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Comparison of Gut and Leg Pollen Composition in female Halictus ligatus with Flower Source

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Introduction

It is commonly believed by bee biologists that wild bees visit one single flower species during each trip to make nest provision. However, the exact foraging behavior is not clear and may vary in different species of bees, and therefore the pollination patterns have continued to be studied. When a bee undergoes the process of pollination, the majority of the pollen consumed by the bee passes through the digestive tract and remains undigested. However, when the pollen is digested and used as an energy source, the pollen grain digestion occurs in the midgut intestine within the bee instead of the anterior or posterior intestine for food absorption[1]. In this study, we look at the pollination behavior of *Halictus ligatus* bees, by analyzing the pollen found within the gut and atop the leg, and comparing them to the pollen grain of the source flower where the bee was collected.

Methods

- The 44 specimens of *Halictus ligatus* used in this study were collected between July and August of 2018 and 2019, on 11 flower species at 5 Conservation Reserve Program locations near the University of Northern Iowa.
- The pollen from the pollen storage scopa of the rear legs of each bee was collected using a small brush, placed on a slide, and stained with fuchsin dye before evaluation under a microscope.
- In order to rehydrate the stomach content, the abdomen was removed from each bee (Figure 2) and soaked in 15 drops of one of the four rehydrating solutions–sodium hydroxide, saline, dish soap and water, before undergoing refrigeration for 24 hours.
- After 24 hours, the abdomen was dissected using tweezers under a dissection scope where the gut content (Figure 1) was removed and macerated with forceps on a slide.
- The slide was then stained with fuchsin dye and sat uncovered for 5 minutes before a coverslip was placed overtop of the dye.
- A microscope of 40x10 magnification was used to analyze the pollen grains and images of 5 random points along the long axis of the slide were taken at various depths to observe the abundance of each flowers' pollen grain within the gut of the bee.

Results

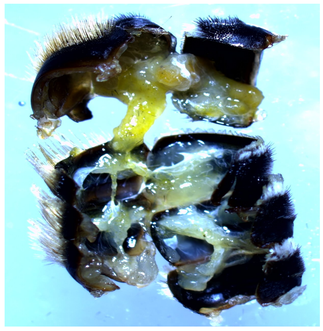


Figure 1

Figure 2

- Out of the four solutions tested (sodium hydroxide, saline, dish soap and water, and distilled water), saline presented the best results when used to rehydrate the bee abdomen for dissection purposes.
- Out of 44 bees collected, 16 specimen contained multiple types of pollen within the gut; 38/44 bees' guts contained pollen from the flower it was found on.

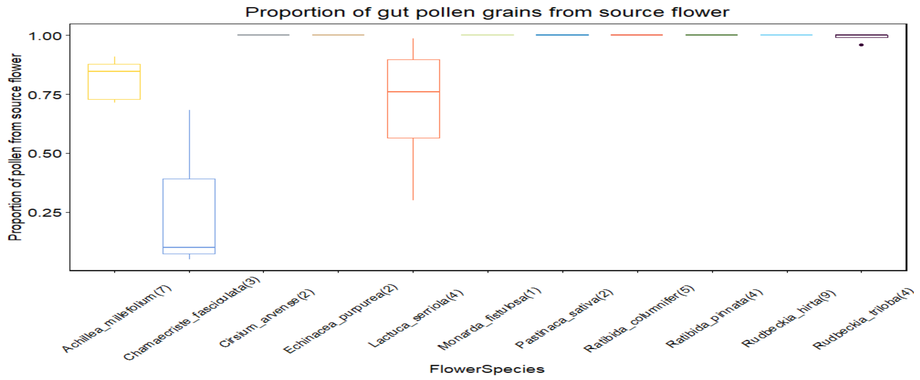


Figure 3

- *Halictus ligatus* bees caught at *Chamaecrista fasciculata* had the greatest variation in the pollen found within the gut.
- Bees collected on *Achillea millefolium*, *Chamaecrista fasciculata*, *Lactuca serriola*, and *Rudbeckia triloba* contained more than one pollen grain type within the gut.

Halictus ligatus Gut Pollen Versus Leg Pollen Comparison

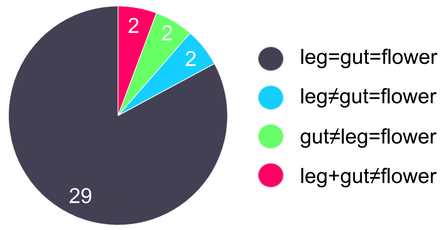
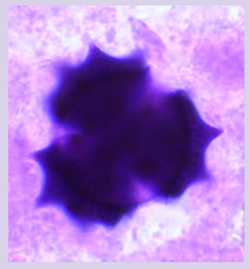


Figure 4

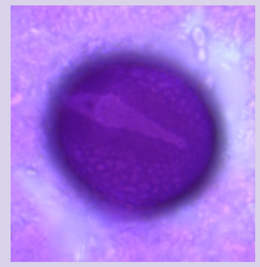
- 35/44 bees' legs contained pollen (Figure 4), where 31/35 bees' leg pollen matched the pollen contained in the gut

Conclusion

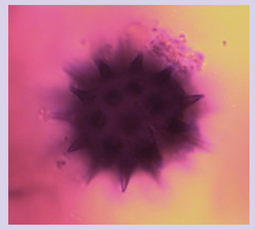
- The majority of the bees have the same type of pollen grains in their leg and gut content, which match the flower species they were collected from;
- However, some bees do show a variety of pollen grains mixed in the gut content, which may suggest bees forage from various floral sources before provision for their offspring, rather than the commonly assumed single species visit
- These gut content results showed the complexity of wild bee foraging behavior, where more study is needed.



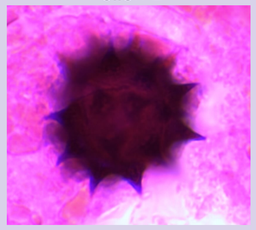
Achillea millefolium Gut Pollen 1



Achillea millefolium Gut Pollen 2



Monarda fistulosa Gut Pollen 1



Chamaecriste fasciculata Gut Pollen 1

Acknowledgements

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References

[1] Brys, Skowronek and Strachecka (2021). Insects, 12(9): 798

[2] AutPal. (n.d.). *Palynological Database*. PalDat.