Revista Brasileira de Farmacognosia xxx (2017) xxx–xxx

Brazilian Journal of Pharmacognosy
REVISTA BRASILEIRA DE FARMACOGNOSIA
www.elsevier.com/locate/bjp

Original Article

# Ecuadorian honey types described by Kichwa community in Rio Chico, Pastaza province, Ecuador using Free-Choice Profiling

Q1 Patricia Vit[a,b], Silvia R.M. Pedro[c], Carlos Vergara[d], Rosires Deliza[e,*]

[a] Food Science Department, Faculty of Pharmacy and Bioanalysis, Universidad de Los Andes, Mérida, Venezuela
Q2 [b] Cancer Research Group, Sydney Medical School, The University of Sydney, Australia
Q3 [c] Departamento de Biologia, Faculdade de Filosofia, Ciências e Letras, Universidade de São Paulo, Ribeirão Preto, SP, Brazil
Q4 [d] Department of Chemical and Biological Science, School of Science, Universidad de las Américas Puebla, Mexico
[e] Embrapa Agroindústria de Alimentos, Rio de Janeiro, RJ, Brazil

ARTICLE INFO

*Article history:*
Received 11 July 2016
Accepted 22 January 2017
Available online xxx

*Keywords:*
*Apis mellifera*
Kichwa
Ecuador
Honey
Free-Choice Profile
Meliponini

ABSTRACT

Pastaza is the largest and least populated province in Ecuador, with seven native indigenous nationalities. The Kichwas from the Rio Chico community live near to the capital city Puyo, are recognized for their knowledge on stingless honey bees. From the 400 species of Neotropical Meliponini that make honey in cerumen pots, almost 100 thrive in Southern Ecuador, and confer such biodiversity to pot-honey. In this study sensory characteristics of Ecuadorian false and genuine honeys with diverse entomological origin: *Apis mellifera* – light amber and amber, *Geotrigona leucogastra*, *Melipona grandis* and *Scaptotrigona* sp. (*S. ederi* np Schwarz) were investigated with Kichwa assessors (four female and four male, aged 18–62 years old). The panel was asked to taste and to identify sensory attributes of honey (appearance, taste, smell, aroma, mouthfeel, other tactile sensations), and to score their intensities in 10 cm unstructured line scales anchored with the words weak and strong, using the Free-Choice Profile methodology The Generalized Procrustes Analysis was used on the data. The first and second dimensions accounted for by 61.1% of the variance. In the descriptive sensory evaluation, darker honeys (amber *A. mellifera*, false and *Geotrigona*) were separated from (light amber *A. mellifera*, *Melipona* and *Scaptotrigona*) by the first dimension; whereas thicker honeys (*A. mellifera* and false) were discriminated from thinner honeys (*Geotrigona*, *Melipona* and *Scaptotrigona*) by the second dimension. The assessors were able to evaluate and differentiate honey types without previous sensory training. Remarkably, two Kichwa ladies immediately spit out the false honey, in contrast to an acceptance study on 18-honeys, where the false honey was scored among the preferred ones by 58 participants of the First Congress on Apiculture and Meliponiculture in Ecuador. Therefore, results suggest that Ecuadorian native Kichwas keep a sensory legacy of ancestral knowledge with forest products such as honey.



## Introduction

Ecuadorian indigenous population keeps a legacy of a vast Pre-columbian entomological knowledge, present in their mythology, art, gastronomy (Barragán et al., 2009) and medicine. In particular, the stingless bee *Melipona beecheii* was considered a reincarnation of divine forces by the Mayas, and still today this *Melipona* bee is known with the goddess name *Xunan kab*, from maya "*Xunan*" principal lady and "*kab*" honey (Ocampo Rosales, 2013).

Forest experiences of meliponiculture or honey hunting are reported in the Amazon forest with Kayapó (Posey and Camargo, 1985; Camargo and Posey, 1990) and Pankararé (Costa-Neto, 2002) in Brazil, and Huottuja in Venezuela (Salas and Pérez, 2008). Q5

Pollination is the greatest service of the bees for the environment, and the benefits of pollination for agriculture are more profitable than the honey and pollen harvested (López-Palacios, 1986; Heard, 1999; Cruz et al., 2005). Pot-honey (Guerrini et al., 2009), pot-pollen (Cruz et al., 2005) and propolis (Campos et al., 2014) produced by Meliponini are studied with increasing interest by international scientific teams. The interactions of Meliponini with microrganisms (Morais et al., 2013), besides the vegetal–animal nature of this medicinal food, originates active principles with medicinal properties attributed to traditional healing, awaiting for scientific demonstration.

The study of pot-honey requires the discipline to refer the bees producing honey in a collection, identified by an entomologist.

* Corresponding author.
*E-mail:* rosires.deliza@embrapa.br (R. Deliza).

http://dx.doi.org/10.1016/j.bjp.2017.01.005

**Table 1**
Description of Ecuadorian honey samples evaluated in the study.

| No. | Code | Bee species | Ethnic names | Province of origin | Stingless bee vouchers |
|---|---|---|---|---|---|
| 1 | 105 | *Apis mellifera* (light amber) | "abeja" | Los Ríos | – |
| 2 | 291 | *Scaptotrigona ederi* | "catiana" | El Oro | 17044-17046 RPSP |
| 3 | 376 | *Melipona grandis* | "bunga negra" | Pastaza | 171037-171045 RPSP |
| 4 | 442 | *Apis mellifera* (amber) | "abeja" | Pichincha | – |
| 5 | 551 | fake honey | "artificial" | Morona Santiago | – |
| 6 | 686 | *Geotrigona leucogastra* | "abeja de tierra" | Manabí | 0238-0239 UPSE |

The great Neotropical biodiversity has been carefully reviewed by Camargo and Pedro (2007), reporting 391 species-group of Meliponini, up to 417 valid species (Camargo and Pedro, 2013). Ramírez et al. (2013) inform 89 species of stingless bees in the Southern region No. 7 of Ecuador that comprises three provinces: El Oro, Loja and Zamora Chinchipe.

Honeys produced in pots by Meliponini have been appreciated for their tropical features (Schwarz, 1948). Pot-honeys are more sour and thinner than honeys produced in combs by *Apis mellifera* (Gonnet and Vache, 1984) – where fermentation is considered a defect – and vary much more due to the enormous entomological biodiversity. Vit et al. (2011) initiated a research on perceptions of honey types by Huottuja from the Amazone forest in Venezuela. Pastaza is the largest and least populated province in Ecuadorian Amazone, with seven native indigenous nationalities. The Kichwas from the Rio Chico community live near to the capital city Puyo, and were chosen to take part in this study for their knowledge on stingless honey bees. From the nearly 400 species of Neotropical Meliponini (Camargo and Pedro, 2007), that make honey in cerumen pots, almost 100 thrive in Southern Ecuador (Ramírez et al., 2013), and confer such biodiversity to pot-honey. However, Pre-columbian pot-honeys are not regulated (Vit, 2008), and only the honey produced by *A. mellifera* is included in the Ecuadorian Honey Norm (NTE INEN, 1988). A paradox between keeping gentle bees to protect forest (Vit, 2000) and protecting Meliponini from conspicuous population decrease (Villanueva-Gutiérrez et al., 2013).

This study aimed at characterizing false and genuine Ecuadorian honeys with diverse entomological origin (*A. mellifera* – light amber and amber, *Geotrigona leucogastra*, *Melipona grandis* and *Scaptotrigona* sp.) in terms of their sensory characteristics using Kichwa assessors.

## Materials and methods

### *Stingless bees*

Entomological samples of the stingless bees were collected in alcohol, dried and sent for entomological identification to the Biology Department at the Universidade de São Paulo in Ribeirão Preto, Brazil (Vouchers No. 17044-17046 RPSP and 171037-171045 RPSP in the Camargo Collection RPSP, housed at the Universidade de São Paulo, Ribeirão Preto, Brazil), and the Department of Chemical and Biological Science at Universidad de Las Américas Puebla in Mexico (Vouchers No. 0238-UPSE and 0239-UPSE deposited in the Entomological Collection at Universidad Estatal Península de Santa Elena, Ecuador) (see Table 1).

### *Honey*

Six Ecuadorian honey samples were purchased at the local markets (light amber and amber *A. mellifera* honey named as "abeja", and one fake honey) or harvested from stingless bee nests, named as "abeja de tierra", "bunga negra" and "catiana", which are the ethnic names given to *G. leucogastra*, *M. grandis* and *Scaptotrigona* sp. Honey, respectively. The six honey samples are described in Table 1.

### *Assessors*

A group of eight honey consumers, four females and four males, aged between 18 and 62 years old, from a native Kichwa community located in Rio Chico, Pastaza province, Ecuador, took part in this study. They were selected based on their knowledge on stingless bees, nutritional and medicinal interest on honey, commitment and availability for the sensory test. None of the assessors had previous experience with sensory analysis, but all were familiar with Ecuadorian pot honey from Pastaza province. Their sense of smell was not altered by smoking, allergies, flues, or insomnia. The first, second and third sessions took place in the morning, 2–3 h after breakfast. Their participation was voluntary.

### *Sensory evaluation*

Three sensory sessions were performed after an informed consent form was filled for the sensory test. The Free-Choice Profile methodology (Williams and Langron, 1984) was used in this study.

In the first session, the Free-Choice Profile procedure was explained and then the sensory characteristics were elicited by participants. They were asked to list honey's sensory attributes using their own words to describe the appearance (color and visual consistency), odor, flavor (aroma and taste) and other sensations in their mouth and throat. Instructions were given to prevent comparative and hedonic terms. Each of the six honeys showed in Table 1 were presented in capped plastic bottles coded with three-digit numbers, in a daylight illuminated room, and participants were asked to list the sensory characteristics they perceived after tasting each honey. Appearance was evaluated first, then the odor, and finally half spoon of honey was taken to evaluate taste, aroma, mouth feel and any other sensation. Mineral water was served to rinse the mouth between honey samples, to reset the palate.

For the second and third sessions, individual score cards were prepared based on the attributes they elicited during the first session to evaluate the intensities of each sensory attribute. The honey samples were monadically evaluated by using unstructured 10 cm line scales anchored with the words "weak" or "absent" at the left end, and "strong" at the right end. Each assessor crossed the intensity on the line scale in the position that best described his/her perception. Help was individually provided during the test to facilitate the evaluation process without any induction.

### *Statistical analysis*

The Generalized Procrustes Analysis was used on the Free-Choice Profile data, to generate an optimized consensus matrix by mathematical transformations, to reach a minimal overall deviation, which was able to summarize the information about the samples, and replace the panel mean (Williams and Langron, 1984). Correlations between the sample score of each sensory attribute and the corresponding sample score principal component, allowed the selection of the important attributes.



Please cite this article in press as: Vit, P., et al. Ecuadorian honey types described by Kichwa community in Rio Chico, Pastaza province, Ecuador using Free-Choice Profiling. Revista Brasileira de Farmacognosia (2017), http://dx.doi.org/10.1016/j.bjp.2017.01.005