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Physicochemical and melissopalynological characterization of Estonian summer honeys

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Abstract

The samples of 14 honeys, retained from Estonian beekeepers, were analyzed for parameters such as pH, moisture content, free acidity, electrical conductivity, diastase activity, hydroxymethylfurfural (HMF) content and mineral content, including sodium (Na), potassium (K), magnesium (Mg) and calcium (Ca). Fructose, glucose and disaccharide content were also identified and fructose/glucose ratio was calculated. In addition melissopalynological analyses were carried out for characterization of honeys. The mean values of analyzed honeys were: pH 3.8; moisture 17.3%; free acidity 20.4 mmol/kg; electrical conductivity 0.2 mS/cm; diastase activity 23.1 DN and HMF was below 3.8 mg/kg. Within the mineral content, potassium was quantitatively the most important mineral in the range of 125.79 to 1381.53 mg/kg followed by calcium of 20.37-63.65 mg/kg, magnesium 5.53-25.49 mg/kg and sodium 4.77-19.44 mg/kg. The predominant sugar in honey samples was fructose having the mean value of 35.91 g/100g followed by glucose 35.00 g/100g. The disaccharide average content was 6.00 g/100g. The melissopalynological analyzes showed that the most dominant pollens in honey samples were cruciferous (*Cruciferae*)-mainly rape (*Brassica napus*); rosacean (*Rosaceae*)-mainly raspberry (*Rubus idaeus*); white clover (*Trifolium repens*); sweet clover (*Melilotus officinalis*) and willow (*Salix*). The results of honey pollen profile analysis and calculated fructose/glucose ratios (0.89-1.17) both indicated to flower honeys. All of the analyzed honeys were found to meet European Legislation (EC Directive 2001/110) for all parameters.

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Keywords: honey; physicochemical properties; mineral content; melissopalynological analysis

1. Introduction

Honey is a natural sweet substance produced by honey bees from the nectar of plants (blossom honey), secretions of living parts of plants, or excretions of plant-sucking insects (honeydew honey). Bees collect honey, transform it by combining it with their specific substances, deposit, dehydrate, store, and leave in

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the honey comb to ripen and mature. Honey consists essentially of various sugars, predominantly D-fructose and D-glucose, as well as other compounds and substances such as organic acids, enzymes, minerals and solid particles collected by bees [1].

The properties and composition of honey are known to vary widely depending on the region, season, variety of bee, plant source of nectar, period for which it is stored in the honeycomb, mode of harvesting and postharvest storage [2]. Considering the number of possible floral sources, it is understandable that no honey is completely the same as another [3].

Honey physicochemical quality criteria are well specified by the European Legislation. The major criterias for honey concern sugar content, moisture content, electrical conductivity, free acidity, ash content, diastase activity and hydroxymethylfurfural (HMF) content [4].

Honey quality, flavour and colour can also be determined by the floral origin of honey, and there are various methods for characterizing it. The standard procedure for assessing honey floral origin is melissopalynology, which consists of microscopical analysis of the pollen present in the honey after filtration or centrifugation [5].

Several studies have been made for characterizing honeys in different countries [6; 7; 8; 9; 10]. Thus the purpose of the present was to characterize honeys from different regions in Estonia by physicochemical and melissopalynological analysis and by mineral content.

2. Materials and Methods

2.1. Honey samples

Honey samples that were harvested in July 2010, were obtained directly from Estonian beekeepers. These honeys were stored in a controlled temperature (18±2ºC) in airtight glass containers until further analysis.

2.2. Melissopalynological analysis

The melissopalynological analysis was carried out according to the method described by D' Albore [11].

10 g of honey was dissolved in 20 ml of hot distilled water, not above 40ºC. The solution was centrifuged for 10 min at 3000 rpm and drawn off the supernatant liquid. The sediment was dispersed again with 10ml of distilled water and centrifuged. The sediment was put on a slide and spread out. After drying, the sediment was covered with a liquefied Kaiser' s glycerine gelatine and the cover glass. In about 24 h at 30ºC the sample was ready for microscopical examination. 500-600 pollen grains were counted and binocular light-microscope with 40x15 magnification was used.

2.3. Physicochemical parameters

Physicochemical properties, such as moisture content, pH, free acidity, electrical conductivity, diastase activity and HMF were determined by using method EVS 738:1997 [12].

Glucose, fructose and apparent sucrose content were identified by using High Pressure Liquid Chromatograph (HPLC), that consisted of Alliance Separations Module (Waters), Aminex HPX-87H 300x7.8mm column, Cation-H precolumn and Refractive Index Detector (Waters). 0.4g of honey sample was dissolved in a few milliliters of milli-Q water and transferred to a 50 ml volumetric flask. Milli-Q water was added to the mark and the solution was well mixed. The sample was filtered through a 0.2µm Millipore filter and additional 10x dilution was made with HPLC eluent.