

Mycorrhizae in the Ambler Arboretum and the Urban Environment

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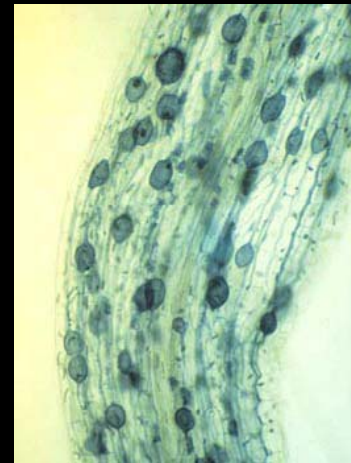
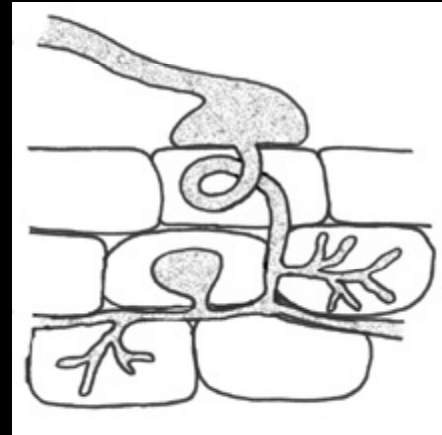
Fall 2008

Mycorrhizae

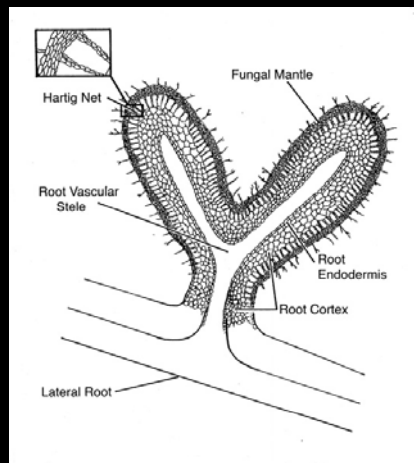
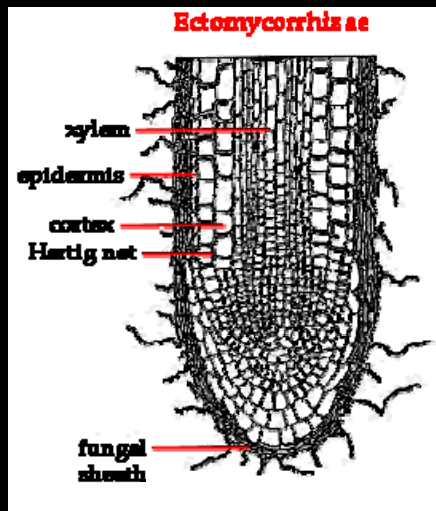
- Mycorrhizae are fungi that form symbiotic associations with the roots of plants.
- Plant roots provide a source of carbon for the fungi, while the fungi increase nutrient uptake and water absorption for the plant.
- Mycorrhizae are major players in many ecosystems, and are especially important to plant survival in nutrient-poor soils.

Endomycorrhizae

- These fungi penetrate root tissues intracellularly, forming distinctive branched structures (arbuscles) between the cell wall and plasma membrane.
- Most endomycorrhizae form thick-walled spores (vesicles) inside plant cells and are classified as vesicular-arbuscular mycorrhizae (VAM).
- VAM are classified as Zygomycetes in the order Gomales.



Ectomycorrhizae



- Ectomycorrhizae colonize the exterior surface of roots.
- They form a sheath-like structure around root tissue.
- Characteristic structures of this kind of fungi include the Hartig net and fungal mantle.
- Some fungi have attributes of both endo- and ectomycorrhizal fungi, and are classified as ectendomycorrhizae.

Other Kinds of Mycorrhizae

- Ericoid Mycorrhizae-found in ericaceous plants and kin.
- Orchid Mycorrhizae-important to seed germination and provision of carbon.
- Arbutoid Mycorrhizae-found in Ericales. These fungi feature both a mantle and intracellular penetration.
- Monotropoid Mycorrhizae-also found in Ericales, specifically those that lack chlorophyll.



Effects of Soil Conditions on Mycorrhizae

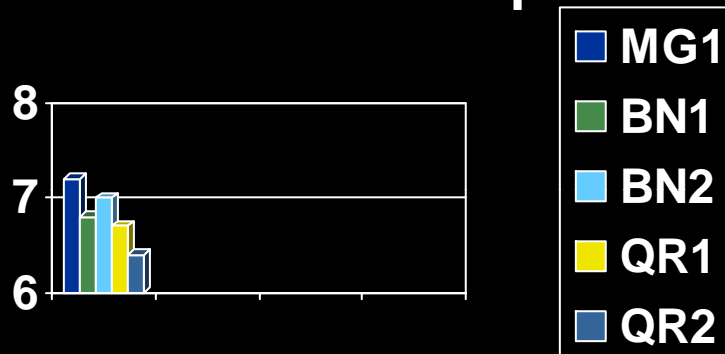
- Soil moisture encourages formation of mycorrhizae, but flooded conditions have a negative effect in most cases. Some fungi are found in aquatic conditions.
- VAM development can be reduced if soil nutrients are enriched, especially if there is a high phosphorus content.
- Mycorrhizae are adapted to a variety of pH values. Optimum pH range depends on genus, species, and variety of fungi.
- Soil compaction has severe negative consequences for mycorrhizal fungi. They can be suffocated by resultant anaerobic conditions or physically crushed by the compacted soil.

Trees Sampled For Research

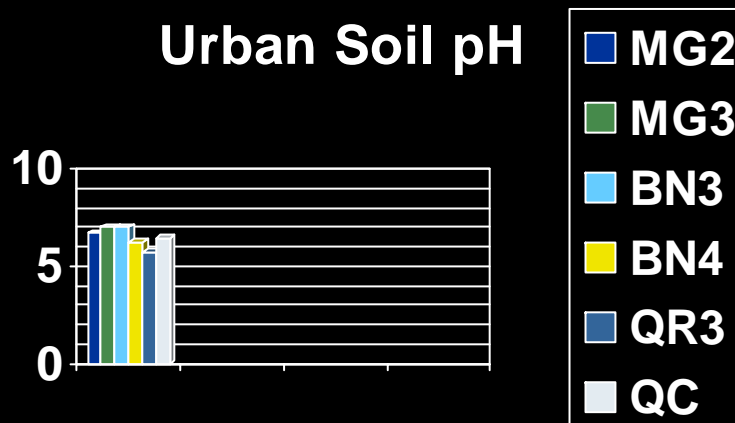
- Several species were chosen-Southern magnolia (*Magnolia grandiflora*), river birch (*Betula nigra*), red oak (*Quercus rubra*), and scarlet oak (*Quercus coccinea*).
- Urban trees were paired with similar specimens from the arboretum. Tree sets were chosen based on availability and similarities in size and condition.
- Soil samples were tested to determine pH, nutrient levels, compaction, and other variables.

Conditions at Test Sites-pH and Nutrients

Arboretum Soil pH

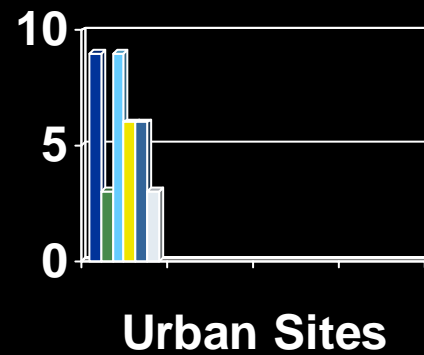
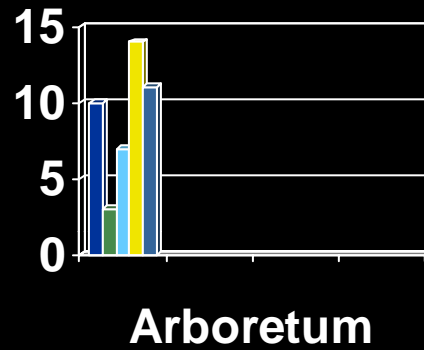


Urban Soil pH



- Soil pH values displayed variation in both urban sites and the arboretum.
- Phosphate levels were below optimum at most arboretum sites, optimum or above optimum at all but one urban site.
- Potassium levels were varied.
- Magnesium levels were optimum or above at all sites.
- Calcium levels were optimum or above at all sites except for one urban location.

Conditions at Test Sites- Compaction



The Experimental Process

- Root samples were collected from the trees to be studied.
- The roots were cleared in 10% KOH in an 80 °C water bath for 1 to 2 and a half hours, to which 30% hydrogen peroxide was later added.
- The roots were soaked in 10% hydrochloric acid, then incubated in a solution of 85% lactic acid and aniline blue to stain the fungal tissue.

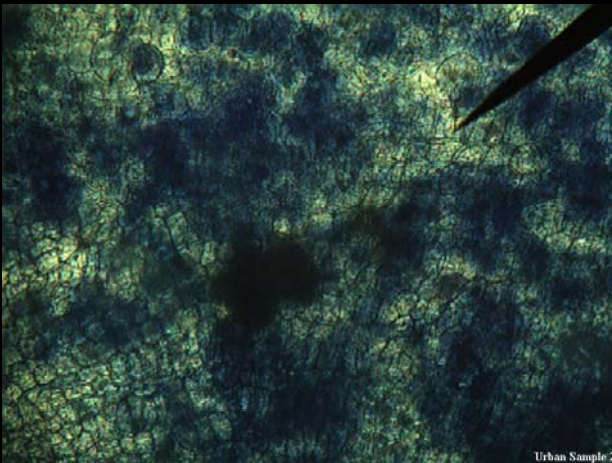
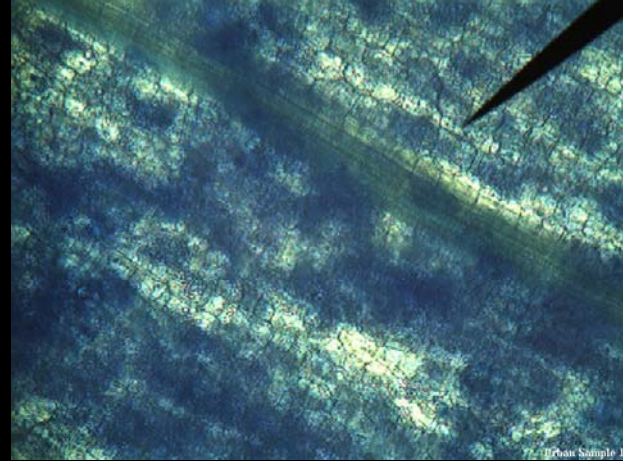
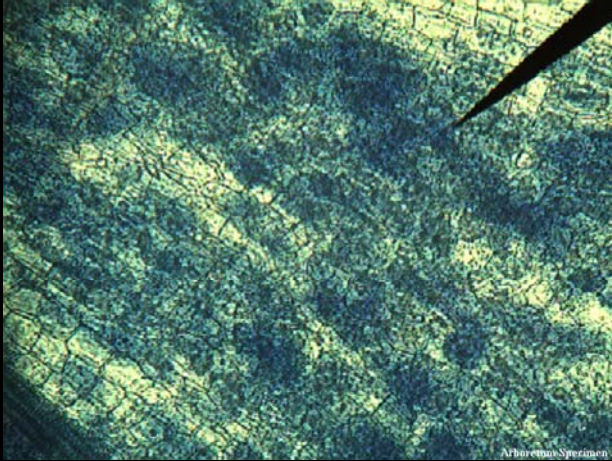
Results

- Roots samples were examined under a microscope, fungal structures were visible due to the blue stain.
- Photographs were taken from which the percentage of infested tissue will be calculated.

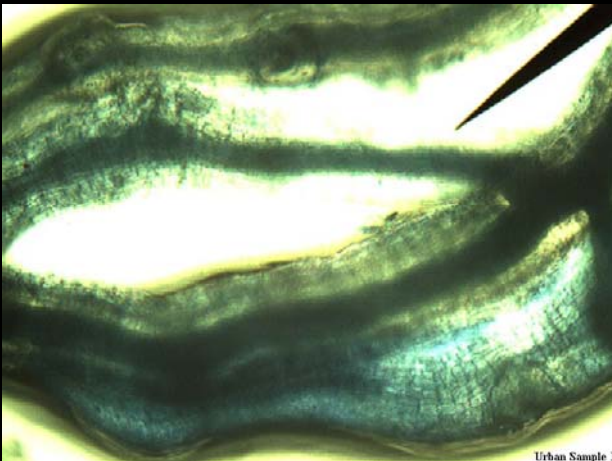
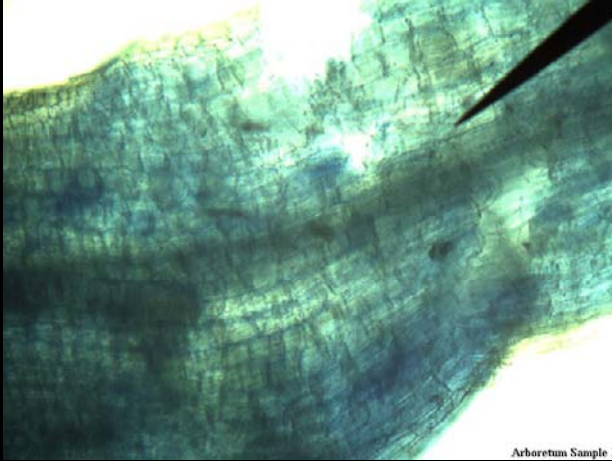


Southern Magnolia-Urban Sample 2 (4x)

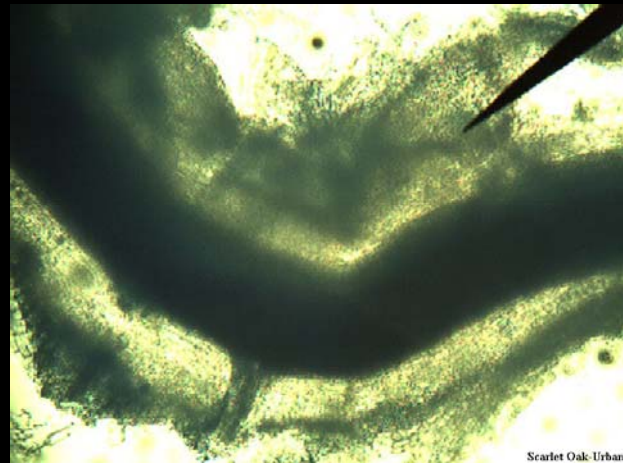
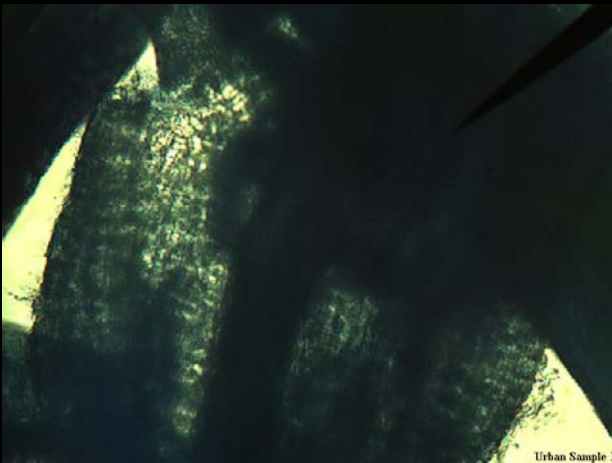
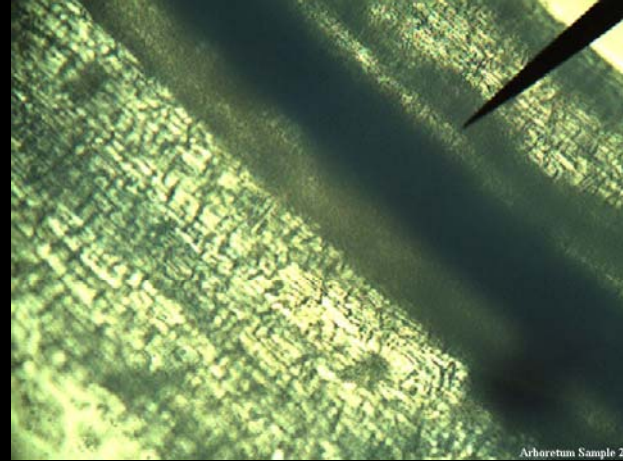
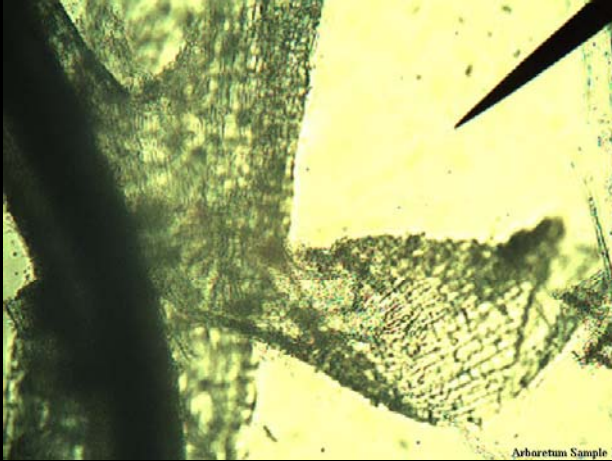
Tree Set #1-Southern Magnolia



Tree Set #2- River Birch



Tree Set #3-Red and Scarlet Oak



Analysis of Results

- Populations of VAM visible in the photos will be counted and compared.
- Preliminary examination of the slides shows no drastic differences between populations of mycorrhizae in the urban test sites and the arboretum.

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