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A Comparison of Fluorescence and ETR Between Malosma laurina and Rhus integrifolia

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Abstract

Malosma laurina and *Rhus integrifolia* are both native species to the Santa Monica Mountains and belong to the same family, *Anacardiaceae.* The two natives have lived alongside each other but in recent years *M. laurina* has been heavily affected by the prolonged drought. The *Malosma laurina* population in the Santa Monica Mountains has withstood wildfires and droughts, and has remained relatively stable and healthy up until recently. A recent Pepperdine graduate published her findings explaining the high levels of dieback in *Malosma laurina* and attributed it to the fungus, *B. dothidea*. We hypothesized that *Rhus integrifolia* would have higher fluorescence and ETR rates because there have been no recorded cases of *Rhus integrifolia* being infected by the fungus or that it would physiologically outperform *M. laurina.* We concluded that there was no significant difference in light and dark adapted fluorescence rates between both plants. However, *Malosma laurina* proved to have a significanty higher electron transport rate.

Introduction

Malosma laurina, commonly known as laurel sumac, is coined the "super plant" of the Santa Monica Mountains. Because of its incredible drought resistance, wildfire survival rates, and physiological adaptations, it was surprising to see the high levels of dieback present. Data on *M. laurina,* before infection, outperformed *Rhus integrifolia* and all plants in the *Anacardiaceae* family, and its success was attributed to its physiological adaptations. Recently, these adaptations don't appear to be enough because when we examined potential study sites, the amount of dieback present within the *M. laurina* population greatly exceeded *R. integrifolia's* dieback numbers. Because there have been no recorded cases of *B. dothidea* infecting *R. integrifolia* we wondered, why and how was *R. integrifolia* able to resist the fungus? In order to answer this question, we compared their light adapted and dark adapted fluorescence rates, and their electron transport rates during the spring months of 2018. We decided to study these species in their natural habitat and found both plants cohabitating near the Drescher Campus. Using this location we wanted to determine whether *Malosma laurina* would continue to outperform *Rhus integrifolia* even when infected with the fungus. *Rhus integrifolia* appeared more green and lush compared to *M. laurina* and based on this observation we hypothesized that *Rhus integrifolia* would physiologically outperform *Malosma laurina*. We utilized a light and dark adapted fluorometer which provided the data necessary to make this comparison.

Methods

Figure 1. and Figure 2.
We measured photosynthetic parameters using the dark and light adapted fluorometer. We tested 3 leaves per plant and found 5 plants of each species to test.

Study Sites

Thirty different leaves were tested in total: five *M. laurina* for dark adapted, five *M. laurina* for light adapted, five *R. integrifolia* for dark adapted, five *R. integrifolia* for light adapted

Figure 4. All plants found in Drescher Graduate Campus

Results

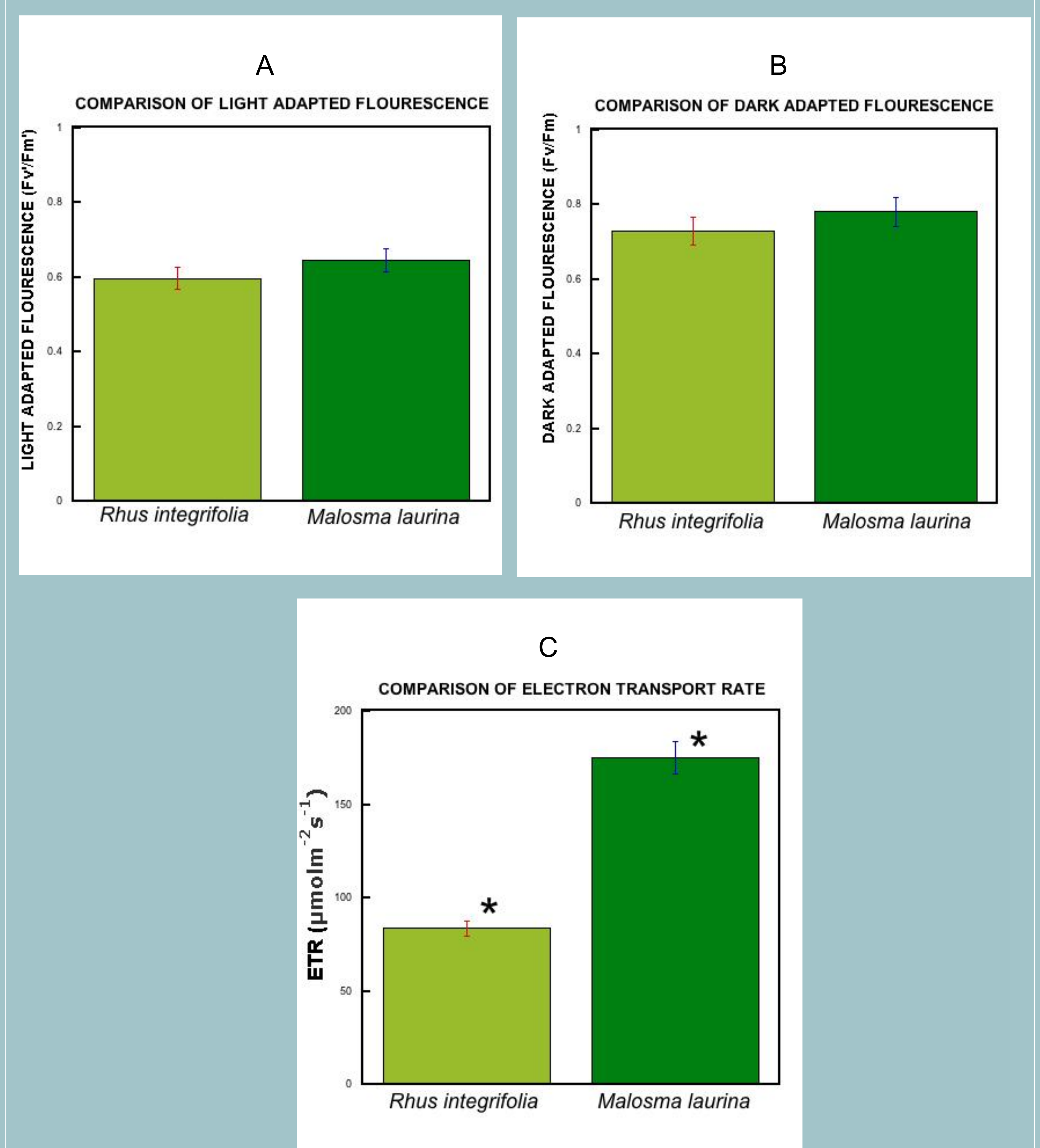

Figure 6. Comparison of A) Light Adapted Fluorescence, B) Dark Adapted Fluorescence, and C) Electron Transport Rate during midday (12:00 pm-2:00 pm) concurring *R. integrifolia* and *M. laurina* at a non- irrigated site. Error Bar symbols represent significant differences in mean value by Standard T-Test.

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Discussion

After analyzing the dark and light fluorescence data we were able to conclude that there is no significant difference between *M. laurina* and *R. integrifolia's* fluorescence rates. However, when we compared the ETR rates between *R. integrifolia* and *M.laurina* there was a significant difference between the two plants. This test demonstrated that *M. laurina* had a higher ETR rate which means it is more efficient at converting light energy into chemical energy. Our data did not support our hypothesis.The results were interesting because it did not validate our visual observations that can be seen in Figure 4. *Malosma laurina* had a far greater amount of dieback than *R. integrifolia,* and *R. integrifolia* appeared to be flourishing better and lusher. After calculating the Student T test, we are 95% positive that our results prove the survival skills of *M. laurina* in harsh drought conditions were high, even while infected with the fungus, *B. dothidea.* Our experiment touches on the 'superplant' qualities of *M. laurina,* given that it still has higher electron transport rates than the healthy chaparral plants that grow side by side with it. It is reasonable to predict that *M. laurina* will continue to grow and flourish in the Santa Monica mountains if it finds a way to fight off or halt the spread of the fungus that infects it, affecting the *M. laurina* population on the mountainside.

Conclusion

California is currently experiencing the longest and driest drought in its history. Due to this extreme drought and severe lack of water, native chaparral plants which are usually very drought tolerant are experiencing high levels of dieback and are having trouble surviving, including *Malosma laurina*. *M. laurina* previously thrived and survived through wildfires and droughts but is now dying in high numbers due to the fungus, *B. dothedea.* Going into this project, we assumed that *R. integrifolia* would outperform *M. laurina* in their fluorescence rates because *R. integrifolia* appeared to be doing better and had less physical amounts of dieback. However, the data proved that they have similar fluorescence rates and there was no significant difference *M. laurina's* ability to efficiently convert light energy into chemical energy allows it to continue to live in non-irrigated environments. Future research could include further testing on *R. integrifolia's* water potential, stomatal conductance, and photosynthetic rates compared to *M. laurina,* in order to deduce which factor is preventing R. integrifolia from contracting the fungus.

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