A mutation in the ABA biosynthesis gene in tomato causes changes in viral RNA accumulation and viral vector behaviour during PVY infection

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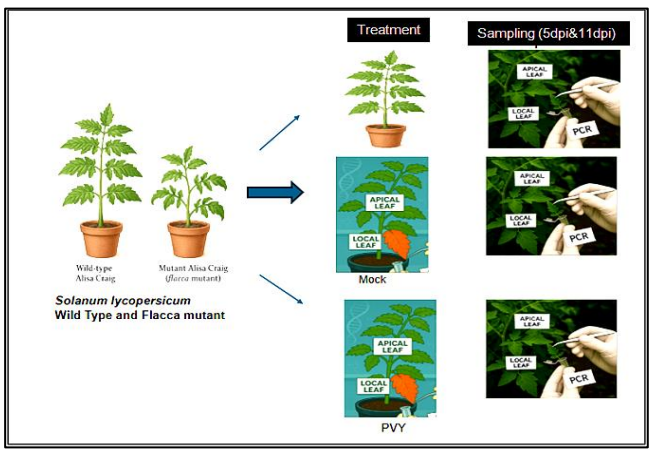
Introduction

Abscisic acid is an isoprenoid phytohormone that plays a key role in plant development and in regulating responses to both biotic and abiotic stress. ABA interferes with the accumulation and movement of virus. Potato virus Y (PVY), a member of the *Potyvirus* genus in the family *Potyviridae* is one of the most economically damaging viruses affecting solanaceous crops such as tomato and potato. The virus is transmitted from plants-to-plants by aphids, primarily by *Myzus persicae* in the non-persistent, non-circulative manner.

Our recent studies have shown that mutations in ABA biosynthesis genes can influence virus accumulation and the behavior of insect vectors (*M. persicae*), which are responsible for PVY transmission.

Material and methods

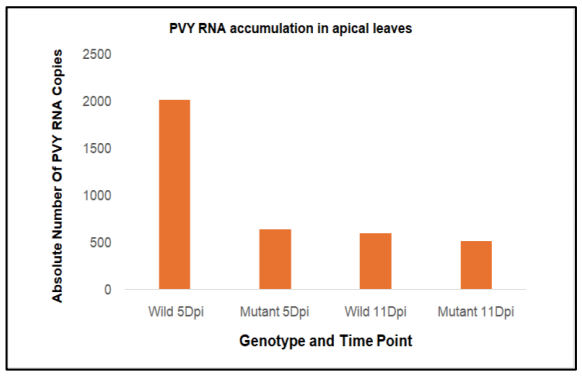


Steps	Description
Plant Material	Collection of healthy, mock-infected, and PVY-infected leaves from *Solanum lycopersicum* (wild type and mutant)
Sampling Time points	Samples collected at 5 days post-inoculation (5 dpi) and 11 days post-inoculation (11 dpi)
RNA Isolation	Total RNA extracted from collected leaf samples
cDNA Synthesis	Reverse transcription of RNA to complementary DNA (cDNA)
qPCR Analysis	Quantitative PCR performed using iTaq SYBR Green Master Mix to quantify gene expression and viral RNA accumulation

Results: Objective 1

1) In the apical leave samples of the wild-type variety, highest viral RNA accumulation was observed at 5 dpi and 11 dpi.
2) In the local leave samples at 5 dpi, the highest viral RNA accumulation was detected in the mutant variety. However, by 11 dpi, a notable increase in PVY RNA levels was seen in the wild-type plants.

Research Objective1: To Study the Viral RNA accumulation in *Ailsa Craig* Wild-type variety and its ABA-deficient Mutant



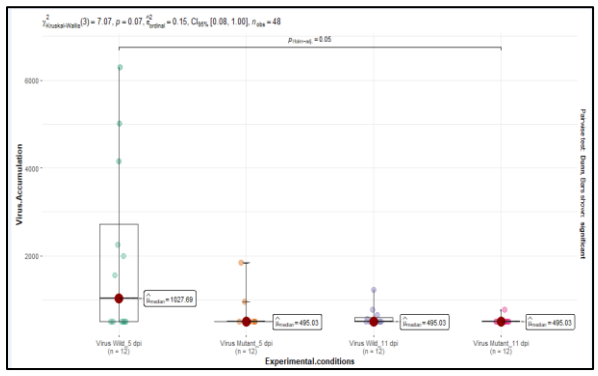
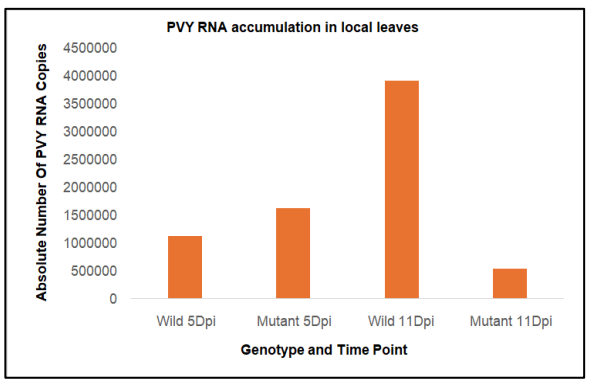


Figure 1. PVY RNA accumulation in apical leaves of *Alisa Craig* (Wild and Flacca mutant) at 5 and 11 dpi



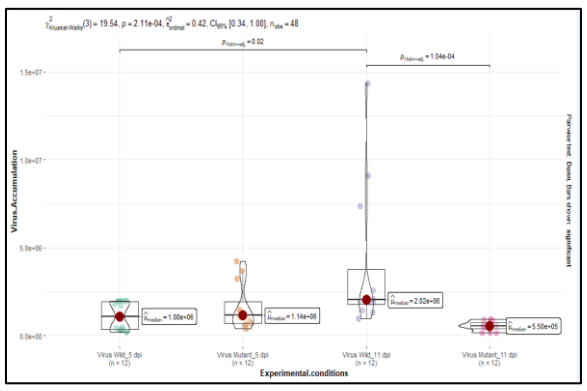


Figure 2. PVY RNA accumulation in local leaves of *Alisa Craig* (Wild and Flacca mutant) at 5 and 11dpi

Research Objective 2: Evaluate Aphid Nymph Production on Wild and ABA-deficient Mutant of *Alisa Craig*

Nymph population at 5 dpi over four days

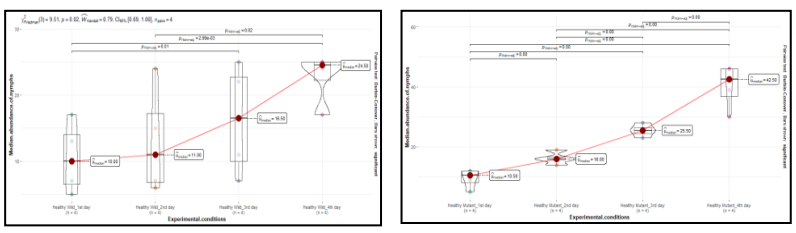


Figure 1. Nymph population on wild-type and mutant healthy *Alisa Craig*

Figure 2. Nymph population on mock treated wild-type and mutant *Alisa Craig*

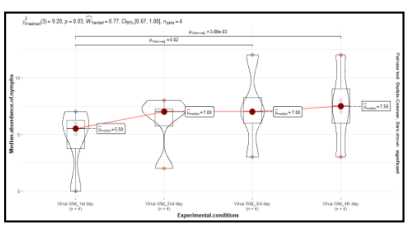


Figure 3. Nymph population on virus treated wild-type and mutant *Alisa Craig*

Nymph Population at 11 dpi over 4 days

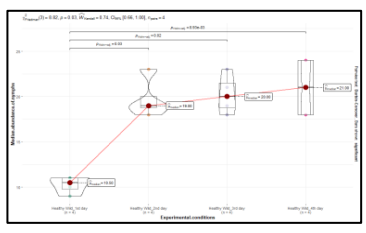


Figure 4. Nymph population on wild-type and mutant healthy *Alisa Craig*

Figure 5. Nymph population on mock treated wild-type and mutant *Alisa Craig*

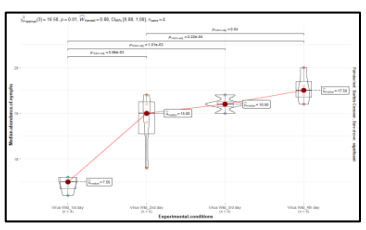


Figure 6. Nymph population on virus treated wild-type and mutant *Alisa Craig*

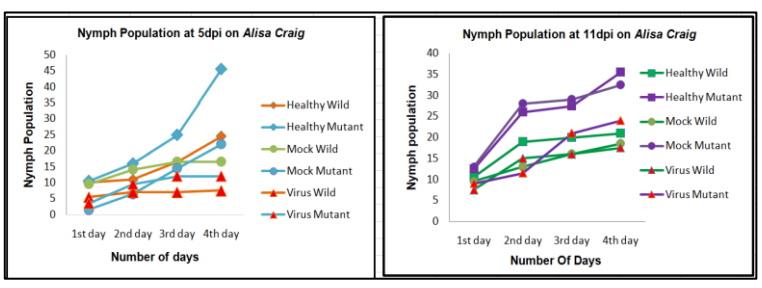


Figure 7. Average Nymph population at 5 dpi and 11 dpi on wild and mutant type *Alisa Craig*

Results: Objective 2

a) At 5 dpi and 11 dpi in healthy plants, nymph numbers are consistently higher on the *flacca* mutant.

b) In virus-infected plants, both wild and mutant plants showed much lower increase in nymph numbers in comparison to healthy and mock-inoculated plants.

Conclusion

1) The highest PVY RNA accumulation was observed in the apical leaves of wild-type plants at both 5 and 11dpi, while mutant plants showed greater accumulation in local leaves at 5 dpi. These are preliminary findings, and the experiment needs to be repeated for confirmation.
2) ABA *flacca* mutation leads to higher increase in abundance of nymph, suggesting ABA plays a defensive role against insects. PVY-infected plants showed suppressed nymph number, but less in mutants, possibly because ABA-related defense is compromised.

Refrences

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