

# Corn Leaf Aphids Do Not Benefit from Greenbug Feeding and Plant Damage

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## Abstract

Greenbugs (*Schizaphis graminum*) are known for their devastating effects on crops including cereal grains. Their saliva contains toxins, which break down the plants defenses and allow the aphids to utilize nitrogen from the plant. This quality makes the greenbug more destructive than other species including the corn leaf aphid (*Rhopalosiphum maidis*). To observe whether aphid feeding influences the success of other aphid species that later feed on the same plant, we designed an experiment which measured aphid virulence and plant damage. We found that the presence of aphids generally stunts plant growth, combined damage of two aphid species is greater than a single species, and damage done by greenbugs does not necessarily benefit corn leaf aphids.

## Purpose

To determine whether the toxic saliva of greenbugs breaks down plant defenses to benefit other aphid species.

## Hypothesis and Predictions

**Hypothesis:** Damage caused by greenbugs to their host plant benefit other aphid species in a mutualistic relationship.

**Predictions:** Corn leaf aphids will reproduce at a higher rate and cause more damage while feeding on plants already damaged by greenbugs or other corn leaf aphids.

## Study System

Greenbugs (*S. graminum*) are small, lime-green or yellow aphids that have a dark green line down the middle of the back and long antennae.<sup>1</sup> While feeding, greenbugs inject saliva that is toxic to cereal grains including sorghum, wheat, and barley.<sup>2</sup> Found in most parts of North America and worldwide.<sup>4</sup>

Corn Leaf Aphids (*R. maidis*) vary from blue-green to gray, are soft-bodied and pear-shaped. They expel droplets of sticky honeydew through dark cornicles on their rear end. Corn leaf aphids feed on corn, sorghum, barley and other grasses. They have been found worldwide.<sup>3</sup>

Corn Leaf Aphid

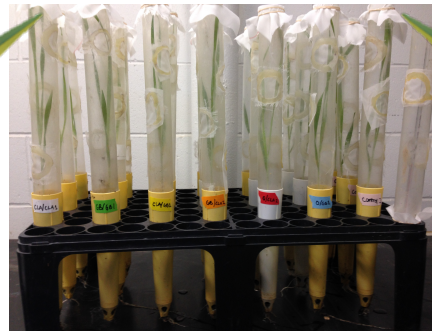


Greenbug

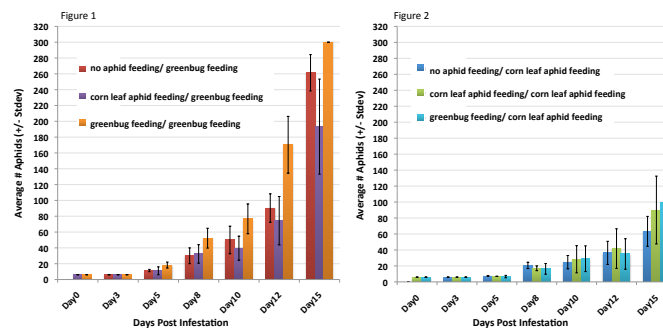


## Methods and Experimental Design

To test the relationship between these two aphid species and their host plant, we designed an experiment with six experimental groups (3 replicates each) and a control which was not infested with aphids. A susceptible strain of barley (Otis) was chosen because neither species was previously reared on barley and would have an equal advantage for feeding. Barley plants were grown in a greenhouse for ~2 weeks and then 4 treatment groups were infested with six aphids. Aphids were housed on a single barley plant under a cage to avoid cross contamination of aphids. After the initial infestation, we allowed the aphids to reproduce for 48hrs then removed them and infested the same plant with either six of the same aphid species or six of the opposite species. Two treatments were included where no aphids fed for the initial 48hrs. Aphid numbers were measured every 48-60hrs for 15 days. Plant damage was rated on a scale of 1-5 and the initial and final plant heights were measured as well. We chose to infest each plant with six aphids to avoid overpopulation of each plant and for ease of counting.



## Results



## Conclusions

- Greenbug feeding and plant damage does not benefit corn leaf aphids (Fig. 2)
- Corn leaf aphid feeding and plant damage impose a negative impact on greenbug populations (Fig. 1)
- Aphid feeding stunts plant growth (data not shown)
- Combined feeding of multiple aphid species stunts plant growth more than a single species (data not shown)

In conclusion, our data did not prove our hypothesis but instead gave us an insight as to how the corn leaf aphid affects other aphid species. Possible explanations for this result could be the excessive amounts of honeydew produced by corn leaf aphids inhibiting greenbug success, or corn leaf aphid plant damage may be more internal compared to the greenbug's obvious damage.

## Future Directions

If we were to continue this experiment, it would be interesting to determine if the corn leaf aphid's honeydew is a reason for the declined rate of greenbug reproduction on plants previously fed on by corn leaf aphids. A possible experiment could include observing greenbug populations and damage to a plant post corn leaf aphid feeding. The design could be very similar to the one we performed, simply focus on the CLA/GB treatment.

Another possible experiment might be to test the spread of greenbug toxins in the host plant. Is this a localized effect or does it spread throughout the plant? This could be tested by only allowing greenbugs to feed on a certain part of the plant (i.e. one leaf) then allow corn leaf aphids to feed on the entire plant and record populations as well as preferred feeding areas

## References

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- \* Aphid illustrations by Justin Spurlin

## Acknowledgements

Thank you to Dr. Laramy Enders and Dr. Michael Smith for their guidance and support throughout this valuable experience. Thank you to the Kansas State Entomology Department for funding this experiment and the opportunity to grow as a scientist. Thank you to Benjamin Goller for the fantastic aphid photographs