Latex Induction and Effects of Herbivory on *Apocynum cannabinum*

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Introduction

Apocynum cannabinum, also known as hemp dogbane, is a species of perennial native to the U.S. This species has been found to be extremely plastic, meaning that its environment has significant effects on its phenotypic traits (Ransom et al. 1998). Plant-herbivore interactions, such as herbivory, can drive this plasticity. One of these responses includes the induction of Latex, a white sappy fluid that exits leaves and stems induced by damage (Agrawal and Konno 2009). Latex contains Cardenolides which, when ingested, inhibits an herbivores Na+/K+-ATPase, an essential enzyme responsible for maintaining cell volume, membrane potentials, and secondary active transport to vital organs (Jorgensen et al. 2003).

- **Question**: What are the effects of early-season herbivory vs. late-season herbivory on dogbane, and how do herbivory treatments affect latex production?
- **Hypotheses**: **1)** Herbivory treatments will increase latex production post-application and **2)** Plants in early treatments will either have increased or decreased rates of
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Materials and methods

- (5) Treatment groups: Early Jasmonic Acid (JA), early clip, late JA, late clip, and a control with 35 plants per treatment
- 0.5 mM jasmonate: sprayed 3-5 times and Clip: 50%
- Latex was collected before treatments and after treatments using filter paper. Differences in weight were recorded.
- Herbivory damage and fitness traits were measured before early treatments and one week post late-season treatments.

Plants with increased early-season herbivory experienced higher amounts of late-season herbivory.

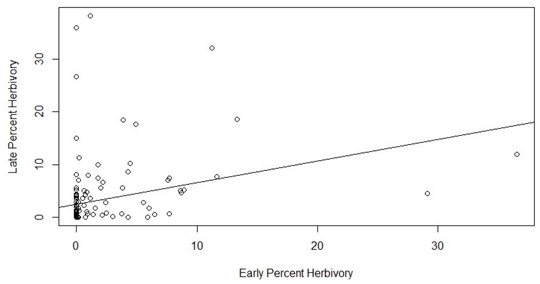

Figure 1. Plot showing herbivory recorded on plants pre-treatment (early) and one-week post-treatment (late). Positive correlation between early and late percent herbivory.

Type of treatment did not have a significant effect on herbivory.

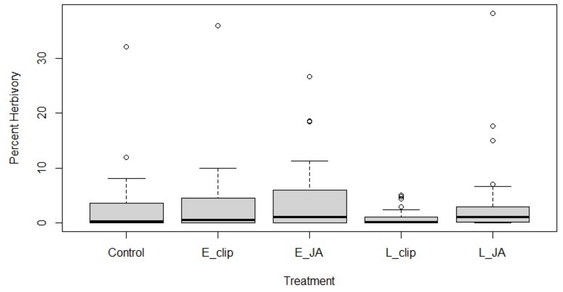

Figure 2. Boxplot showing amount of herbivory by percent one-week post-treatment, based on treatment group applied. Treatment had no effect on final herbivory (ANOVA, n=139, $p > 0.05$).

There is significant loss of latex production in plants within the late-clip treatment group.

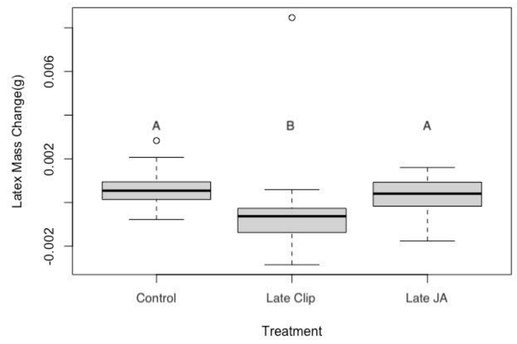

Figure 3. Latex mass change (g) in response to the late treatments: "Late clip" and "Late JA." Letters indicate significance. (ANOVA, Late clip: $P > 0.05$, n= 29 Late JA: $P < 0.05$, n= 34 Control: $P < 0.05$, n= 29)

Discussion

- Cutting of 50% of plant leaves in Late Clip treatment prevented overcompensation of latex production.
- The treatments overall were not significant in inducing latex (fig. 3), possibly due to an error in the jasmonate solution concentration.
- Jasmonate is also involved in the defense pathway of dogbane, possibly upregulating cardenolide defense compounds which would deter herbivores (Isah 2019).
- Clipping also was not significant on herbivory (fig. 2), possibly due to the process of clipping not replicating herbivory processes naturally.

Conclusions

Understanding the way plants interact with other species is important to give insight into how changes to an environment can affect an ecosystem. Hemp dogbane is also an agricultural weed, so this work could be useful in better understanding the species in order to mitigate agricultural effects (Pedigo et al. 1986).

Future research and testing on what the ideal concentration of jasmonate is to ensure an inductive response as seen in Thaler et al. 1996 is needed. Using a different physical defense method by cutting fewer plant leaves or less than 50% of each might alleviate loss of latex production in future studies. This may result in an over compensatory induction of latex, or the plant may not induce latex due to scissors not replicating herbivore chewing or the salivary chemicals that are
herbivory.

Future research questions:

1. How might climate change impact these plant-herbivore interactions?
2. How do changes in water availability affect latex production after herbivory?
3. How do specialist herbivores affect latex production compared to generalists?

Literature cited

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Acknowledgments

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