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Food Chemistry 92 (2005) 305–309
Food Chemistry
www.elsevier.com/locate/foodchem

Contribution to the study of avocado honeys by their mineral contents using inductively coupled plasma optical emission spectrometry

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Received 10 May 2004; received in revised form 20 July 2004; accepted 20 July 2004

Abstract

Avocado honey samples were analyzed by inductively coupled plasma optical emission spectrometric. First, the botanical origin of the honeys was confirmed by melissopalynological analysis. Twenty-four minerals were quantified for each honey sample. The elements Al, Ba, Ca, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Na, Ni, P, Pb, S, Se, Si and Zn were detected in all samples; seven elements were very abundant (Ca, K, Mg, Na, P, S and Si), six were not abundant (Al, Cu, Fe, Li and Zn) and 11 were trace elements (As, Ba, Cd, Co, Cr, Mo, Ni, Mo, Pb, Se, Sr and V).

Keywords: ICP-OES; Minerals; Honey; Avocado

1. Introduction

The mineral content of honey has been the subject of many studies. A flow injection analysis, coupled with atomic spectroscopy in order to determine the mineral elements of honey, was used (Salinas, Montero, Osorio, & Lozano, 1994). The mineral contents of some honeys from Galicia (Spain) were analyzed by flame atomic absorption spectrometry (Rodríguez-Otero, Paseiro, Simal, & Cepeda, 1994). High-performance ionic chromatography was used to quantify minerals in some unifloral honeys of Italian origin (Poiana, Fudo, Manzin, Postarino, & Mincione, 1996). The mineral content of Moroccan honey was also studied using inductively coupled plasma atomic emission spectrometric (Terrab, González, Diez, & Heredia, 2003).

Avocado honey is one of the less studied types, Israel and Spain being the main producers of this honey type in the Mediterranean area. A avocado-growing was introduced to Spain in the 1980s, Granada, Málaga and Canary Islands being the main producing regions. Although there are some melissopalynological studies on avocado honey (Orantes, Torres, & Delgado, 2002; Ramos, Pérez, & Ferreras, 1998), the physicochemical work on the characterization of this honey type is unknown, contrary to the various studies carried out on other honey types, such as acacia, berseem clover, chestnut, citrus, eucalyptus, lavender and mustard, (Conti, 2000; Nanda, Sarkar, Sharma, & Bawa, 2003; Poiana et al., 1996; Serra Bonvehi, 1988, 1989; Terrab, Díez, & Heredia, 2003a, Terrab, Díez, & Heredia, 2003b).

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doi:10.1016/j.foodchem.2004.07.033

This study is part of a series referring to the mineral characterization of the unifloral honeys produced in the Mediterranean area (Terrab, Hernanz, & Heredia, 2004). Thus, the goal of the present study is a contribution to the characterization of avocado honey, analyzing the mineral content of this honey type produced in Spain, by inductively coupled plasma optical emission spectrometry (ICP-OES).

2. Materials and methods

2.1. Samples

The present study made use of eleven avocado honey samples from *Persea americana* Mill., collected in Spain, between 2002 and 2003. The samples were taken directly from the beekeepers, all professionals, and the extraction of honey from combs was done by centrifugation. For the site of collection, see Appendix A and Fig. 1. All samples were unpasteurised and were taken no more than three months after extraction, stored in holders and immediately transferred to the laboratory and kept at 0 °C. Analyses were done within a 6-month time period after harvesting.

2.2. Pollen analysis

The quantitative analysis of the samples was carried out using the light microscope (LM) on slides prepared without any chemical treatment, according to the method described by Maurizio (1979); all the pollen grains (PG) and honeydew elements (HDE) were counted for each honey sample in four different slides, covering the whole surface of each slide. The botanical elements (BE) represent the addition of the pollen grains and the honeydew elements. The qualitative analysis was carried out using acetolysed slides prepared according to the method described by Erdtman (1960) and always using a subsample of 10 g of honey. Following the results obtained by Behm, VonderOhe, and Henrich (1996), at least 500 pollen grains were counted among four different slides for each honey sample. For the identification of the pollen grains, the general key to pollen types was used (Díez, 1987). Due to the fact that the pollen from the *Persea americana* and Lauraceae families, in general, is

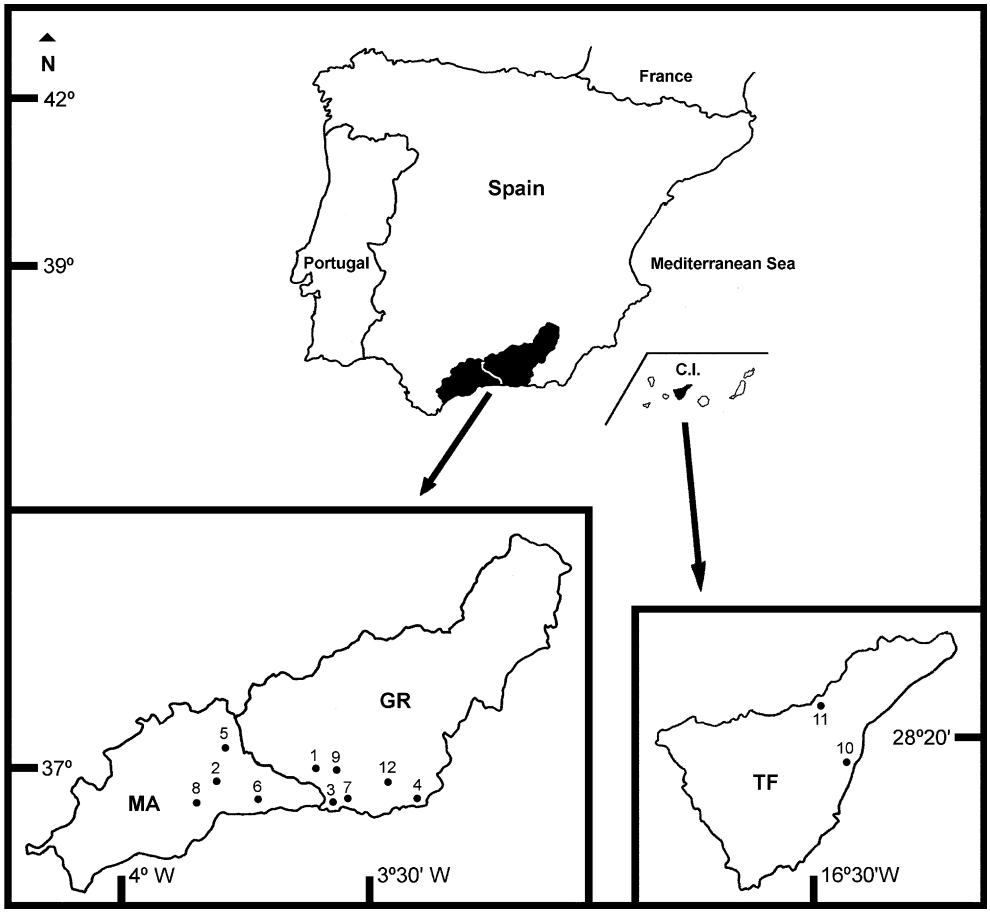

Fig. 1. Distribution of the honey samples. GR, Granada Province; MA, Málaga Province; TF, Tenerife Province; C.I., Canary Islands.