

The Fate of Artificial Food given to a Honeybee Colony

U. Riessberger-Gallé, J. Vollmann, K. Crailsheim



Institut für Zoologie, Karl-Franzens-Universität-Graz, Universitätsplatz 2, A-8010 Graz, Austria

Introduction

An additional offering of artificial food sometimes containing protein to honeybee colonies is popular to ensure a better and faster colony development during spring.

Materials and Methods

Investigations were carried out in the summer of 2006, using two three-frame observation hives with about 5000 bees each. Individually marked bees emerged in an incubator were introduced every second day. Feeding dishes were installed in the middle of the honey stores or in the middle of the brood nest. Each dish could hold about 30g of food, containing powdered sugar (89.5%), yeast (4.5%) and a suspension of indigocarmin (a blue dye from Merck) in water (6%). Three trials per colony were performed, dishes were placed alternatively in the honey stores or in the brood nest. After four hours the observation hives were opened and about 20 bees of each labelled age cohort were sampled randomly and frozen. Later honey crops and midguts were dissected, homogenised in H₂O, acetonitril was added, and after centrifugation the supernatant was measured photometrical at 600 nm (Fig. 1 and 2).

The age of bees feeding on an artificial food pellet was recorded. Attractiveness of food located in the brood nest or honey stores was compared (Fig.3).

After 24 hours combs were photographed and investigated for blue colour (Photo).

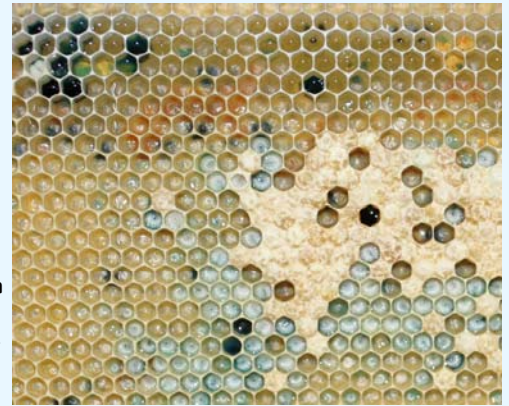


Photo: After 24 hours blue colour was found in brood cells, honey cells and even in pollen cells.

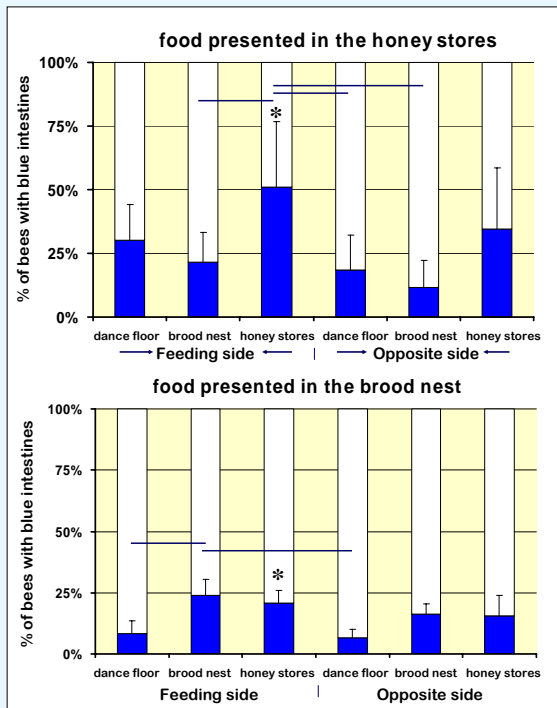


Fig. 1.: Proportion of bees (all ages) with blue colour in their intestines (blue columns) in different areas of the hive (honey stores; brood nest; dance floor), on both sides of the observation hive. Comparison of distribution of artificial food presented in the honey stores, n=1057, and in the brood nest, n=797. All bees collected at the dance floor, brood nest or honey stores represent 100%. Means and standard deviations of three trials are given. Lines indicate significant differences between hive areas, asterisks indicate significant differences between treatments (T-test; p<0.05).

Feeding area	Colony/ trail	n	% of bees with blue intestines	amount of food consumed in 4 h [g]
honey stores	C1/1	305	26,6	-
honey stores	C1/2	395	21,5	13,29
honey stores	C2/1	357	32,5	14,19
brood nest	C1/3	332	16,9	16,25
brood nest	C2/2	211	15,6	19,09
brood nest	C2/3	254	15	11,06

Fig. 2: Absolute numbers of samples taken after 4 hours (n) per colony, percent of bees with blue coloured food in their honey crop or midgut (T-test, p=0.069) and amount of artificial food consumed by the bees within 4 hours (T-test p= 0.54).

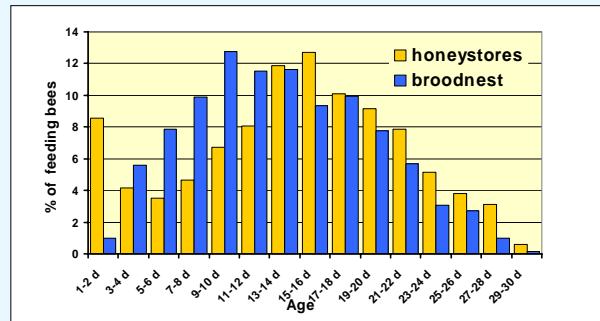


Fig. 3.: Comparison of number of bees and their ages feeding on the artificial food pellet located in the brood nest or honey stores. Number of recorded bees give 100% (n=1029 for food located in the honey stores; n=1425 for food located in the brood nest). Counts were carried out during days (11:00 – 16:00) and during nights (23:00-24:00). Median ages between bees observed during days and nights never differed (data not shown). Median ages of bees feeding in the brood nest were significantly lower than those of bees feeding in the honey stores. The high number of 1d old bees at the honey stores was caused by the introduction of individually marked freshly emerged bees via the hive top.

Results and Discussion

Differences in the distribution of the blue colour within the bees of a colony were found regarding the feeding area. Significantly more bees were found with blue intestines on the honey stores when the artificial food was presented in the middle of the honey stores. But regardless to the feeding area about the same proportion of bees in the brood nest area consume the artificial diet either itself or via trophallaxis (Fig. 1). These findings should be kept in mind as feeding in the honey store area is a common tradition in beekeeping. If additional food is not utilised by the bee itself it is stored in cells and therefore could be detected again in all areas of the colony (Photo). Investigating the combs after 24h a wide distribution of the blue colour within a colony resulting in coloured larvae, honey cells and even pollen cells could be detected (Photo). No strong differences could be found among the amount of food consumed by the bees (Fig. 2) or between the ages of bees consuming in different areas (Fig. 3).

Beekeepers should become aware of the fact that using any kind of artificial food will have an impact on the quality of honey or bees they produce.

Acknowledgements: We acknowledge the support of R. Brodschneider.