



Influence of Management on the Fungal Microbiome of North American Grapes

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Background

- North American grapes and their resistance to many diseases and pests, are what saved long domesticated European grapes from potential extinction (Fig. 1).
- The grafting of American rootstocks is a way of protecting European grapes from Phylloxera to which they lack resistance (Fig. 2).
- Despite all of this, the microbiome of American grapes remains to be studied in depth.



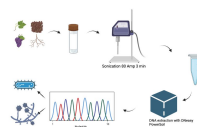
Figure 1. (left)
Figure 2. (right) Leaf damage caused by Phylloxera

Methods

1. Collection

- Region 15 miles radius around Amherst, MA (Fig. 3)
- Managed vs. wild samples
- *Vitis riparia* and *Vitis labrusca*
- 3 varieties related the wild species:
- Use of sterile gloves and tools
- Four plant parts, leaves, berries, roots and soil
- Soil sampled ~30cm from trunk.
- Feeder roots sampled close to the trunk

2. DNA Extraction and sequencing - Figure 4 (below)



3. Microbiome analysis

- PCR fungal (ITS)
- Biodiversity indexes
- Databases match sequences to taxa

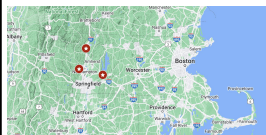


Figure 3. (left) Map of sampling region.

Taxons in Compartment: x axis is management and y axis is percentage of total sequences

Managed
Wild

Berries

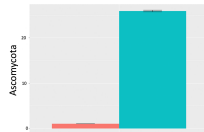


Figure 5. Berries have significantly higher ascomycota in the wild rather than managed.

Leaves

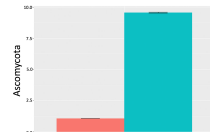


Figure 7. Leaves have significantly higher ascomycota in the wild rather than managed.

Roots

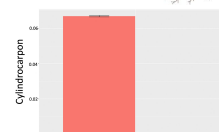


Figure 9. Cyndrocarpon is completely absent from wild roots.

Soil



Figure 11. Cyndrocarpon is completely absent from wild soil.

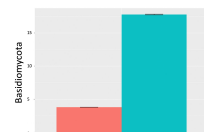


Figure 6. Berries have significantly higher basidiomycota in the wild rather than managed.

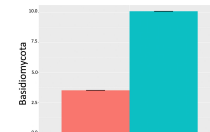


Figure 8. Leaves have significantly higher basidiomycota in the wild rather than managed.

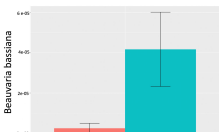


Figure 10. Beauveria bassiana is significantly higher in wild roots.

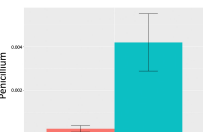


Figure 12. Penicillium is significantly higher in wild soil.

Diversity

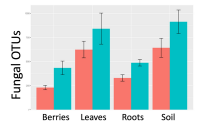


Figure 13. Fungal ITS Fungal Richness. Berries, roots and soil all have significantly higher fungal richness in the wild than managed.

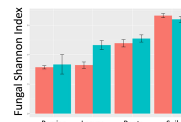


Figure 14. Fungal ITS Evenness Shannon Index. Leaves have significantly higher fungal evenness in the wild compared to managed.

Discussion

- **Richness and evenness** show that wild microbiome diversity is higher than managed, which suggests that there are management practices **decreasing wild microbial biodiversity** (Fig. 13 & 14.)
- Management decreases biodiversity across phylums **Ascomycota** and **Basidiomycota** in leaves and berries (Fig. 5,6,7 & 8.)
- The disease causing fungi, **Cyndrocarpon**, was exclusively found in managed samples. (Fig. 9 & 11.)
- Beneficial fungi that are used as healthy soil indicators, like **Penicillium** and **Beauveria Bassiana**, were significantly higher in the wild (Fig. 10 & 12.)

Next Steps....

- Include bacteria
- Larger geographic region
- Look into effects of types of management (organic, biodynamic, conventional)