Endophyte community shifts in response to drought in monkeyflowers (Erythranthe laciniata) grown in native soil

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Background and Introduction
- All plants have a community of asymptomatic microbes inhabiting their tissue known as *endophytes*.
- Endophytes are an extension of plant host phenotype and can help plants adapt in response to stress, including drought.
- Stressful conditions may select for distinct endophyte taxa with specific functions.
- As plants experience stress, these microbial community compositions may shift, providing evidence for the effect of stress on the endophyte community structure.
- Further understanding of how the structure of endophytes communities shift in response to drought is a potentially important avenue for identifying significant biotic interactions that may play a role in stress response.

PROJECT GOAL: To examine changes in endophyte communities in plants suffering from drought.

The Plant Host: Erythranthe laciniata
- Cut-Leafed Monkeyflower (E. laciniata) is an endemic flowering plant of the Sierra Nevada range in California
- Model system in ecological and evolutionary genetics
- Lives in a known stressful habitat experiencing drought
- Annual plant to measure lifetime fitness
- Easy to collect and grow in lab with short generation times
- Capable of self-fertilizing to maintain populations
- Grows from mossy patches in granite rock outcrops (Fig. 1)

Methods and Materials

**Soil Collection and Plant Growth**
- Soil collected in 2017 containing native microbes
- Raised plants from seed bank in growth chambers

**Endophyte Isolation and Sampling**
- Plants separated in three treatments 1) Pre-experiment (harvested at maturity), 2) Drought, and 3) Control (harvested 2 weeks into maturity) (Fig. 2).
- Roots and shoots sampled separately (Fig. 2)
- Endophytes isolated by sonication

**DNA Amplicon Sequencing**
- Bacteria: 16S rRNA
- Fungi: ITS2

**Community Bioinformatics**
- Microbial composition analyzed using Qiime2.
- Microbial community compared using Unifrac.

Species Richness: Alpha Diversity
- Species richness varies by plant compartment.
- The root has more fungal and bacterial species.

Comparing Communities: Beta Diversity

<table>
<thead>
<tr>
<th></th>
<th>Fungi Roots</th>
<th>Fungi Shoots</th>
<th>Bacteria Roots</th>
<th>Bacteria Shoots</th>
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<td>Control vs. Drought</td>
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<td>0.401</td>
<td>0.001</td>
<td>0.074</td>
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</tbody>
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Comparing Communitie: Alpha Diversity

- Root and shoot communities are distinct from each other.

Conclusions
- Drought alters the endophyte root community significantly.
- Both community composition and species richness were increased in the root more than in the shoot.
- The root endophytes in E. laciniata may play an important role in drought stress response.

References

Sierra Nevada, California

Fig. 1: Soil collected from center of the E. laciniata range

Fig. 2: DNA Amplicon Sequencing

Fig. 3: Community Bioinformatics

Fig. 4: Comparing Communities: Beta Diversity

Fig. 5: Species Richness: Alpha Diversity

Fig. 6: Comparing Communitie: Alpha Diversity

Fig. 7: Conclusions

Fig. 8: References