Impacts of Ozone Pollution on Plant-Pollinator Interactions

Potential Influences on Bumblebee Foraging

NATURAL ENVIRONMENT RESEARCH COUNCIL

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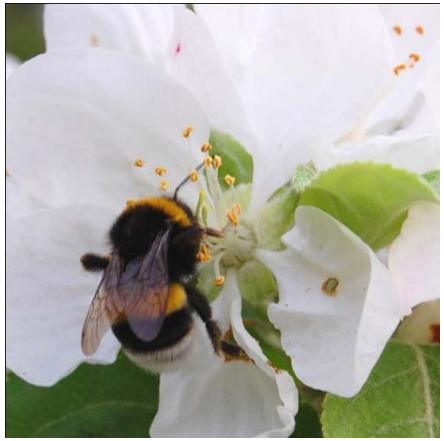
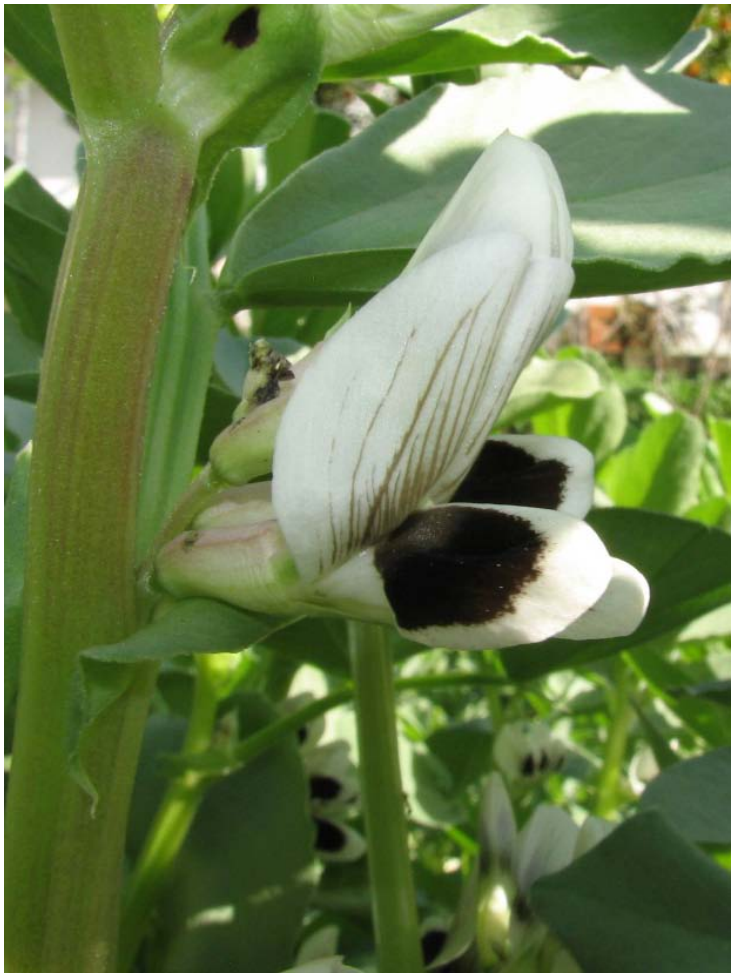
Introduction



Aims:

- Investigate effect of ozone stress on plant resource provisioning
- How nectar and pollen quality and quantity influences pollinator behaviour

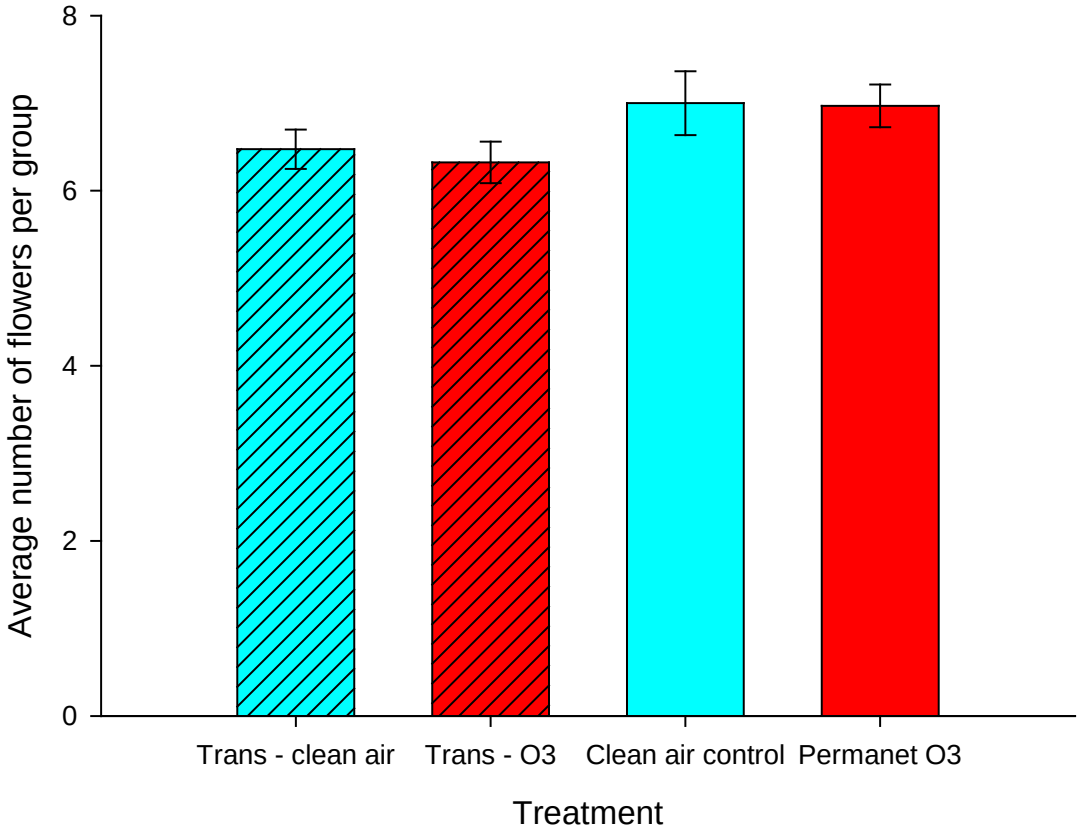
Plant resource allocation



- Dwarf broad beans *(Vicia faba)*
- **Chronic stress**
  - Clean air control
  - 110 ppb ozone for 8 hours per day
- **Acute stress**
  - Transfer from O3 to clean air at flowering
  - Transfer from clean air to O3 at flowering
- Nectar and pollen collected
- HPLC analysis for carbohydrates and amino acids
- Measured dry weight

Results

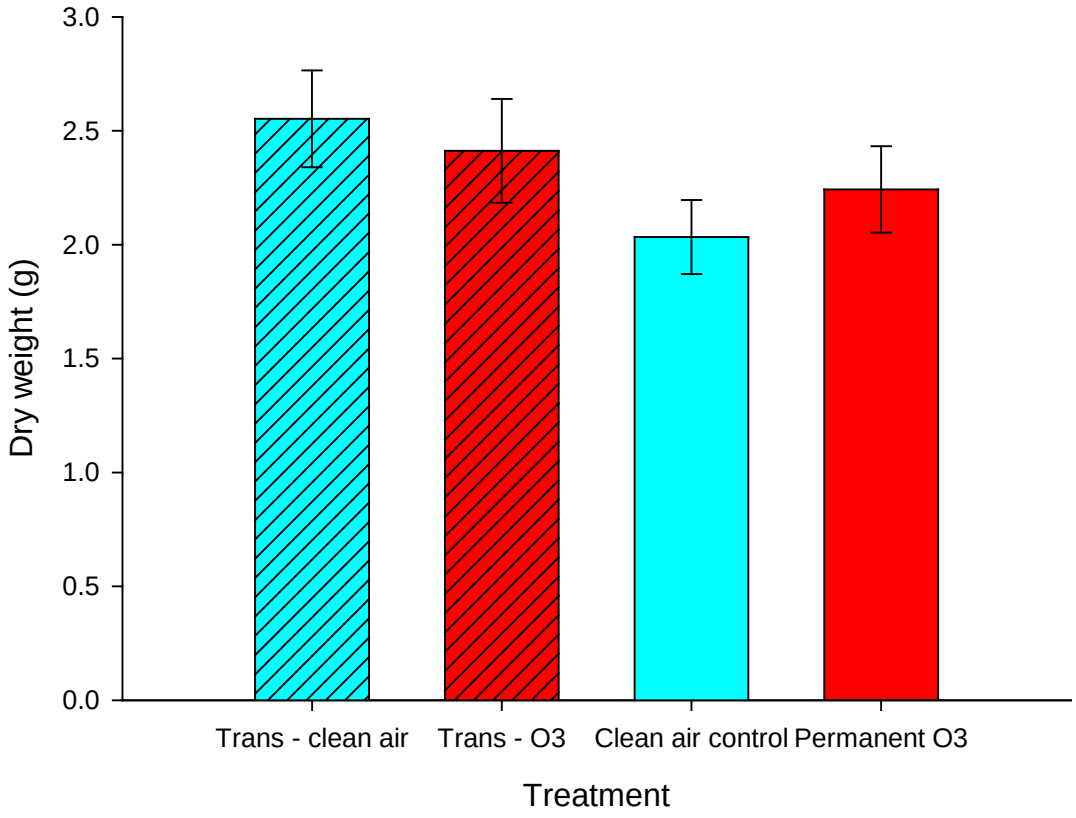
- Number of flowers



• No significant differences in number of flowers between any treatment

Results

- Dry weight (biomass)

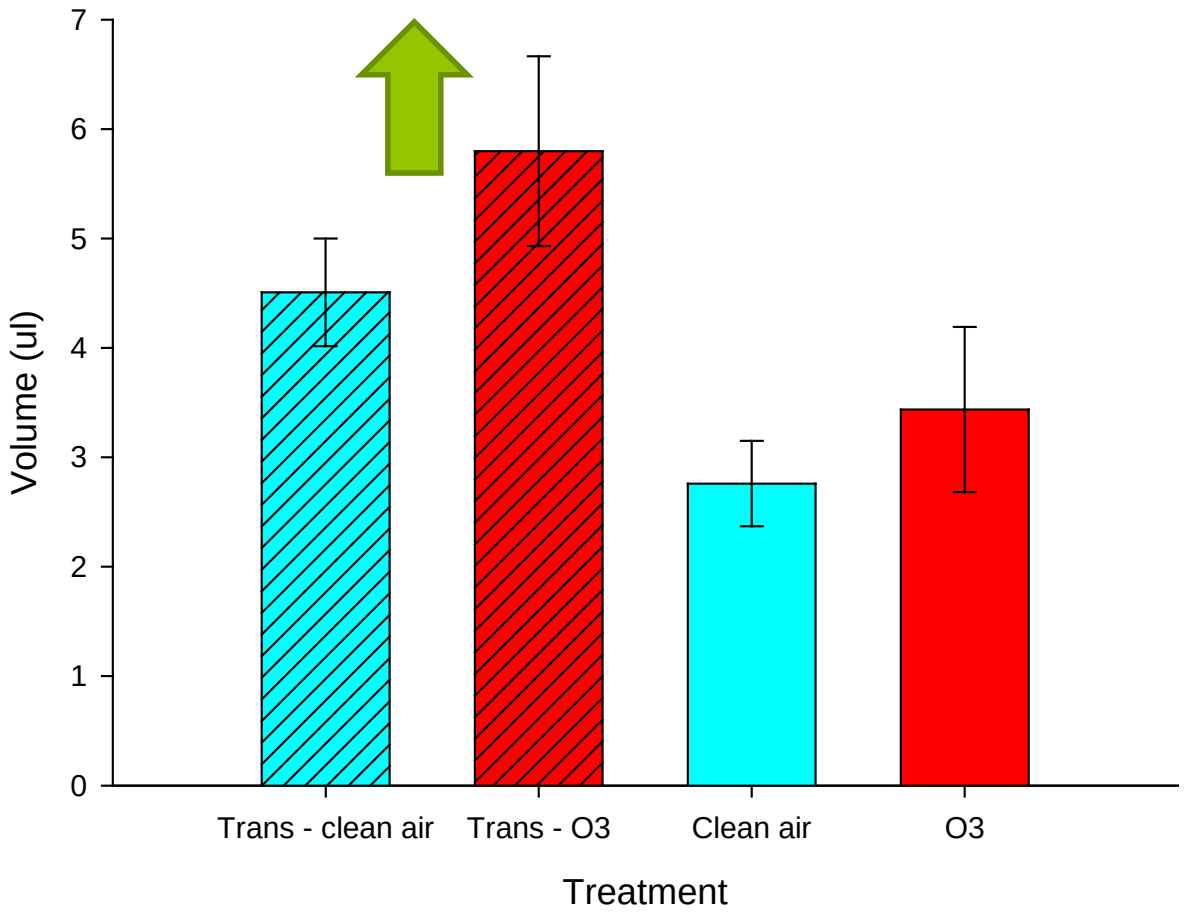


- Ozone fumigation has no influence on biomass

- So, are broad beans ozone tolerant?

Results

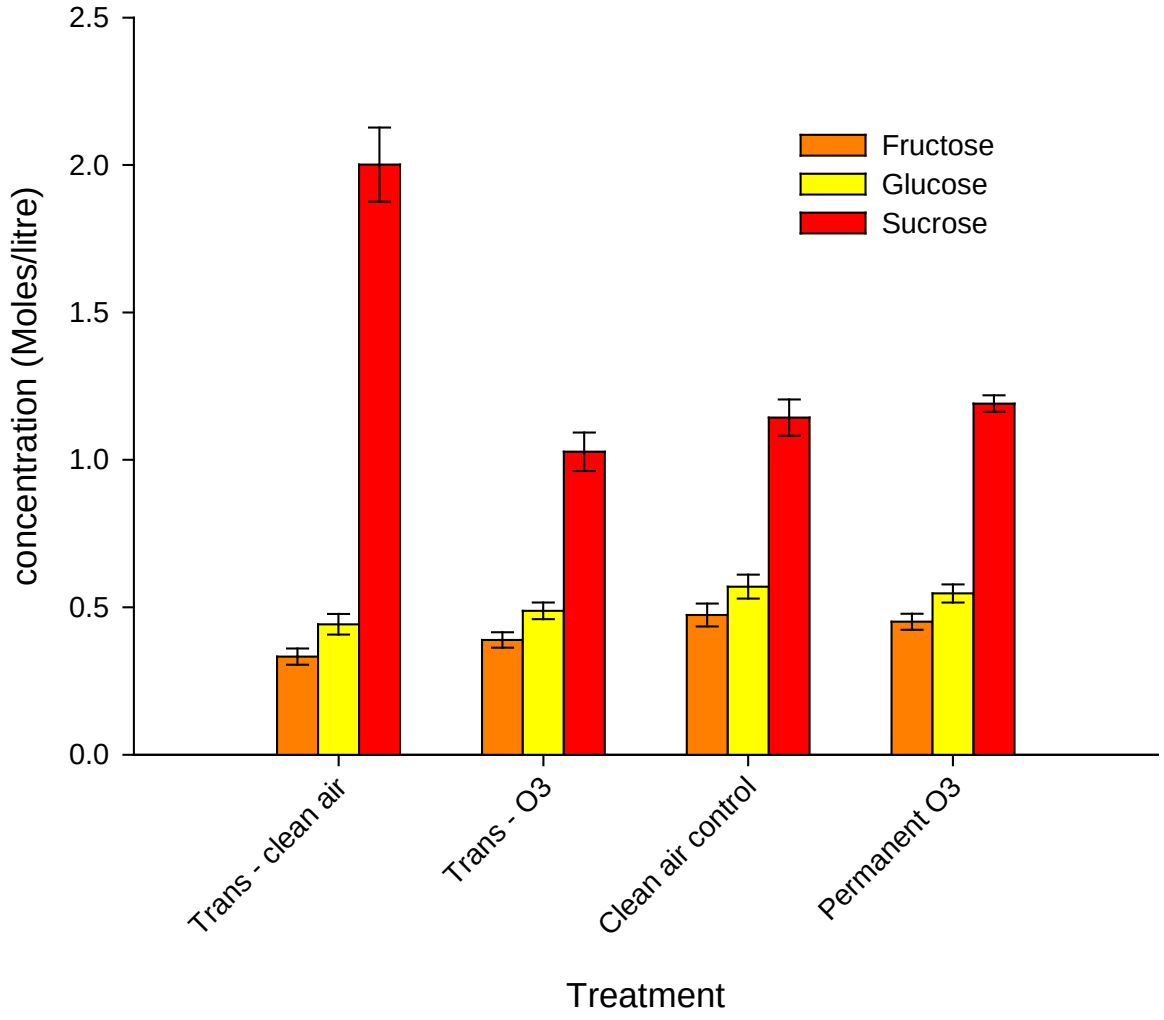
- Volume of nectar



- Transfer causes an increase in the volume of nectar provided

Results

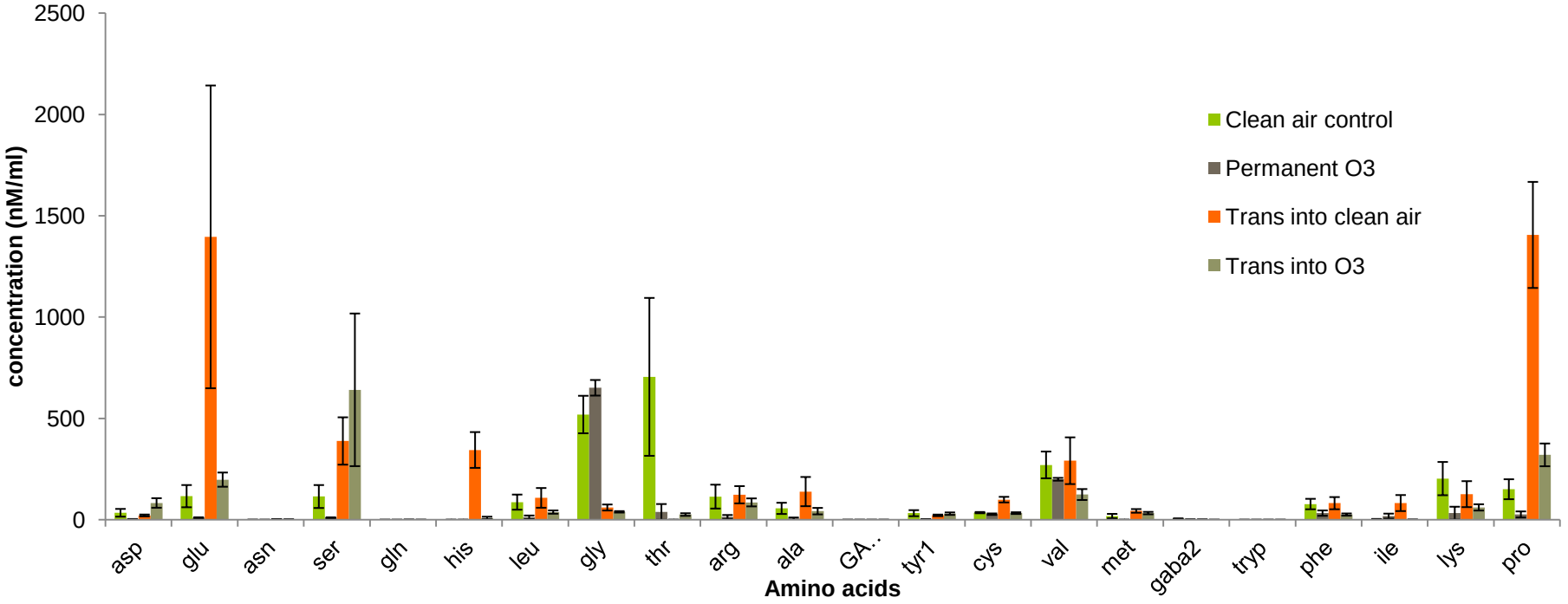
- Carbohydrate profile



- Plants moved from ozone into clean air at flowering produce twice the concentration of sucrose in the nectar

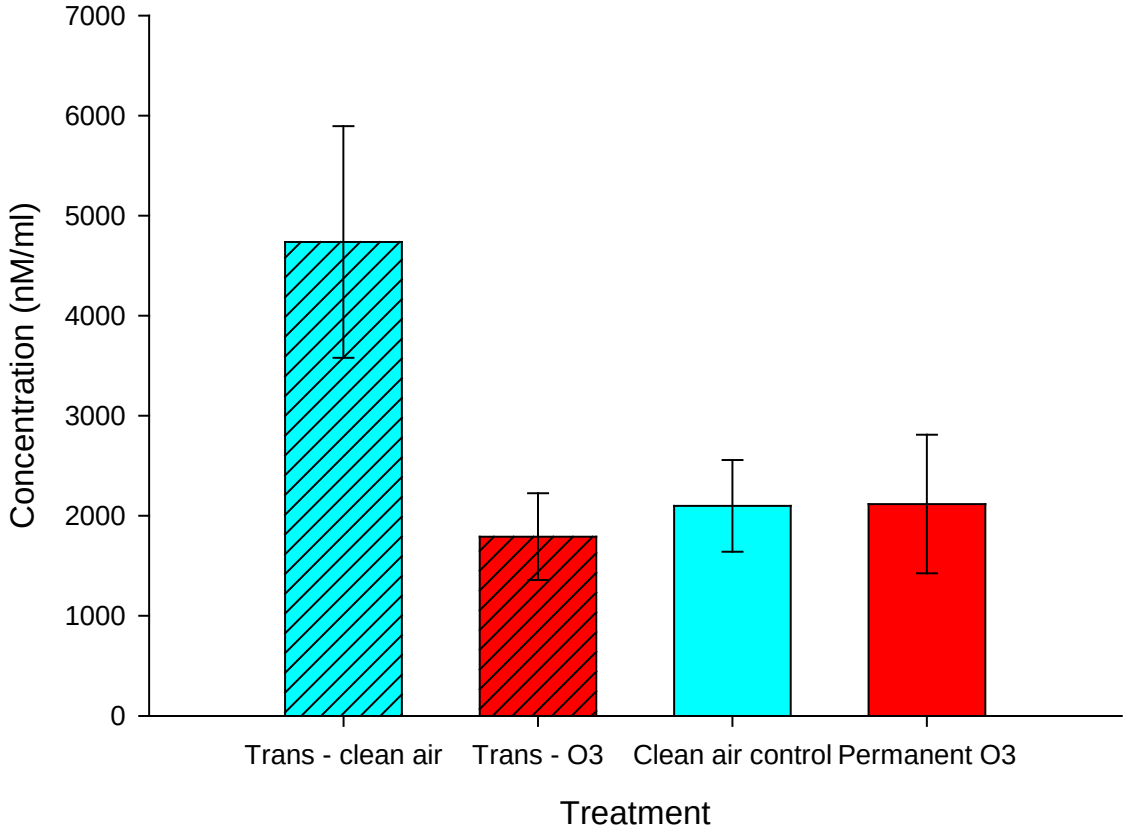
Results

- Amino acid profile



Results

- Amino acid total nectar composition



• Total amino acid composition of nectar in plants grown under ozone and moved to clean air at flowering is more than double found in other treatments

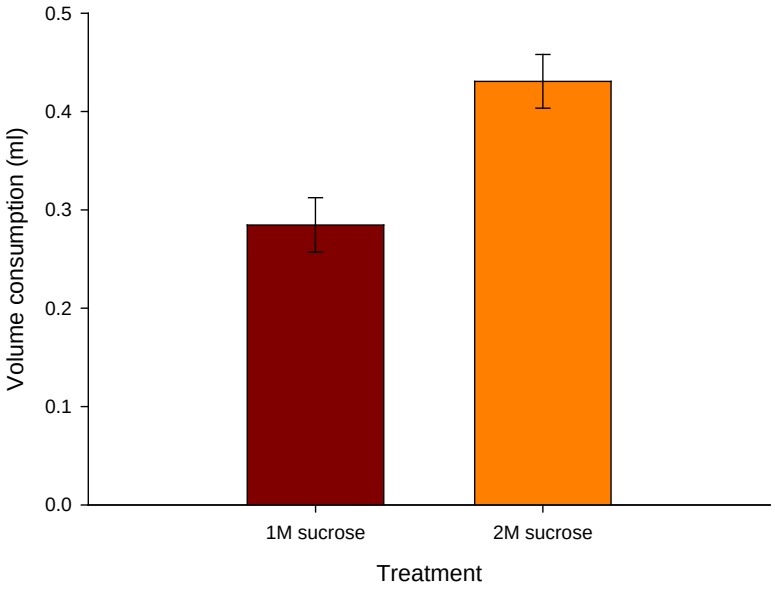
Bumblebee taste

- Can bees detect changes in carbohydrates and amino acids?
- Representative solutions from HPLC analysis
- Consumption measured after 24 hours

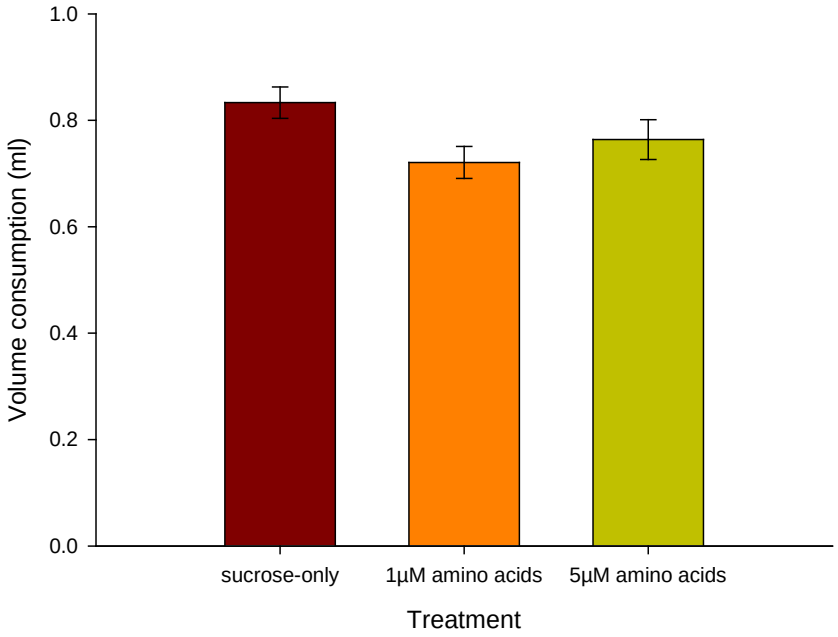
Results

- Bee choice experiments

Carbohydrates

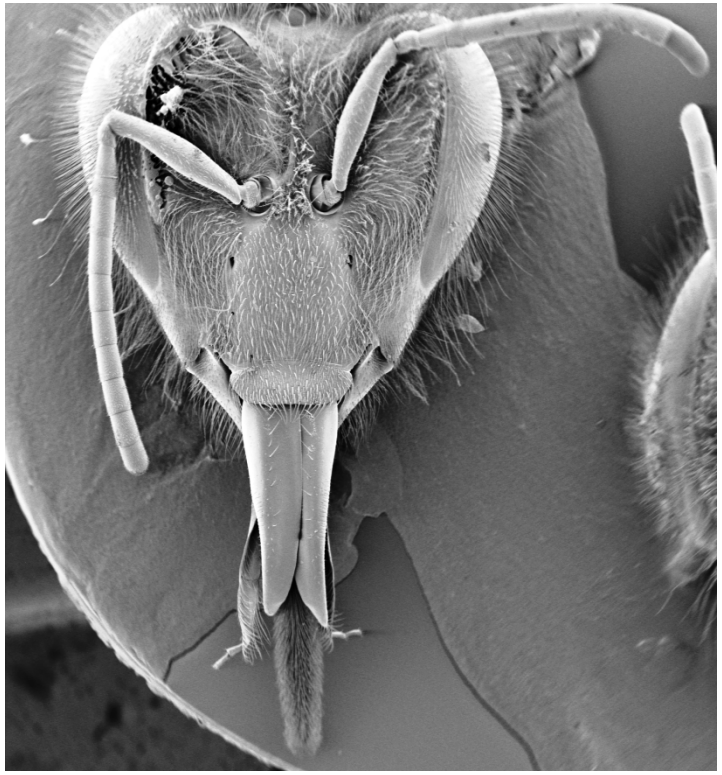


Amino acids



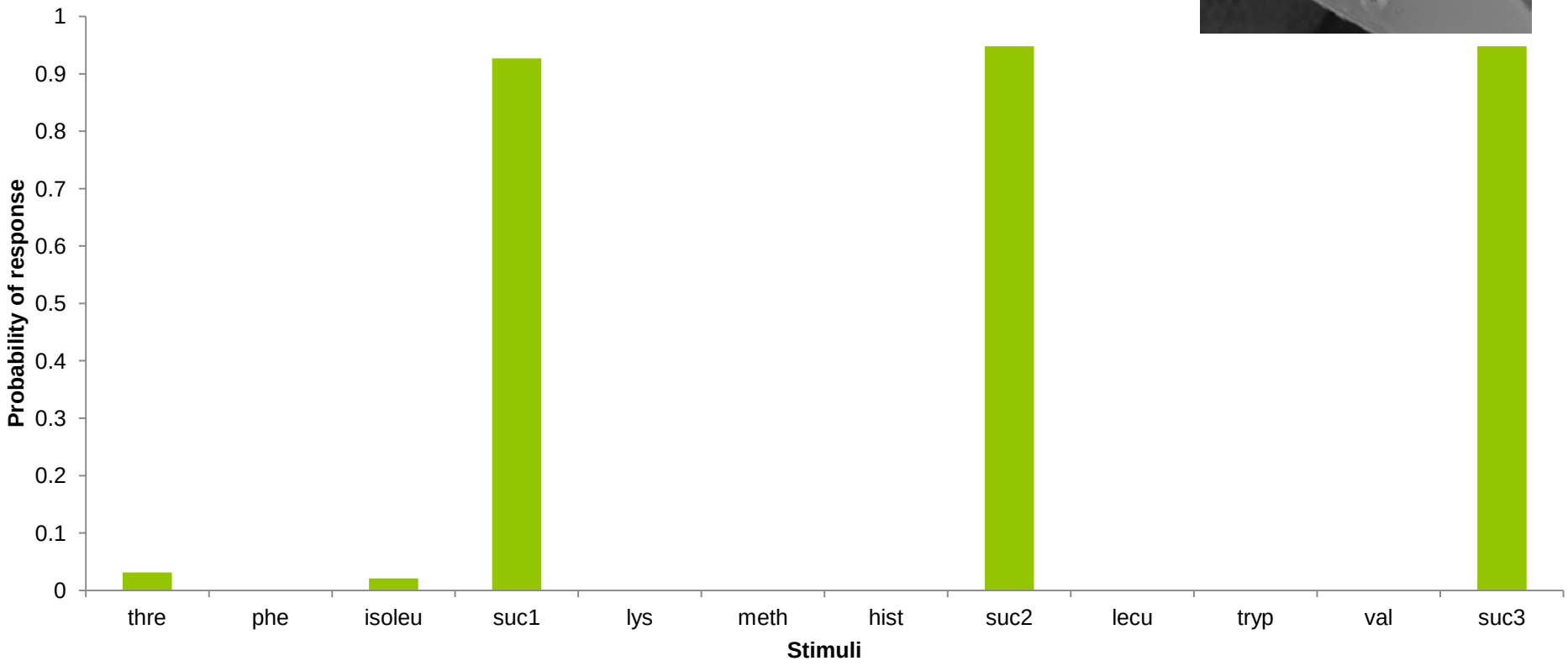
Results

- Honeybee PER to antennal stimulation with 0.1M Amino acids



Results

•Honeybee drink responses on proboscis to 0.1M Amino acids



Future plans...

- Pollen analysis from broad beans
- Identify amino acid and carbohydrate allocation in plant tissue
- Free-flying bee experiments:
  - Effect of ozone on navigation to flowers
  - How affected reward quality influence foraging decisions
- Acknowledgements:
- Sophie Derveau and Daniel Reed - bumblebee photography
- Koppert Uk Ltd. Bumblebee colonies