

# **Micro- and Macroelements Content in Soil, Plants Nectar-Pollenifer Leaves, Pollen and Bees Body**

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## **Abstract**

Taking into account the fact that quality and biological value of bee products depend on the chemical composition and taking account of the environmental situation, studying the content and dynamics of micro-, macro elements composition of soil, plant, bee products and bee body have theoretical and practical interest. Our research was conducted to determine the micro-and macro elements content in soil composition, nectar-pollen plant leaves, pollen, bee bread and body. Content of micro- and macro elements were determined by atomic spectroscopy method in the laboratory of the Institute of Atomic Spectroscopy Chemistry of the ASM. It was established that the soil composition is containing 5434,69 mg/kg micronutrients in nectar-pollen plant leaves - 319,3 mg/kg, pollen - 179,04 mg/kg, pasture - 152,7 mg/kg, honey - 5,01 mg/kg and the bee body - 103,76 mg/kg. It was revealed that the total quantity of studied macro elements in soil was 6230,1 mg/kg, nectar-pollen plant leaves - 54409,9 mg/kg, pollen - 13772,74 mg/kg, pasture - 9311,2 mg/kg in bee body - 24234,2 mg/kg.

**Keywords:** bee, honey, micro-, microelements, pollen.

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## **1. Introduction**

Beekeeping plays an important role in Moldovan agriculture, given that bees provide people with products such as honey, wax, pollen, bee bread, propolis, etc. Because of significant content of biologically active substances with therapeutic qualities, people successfully are using products as raw material, in pharmaceuticals and cosmetics. Honey bees also are participating in pollinate crops, as the result is the significantly increasing the quantity and quality of seeds and fruits.

Getting quality goods production depends largely on the conditions of maintenance of bee families, treatments applied, election precincts and the location of hives, feeding bees, bee products harvest technology, storage and packaging, and environmental quality.

Кулаков В.Н., Русакова Т.М. [3] have noted that environmental pollution by dumping of industrial and hazardous substances of auto transports, port itself toxic pollution danger of beekeeping products. Collecting nectar and pollen from plants

attacked by these factors, bees are a source of pollution of beekeeping products.

The results of research scientists' Осинцова Л.А., Чекрыга Г.П., Соловьева О.В. [4] showed that the presence of dark green pollen, yellow and beige shaded are increasing the accumulation in the product of lead, yellow pollen- copper, the brown colour of pollen- copper and zinc.

Over several years have carried out research in the field studding the chemical composition of bee products [1]. It was established that the total amount of micro-nutrients in studied bee products varied between 1,53 mg/kg (honey) and 89,49 mg/kg (propolis) [2].

Bees can give information on environmental quality, or about its status at any time, even if it normally requires a very large number of interacting factors.

Since quality and biological value of bee products depend on the chemical composition and taking into account environmental conditions, the study of micro-and macro elements composition of soil, plant, bee products and bee body has theoretical and practical interest.

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Our research was conducted to determine the content of micro-, macro elements in soil composition, nectar-pollen plant leaves, pollen, bee bread and body.

## **2. Materials and methods**

To achieve the set aim, as the object of investigations have served the families of bees from the apiary experimental didactic faculty of Animal Husbandry and Biotechnology, State Agrarian University of Moldova and useful resources of nectar-pollen of the flight range of bees.

During the year, have been taking samples of bee pollen, bee bread, honey, plant leaves and soil nectar-pollen for determination of micro and macro elements.

Content of micro and macro elements were determined by atomic spectroscopy method in the laboratory Spectroscopy Atomic Institute of Chemistry of the ASM. Data obtained were processed by statistical variation method, using computer programs Microsoft Office (Microsoft Excel).

## **3. Results and discussion**

Micro elements quantity and quality varies depending on the characteristics of the area and land-based plant species visited by bees. Biological activity of many trace elements is related to the fact that they act synergistically with enzymes and vitamins. Respiratory enzymes in covering iron, zinc in the composition of yeasts, participating in the metabolism of carbohydrates and protein.

Analyzing the content of the samples studied micro-elements in soil can indicate that a major amount was detected 90,4% of total iron and manganese - 8,78%. Content of chromium, cobalt, zinc is 0,10-0,32% of the total. In nectar-pollen plant leaves iron is 200,2 mg/kg or 62,7% of the total micro-nutrients and manganese respectively - 59,8 mg/kg or 18,73% (table 1). All along in leaves increased the share of zinc - 9,58%, copper - 8,14% cobalt - chromium and 0,69% - 0,16%. In pollen and bee bread the iron content was reduced to 1,89 and 2,16 times to leaves copper respectively - 2,02 and 2,48 times, and zinc increased by 1,24 and 1,10 times. Of the total quantity of studied microelements in bees body

the highest weight has iron - 52,79%, zinc - 30,09%, copper - 10,4%, manganese - 4,9%, chromium and cobalt - 0,91%.

The total amount of micro-elements in the soil is dry mass - 5434,69 mg/kg in nectar-pollen plant leaves - 319,3 mg/kg in pollen - 179,04, pasture 152,7 mg/kg, in bees body - 103,76 mg/kg.

The largest amount of macro elements has been found on nectar-pollen plant leaves - 54090,6 mg/kg, in soil - 6230,1 mg/kg, in pollen - 13593,7 mg/kg and 9311,2 mg/kg in pasture (table 2). In the dry body mass of bees have been identified 24453,99 mg/kg of macro elements. The percentage of ash in the soil is - 91,3% in plant leaves - 12,2%, in the pollen and bee bread 2,10-2,44% and in the body of bees - 2,48%.

The highest weight of studied macro elements in the soil has a calcium - 82,98% of the total amount, potassium concerned - 13,32% and phosphate - 3,05%. To a lesser quantity is contained magnesium 2,9 mg/kg or 0,05% sodium and 37,2 mg/kg or 0,6%.

The nectar-pollen plant leaves amount of calcium is 61,56%, magnesium - 10,81%, potassium-22,37%, phosphate - 5,14% and sodium - 0,12%. In pollen and bee bread the total quantity of macro elements was reduced 16,0 and 20,8 times compared with their content in leaves. Weight of calcium is 15,3 and 17,47%, potassium - 36,03 and 36,91%, phosphates - 41,1 and 37,66%. Magnesium it is 7,24 and 7,23% and sodium - 0,33 and 0,73% of the total.

The most quantity of bees body weight is phosphates - potassium and 60,38% - 31,77%, and calcium, sodium and magnesium respectively - 1,88, 2,84 and 3,13%.

In honey bees have been detected averaged 5,01 mg/kg microelements, with variation between 3,30-7,03 mg/kg and 324,91 mg/kg, macro elements (169,69-492,45 mg/kg).

It was revealed that bee products are rich in macro elements, the maximum quantity of calcium (2079,6 mg/kg) and magnesium (983,2 mg/kg) is contained in the pollen, and potassium (7699,15 mg/kg), sodium (687,3 mg/kg) and phosphates (14633,35 mg/kg) – in the body of bees.

To ensure success in obtaining organic products require the use of integrated technologies that do not affect in any food chain soil - plant - bee - bee product.

**Table 1.** Microelements quantity in the soil, nectar-pollen plant leaves, pollen, bee bread and honey bees body, mg/kg\*

Elements	Soil	Nectar-pollen leaves plants	Pollen	Bee bread	Bees body
Manganese	477,0	59,8	20,92	14,2	10,77
Chromium (Cr)	5,65	0,5	0,64	0,5	2,0
Cobalt (Co)	6,24	2,2	1,0	1,0	2,0
Zinc (Zn)	17,2	30,6	37,82	33,8	66,13
Copper (Cu)	15,6	26,0	12,86	10,5	22,86
Iron (Fe)	4913	200,2	105,8	92,7	116,03
<b>Microelements' quantity</b>	<b>5434,69</b>	<b>319,3</b>	<b>179,04</b>	<b>152,7</b>	<b>103,76</b>

\*Samples collected were dried at T-65<sup>0</sup>C

**Table 2.** Quantity of macro elements in soil, nectar-pollen plant leaves, pollen, bee bread and honey bees body, mg/kg\*

Elements	Soil	Nectar-pollen leaves plants	Pollen	Bee bread	Bees body
Calcium (Ca <sup>2+</sup> )	5170	33300	2079,6	1600	455
Magnesium (Mg <sup>2+</sup> )	2,90	5846,5	983,2	662,1	759,4
Potassium (K <sup>+</sup> )	830	12100	4898,0	3380	7699,15
Sodium (Na <sup>+</sup> )	37,2	64,1	45,3	66,4	687,3
Phosphates (P <sub>2</sub> O <sub>5</sub> )	190	2780	5587,6	3450	14633,35
<b>Quantity of macro elements</b>	<b>6230,1</b>	<b>54090,6</b>	<b>13593,7</b>	<b>9158,5</b>	<b>24234,2</b>
Dry matter, %	91,3	12,2	2,44	2,10	2,48

\* Samples collected were dried at T-65<sup>0</sup>C

Can the organic honey produced by bees participation in picking the plants that were applied treatments with pesticides or other chemical treatments, plants or soil, etc. All along, the main conditions for obtaining a pure bee products is searching for their production of organic hazardous.

Therefore, the amount of micro-, macro elements in the body of worker bees, and bee products is identical and largely depends on its origin.

#### 4. Conclusions

1. It was established that the soil composition containing 5434,69 mg/kg micro elements in plant nectar - pollen leaves - 319,3 mg/kg, pollen - 179,04 mg/kg, pasture - 152,7 mg/kg, honey - 5,01 mg/kg and the body of the bee - 103,76 mg/kg.

2. It was revealed that the total studied macro elements quantity in soil is 6230,1 mg/kg, plant nectar – pollen leaves - 54409,9 mg/kg, pollen - 13772,74 mg/kg, pasture - 9311,2 mg/kg, honey -

324,91 mg / kg and the body of bees - 24234,2 mg/kg.

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