Preliminary characterization of unifloral *Coffea* spp. honey

L. Navarini[1], S. Colomban[2], E. Schievano[3], A. Illy Belci[4] ; L. Turello[1], and S. Mammi[3]

1 illycaffe S.p.A., via Flavia, 110, I-34147 Trieste (Italy);
2 Aromalab, illycaffe S.p.A.,AREA Science Park, Padriciano 99, I-34012 Trieste (Italy);
3 Dept. of Chemical Sciences, University of Padova , Via Marzolo, 1, I-35131 Padova (Italy);
4 Ernesto Illy Foundation, via Flavia 110, I-34147 Trieste (Italy)

INTRODUCTION

Coffee is one of the most consumed and appreciated beverages in the world. However, in addition to providing coffee beans to be roasted for our pleasure, the coffee plant has a large floral display with a strong scent and produces more fruits and seeds when pollinated by bees. In view of these aspects, it is not surprising to encounter coffee honey as a side-product, albeit rare and almost unexploited, of coffee production. In the framework of a project of the Ernesto Illy Foundation in Colombia, a sample of coffee honey has been preliminary characterized by NMR and liquid chromatography and compared with different *Citrus* spp. honeys.

METHODS

Coffee honey produced by Apicalarama (Calarama Group) in Colombia (municipality: Chaparral, Dept. Tolima) under the supervision of John Ever Cardona (La Promotora de Bienes Y Servicios Apicolas Proapis s.a.s.) has been used. The honey was obtained starting from a less aggressive African bees (*Apis mellifera scutellata*) duly selected and bred by J. E. Cardona. *Coffea* pollen higher than 60% makes the product «unifloral». Three different *Citrus* spp. honeys from Sicily (Italy) have been used for comparison (lemon and orange unifloral and generic *Citrus* honey). The UHPLC analysis (Agilent 1290) was performed dissolving a sample of honey in H_2O/CH_3OH 70/30 and using an Agilent Poroshell 120 SB-C18 4.6 x 150 2.7µ column, a DAD UV detector at 272 nm, and an elution gradient from 90% A/10% B to 67% A/23% B (A = 0.1% HCOOH in H_2O; B = CH_3OH). ^{1}H-NMR spectra were collected in D_2O with a Bruker Avance DMX 600.

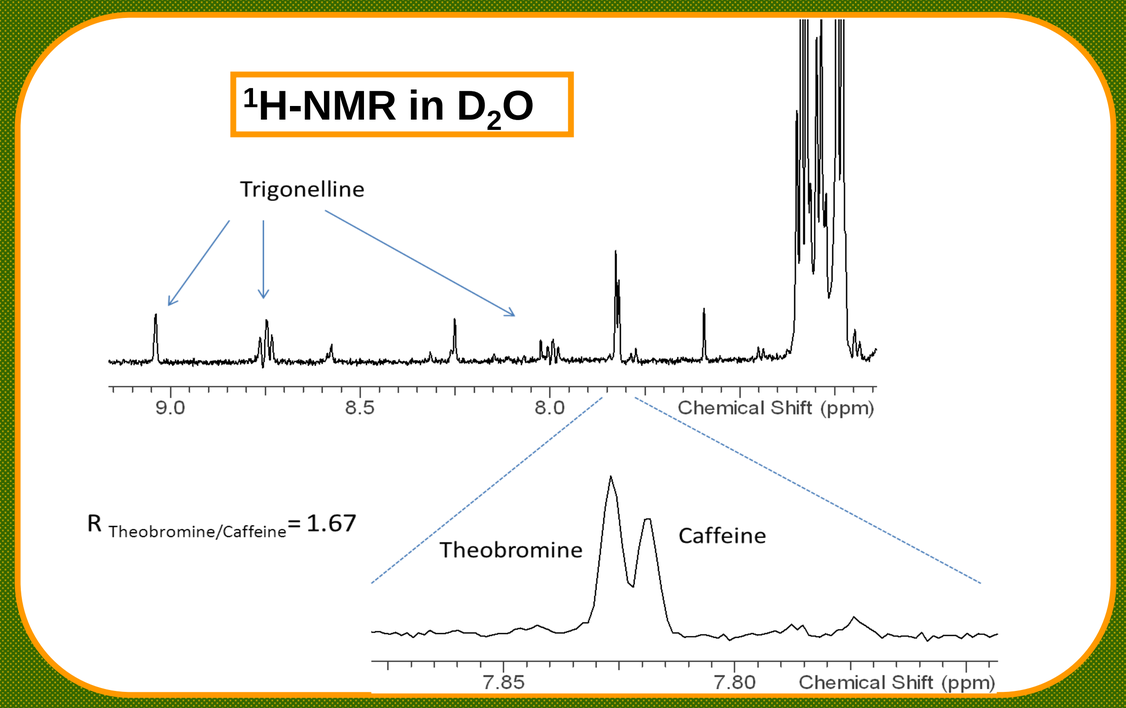
Photo by Nicol Belci

RESULTS & DISCUSSION

mg/kg	Coffea spp.	Lemon	Orange	Citrus spp
Trigonelline	185.0	68.7	78.3	87.5
Theobromine	160.0	nd	nd	nd
Caffeine	95	4.2	6.9	5.9

As far as pyridine alkaloids is concerned, trigonelline has been detected. This compound, well known constituent of coffee beans, has been recently identified for the first time in several European honeys (Donarski et al., 2008). The content of trigonelline in coffee honey is about 2 - 2.5 times higher than that determined in *Citrus* spp. honeys.

Purine alkaloids caffeine and theobromine are particularly abundant if compared with the reported content of these methylxanthines in *Citrus* spp. honeys (Kretschmar & Baumann, 1999).
The ^{1}H-NMR spectrum confirms the presence of trigonelline and a higher content of theobromine than caffeine. The molar ratio theobromine/caffeine measured by NMR (1.67) is in good agreement with that determined by LC (1.81). Even though the pollen analysis indicates the unifloral origin of the honey, it does not explain the high amount of theobromine found. Theobromine is present in coffee flowers; however, its content is lower than that of caffeine. Bee metabolism could be responsible for the high content of this purine alkaloid.



Caffeine has been recently proposed as one of the fingerprint markers for the description of *Citrus* honey (Vacca et al., 1997, Schievano et al., 2012). On the basis of the present data, caffeine and theobromine may be suggested as reliable markers to trace coffee honey authenticity; however, further studies on a wide number of samples are necessary to confirm this hypothesis.

Kretschmar, J.A., Baumann, T.W. (1999) *Phytochemistry*, 52 , 19-23; Donarski et al., (2008) *J. Agric. Food Chem.*, 56, 5451–5456 ; Vacca et al., (1997) *Industrie Alimentari*, 36, 611–613; Schievano et al., (2012) *Metabolomics*, 8, 679-690.