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A Comparison of Water Potential and Mechanical Strength of Tip and Base Leaves in Heteromeles arbutifolia

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Abstract

Heteromeles arbutifolia, commonly known as, Hollywood, is a plant that is extremely common in the California Chaparral ecosystem. It was observed that with Hollywood, the leaves grow on the tips of the branches predominantly. However, there are leaves that grow on the base of the branches that appear to be equally as healthy. The purpose of this investigation was to determine whether the leaves that grow at the tips of the branches or at the base of the branches were better suited to benefit the rest of the plant. Our hypothesis was that the leaves at the tips of the branches would be better suited to benefit the rest of the plant due to their better access to sunlight, as the rest of the plant does not overshadow them. We determined which leaves would be better suited to benefit the plant by measuring the water potential and mechanical strength of leaves at the tip and bases of branches on Heteromeles arbutifolia plants across the street from the Pepperdine cross. Samples were collected from Heteromeles arbutifolia specimen that were both in the sun and in the shade. After the results were compared, the plants in the sun showed that leaves at the base were mechanically stronger than those at the tip, while plants in the shade showed leaves at the tip were mechanically stronger. As for water potential, base leaves had higher water potential across the board.

Introduction

Heteromeles arbutifolia is a plant that is extremely prevalent in the California Chaparral ecosystem. It lives in many locations and the different locations they live in have an influence on how successful the plant is in terms of survival. Our hypothesis is that leaves on H. arbutifolia plants that are on the tips of the branches will be stronger than those at the base. This is because they will have better access to sunlight and are not overshadowed by the rest of the plant. In order for a plant to function properly, its leaves have to contribute to the plant by carrying out photosynthesis. If the leaves have higher mechanical strength and lower water potential, then they will be more likely to survive, and thus, benefit the plant in the future. Mechanical strength is important when talking about leaves because it shows how much stress and strain a leaf can take before it tears, thus causing damage to the plant. Stronger leaves mean they will be more suited to stand against the forces of nature and thus, be able to survive to benefit the plant. Water potential is significant because it shows how hydrated the leaves are. Leaves that have lower water potential have a higher level of hydration, which is necessary for the plants survival. Thus, plants with lower water potential will be more beneficial to the plant than leaves with a higher potential.

Materials and Methods

To test our hypothesis, we chose a test site that was abundant in Heteromeles arbutifolia so we could test multiple plants in multiple locations. Across the street from the Pepperdine Cross proved to be a perfect location. The first step in the process was to obtain samples. Two specimen of these samples were first located. Two of these plants were in the shade, the other two were in the shade. One healthy leaf was then clipped from the tip and base of each of the plants in both the shade and sun. Four of these leaves (one from tip and base from each plant) were tested for water potential using a pressure chamber. The remaining samples were then tested for their mechanical strengths using the Instrom Mechanical Testing Device. The results from these tests for all the leaves were then compared and conclusions were drawn.

Study Site

Our study site was across the street behind the Theme Tower on the Pepperdine University campus.

Discussion

This experiment was performed in order to see the difference between the leaves at the base and tip on the branches of Heteromeles arbutifolia. It was hypothesized that the leaves at the tip of the branches would benefit more than the leaves at the base of the branch because of its higher exposure to sunlight. Our data shows that the leaves at the tip of the shaded H. arbutifolia are more hydrated and have mechanically stronger leaves compared to the leaves at the base of the branch. This is significant because it shows that the water and nutrients, which come from the base of the plant, are directed more to the leaves at the tip than the leaves at the base of the branch. The plant in the shade wants to promote new growth at the tip of the branch, while the plants in the sun direct its water and nutrients in order to survive its drier environment.

Conclusion

- The leaves at the tip of the branch of the shaded plant are mechanically stronger than the leaves at the base of branch.
- The leaves at the base of the branch of the non-shaded plant are mechanically stronger than the leaves at the tip of branch.
- The leaves at the tip and base of the branch of the non-shaded plant have the same water potential.
- The leaves at the base of the shaded plant have a higher water potential than the leaves at the tip of branch.
- Shaded Heteromeles arbutifolia directs more of its nutrients and water to the tips of the branches than the base of the branch.

Literature Cited


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