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The Effect of Integrated Pest Management on Nutrition of Bee Collected Pollen

Kaitlyn Bresnahan '25
Providence College

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Kaitlyn Bresnahan, Dr. Rachael Bonoan

Biology, Providence College, Providence, RI

Introduction

Honey bees are the world's most commercially valuable pollinators (1), and they face many threats. The greatest challenge facing honey bees is *Varroa* mites, parasitic mites that feed on bees' fat bodies, killing bees and spreading diseases (1). While chemical treatments are available to stop the spread of mites, these treatments are insecticides, which are not ideal to put in a hive of insects. A popular organic method of mite management is using drone comb (Fig. 1a). Drone brood is preferentially chosen by mites for ovipositing and development because of its larger size and longer development time (Fig. 3)(2), so removing drone brood can drastically reduce mite numbers in the hive. However, forcing bees to raise drones could create nutritional stress. It is known that drone comb removal does not detrimentally affect population size (3), but it is not known if nutrition is affected by this process. My research investigates if health and nutrition change in the presence of drone comb for mite management. The results could help us understand the effects of integrated pest management, and determine what nutrients honey bees need during mite treatment.

Figure 1: a) A frame with drone brood to be removed on the bottom. **b)** Collecting pollen samples from chilled bees. **c)** Pollen pellets taken from a forager.

Materials and Methods

Data and Sample Collection

- Data were collected throughout drone development (Fig. 3).
- Pollen pellets (Fig. 1c) were collected from foragers upon return to the hive.

Sample Analysis

- Nutrition of pollen was measured as percent carbon and percent nitrogen content and determined via combustion (Elementar UNICUBE).

Results

Carbon: (Fig. 2a) Percent carbon content of bee-collected pollen significantly increased with date (ANOVA on LMM, X^2 = 9.025, df = 1, p<0.05). Hives with and without drone comb brought back pollen with similar carbon content, so treatment had no significant effect (ANOVA on LMM, X^2 = 1.3469, df = 1, p>0.05); neither did the interaction (ANOVA on LMM, X^2 = 0.7418, df = 1, p>0.05).

Nitrogen: (Fig. 2b) Hives with and without drone comb brought back pollen with similar nitrogen content (ANOVA on LMM, X^2 = 0.0623, df = 1, p>0.05). Date had no significant effect (ANOVA on LMM, X^2 = 0.1696, df = 1, p>0.05); neither did the interaction (ANOVA on LMM, X^2 = 0.4280, df = 1, p>0.05).

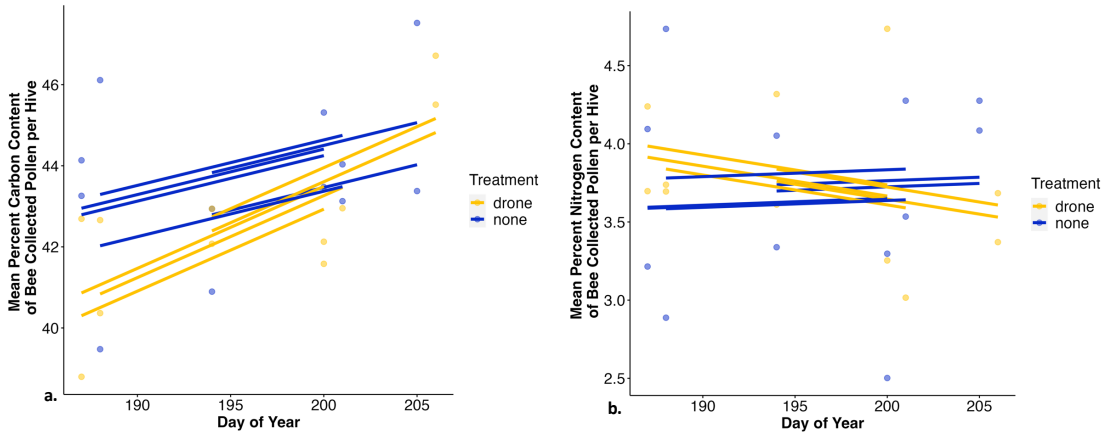

Figure 2: a) Graph showing the mean percent carbon content of bee collected pollen per hive vs. the day of year, color coded by drone treatment (n = 11) or no treatment (n = 12). **b)** Graph showing the mean percent nitrogen content of bee collected pollen per hive (n = 23) vs. the day of year, color coded by drone treatment (n = 11) or no treatment (n = 12).

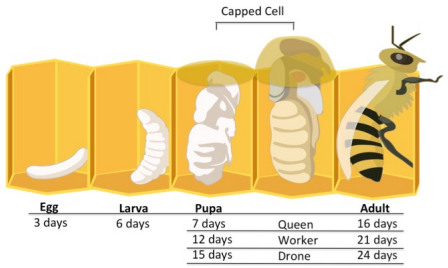

Figure 3: Diagram of honey bee development.

Conclusion

These results show that the nutrition of bee collected pollen, and therefore the nutritional needs of the hive, are not affected by the use of drone comb for mite management. However, some of these preliminary data were affected by the maintenance done by the beekeepers we worked with. Protocol will be improved by maintaining hives ourselves, and accounting for more confounding variables, such as chemically treating all hives before data collection, and determining the amount of drone comb present.

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