Effects of Ion Exposure on Venus Flytrap Trap Closure Speed

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Introduction

Dionaea muscipula, commonly known as Venus flytraps, are carnivorous plants native to North and South Carolina. They require an open understory and grow in soil characterized by high levels of moisture and acidity. In this low-nutrient environment, Venus flytraps evolved "snap traps" that capture prey rich in nitrogen and phosphorus. In order to effectively close these traps, they rely on an action potential triggered by the mechanical stimulation of trigger hairs on the trap's inner surface. There have been many experiments related to the resting potential and growth experiments with varying levels of potassium and other ions. According to previous studies, potassium is the primary ion that has a significant effect on the resting potential of Venus flytrap's sensory hairs. However, the effect of varying levels of these ions on the closure speed of their traps was previously untested.

Materials and Methods

- We assigned eight plants to groups which consisted of solutions of 0.0004 M KCl, 0.0004 M NaCl, a combination of 0.0002 KCl and 0.0002 M NaCl, and a control treatment of deionized water for the first concentration trial period, after which they were increased by a power of ten and tested again over the three time periods.
- The three time periods tested for both concentration trials were 24, 48, and 168 hours.

Abstract

Our experiments examined the effects of varying concentrations of potassium and sodium ions as well as mixed solutions compared to deionized water.We hypothesized that increasing sodium and potassium ion concentrations and exposure times will cause decreased trap closure speeds, as exposure to ion concentrations will interfere with the snap-trap mechanism action potential.

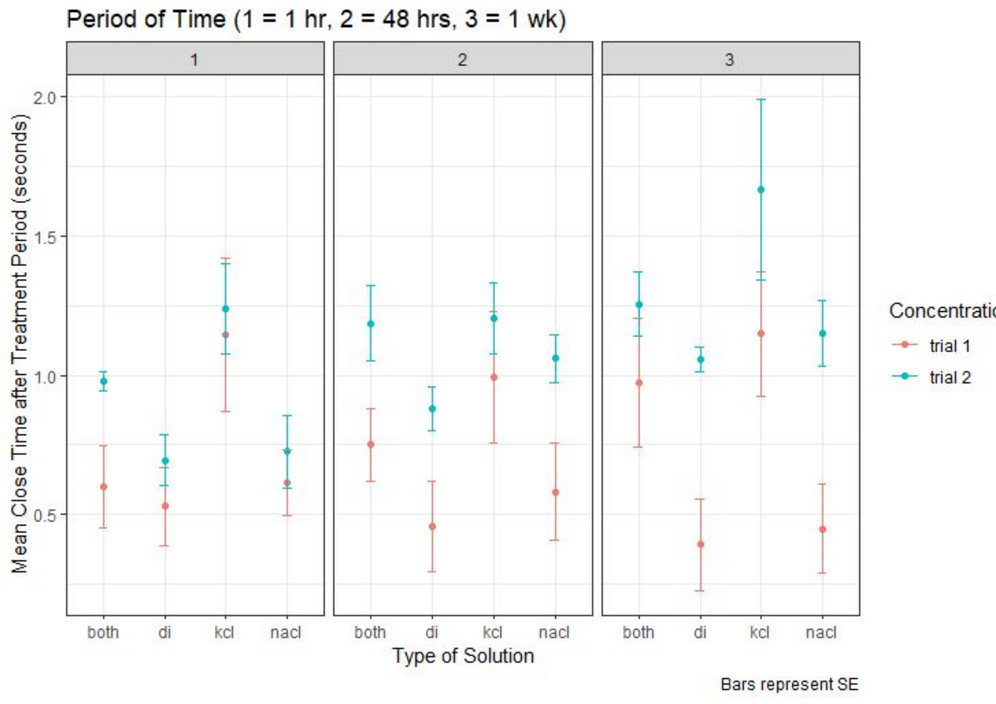

Figure 2: Trap closure times for combined data of Trials 1 and 2.

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Results and Discussion

After performing an ANOVA analysis, we found that KCl, along with concentration, had a significant effect on trap closure speed. NaCl and time period did not have a significant effect. Thus, our hypothesis was partially supported, as KCl and concentration but not NaCl or time period, had significant effects on trap closure speed.

The potassium ions present in the solution and are taken up by the plants likely result in a reduced action potential, as they decrease the electrical charge across the cell membrane. This reduced action potential is a plausible explanation based on past studies for the decreased trap closure speed found from potassium ion exposure. NaCl showed little effect compared to deionized water for closure times, which likely indicates that the resting potential was not affected.

Our conclusions point to the impact of runoff and other forms of pollution that cause increased levels of potassium ions and other ions in the environment. These pollutants can decrease the health and fitness of *D. muscipula*, specifically causing slower closure speeds of *D. muscipula* traps, which makes it more difficult for these plants to effectively capture insects and ultimately decreases their likelihood of survival. Since *D. muscipula* is already listed as an endangered species, the prevention of pollution in their natural environment is of utmost importance to their continued existence.

Future directions for research include experiments examining higher concentrations of potassium solutions and more prolonged periods of exposure. Additionally, the comparison of KCl solution with other potassium-containing solutions or chlorine-containing solutions would provide further insight into the effects of chlorine separate from the effects of potassium.