The impact of herbivory-induced plant stress on flowers and flower feeding insects

M. S. Chan, H. Ronan-Brown, S. A. Campbell
School of Biosciences, The University of Sheffield, Western Bank, Sheffield
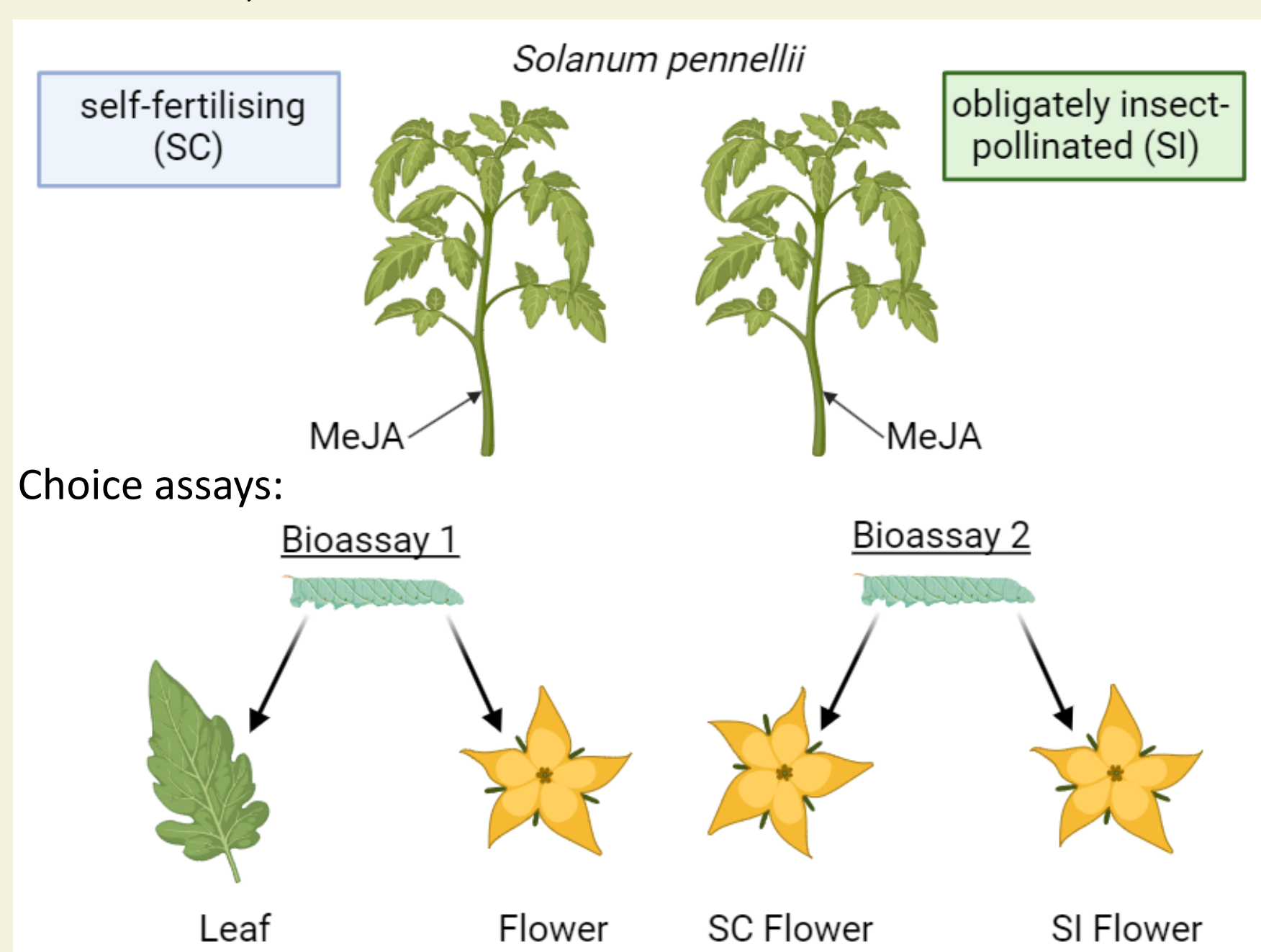
Background

- While herbivore-plant interactions are well studied, effects of herbivory stress on flowers and flower-feeding insects are still poorly understood.
- Optimal defence theory (ODT) posits that plant tissues are defended relative to the fitness value and vulnerability to herbivory,[1] e.g. flower with crucial reproductive function should be better defended.
- Ecological trade-offs between reproduction and defence, mean that plants with high defence may experience reduced pollination when defences are expressed in flowers.[2]
- Here we investigated the effect of herbivory on leaves and flowers; the regulation of floral defences in response to herbivory in self-fertilising and obligately insect-pollinated individuals.

Research questions:
Q1: What is the preference pattern for different tissues?
Q2: Do pollinator-reliant plants have lower defences?
Q3: Which tissue is better defended against herbivory?

Methods

- Two populations of the wild tomato *Solanum pennellii*: self-fertilising (SC) and obligately insect-pollinated (SI).
- The plants were treated with the endogenous plant hormone methyl jasmonate (MeJA), which was used to mimic the plant's response to herbivory.[3]
- Defence in leaves and flowers were measured 72 hours post-induction using chemical analysis (HPLC).
- Choice bioassays with *Manduca sexta*, a specialist herbivore,[4] were also conducted at the same time.
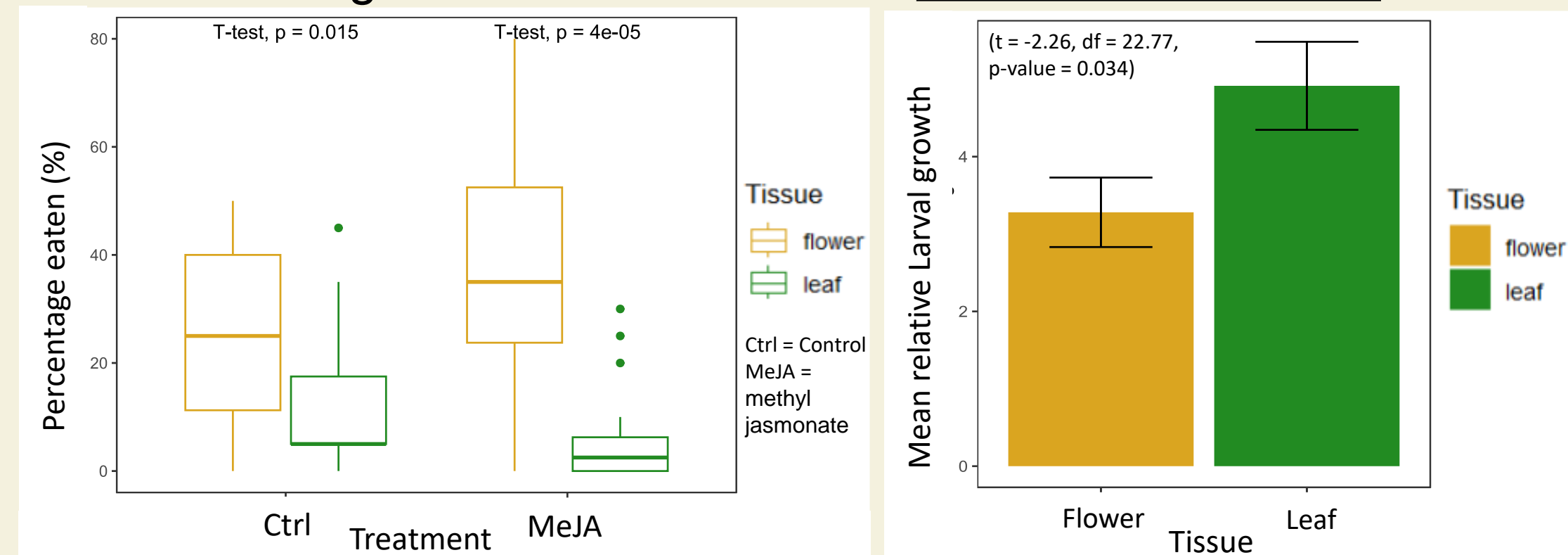

Solanum pennellii
self-fertilising (SC) — MeJA
obligately insect-pollinated (SI) — MeJA

Choice assays:
Bioassay 1 → Leaf / Flower
Bioassay 2 → SC Flower / SI Flower

Results

Bioassay 1 – Larvae show _preference for flowers_ over leaves regardless of treatment.
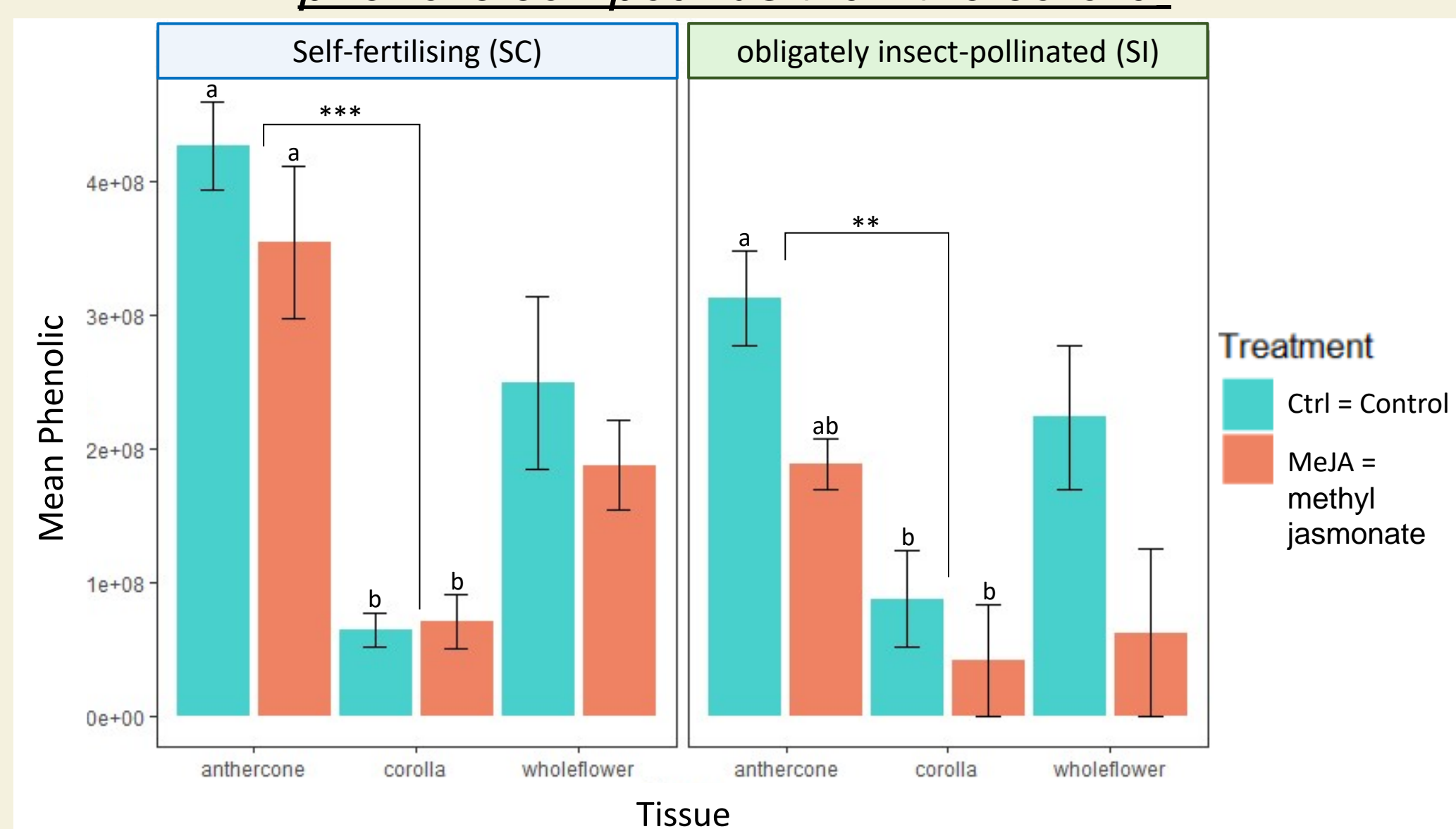
- Despite feeding preference, _larval growth is lower on flowers than leaves._

Bioassay 2 – _Larvae preferentially feed on SI flowers regardless of treatment. This suggests that SI flowers may have a lower level of defence than SC flowers._
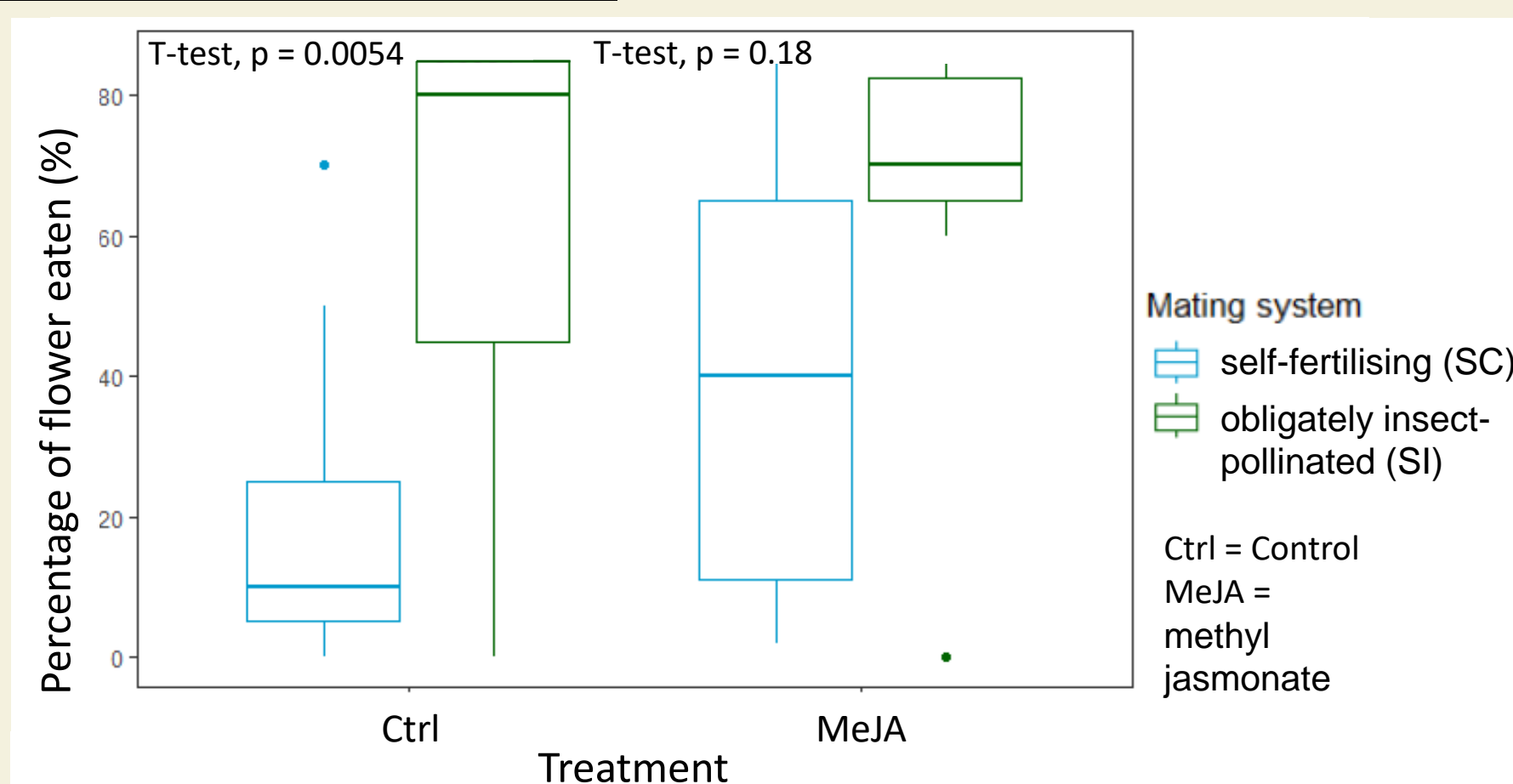
The anther cone had significantly higher concentrations of phenolic compounds than the corolla.

Conclusion

Q1: Larvae prefer to feed on flowers, despite lower growth.
Q2: SI flowers were preferred suggesting lower defences.
Q3: Floral defence is mainly driven by the anther cone, which is the most important tissue, containing pollen.

Further study:
- Separate analysis of each secondary metabolite found in the tissue to determine the effect of each metabolite.
- Test function of each metabolite e.g. attraction or deterrence.

Contact
Agnes Man Sum Chan
Email : mschan1@sheffield.ac.uk
Linkedin: linkedin.com/in/agnes-man-sum-chan-233b79203
Dr Stuart Campbell
Email: stuart.campbell@sheffield.ac.uk

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