Influence of Light Intensity and Light Duration on Plant Growth

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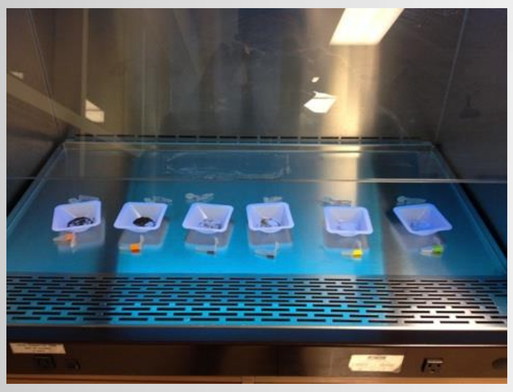
Hypothesis

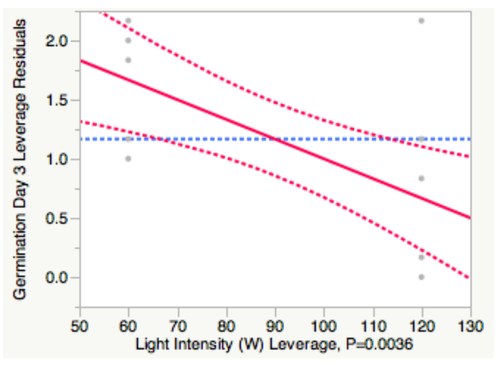
Stronger light intensity and longer light duration will arrest plant growth.

Introduction

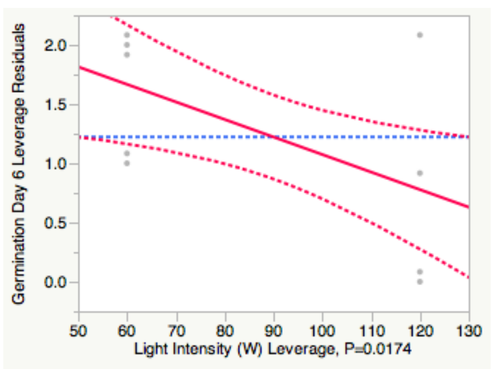
There is growing interest in understanding the growth of non-invasive and invasive plants in New England such as garlic mustard (*Alliaria petiolata*), hairy bittercress (*Cardamine hirsuta*), shepherd's purse (*Capsella bursa-pastoris)*, and *Arabidopsis thaliana.* Light intensity and light duration are some of the factors that can affect plant growth. Light intensity refers to the quantity of light and light duration refers to the amount of time that a plant is exposed to light.



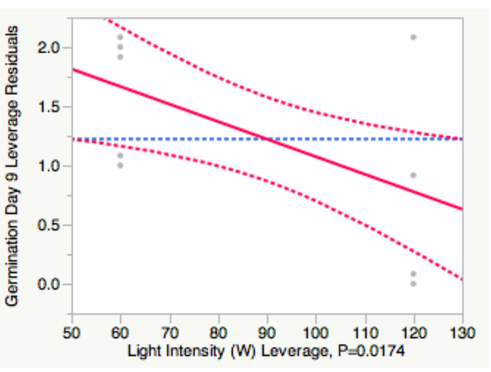
Germination Day 3 in *A.thaliana*



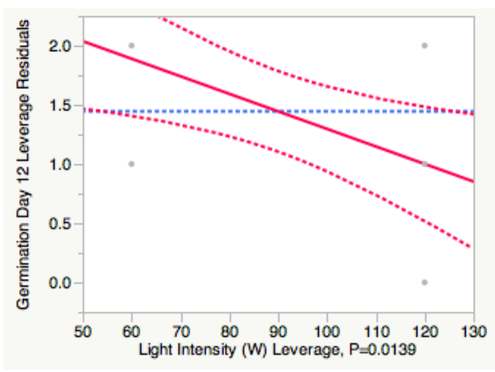
Germination Day 6 in *A.thaliana*



Germination Day 9 in *A.thaliana*



Germination Day 12 in *A.thaliana*



Aim

The objective of this research was to test the impact of light intensity and light duration on the plant growth of *Alliaria petiolata*, *Cardamine hirsuta*, *Capsella bursa-pastoris*, and *Arabidopsis thaliana*.

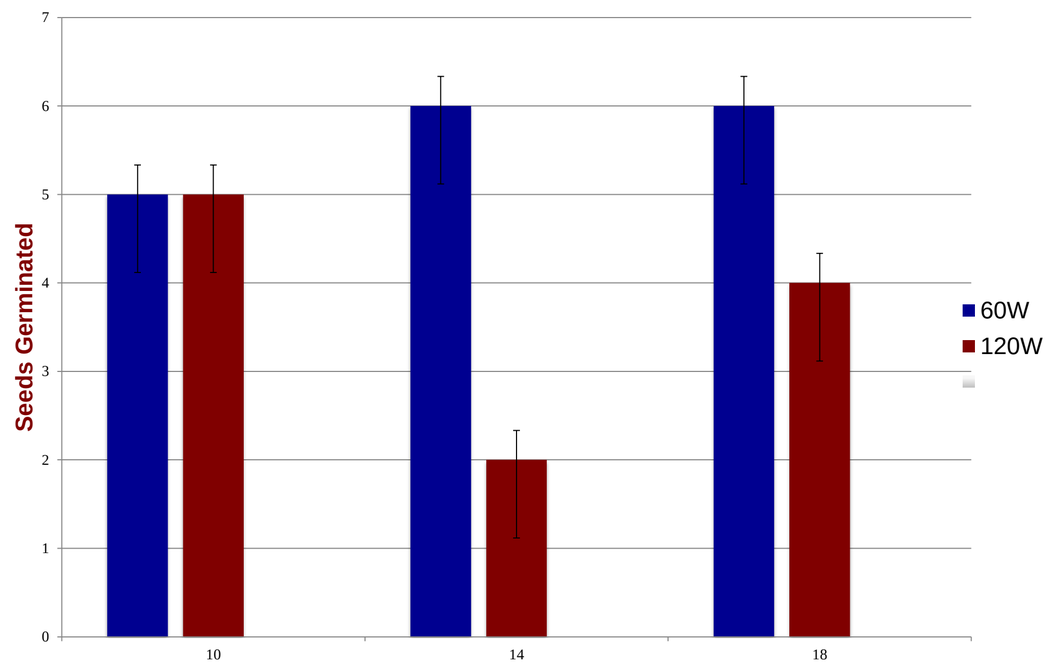
Methods

Four species of plant seeds were obtained: *Alliaria petiolata*, *Cardamine hirsuta*, *Capsella bursa-pastoris, and Arabidopsis thaliana* ecotype Columbia. Two seeds from each of the four plant species were placed in eighteen Petri dishes within their respective quadrants. The Petri dishes contained Murashige and Skoog medium (MSO) and Bacto Agar. The Petri dishes were divided into groups of 3 (6 groups in total). The 6 groups were further sub-divided into 3 groups with different light conditions. The first group contained a group with 10-hour days and 60W, and a group with 10-hours days and 120W. The second group contained a group with 14-hour days and 60W, and a group with 14-hour days and 120W. The third group contained a group with 18-hour days and 60W, and a group with 18-hour days and 120W. A curtain was placed in between all 6 groups to prevent the entry of light from neighboring groups. Germination was tested for an experimental period of 12 days.

Results

At 26 C, *C. hirsuta*, *C. bursa-pastoris, and A. thaliana* germinated by day 3, while *A. petiolata* did not germinate within the experimental period. At 26 C, under both light conditions, *C. hirsuta*, *C. bursa-pastoris, and A. thaliana* germinated. Statistical analysis was performed on JMP to test the hypothesis, and to determine whether or not light intensity and light duration are statistically significant. Only *A. thaliana* had statistically significant data. The P-value in the analysis of germination day 3 by light intensity was 0.0036, the P-value in the analysis of germination day 6 and day 9 by light intensity was 0.0174, and the P-value in the analysis of germination day 12 by light intensity was 0.0139. This indicates that there is a statistically significant relationship between germination and light intensity.

Germination Day 12 in *Arabidopsis thaliana*



Conclusion

By germination day 12, more *A. thaliana* had germinated under 60W and less had germinated under 120W. However, more *A. thaliana* germinated with longer light duration. It is possible that *A. thaliana* is not adapted to higher intensities of light, or that *A. thaliana* is not adapted to higher temperatures caused by higher intensities of light. Additionally, the ability of *A. thaliana* to grow in the conditions set by this study is an indication of its level of invasiveness. The verity that *A. thaliana* was able to grow with longer light duration could make these implications more plausible. These results also show that *A. thaliana* may be more invasive than the other species studied since their growth was mostly inhibited. We reject our hypothesis because even though stronger light intensity arrested growth in *A. thaliana*, longer light duration led to more germination.

Acknowledgements

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