Chapter 28
The Pot-Honey of Guatemalan Bees

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28.1 Introduction

In Guatemala there are at least 32 species of native stingless bees that produce honey. Guatemalan beekeepers have developed, since Pre-Columbian times, skills for bee breeding and nowadays refer to about 15 species by their common name. However, the species with superior realized breeding potential and honey production are *Melipona beecheii* Bennett, 1831, *Tetragonisca angustula* (Latreille, 1811), *Scaptotrigona pectoralis* (Dalla Torre, 1896), and *Scaptotrigona mexicana* (Guérin-Méneville, 1844). *Geotrigona acapulconis* (Strand, 1919) is also greatly appreciated for its honey, which is believed to have medicinal properties. However, the bee nests underground and is not kept in hives easily thus no traditional breeding apparently exists (Yurrita et al. 2004; Enríquez et al. 2001, 2004, 2005).

In some regions stingless bee breeding and artificial feeding, in the rainy season, are practiced. This is an economic alternative currently promoted by nongovernmental organizations, to benefit families in the rural area. However, there are still regions of Guatemala where stingless bee colonies are kept in traditional log hives, and beekeeping practical knowledge is transmitted orally, from generation to generation (Yurrita et al. 2004; Enríquez et al. 2001, 2004, 2005). Honey is the hive's most coveted product; there are few reports on the use of wax (i.e., cerumen—a mixture of wax with resin), pollen and no reports on the use of propolis (i.e., pure resin). Most of the beekeepers use the honey only for their own consumption, either as medicine and food, because of the scarcity of the product. Only those who have many hives sell the honey, but

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always locally. The honey of stingless bees is priced three times higher than that of *Apis mellifera* L., as in other countries of the region (Yurrita et al. 2004; Enríquez et al. 2001, 2004, 2005).

Popularly, the honey of stingless bees is claimed to have a great number of medicinal properties that together with cultural, historic, and biologic components, gives an added value to it (Enríquez et al. 2001, 2004, 2005 and chapters in this book). However, the exact composition of the honey is unknown, which represents a challenge that has to be overcome to encourage the conservation of these species and their honey. There are many characteristics to study in honey, for example physicochemical, pollen composition, nutrition and taste or sensorial evaluation. Also the sanitary quality of the product and popular beliefs regarding properties and uses require validation, before marketing can be pursued. Part of this work has already begun, and the results are discussed below.

28.2 Physicochemical Characteristics of Guatemalan Pot-Honeys

Honey presents a great variety of physicochemical characteristics that have been used to determine its quality. In *A. mellifera* some useful parameters are acidity, ash, sucrose, reducing sugars, moisture content, diastase and hydroxymethylfurfural. These parameters may also be used to establish quality control and to avoid adulteration of stingless bee honey. However, the composition of honey should be known, throughout the regions from which it comes, to define normal values for such parameters and lead to its commercialization. Composition has been studied, preliminarily, in 18 samples of honey from *Melipona beecheii, M. solani* Cockerell, 1912, *M. yucatanica* Camargo, Moure and Roubik 1988, *Tetragonisca angustula*, *Plebeia sp.*, *Nannotrigona perilampoides* Cresson 1878, *Scaptotrigona mexicana* and *Geotrigona acapulconis* (Dardón and Enríquez 2008).

28.2.1 Reducing Sugars

The principal reducing sugars found in honey, generally in almost equal proportions, are glucose and fructose (Alves et al. 2005). The reducing sugars in the honey of Guatemalan stingless bees (Table 28.1) are of higher content than the minimum proposed by Vit et al. (2004) (50 g/100 g) and Souza et al. (2006) (58.0–75.7 g/100 g), as honeys show values between 57.22 and 75.97 g/100 g. Average values of reducing sugars are not very different among honeys of different stingless bee genera. The honey of the genera *Melipona* and *Trigona* present a higher quantity of reducing sugars, while honey of *Scaptotrigona* has about 20% less reducing sugars, compared to honey of *Melipona*, so their honey is usually less sweet.

Table 28.1 Sugars content of stingless bees honey from Guatemala

Bee species	Honey samples n	Reducing sugars (g/100 g)	Apparent sucrose (g/100 g)	Total sugars (g/100 g)
Melipona beecheii	7	68.77 ± 3.82	3.50 ± 4.14	72.45 ± 6.10
Melipona solani	1	75.97	1.7	76.19
Scaptotrigona mexicana	1	57.22	0.06	57.28
Tetragonisca angustula	1	65.78	4.83	70.86

After Dardón and Enríquez (2008)

28.2.2 Sucrose

Sucrose represents about 2–3% of the carbohydrates in honey of *A. mellifera* (Swallow and Low 1990); high values of this disaccharide are related with premature honey harvest, where sucrose has not been converted into glucose and fructose by the action of invertase (Alves et al. 2005). The sucrose in honey of Guatemalan stingless bees (Table 28.1) is in the allowed parameters for the Codex alimentarius (maximum of 5 g/100 g) and the values coincide with those reported by Souza et al. (2006) for stingless bees (1.1–4.8 g/100 g). Values for sucrose in the honey of *Scaptotrigona* are lower than those of *Melipona* and *Geotrigona*, as suggested by Vit et al. (2004) and Dardón and Enríquez (2008).

28.2.3 pH

The pH values in honey refer to the hydrogen ions present in solution that participate in formation of other components (e.g., hydroxymethylfurfural) (Carvalho et al. 2005). According to Alves et al. (2005), pH is determined by nectar, the cephalic secretions of the bees while they carry the nectar to the hive, by the origin of the honey and the concentration of different ions like calcium, potassium, and sodium. Most (Table 28.2) are found in the ranges reported by Souza et al. (2006), with values between 3.71 and 5.18, with the highest pH in the honey of *Geotrigona* (Dardón and Enríquez 2008).

28.2.4 Free Acidity

Honey contains acids that contribute to its stability and retard development of microorganisms; gluconic acid is the most common (Mato et al. 1997). This acid is formed by the action of glucose-oxidase on glucose, this enzyme is produced in the hypopharyngeal glands of bees, acting even after the honey is stored (Alves et al. 2005). Acids found in smaller quantities include acetic, benzoic, butyric, citric, phenylacetic, formic, isovaleric, lactic, maleic, oxalic, propionic, pyroglutamic, succinic, and valeric acids (Carvalho et al. 2005). The values were less than 20 meq/100 g

Table 28.2 Physicochemical parameters of stingless bees honey from Guatemala

		Physicochemical parameters					
Bee species	Honey samples n	pH	Free acidity (meq/100 kg)	Moisture content (g/100 g)	Ash content (g/100 g)	Diastase activity (DN)	HMF (mg/kg)
Mb	7	3.67 ± 0.12	23.2 ± 30.0	17.3 ± 2.6	0.07 ± 0.05	21.3 ± 32.8	n.d.
Ta	4	5.18 ± 1.35	17.4 ± 10.4	17.5 ± 2.8	0.35 ± 0.26	12.3 ± 10.3	n.d.
Sm	2	4.04 ± 0.4	12.7 ± 3.0	18.7 ± 0.2	0.10 ± 0.04	18.6 ± 12.7	n.d.
Ms	1	3.81	4.95	19.66	0.06	8.3	n.d.
Ga	1	3.06	85.53	32.09	0.09	2.6	n.d.
Pl	1	3.8	15.31	30.26	1.25	7.6	n.d.
My	1	3.79	10.59	20.37	0.06	10.0	n.d.
Np	1	3.8	9.93	16.54	0.33	6.8	n.d.

Mb = *Melipona beecheii*, Ms = *Melipona solani,* My = *Melipona aff. yucatanica,* Ta = *Tetragonisca angustula,* Pl = *Plebeia* sp., Np = *Nannotrigona perilampoides,* Sm = *Scaptotrigona mexicana,* Ga = *Geotrigona acapulconis*

After Dardón and Enríquez (2008)

in our study, although in *G. acapulconis* the value is four times higher and tends to reach values above 80 meq/100 g (Table 28.2) (Dardón and Enríquez 2008). Vit et al. (2004) proposed maximum values between 70 and 85 meq/100 g for the genera *Melipona*, *Scaptotrigona* and *Trigona*. The free acidity range was (5.9–109.0), with averages between 36.6 and 49.7 in the most studied species (Souza et al. 2006).

28.2.5 Moisture Content

The moisture content, besides water, has a relation with the viscosity, specific weight, maturity, crystallization and taste of honey. The honey of Guatemalan stingless bees (Table 28.2) is, on average, below 20 g/100 g, which is an acceptable value for commercial *A. mellifera* honey. There is also an exception for *Geotrigona acapulconis* and *Plebeia* sp., which acquire moisture values above 30 g/100 g and give honey the lowest viscosity. Souza et al. (2006) point out that, in honey of these species, the most common range is 19.9–41.9 g/100 g. However, Vit et al. (2004) proposed a maximum of 30 g/100 g for *Melipona*, *Scaptotrigona* and *Trigona*. According to observations on honey of *Plebeia* and *Geotrigona* with higher moisture values, an extension of the parameter should be considered.

28.2.6 Ash Content

The amount of ash found in honey is a quality criterion influenced by botanical origin. This parameter is correlated with the color of the honey; darker honeys have more ash and, consequently, more minerals (González-Miret et al. 2005). Our honey

(Table 28.2) contains, an average of 0.23 g/100 g of ash content. However, the high quantity of ash in the honey of *Plebeia* sp. stands out, acquiring values above 1.25 g/100 g. Vit et al. (2004) propose a maximum of 0.5 g/100 g for ash of stingless bee honey, while Souza et al. (2006) list the common values of stingless bee honey at 0.01–1.18 g/100 g.

28.2.7 Diastase (a-Amylase)

Enzymes present in honey are formed by bee hypopharyngeal glands in the head and are found in small proportions in collected pollen (Moritz and Crailsheim 1987). Diastase is a heat-sensitive enzyme, so it is recommended for testing honey quality. The diastase activity is calculated as diastase number (DN = units of diastase activity). One unit is defined as the amount of enzyme that will convert 0.01 g of starch to the prescribed end point in that 40°C under the condition of the test (Vorlová and P idal, 2002). The stingless bee honey in Guatemala is highly variable in diastase number. This is reflected in the values of standard deviations presented in Table 28.2, particularly in *M. beecheii* honey. Vit et al. (1998) reported diastase values 2.9–23.0 DN for *Melipona favosa* honey, somewhat similar to values found in some Guatemalan stingless bees, 2.6–21.3 DN (Table 28.2), in agreement with the minimum of 3 DN for *Melipona* honey, initially proposed by Vit et al. (2004).

28.2.8 Hydroxymethylfurfural (HMF)

HMF is a degradation compound formed by the reaction of certain sugars with acids, principally by the decomposition of fructose (Spano et al. 2006). Its presence is an indicator of honey quality because it is found in small quantities in recently collected honey, and also because the quantity increases with time and overheating. HMF was not detected in honey of Guatemalan stingless bees (Table 28.2). Vit et al. (2004) proposed a maximum of 40 mg/kg. For Souza et al. (2006) the averages for the stingless bee honey most studied varied between 2.4 and 16.0 mg/kg, although the highest HMF value known so far is 78.5 mg/kg from an abstract meeting (Grajales et al. 2001).

28.3 Nutritional Characteristics

The honey of *A. mellifera* is recognized as a high-energy and nutritive food, and for being a sugar substitute of wide use in the food industry. The honey is principally composed by carbohydrates, which are about the 95–99% of the solids, and of those, 85–95% corresponds to reducing sugars that give honey its sweet taste and energy.

Table 28.3 Nutritional characteristics of stingless bees honey from Guatemala

Bee species	Honey samples n	Carbohydrates (g/100 g)	Proteins (g/100 g)	Calories kcal/100 g
Scaptotrigona pectoralis	2	70.22	0.41	283
Melipona beecheii	3	75.08	0.07	300
Tetragonisca angustula	3	70.22	1.19	286
Scaptotrigona mexicana	1	71.73	0.47	289

After Rodas et al. (2008)

The protein content of honey, in *A. mellifera,* presents a maximum of 0.1% and 7 proteins have been identified, five from the bees and two from plants. Of these proteins, enzymes are the most important for their role in the conservation of honey. Proline is the most abundant protein amino acid in honey (Carvalho et al. 2005). Honey also contains most of the essential chemical elements for the organism, such as K, Na, Ca, Mg, Mn, Ti, Co, Mo, Fe, Cu, Li, Ni, Pb, Sn, Zn, Os, Ba, Ga, Bi, Ag, Au, Ge, Sr, Be, and Ba (Freitas et al. 2006). Other compounds are found in smaller quantities, like organic acids, vitamins and aromatic substances, which play an important role in nutrition.

Preliminary studies of the honey of four Guatemalan stingless bees (Table 28.3) demonstrate an energy value of 280–300 kcal/100 g, 70–75% carbohydrate, each lower values than honey of *A. mellifera*. The percentage of protein in the honey of stingless bees varies between 0.073 and 1.19, for *M. beecheii* and *T. angustula* with the lowest and highest protein contents, respectively.

28.4 Antibacterial Properties of Guatemalan Pot-Honey

Honey has been used since ancient times in efforts to cure many diseases. It has been utilized by Chinese, Egyptian, Hebrew, Greek, Hindu, Persian, Roman, and Mayan cultures (see the Ocampo Rosales chapter in this book). The scientific mechanism known for the antibacterial activity in honey is hydrogen peroxide (H_2O_2), slowly released by the action of glucosidase and ingredients including antioxidant activity, vitamins, osmotic pressure, and polyphenol content, etc., which are of botanical origin (Aguilera et al. 2006). The study of antibacterial activity of honey validates its therapeutic use and has shown activity against some pathogenic bacteria. There should be valid reasons for medicinal use of this hive product, and its derivatives, in the treatment of infectious disease (Aguilera et al. 2006). After evaluating the antibacterial activity (Table 28.4) it was found that honey of eight among nine species shows antibacterial activity, against eight pathogen microorganisms, at concentrations of 2.5–10%. The honey of *M. solani*, however, had no such activity. The least susceptible microorganisms to the honey were *Candida albicans* and *Salmonella tiphy*. However, in dilutions of 2.5%, the honey of *S. pectoralis* was effective (Table 28.4). The stingless bee honey inhibited growth of *Staphylococcus aureus*, in

Table 28.4 Antimicrobial activity of stingless bees honey from Guatemala

Stingless bee species[a]	Mb	Ms	My	Ta	Pl	Np	Sm	Sp	Ga
Sample size	12	3	1	5	1	6	1	1	1
Bacterias and yeasts	Dilutions with microbial growth								
Staphylococcus aureus	5	–	5	10	5	5	5	2.5	10
Salmonella typhi	5	–	10	10	5	5	5	2.5	10
Mycobacterium smegmatis	5	–	5	5	5	2.5	5	2.5	5
Bacillus subtilis	5	–	5	5	5	2.5	5	2.5	5
Pseudomonas aeuroginosa	5	–	5	10	5	5	5	2.5	5
Escherichia coli	5	–	5	5	5	5	5	5	5
Candida albicans[b]	10	–	5	10	10	5	5	5	–
Criptococcus neoformans[b]	5	–	5	5	5	2.5	5	2.5	5

[a]Stingless bee species are indicated in the Table 28.2
[b]Yeast
After Dardón and Enríquez (2008)

dilutions ranging from 2.5 to 10%, with exception of *S. pectoralis*, which inhibited at 2.5%, and *M. solani,* which had no activity. *Mycobaterium smegmatis* was inhibited by honey of eight species, at an average dilution of 5% (Table 28.4).

28.5 Sensory Characteristics of Guatemalan Pot-Honey

Sensory characteristics are those perceived through the sense organs (eyes, nose, tongue, skin, or ears) to evaluate the color, size, shape, smell, aroma, taste, texture, malleability, and sound of consumables. Honey has a wide range of qualities that are very useful for detecting or describing its attributes (Vit 2007; Vit et al. 2008). The honey of five Guatemalan stingless bees was analyzed in color, smell, taste, and viscosity. Color allowed recognition of four descriptors ranging from transparent white (honey of *M. solani*) to orange (honey of *T. angustula*) (Table 28.5). Generally, the honey of *Melipona* is characterized for color ranging from pale yellow to white, or "white honey". In addition, refrigerated honey, stored for 10 years, changes color, giving rise to many colors of the same origin but different age.

For the taste of honey, of Guatemalan stingless bees, 10 descriptors were identified: strong acetic acid, sugar, sugarcane, sweet, slightly sweet, floral, formaldehyde, fruity, slightly acetic acid, and "nance" (the sour, edible fruit from a tree, *Byrsonima crassifolia*, Malpighiaceae). For the smell, 11 descriptors were recognized: accentuated acetic acid, sugar, "panela" (jaggery), fermented, floral, slightly formaldehyde, slightly fat, slightly acetic acid, slightly alcoholic, slightly fruity, and hive (Table 28.5). Both the smell and taste varied between the samples analyzed, influenced possibly by their location of origin. According to these results we can say that the pot-honey of Guatemalan stingless bees present sweet smell and taste, but the smell is also slightly acetic acid because of the relatively high water content, which triggers the fermentation processes.

Table 28.5 Sensory characteristics of stingless bees honey from Guatemala

Bee species	Honey samples n	Color	Odor/aroma	Taste	Viscosity
Melipona beecheii	5	Pale yellow	Slightly fat, floral, hive, slightly acetic acid, slightly frutal	Slightly sweet	78.8
Scaptotrigona mexicana	3	Pale yellow	Slightly ethanolic, floral	Slightly sweet	72
Melipona solani	3	Transparent white and pale yellow	Slightly acetic acid, slightly formaldehyde	Sweet	76
Trigona angustula	2	Yellow and orange	Fermented, jaggery, strong acetic acid	Sweet, slightly acid	81
Geotrigona acapulconis	1	Yellow	Strong acetic acid	Sweet, strong acid	64

After Rodas et al. (2008)

28.6 Pollen Composition of Guatemalan Pot-Honey

Melissopalynology considers pollen types found in honey and information on botanical origin, sometimes used for honey classification as unifloral or multifloral (Louveaux et al. 1970). A unifloral honey is the one that presents at least 45% of a single species, while a multifloral honey presents a high number of pollen resources or, at least, three different species in similar proportion. Honey characteristics are strongly influenced by botanical origin due to bee-plant interaction (i.e., bee foraging preferences), and it is useful to apply palynology for understanding bee flora. Our 53 honey samples of 9 different species revealed 20 botanical families (Table 28.6). The families Asteraceae, Fagaceae, Melastomataceae, and Tiliaceae were found in the honey of at least five different species and were the most commonly visited families. The honey of *T. angustula* presented a higher richness of families (18), while the honey of *S. mexicana* and *G. acapulconis* were the poorest (3). *Melipona* honey in Guatemala did not exceed eight plant families in pollen content.

Table 28.6 Floral resources of stingless bee honey from Guatemala

Bee species[a]	Mb	Ms	M	Ta	P	Np	Sm	Sp	Ga
Sample size	13	6	1	21	1	4	4	2	1
Botanical Family	Pollen types								
Acanthaceae				X	X				
Amaranthaceae				X					
Asclepiadaceae				X					
Asteraceae	X	X	X	X	X	X			X
Begoniaceae	X			X					
Bignoniaceae				X					
Cochlospermaceae[b]				X					
Convolvulaceae				X	X				
Fabaceae	X	X		X	X		X		
Fagaceae[b]	X	X		X			X	X	X
Lamiaceae				X					
Malvaceae						X			
Melastomataceae	X	X	X	X	X		X	X	
Myrsinaceae							X		
Myrtaceae	X	X		X		X			
Onagraceae				X					
Piperaceae[b]		X		X					
Rutaceae				X					
Solanaceae[b]	X	X		X		X			
Malvaceae (Tilioideae)	X	X		X		X		X	X
Total	8	8	2	18	5	5	4	3	3

[a]Bee species are indicated in Table 28.2
[b]Pollen is not indicator of nectar origin

28.7 Sanitary Quality of the Honey of Guatemalan Stingless Bees

The sanitary quality control of a product insures a safe product by detecting the presence of components that may negatively affect human health. Honey of stingless bees has been studied to detect presence or absence of insecticides. During flight and foraging, as well as in search of water, nectar, and/or honey, a bee may have contact with agricultural pesticides and other artificial chemical sources. This is why they are considered excellent bioindicators of the distribution of pesticides (Kevan 1999). One type of the most common pesticides is the organophosphates, which have been detected in low levels in the honeys of *A. mellifera*. The presence of pesticides represents a major risk to public health and maximum values allowed in honey have not been established, although some acaricide residues are regulated (Blasco et al. 2004).

In Guatemala, organochlorides, organophosphates, pyrethroids, bipiridils, glyphosate, and atrazines are used around apiaries and meliponaries (Rodas et al. 2008). Therefore, there may be pesticide contamination of honey from agricultural areas. Four Guatemalan stingless bees studied by gas chromatography/mass spectrophotometry revealed no contaminants (Rodas et al. 2008). Detectable levels of pesticides were not found in six samples of honey from *M. beecheii*, 3 *T. angustula*, 2 *G. acapulconis*, and 1 of *S. pectoralis.* There is no detectable risk, at present, of pesticide in the honey, despite the fact that these compounds are used in the immediate environment.

28.8 Honey Attributes of the Four Most Appreciated Stingless Bee Species in Guatemala

28.8.1 Melipona beecheii

This species is popularly known in Guatemala as the creole bee "abeja criolla," large beehive "colmena grande," "bichi," and, in Mayan language, "sak'q qaw." This species has been used extensively since PreColumbian times. Its pot-honey, denominated "white honey," is very prized in Guatemala and is used against various maladies, such as stomach, respiratory and ocular disease or sickness, bumps, sores, and skin wounds.

Due to its physicochemical components, the honey of *M. beecheii* presents a high degree of acidity, 23.2 meq/kg honey, in comparison with the other species studied (excluding *G. acapulconis*). The ash content is relatively low, possibly the reason for the pale yellowish color, also reflected in low protein content (in comparison with *T. angustula*). The floral-fruity, fermented and woody odors and aromas make this honey very pleasant to the consumer. The price of *M. beecheii* honey ranges from Q75.00 to Q300.00 (US$ 10–40), per L, which is a price two to eight times higher than the local honey of *A. mellifera*. When evaluated against various microbial pathogens, *M. beecheii* honey inhibited their growth at dilutions of 5–10% and was least effective against the yeast *C. albicans* (Table 28.6).

28.8.2 Geotrigona acapulconis

This species is commonly called "talnete". It produces a considerable amount of honey that is popularly used to treat broken bones, internal injuries, eye diseases, cleaning the kidneys, and as a purgative. Due to the biology of this bee and its strict nesting habits, captive breeding is not practiced. Honey is obtained by digging up underground nests. The free acidity, 85.5 meq/kg honey of one sample, was at least four times higher than other Guatemalan stingless bees. Accordingly, the smell of the honey has relatively high acetic acid content and its flavor is described as sweet and strong acetic acid. The moisture content is high, making it a very liquid honey, and ash values are similar than those found in the genus *Melipona*. It has low diversity in pollen content, with only three plant families recorded. These families are often visited by stingless bees kept in our country. The honey, of yellow color when extracted, is not very well known and its sale is by a prior agreement. It is strictly a product of "honey hunting," not rational beekeeping. It is also a highly prized honey, and it is conducive to fraud and adulteration. It has been observed that some people offer a honey prepared with panela and lemon, as "talnete" honey.

28.8.3 Scaptotrigona mexicana

The breeding of this bee, commonly named "magua negro" or "congo negro," has advanced because it produces a considerable amount of honey. The honey has a pale yellow color and its smell is alcoholic and slightly floral. All the sensory families described by Vit (2007) for the aroma and smell of stingless bee honeys were found here floral-fruity, fermented, woody, mellow, primitive, industrial chemicals, hive, and vegetable.

The honey of *S. mexicana*, as in *S. pectoralis*, presents a higher percentage of protein, more than honey of *M. beecheii*, although it shows lower values for carbohydrates and this is reflected in its kilocalorie content. The study of four honey samples of this species allowed identification of four plant families in its pollen composition. With respect to the biotic activity of honey, *S. mexicana* was effective against all the evaluated microorganisms, in a dilution of 5%, being therefore one of the most active pot-honey (Table 28.6). Curiously, beekeepers report little medicinal use, even though the honey shows a potential for therapy.

28.8.4 *Tetragonisca angustula*

T. angustula is a very small and normally docile bee, commonly known as “chumelo,” “doncella,” “doncellita,” in Mayan language it is known as “an us” and “qán us.” It can form big colonies, but due to the small size of the honey pots, the quantities of honey produced are considerably less than those obtained in species like *M. beecheii*, with larger honey pots. This honey is very popular for the treatment of eye diseases (cataract and pterygium) but is also used for stomach illness, wounds and ulcers, and sometimes as an energy food or drink. The honey of *T. angustula* has yellow to orange color, with the aroma and smell families: floral-fruity, fermented, woody, mellow, primitive, industrial chemicals, hive, and vegetable. Its honey contains 19 families identified in Guatemala, reflected in color variation and high values of ash and protein.

Its physicochemical composition stands out from the other stingless bees, having the highest pH (>5) and the highest sucrose content (4.8 g/100 g). Antibacterial activity occurs at 5–10% honey dilution and was least effective of all evaluated honey. The microorganisms *Staphylococcus aureus*, *Salmonella typhi*, *Pseudomonas aeruginosa*, and *Candida albicans* were the most resistant (Table 28.6). Popularly, this honey is considered useful for the treatment of eye diseases, so it has to be evaluated to confirm this putative medicinal property.

28.9 Conclusions

The honey of stingless bees is a patrimony for tropical regions, especially for Latin America, where most of these bees exist. The honey of each varies among species and also within the same species, depending on the region where they are found and the plant resources they utilize. Determining the composition of this greatly varied honey, and knowing its attributes, is a difficult task. However, the challenge has been taken by research from Argentina, Bolivia, Brazil, Colombia, Costa Rica, Perú, Venezuela, and us, in Guatemala. We have 33 species of stingless bees, 32 produce honey and of these, only 9 species have been studied: all of them in manners considering antibacterial activity and pollen composition, 8 in physicochemical properties, 5 in sensory attributes and 4 for its sanitary quality. There are still 23 species that have not been studied, this corresponding to 60% of the entomological diversity of honey in the country. Efforts for understanding more about the pot-honey of stingless bees have begun, and for the moment, boosted stingless bee keeping. However, it is necessary to continue, to get to know all the diversity of honey, and promote its commercialization, and to validate potential therapeutic use.

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