Effects of Varying Thermal Regimes on the Flight Capability of *Megachile rotundata*

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Introduction

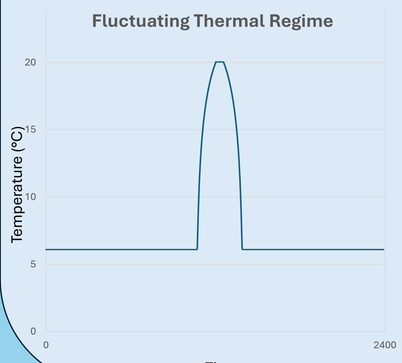
- The *Megachile rotundata*, also known as the alfalfa leafcutting bee (ALCB) are important agriculturally in the U.S. for the pollination of alfalfa.
- Previous research has shown that exposure to lower temperatures during development, specifically the red-eye stage, can delay emergence[1].
- Due to the varying climates in the U.S. this delay can be utilized to synchronize the emergence of the ALCB with local climates and crop growth.

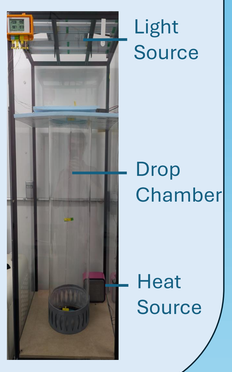
Question

How does exposure to different thermal regimes during the red-eye stage impact flight capability of adult *Megachile rotundata*?

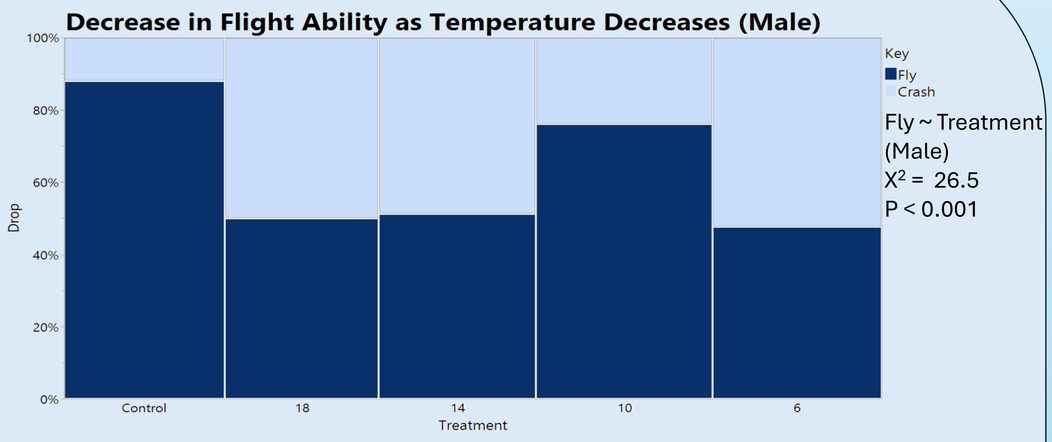
Methods

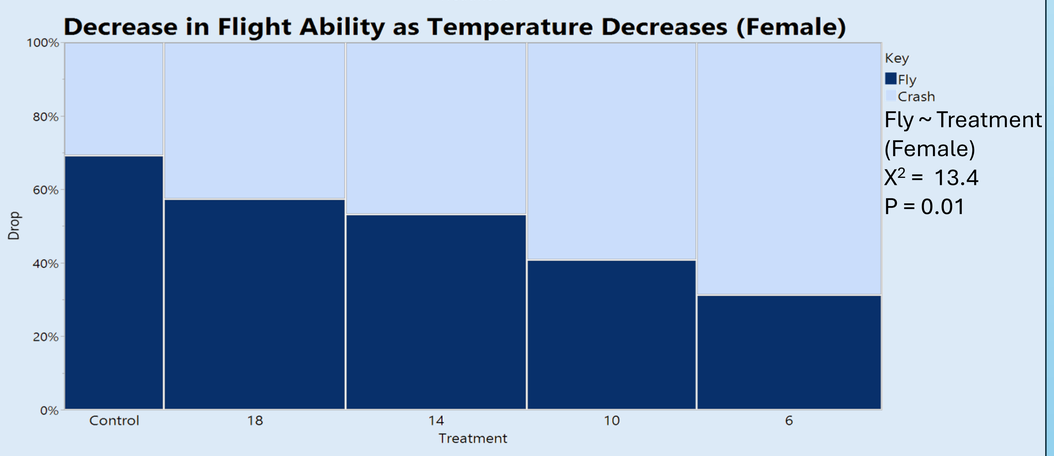
1. Brood cells were separated into 24-well plates and placed in 29°C incubator for two weeks until red eye stage.
2. Brood cells were placed into the various treatments, a control (29°C) and either, a temperature treatment for one week (18°C, 14°C, 10°C, or 6°C), or a fluctuating thermal regime (FTR) for various treatment times (one week, two weeks, three weeks, four weeks).
3. Brood cells were then placed back into 29°C incubator after treatment until emergence (~1 week).
4. Bees (n=50/sex) were drop tested to determine flight capability, resulting in either a *Fly* or *Crash*.

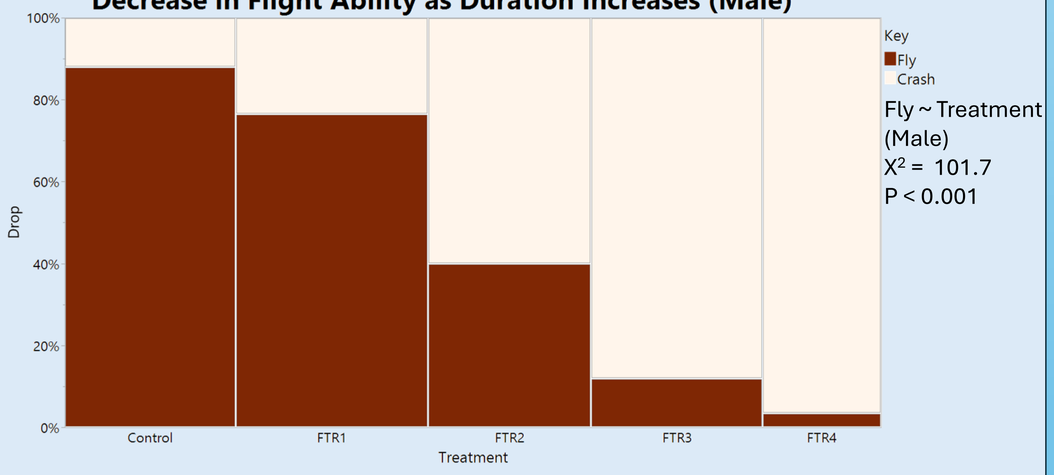


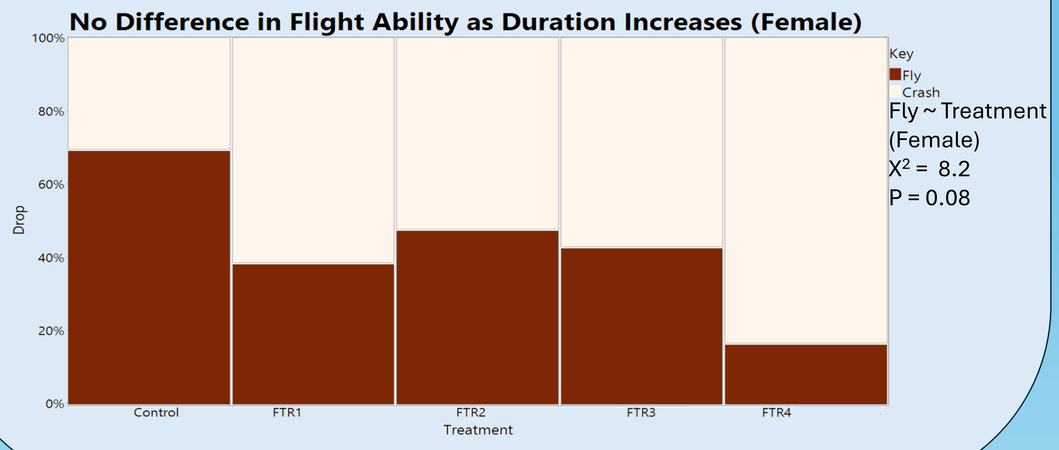


Results









Discussion

- There is a significant difference in flight capability of male ALCB when exposed to lower temperatures for one week starting at 18°C.
- There is a significant difference in flight capability of female ALCB when exposed to lower temperatures for one week starting at 6°C.
- There is a significant difference between the impact of exposure to FTR for varying durations between sexes.
- There is a significant difference in flight capability in male ALCB.
- There does not appear to be a significant difference in flight capability of female ALCB.

Conclusion

Based on the results, we can conclude that exposure to temperatures ≤18°C reduce flight ability in male ALCB, while females do not show a significant difference until temperatures ≤6°C. We can also conclude that when using a FTR to delay emergence, there is no discernable difference in flight capability based upon exposure duration up to four weeks among females, however there is a significant decline among males.

Acknowledgements

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References

[1]Rinehart, J. P., Yocum, G. D., West, M., & Kemp, W. P. (2011). A fluctuating thermal regime improves survival of cold-mediated delayed emergence in developing Megachile rotundata (Hymenoptera: Megachilidae). Journal of economic entomology, 104(4), 1162–1166. https://doi.org/10.1603/ec11062