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

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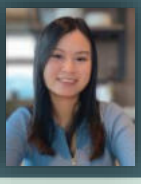

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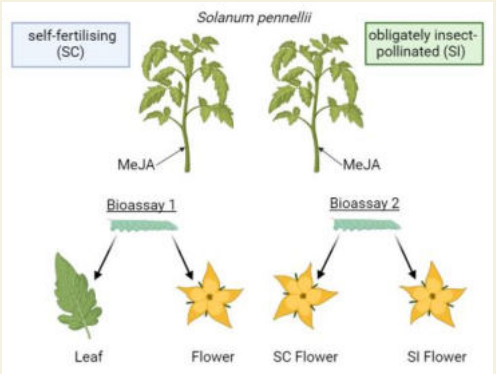
Background

- 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?

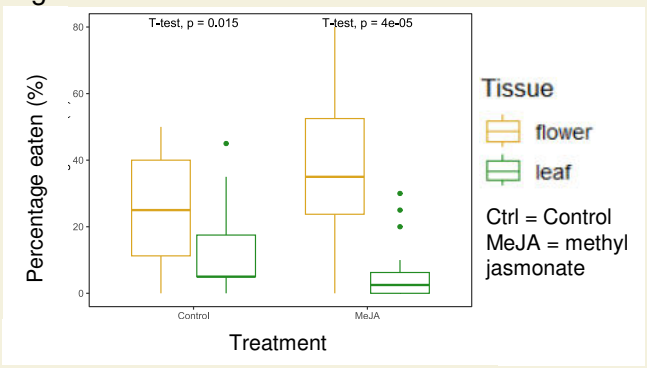
Method

- 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.



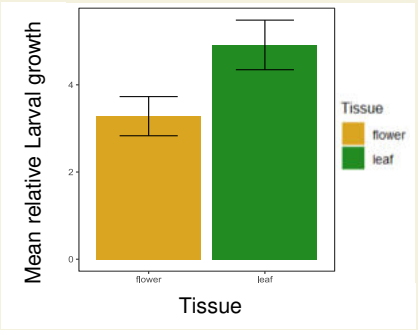
Results

Bioassay 1 –
Larvae show *preference for flowers* over leaves regardless of treatment.

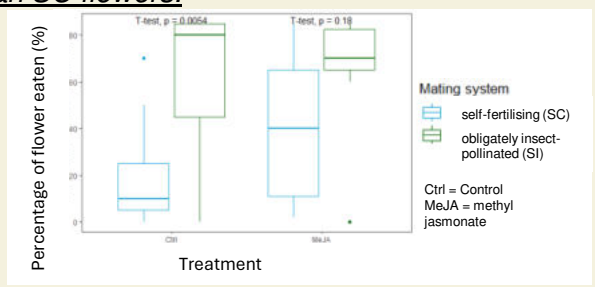


- Despite feeding preference, *larval growth is lower on flowers than leaves.*

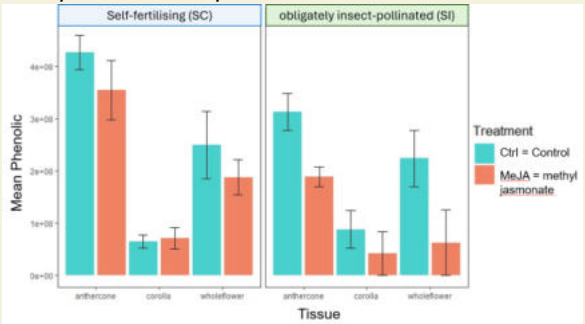
(t = -2.26, df = 22.77, p-value = 0.034)



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.

Reference:
1. McCall, A.C., Fordyce, J.A., 2010. Journal of Ecology 98, 985–992. https://doi.org/10.1111/j.1365-2745.2010.01693.x
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4. Byron, M.A., Gillett-Kaufman, J.L., 2020.ask IFAS. URL https://edis.ifas.ufl.edu/publication/IN1187 (accessed 11.13.23).