Investigating the Role of Core Gut Symbionts in Defending Bumble Bees Against an Opportunistic Pathogen

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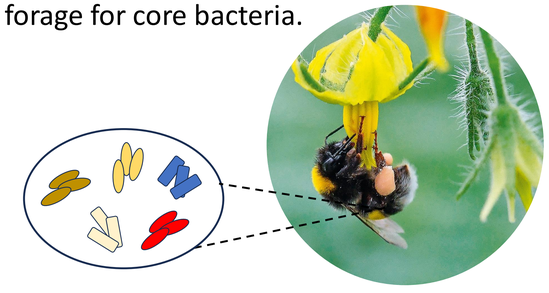
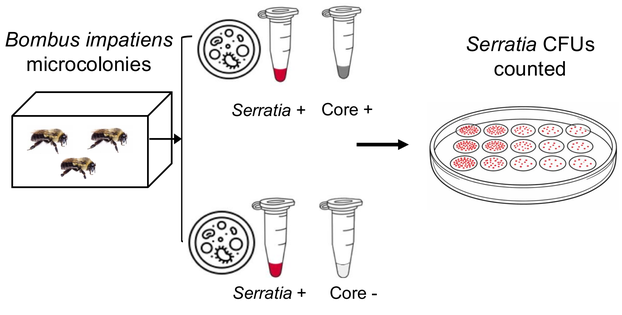
Introduction

- Global declines in bee populations have been linked to multiple factors, including disease[1].
- Bumble bees possess a core gut microbiome composed of a small number of bacterial taxa that are remarkably conserved across populations and species[2].
- The whole core microbiome plays a key role in defending bumble bees against pathogens[3]; however, the roles of individual core symbionts in contributing to this defense remain unknown.
- We tested whether two highly abundant core gut symbionts—*Gilliamella bombi* and one unidentified strain isolated from the common eastern bumble bee *(Bombus impatiens*)—provide resistance against an opportunistic pathogen (*Serratia marcescens*) and if bees preferentially forage for core bacteria.

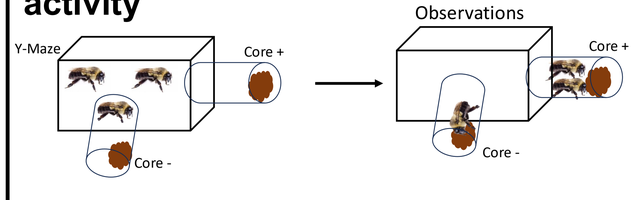


Methods

1. Core gut bacterial effects on pathogen colonization



2. Core gut bacterial effects on bee foraging activity



Results

1 Do core gut symbionts individually reduce bumble bee infection by an opportunistic pathogen?

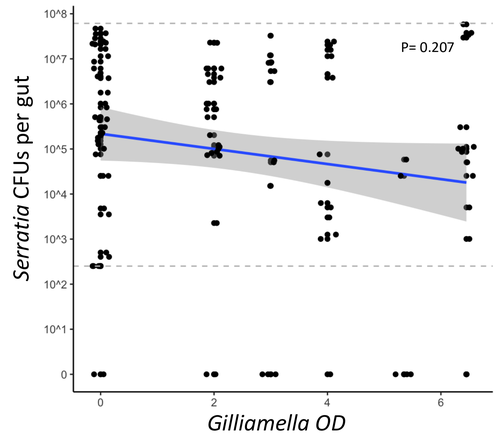


Fig. 1. *Serratia* colonization did not depend on the intensity of exposure to the core symbiont *Gilliamella bombi*.

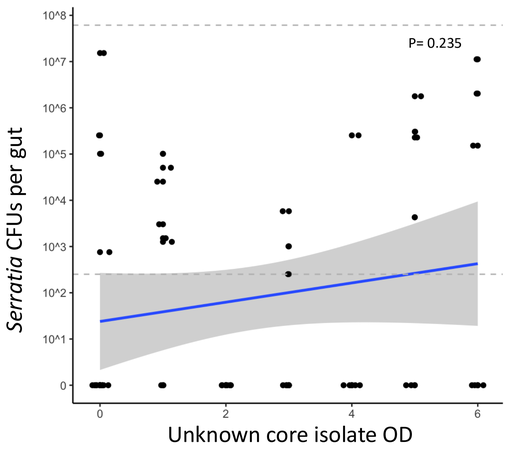


Fig. 2. *Serratia* colonization did not depend on the intensity of exposure to an unidentified core symbiont.

2 Do bumble bees preferentially forage on pollen contaminated with core gut symbionts?

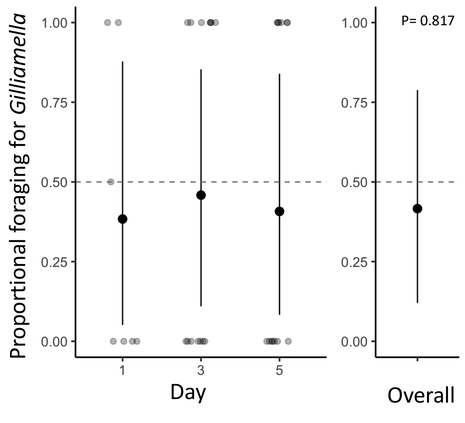


Fig. 3. No preference in foraging for *Gilliamella* treated pollen observed.

Conclusions

- Neither of the two core gut bacteria tested here defended bumble bees against infection by an opportunistic pathogen.
- Bumble bees also did not preferentially forage for pollen contaminated with core symbionts.
- These results suggest that individual core gut bacteria are insufficient to influence infection outcomes, and that any microbiome effects on pathogen resistance likely depend on interactions among multiple microbial taxa.
- The lack of selective foraging further indicates that bees are unlikely to shape their microbiome through targeted foraging for ore gut bacteria.
- Overall, microbiome-mediated effects in bumble bees appear to operate at the community level, and disruptions to microbial diversity may increase disease susceptibility and contribute to pollinator declines.

References

1. Arbetman MP, Gleiser G, Morales CL, Williams P, Aizen MA. Global decline of bumblebees is phylogenetically structured and inversely related to species range size and pathogen incidence. Proc Biol Sci. 2017
2. Hammer, T. J., E. Le, A. N. Martin, and N. A. Moran. 2021. The gut microbiota of bumblebees. Insectes Sociaux 68:287–301.
3. Nelson, A. S., Larson, M. J., & Hammer, T. J. (2025). *Journal of Animal Ecology*, 94, 985–998. DOI: 10.1111/1365-2656.70029

Acknowledgements

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