Mating System Evolution in *Clarkia*: physiological rates correlated with plant biomass

Nicolette Geluz, Oxnard College
Post Doc. Mentor: Leah Dudley, PI: Susan Mazer
Department of Ecology, Evolution, and Marine Biology, UCSB

Abstract

Among angiosperm taxa, the ability to self-fertilize has evolved multiple times. Most research has attempted to explain the evolution of selfing as an adaptive response to selection under particular environmental conditions (e.g., where pollinators are scarce or unreliable). If selection for self-fertilization is occurring in outcrossing taxa in the extreme of their range, then we expect plants with the highest fitness to have traits that allow them to complete their lifecycle when water is plentiful such as higher rates of carbon gain, earlier flowering at smaller plant sizes, and lower water use efficiency. In this study, we measured above-ground plant biomass in an outcrossing population of *Clarkia xantiana* ssp *xantiana* to determine whether there is a significant correlation between their physiological processes (photosynthesis, transpiration, and water use efficiency) and above-ground plant biomass. Gas-exchange rates were measured on plants growing in the field. At plant senescence, above-ground stems were collected, dried and weighed. Our results show no significant correlation between photosynthesis, transpiration, or water use efficiency with plant biomass. All three relationships showed near zero slopes, small r^2 values and large P-values. In conclusion, the current study did not support our prediction that outcrossing phenotypes growing at the edge their range should possess drought avoidant traits (low biomass with high gas-exchange rates). One explanation for this result may be that this study population grows at a high elevation with cooler temperatures, which may alleviate selection for drought avoidant traits.

Objective

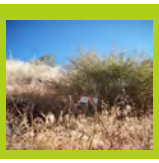
Do outcrossers at the dryer climates show drought avoidant phenotypes?

Are carbon gain and water loss negatively correlated with above-ground plant biomass?

Photosynthesis (umol CO_2 m^{-2} s^{-1})	Transpiration (mol H_2O $m^{-2}s^{-1}$)	Water Use Efficiency (umol CO_2/mol H_2O)
Measure: Carbon gain	Measure: Water loss	Measure: Photosynthesis/transpiration
Drought Avoidant Traits: Increased rates, decreased biomass	Drought Avoidant Traits: Increased rates, decreased biomass	Drought Avoidant Traits: decrease WUE, decrease plant biomass

Study System

Clarkia xantiana ssp *xantiana*


Methodology

•Randomly selected and tagged ninety *Clarkia xantiana* ssp *xantiana.*

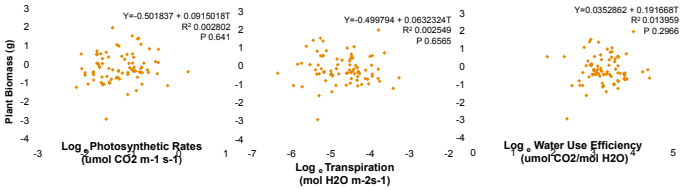
•At plant senescence, above-ground stems were collected, dried and weighed.

•Physiological rates such as photosynthesis, transpiration, and water use efficiency were measured an infrared gas exchange analyzer [Fig 1].


Fig. 1

Results

Physiological Rates Correlated with Plant Biomass:
Clarkia xantiana ssp *xantiana*



Each plot represents a plant

Fig. 2 shows photosynthetic rates correlated with plant biomass and shows no significant correlation

Fig. 3 shows transpiration rates correlated with plant biomass and shows no significant correlation

Fig. 4 shows water use efficieny correlated with plant biomass and shows no significant correlation

Discussion

•In *Clarkia xantiana* ssp *xantiana,* there was no significant correlation between physiology and above-ground plant biomass.

•This could be due because current climate change is currently at a slow rate or does not exist.

•Also, the location of Clarkia xantiana ssp xantiana is a much cooler region.

References

Aniya, A.O. 2004. Water use efficiency, leaf area and leaf gas exchange of cowpeas under mid-season drought. Europ J Agrogomy 20 327-339.

Garnier, Eric. 1991. Resource Capture, Biomass Allocation and Growth in Herbaceous Plants. TREE: vol 6, no. 4.

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