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Body Protein Reserve and Possibilities for improvement in Honey Bee Colonies - Review

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Abstract: *The purpose of this review is to assess the body's protein reserve in honey bee colonies and the possibilities for improving it. Understanding the causes of changes in body proteinis is important for the beekeeping sector in order to improve bioproductive indices and ensure the health of bees.*

• Introduction

The body's protein reserves of bees are located in the fat body, hypopharyngeal glands and plasma proteins (vitellogenin). Its active role has been proven in the following aspects: the secretion of larval food (royal jelly), longevity, metamorphosis, the evolutionand behavior of adults, immunity and detoxification of bees. Body protein values ranges from 21 to 67% of the dry matter. The values considered physiologically normal are over 40%. The factors that reduce the protein content are the quantity and quality of protein feed, overuse (enzymatic, immune, toxic or various diseases).

• Material and method

The data presented in this review were collected from the scientific papers studied.

• Results and discussions

Body protein values ranges from 21 to 67% of the dry matter. The values considered physiologically normal are over 40%. The factors that reduce the protein content are: the quantity and quality of protein feed, overuse (enzymatic, immune, toxic or various diseases). Body protein deficient determines the bees to fly at a youngerage; also, they become rapidly collecting bees and their longevity is shortened. Research has established the ideal protein for bees, which is close in value to the proportion of aminoacids in royal jelly. Pollen as a source of protein for bees was classified as follows: poor quality below 20% CP (crude protein), average quality between 20-25% CP (supports the development and health of bees) and high quality with over 25% CP (can protect bees from wear of if there is an abundant harvest of nectar or in case of abundant feeding on sugar). In the situation of starvation and during diseases that reduce the protein reserve (varroa, viruses, nosemosis), the bees become prematurely collecting bees, without completely or not at all completing the stage of nursing, starting at the age of 7 days, which added up to the 8-12 days that they still has to live after they become collecting bees reveals a shorter lifespan than a complete development cycle of the young bees (21 days) and thus, a tendency to depopulate the colony. The fact that protein deficiency is inherited from one generation to the other, while the restoration of the body's protein reserve usually takes more than a generation, is also confirmed by a team of US researchers who observed that bees that were raised during their larval stage in families with limited access to pollen has much diminished performance in harvesting, orientation, searching for feed resources and reduced longevity, compared to those who benefited during larval stage of pollen abundance, which were longer lived and longer efficient in activities. The quality of pollen protein is given by the presence of essential aminoacids.

No deficiencies of essential aminoacids are reported in pollen produced by species of the family *Rosaceae*, *Phacelia spp.*, *Echium spp.*, nor in most species of the families *Brasicaceae* and *Fabaceae*. It is noted that the plants produce pollen with a low content of protein and essential aminoacids in summer and autumn.

There are several species of plants that secrete a large amount of nectar, but the quality of pollen is poor. Pollen varieties that fall into this category are: *Eucalyptus spp.*, *Fagopyrum esculentum*, *Lavandula spp.*, *Medicago sativa*, *Lavandula spp.*, *Compositae* family and even *Robinia pseudoacacia*.

Castanea sativa pollen protein is characterized by a good ratio of essential amino acids, according to the concept of ideal protein for bees and also by a good proportion of essential amino acids in the structure of the protein.

Some studies show that in temperate areas, spring pollen is medium and high quality (over 20% PB), but during summer and autumn, pollen quality tends to decline over many years to levels between 13.88 and 15.09% PB. This is also doubled by the reduction of the abundance and diversity of spontaneous flora, being replaced by large areas of agricultural crops whose pollen is of lower quality during the summer (*Helianthus anuus*, *Zea mays*, *Sorghum bicolor*, *Fagopyrum esculentum*, *Lavandula angustifolia*).

The attractiveness of pollen is not always related to its nutritional value, but to the proportion of certain substances that are attractive to bees, both for nursing and collecting bees. It is also known that the nurse bees do not communicate with the collecting bee's data regarding pollen. Nurse bees prefer to consume fresh pollen within 1 to maximum 4 days of harvest and avoid pasture consumption.

During an abundant harvest of nectar (or feeding with large amounts of sucrose), even a pollen with more than 30% PB may be insufficient to maintain health, body protein, development, conditions in which the simultaneous intake of quality pollen is beneficial, or it is recommended to combine carbohydrate feed with supplemental protein feed.

The deficiency of pollen protein quality can sometimes be compensated by increasing consumption if the population of the colony is sufficiently abundant (nurses, collecting bees). The accumulation of body proteins increases during the periods when the colony has more nurses and fewer larvae. In order to benefit from a colony, it is necessary for it to have more than 50,000 adult bees. Bee colonies are strengthened by access to good quality pollen or by supplemental feeding with protein feed, administered at least four weeks before harvest, but also for winter preparation.

• Conclusions

In conclusion, it is necessary to supplement the bee families with protein feed in order to ensure the body protein reserve according to the requirements.