Sub Lethal Effects of Low Temperature Stress on *Megachile rotundata*

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Introduction

- Alfalfa leafcutting bees (ALCB) overwinter as prepupa and are vulnerable to fluctuating temperature stress as they are developing.[1]
- Decreased adult bee quality can have negative effects on alfalfa pollination.[2]

Question

- What are the sub lethal effects of low temperature stress on ALCB across temperatures?
- **Hypothesis**: Lower temperature will decrease bee quality

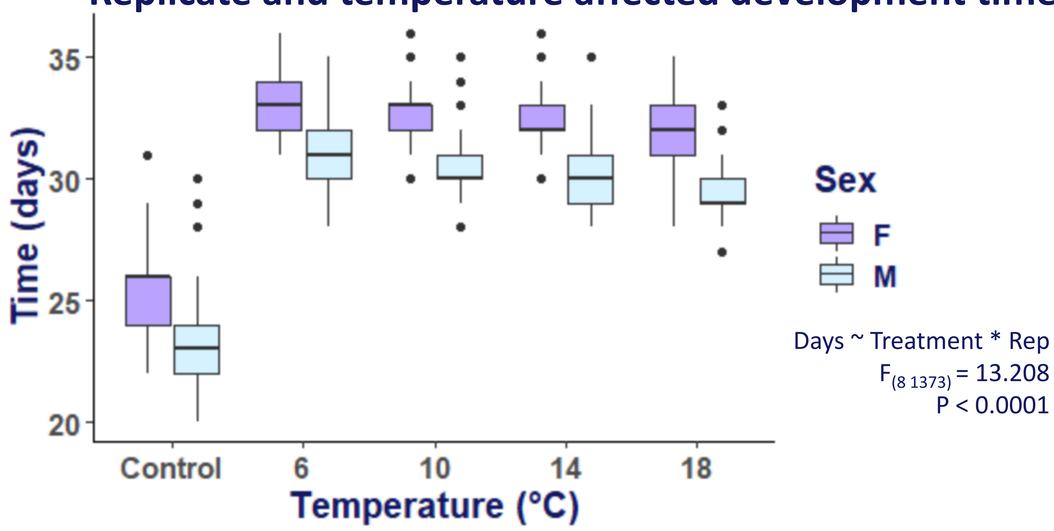
Methods

1. X-ray prepupa bees in brood cells
2. Put bees into four 24 well plates
3. Into 29°C incubator for two weeks
4. Put bees into temperature treatments for one week (6°C, 10 °C, 14 °C, 18 °C, and control)
5. Bees go back into 29°C to finish developing until adult
6. Check bees for deformities, flight ability, and development time

Deformed ALCB (M)

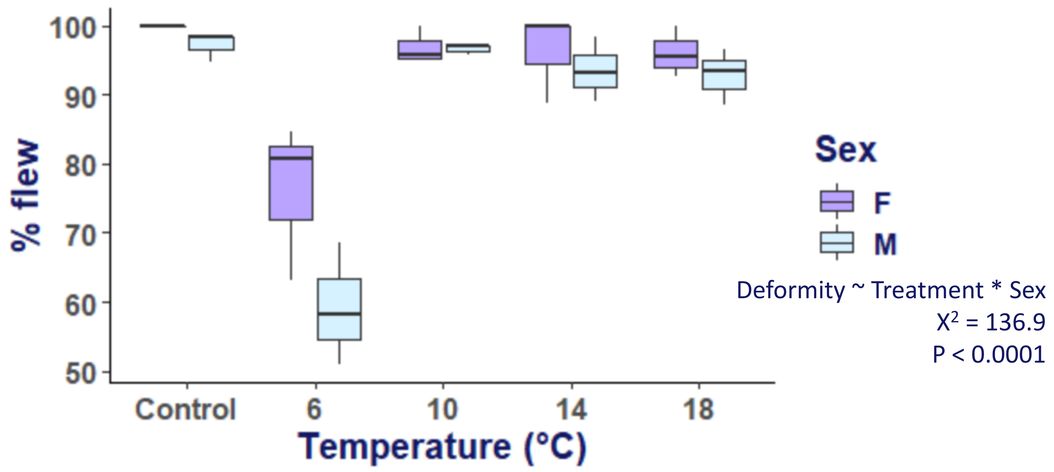
Results

Replicate and temperature affected development time



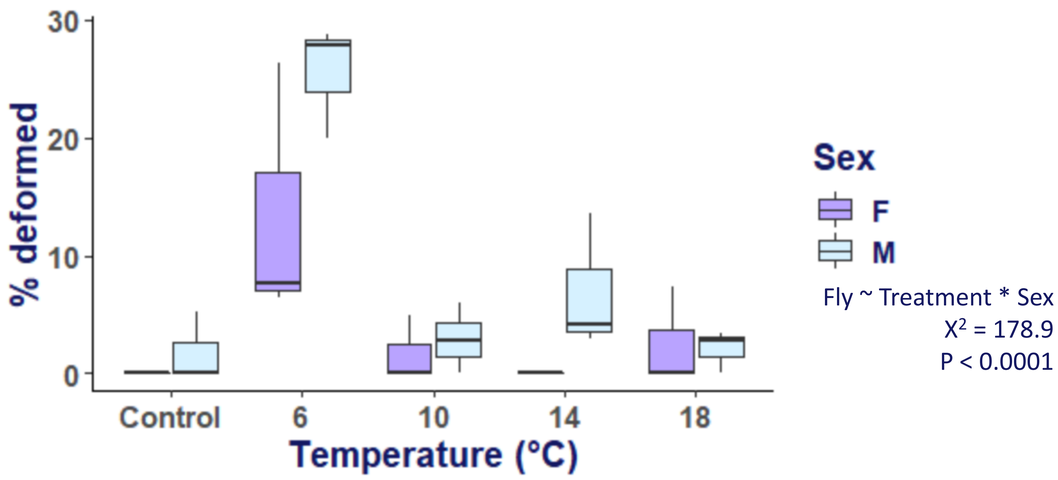
Days ~ Treatment * Rep
$F_{(8\ 1373)} = 13.208$
$P < 0.0001$

6°C bees had the lowest flight ability



Deformity ~ Treatment * Sex
$X^2 = 136.9$
$P < 0.0001$

6°C bees had the most deformities



Fly ~ Treatment * Sex
$X^2 = 178.9$
$P < 0.0001$

Discussion

- The hypothesis was supported that lower temperatures lead to increased stress and decreased bee quality.
- Replicate was a significant factor, possibly due to age.
- Males were more affected by low temperature stress resulting in more deformities and lower flight ability.
- Only 59% of male bees exposed to 6°C are of good quality and 76% of females.

Examples of ALCB

Conclusion

- This research of constant temperature is helpful for farmers who use ALCB to pollinate their fields because they will be able to replicate our methods to produce high quality bees.
- Future research will look at the sub lethal effects of low temperature stress over various periods of time and consider the long-term effects of low temperature stress by doing a field study.

References

[1]Earls. etal. (2021) *J. Exp. Biol.* Vol. 224, 1-9

[2]Rinehart. etal. (2011) *J. Econ. Entomol.* Vol. 104, no. 4, 1162-1166

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