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RESEARCH ON THE QUALITY OF HONEY AND POLLEN OBTAINED DURING THE BEEKEEP FROM BOIAN VILLAGE SIBIU COUNTY, ROMANIA, IN VIEW OF THE ECOLOGICAL CERTIFICATION OF BEEKEEPING PRODUCTS

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Abstract

The present paper aimed to perform instrumental analyzes on actual hive products: six varieties of honey and three varieties of pollen, extracted from the apiary in the village of Boian, Bazna commune, Sibiu county, in order to certify them as organic products. The hive consists of 130 bee families, the form of beekeeping is stationary and pastoral. The type of crates is 90% of the vertical Dadant type, and the remaining 10% of the horizontal Dadant type. Bee families benefit from adequate microclimate conditions and care. The geographical factors and the honey base in the village of Boian, but also the pastoral movement make possible the good functioning of the apiary and to obtain important incomes following the beekeeping activity. In order to ecologically certify the bee farm, the following conditions are met: the apiary is well organized and has been operating for 25 years and can be reconverted from conventional apiary to organic apiary, there is an ecological honey base in the areas where the harvest is done, environmental conditions are optimal in the village of Boian, and the bees benefit from organic hives and quality ecological food in winter.

Key words**:** *pollen, honey, quality, product certification*

INTRODUCTION

Honey is a sugary substance that bees produce by collecting floral nectar using the invertine in their goiter [6]. The resulting product is deposited in honeycombs, where the process of transformation into continuous honey, resulting it as a natural product being in a permanent evolution [12,13,14].

Romania produces an average of 22,000 tons of honey annually, ranking us as the fourth country in Europe. Nationally, about 40,000 beekeepers are registered, with a population of 900,000 bee families [1].

The latest data shows that Romania is importing between 3,000 and 6,000 tons of honey annually, having almost 30-35% of domestic consumption. Honey consumption per capita is between 800-900 g of honey, thus being among the last countries in Europe [1].

The Hașu Boron apiary is located in Bazna commune, Boian village (Photo 1) and was founded in 1993, with 30 multi-storey Dadant hives. In 2020, it reached a total of 130 Dadant type hives and horizontal boxes. The form of hives is also stationary 50 hives and pastoral with 80 hives. The exploited bee is *Apis carpatina*, with a native queen from the Romanian Beekeepers Association. The queen is in operation between 3 and 4 years depending on it's productivity. The queens are marked with specific colored markings per year: 2020-blue, 2019-green, 2018-red. In a hive the bee population is between 10,000-50,000 individuals, of which about 500-1,000 drones, a queen rarely 2 queens (which never meet) and the rest stating among the working bees population.

The products obtained on the apiary: honey with the following varieties: (polyflora, raspberries, rapeseed, manna, acacia, mountain fir, sunflower), pollen, propolis, royal jelly and wax. Boian commune, like other areas in Sibiu county, is propicious to beekeeping (Photo 2), and the honey base in

Sibiu county has been studied over time by specialists who certify this [2, 3, 4, 5].

From May to August, some of the bee families in the apiary are transported to the pastoral in Dolj county, Desa locality, to pick acacia, and after two weeks in Covasna county to raspberry. The hives from the village of Boian at the acacia II harvest from the hayfields around the town of Mediaș in Sibiu County. In July, it leaves for pastoral care in Tulcea County in Ciucorova, located in the linden forest, considered to be the largest in Europe. At the beginning of August, it goes to pastoral care in Ialomița County, in Tăndărei to pick sunflowers. From the middle of August, in the interval of 15-20, we return to the village of Boian, to harvest hay from which the assortment of honey of the same name is harvested.

Photo 1. Location of apiaries in Boian village
Source: Google earth view [7].

Photo 2. Picture of Boian village
Source: Original.

The products obtained in the hive are capitalized on the Romanian market, at private customers and at a processor in the city of Blaj. The price of honey varies between 20-35 lei/Kg for private customers and between 8-14 lei Kg for processors. Wax is also used at a processor in Bistrita at the price of 40 lei/Kg. The pollen is sold to local customers at the price of 40 lei/Kg. Propolis is sold as a tincture at a price of 10 lei/20 ml.

In this context, the purpose of the paper is to analyze six varieties of honey and three varieties of pollen, extracted from the apiary in the village of Boian, Bazna commune, Sibiu County, to certify them as organic products.

This research work continues the studies on honey quality carried out over the years by the author in several specialized articles [15, 16, 17, 18, 19].

MATERIALS AND METHODS

In order to reconvert the apiary and to certify honey as an ecological product, we performed laboratory analyzes on the six varieties of honey: rapeseed, polyflora, acacia, lime, honeysuckle, sunflower.

Three pollen varieties were also analyzed: dandelion, rapeseed, hay, and six types of honey most found in the spontaneous flora of Boian village.

All samples were analyzed in aqueous extract for both honey and pollen varieties. About 10 grams of sample (honey and pollen), dissolved in distilled water prepared before analysis, were used.

In order to determine the quality of honey and to prove its authenticity in order to certify it as an ecological product, the following categories of analyzes were performed: acidity index, in the presence of phenolphthalein color indicator and titration with 0.1 N NaOH; the electrical conductivity of honey related to the concentration of inorganic salts, organic acids and proteins, the pH of honey is important during honey extraction and preservation, and it influences the texture, stability and shelf life of honey and the determination of water content. For

pollen, pH, conductivity, and acidity analyzes were performed for analysis.
The water content was determined using the refractometer, and the acidity index by titration, in fact, the pH was determined using the Loger Data device to which the pH sensor was attached (Fig. 3).

RESULTS AND DISCUSSIONS

Assortments of honey on which the instrumental analyzes were performed (Photo 3) are the following ones:
-***Rapeseed*** honey. The harvest took place in April 2020. As the environmental conditions of last year were unfavorable, the production of this honey assortment was quite low, the harvest depended on the weather conditions and the flowering period of rapeseed in Boian.
-***Acacia*** honey. The assortment of honey for analysis was obtained at the end of May-beginning of June 2020 in the Boian apiary. This honey has a whitish color and aroma specific to acacia.
-***Mountain*** honey was another variety of honey analyzed, collected by bees from the apiary in the summer of 2020 from spontaneous flora, ***polyfloral honey (hay)*** collected from the Boian area and after the organoleptic examination we can say that it is the best in taste.
-The ***sunflower honey*** obtained after harvesting from the fields near Boian village is also from 2020, the taste being astringent and very pronounced. In the crystallization process, the formed particles are larger and harder.
-**Honeysuckle** honey was obtained in 2020 and is considered the sweetest variety of honey.

Photo 3. The six varieties of honey under analysis
Source: Original.

As a water content, sunflower honey had the lowest water content (17.8%), acacia (18%), polyflora (18.2%) and the highest water content was rapeseed honey (18.4%).
The dry matter content was highest in sunflower honey (83.1%), followed by rapeseed (81.5%), polyflora (81%) and acacia with the lowest dry matter content (80.2%). (Table 1).
The results obtained are within the norms regarding the quality of honey STAS SR 784-3: 2009 in Romania and Regulation 1151/2012 of the Council of Europe.
A honey certified as natural must not have a water content of more than 20% [8, 20, 21]. It is known that bees "cap" honeycomb cells and store honey only after the water has evaporated. This analysis is another criterion for recognizing natural honey that goes through the "sugaring" stage during storage.

Table 1. Determination of water content

The type of honey	% SU	Refraction index	% water
Lime honey	81,5	14,896	18.4
Rapeseed honey	81	14,895	18.2
Sucklehoney honey	80.2	14,896	18
Mountain honey	83.1	14,894	17.8
Sunflower honey	86	1,4894	18,9
Acacia honey	83	1,4895	18,8

Source: original.

Table 2. Determination of acidity index

Honey type	Quantity(g)	Distilled water (ml)	Phenolphthalein (drops)	NaOH titration (ml)
Lime honey	10,228	30	3	1.51
Rapeseed honey	12,441	30	3	1.89
Mana honey	10,756	30	3	2.8
Mountain honey	10,374	30	3	2.9
Sunflower honey	10,124	30	3	2.0
Acacia honey	10,098	30	3	1.4

Source: original.

The results obtained from the analysis of the acidity index can be interpreted as follows: acacia honey 1.51 degrees of acidity; sunflower 1.89 degrees of acidity; polyflora 2.8 degrees of acidity; rapeseed 2.9 degrees of acidity; this represents ml of NaOH used for drawing in the presence of the phenolphthalein color indicator (Table 2). Following the interpretation of the data, it can be concluded that all assortments are natural and the values fall within the norms in force STAS SR 784/3–2009.

Table 3. Determination of electrical conductivity

The assortment of honey	Conductivity electrical µS · cm-1
Lime honey	263
Rapeseed honey	212
Honeysuckle honey	226
Mountain honey	208
Sunflower honey	195
Acacia honey	377

Source: original.

The electrical conductivity of honey was directly related to the concentration of inorganic salts, proteins, and organic acids [5-7]. Depending on the floral origin, this parameter indicates the variability for differentiating the floral origin [9-11]. The results obtained are according to the quality standards SR 784-3: 2009, 2009 in Romania and Regulation 1151/2012 of the Council of Europe (Table 3).

Table 4. Determination of pH

Honey assortment	pH
Lime honey	5.3
Rapeseed honey	5.6
Mana honey	5.2
Mountain honey	6.0
Sunflower honey	5.1
Acacia honey	4.8

Source: original.

The chemical reaction of honey due to its rich content in organic acids is acidic.
The pH was measured with a pH meter of 340-B/SET1, from a solution containing 10.0 g of honey sample in 75.0 ml of ultrapure water (Table 4).
The pH of the honey was between the range of values 4.8-6 pH units (Photos 4-9).

Photo 4. pH of linden honey
Source: Original.

Photo 5. pH of rapeseed honey
Source: Original.

Photo 6. pH of hand honey
Source: Original.

Photo 7. pH of mountain honey
Source: Original.

Photo 8. pH of sunflower honey
Source: Original.

Photo 9. pH of acacia honey
Source: Original.

The pH value is of great importance during the extraction and storage of honey. It influences the texture, stability and shelf life of honey, and the values obtained from the analyses are in accordance with SR 784-3: 2009, 2009 in Romania and Regulation 1151/2012 of the Council of Europe.

The pollen is in the form of a very fine powder, variously coloured, depending on the species (Photos 10-12).

It is the main source of protein food for bees, but can also be used in human nutrition [13, 22].


Photo 10. Dandelion pollen grains
Source: Original.


Photo 11. Haystack pollen grains
Source: Original.

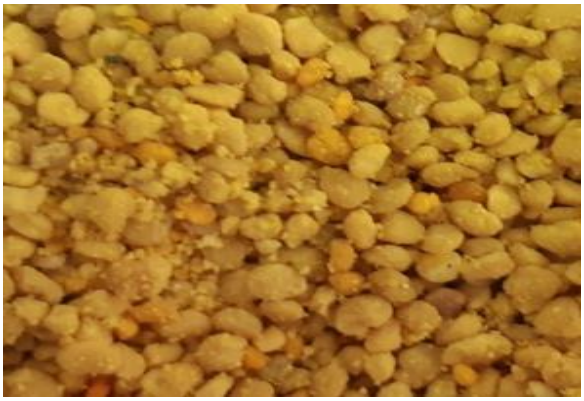
Photo 12. Rapeseed pollen grains
Source: Original.

The pollen is collected from the floral anthers, then the bee with the help of the forelimbs collects the pollen from the head, from the mouth pieces, but also from the neck region, and with the middle limbs it collects from the thorax and abdomen. After collecting all the pollen from the body, the bee stores it in the hollow of the pollen basket (corbicula).

The results of the analyzed pollen varieties are shown in Table 5.

Table 5. Results of the analyzes of the three pollen varieties

Characteristics	Dandelion pollen	Rapeseed pollen	Haystack pollen
Quantity g	10.38	10.386	11.014
Ph	4.3	4.3	4,2
Electrical conductivity, microsiemens x 10^2, minimum	156	214	350

Source: original.

Photo 13. Preparation of pollen samples for analysis
Source: Original.

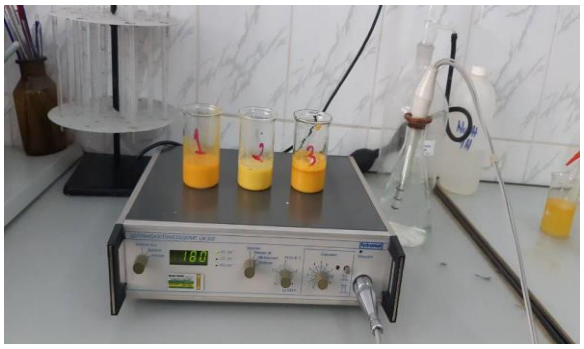

Photo 14. Conductivity analysis of the three pollen varieties
Source: Original.

Photo 15. pH value of dandelion pollen
Source: Original.

Photo 16**.** pH value of grassland pollen
Source: Original.

The photos 13-17 reflect how the analyses were made on the three pollen varieties.

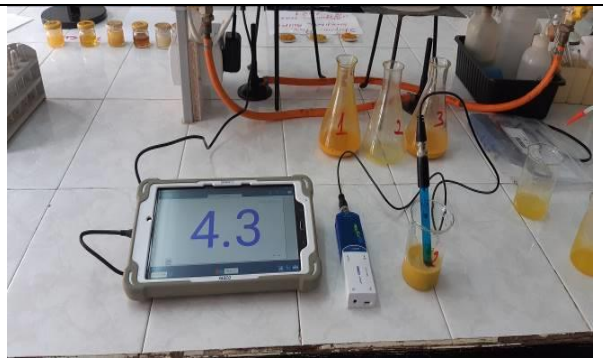

Photo 17**.** pH value of rapeseed pollen
Source: Original.

Pollen has in its composition all the minerals present in our body, but also most of the vitamins and the main enzymes and proenzymes, along with many other active elements, vital for health. After performing pH analyzes we can conclude that it is acidic as well as honey, with values of 4.2 and 4.2 pH units.

CONCLUSIONS

Through this paper we aimed to highlight the natural qualities of honey varieties under analysis in order to certify it as an organic product.

Through the physico-chemical analyzes performed in the laboratory: acidity, pH, conductivity and refractive index, we can conclude that all six varieties of honey are natural, without fakes and fall into the category of natural honey according to current standards SR 784-3: 2009, 2009 in Romania and Regulation 1151/2012 of the Council of Europe. After the conversion of the apiary, the honey and the other products of the hive can be certified as ecological products.

Following the analyzes performed and after the interpretation of the obtained results, we certified the fact that both the honey and the analyzed pollen are produced by bees in their natural state without the intervention of the beekeeper.

In conclusion, it was certified that the bee families found in the bee farm in the village of Boian harvested the nectar of the flowers, obtaining the six varieties and then transformed the sucrose from the nectar into glucose and fructose.

After analyzing the water content, we can conclude that all six varieties of honey are natural, because the values obtained are below 20% water, which shows that honey is natural and the varieties can be certified as organic products.

The phenomenon of "Sugaring" was confirmed during the storage of honey, this being another criterion for recognizing natural honey.

In order for the products obtained in the Boian apiary: honey, propolis pollen, royal jelly and wax to be certified as organic products, the following steps will be completed by the end of 2022 in order to certify them:

-Accreditation of the conventional apiary as an ecological apiary
-Ecological registration of honey
-Conversion from conventional apiary to organic apiary
-Purchase of water-based varnish-painted boxes
-Acquisition of organic honeycombs.
-Administration of treatments for bees based on organic substances.

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