Do water limitation and species divergence affect physiological traits in *Quercus oleoides?*

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Introduction

- Widely distributed species are usually subjected to environmental variation within their distribution range
- *Quercus oleoides* is a long-lived tree species distributed from Central America to Mexico occupying areas with contrasting precipitation regimes.
- Previous studies have shown high genetic differences among populations in leaf traits, growth rates and neutral molecular markers (Cavender-Bares et al. 2011, Koehler et al. 2012).
- In this study, we examine the extent to which populations of *Q. oleoides* differ in allometry under contrasting conditions of water availability

Hypotheses

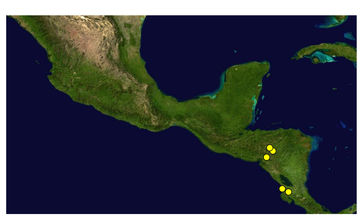
1. *Q. oleoides* populations originating from differing climates will express significant differences in allometric traits.
2. *Q. oleoides* will also express differing allometric traits when subjected to differing water treatments on a species level.

Specific objectives

- To explore whether populations differ in allometric traits: root ratio (root biomass/total biomass), alive leaf ratio (alive leaf biomass/total biomass) and dead leaf ratios (dead leaf biomass/total biomasss) will be examined
- To test for differences between treatments in allometric traits
- To perform allometry curves. If differences in allometric traits among populations or between treatments are found, I will determine allometry curves for each group separately
- To compare population divergence in allometry with previous results on leaf morphology, growth rates and neutral differentiation in *Quercus oleoides*

Methods

Q. oleoides from five different populations were analyzed. These five populations included three from Honduras (Las Tablas "TA", Sabana Grande "SB", Macuelizo "MZ") and two populations from Costa Rica (Rincon "RI", Santa Elena "SE").

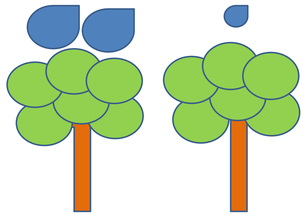


Honduran (northern) populations are considerably drier (annual precipitation 1000-1300 mm) than Costa Rican (southern) populations (1700-2500 mm).

Methods, cont.

1470 acorns were collected in total from 93 open-pollinated families. Acorns were sown in June 2013 and grown for 9 months under optimal conditions of water and nutrients.

Seedlings were then placed under two differing water treatments in a greenhouse. These included high (20-30% relative water content (RWC)) and low (5-10% RWC) treatments.

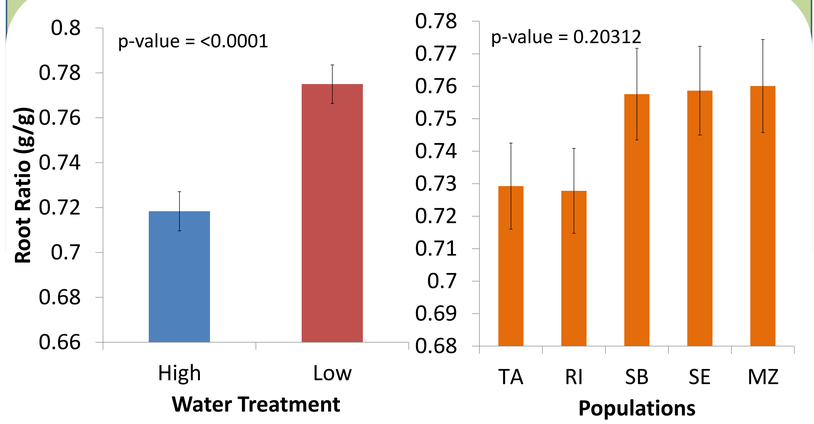


Temperatures were kept at similar values to the source populations (18-30 °C). Plants were then allowed to grow in these conditions for about seven months.

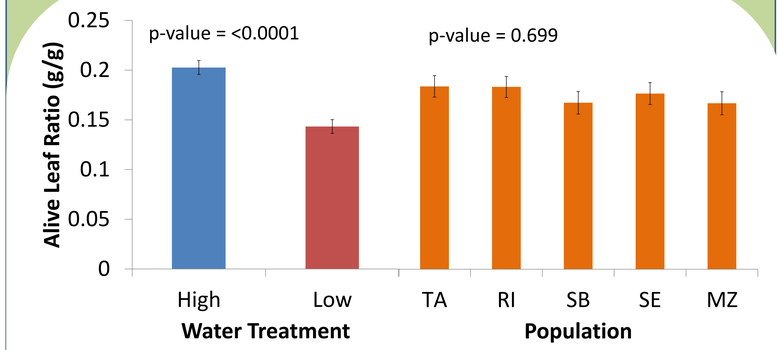
After this growth period the seedlings were measured first for growth traits and subsequently harvested and dried for biomass measurements.

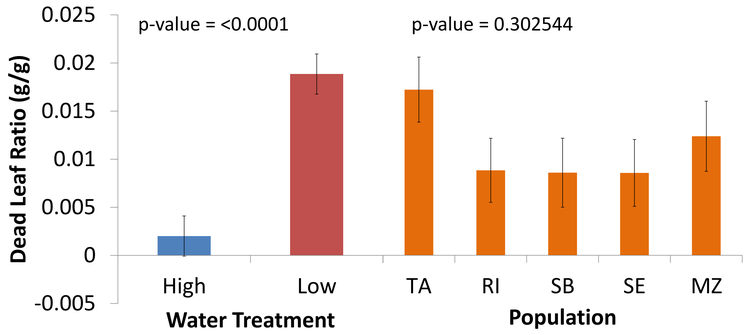
Once the data was acquired, two-way ANOVA was used to assess the effects of treatment and population on the ratios selected for examination. Allometric curves were also generated for the plants in the two water treatments.

Results



Results, cont.





Conclusions

- There were no significant trends found suggesting plants had differing ratios based on population.
  - This suggests adaptation to different environments is not due to biomass partitioning.
- *Q. oleoides* plants that are grown in low water environments invest more energy in root production.
- More alive leaves are found on plants in the high water treatment.
  - Due to the fact plants with more water could afford to invest more in photosynthetic tissues, thus allowing them to grow faster.
- Dead leaves are more commonly found on low water treatment plants in an attempt to conserve water loss.
  - Cavitation of leaves was another possible reason for the loss.
- Allometry curves were then generated for the two water treatment groups.

References

Cavender-Bares, J., Gonzalez-Rodriguez, A., Pahlich, A., Koehler, K., and Deacon, N. (2011) Phylogeography and climatic niche evolution in live oaks (*Quercus* series *Virentes*) from the tropics to the temperate zone. J. Biogeogr. 38: 962-981.

Koehler, K., Center, A., and Cavender-Bares, J. (2012) Evidence for a freezing tolerance-growth rate trade-off in the live oaks (*Quercus* series *Virentes*) across the tropical-temperate divide. New Phytologist. 193:730-744