QUALITY PROPERTIES OF THE HONEY OBTAINED IN THE LOCALITY OF THE BAZNA, SIBIU COUNTY

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Abstract. The researches of the present work were carried out within an apiary in Bazna village, Sibiu County, where the obtained honey assortments were subjected to laboratory analyses. The hive exploits have 220 families of bees, of which 80 are maintained in the horizontal hive system and 140 in the vertical hive system. In order to certify the Bazna honey, a series of preliminary analyses were carried out, which consisted in the determination of water content, dry substance, acidity index, conductivity, pH and a diastatic index. In this paper the importance of bee honey was highlighted and we demonstrated the qualities of the four honey assortments analysed. The analyses also certified the originality and naturalness of each assortment, the absence of forgeries or any artificial intervention of the beekeeper.

Keywords: honey analysis, diastatic index, honey assortments.

Rezumat. Proprietăți și calitatea mierii obținute în localitatea Bazna, județul Sibiu. Cercetările prezentei lucrări au fost efectuate în cadrul unui stup în satul Bazna, județul Sibiu, unde sortimentele de miere obținute au fost supuse unor analize de laborator. Exploatația are 220 familii de albine care sunt menținute atât în sistemul de stupi orizontal (80), cât și în cel vertical (140 de familii). Pentru a certifica mierea Bazna, s-au efectuat o serie de analize preliminare, care au constat în determinarea conținutului de apă, a substanței uscate, a indicelor de aciditate, a conductivității, a pH-ului și a unui indice diastatic. În această lucrare sa evidențiat importanța mierei de albine și am demonstrat calitățile celor patru sortimente de miere analizate. Analizele au certificat și originalitatea și naturaleța fiecărui sortiment, lipsa falsurilor sau orice intervenție artificială a apicultorului.

Cuvinte cheie: analiza mierii, indice diastatic, sortimente de miere.

INTRODUCTION

Honey is a sweet hive product, with a semifluid, viscous or crystallized appearance and a specific flavour, with a high content of sugars and minerals, vitamin, enzymes, organic acids (MARIN, 1966). Some bee breeders give them a kind of sugar syrup that is processed into a honey of poor quality. First of all, honey must be naturally produced without the beekeeper's artificial intervention. Bees need to take their pollen and nectar from flowers and then convert the nectar sucrose to glucose and fructose.

A natural honey should not have more than 20% water because the bees sealed the cells of the beehives and put the honey in it only after the water has evaporated in that proportion. Another criterion for recognizing natural honey is "sugar-making".

The process of charring or crystallization is as natural as possible and does not constitute a deterioration of honey. Moreover, forged honey does not get sugar. It is just a matter of choice between fluid honey and crystallized honey: some northern nations prefer even to consume only crystallized honey because it looks tastier and more natural. On the other hand, sugary honey can be "loose", it is brought back to the fluid state by heating in water. But unfortunately, this honey-crystallized honey loses some of its properties (MÂRZA & NICOLAIDE, 1990).

There are several types of honey, depending on what kind of flowers the bees take the nectar from (they pick nectar and pollen, but honey results only from the processing of nectar). The most famous honey is acacia, which is obtained at the end of April or beginning of May. This honey is white and has specific flavour. Lime honey comes in June, but here everything depends on weather and temperature. June-July is the time when sunflower honey is obtained, which has great therapeutic virtues, being good for the heart. Polyfloral honey is made in summer and some say it has the best taste. Others say the most delicious honey is the only one from the hives in the Danube Delta. There is also "tree honey" from trees such as fir, spruce, oak, beech. This is the only honey of dark colour, a very dark brown. The average amount of honey constituents, according to the results of the study, is included in the results of a research undertaken in four countries, including Romania (CRANE, 1990).

The physico-chemical and microscopic quality conditions of honey are regulated in Romania by STAS SR 784/2-1989 (http://www.honey.com). European honey norms are less restrictive. In the paper we wanted to determine the natural qualities of honey one of the hives products, namely 3 assortments: honey, lime and sunflower honey that have undergone laboratory analysis.

MATERIALS AND METHOD

The main analyses were: determination of water content with Abbe refractometer, acidity index, diastase index by the Gothe method (MOISE, 2015; 2016), identification of sugar syrup addition in honey, determination of electrical conductivity of honey, determination of pH.

Determination of water content with Abbe refractometer

At the Abbe Refractometer, in addition to the refractive index on the scale, expressed as a percentage, the content of dry matter and water was determined. In the refractometer, we determined only the refractive index. If the analysis is determined at a temperature other than 20°C, correct the water content obtained by subtracting the value 0.07 for each temperature degree above 20°C and adding the value 0.07 for each degree of temperature below 20°C. When water content is below 20 %, it can be certified that honey is not falsified. This is the moment when the honey can be extracted from sealed honeycomb.

Acid index

The water-diluted honey sample was titrated with 0.1 M sodium hydroxide solution in the presence of phenolphthalein and the acidity was calculated and expressed in ml of 1 M sodium hydroxide solution per 10 grams of honey.

Diastatic index using the Gothe method

Diastatic index defined as the number of millilitres of a 1% starch solution which was converted into dextrins for 1 hour at 45°C in the presence of the specific enzyme activator (Cl^- ion of sodium chloride) by amylase containing 1 g of honey.

In a Berzelius beaker weighting 10 g of honey, dissolve with about 50 ml of water, neutralize with sodium carbonate in the presence of indicator paper and bring it into a 100 ml volumetric flask with water (1 ml solution contains 0, 1 g of honey).

From the well homogenized honey solution, descending quantities (numbered 1 to 10) are placed in the tubes. A pipette of 0.5 ml of acetic acid solution, 0.5 ml of sodium chloride solution and 5 ml of 1% starch solution is poured into each tube. Continue to fill the contents of each tube to the nearest 11 ml and mix.

Immediately place in a suitable stand in the water bath set at 45°C. Bath water should exceed 1 cm or 2 cm the liquid level in the test tube. From this moment you have to wait 1h.

After this time has elapsed, the tubes are immediately cooled down in ice water to stop amylase activity, they are arranged in increasing order in the tripod, one drop of iodine solution is added to each tube and homogenized by overturning.

In the tubes with the smallest honey content, in which the starch was not completely hydrolysed (JARVIS, 1989) the blue colon appears. In the tubes where the starch was completely hydrolysed, a range of shades appears: colourless, yellowish, orange, tingling red, violet, purple.

Identification of the addition of sugar syrup in honey

To identify this type of addition, about 5 g of honey was taken from each assortment, as follows:

- Polyfloral 1: 5.0272 g
- Lime Flower: 4.9690 g
- Polyfloral 2: 5.0299 g
- Sunflower: 5.0503 g; then each diluted in a 20% aqueous solution of honey.

From each assay, 5 ml of solution were taken, 2.5 g of lead acetate and 22.5 ml of methyl alcohol were added. If sugar was added in the analysed honey, there was a white-yellowing abundant sediment.

Determination of electrical conductivity of honey

The electrical conductivity of the honey is directly related to the molar concentration of inorganic salts, organic acids and proteins ending with a Hydromat LM302 conductometer to a 20% solution in ultrapure water and measured at 20° C. This parameter indicates high variability depending on floral origin and considered best for differentiating between different floral honey.

The honeycomb electric conductivity must have values ranging from 280 to 523 μS·cm-1.

Determination of pH

The chemical reaction of honey is acidic because of the rich content of organic acids. pH value is of great importance during extraction and storage of honey. It influences the texture, stability and shelf life of honey (MĂRGHITAȘ, 1997). The pH was measured with a pH-meter 340-B/SET1 from a solution containing 10.0 g of honey sample in 75.0 ml of ultrapure water.

RESULTS AND DISCUSSIONS

Because honey is first seen as a natural medicine and then as food, everyone wants to benefit from the healing properties of honey, characteristics that are effective only if you consume natural, high-quality honey, obtained by bees only from the nectar of flowers. The purpose of this paper was to analyse the quality of four types of honey obtained in the hive area of Bazna, Sibiu County. The technique and methods of analysis have highlighted the superior quality of honey which is dated to the nectar and pollen collected by the bees.

The determination of water content and dry matter was performed in the laboratory using Abbe Refractometer (Table 1). The study determined a water content below 20% for each analysed assortment. When honey contains less than 20 % water, the bees catch it giving the signal that the product is finished and can be extracted. The determination of water content is very important both for the subsequent finding of honey loss and because honey with high water content (over 20 %) will ferment (ANTONIE, 2016). Depending on the temperature and the humidity of the environment, honey may reduce or/and raise the water content. The optimal conditions for keeping honey are a temperature of 10-12°C and a humidity of about 60%.

Table 1. Determination of water content with Abbe Refractometer, for the four assortments of honey under analysis.

No.	Honey assortment	Dry substance (%)	Refraction index	Water (%)
1	Polyfloral honey 1	90	1,4896	19,1
2	Lime honey	83	1,4895	18,8
3	Polyfloral honey 2	89	1,4896	19,1
4	Sunflower honey	86	1,4894	18,9

Legend: Reporting to the regulations in force: STAS SR 784-3: 2009 in Romania and Regulation 1151/2012 of the Council of Europe.

Honey acidity helps determine honey freshness. The water-diluted honey sample was titrated with 0.1 N sodium hydroxide solution in the presence of phenolphthalein and the calculated acidity was expressed in 1 ml of sodium hydroxide 1 N solution per 10 g of honey (Table 2). In order to determine the acid index I used STAS SR 784/3 – 2009.

Table 2. Determination of acidity, for the four assortments of honey under analysis.

No.	Honey assortment	Amount (g)	Distilled water (ml)	Phenolphthalein (drops)	Honey acidity ml NaOH/10 g honey
1	Polyfloral honey 1	10	30	3	3
2	Lime honey	10,25	30	3	3,5
3	Polyfloral honey 2	10	30	3	4,2
4	Sunflower honey	10,12	30	3	4,5

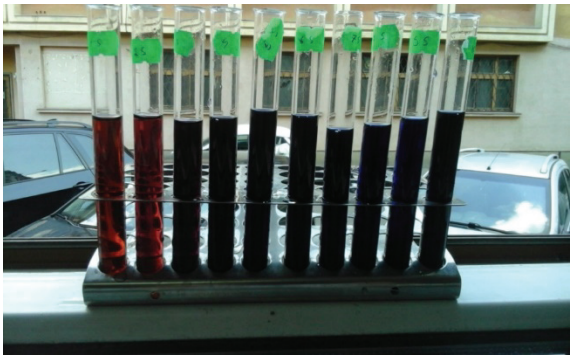
Legend: Reporting to the regulations in force: SR 784-3:2009 2009 in Romania and Regulation 1151/2012 of the Council of Europe.

As a result of the laboratory analyses and then the calculations carried out on them, we concluded that from the point of view of the diastasis index (Table 3), the four analysed honey assortments are within the normal parameters, being high-quality honey (Figs. 1, 2, 3, 4). To guarantee honey freshness, the diastatic index must be below 40 (VORWOHL, 1980; FINI & SABATINI, 1972; ACCORTI et al, 1986).

Table 3. Value of the diastasis index, for the four assortments of honey under analysis.

No.	Honey assortment	The value of the diastasis index
1	Polyfloral honey 1	tube7 / 23,8
2	Lime honey	tube7 / 23,8
3	Polyfloral honey 2	tube 8 / 29,4
4	Sunflower honey	tube 7 / 23,8

Legend: Reporting to the regulations in force: SR 784-3:2009 2009 in Romania and Regulation 1151/2012 of the Council of Europe.



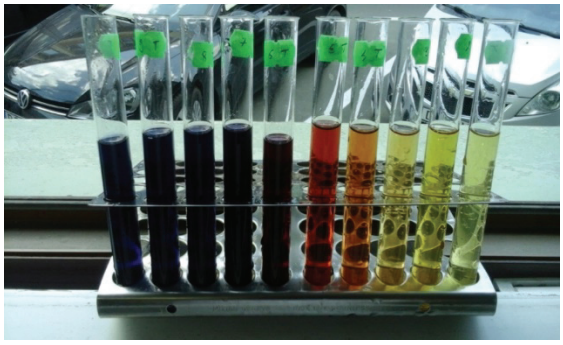


Figure 1. The results of the diastatic index for the honey assortment polyfloral honey 1 (orig. photo.)
Figure 2. The results of the diastatic index for the honey assortment lime honey (orig. photo.)

Figure 3. The results of the diastatic index for the honey assortment polyfloral honey (orig. photo.)
Figure 4. The results of the diastatic index for the honey assortment Sunflower honey (orig. photo.)

Natural honey includes several enzymes. Amylase is the enzyme with the highest resistance to heat treatment, the last one to be destroyed. Based on this attribute, amylase can be used as a general assay (enzymatic or diastasis index) of the quality of natural honey. Natural honey subjected to brutal heat treatment will have the diastase index with low or even zero values. The same is true of fake honey. The basis for the determination of the diastase is the determination of amylase activity. The diastase index is defined as the number of ml of a 1% starch solution that was transformed into dextrin for one hour at 45°C and optimum pH by amylase containing 1g of honey.

Identification of the addition of sugar syrup in honey

As a result of these experiments no added sugar syrup was found for any of the analysed honey assortments.

Determination of electrical conductivity of honey

The electrical conductivity of honey indicates great variability depending on the floral origin and is considered best for differentiating between different floral honey (Table 4). The results are expressed as µS·cm-1 by reading directly on the device.

The electrical conductivity of honey is directly related to the concentration of inorganic salts, organic acids and proteins. The honeycomb electric conductor has values ranging from 280 to 523 µS cm^{-1}. The electrical conductivity of the honey is determined by means of a conductor at a 20% solution in ultrapure water and measured at 20°C.

Table 4. Determination of electrical conductivity, for the four assortments of honey under analysis.

Nr. crt.	Honey assortment	Electrical conduction µS· cm^{-1}
1	Polyfloral honey 1	400
2	Lime honey	288
3	Polyfloral honey 2	454
4	Sunflower honey	188

Legend: Reporting to the regulations in force: SR 784-3:2009, 2009 in Romania and Regulation 1151/2012 of the Council of Europe.

Determination of pH

The pH value was of great importance during the extraction and subsequent storage of honey. The pH values of honey after analysis were in the range of 3.81-4 pH units. The chemical reaction of honey is acidic because of the rich content of organic acids, pH value is of great importance during extraction and storage of honey (Table 5).

Table 5. Determination of pH, for the four assortments of honey under analysis.

Nr. crt.	Honey assortment	pH
1	Polyfloral honey 1	4
2	Lime honey	3,98
3	Polyfloral honey 2	3,95
4	Sunflower honey	3,81

Legend: Reporting to the regulations in force: SR 784-3:2009, 2009 in Romania and Regulation 1151/2012 of the Council of Europe.

It influences the texture, stability and shelf life of honey. The pH was measured with a pH meter of a solution containing 10.0 g of honey sample in 75.0 ml of ultrapure water. The pH of the honey ranges from 3.5 to 4.8 pH units (National Honey Board Food Technology/Product Research Program, 2006).

The smallest percentage of water was found in lime honey 18.8 and the highest in the two honey varieties was 19.1. Water content <20% reveals that honey is natural.

The analysis for determining the acidity of honey was the second analysis carried out, which can be interpreted as: polyfloral honey 1 and 2 with the value of 4.2; honey 3,5; sunflower honey 4.5. Values are ml of NaOH used for titration in the presence of phenolphthalein.

Based on standards, we have concluded that all honey varieties have the acidity index at normal parameters, i.e. less than 5. The next analysis of honey was to check its freshness by the diastatic index method. To be considered a quality product, honey must have a diastatic index value of at least 10.9. The analysed honey has diastatic value between 23.8-29.4.

Other analyses were the conductivity, sugar addition and pH meter, all the values obtained being in the quality parameters.

CONCLUSIONS

After the honey was analysed, the following conclusions can be drawn. Sunflower honey, derived from the nectar of the flower of the same name, was harvested in 2017, July, at that moment the hives are located in the area of Bazna, Sibiu County. This assortment of honey has a yellowish colour and a strong sunflower taste. All honey is good, provided it is natural. And no honey can be judged just by appearance because it is the taste that ultimately differentiates the honey from the other.

The food value of honey consists primarily in its richness in sugars (70-80%), from this point of view, being an energy food. As a result of physical and chemical analyses, it was found that all sorts are natural, none of them interfering with additives or incentives in the bee's feeding during harvesting.

Following analyses, we have shown that honey has been harvested, processed and preserved in good humidity conditions between 17-18%. Following enzyme analysis in honey, pH ranges between 3.81-4, which favours invertase activity. The value of honey is also given by its vitamin content, coming exclusively from pollen and nectar of bee-picked plants.

The analyses carried out are preliminary and aim at the future certification of Bazna honey. For this purpose, more detailed analyses of pollen, micro and macro-elements, heavy metals and pesticides will be needed.

Following the analyses carried out after processing the obtained data and referring them to the quality regulations in the country and in Europe, we can say that the analysed is of superior quality, corresponding to the flora from which it was harvested, it is natural without a beekeeper's intervention, having all the characteristics of a high quality natural product.

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