



The Affect of Host Plant on Aphid Population Growth

Elyse Dostal, Laramy Enders¹, and C. Michael Smith¹

¹Department of Entomology, College of Agriculture, Kansas State University



Abstract

Damage from aphids to wheat plants is noticeable from a distance and can result in water stress, reduced plant growth and wilting. Different aphids are said to cause different colorations when damaging the plants. The comparison of aphid performance on a set of closely related species can help identify traits related to plant defense and aphid performance. Such studies can help inform future experiments that study specific mechanisms of plant resistance. Its important to know what causes aphids to damage some plants more than others so we can find ways to prevent it.

I observed the effects that wheat, barley and sorghum have on the population growth rate of corn leaf aphids and green bugs. Also, the effect the aphids have on the plants and how much they damage each type. Will one aphid species have an exceptionally higher rate of reproduction on a specific plant? Is aphid population growth affected by competition between species?

I found the green bug population grew faster than the corn leaf aphids and they preferred the wheat, which in return resulted in the wheat having the highest plant damage.

Purpose

The purpose of this research was to gain a better understanding of how different aphids species interact when combined on the same plant and to see whether different plants types effect the growth and reproduction of the aphids. I also characterized the location on the plants that the aphids tend to gravitate to when feeding. Finally, I compared how different plants respond to the growing populations of the aphids by measuring how much damage the aphids caused.

Questions, Hypotheses, and Predictions

Question: Will one aphid species have an exceptionally higher rate of reproduction on a specific plant? Is aphid population growth affected by competition between species?

Hypothesis: The aphids will reproduce at normal rates on each different plant but different plants will have different plant damages and over time wont be able to continue to feed to aphids.

Prediction: The green bugs will have a greater population on the treatment group that includes both the green bugs and corn leaf aphids.



Green bugs (Schizaphis graminum)



Corn leaf aphids (Rhopalosiphum maidis)

Study System

Aphids are soft-bodied, slow-moving insects, often with a fat abdomen; they cluster on the new growth of many plants, sucking fluids from tender shoots and causing wilting or distortion. Aphid infestations often seem to develop overnight, but they rarely last longer than a few weeks.

Methods and Experimental Design

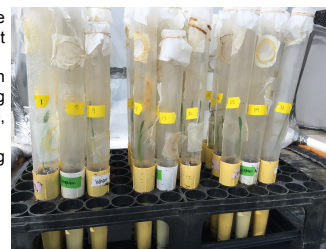
Set Up

- I planted 36 plants total; 12 sorghum, 12 barley and 12 wheat.
- I separated the plants into 3 different groups of 12. Each treatment group included 4 sorghum, 4 barley and 4 wheat plants.
- Plants were grown in a greenhouse for 2 weeks before being infested with aphids.
- I put 8 adult corn leaf aphids on each plant in the first group.
- I put 8 adult green bugs on each plant in the second group.
- I put 4 adult green bugs and 4 corn leaf aphids on each plant in the third group.
- Plants were covered with custom built plastic cages to prevent aphids escaping.

Collecting and Analyzing Data

- Over a period of two weeks I counted the number of adults and nymphs on each plant four different days.
- I also measured the placement of leaves on each plant by dividing it into thirds and counting how many aphids were on each section; top, middle and bottom.
- I also measured the plant damage by giving each plant a number from the following scale:

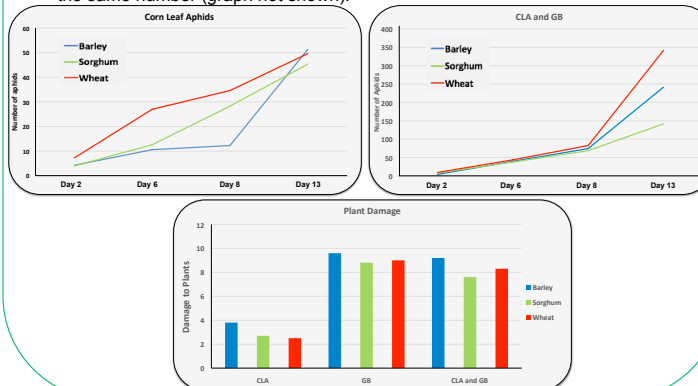
- | | |
|--------|-----------------|
| 1: 10% | 6: 60% |
| 2: 20% | 7: 70% |
| 3: 30% | 8: 80% |
| 4: 40% | 9: 90% |
| 5: 50% | 10: 100% (dead) |



Experimental Set Up: Each plant type (wheat, barley, sorghum) was infested with 8 aphids

Results

- Populations that grew dramatically more than the others had both green bugs and corn leaf aphids.
- Green bug populations grew faster than corn leaf aphids, but both species reached similar population sizes on all plant types.
- The most plant damage occurred on the wheat infested with green bugs.
- Aphids were dispersed across the whole plant, but the majority stayed on the bottom half.
- Green bugs grew at about the same rate on each plant and ended with roughly the same number (graph not shown).



Conclusions

- Green bugs reproduce at a much faster rate than the corn leaf aphids do; especially on the wheat plant.
- Due to their high number green bugs cause much more damage to the plant they are feasting on.
- When corn leaf aphids and green bugs cohabitated the green bugs still reproduce and grow much faster than the corn leaf aphids.
- This data tells me that with both species, especially green bugs, plants are in danger to be killed off because of the rapid growth of aphids and their feeding manners.
- Judging from the growth rates on each plant type wheat is in the most danger, followed by barley and then sorghum.

- This is important in science because it can help scientists come up with chemicals or pesticides to help keep aphids off plants to prevent damaging the plant.
- It can also help scientists figure out a way to make plants resistant to aphids so the aphids can still feed on the plants without killing the plants.

Future Directions

- I could continue this research by next evaluating plants at later growth stages to gather a bit more information on how the aphids effect larger/older plants.
- I could then explore the chemical composition of the aphid species and figure out what causes them to reproduce more efficiently on one plant type versus the other.
- I could also explore the chemical composition of the plants and find out why some plants can survive better/ longer than the others with hundreds of aphids living on them.
- I would use the same amount of controls because I found it was a good number; not too overwhelming but enough to get a good variety of data to calculate a solid average.

References

- Group, Lifestyle. "Aphids." *Sunset*. MyRecipes Network, Mar. 2016. Web. 09 Nov. 2016.
- Jaouannet, Maëlle, Patricia A. Rodriguez, and Peter Thorpe. "Plant Immunity in Plant-aphid Interactions." *Frontiers in Plant Science*. Frontiers Media S.A., Dec. 2014. Web. 09 Nov. 2016.
- Michaud, J.P., and Phillip E. Sloderbeck. "Russian Wheat Aphid." (n.d.): n. pag. *Kansas State University*. Http://www.oznet.ksu.edu, May 2005. Web. 17 Oct. 2016.
- Züst, Tobias, and Anurag A. Agrawal. "Mechanisms and Evolution of Plant Resistance to Aphids." *Nature Plants*. Macmillan Publishers, 6 Jan. 2016. Web. 10 Oct. 2016.

Acknowledgements

I am grateful for the opportunity given to me by Jeremy Marshall and Mike Smith. Also for the help and direction from Laramy Enders.