MELISSOPALYNOLOGICAL ANALYSIS AND PHYSICOCHEMICAL CHARACTERISTICS OF MULTIFLORAL HONEY FROM POŽEGA-SLAVONIA COUNTY

MELISOPALINOLOŠKA ANALIZA I FIZIKALNO-KEMIJSKE KARAKTERISTIKE MULTIFLORNOG MEDA IZ POŽEŠKO-SLAVONSKE ŽUPANIJE

MINDUM, Anita; PENAVA, Ariana & FLANJAK, Ivana

Abstract: *Multifloral honey is characterised by presence of pollen from many floral sources, none of which is predominant. Due to the fact that no botanical species prevails, the physicochemical and sensory characteristics, as well as the pollen spectrum of multifloral honeys can vary considerably. The aim of this study was to conduct melissopalynological analysis of multifloral honeys in order to determine the botanical species present in honeys from Požega-Slavonia County.*

Key words: *multifloral honey, melissopalynological analysis, physicochemical characteristics*

Sažetak: *Multiflorni med karakterizira prisutnost peludi velikog broja biljnih vrsta od kojih niti jedna nije prevladavajuća. Upravo zbog činjenice da niti jedna biljna vrsta ne prevladava, fizikalno-kemijska i senzorska svojstva, kao i peludna slika multiflornog meda mogu značajno varirati. Cilj ovog istraživanja bio je provesti melisopalinološku analizu multiflornih uzoraka meda kako bi se utvrdile biljne vrste prisutne u medu sa područja Požeško-slavonske županije.*

Ključne riječi*: multiflorni med, melisopalinološka analiza, fizikalno-kemijske karakteristike*

Authors´ data: Anita, **Mindum**, Mag. med. chem., Instutite of Public Health Požega-Slavonia County, Županijska 9; Ariana, **Penava**, Mag. nutr., Instutite of Public Health Požega-Slavonia County, Županijska 9; Ivana, **Flanjak**, Associate professor, University of Josip Juraj Strossmayer Osijek, Faculty of Food Technology Osijek, Franje Kuhača 18, iflanjak@ptfos.hr

1. Introduction

Nectar or flower honey is produced by the honeybees from nectar-producing plants. Considering the floristic composition of the area where the honeybees collect nectar, honey can be unifloral or multifloral. Honey may be declared as unifloral honey if a specific plant species dominates sufficiently to have the organoleptic, physicochemical and microscopic characteristics of the source [1]. Unless any plant species predominate, honey is multifloral. The geographical area, floristic composition and climatic conditions influence the physicochemical and sensory properties, as well as the pollen spectrum of multifloral honey [2]. Due to the presence of pollen form a many plant species, characterization of multifloral honey is not possible.

Due to its favourable geographical position and rich floral composition, the Republic of Croatia has the possibility to produce different types of honey. In the continental region, black locust, chestnut and lime honey are most commonly produced, while in the Adriatic region sage and winter savory honey are largely produced [2-4]. Multifloral honey is produced in all parts of the Republic of Croatia, but the properties of honey vary depending on the geographic area (continental, mountainous or Adriatic) and floristic composition [5,6]. The area of Požega-Slavonia County is located on the border of three different climatic impacts, which results in exceptional biodiversity of nectar-producing species. As stated by Špoljarić Maronić et al. [7] and Tomašević [8], over 1500 plant species have been recorded in the area of the Požega valley, many of which are nectar-producing. The beekeeping is an important area of agriculture in Požega-Slavonia County that has great economic significance. Knowing the composition and characteristics of honey produced in a specific area is important for the producers because they will gain insight into the quality of their honey, and the results could be used to educate/inform consumers about the product given the fact that honey is primarily considered as energy-rich foods.

Bearing in mind that honey properties depend primarily on botanical origin, the aim of this paper is to perform a melissopalynological analysis of multifloral honey from the area of the Požega-Slavonia County to determine which plant species predominate and to determine some physicochemical parameters of honey quality associated with botanical origin and honey quality. In addition, the results of this research will help the competitiveness of Slavonian honey on the national and international market.

2. Materials and methods

Honey samples were collected from the area of the Požega-Slavonia County for the purpose of county honey quality competition during 2019. Melissopalynological analysis and physicochemical parameters most commonly used in the evaluation of botanical origin and honey quality have been performed. After analyses, 28 honey samples were categorised as multifloral honeys.

Qualitative melissopalynological analysis was performed by counting 300 pollen grains using Olympus BX41 microscope, according to the method of Louveaux et al. [9]. The identification of pollen grains in insoluble sediment was performed by comparing the morphological characteristics of the observed pollen grains with the available literature references [10, 11]. The results of melissopalynological analysis were expressed as frequency classes as follows: predominant pollen (>45 %), secondary pollen (16-45 %), important pollen (3-15 %) and minor pollen (>3 %).

Moisture, electrical conductivity and hydroxymethylfurfural (HMF) content according to the standardized methods of the International Honey Commission [12]. The moisture was determined by refractometric method using Abbe refractometer (A.Krüss Optronic, Germany) at 20 ° C while the electrical conductivity of 20% (w/v) water solution of honey (dry matter basis) at 20°C was determined by conductometer (Hach Lange HQ430D, USA). The HMF content was determined according to the spectrophotometric method after White using UV/Vis spectrophotometer (Hach Lange DR6000, USA).

Data analysis was done using Microsoft Excel 2003 software (Microsoft Corp.).

3. Results and discussion

Samples collected for annual county honey quality competition were subjected to melissopalynological analysis in order to determine their botanical origin. In addition, physicochemical quality parameters were determined. Based on the obtained results, 28 samples were characterised as multifloral. Multifloral honeys are characterised by presence of pollen and nectar from many floral sources, none of which is predominant. According to the results present in Fig. 1., in 28 analysed samples 31 pollen types were identified.

Most frequently present pollens were *Fabaceae* and *Brassica* sp. present in more than 80 % of analysed honey samples followed by *Rosaceae*, *Salix* sp., *Robinia pseudoacacia* and *Asteraceae* present in more than 60 % of samples. This pollen composition in insoluble sediment of honey is characteristic for continental region of Croatia, and in accordance with previous studies of pollen spectrum of honeys from Požega valley [7]. In general, honey can be denominated as unifloral if

relative frequency of the pollen of that taxon exceeds 45 % [1, 13]. However, some botanical species have over-representative pollen grains, which means that the percentage of pollen in the sediment if greater than the percentage of the corresponding nectar in honey. For this honey types, like chestnut or rape honey, it is necessary that the sediment contain more than 45 % of specific pollen to confirm the uniflorality of honey.

According to the Croatian regulation [1], a mimimum of 80 % of *Castanea sativa* pollen and 60 % *Brassica* pollen is necessary to declare honey as unifloral chestnut and rape honey, respectively. Also, physicochemical and sensory properties have to be characteristic for that unifloral honey. As seen in Fig. 1. *Castanea sativa* and *Brassica* pollens are present in more than 45 % percent in some analysed honey samples but their share was less than prescribed by national regulation [1] and consequently that honey samples have to be classified as multifloral. The high presence of *Castanea* pollen and nectar in honey can be easily detected in physicochemical and sensory properties. Namely, chestnut honey has very high electrical conductivity and strong aroma and bitterness [14]. These specific sensory characteristics of chestnut honey present in multifloral honeys are not desirable because the harmony of aroma and taste is reduced.

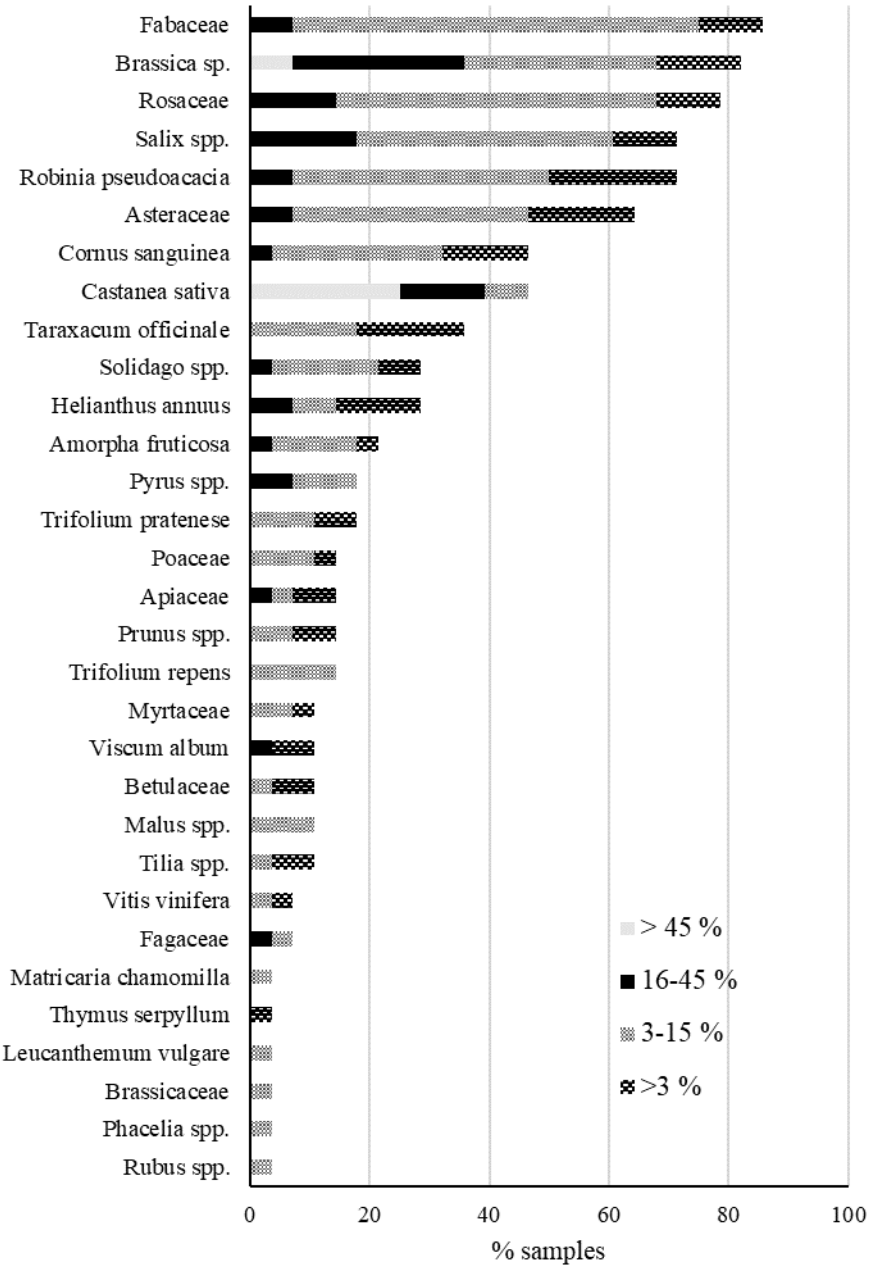

Figure 1. Pollen types present in analysed multifloral honeys

Although the melissopalynological analysis is important technique in honey botanical origin determination, the final confirmation is always based on the combined results of three methods/techniques; melissopalynological, sensory and physicochemical analysis. Some physicochemical parameters, like electrical conductivity, are used for classification of honey while others, like water content, HMF content and diastase activity, indicate processing and storage conditions important for quality assessment. The results of physicochemical parameters of analysed multifloral honey samples are summarised in Table 1.

Statistics	Moisture (%)	Electrical conductivity (mS/cm)	HMF content (mg/kg)
Average	18.32	0.43	7.56
SD	0.96	0.18	4.26
Minimum	16.50	0.19	0.75
Maximum	20.00	0.73	17.06

SD-standard deviation

Table 1. Physicochemical parameters of analysed multifloral samples (n=28)

All analysed honey samples had electrical conductivity lower than 0.80 mS/cm (Table 1.) that is prescribed by national and international regulations [15-17] for nectar (floral) honeys. Average moisture in analysed samples was 18.32 % (Table 1.) which implies that samples were ripe. Only two samples had limit value of moisture (20.00 %) prescribed in regulations [15-17]. The HMF content is usually used as indicator of processing and storage conditions and the maximal prescribed value is 40 mg/kg [15-17]. All analysed samples had HMF content lower than 40 mg/kg (average 7.56±4.26 mg/kg) that purports the fact that samples were fresh and properly processed. Overall quality of analysed multifloral honeys was satisfactory regarding the analysed physicochemical quality parameters.

4. Conclusion

Although it achieves a lower market price than unifloral honey, the multifloral honey is not of less quality. Among consumers, multifloral honey is one of the most consumed honey type. Pollen spectrum, physicochemical and sensory properties depend on botanical and geographical origin. This study present contribution to description of multifloral honeys form Croatia.

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