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Phytochemical Diversity of Honey: Supplementary Factor to Determining the Botanical Origin and Authenticity of Honey

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Abstract

Tracing the botanical origin and authenticating honey are key steps in the supply and trade of this valuable natural product. Melissopalynology, phytochemistry, microbiology, organoleptic, physicochemical and chemical pollution analyses, together complete the puzzle of honey quality control. These methods are complementary and together provide the basis for the quality control and accurate authentication of honey.

Keywords: Natural honey; Botanical origin; Phytochemistry; Phytochemical factors; Phenolic compounds; Ecological elements; Diverse habitats; Floral markers; Auxiliary markers; Quality control

Introduction

Tracing the botanical origin and authenticating honey are key steps in the supply and trade of this valuable natural product. Melissopalynology, phytochemistry, microbiology, organoleptic, physicochemical and chemical pollution analyses, together complete the puzzle of honey quality control. Unfortunately, throughout the world, honey is evaluated mainly with classical methods (e.g. physic-chemical ones) [1]. This shortcoming lead to many problems such as the supply of counterfeit honey and the lack of proper pricing, grading and consumer confidence as well as production and export problems. Natural honey is a complex product with highly diverse chemical compounds that depend mainly on a botanical origin (nectar providing plants).

Results and Discussion

Phytochemical factors (floral markers) comprising carbohydrates, nitrogen content, and volatility as well as phenolic compounds are used to authenticate and grade natural honey [2], and the botanical origin of honey directly affects it's prices [3]. To date more than 600 organic compounds in honey originating from diverse habitats around the world have been reported [4]. Because honey comes from different plant sources and /or honeydew, it's quality control, especially that of unifloral honey, faces several challenges [5]. Moreover, its phytochemical composition severely affects the biological activity in natural honey [6]. Several factors, such as ecological elements as well as harvesting and post-harvest processes greatly influence are highly effective on these compounds. Specific volatile (aromatic) compounds derived from plant nectars are used as botanical markers for unifloral honeys for example, thyme (thymolol), citrus (methyl anthranilate), sunflower (2-methoxyphenol), eucalyptus (acetoind), cotton (cinnamaldehyde), Mint (hexanal) alfalfa (2-methoxyphenol)[7].

However, several similar aromatic compounds (e.g. benzaldehyde, lilac aldehyde, nonanal, benzaldehyde) have been reported in different unifloral honeys. Phenolic compounds are other important botanical markers in unifloral honey and include quercetin (sunflower), flavanone hesperitin (citrus), naringenin and luteolin (lavender) and 8-methoxykaempfrerol (rosemary). Other common phenolic compounds (e.g. abscisic acid, benzoic acid, ferulic acid) have also been reported in different honeys [8]. Carbohydrates, another floral marker are the main chemical components in honey. The quantitative composition of carbohydrates (e.g. mono, di oligo and polysaccharides) has been used to differentiate various unifloral honeys such as fructose, glucose, sucrose, maltose and glucose/water(rosemary, citrus,

eucalyptus), high glucose concentration, absence raffinose, melezitose and erlose (rape, sunflower), high fructose, sucrose and minor oligosaccharides (acacia) (Cotte et al. 2004 a, Mateo Bosch-Reig 1997).

With the exception of proline that is added to honey by the honey bee, other amino acids originating from plants that show diversity in different honeys. Moreover, some amino acids have been reported as floral markers to differentiate honeys from honeydew [9]. These markers are also used to determine the geographical origin of honey [10]. In comparison, phenolic and aromatic compounds are stronger markers than carbohydrates and amino acids in authenticating and controlling the of honey. However a quantitative ratio of amino acids and carbohydrates will be useful as auxiliary markers.

Conclusion

Several challenges must be met in authenticating unifloral honey. Each type of honey test (e.g. phytochemistry, organoleptic etc.) evaluates only a part of the health and quality of honey, so alone, these analyses are incomplete. Accordingly, these methods complement each other and together form the basis for the quality control and accurate authentication of honey. Certainly, mellisopalynology is a supplement to the phytochemical analysis of honey; however ecological factors can have severe effects on the quantitative and qualitative profile of honey. Therefore it is necessary to prepare an accurate identification of each honey based on all markers in each ecological region. While maintaining international standards, focusing on national and regional standards will be very helpful. Achieving these goals requires the time and cooperation of all researchers in the field of honey quality in different countries of the world.

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