

Consumption of supplemental protein diets in honeybee colonies



Institut für Zoologie
Universitätsplatz 2
A-8010 Graz

Caroline Haidmayer, Robert Brodschneider,
Ulrike Riessberger-Gallé & Karl Crailsheim

- Introduction -

Honeybees need protein rich nutrition to feed larvae with synthesized jelly. Protein is obtained from pollen, the colonies' only protein source. In times of bad weather conditions or to enhance colony growth in spring, additional protein diets may be fed to honeybee colonies by beekeepers. In a choice-experiment we compared the consumption of two supplemental protein diets presented to the bees simultaneously.

- Material and methods -

Two diets (the first one made of pollen, and FeedBee, a commercial protein diet made of non-hive products, Tab.1) were prepared as 3x8 cm patties. They were placed simultaneously at the honey-store region of two 3-frame observation hives (Fig.1), each containing 6000 bees and one queen, respectively. One patty of pollen offered in the hive weighed on average 26.03 (+/- 4.43) mg and a patty of FeedBee weighed 21.89 (+/- 1.93) mg. Over a period of 5 consecutive days (4.5.-8.5.2007) every 15 minutes the number of bees present at the feeding locations, the number of bees feeding on the supplemental diets and the number of bees present at control areas (located at the backside of the comb where the supplemental diets were applied, with the same size as the patties) was recorded. Observations started at 10 am in the morning and ended at 4 pm. Every day the patties were renewed and the amount of consumed diet determined by weighing. From thus we could calculate the protein uptake per 24 hours per colony (taking into account the protein content of the patties, Tab.1) and per bee. On the days 1-3 of our experiments we applied one pollen and one FeedBee patty simultaneously. On days 4+5 of our experiments we doubled the amount of patties of each diet to investigate possible effects of the amount of applied food on consumption.

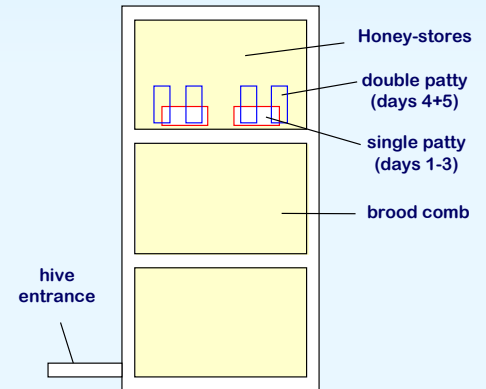


Figure 1: Experimental setup and position of the protein diets in the hive for the "single patty" (red) and for the "double patty" (blue). Pollen and FeedBee patties altered daily between left and right position.

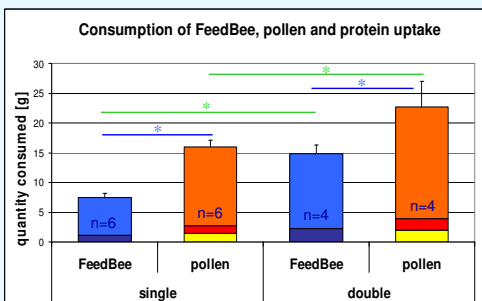


Figure 2: Average quantity consumed of FeedBee and pollen in 24 hours, for both colonies.

- Protein uptake for FeedBee
- Protein uptake for pollen (with 10% protein)
- Protein uptake for pollen (with 20% protein)

The height of the bars show the quantity of protein diet consumed. (blue lines: $p=0.0051$ for single; $p=0.0304$ for double; green lines: $p=0.0142$ for FeedBee; $p=0.0252$ for pollen, Mann-Whitney-W-Test).

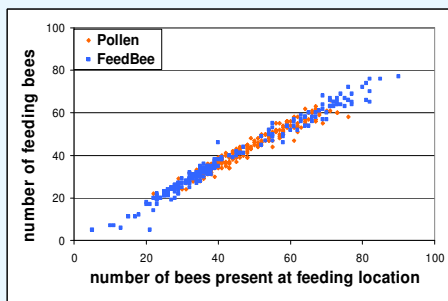


Figure 3: Correlation of the number of feeding bees and the number of bees present at the feeding location for pollen (n=222) and FeedBee (n=222) for both colonies.

	pollen patty	FeedBee patty
pollen or FeedBee	86.2	41.72
water	5.52	15.89
saccharose	8.28	42.39
protein content*	8.62/17.24	15.18

Table 1: Composition of pollen and FeedBee patties and the protein content in percent. Pure FeedBee contains 36.4% protein according to manufacturer. *The protein content of pollen was assumed to be either 10% or 20% for calculation.

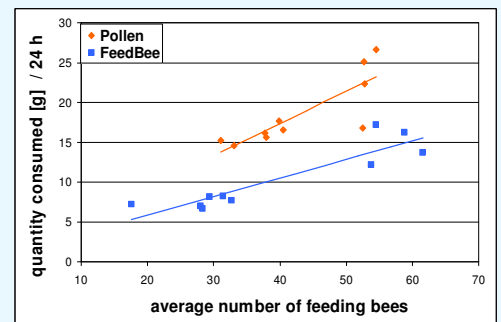


Figure 4: Correlation of the quantity consumed in 24 hours and the average number of feeding bees for pollen and FeedBee. (n=10 for pollen, n=10 for FeedBee for both colonies)

- Results -

More pollen was consumed than FeedBee (Fig.2, blue lines), independent of the amount of food applied. When the amount of food was doubled the consumption was also higher, for both, pollen and FeedBee (Fig.2, green lines). When assuming the protein content of pollen to be 10%, the protein uptake of feedbee and pollen is equal. When pollen is taken into account having a protein content of 20% protein uptake is higher for the pollen patty. Since pollen and feedbee diets were simultaneously applied in the same colonies, with about 6000 bees, we can estimate an average protein uptake of 0.189 mg per bee and 24 hours for FeedBee and of 0.229 mg for pollen (assuming 10% protein content) on the days 1-3. For the last two days we can estimate an average uptake of 0.375 mg protein for FeedBee and 0.326 mg protein for pollen.

For both diets, pollen and FeedBee, we found that more bees were feeding at the patties when a higher number of bees was present at the feeding location ($R^2=0.9465$ for pollen; $R^2=0.9783$, Fig.3).

For both diets, pollen and FeedBee, the number of feeding bees reflects the amount of consumed food (Fig.4).

- Conclusion -

Both protein diets are well accepted by honeybees. When more diet is fed, consumption is higher because more bees have access to it. Pollen is preferably consumed when applied simultaneously with feedbee, but taking into account the higher protein contents of processed diets, the protein uptake is similar for both diets.