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Measuring Water Use Efficiency in Large and Small Leaves of Malosma laurina

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Abstract

Our study set out to compare Water Use Efficiency (WUE) levels of *Malosma laurina* plants in both small and large leaves. We collected a total of 3 data sets, with each set consisting of 5 small leaves and 5 large leaves from a single specimen of *Malosma laurina* located on Pepperdine's campus. Parameters including transpiration and photosynthesis were measured to calculate WUE of small and large leaves using an LI- 6400 Gas Exchange System. We hypothesized that small leaves would have a higher WUE rate than large leaves of the *M. laurina*. Analysis of this data via a paired Student's *t*-test showed that our hypothesis was not supported, as our results indicated that the WUE in small leaves was less efficient than that of large leaves.

Introduction

***Malosma laurina* often displays large and small leaves growing directly adjacent to one another on the same branch of a single plant. This noticeable morphological change in such a close proximity is caused by cycles of water abundance and deficiency in the chaparral environment. In the Mediterranean-climate springtime, frequent rainfall increases the amount of water available for plants to utilize; with more water, *Malosma laurina* is capable of opening stomata wide and fixing more carbon dioxide to produce increased leaf growth. Contrarily, in summertime—when water levels are extremely low or even nonexistent—stomata close to minimize water loss. In this situation, carbon dioxide cannot be constantly fixed from the atmosphere, and concentration within the leaf decreases for the plant to be able to still engage in photosynthesis. As a result, less growth is possible, and overall leaf size is smaller. We chose to analyze and compare WUE in large and small leaves of *Malosma laurina*. Our hypothesis was such that small leaves would have a higher water use efficiency rate than large leaves**

Acknowledgements

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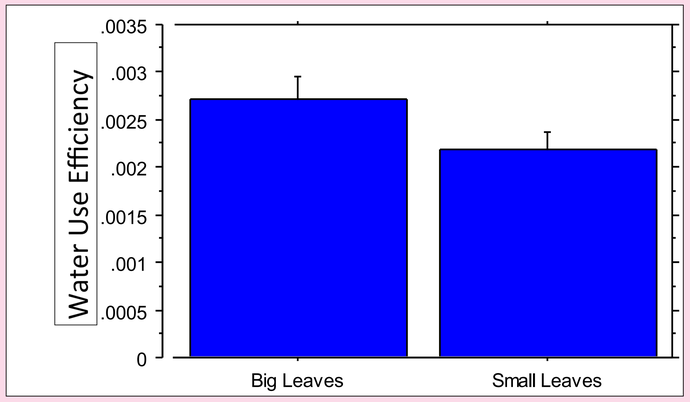

Paired Student's *t*-test showing WUE between large and small leaves

Procedure

Our study site was chosen for being both well-lit as well as easily accessible, and our sample of *Malosma laurina* clearly displayed a difference in leaf sizes, indicating survival through both drought and rainy periods. We used an LI-6400 Gas Exchange System to measure photosynthesis (A) and transpiration (E) rates to determine Water Use Efficiency (WUE = A/E). These basic parameters were measured for 5 large and 5 small leaves from a branch. A total of 3 different branches on the same *M. laurina* was measured. We then measured Leaf Area Index (LAI) using an LI-3100 Leaf Area Meter. Leaves were then dehydrated and massed. A paired Student's *t*-test was used to analyze the data

Discussion

After collecting our data and analyzing the results, we were able to conclude that *water use efficiency in* M. laurina *was significantly lower in small leaves in comparison to large leaves (*p value = 0.0027). This was contrary to our original hypothesis that the smaller leaves had higher WUE. We believed that, because smaller leaves arise in times of drought, they would need to be more efficient in their water use to most effectively use the limited water. Our idea was originally supported by the fact that the leaves are modified during dry periods. However, we now see that modification may actually be a result of the low water intake, causing stunted growth, rather than a response in order to maximize water uptake. Even though we collected data in many different light settings and adjusted accordingly, the results were all consistent with one another, demonstrating *M. laurina's amazing ability to adapt to different situations.* If we were to continue our research, we could attempt to distinguish if the WUE changes were a cause or an effect from drought.

Literature Cited

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