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QUALITY OF POLLEN AND HONEY BEE BREAD COLLECTED IN SPRING

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Abstract

Pollen is the only source of protein in the honey bee colonies and it is very important for the development of brood, and consequently, for the development of the colony. Pollen and honey bee bread, collected by honey bees, represent a significant source of protein for human consumption. Honey bee bread is the pollen which the bees collected from flowers and stored in honeycomb cells. Unlike pollen, which is obtained from the pollen collectors, honey bee bread, in cells of the comb, passes through the fermentation process and under the influence of enzymes; one of the most valuable honey bee products is formed. It is extremely important both for the honey bee colonies, and for the human usage in apitherapy.

For this study, ten honey bee colonies were selected. Pollen was sampled from the pollen collectors, and honey bee bread was sampled from the combs. The quality of pollen and honey bee bread was determined by the chemical composition, using standard methods used in food analysis. Total nitrogen was determined by Kjeldahl method. Micro- and macroelements were determined by spectrophotometric method.

Key words: *Pollen, honey bee bread, nitrogen, microelements, macroelements*.

1. Introduction

Considering the honey bee nutrition, for the development of strong and healthy colonies, honey bees require similar nutrients as human. The need for carbohydrates is fully met by the consumption of honey, but other nutrients (primarily proteins, minerals, vitamins, etc.) are far less present in honey, and the need for these is met by the consumption of the pollen (Adekanmbi and Ogundipe [1]).

Pollen is a fine to coarse powder containing the microgametophytes of seed plants. Pollen grains have a hard membrane that protects the sperm cells during their movement between the stamens to the pistil of flowering plants or from the male cone to the female cone of coniferous plants. Various plants are pollinated by various ways (by wind, by insects, etc.). When pollen lands on a compatible pistil of flowering plants, it germinates and produces a pollen tube that transfers the sperm to the ovule of a receptive ovary (Taranov [2]). Pollen is very rich in protein, which serves as material for tissue growth and tissue regeneration (Kulinčević [3]).

The amount of protein ranges greatly, depending of the plant species. Considering chemical composition, besides protein, pollen also includes: free amino-acids, lipids, carbohydrates (sugars, starch and cellulose), minerals (Ca, Mg, P, Fe, Na, K, Al, Mn, S, Cu, etc.), vitamins (pantothenic and ascorbic acid, vitamins of B complex, etc.), various enzymes and coenzymes, etc. For the honey bees, it is the best if they have access to pollen derived from different plants, because balanced nutrition is of key significance for the development of honey bee colony (Kulinčević [3]).

Forager honey bees collect pollen on their hind legs, pack it together with saliva and nectar and bring it to the hive. There, that pollen is stored into the cells of honeycombs.

Pollen and bee bread differ biochemically. For example, bee bread contains more reducing sugars than pollen from the same plant species (Casteel [4]). Also, bee bread contains vitamin K (Haydak and Vivino [5]) and a milk-digesting enzyme (Hitchcock [6]); pollen collected from the legs of foraging bees does not. Avetisian [7] found that bee bread made from birch pollen contained six times as much lactic acid as hand-collected birch pollen. The conversion of pollen to bee bread and the accompanying biochemical changes have often been postulated to be the result of microbial action, principally a lactic acid fermentation caused by bacteria and yeasts (Foote [8], Haydak [9]).

Recently, pollen is becoming one of most sough nutrition products for human nutrition due to its rich protein content and high levels of micro- and macroelements, vitamins and other essential elements required in human diet.

2. Materials and Methods

The aim of this paper was to determine the differences between pollen collected by honey bees and honey bee bread. The experiment was conducted in April.

Pollen and bee bread was sampled from the honey bee colonies of the Institute for forage crops Kruševac. Pollen was sampled using pollen collectors mounted onto honey bee colonies. Bee bread was sampled directly from the honeycomb.

The proximate composition of the pollen was determined by using standard methods of food analysis (Roma *et al*. [10]). Ash content was measured in pollen samples that were heated in a muffle furnace at 600 °C until a uniform gray-white ash remained. The samples were then used for the subsequent determination of macro- and microelements by using atomic absorption spectrophotometry (AAS-Perkin Elmer 1100 B USA). Total nitrogen in the samples was determined by micro-Kjeldahl method.

3. Results and Discussion

By chemical analyses, it was determined that there are chemical differences between pollen and honey bee bread.

The content of crude ash was increased in honey bee bread for 7.54% when compared to pollen. Also, the content of crude protein was increased in bee bread for 19.91%, as were the content of NEM (non-nitrogen extractive matter) for 0.73% and the content of crude fat for 4.47%. The only parameter that showed decrease in the process of transformation of pollen into bee bread was crude cellulose, which in bee bread decreased for 40.90% (Tables 1 and 2).

Table 1. Chemical composition of pollen

Component	Average	SD
Crude ash (%)	2.82	0.0960
Crude protein (%)	23.97	0.0884
Crude cellulose (%)	3.72	1.6988
Crude fat (%)	4.70	0.2759
NEM(%)	64.78	1.7234

Table 2. Chemical composition of bee bread

Component	Average	SD
Crude ash (%)	3.05	0.2329
Crude protein (%)	29.93	8.5807
Crude cellulose (%)	2.64	0.8701
Crude fat (%)	4.92	0.6975
NEM (%)	65.26	3.0353

The differences were also determined for the mineral composition of pollen and honey bee bread (Tables 3 and 4).

Table 3. Mineral composition of pollen

Mineral	Average	SD
Ca (%)	0.33	0.1889
P (%)	0.61	0.0179
K (%)	0.65	0.0262
Mg (%)	0.24	0.0244
Fe (mg/kg)	104.25	6.7285
Zn (mg/kg)	50.45	1.6162
Mn (mg/kg)	100.77	3.6677

Table 4. Mineral composition of bee bread

Mineral	Mineral	Mineral
Ca (%)	0.65	0.1774
P (%)	0.65	0.0332
K (%)	0.74	0.0492
Mg (%)	0.27	0.0250
Fe (mg/kg)	121.99	31.8625
Zn (mg/kg)	44.09	3.8639
Mn (mg/kg)	29.92	0.6006

The content of calcium, phosphorus, potassium and manganese was increased in the bee bread when compared to the pollen. The increase was 49.23% for Ca, 6.15% for P, 12.16% for K and 11.11% for Mg. The amount of iron was, also, increased in bee bread for 14.54%. However, both zinc and manganese showed decrease in bee bread when compared to pollen (14.42% and 236.7%, respectively).

These differences can be explained by the addition of other matter; such are honey and honey bee secretions, and the activity of microorganisms in the process of transformation of pollen into honey bee bread (Foote [8]; Haydak [9]).

4. Conclusions

- The aim of this study was to determine the changes in the chemical composition between pollen collected by honey bees and honey bee bread. It was found that most of studied matter has increased levels in honey bee bread when compared with pollen.
- These changes in the chemical composition can be explained by the various chemical processes that occur during the transformation of pollen into honey bee bread.

5. References

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