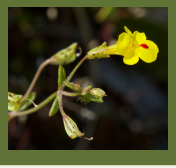
Endophyte community shifts in response to drought in monkeyflowers (*Erythranthe laciniata*) grown in native soil



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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[1].
- Stressful conditions may select for distinct endophyte taxa with specific functions[2].
- 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**[3]
- 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[4] (Fig. 3).


Fig. 2

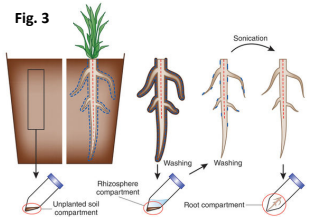


Fig. 3

Lundberg *et al.* 2012

DNA Amplicon Sequencing

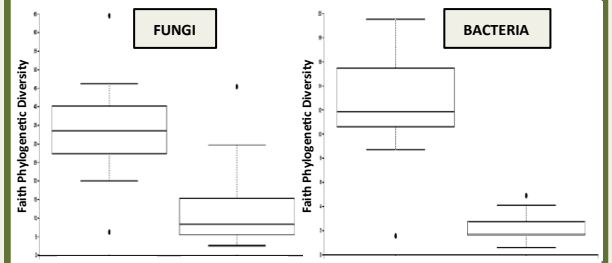
- Bacteria: 16S rRNA[5]
- Fungi: ITS2[6]

Community Bioinformatics

- Microbial composition analyzed using Qiime2[7].
- Microbial community compared using Unifrac[8].

Species Richness: Alpha Diversity

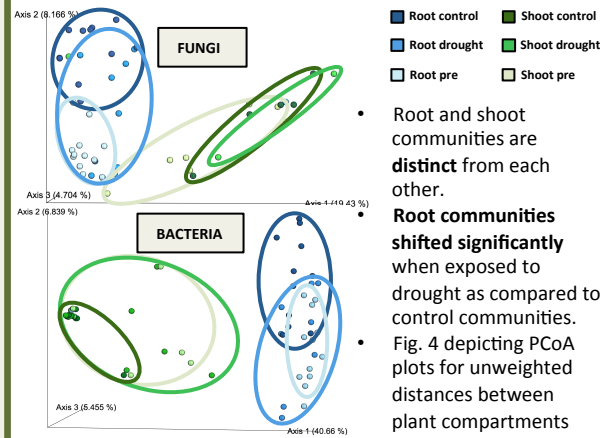
- Species richness varies by plant compartment.
- The root has more fungal and bacterial species.



Comparing Communities: Beta Diversity

Comparing Control vs. Drought	Fungi Roots	Fungi Shoots	Bacteria Roots	Bacteria Shoots
P-value	**0.001**	0.401	**0.001**	0.074

Fig. 4



- Root and shoot communities are **distinct** from each other.
- **Root communities shifted significantly** when exposed to drought as compared to control communities.
- Fig. 4 depicting PCoA plots for unweighted distances between plant compartments

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

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Mycological society of america

SOMA Sonoma County Mycological Association

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Thank you for reading

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