Insect Predator-Prey Interactions in Hemp (IMPRINT-Hemp)

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INTRODUCTION

- Hemp production is a fast-growing industry.
- The value of the US industry totaled $824 million in 2021 (Nseir 2022).
- Because industrial production of hemp was only recently legalized in many places, not much is known regarding how to manage both the crop and its pests most effectively (Britt et al. 2020).
- Hemp serves as a host for several caterpillar pests, including Eurasian hemp borer, corn earworm, and several species of armyworms, including the beet armyworm (*Spodoptera exigua*), which feed on the leaves typically, but can feed on the buds and seeds when the plant is well-infested with larvae (Colorado State University). There are limited insecticides registered for use on hemp; however, natural enemies of these pests, including parasitoids, minute pirate bugs, and predatory stinkbugs have been observed on hemp and could provide pest suppression (Serber et al. 2021).
- To gain understanding of predator-prey interactions involving this insect on hemp, we exposed beet armyworm (BAW) eggs to predation treatments on the top and bottom of hemp plants for 48 hours.
- **This study takes a general look at insect predator-prey interactions in hemp and serves to provide some understanding of baseline insect activity in the crop.**

METHODS

- We counted out 100 BAW eggs using a dissecting scope and cut the material holding the eggs accordingly to fit all 100 on a single piece. The material containing the eggs was then stapled to a similarly sized piece of cardstock.
- We used 10 hemp plants (variety: Early Remedy) at Meigs Agricultural Research Center in Lafayette, IN. We set up the experiment on 10/3/22, took it down on 10/5/22, and examined the eggs on 10/7/22.
- **We used two experimental treatments: placing the egg masses at the top of the plant versus the bottom of the plant and covering the egg masses with either an intact mesh bag or a cut-open mesh bag.**
- On each plant, we placed 4 egg groups using clothes pins (Photo 1): 2 near the top of the plant, 2 near the bottom. Each group was covered with a mesh bag, either intact or cut open to allow access for natural enemies. For the 2 groups near the top of the plant, 1 was covered with an intact bag and the other was covered with an accessible bag. The same was done for the 2 groups near the bottom (Photo 2).
- 48 hours after set-up, we returned to collect the egg groups and inspect them. In the lab, we counted the number of individual eggs that were visibly damaged or broken for each treatment on each plant.
- Each plant served as 1 experimental unit, and we had 10 replicates. The key variables in this study were intact vs. accessible mesh bags, and top vs. bottom of the plant. We compared the mean number of damaged eggs in each treatment and used ANOVA to analyze the data. Statistical analysis was done in SAS.

Photo 1. Egg group set-up (intact mesh bag).

Photo 2. Treatment group distribution on 1 plant.

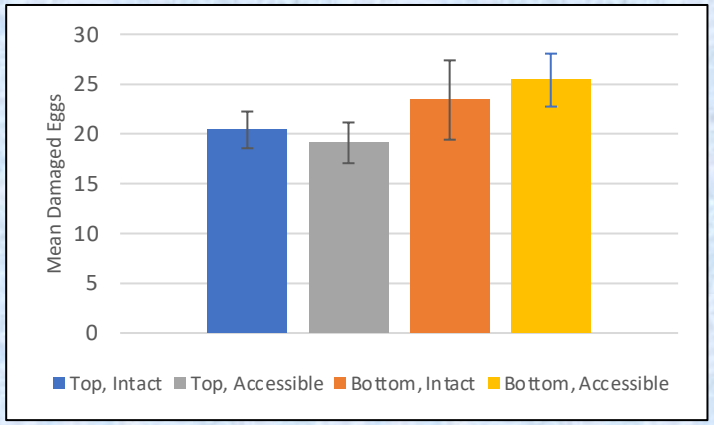

Figure 1. Mean number of damaged eggs in each treatment group. Bars represent standard error values.

Table 1. The sample size and mean number of damaged beet armyworm egg masses placed on the top and bottom of CBD hemp plants in closed or open mesh cages.

	Top of Plant		Bottom of Plant	
Intact Bag	N	10	N	10
	Mean	20.4000	Mean	23.4000
	Std Error	1.8451	Std Error	3.9838
Accessible Bag	N	10	N	10
	Mean	19.1000	Mean	25.4000
	Std Error	2.0464	Std Error	2.6591

RESULTS & DISCUSSION

- **There were no significant differences in egg predation between treatments** (Figure 1). We found that the mean number of damaged eggs was no different between the top or bottom of hemp plants ($F_{1,37}$ = 2.88, P = 0.10), or between intact or open mesh bags ($F_{1,37}$ = 0.02, P = 0.90). At the top of plants, we found an average of 20.4 damaged eggs in intact mesh bags versus 19.1 damaged eggs in open mesh bags. At the bottom of plants, we found an average of 23.4 damaged eggs in intact mesh bags versus 25.4 damaged eggs in open mesh bags.
- In the field, we observed natural enemies which could have contributed to the egg predation we observed. We found live minute pirate bugs and brown predatory stink bugs, as well as "liquefied" caterpillars that appeared to be infected with a virus.
- This study serves as a steppingstone on the path to better understanding predator-prey interactions on hemp. It was difficult to tell how the eggs were damaged; whether it was predation by another insect, the egg hatching, or the egg growing old and dying, the type of damage was difficult to discern. In future studies, more focus should be placed on observing predators consuming the eggs.
- **If we can identify which predators are eating the eggs, we can better predict when and how natural enemies may be of use during a growing season. This could influence the use of other pest management techniques and allow for the optimization of industrial hemp production.**

REFERENCES

Britt, K., Fike, J., Flessner, M., Johnson, C., Kuhar, T., McCoy, T., Reed, D., Virginia Tech, & Virginia State University. (n.d.). Integrated Pest Management of Hemp in Virginia. *Virginia Cooperative Extension*, 1.
Colorado State University. (n.d.). *Beet Armyworm*. Insects That Feed on Hemp - Leaf Chewers. Retrieved April 24, 2023.
Nseir, A., USDA, & Agriculture Counts. (2022, February 17). *Value of hemp production totaled $824 million in 2021.*National Agricultural Statistics Service - News Release. Retrieved April 24, 2023.
Serber, Z., & Long, E. Y. (2021, December). *Management Strategies For Common Arthropod Pests of Greenhouse Hemp In Indiana*. Purdue University Extension - Entomology. Retrieved April 24.