboring similar fungi were collected from Pine Ridge Conservation Area (susceptible to pests) and the Massapequa Nature Preserve (susceptible to water damage). After isolating the DNA through the silica protocol, PCR was used to amplify the ITS region. *Ganoderma curtisii*, *Scleroderma cepa*, and *Tyromyces galactinus* were identified. Of these particular species, *Ganoderma curtisii* is commonly found growing on the roots of live, rotting trees. In order to confirm the relationship between fungi and tree rot, a longitudinal study must be conducted.

Introduction

Fungi reproduce via spores and serve as bioindicators of forest health (Bai et al. 2018). Due to the close symbiotic relationships, they maintain with trees, environmental sensitivity and proximity to timber, it was hypothesized that fungi could be used to identify whether a tree is dead, diseased, or damaged. This study investigated whether fungi would be an effective diagnostic tool for detecting abnormal stress and early-onset arboreal necrosis, the decay of trees due to external factors.

Identified Species

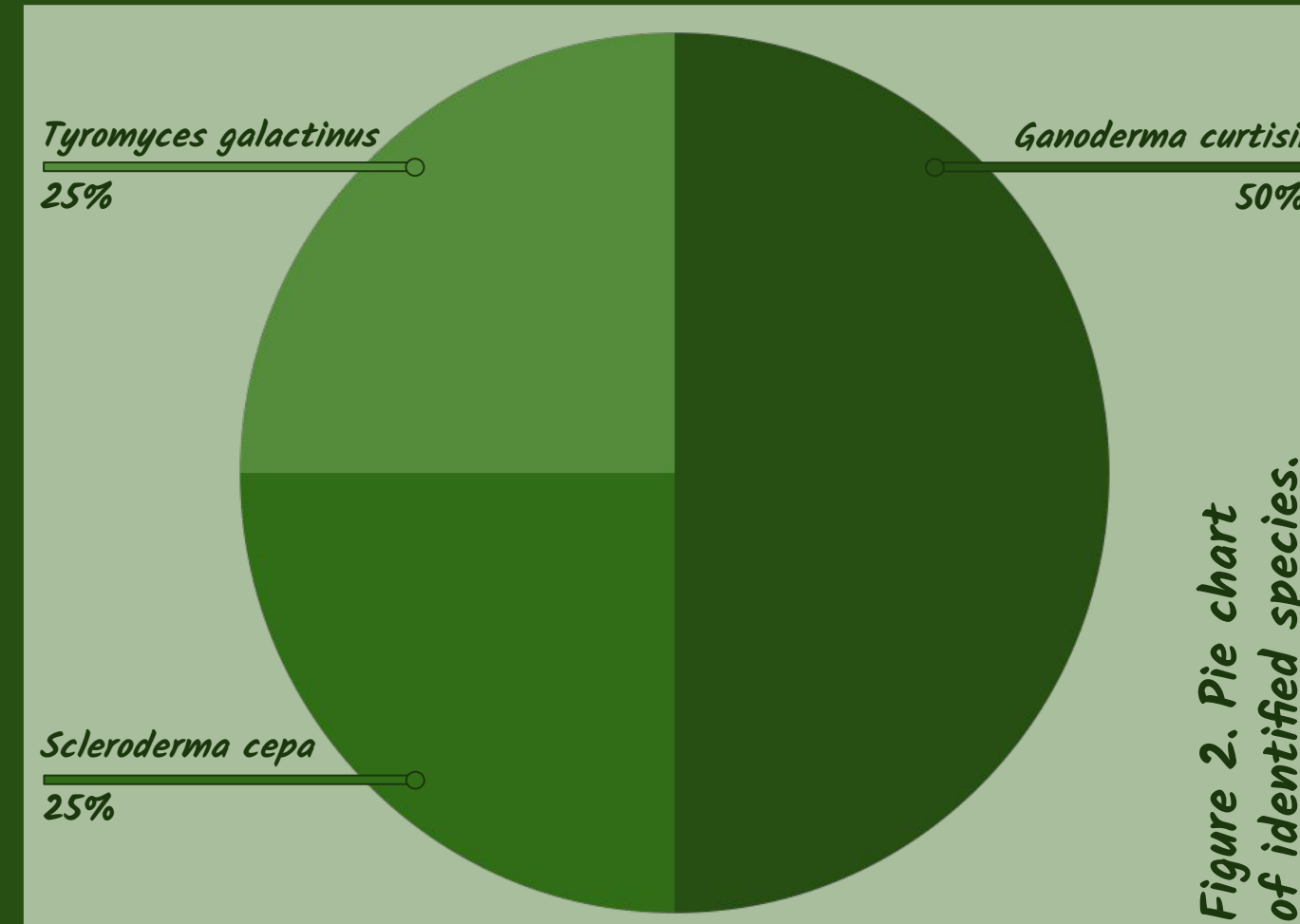


Figure 2. Pie chart of identified species.

Discussion

Ganoderma curtisii, *Tyromyces galactinus*, and *Scleroderma cepa* are all fungi that typically grow on or near rotting wood. *Ganoderma curtisii* was found twice near two different rotting tree roots. Additionally, both the sample of *Ganoderma* identified (Figure 4) and the *Ganoderma* from the Texas Plant Disease Diagnostic (Le 2018, Figure 6) had a similar hole in the trunk of the tree. From this, it can be deduced that the same rot which allowed for the *Ganoderma* to enter the tree from both personal study and a study from Texas Plant Disease Diagnostic Lab was present, and therefore the presence of *Ganoderma* can indicate an arboreal infection.

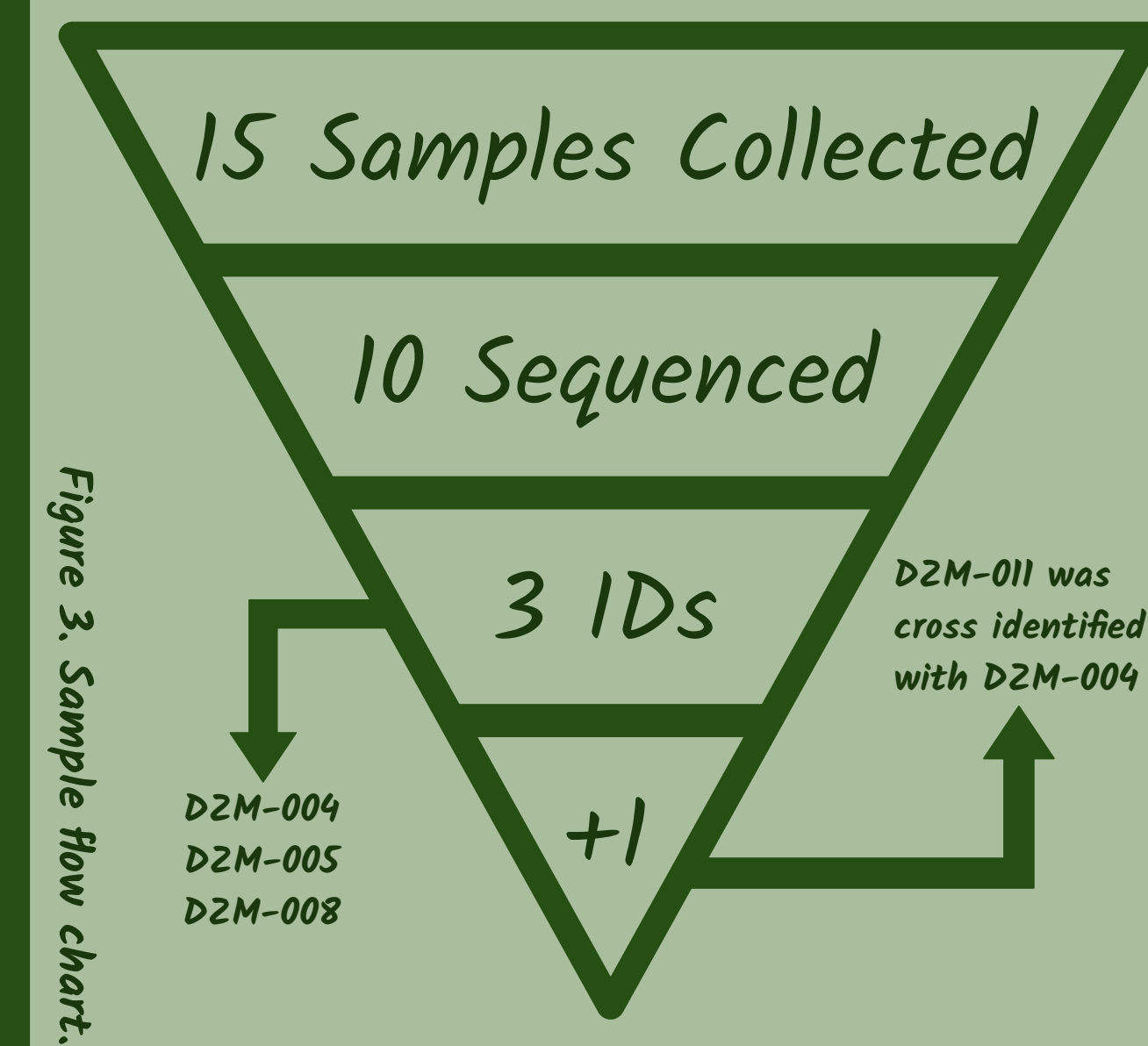
All samples were found on, and around, dying or already dead trees, showing that there is a correlation between tree health and fungi; however, the relationship between specific mushrooms and their hosts is not as clear.

To have a better understanding of such relationship, it would be beneficial to perform a longitudinal study, utilizing more successful methods of ITS isolation, and avoid using specimens of denser fungi with tougher cell walls, as these specimens are often difficult to isolate DNA from (DNA Learning Center Barcoding 101 2024). This way, a correlation between fungi such as *Ganoderma curtisii* and specific diseases on trees can be made. It would also be suggested to sample and barcode a greater variety and a greater quantity of fungi. This would allow for the correlation between mushrooms and diseased trees to be defined more clearly, and potentially even allow for mushrooms to be officially used as a stress/disease indicator for trees.

Methods

Samples collected
 ↓
 Site documented
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 Notes taken on abnormalities
 ↓
 X-ACTO knife used to take sample
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 Sample stored in a microfuge tube containing 95% ethyl alcohol
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 Fungi DNA was isolated using Silica protocol
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 Internal Transcribed Spacer region (ITS) amplified by PCR
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 Gel electrophoresis was run
 ↓
 Successful sequences sent to GeneWiz for sequencing
 ↓
 Specimen sequences were analyzed in DNA Subway
 ↓
 Compared to establish correlations between the type of fungus and ailment

Sample Flowchart



References



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Results

- Three samples from Massapequa Preserve were successfully identified using BLAST
 - *Ganoderma curtisii* (DZM-004)*
 - *Tyromyces galactinus* (DZM-005)
 - *Scleroderma cepa* (DZM-008)
- DZM-003, DZM-004, DZM-002, and DZM-001 were closest in vicinity to a body of water.

*Additionally, DZM-011, which was unsuccessfully barcoded, was later cross-identified with DZM-004 to be in a later stage of life than it, but the same species.



Figure 4. Tree trunk where DZM-011 was found

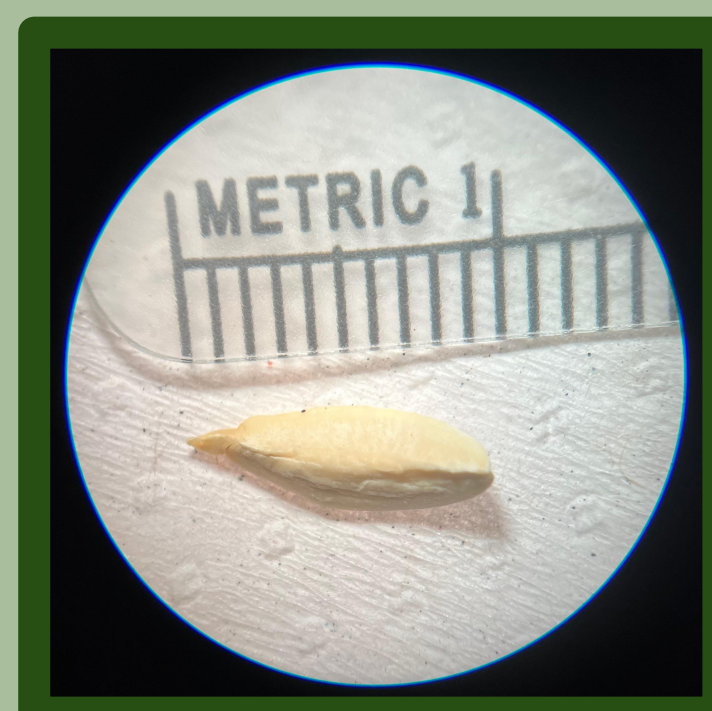


Figure 5. Magnified image of DZM-004 (*Ganoderma curtisii*)

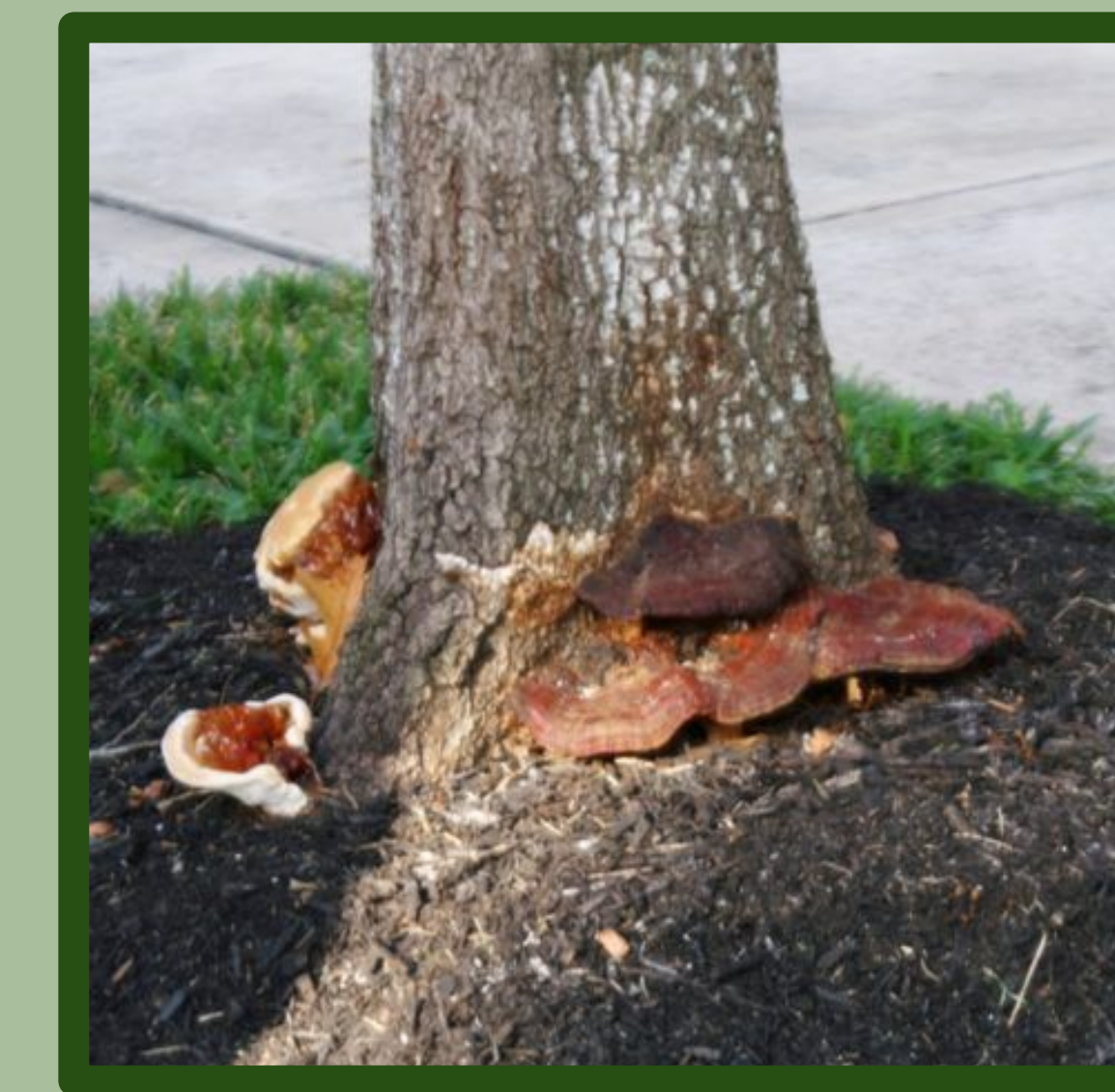


Figure 6. Photo of *Ganoderma* rot (Texas Plant Disease Diagnostic Lab 2018).