

# Sometimes, When it Rains it Pours: How Does Flooding Alter Plant-Herbivore Relationships?

Objective: To understand how flooding alters volatile emissions of tomatoes and affects caterpillar growth and performance

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## Introduction

- Flooding, an under-studied abiotic stressor, creates hostile soil conditions, including hypoxia, which hinder the growth and development of plants [1]
- Plants respond to abiotic and biotic stressors. A common response is the production of volatile organic compounds (VOCs), which modulate stress responses and mediate plant and insect interactions [2]
- Flooding causes significant losses in crops of agricultural and economic importance including tomato [3]
- Understanding how flooding impacts plant growth, plant chemistry, caterpillar performance and chemical mediated plant-herbivore interactions will create fundamental knowledge to an emerging challenge brought about by climate change and inform pest management decisions post flooding events [4]**
- This study investigated how flooding alters tomato plant volatile emissions and affects caterpillar growth and performance



## Hypotheses

- Volatile emission will increase in plants exposed to flooding
- Herbivores feeding on flood-stressed plants will have lower growth rate than herbivores feeding on healthy plants

## Materials & Methods

**Plants:** Tomatoes [*Solanaceae lycopersicum* 'Cherokee Purple']

**Insect Herbivores:** Specialist *Manduca sexta* (Lepidoptera: Sphingidae) and generalist *Spodoptera exigua* (Lepidoptera: Noctuidae)

**Volatile Collection & Analysis:** Solid-phase microextraction (SPME) used to collect headspace volatiles from flooded and non-flooded plants. Gas chromatography-mass spectrometry (GC-MS) utilized to analyze and identify VOCs



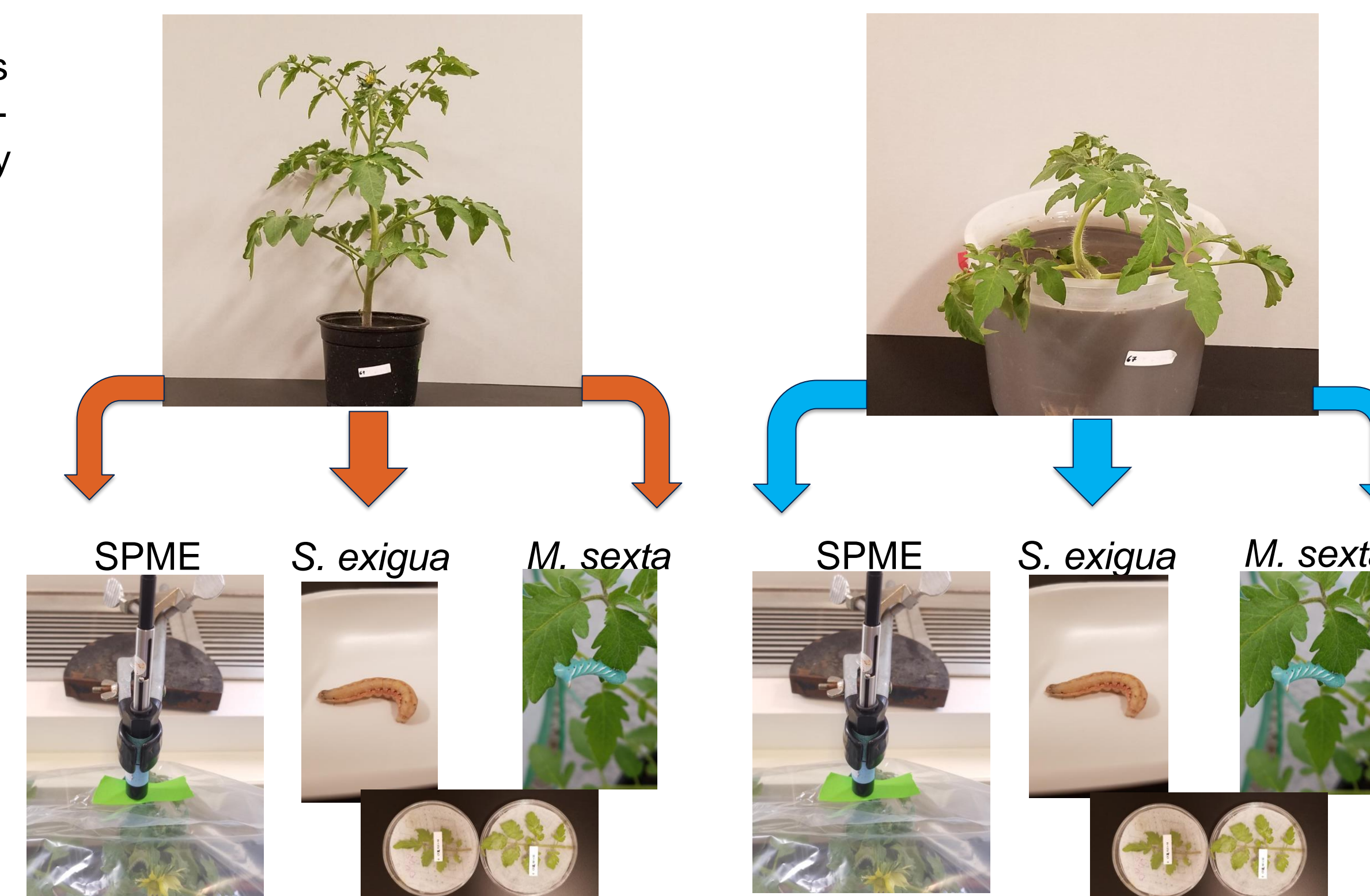
## Experimental Design

Plants grown from seed in greenhouse



Leave unflooded

Flooded for 1 week



## Discussion

Preliminary data indicates that flooding increases tomato plant volatile emissions, including the following major secondary compounds: (+)-4-carene and caryophyllene. Increased volatile emissions in plants undergoing flooding stress may have important ecological and physiological functions. Early data suggests that flooding may negatively affect caterpillar growth and performance.

## Ongoing and Future Work

- Work with herbivores and foliar nutrition analysis is underway
- Future studies will investigate how increased tomato VOCs influence host plant location and how tomato plants recover from flooding plant stress
- Knowledge will be useful to tomato farmers



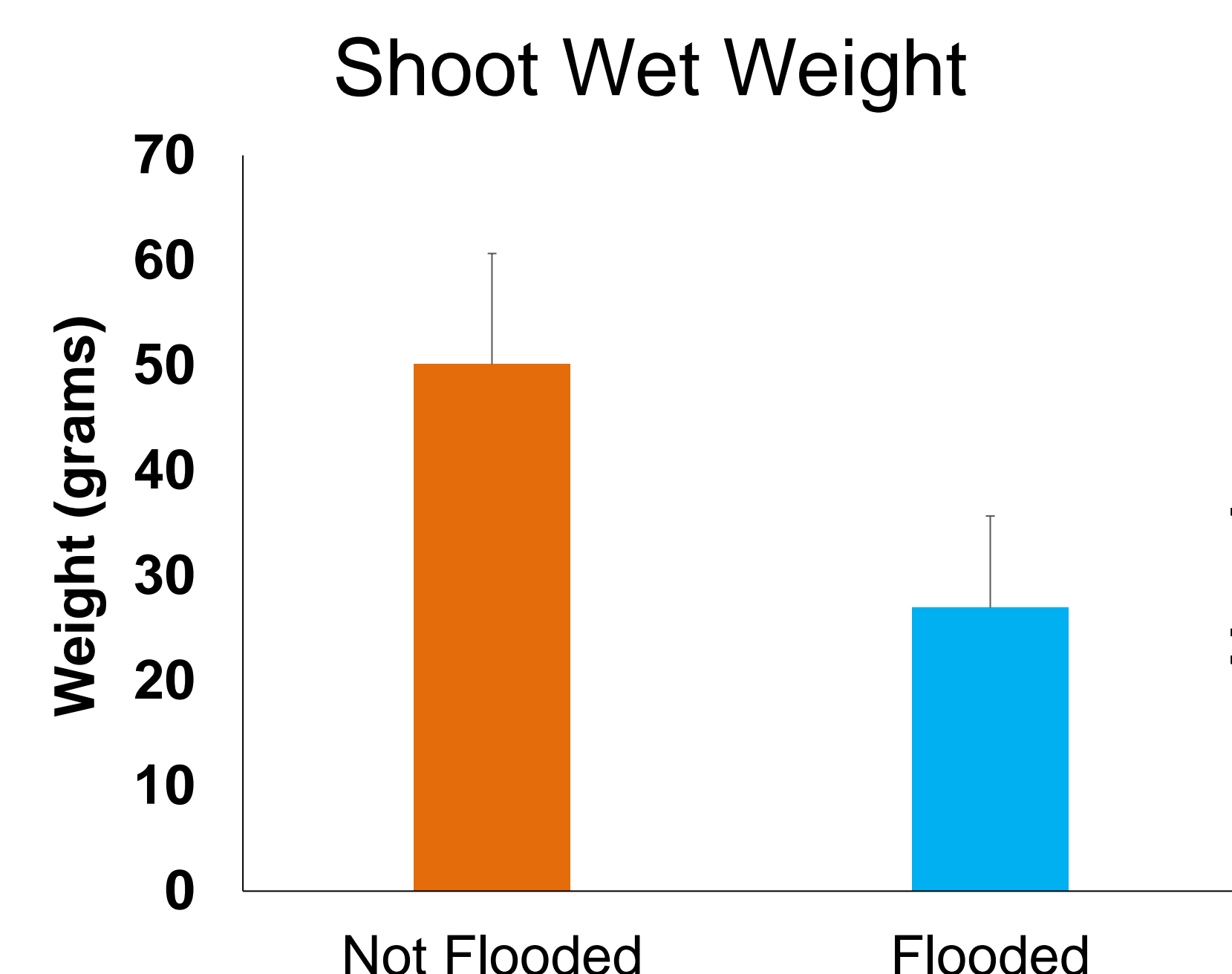
Image: WGLT. 2021 "The vegetable field at Cook Farm after floodwaters receded" (bottom)

## References

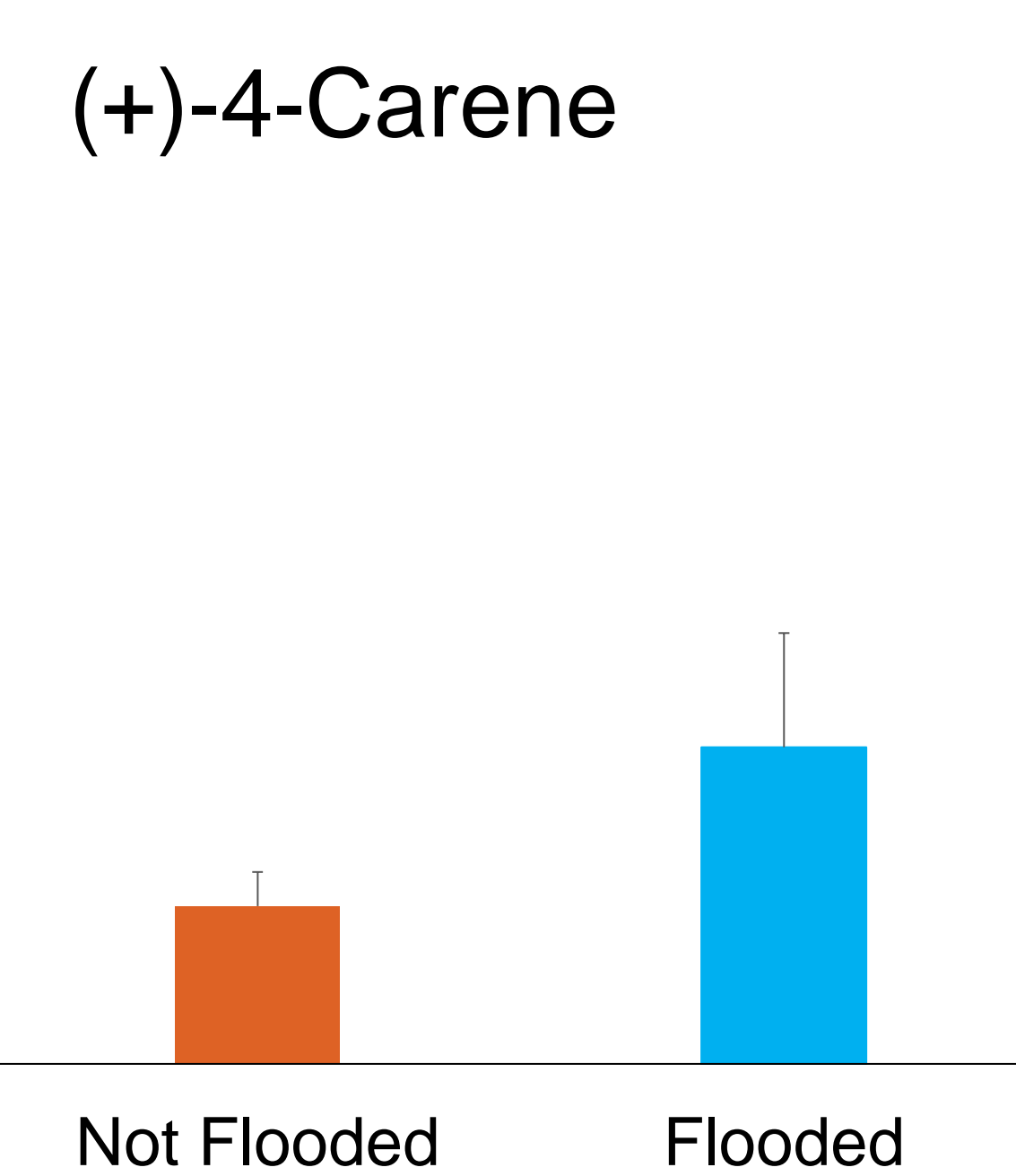
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## Results

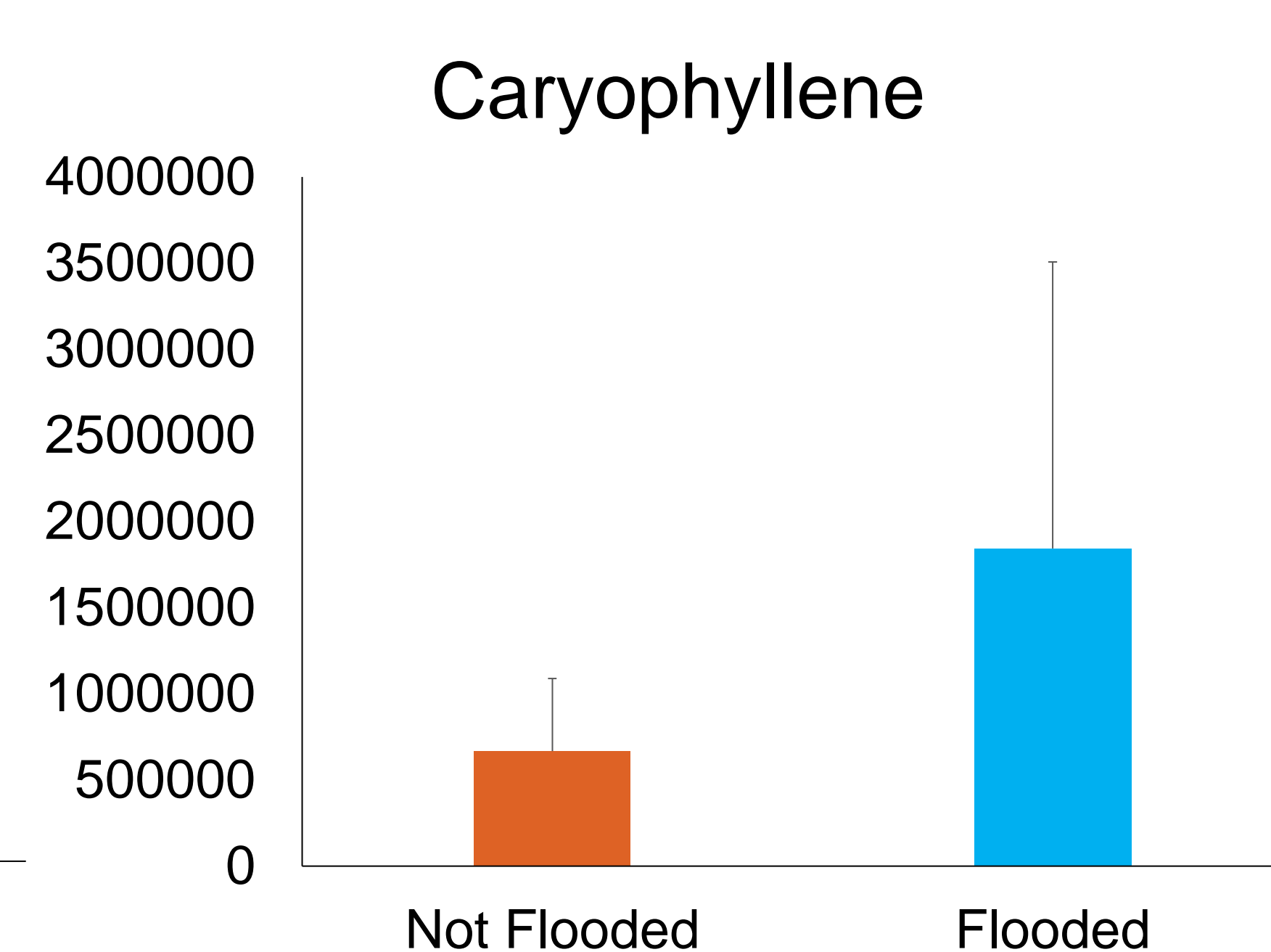
### 1. Flooding impacts tomato plant growth



### 2. Flooding increases volatile emissions in tomato



### 3. Flooding induces several adaptation traits



Adventitious roots

## Acknowledgments

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