4-2020

Sorghum Tolerance of Phloem-Feeding Aphids

Earl Agpawa
University of Nebraska - Lincoln, eagpawa@huskers.unl.edu

Sajjan Grover
University of Nebraska - Lincoln, sajjan.grover@huskers.unl.edu

Joe Louis
University of Nebraska - Lincoln, joelouis@unl.edu

Sorghum tolerance to phloem-feeding aphids

Earl Agpawa[1], Sajjan Grover[1], and Joe Louis[1,2]

[1]Department of Entomology and [2]Department of Biochemistry, University of Nebraska-Lincoln, Lincoln, NE

INTRODUCTION

- Aphids are phloem sap-feeding insects that negatively affects plant productivity and have short generation times. This can lead to rapid creation of new biotypes that are capable of resisting pesticides and other plant based defenses.[1]
- Tolerance traits reduce the negative effects of herbivory on plant fitness after herbivory has occurred, all the while maintaining insect populations similar to those seen on susceptible plants.[2]
- In this study, we utilized the natural variation in a panel of sorghum inbred lines to explore novel sources of sorghum tolerance to the sugarcane aphid (SCA), *Melanaphis sacchari* (Zehtner).

Fig. 1. Sugarcane aphids feeding on a sorghum plant.

PURPOSE

- Characterize sorghum tolerance to sugarcane aphids in the founder lines of the sorghum nested association mapping (NAM) population.

METHODS

- **Plants and aphids:** Sorghum plants were grown at the University of Nebraska-Lincoln greenhouse and aphids were infested during 3-leaf stage. SCA were raised in growth chamber in a 12-hour day-night cycle at 26°C.
- **Tolerance setup:** 10 wingless adult aphids were placed on each sorghum plants, and aphids were counted after 14 days.
- **Damage ratings:** Damage ratings were given to each infested plant on the 14th day ranging from 1 to 5, where 1 is the least damage and 5 is the most damage.
- **Chlorophyll loss index:** On the 14th day, chlorophyll loss was recorded with a spad meter.
- **Biomass collection:** On the 14th day after all other parameters were collected, root and leaf biomass were collected by cutting the plant at the stem and washing the roots. Roots and leaves were then dried in a drying oven.

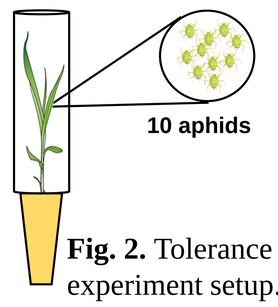
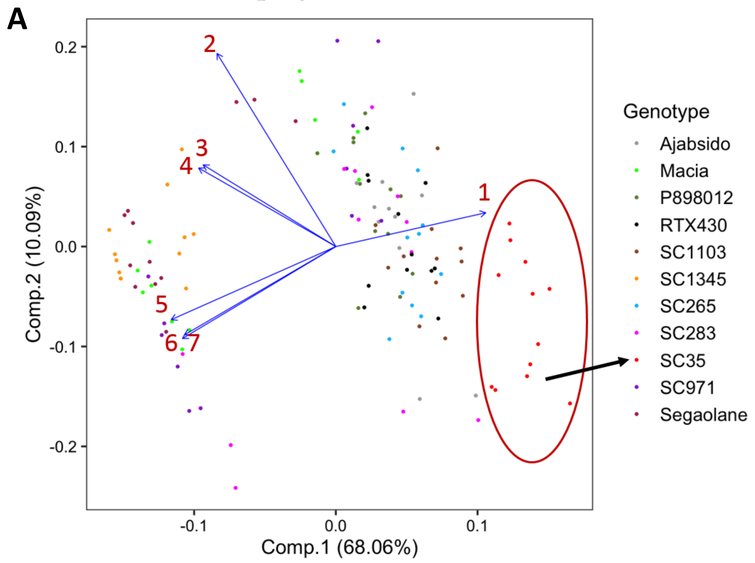


Fig. 2. Tolerance experiment setup.

RESULTS

SC35 displayed tolerance characteristics



Variables included:
1. Aphid count 2. Root biomass loss 3. Damage rating 4. Leaf biomass loss 5. Chlorophyll loss index 6. Leaf count loss 7. Height loss

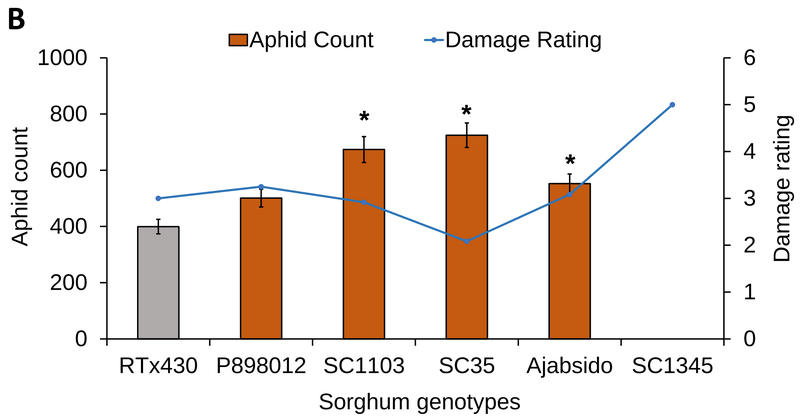


Fig. 3. (A) Principal Component Analysis (PCA) of tolerance characteristics on different sorghum NAM lines. SC35 plant clustered farthest from other sorghum NAM lines, suggesting that SC35 displays tolerance characteristics**. (B)** Aphid count and damage ratings on 14th day after SCA feeding. Error bars represent ± SE. N = 12. Asterisks above error bars represent significant difference from RTx430.

SC35 shown a low chlorophyll loss index

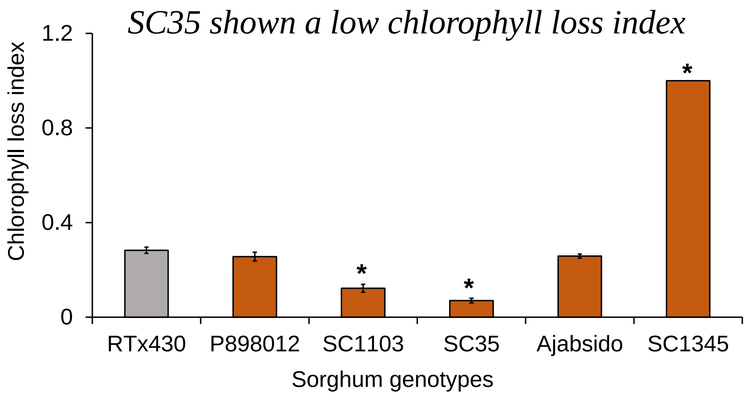


Fig. 4. Chlorophyll loss index on different sorghum genotypes after 14 days of SCA feeding. Error bars represent ± SE. N = 12. Asterisks above error bars represent significant difference from RTx430.

SC35 showed reduced leaf and root biomass loss against SCA

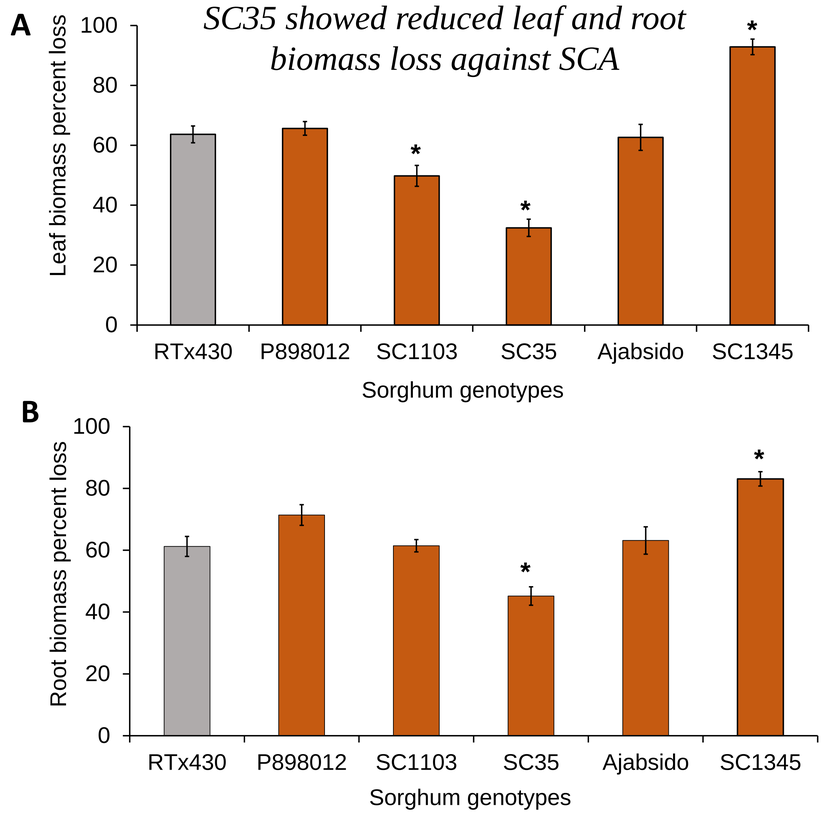


Fig. 5. (A) Leaf and **(B)** root biomass percent loss on different sorghum genotypes after 14 days of SCA feeding. Error bars represent ± SE. Asterisks above error bars represent significant difference from RTx430.

CONCLUSIONS

- SC35 have shown tolerance characteristics after 14 days feeding of SCA, while sustaining a high number of aphids and retaining relatively low damage levels **(Fig. 3)**.
- SC35 has significantly lower chlorophyll loss index than RTx430 **(Fig. 4)** and reduced leaf and root biomass loss compared to RTx430 **(Fig. 5)**.

SIGNIFICANCE

- Plant tolerance to insect herbivory is a compelling category of resistance, consistent with integrated pest management strategies.

ACKNOWLEDGEMENTS

I would like to thank UCARE and IANR of the University of Nebraska-Lincoln for funding my research.

REFERENCES

[1] Harvey TL, Hackerott LH. 1969. Recognition of a greenbug biotype injurious to sorghum. Journal of Economic Entomology. 62(4): 776-779.
[2] Koch KG, Chapman K, Louis J, Heng-Moss T, Sarath G. 2016. Plant tolerance: a unique approach to control hemipteran pests. Frontiers in Plant Science. 7: 1363.