Evaluating Drought Impacts on the Cold Hardiness of Climate-Ready Landscape Plants

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01 Introduction

Recent irrigation trials have been conducted on a number of landscape plants in order to combat recent drought and water availability issues. While water use is a crucial aspect of plant health and survival, it is also critical to consider other environmental conditions, such as cold temperatures. The goal of the project is to assess the cold hardiness of four species of landscape plants and explore the impacts of water stress on cold hardiness.

02 Methods

To assess the cold hardiness of landscape plants, the freeze-induced electrolyte leakage (FIEL) method was utilized. The study included four plant varieties: *Cercis canadensis, Cercis occidentalis,* and two *Physocarpus* opulifolius cultivars, "*Diabolo*" and "*Little Devi*l." Each variety underwent high and low irrigation treatments, with the low irrigation treatment simulating drought conditions. One cm stem segments from each plant and treatment were subjected to an artificial freeze test, with temperatures from -7°C to -60°C, plus a control at 5°C. Post-freeze, the electrical conductivity was measured to quantify electrolyte leakage due to ice crystal formation that ruptures plant cells (Gopinath, 2020). Following initial measurements, samples were autoclaved to achieve maximum leakage. The conductivity ratio post-freezing to post-autoclave was used to quantify the plant's cold hardiness.

03 Subjects

Three replicates of each irrigation treatment were tested per plant variety to assess cold hardiness using the FIEL protocol

Cercis canadensis

Cercis occidentalis

Physocarpus opulifolius 'Diabolo'

Physocarpus opulifolius 'Little Devil'

04 Results

- The low irrigation treatment was associated with increased cold hardiness for *C. canadensis* and *P. opulifolius 'Diabolo'*
- The high irrigation treatment was associated with increased cold hardiness for P. opulifolius 'Little Devil'

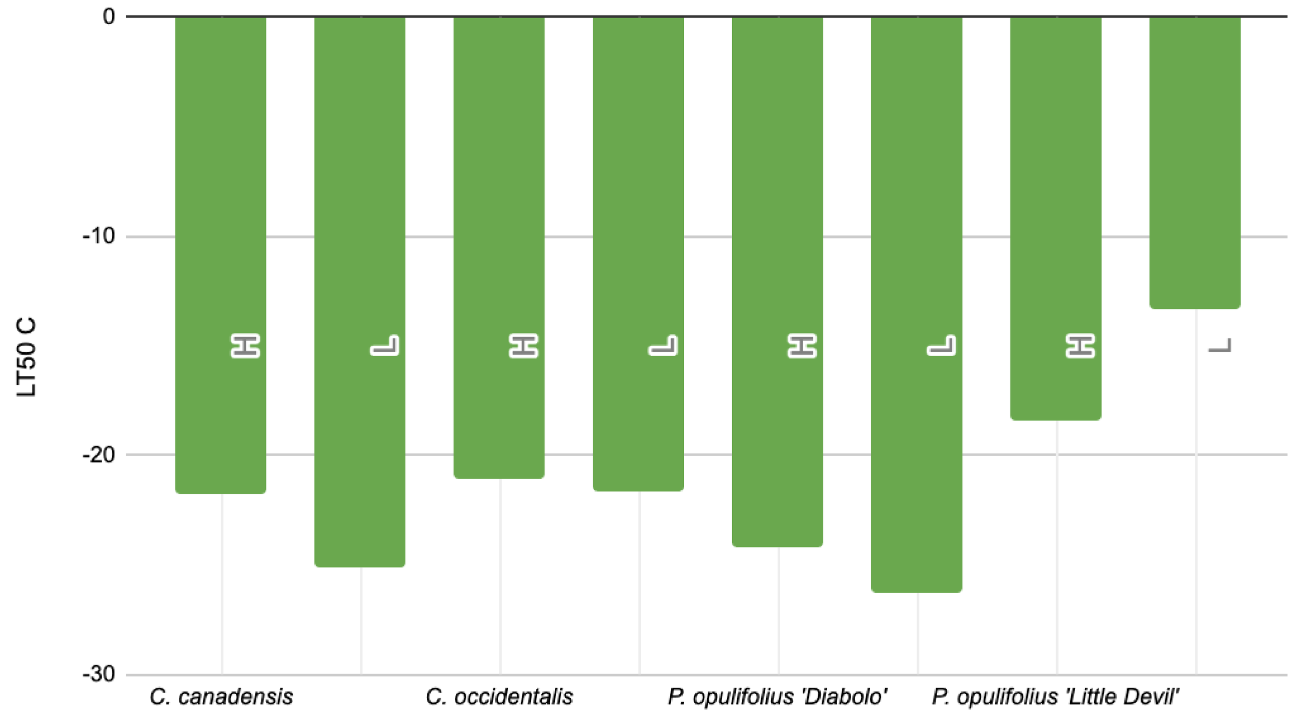

Figure 1. LT50 (lethal temperature of 50% the population) for high and low irrigation treatments of each plant variety

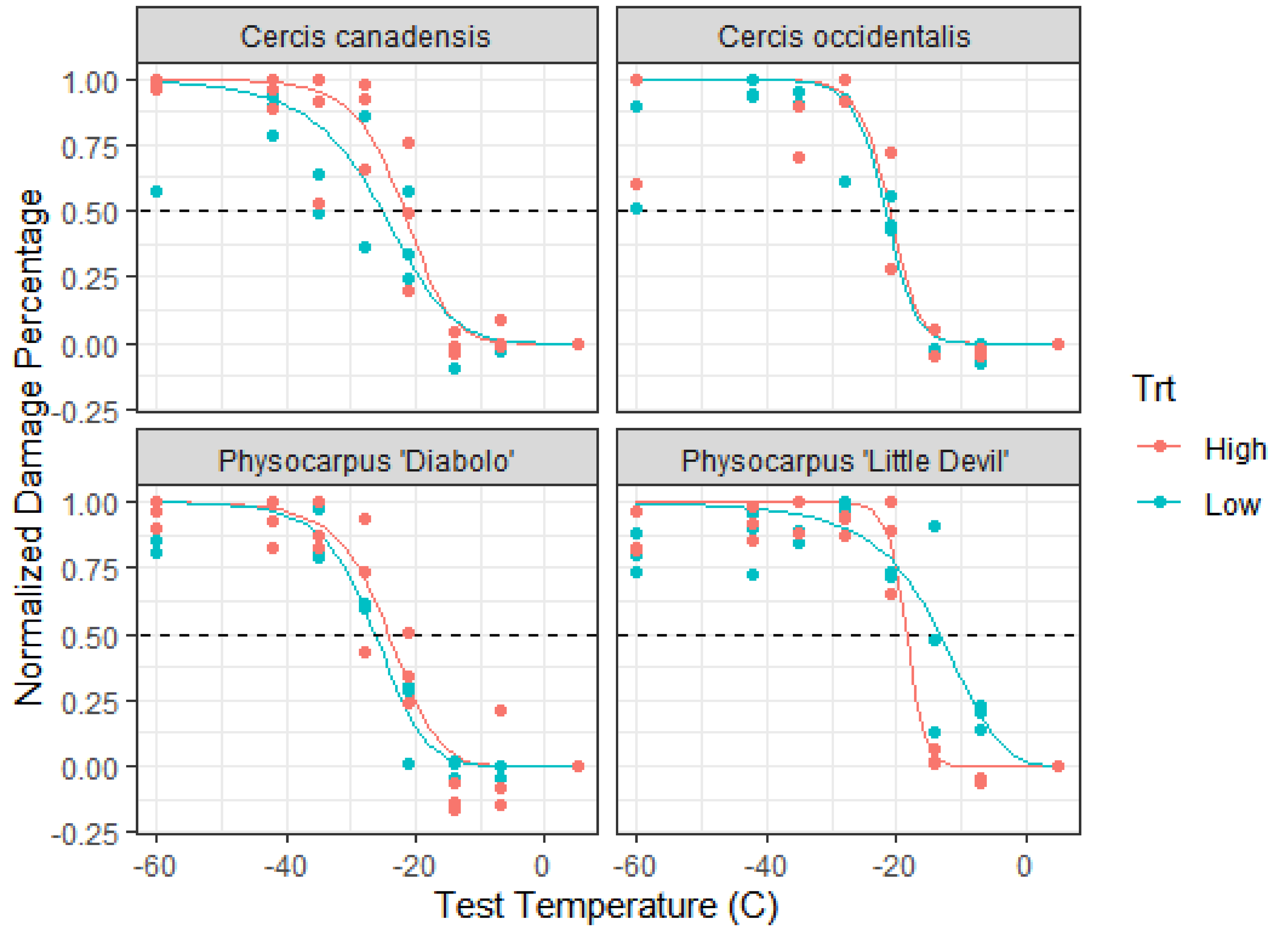

Figure 2. Damage percentage curves comparing high and low irrigation treatment. Dashed line indicates approximate LT50

05 Discussion

- *Despite being the same species, Physocarpus opulifolius 'Diabolo'* was the most cold hardy of the 4 varieties, and *Physocarpus opulifolius 'Little Devil'* was the least cold hardy.
- The impact of drought on cold hardiness varied among the plant varieties studied, but irrigation treatment appeared to have some influence cold hardiness in specific plant varieties. This highlights the importance of considering multiple stressors in plant selection and studies.
- Further analyses can be done regarding physiological changes induced by drought that effect cold hardiness in order to develop water management techniques to promote plant cold hardiness

References

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