



Original Article

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



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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* n.p. 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.

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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.

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 microorganisms (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.

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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	<i>Apis mellifera</i> (light amber)	“abeja”	Los Ríos	–
2	291	<i>Scaptotrigona ederi</i>	“catiana”	El Oro	17044-17046 RPSP
3	376	<i>Melipona grandis</i>	“bunga negra”	Pastaza	171037-171045 RPSP
4	442	<i>Apis mellifera</i> (amber)	“abeja”	Pichincha	–
5	551	fake honey	“artificial”	Morona Santiago	–
6	686	<i>Geotrigona leucogastra</i>	“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 Amazon forest in Venezuela. Pastaza is the largest and least populated province in Ecuadorian Amazon, 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.

Results and discussion

Stingless bee identification

M. grandis Guérin, 1834 and *G. leucogastra* (Cockerell 1914) were the two stingless bees identified in this research. The bee named *Scaptotrigona* sp. was identified as *Scaptotrigona ederi* (Schwarz, unpublished). However due to the fact that this species was recognized by Schwarz, but never described and published, the name must not be used, following the recommendations of the International Code of Zoological Nomenclature. See Table 1 with the ethnic name of these bees.

Elicited sensory attributes

A list of 28 terms was elicited by participants in the first session. The number of attributes varied among assessors. Ferreira et al. (2009) pointed out that the vocabulary developed to describe stingless bee honey by Free-Choice Profile, was similar to descriptors of appearance, odor, flavor, and trigeminal sensations used to describe *A. mellifera* honey by Quantitative Descriptive Analysis (Vit, 1993; Anupama et al., 2003; Persano Oddo and Piro, 2004; Galán-Soldevilla et al., 2005).

Honeys

The first and second dimensions accounted for by 61.1% of the variance. It is possible to see that darker honeys (amber *A. mellifera*, false and *Geotrigona*) were separated from lighter colored by the first dimension; whereas thicker honeys (light amber *A. mellifera*, amber *A. mellifera* and fake) were discriminated from thinner honeys (*Geotrigona*, *Melipona* and *Scaptotrigona*) by the second dimension in Fig. 1.

The consensus configuration of the six Ecuadorian honeys in Fig. 1, shows the position of the samples and their sensory attributes. The first dimension explained 35.29% of the variance, and separated darker honeys (amber *A. mellifera*, fake, and *Geotrigona*) to the left, from lighter honeys (light amber *A. mellifera*,

Melipona and *Scaptotrigona*). The second dimension explained 25.8% of the variability, and separated thicker genuine light amber *A. mellifera* and amber *A. mellifera*, and fake honey in the top, from the thinner pot honey samples (*Scaptotrigona*, *Melipona*, *Geotrigona*) in the bottom.

False honey was described by the following attributes: vomit, peppermint, caramel, bitter, artificial. Assessors used the terms caramel, fermented, sweet, when evaluating amber *A. mellifera*. The light amber *A. mellifera* was perceived as floral, fruity, sunflower, fresh fruit, sour throat, yellow, honey. The *Melipona* and the *Scaptotrigona* were described as resin, fermented, medicinal, sugar cane, liquid honeys. The *Geotrigona* honey was characterized as brown, numb, sour, floral, fruity, sweet, fermented, liquid.

Assessors

The Kichwa assessors were able to describe and to 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 three most liked honeys by 58 participants of the First Congress on Apiculture and Meliponiculture in Ecuador (Vit et al., 2015). Therefore, results of the perceptions of the eight assessors suggest that Ecuadorian native Kichwas keep a sensory legacy of ancestral knowledge, and are more familiar with natural products.

Conclusions

The sensory profiling method used in the study demonstrated to be adequate to describe the samples of false and genuine honeys. They differed in their sensory attributes, which were identified by the assessors, despite their lack of familiarity with the task. However, the Kichwas consumers were familiar with the honeys and this characteristic allowed them to use specific terms to describe and differentiate the honeys. Practical implications of this study can be suggested, and one of them refers to the Codex.

The Codex Alimentarius Commission could benefit from the results of this research on native Kichwas from Ecuador using current words to recognize sensory differences and similarities between fake and genuine honey produced by *A. mellifera* and Meliponini. Besides the chemical standards for honey, key sensory attributes play a role as an analytical support to confirm its entomological origin and authenticity.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this investigation.

Confidentiality of data. The authors declare that no patient data appears in this article.

Right to privacy and informed consent. The authors declare that no patient data appears in this article.

Authors' contributions

PV collected the Ecuadorian honeys and the stingless bees, selected the Kichwa community, and did the field work interviews in the community. SRMP did the entomological identification of *M. grandis* and *S. ederi*, and CV identified *G. leucogastra*. PV sent the database to RD, who did the statistical analysis. PV and RD wrote the manuscript. All authors proofread and approved the manuscript.

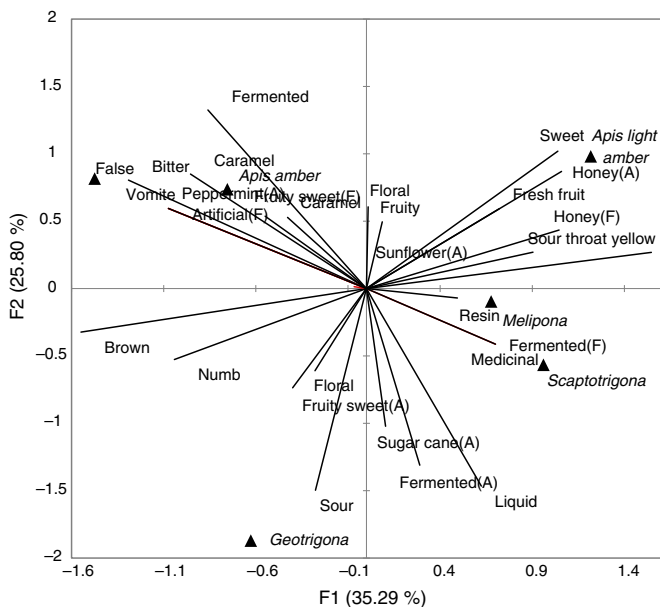


Fig. 1. The six Ecuadorian honeys defined by the first two dimensions of the consensus configuration, showing the sensory attributes used to describe them. Aroma (A) and flavor (F) attributes are indicated. See Table 1 for the identification of honey samples.

Conflicts of interest

The authors declare no conflicts of interest.

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