# Role of Plant – Soil Interactions in the Conservation of the Strawberry Tree (*Arbutus andrachne*)

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## Introduction

- *Arbutus andrachne* is an increasingly threatened species in the Republic of Georgia, and efforts to establish seedlings have largely failed.
- Two possible factors could limit seedling establishment: soil nutrient levels and microbial communities.
- As a first step to understanding the limits to seedling establishment, we examined and compared plant-soil interactions in *Arbutus andrachne* from the Republic of Georgia with phylogenetically-related species.
- **Species complex** comprised of *A. andrachne*, *A. andrachnoides*, *A. menziesii*, and *A. undeo*
- This project examines both soil and plant interactions of *A. andrachne*, *A. andrachnoides*, *A. menzesii*, and *A. undeo* to test their similarities and differences traits.

## Objectives

- Our overarching objective was to identify any differences and similarities in plant-soil interactions between species.
- Specifically, we wanted to identify any differences in soil nutrients, microbial and fungal activity, and mycorrhizal root colonization in the *A. andrachne* species complex.

## Methods

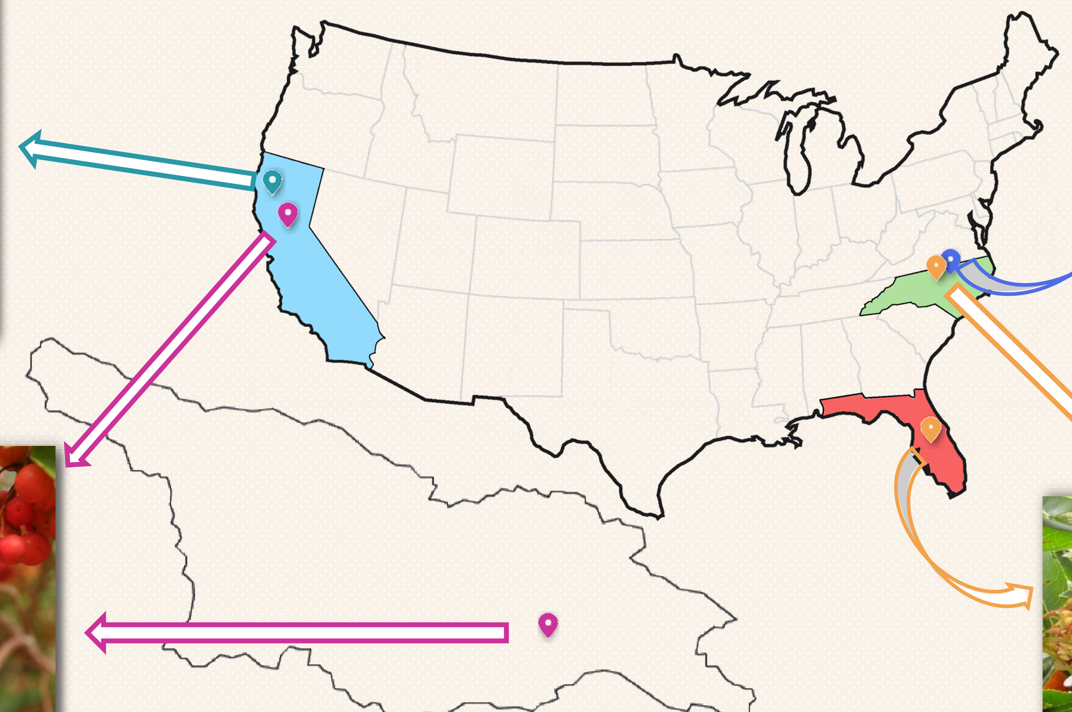
**PLANT:**

- Leaf tissue samples of all three *Arbutus* species were dried and ground, and then analyzed for %C and %N by combustion.

**SOIL:**

- Soil samples from each site were analyzed for pH and levels of nutrients by colorimetry ($NH_4$, P)[1] or ion-specific probes ($NO_3$, K, Ca). Soil organic matter (%C) and (%N) were analyzed by combustion. Microbial biomass was estimated using substrate-induced respiration.[1]
- Fine roots were stained using Trypan blue[1] and examined for the abundance of ericoid and arbuscular mycorrhizal structures.

*A. menziesii*
**Mendocino, California**



*A. andrachne*
**Davis, California**
**Tbilisi, Georgia**

*A. andrachnoides*
**Raleigh, North Carolina**

*A. unedo*
**Orlando, Florida**
**Raleigh, North Carolina**

## Key Soil Factors

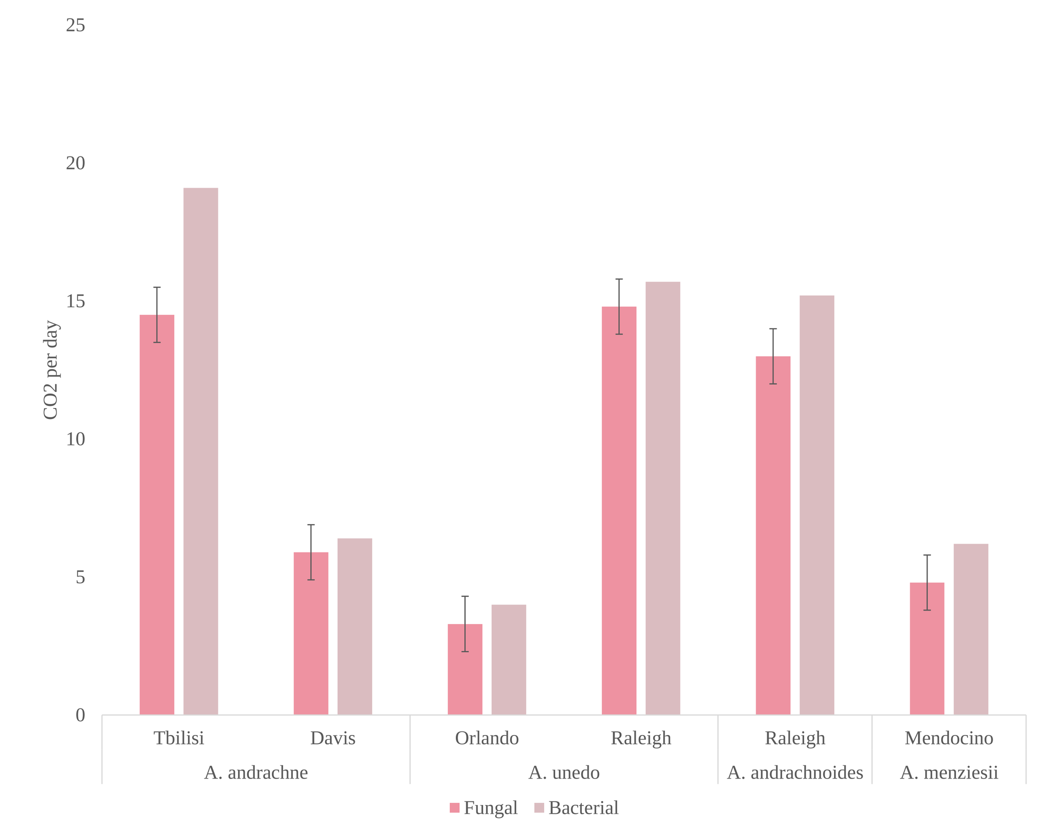



Figure 1: Microbial Biomass

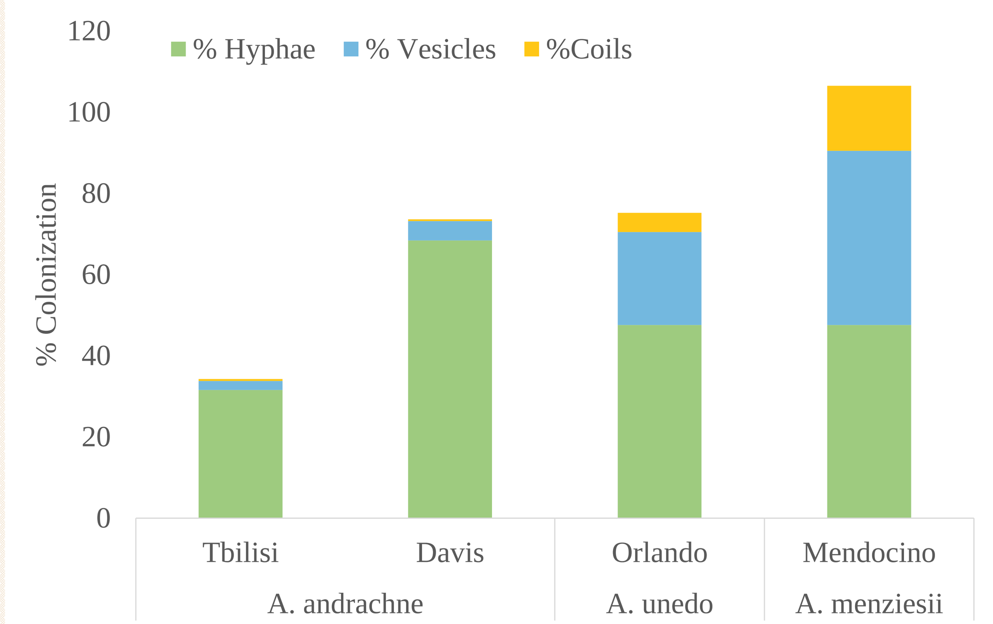



Figure 2: Arbuscular Mycorrhizal Levels

- Nutrient (N, P, K) levels in all *A. andrachne* soils were largely similar; Ca was high in Tbilisi soils as is typical for the region
- Soil microbial biomass in *A. andrachne* (Tbilisi) was the highest across all collections (Figure 1)
- *A. andrachne* and other *Arbutus* host both arbuscular and ericoid mycorrhizas (Plates 1,2)
- *A. andrachne* (Tbilisi) has a lower levels of vesicles and coils compared to other species
- The abundance of pelotons (bundles of hyphae) in *A. andrachne* (Tbilisi) was minor compared to other species

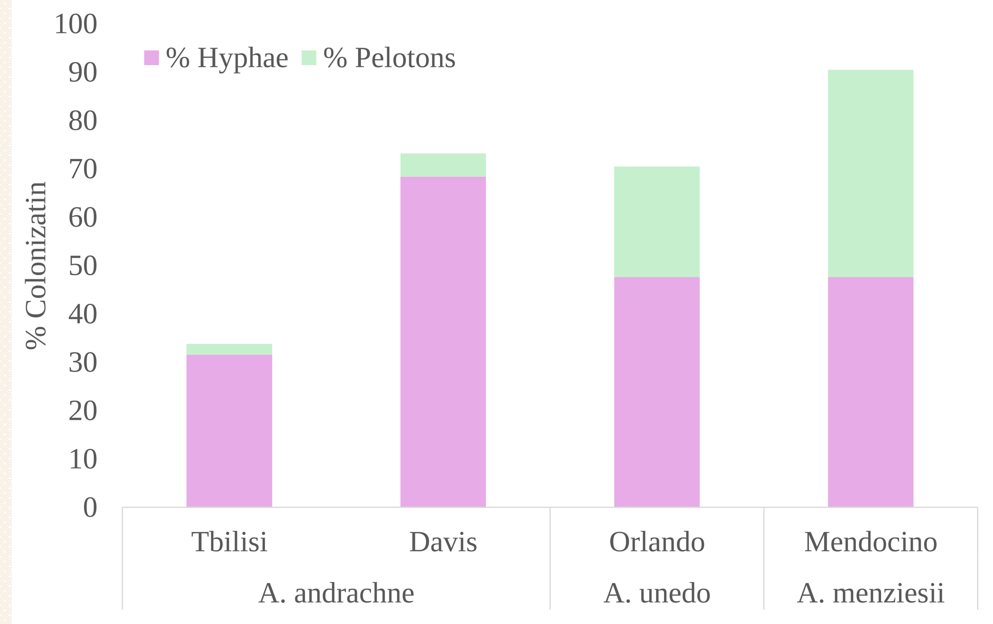



Figure 3: Ericoid Mycorrhizal Levels

## Arbuscular Mycorrhizas

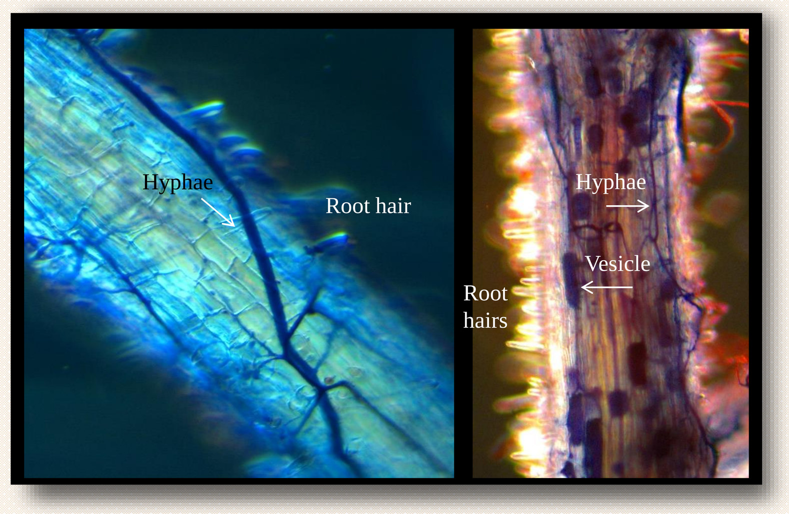



Plate 1: Arbuscular mycorrhizal structures in *Arbutus* roots. These mycorrhizas acquire water and inorganic nutrients and transfer them to the plant in exchange for sucrose.

## Ericoid Mycorrhizas

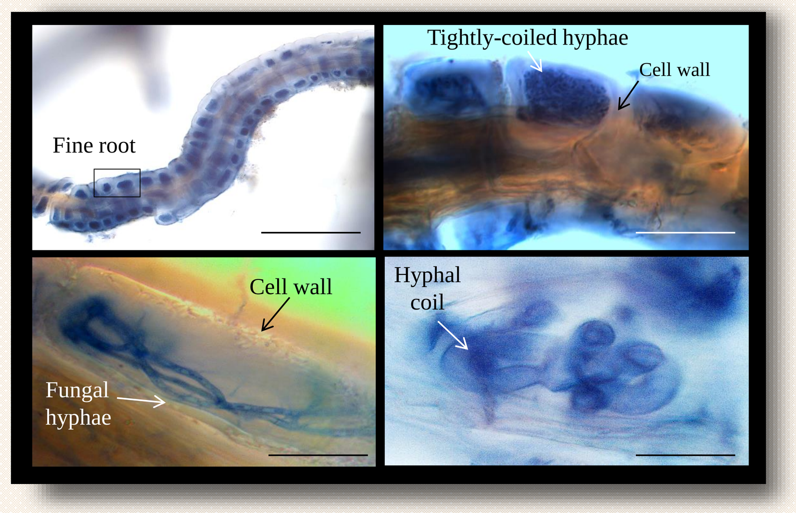



Plate 2: Ericoid mycorrhizal fungi acquire organic nutrients, especially nitrogen, and transfer nitrogen to the plant in exchange for carbon. These mycorrhizas also release enzymes that degrade plant litter.

## Conclusions

- **Minor differences in soil nutrients and a lack of striking differences** in fungal and bacterial activity between species in ***A. andrachnoides*** complex and within the **complex** rule out soil fertility and microbial abundance as limitations to seedling establishment
- However, the **low levels of ericoid mycorrhizal colonization** in *A. andrachne*, and specifically the pelotons that are exchange sites for nutrients, indicate that mycorrhizal fungi may be an important limitation to seedlings
- Future work: Increase sample size for the population in the **species complex** for soil and plant interactions, and test for mycorrhizal infectivity in new seedlings

References:
Robertson, G.P, Coleman, D.C, Bledsoe, C.S, and Sollins, P. (Eds.) (1999) Standard Soil Methods to Long-Term Ecological Research. Oxford University Press, NY.

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