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William Cohen
Pepperdine University

Gina Fitzgerald
Pepperdine University

Joseph Liao
Pepperdine University

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William Cohen, Gina Fitzgerald, Joseph Liao

Department of Biology, Pepperdine University, 24255 Pacific Coast Hwy, Malibu CA 90263

Abstract

The overall well being of the riperion *Salix lasiolepis* has a great deal to do with its state of hydration. This experiment sought to test a potential correlation between mechanical strength of branches and water potential. Using a Scholander-Hammel pressure bomb to test water potential and an Instron 5500 to test mechanical strength, the two variables were compared directly from hydrated and dyhydrated samples of *Salix lasiolepis* No correlation was detected between mechanical strength and water potential, leaving the conclusion that mechanical strength is not an indicator of water potential.

Results

There appears to be no direct correlation between water potential and tensile strength of hydrated and dehydrated samples of *S. lasiolepis*. While hydrated samples do indeed have higher water potentials and slightly higher tensile strength than do dehydrated samples, the phenomenon cannot be explained by water potential (P=0.5892). It is likely that hydrated samples have healthier tissues than dehydrated samples, thus, allowing hydrated samples to have a slightly higher tensile strength contributed by living tissues. The fairly similar tensile strength despite contrasting water potentials suggests that tensile strength is primarily determined by the existence of already "dead" plant tissues, particularly fibers. Living tissues do not contribute significantly to the tensile strength of *S. lasiolepis*.

Introduction

Salix lasiolepis, also known as the Arroyo Willow, is a very important plant to modern medicine and pharmaceutical companies because of its abundance in salicylic acid. Aspirin, one of the most commonly used drugs around the world, is directly derived from salicylic acid. Since the discovery of aspirin in 1829, *Salix lasiolepis* has become an indispensable resource. The results of this experiment indicate the relationship, if any, between mechanical strength and water potential in *Salix lasiolepis*. Tensile strength has been studied in several plants of the genus *Eragrostis*. It has been determined that leaf tensile strength directly correlates with drought tolerance, ultimately affecting a plant's well-being (Balsamo, 2006). Suggestions have been made that size of pores in pit membranes may be a factor in determining both xylem efficiency and vulnerability to embolism (Jarbeau, 1995). Furthermore, it is known that xylem must withstand mechanical stresses associated with negative pressure (Jacobson 2005). With the insights of mechanical strength and water potential, drought tolerance may be predicted; this can be crucial for a riparian plant living in the drought-prone chaparral. Given the knowledge of all of these factors, harvesters of salicylic acid from Salix lasiolepis can potentially determine whether or not a tree is healthy enough for medicinal consumption through just taking the water potential and/ or tensile strength of a *Salix lasiolepis* stem.

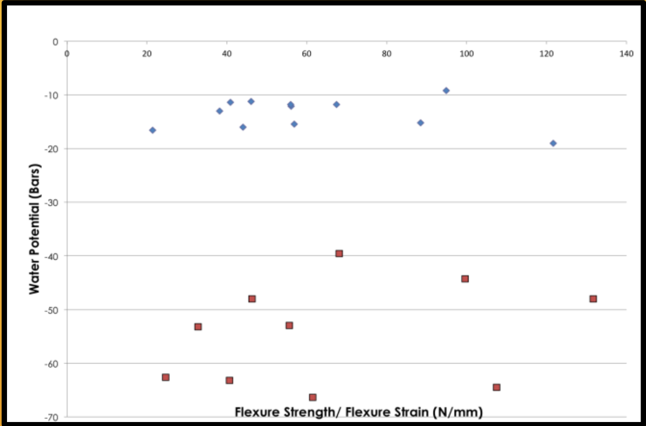

Figure 1 Tensile Strength versus Water Potential in *Salix lasiolepis*

S. lasiolepis Sample Type	# of Samples	Water Potential (bars)	*Tensile Strength (N/mm)
Dehydrated	13	-60.215 ± 13.915	64.820 ± 8.962
Hydrated	13	-13.385 ± 2.791	60.995 ± 8.117

Table 1. Summary of attained data. Hydrated *S. lasiolepis* n = 13; Dehydrated *S. lasiolepis* n= 9. *Tensile strength = flexure strength/flexure strain (N/mm). For further explanation of attained reults see Results section

Methods

Several *Salix lasiolepis* from Marie Canyon were tagged and predawn samples were collected and divided into "Wet" and "Dry" categories. Wet samples were bagged for 12 hours prior to testing to prevent transpiration and allow the plant to come to equilibrium. The dry samples were left to out for 24 hours, then bagged for 12 hours . Using the Scholander-Hammel pressure bomb, lateral branches with photosynthetic leaves were tested for water potential. Samples of approximately were cut from the core branch of each sample. The four point setting of the Instron was used to measure the Modulus of Elasticity (MOE), Modulus of Rupture (MOR) flexural stiffness (EI), and flexure strength over flexure strain (F/V). Results were graphed against one another and analyzed for correlation.

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Discussion

The comparison in this investigation found that the relationship between mechanical strength of stems, measured by the ratio of Flexure Strength (F) to Flexure Strain (V), and water potential (bars) had no noticeable correlation. This indicates the hypothesis is false and gives credit to the null hypothesis. Figure 1 shows mechanical strength against water potential. There is a clear separation between the wet and dry treated samples, but no clustering indicating a prevalence of wet or dry stems to stronger or weaker stems. This might be understood to show that the water potential of a stems is not an indicator of mechanical strength. The mechanical strength may be due to more robust construction of apoplastic structures in the stem of *Salix lasiolepis*. More research must be conducted to confirm these further hypotheses.

Conclusions

There is no conclusive evidence that a correlation exists between water potential and mechanical strength in *Salix lasiolepis*. Tensile strength is likely due to structures of the dead tissues, specifically fibers, which are largely unaffected by dehydration.

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