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Physiology as a Mechanism Driving Early Fitness Response in *Cornus florida*

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Introduction

- As cities continue to grow, urban encroachment is rapidly decreasing the distance between cities and natural ecosystems.
- *Cornus Florida*, flowering dogwood, is an understory tree, native to mixed hardwood forests of eastern North America, but cultivated varieties are popular in urban landscapes due to their springtime blooms.
- Cultivar *C.florida*, and has been artificially selected for large floral displays, an ability to tolerate urban landscapes, and resistances to diseases.
- Urbanization increases the chances of gene flow of cultivar genotypes into native populations because cultivar and native individuals occur within close proximity. The consequences of cultivar gene escape into native populations is unknown.
- Common gardens experiments control for environmental conditions, so we can measure differential responses of genotypes. This makes them a useful way to study possible consequences of gene escape in *C.florida*
- Here we investigate physiological variables as a possible mechanism driving differences between native and cultivar *C. florida* in a common garden

Possible outcomes for seedling performance in the common garden:

H₀: Cultivar = Native

H₁: Cultivar > Native

H₂: Cultivar < Native

Methods

- A common garden, consisting of 569 seedlings from 20 cultivar and 17 families was established at the VCU Rice River Center in Charles City County in May 2018 (Fig 1).
- Plant traits including height to apical meristem and stem diameter were measured throughout the 2018 and 2019 growing season to determine differences in early fitness response. Above and below ground biomass were measured at the end of the experiment.
- A Li-Cor 6400 Portable Photosynthesis System (Fig. 2A) was used to measure photosynthetic rate on a subset of seedlings in the common garden.
- Area of the largest leaf was measured from base to tip and was calculated in ImageJ (Fig 2B) on 36 native and 54 cultivar *C.florida* seedlings (n = 90).
- Linear mixed effects models (R package nlme) were used to assess differences in plant traits and photosynthesis.

Results

Plant height was significantly greater in cultivar versus native seedlings (*P* = 0.004), however, stem diameter was not significantly different (*P* = 0.365) when grown in native understory conditions. Above and below ground biomass were significantly greater in cultivar seedlings (Fig. 3) but leaf area was not significantly different between cultivar and native seedlings (Fig. 4). No significant differences in rate of photosynthesis were seen (Fig. 5).

Discussion

Cultivar seedlings were significantly larger than native seedlings in height, above and below ground biomass. This could indicate cultivar *C. florida* has been artificially selected for rapid biomass accumulation.

There were significant differences in leaf area (cm²) from the leaf base to tip, but there were not significant differences in photosynthetic rate. A larger leaf area may be allowing cultivar seedlings to accumulate biomass more rapidly than native seedlings.

The lack of significant differences in rate of photosynthesis between native and cultivar seedlings does not support the hypothesis that differences in this physiological variable are a mechanism driving the differences in the early fitness traits of height, above and below ground biomass between cultivar and native seedlings.

Differences in early fitness response indicate how cultivar genotypes might perform in a native environment relative to native genotypes. Plant traits generally support the first alternative hypothesis that cultivar seedlings are outperforming native seedlings over two growing seasons. If cultivar genotypes can outcompete native genotypes even in shaded conditions, it is possible that cultivar genes escaping from urban areas could establish in native populations.