The Effects of Microbial Biopesticides on Honey Bees: Implications for Colony Health

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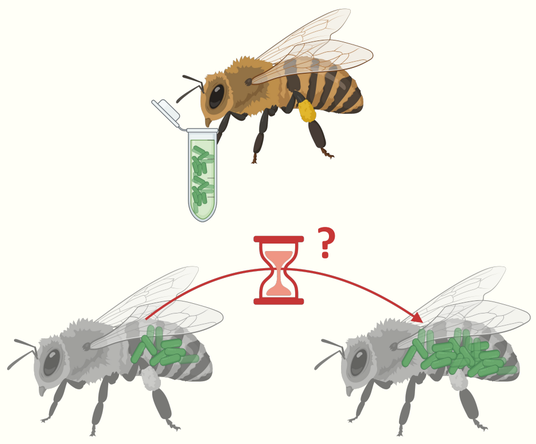
INTRODUCTION

- **Microbial biopesticides** are microorganisms used to control pests and diseases in plant protection[1, 2].
- They are often applied in the **same environment** where **honey bees** forage[1].
- Without honey bees the yield of several **nut, seed and fruit crops** would decrease by over 90%[3].
- **Formal methodology guidelines** for testing microbial biopesticides on honey bees are yet to be developed[2].

REFERENCES: [1] Erler *et al*., 2022. Impact of microorganisms and entomopathogenic nematodes used for plant protection on solitary and social bee pollinators: Host range specificity, pathogenicity, toxicity, and effects of experimental parameters. In *Environmental Pollution* (Vol. 302). **[2]** Borges *et al*., 2021. Overview of the testing and assessment of effects of microbial pesticides on bees: strengths, challenges and perspectives. In *Apidologie* (Vol. 52, Issue 6, pp. 1256–1277). **[3]** Klein *et al*., 2007. Importance of pollinators in changing landscapes for world crops. In *Proceedings of the Royal Society B: Biological Sciences* (Vol. 274, Issue 1608, pp. 303–313).

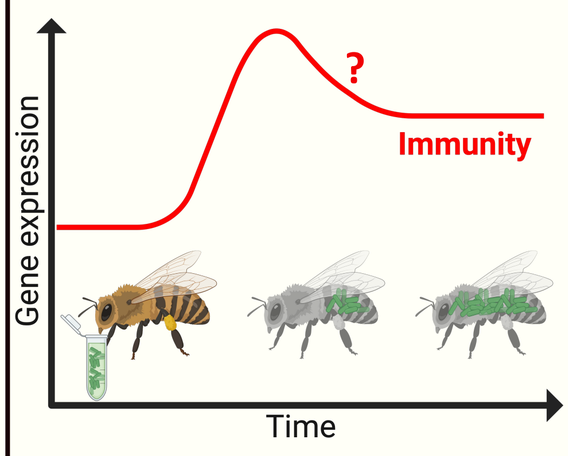
PROJECT AIMS

1 Evaluate the infective ability of microbial biopesticides in honey bees.



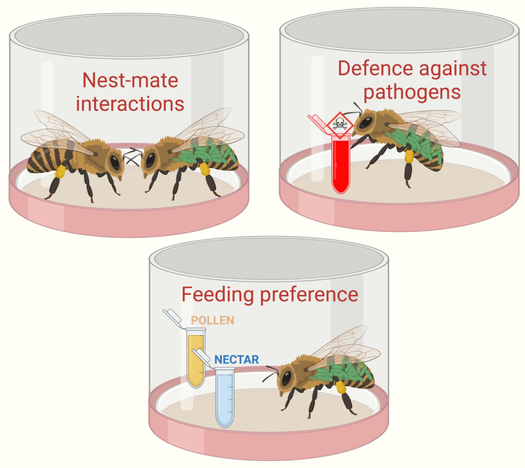
METHOD DNA quantification of the microbial biopesticides tracked by qPCR over time to establish replication within honey bee host.

2 Investigate whether microbial biopesticides activate an immune response in honey bees.



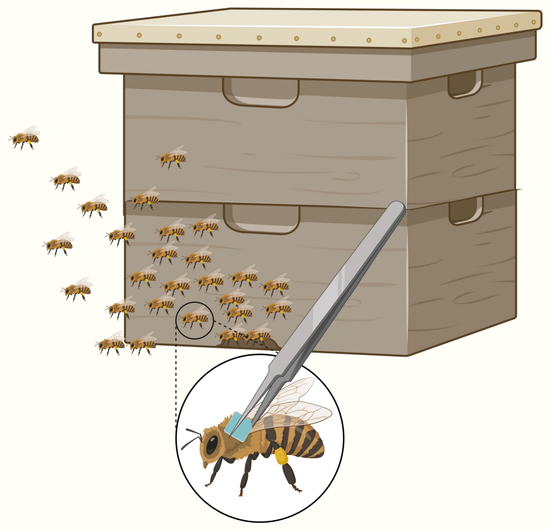
METHOD mRNA transcript quantification of markers of immune function in honey bees tracked by RT-qPCR.

3 Describe honey bee behaviour after exposure to microbial biopesticides.



METHOD Laboratory studies to determine behaviour towards infected nest-mates, feeding behaviour and defence against pathogens.

4 Assess the impact of microbial biopesticides on honey bee colonies.



METHOD Field study to investigate behavioural responses at a colony level. Use of RFID tags to monitor the activity of infected bees.

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QUESTIONS YOU MAY HAVE:

1. What are the advantages of using biopesticides over conventional chemical pesticides?

2. What are the problems with the current regulatory guidelines for testing microbial biopesticides?

3. What about other bee species and other insect pollinators?

4. Why are you looking at immune function as a response?

5. How is your project going to support the development of methodology guidelines for testing microbial biopesticides on honey bees?

PROJECT IMPACT

- Further the understanding of the **lethal and sublethal effects** of microbial biopesticides on honey bees by investigating their impact on honey bee **immune function** and associated **behavioural responses** at the individual and colony level.
- Inform regulatory agencies in designing appropriate testing guidelines for safe and **sustainable agriculture practices**, ensuring pollination services for **food security**.