

Nourishing the Hive: The Interplay of Nutrition, Gene Expression, and Queen Egg-Laying in Honeybee Colonies

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Abstract : Honeybee population sustainability is a critical concern for environmental stability and human food security. The success of a colony relies heavily on the egg-laying capacity of the queen, as it determines the production of thousands of worker bees who, in turn, perform essential functions in foraging and transforming food to make it digestible for the colony. The main sources of nutrition for honeybees are nectar, providing carbohydrates, and pollen, providing protein. This study delves into the impact of the proportion of these macronutrients on the food consumption patterns of nurse bees responsible for feeding the queen and how it affects the characteristics of the eggs produced. Using nutritional geometry, qRT-PCR, and RNA-seq analysis, this study sheds light on the pivotal role of nutrition in influencing gene expression in nurse bees, honeybee queen egg-laying capacity and embryonic development. Interestingly, while nutrition is crucial, the queen's genotype plays an even more significant role in this complex relationship, highlighting the importance of genotype-by-environment interactions. Understanding the interplay between genotype and nutrition is key to optimizing beekeeping management and strategic queen breeding practices. The findings from this study have significant implications for beekeeping practices, emphasizing the need for an appropriate nutrition to support the social nutrition of *Apis mellifera*. Implementing these insights can lead to improved colony health, increased productivity, and sustainable honeybee conservation efforts.

Keywords : honeybee, egg-laying, nutrition, transcriptomics

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