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PP-451 [Bee Biology]

Studying ozone pollution effects on honey bee behaviour and cognition

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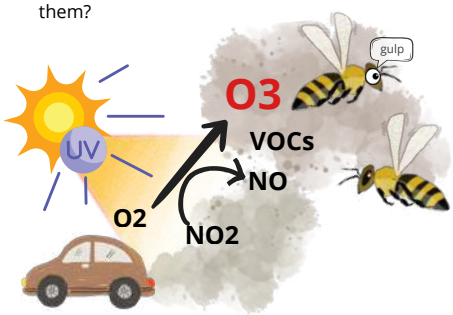
INTRODUCTION

- Cities promote projects to include native bees and urban beekeeping, but how is life in the city for them?



- Ground-level **ozone (O3)** is an air pollutant, a strong oxidant, and considered highly harmful to human health(1), but what about honey bees?

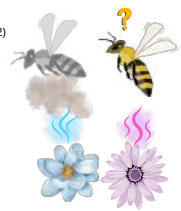
- **Foragers** and air pollution:

→ Lower foraging activity (2)

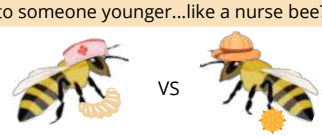
→ Scent perception changed (3)

→ Lower survivability (2)

→ Learning and memory impairments (4)



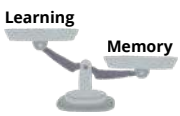
What happens to the rest of the bee hive?... to someone younger...like a nurse bee?



AIMS

1. Determine if ozone exposure impairs learning and memory in nurse bees

2. Assess which cognitive processes are the most susceptible towards ozone



METHODS

- **Discrimination learning, PER conditioning**
- **Short-term memory test**
- **Long-term memory test**

Reward association

No-Reward association

1-hr post-learning

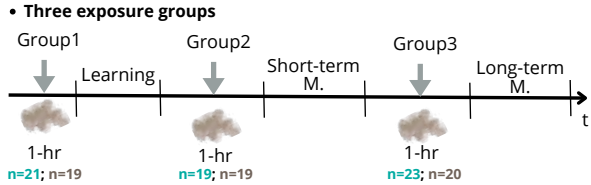
24-hr post-learning

- **Exposure to different O3 levels for 1 hour**

Control: 0 ppb

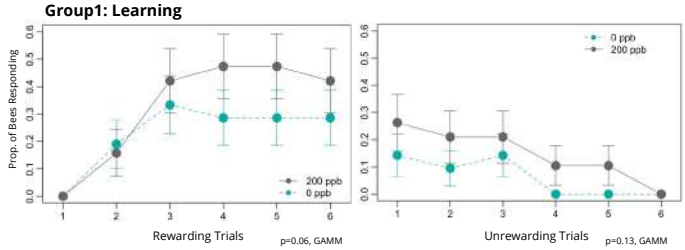
High-level treatment: 200 ppb

- **Three exposure groups**



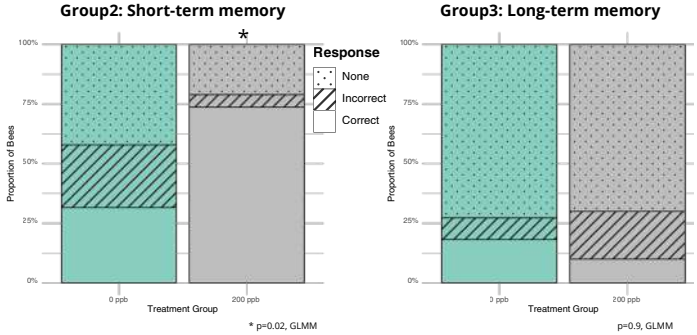
RESULTS

Group1: Learning



Group2: Short-term memory

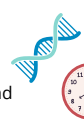
Group3: Long-term memory



CONCLUSION

- Discriminative learning and long-term memory are not changed by ozone exposure, **BUT** short-term memory appears to be significantly improved by it.

- A theory might be that **younger** bees have a **better** antioxidant system that can fight the oxidative stress effect caused by ozone, and 1 hour of exposure might not be enough to affect them.



- Future work will analyse **gene expression** for learning/memory and antioxidant genes, both for unique and **chronic exposures.**

References

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Cities around the world are growing at an accelerated rate and so is the interest in urban beekeeping and projects that allow the inclusion of native bees in these urban spaces. Nonetheless, living in an urban environment presents many challenges for bees, such as being exposed to higher air polluted levels associated to cities. Air pollutants are known to have a major effect on human health, but little is known about how it might be affecting bees.

This project aims to characterize the impact ozone, a harmful but common air pollutant in cities, has on honey bees (Apis mellifera), to provide insight for urban bee conservation projects. This project is divided on studying the effects of how different concentrations of ozone could affect bees from an individual level to the entire colony, by changing their behaviour, cognition, and gene expression.

First work was to assess cognitive effects with learning and memory tests, by using nurse honey bees and exposing them to low (0 ppb) and high (200 pb) ozone concentrations for an hour. Preliminary results suggest ozone does not influence the learning capabilities and long-term memories of nursing bees. However, contrary to expected, higher ozone levels shown an improvement in the short-term memory. Future work will compare these effects on another cast of the colony, forager honey bees, as well as brain gene expression analysis to support and understand better these results.