Exploring the Potential of Brown MidRib (BMR) Sorghum in Managing of Sorghum Aphid

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Introduction

•Sorghum is a vital crop known for its resilience and versatility in food and feed. However, its productivity is threatened by insect pests like the sorghum aphid (*Melanaphis sorghi*).

- Sorghum plants have evolved direct and indirect defense strategies against pests (wax production, Volatile Organic Compounds (VOCs). This research project focuses on Brown MidRib (BMR), a recessive plant gene.
- Plants that express BMR have lower amounts of lignin, making it a more digestible crop for ruminants; however, the effect of BMR in insect pest management is not understood.

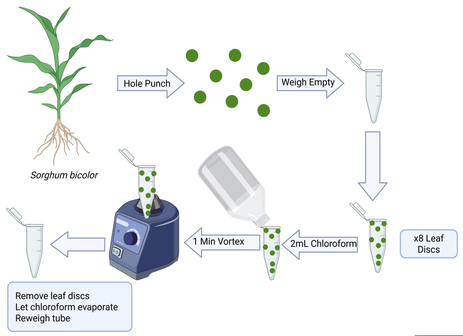
•To bridge this knowledge gap, we will investigate whether the presence of BMR leads to changes in both plant defenses (wax, VOCs) and plant growth (biomass, root traits, physiology) and the subsequent effect of these differences on sorghum aphid based on its ability to establish and reproduce.

Methodology

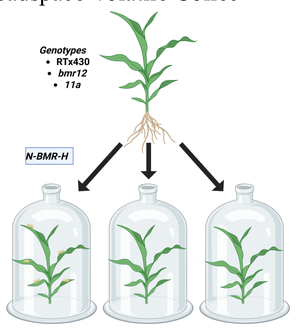
Genotypes Used:

- RTx430 – Control genotype, conventionally used
- *bmr12* – *bmr* mutant, reduced lignin content
- 11a – *bmr* overexpressed, increased lignin content

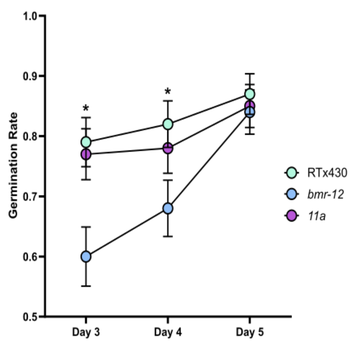
Wax Extraction



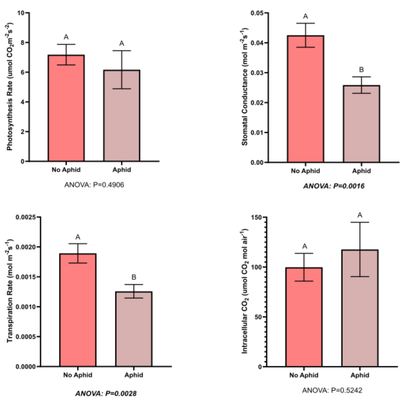
Headspace Volatile Collec



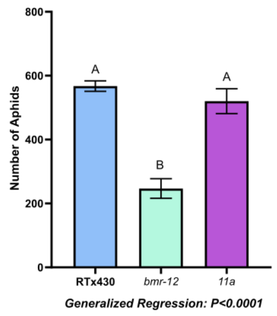
Germination



Physiology

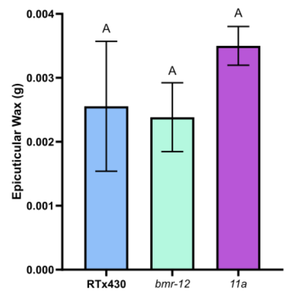


Aphid Count



Picture Credit: Rupesh Kariyat

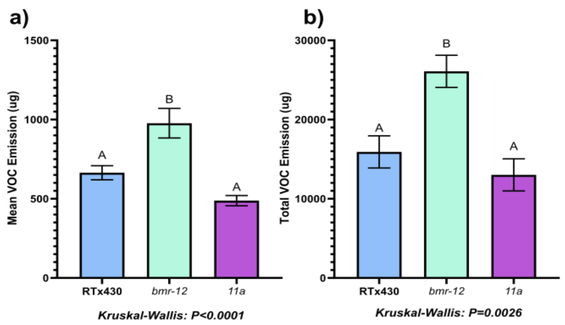
Epicuticular Wax Content

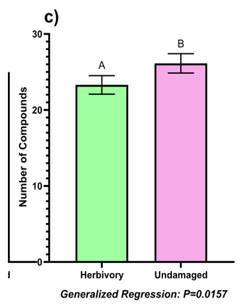


Kruskal-Wallis: P=0.5046

Picture Credit: Rupesh Kariyat

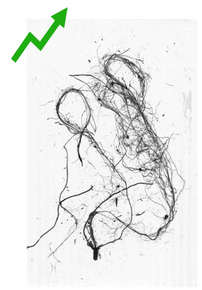
Volatile Organic Compound Emission





Picture Credit: Rupesh Kariyat

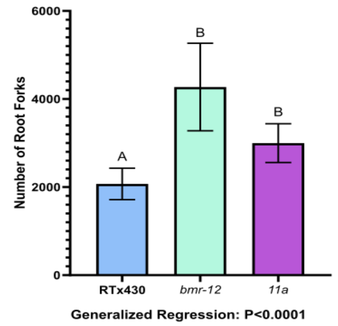
Root Comparison



bmr-12 Root

RTx430 Root

Root Morphology



Results

- *bmr12* has lower initial germination but catches up after 3 days.
- 10 days after aphid feeding, transpiration and stomatal conductance were significantly reduced.
- *bmr12* has significantly lower aphid colonization.
- There is no difference in epicuticular wax between genotypes.
- *bmr12* emitted significantly more VOCs than other genotypes, and undamaged plants had more diverse compounds than damaged plants.
- *bmr12* has significantly more root forks and complex root structures.

Implications

- *bmr12* delays germination and may have less access to resources.
- 10 days of aphid damage are interfering with plant physiological processes.
- *bmr12* is better adapted to mitigating sorghum aphid attacks
  - (50% reduction in aphid colonization)
- *bmr12* has greater indirect defenses via VOCs and aphids are potentially suppressing compound emission.
- *bmr12*'s increased fork number indicates higher water use efficiency.

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