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ESTIMATION OF QUALITY OF 4 MONOFLORAL HONEY SAMPLES: ACACIA HONEY, LIME HONEY, OILSEED RAPE HONEY AND RASPBERRY HONEY

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Abstract

Honey is a natural, very complex product that can be adulterated using different methods. A reliable determination of honey quality includes complex physico-chemical analyses, organoleptic evaluation as well as microscopic identification of the pollengrains. From the large offer of different honey types made in Romania that are commercially available today, ten brands of monofloral honey bought in Bucharest were analyzed in our lab and the results were compared to the honey standards and other relevant information found in the literature. Simple indicators of quality such as fragrance, appearance and consistency, and the identification of the most frequently occurring pollen helped estimate the accurate labeling of the product. The present study includes the results of the analysis for the samples of 4 monofloral honey types, namely acacia honey, lime honey, oilseed rape honey and raspberry honey.

Key words*: monofloral honey, honey quality, pollen analysis.*

INTRODUCTION

Adulteration of honey can be done directly by using different substances that replace, cover, preserve or change the original product, or indirectly, by feeding the bees with diverse unnatural products (Mencinicopschi, 2010; Colţa, 2012). The consumer preference for some monofloral honey types may lead to an increase in price (Ianovici et al., 2008), therefore the control of the correct labeling of monofloral honey is necessary.

Microscopic pollen analysis is among the lab tests that are carried out to determine the quality of honey since it helps to establish the floral source used for its production. Bees bring pollen to the hives along with the nectar from the flowers that they have visited. Since vegetation is specific to each geographical area, the pollen in honey can also help tracing the honey's region of origin. Although theoretically specific pollen could be added to honey, in practice it is difficult to add all types of pollen found in one area and to obtain the right qualitative and quantitative combination of a pollen spectrum found in natural honey (Vorwohl, 1971).The analysis of pollen in honey can be done with only an optical microscope and a centrifuge as apparatus, but it requires a lot of experience and skill regarding the identification of pollen grains and their combinations in different types of honey (Vorwohl, 1971).

At present, international organizations that set food safety standards consider necessary the presence of the pollen in honey and suggest the use of filtering devices with meshes not smaller than 200µm, thus allowing 95% of pollen in the original honey to remain in the product (Food Safety News, 2011).

In Romania most honey comes from false acacia trees, lime trees, sunflower, forage crops or grass land vegetation, but there is also a smaller production of numerous other varieties. Table 1 presents some examples of honey types produced in Romania.

Previous studies of melissopalynological analysis of monofloral acacia and lime honey samples from markets in Timişoara were done by Ianovici et al. (2008) who found a polifloral profile in a preliminary study, while problems regarding the establishment of standards for monofloral honey were presented by Prepelicean&Teuşan who analyzed acacia honey from markets in Iaşi. Dobre (2012) determined the pollinic profiles of 8 types of Romanian honey, including acacia honey, lime honey and oilseed rape honey.

In the present study the correct labeling of 4 monofloral honey types was estimated using specific indicators of quality (fragrance, consistency, appearance) and an orienting microscopic analysis that consisted in the identification of the most frequently occurring pollen type.

Table 1. Some examples of honey types produced in Romania

Types of honey	Sources of honey
Acacia honey	False acacia trees from forests (*Robinia pseudacacia*, Fam. *Fabaceae*)
Chestnut honey	Chestnut trees from forests (*Castanea sativa*, Fam. *Fagaceae*)
Clover honey	Cultures of forage crop varieties of white clover (*Trifolium repens,* Fam. *Fabaceae*)
Coriander honey	Cultivated coriander(*Coriandrum sativum*, Fam. *Apiaceae*)
Honeydew honey	The sweet secretions of some insects (for example aphids) that feed on tree sap
Linden honey	Linden/lime trees from forests (*Tilia* sp., Fam. *Tiliaceae*)
Meadow honey	Grassland vegetation, the predominant source may be cornflower (*Centaurea cyanus,* Fam. *Asteraceae*)
Mint honey	Mint in cultivation or mint from the spontaneous vegetation in certain areas (*Mentha* sp., Fam. *Lamiaceae*)
Oilseed rape honey	Oilseed rape cultures (*Brassica napus* var. *oleifera*, Fam. *Brassicaceae*)
Raspberry honey	Raspberry in the forest area (*Rubusidaeus*, Fam. *Rosaceae*)
Spring honey (May honey)	Plants that flourish in spring (fruit trees, alfalfa, rape, acacia)
Sunflower honey	Cultures of sunflower (*Helianthus annuus*, Fam. *Asteraceae*)
Thyme honey	Wild thyme (*Thymus serpyllum*, Fam. *Lamiaceae*)
Danube Delta honey	Wild plants from the Danube Delta (yellow melilot, mint)
Wildflower honey	Plants from spontaneous vegetation
Yellow melilot honey	Yellow melilot (*Melilotus officinalis*, Fam. *Fabaceae*) from the spontaneous vegetation

MATERIALS AND METHODS

The honey was obtained commercially and was brought to the Biology Labat the Faculty of Biotechnology(The University of Agronomic Sciences and Veterinary Medicine of Bucharest) where it was analyzed. Indicators of quality such as fragrance, appearance and consistency were noted (Gonnet & Vache, 1989) and the results were compared to the descriptions found in the literature (Popescu & Meica, 1997; Asociaţia Crescătorilor de Albine din România, 2007).

Honey samples were dissolved in water and were concentrated by centrifugation(10 min at 2500 r/min), then the sediment was analyzed in bright field microscopy without further treatment (Louveaux et al., 1978).An orienting microscopic analysis was carried out by photographing the pollen grains on the slides with a digital still camera (Sony Cyber-shot®, Carl Zeiss Vario-Tessar 5× zoom lens) and using the pictures for later identification of the most frequently occurring particles (Louveaux et al., 1978). Pollen types were determined by comparisons with pollen descriptions and images found in the volumes of Tarnavschiet al. (1981, 1987, 1990, 1994).

RESULTS AND DISCUSSIONS

Organoleptic characteristics noted for the four types of honey that were analyzed are given in Table 2. Results of the orienting microscopic analysis of the pollen are presented in Table 3. A selection of microscopic images of the pollen grains that were identified in the present study is presented in Figures 1-4.

The identification of pollen types was based on shape, morphological characteristics and size of the pollen grains. In the case of *Brassica napus* for example, the length of the polar axis of the pollen indicate that the pollen is from cultivated oilseed rape since this variety has the largest pollen.

In the linden honey, various other pollen types were found, many were from sunflower.

Oilseed rape honey contains mostly oilseed rape pollen and crystalizes fast, so that its creamy consistency is similar to that of a sorbet.

One of the best indicators of quality of honey is its specific fragrance which reflects the plant source and is hard to imitate, for example the fresh flavor of raspberry honey. Honey natural flavor can be lost due to improper processing (heating).

Table 2. Organoleptic characteristics noted for the four types of monofloral honey that were analyzed in the present study

Type of honey	Organoleptic characteristics		
	Fragrance	Color	Consistency
Acacia honey	Characteristic smell of acacia tree flowers	Light golden yellow „Extra white" (18 mm Pfund Scale)*	Fluid
Linden honey	Intense smell of lime tree flowers	Orange „Light amber" (80 mm Pfund Scale)*	Fluid
Oilseed rape honey	Specific smell of oilseed rape flowers	Milky white „Water white" (0 mm Pfund Scale)*	Creamy (set honey with fine texture)
Raspberry honey	Delicate smell of the raspberry fruit	Peach yellow „Extra light amber" (34 mm Pfund Scale)*	Viscous, shows a tendency to crystallize

*The Oxford Honey Company, 2015

Table 3. The most frequently occurring pollen grains in samples of acacia honey, linden honey, oilseed rape honey and raspberry honey determined in the present study (no. of pollen grains > 100) and comparison to the description found in the literature

Honey sample	Most frequently occurring pollen grains	Percent of pollen needed to classify honey as monofloral
Acacia honey	*Robinia* pollen (27%)	*Robinia* pollen ≥5 % (Dobre, 2012)
Linden honey	*Tilia* pollen (27%) and *Helianthus* type pollen (27%)	*Tilia* pollen ≥29 % (Dobre, 2012)
Oilseed rape honey	Pollen of *Brassica napus* var. *oleifera* (85%)	*Brassica napus*> 45 % (Dobre, 2012)
Raspberry honey	Raspberry pollen (61%)	Raspberry pollen > 25 % (Popescu & Meica, 1997)

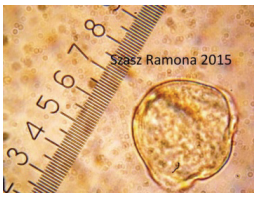
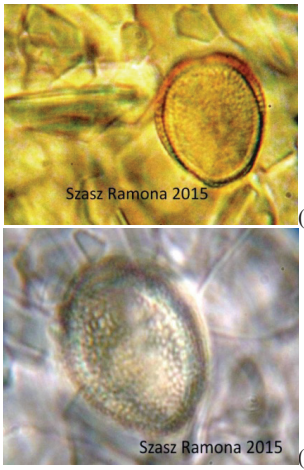


Figure 1. Rounded-triangular tricolpate pollen of *Robinia pseudacacia*in polar view, ~ 30µm size, in a sample of acacia honey analyzed in the present study (ob. 100×)

Figure 2. Apical view of a *Tilia* sp.pollen grain in a sample of linden honey analyzed in the present study (ob. 100×), thicken edexine can be seen in the colpi area



(a)

(b)

Figure 3. (a) Apical view of pollen from *Brassica napus* var. *oleifera* in a sample of oilseed rape honey analyzed in the present study; many small crystals are present(ob. 100×); (b) detail – the reticulate exine

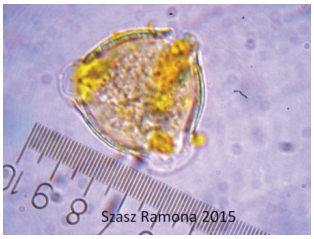


Figure 4. Polar view of *Rubus* type pollen in a sample of raspberry honeyanalyzed in the present study (ob. 100×), size ~30µm

CONCLUSIONS

The results of the orienting microscopic analysis of the pollen carried out in the present study suggest that the honey comes from the indicated floral source in all the 4 samples of monofloral honey that were analyzed. The determination of the floral origin and honey quality should be confirmed further through a complete microscopic analysis.

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