Could a chemical found in a local tree species be used to fight herbaceous invasives?

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Introduction

Invasive species are an issue across the globe and can grow quickly if left without management. Some species of plants are capable of exhibiting their own form of control on the plants around them through allelopathy, in which plants synthesize biochemicals that can stunt the growth of plants within their vicinity. These allelopathic chemicals can be found in various parts of the plant such as the roots, leaves, bark, and even fruit; they are released into the soil as these parts break down. The Tree-of-Heaven (*Ailanthus altissima*), a non-native invasive tree often found in the Midwest, has significant allelopathic tendencies. This chemical control of neighboring plants is proven effective against various herbaceous plants in a lab setting (Heisey 1990). Our experiment focuses on the application of these chemicals from *Ailanthus altissima* against herbaceous invasives in a field setting, specifically targeting Lesser Celandine (*Ficaria verna*) and Winter Creeper (*Euonymus fortunei*), which are commonly found in Cincinnati Parks.

Methods

The first step of this procedure was to extract the allelopathic chemical, ailanthone, out of the bark of *Ailanthus*, where it is found in high concentrations. This was done by crushing the bark into a powder and placing it into cheesecloth to submerge in water for 24 hours at 4°C. The ratio of plant material to water was 1g to 20ml. This solution along with the control, water, was then mixed with one gram of surfactant (sodium dodecyl sulfate, SDS) and placed into a spray bottle for later use. Experimental groups were set up that contained the herbaceous species Lesser Celandine (*Ficaria verna*) and Winter Creeper (*Euonymus fortunei*); two groups of each were treated with either water as the control or the previously made solution. The marked areas were 1m x 1m and were sprayed with approximately 250 ml of water with SDS and solution respectively. The plots were observed a week later to discern the health of the plants as well as percent coverage of the area as plants began to react to treatment.

Results

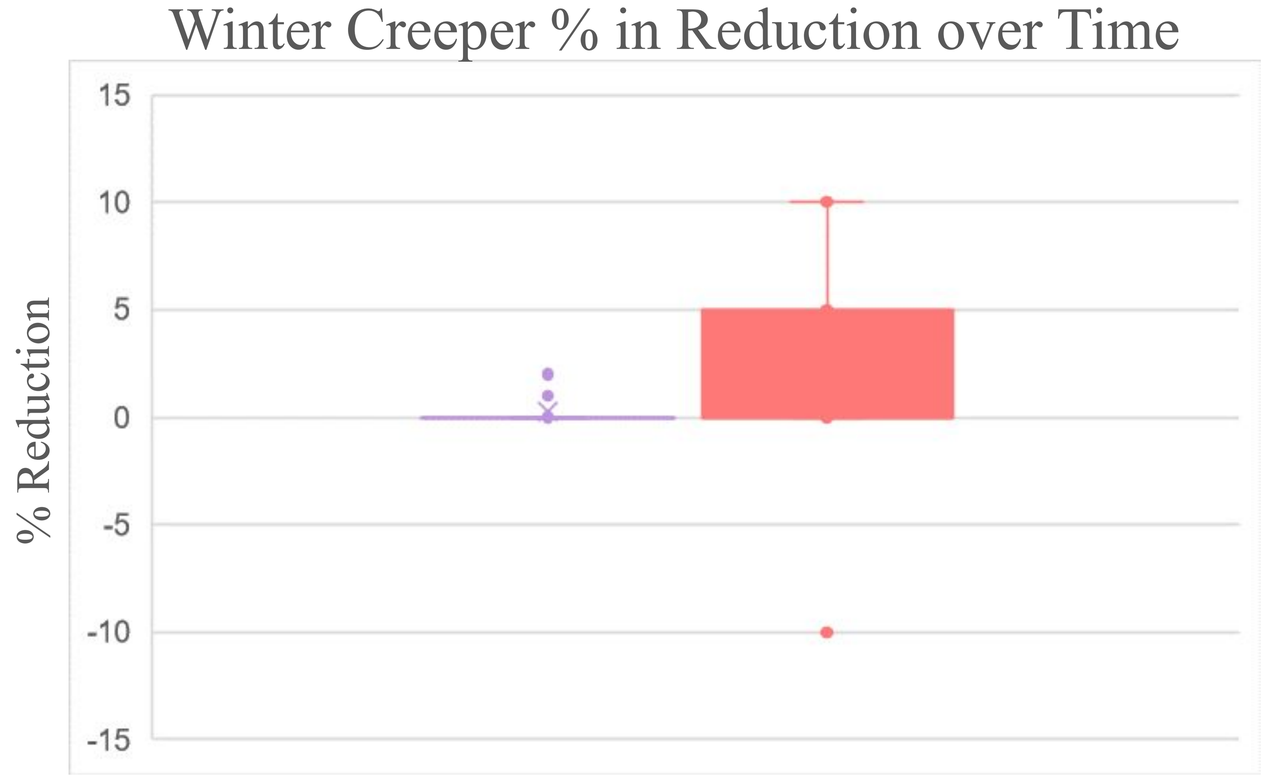


Figure 1
T-test comparing percent in reduction of coverage over time in control and Ailanthus treatments of *Euonymus fortunei*. Significant outliers present in Ailanthus treatment due to post-treatment growth, but no significant difference in percent coverage between groups.
t: -1.10
df: 30
Probability: 0.28

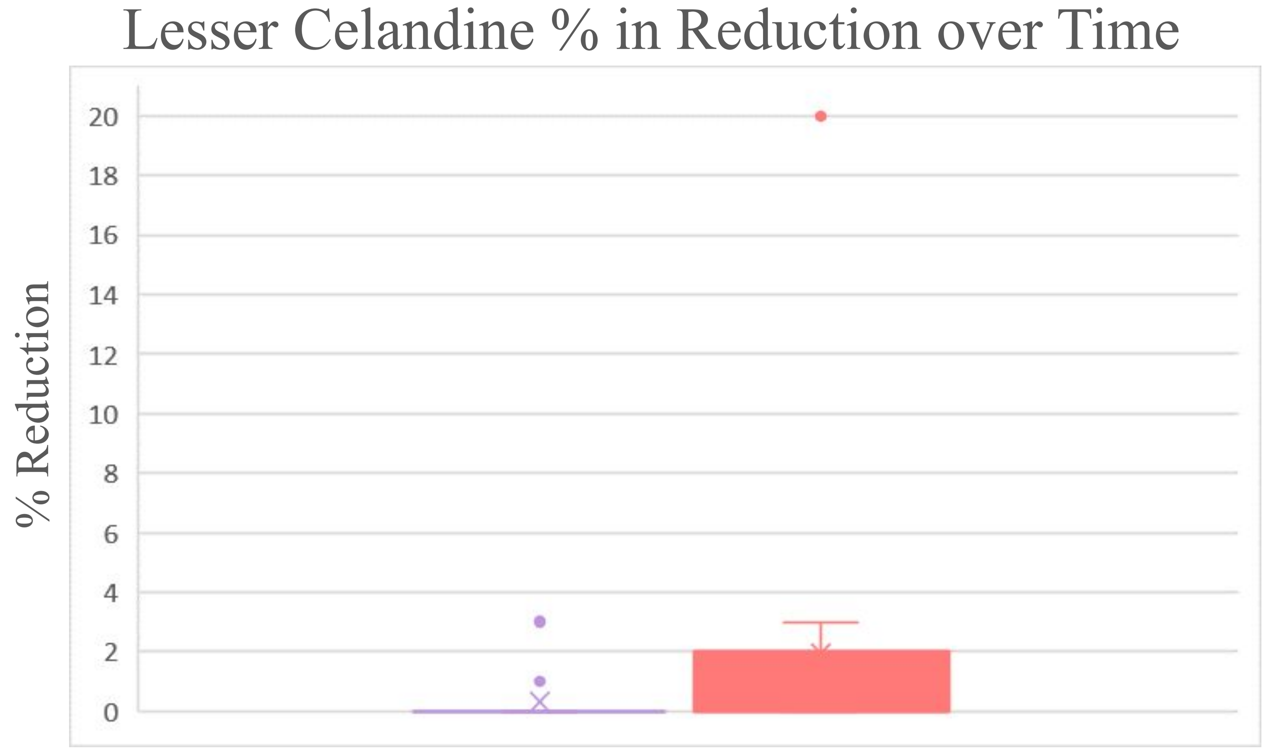
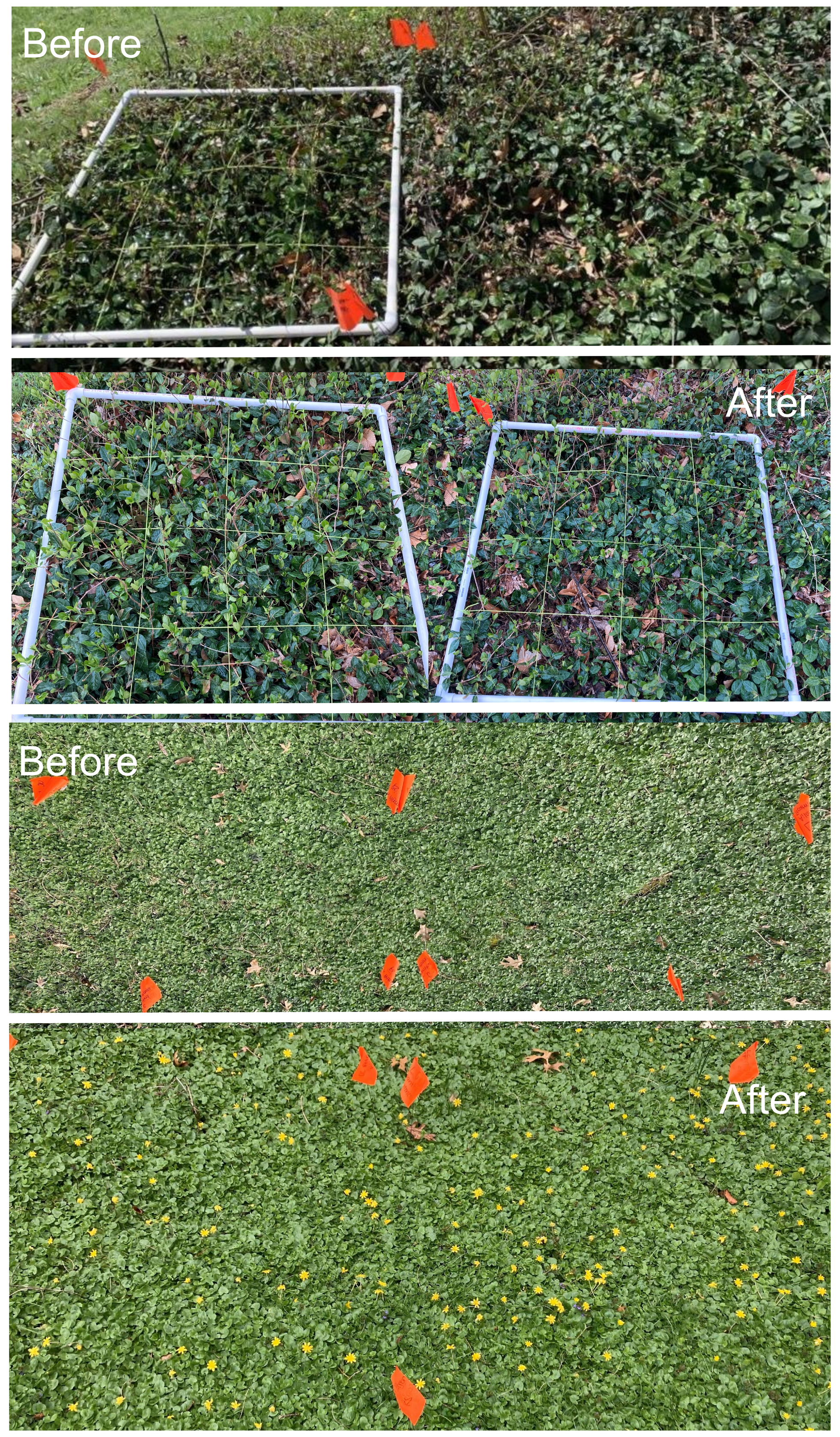


Figure 2
T-test comparing percent in reduction of coverage over time in control and Ailanthus treatments of *Ficaria verna*. No significant difference in percent coverage between groups.
t: -1.28
df: 30
Probability: 0.20

Control Ailanthus



Winter Creeper (*Euonymus fortunei*)

Lesser Celandine (*Ficaria verna*)

Control (42 cm) Ailanthus (26.5 cm)

Conclusion

Our data analysis displayed no significant difference in the percent cover of Lesser Celandine (*Ficaria verna)* or Wintercreeper (*Euonymus fortunei*) after the *Ailanthus* extract application. Despite this, there was an observation made about the height difference between the *Ailanthus* and control tests of *Euonymus fortunei*. The control group showed new vertical growth with taller light green stalks, while the *Ailanthus* group did not display this same kind of growth and remained approximately the same height as it did pre-treatment. One potential explanation for these results could be that the current concentration of 1g to 20 mL does not have enough allelopathic chemicals in the solution to have an effect on already developed plants; although there is an observed effect on the new growth when treated with *Ailanthus* extract. We propose a follow up experiment utilizing a higher concentration of *Ailanthus* to water, as well as a modified version of this experiment that more closely analyzes the various dimensions of growth such as vertical compared to horizontal.

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