# Chapter 6
# Stingless Bees of Guatemala

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## 6.1 Introduction

In many areas of their tropical distribution, the meliponines are the most common bees and hence are considered to play an important role as pollinators of native and crop vegetation (Slaa et al. 2006). This fact has been taken advantage of by local human populations, who have learned to harvest the honey (Villanueva et al. 2005; Posey 1982).

In Guatemala, as in other Central American countries, the inhabitants of some regions keep a few of the stingless bee species in a traditional way and use the honey and the pollen as a medicine and food source. However, despite their importance these and other bees are at risk due to a combination of factors, including deforestation and presumably competition with nonnative species (Villanueva et al. 2005). In the case of the stingless bees destruction of colonies to extract honey and pollen represents an additional threat.

In this chapter we present an overview of the stingless bee species native to Guatemala, the species richness of the group, their distribution in the country, floral resources visited, stingless bee beekeeping activity, and uses of stingless bee-derived products, particularly honey.

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## 6.2 Taxonomy and Distribution of Stingless Bees in Guatemala

The bee family Apidae includes the only two groups of highly eusocial corbiculate bees: the tribes Apini and Meliponini. These two tribes are characterized by the presence of a pollen carrying structure on the hind legs called "corbicula." This feature is shared with other corbiculate bees of the same family: the primitively eusocial bumble bees (Bombini) and the mostly solitary orchid bees (Euglossini). From a behavioral point of view Meliponini, like Apini, differ from other eusocial bees in that they form permanent colonies in which queens and workers are morphologically very different, the queen never forages, and neither the queen nor the workers can establish colonies by themselves (Michener 2007).

The Meliponini exhibit a worldwide tropical and subtropical distribution and are the most diverse group of the corbiculate bees, with several hundred species (Rasmussen and Cameron 2010). Different classifications of the group have been proposed. In one classification system, a few genera and many subgenera are recognized, in order to emphasize the relationships between the groups (Michener 2007). In the other classification system many subgenera are elevated to the generic level to stress the full taxonomic diversity of the tribe (Moure 1961; Rasmussen and Cameron 2007, 2010; Camargo and Pedro 2008). Here, we use the classification system proposed by Moure (1961) and Camargo and Pedro (2008). In this system the entire tribe consists of at least 59 genera (Moure 1961; Camargo and Pedro 2008; Rasmussen and Cameron 2007). The greatest diversity of stingless bees is found in the Tropical America where 33 genera have been recognized that include approximately 400 species (Camargo and Pedro 2008).

Here we present an updated list of the stingless bees of Guatemala that has been prepared using the identification key for the Meliponini of Mexico (Ayala 1999) and the specimens included in the entomological Guatemalan Native Bee Collection "Colección de Abejas Nativas de Guatemala" (CANG), of the Biodiversity Research Unit at the Conservation Studies Center (CECON) of the University of San Carlos of Guatemala. In Guatemala the diversity of Apoidea is estimated as at least 500 species (Enríquez et al. 2012), belonging to the families Andrenidae, Apidae, Colletidae, Halictidae, and Megachilidae. Of these the family Apidae has the highest diversity with 227 reported species (Enríquez et al. 2012). Currently, 33 stingless bee species are included in the collection (Table 6.1). Even though this number may increase with additional taxonomic and collecting work, it is not expected to exceed either the Costa Rican richness (50 species, Ortiz 1998) nor the Mexican one (46 species, Ayala 1999). Indeed a bibliographic survey produced a list of approximately 40 species of meliponines already reported for the country (Enríquez et al. 2012), which covers records from the literature (Camargo and Pedro 2008) like *Paratrigona opaca* (Cockerell, 1917), *Geotrigona lutzi* Camargo & Moure, 1996, *Geotrigona terricola* Camargo & Moure, 1996 and *Scaptotrigona wheeleri* (Cockerell, 1913), as well as material from other collections that was not included here.

**Table 6.1** List of the Guatemalan stingless bees in the native bee collection (CANG). Departments (geopolitical division), number of collecting sites, and altitudinal ranges where they have been collected (from CANG database)

| No. | Stingless bee species | Departments of occurrence | No. of sites | Altitudinal ranges of collecting |
|---|---|---|---|---|
| 1 | *Cephalotrigona zexmeniae* (Cockerell, 1912) | AV, CHIQ, SR | 4 | 0–500, 501–1,000, 1,001–1,500 |
| 2 | *Dolichotrigona schulthessi* (Friese, 1900) | AV, QUE, REU, SM | 7 | 0–500, 501–1,000, 1,001–1,500 |
| 3 | *Frieseomelitta nigra* (Cresson, 1878) | PR | 3 | 0–500 |
| 4 | *Geotrigona acapulconis* (Strand, 1919) | G, SR | 2 | 1,001–1,500 |
| 5 | *Lestrimelitta niitkib* Ayala, 1999 | AV, G, PR | 5 | 0–500, 1,001–1,500, 1,501–2,000 |
| 6 | *Melipona beecheii* Bennett, 1831 | AV, BV, CHIQ, QUI, PE, ESC, G, I, JUT, REU, SR, SOL | 36 | 0–500, 501–1,000, 1,001–1,500, 1,501–2,000 |
| 7 | *Melipona solani* Cockerell, 1912 | AV, I, QUI, PE, HUE, QUE, REU, SM | 19 | 0–500, 501–1,000, 1,001–1,500 |
| 8 | *Melipona yucatanica* Camargo, Moure & Roubik, 1988 | HUE, JUT, SAC, SR | 5 | 501–1,000 |
| 9 | *Nannotrigona perilampoides* (Cresson, 1878) | AV, BV, PE, G, I, JUT, SR, ZAC | 16 | 0–500, 501–1,000, 1,001–1,500, 1,501–2,000 |
| 10 | *Oxytrigona mediorufa* (Cockerell, 1913) | CHIM, I, QUE, SUCH | 4 | 501–1,000, 1,001–1,500 |
| 11 | *Paratrigona guatemalensis* (Schwarz, 1938) | AV, SR | 4 | 0–500, 1,001–1,500 |
| 12 | *Partamona bilineata* (Say, 1837) | AV, BV, CHIQ, G, HUE, I, JUT, JAL, QUE, QUI, REU, SAC, SM, SOL, SUCH | 35 | 0–500, 501–1,000, 1,001–1,500, 1,501–2,000, 2,001–2,500 |
| 13 | *Partamona orizabaensis* (Strand, 1919) | AV, CHIQ, QUI, QUE, REU, SM, SOL, SUCH | 9 | 0–500, 501–1,000, 1,001–1,500, 2,001–2,500 |
| 14 | *Plebeia frontalis* (Friese, 1911) | CHIQ, PE, I, ZAC | 7 | 0–500, 1,001–1,500 |
| 15 | *P. fulvopilosa* Ayala, 1999 | CHIQ | 1 | 1,501–2,000 |
| 16 | *P. jatiformis* (Cockerell, 1912) | AV, G, SR | 10 | 0–500, 1,001–1,500, 1,501–2,000 |
| 17 | *P. llorentei* Ayala, 1999 | AV | 2 | 0–500 |
| 18 | *P. melanica* Ayala, 1999 | BV, CHIQ, QUI | 5 | 1,501–2,000 |
| 19 | *P. moureana* Ayala, 1999 | AV, JUT, SM | 5 | 0–500, 501–1,000 |
| 20 | *P. parkeri* Ayala, 1999 | AV, G, QUE, SM, SR | 7 | 0–500, 501–1,000, 1,001–1,500 |
| 21 | *P. pulchra* Ayala, 1999 | AV, QUI, SR | 6 | 0–500, 1,001–1,500 |

(continued)

**Table 6.1** (continued)

| No. | Stingless bee species | Departments of occurrence | No. of sites | Altitudinal ranges of collecting |
|---|---|---|---|---|
| 22 | *Scaptotrigona mexicana* (Guérin-Méneville, 1844) | AV, CHIM, QUI, QUE, REU, SM, SR | 11 | 0–500, 501–1,000, 1,001–1,500, 1,501–2,000 |
| 23 | *S. pectoralis* (Dalla Torre, 1896) | QUI, REU, SM, SR | 5 | 0–500, 501–1,000, 1,001–1,500 |
| 24 | *Scaura argyrea* (Cockerell, 1912) | AV, PE | 11 | 0–500, 501–1,000 |
| 25 | *Tetragona mayarum* (Cockerell, 1912) | CHIQ, I | 3 | 0–500, 501–1,000 |
| 26 | *Tetragonisca angustula* (Latreille, 1811) | CHIM, SUCH, QUE, REU, PR, G, JUT, I, CHIQ, AV | 19 | 0–500, 501–1,000, 1,001–1,500, 1,501–2,000 |
| 27 | *Trigona corvina* Cockerell, 1913 | AV, BV, CHIQ, PR, JUT, I, SUCH, SR, ZAC | 23 | 0–500, 501–1,000, 1,001–1,500, 1,501–2,000 |
| 28 | *T. fulviventris* Guérin-Méneville, 1844 | AV, CHIQ, PE, PR, QUI, G, I, JUT, QUE, SAC, SM, SR, SOL, SUCH, ZAC | 31 | 0–500, 501–1,000, 1,001–1,500, 1,501–2,000 |
| 29 | *T. fuscipennis* Friese, 1900 | AV, CHIM, PR, I, JUT, SUCH | 8 | 0–500, 501–1,000, 1,001–1,500 |
| 30 | *T. nigerrima* Cresson, 1878 | AV, PE, QUE, SR, SOL, SUCH | 7 | 0–500, 1,001–1,500, 1,501–2,000, 2,001–2,500 |
| 31 | *T. silvestriana* (Vachal, 1908) | AV, I | 10 | 0–500, 501–1,000 |
| 32 | *Trigonisca maya* Ayala, 1999 | PR | 1 | 0–500 |
| 33 | *T. pipioli* Ayala, 1999 | BV, CHIQ | 2 | 501–1,000, 2,001–2,500 |

*AV* Alta Verapaz, *BV* Baja Verapaz, *CHIQ* Chiquimula, *CHIM* Chimaltenango, *ESC* Escuintla, *G* Guatemala; *HUE* Huehuetenango, *I* Izabal, *JAL* Jalapa, *JUT* Jutiapa, *PR* El Progreso, *PE* Petén, *QUE* Quetzaltenango, *QUI* Quiché, *REU* Retalhuleu, *SAC* Sacatepéquez, *SM* San Marcos, *SR* Santa Rosa, *SUCH* Suchitepéquez, *SOL* Sololá, *ZAC* Zacapa

The species included in the CANG belong to 17 different genera of those recognized by Camargo and Pedro (2008) for the neotropical region. *Plebeia* and *Trigona* are the most diverse genera with eight and five species, respectively. *Melipona* include three species and *Partamona*, *Scaptotrigona*, and *Trigonisca* two. The remaining 11 genera are represented by a single species each (Table 6.1). The species *Tetragona dorsalis* (Smith, 1854) and *Scaura latitarsis* (Friese, 1900) included in Ayala (1999) now correspond to *Tetragona mayarum* (or *ziegleri*) and *Scaura argyrea*, respectively (Camargo and Pedro 2008). The species cited here as *Trigona silvestriana* has also been interpreted as *T. amalthea* (Olivier, 1789) (Roubik and Moreno 2009; DW Roubik, personal communication). Of the species listed, *Lestrimelitta niitkib* is the only cleptobiotic one.

Most of the species reported are mainly Mesoamerican, with distributions spanning from Mexico to Colombia (Camargo and Pedro 2008). The exceptions are *Trigona nigerrima*, *Trigona silvestriana*, and *Tetragonisca angustula* which are found farther south than Colombia. The presence of *Trigonisca maya* in Guatemala represents a new distributional record, since it was previously reported only in Mexico (Ayala 1999; Camargo and Pedro 2008).

The distributional analysis presented in this work is based on a geopolitical division of the territory. However, in order to provide a more realistic geographic approach we made reference to the altitudinal range and the type of forest where species were collected. Unfortunately, the available information does not represent the actual distribution of species, given that the collecting effort has not been systematic across the country. Indeed, most of the collecting sites correspond to places where the research group has carried out other studies. Nevertheless, the available data show that Meliponini have a wide distribution in Guatemala, since the species have been collected in all but one of the 22 Departments (administrative division equivalent to Province) of the country. The distributional data correspond to 323 unique localities in which at least one of the 33 species recorded has been collected (Fig. 6.1 and Table 6.1).

Some species can be considered more common since they have been collected in more sites (Table 6.1). For instance, *Partamona bilineata* and *Trigona fulviventris* have been collected in 15 Departments at 31 and 35 localities within them, respectively, while *Trigonisca maya*, *Plebeia fulvopilosa*, *P. llorentei*, and *Frieseomelitta nigra* have been collected in one Department and one or two localities. The departments of Alta Verapaz (North Central region), Santa Rosa (Central South), and Chiquimula (East) show the highest diversity, with more species recorded (22, 14, 12, respectively) (Table 6.1). Nonetheless, this result might be biased by the fact that they correspond to areas where a larger collecting effort has been made. Additionally, the collecting sites within them are very localized (Fig. 6.1).

The stingless bee species in Guatemala are found in a wide variety of forests (pine-oak, dry, thornscrub, montane, and moist) at elevations that range from near sea level to as high as 2,353 m in the mountainous areas. The majority of species do not show a very clear distribution in relation to a certain forest type. Indeed, even species for which we have only a few records can be found in very different areas. For instance, *Plebeia pulchra* and *Paratrigona guatemalensis* have been collected

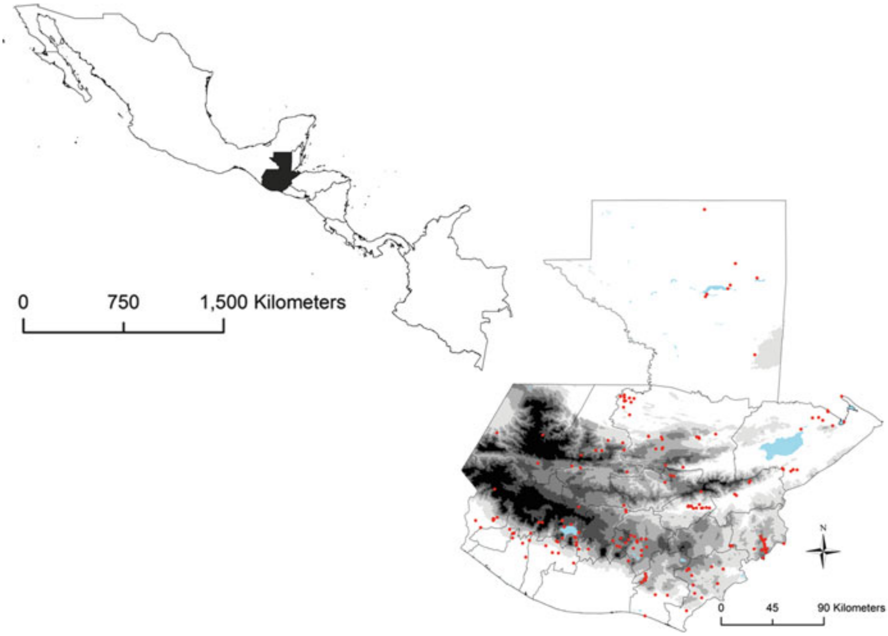


**Fig. 6.1** Occurrence localities of the stingless bees in Guatemala. (•) Collecting sites; altitudinal ranges (masl): 0–500, 501–1,000, 1,001–1,500, 1,501–2,000, 2,001–2,500, 2,501–4,000

in six and four different sites, respectively, located in moist (department of Alta Verapaz) and montane (Santa Rosa) forests. However, a few species like *Trigona silvestriana* that appear in ten different localities exhibit a distribution restricted to very moist forests (Alta Verapaz and Izabal).

Most species (31) occur between sea level and 1,500 m. Four of these (*Trigonisca pipioli, Oxytrigona mediorufa*, *Geotrigona acapulconis*, and *Melipona yucatanica*) have not been collected at the lowest elevation range (0–500 m), while *Frieseomelitta nigra*, *Trigonisca maya*, and *Plebeia llorentei* were captured exclusively in this altitudinal range. However, according to Ayala (1999) *F. nigra* can be found in altitudes over 1,500 m. Fourteen of these species were also collected up to 2,000 m elevation, and in different kinds of forests. *Plebeia fulvopilosa* and *P. melanica* were restricted to elevations of 1,500–2,000 m, as Ayala (1999) reports. Only four species appeared in the highest altitudinal range, and all of them (*Partamona bilineata*, *P. orizabaensis*, *Trigona nigerrima*, and *Trigonisca pipioli*) exhibit a very wide altitudinal range of distribution and habitat preference, occurring from the lowest to the highest elevations and distributed in different habitat types.

Figure 6.1 indicates that collection is few in the southern coast and in northern part of the country, as well as in the central east and central west regions. Nonetheless, given the wide altitudinal and habitat tolerance of some species we expect that most will appear in these areas in future studies.

## 6.3 Floral Resources of Stingless Bees

Animal-mediated pollination is an important ecosystem service for sexually reproducing plants. Bees are considered the most important pollinators for major agricultural crops (Klein et al. 2007) and wild plants (Cane et al. 2006). In the tropics, the stingless bees constitute an important portion of the flower-visiting fauna (Lorenzon et al. 2003; Wilms et al. 1996), having been reported as the major pollinators of 18 crops (Slaa et al. 2006; Heard 1999) and contributing to different degrees to the pollination of many others (Heard 1999).

The stingless bee species stored at CANG were collected on flowers from at least 117 different species (data not shown) that belong to 47 plant families, having information about the resource they provide to the bees (polen and/or nectar) only for a small portion (Table 6.2). Most of the visited families (70%) can be considered

**Table 6.2** Plant families visited by the stingless bee species in Guatemala. Number of bee species visiting and the number of plant species visited per family (from CANG database)

| Plant families visited | No. of visiting bee species | No. of plant species visited | Pollen (P)/nectar (N) source |
|---|---|---|---|
| Asteraceae | 21 | 30 | P, N |
| Zingiberaceae | 16 | 1 | P |
| Fabaceae (Papilionoideae, Mimosoideae, Caesalpinioideae) | 13 | 11 | P, N |
| Bixaceae | 11 | 1 | P |
| Malpighiaceae | 11 | 1 | P |
| Lamiaceae | 10 | 4 | P, N |
| Onagraceae | 10 | 1 | P, N |
| Cucurbitaceae | 9 | 1 | P |
| Poaceae | 9 | 1 | |
| Malvaceae | 8 | 5 | P, N |
| Melastomataceae | 6 | 3 | P, N |
| Rubiaceae | 6 | 4 | |
| Violaceae | 6 | 1 | |
| Solanaceae | 5 | 5 | P |
| Convolvulaceae | 4 | 3 | P, N |
| Commelinaceae | 4 | 2 | |
| Cyperaceae, Piperaceae | 4 | 1 | P, N |
| Cactaceae, Euphorbiaceae | 3 | 3 | P |
| Bignoniaceae, Passifloraceae | 3 | 2 | P, N |
| Bromeliaceae, Salicaceae, Vitaceae, Zygophyllaceae | 3 | 1 | |
| Apocynaceae, Arecaceae, Boraginaceae, Costaceae, Lythraceae, | 2 | 2 | |
| Acanthaceae, Fagaceae, Musaceae, Nyctaginaceae, Orchidaceae | 2 | 1 | P, N |
| Asparagaceae | 1 | 2 | |
| Anacardiaceae, Apiaceae, Brassicaceae, Caryophyllaceae, Myrtaceae, Phytolaccaceae, Ranunculaceae, Rosaceae, Sapindaceae, Verbenaceae | 1 | 1 | P, N |

occasional floral resources, since only a few species (<5) forage on their flowers. In addition, for each of these families, only a few species were visited (<5 species per family) (Table 6.2). On the other hand, Asteraceae and Fabaceae can be suggested to be an important food source for the stingless bees as the diversity of the visited species within these families was higher (30 and 11 visited species, respectively). Moreover, approximately 60% (21) and 40% (13) of the identified bee species, respectively, have been collected while foraging on their flowers (Table 6.2). Other studies have already reported that the family Asteraceae is one of the main food resources for the stingless bees (Wilms et al. 1996). Other plant families visited by more than five bee species show that seven of them are represented by a single species (Table 6.2). This is the case of “achiote” *Bixa orellana* (Bixaceae), “nance” *Byrsonima crassifolia* (Malpighiaceae), “cardamomo” *Elettaria cardamomum* (Zingiberaceae), and watermelon *Citrullus lanatus* (Cucurbitaceae). These species, all important economic and/or food resources for human populations in Guatemala, were part of a more detailed survey. A palynological analysis was carried out to assess the potential of the stingless bees foraging on their flowers as pollen vectors. For *Elettaria cardamomum* eight of the 16 visiting species are suggested as potential pollinators. In the case of *Bixa orellana* six out of 11 can be considered possible pollinators, and for *Citrullus lanatus* and *Byrsonima crassifolia* six and one stingless bee species, respectively, were detected as potential pollinators (Enríquez 2007). Previous studies had already registered these plants as effectively or occasionally being pollinated by stingless bees in other regions (Slaa et al. 2006; Heard 1999). The flowers of maize *Zea mays* (Poaceae), the only recorded species from the Poaceae family, were visited by nine stingless bee species, but there is no evidence proving that these visiting species are acting as potential pollinators.

Eleven meliponines were collected on less than five plant species, and five were not collected on any flower (Table 6.3). Among the latter *Lestrimelitta niitkib* is not expected to collect pollen (or visit flowers) since it has a cleptobiotic behavior. In Guatemala, this bee has been seen attacking colonies of at least two stingless bee species, *Melipona beecheii* and *Tetragonisca angustula* (CL Yurrita 2011, personal observation). *Trigona fulviventris* is the species that visited the widest array of plants (45) (Table 6.3); nonetheless, it has been documented that sometimes it may not act as a pollinator but rather as a nectar or pollen robber (Barrows 1976; CL Yurrita 2010, personal observation). *Melipona* spp. are capable of buzz pollination (Heard 1999), a feature that makes them potential pollinators of many plants. Finally there is a record of *Partamona orizabaensis* captured on feces.

## 6.4 Stingless Beekeeping in Guatemala

There is a long tradition of stingless beekeeping, or meliponiculture, in the Mesoamerican region (Kent 1984; Crane 1992; Cortopassi-Laurino et al. 2006) and in the Amazon (Posey 1982; Posey and Camargo 1985), in comparison with other

**Table 6.3** Number of plant species visited by the stingless bees (from CANG database)

| Stingless bee species | Plant species visited |
|---|---|
| *Plebeia parkeri* | 5 |
| *Scaptotrigona mexicana* | 5 |
| *Scaptotrigona pectoralis* | 5 |
| *Trigonisca maya* | 5 |
| *Trigonisca pipioli* | 5 |
| *Trigona silvestriana* | 7 |
| *Melipona solani* | 8 |
| *Scaura argyrea* | 8 |
| *Tetragona mayarum* | 8 |
| *Partamona orizabaensis* | 8 |
| *Melipona beecheii* | 13 |
| *Trigona nigerrima* | 14 |
| *Cephalotrigona zexmeniae* | 15 |
| *Nannotrigona perilampoides* | 16 |
| *Plebeia jatiformis* | 17 |
| *Trigona fuscipennis* | 17 |
| *Tetragonisca angustula* | 29 |
| *Trigona corvina* | 29 |
| *Partamona bilineata* | 33 |
| *Trigona fulviventris* | 45 |
| *Dolichotrigona schultessi*, *Frieseomelitta nigra*, *Melipona aff. yucatanica, Paratrigona guatemalensis*, *Plebeia frontalis*, *P. fulvopilosa*, *P. melanica*, *P. moureana*, *P. pulchra* | <5 |

The following species were not collected on flowers and were not included in the table: *Geotrigona acapulconis*, *Lestrimelitta niitkib*, *Oxytrigona mediorufa*, *Plebeia llorentei*

regions of the world (Cortopassi-Laurino et al. 2006). This is probably due to the great diversity of meliponines found in Tropical America. In Mesoamerica, stingless bee beekeeping has been culturally important since the precolonial era. Indeed, the Maya codices and some colonial writings record the importance of the stingless bees in the Mayan culture. This importance is revealed by the existence of bee gods (Maya codices) and the rituals of beekeeping and use of hive products documented in the writings of the Bishop Diego de Landa (*apud* Kent 1984). The Mayan region including the Yucatán Peninsula and northern Guatemala and Belize were suggested as a place of intense stingless bee rearing activity in pre-Columbian days, particularly *Melipona beecheii*. Furthermore, this region has been considered the possible place of origin of the practice (Kent 1984; Crane 1992). Thus, both the beekeeping technique and the hive design most commonly employed in the Yucatán Peninsula are considered the original ones (Crane 1992). Nowadays the traditional practice of meliponiculture in the Yucatán Peninsula and in other regions of México (González-Acereto and De Araujo-Freitas 2005), as well as in areas throughout Mesoamerica (Enríquez et al. 2005; Kent 1984), has not changed much over time.

In Guatemala, stingless bee beekeeping is practiced by different ethnic groups across the country. Kent (1984) has documented that the activity takes place in the

**Table 6.4** Common names of stingless bees used in Guatemala [modified from Enríquez et al. (2005)]

| No. | Scientific name | Folk name |
|---|---|---|
| 1 | *Cephalotrigona zexmeniae* | "congo" |
| 2 | *Lestrimelitta niitkib* | "limoncillo" |
| 3 | *Melipona beecheii* | "colmena grande," "criolla," "abeja maya," "xuna'n cab," "bichi" |
| 4 | *Melipona solani* | "chac chow" |
| 5 | *Melipona yucatanica* | "tinzuca" |
| 6 | *Nannotrigona perilampoides* | "serenita" |
| 7 | *Oxytrigona mediorufa* | "tamagás," "pringador" |
| 8 | *Partamona* sp. | "sacar," "cushpun" |
| 9 | *Plebeia* sp. | "chelerita," "serenita," "boca de sapo," "sarquita" |
| 10 | *Scaptotrigona mexicana* | "magua negro," "congo," "congo negro" |
| 11 | *Scaptotrigona pectoralis* | "magua canche," "alazán," "congo canche," "shuruya" |
| 12 | *Tetragonisca angustula* | "chumelo," "doncellita" |
| 13 | *Trigona fulviventris* | "mandinga," "culo de chucho" |
| 14 | *Trigona nigerrima* | "cushusho," "homo," "joloncán" |
| 15 | *Trigona silvestriana* | "homo" |
| 16 | *Geotrigona acapulconis* | "talnete" |

Q'eqchi (Alta Verapaz), Maya-chortí (Jocotán, Chiquimula), and Jacaltec (Jacaltenango, Huehuetenango) areas. Our research group has worked with beekeepers in different regions of the country. The most important group dedicated to rearing the stingless bees are the Ladinos or Mestizos even though the practice is also carried out by Q'eqchí, Chortí, Mam, and Ixil-Quiché populations. For most of these people keeping the stingless bees remains a family tradition inherited for generations, although for others it is a recent activity, initiated as a result of their attendance at workshops carried out by different organizations, including our research group.

People identify at least 16 stingless bee species, some of which have different regional names (Table 6.4). Given the great variety of local names that meliponines receive, we can deduce that they constitute a well-known part of the insect fauna in Guatemala, even if the number of species used in meliponiculture is limited.

Meliponiculture is still practiced in a traditional way in Guatemala. The beekeepers for whom the activity is an inherited family tradition still employ the original techniques (Crane 1992) which involve the use of hollow logs closed at both ends with discs made of wood. Usually the hives are hanging from the roof of houses and less frequently people construct shelters to keep them.

The most important species reared with a honey-harvesting purpose are *Melipona beecheii* and *Tetragonisca angustula*. Another important bee species from which the honey is used is *Geotrigona acapulconis*. However, its nesting behavior (nest constructed deep underground) makes it difficult for people to keep them in hives, and the only way to extract the honey is by destroying the nest. A larger number of bee species are reared with ornamental purposes (because "they are nice"), but eventually their honey can be extracted. Occasionally, people harvest honey from nests kept in their original location without destroying them. This is the case for *Trigona nigerrima* which constructs its nest on tree branches and not in hollows, making it easier to harvest the honey in place. *Scaptotrigona mexicana* and *S. pectoralis* are two species with a special potential in meliponiculture due to the low management requirements and high yields they provide. Finally, the honey of some other species, like that of *Trigona fulviventris*, is avoided due to their anti-hygienic behavior (they collect feces) (M Vásquez 2010, personal observation).

The main product harvested from the stingless bees in Guatemala is the honey, but the pollen and the cerumen are also used. The honey is used mainly for medicinal practices or as an energy supplement, but it is not an important food item, probably due to the small yield. The medicinal properties attributed to the stingless bee honey are very diverse and depend on the species producing it, even though some uses are common to all of them. The honey of *Melipona beecheii* is the most appreciated, probably due to the fact that this species produces larger amounts of honey in comparison with *Tetragonisca angustula* (Vit et al. 2004). Usually the honey is not for sale; if someone in the community needs some, a beekeeper will provide it without any cost. In Guatemala, our research group has undertaken studies aiming to investigate the pollen species content, the antibacterial activity, the physicochemical properties, and the sensory attributes of the honey of nine of the 32 stingless bee species used for honey production (almost 30% of the honey diversity) (Dardón and Enríquez 2008, and Dardón et al., Chap. 28 in this book).

## 6.5 Final Comments

Given the diversity of stingless bees in Guatemala and the wide distributional range of the majority of the species, promoting the use of the honey as an alternative energetic or medicinal supplement or perhaps as a food complement could be a great opportunity.

Nonetheless, as it has been suggested for other regions (Villanueva et al. 2005), bees like *Melipona* and other species that nest in tree hollows may be at risk in Guatemala. One important reason causing this situation is the loss of nesting sites as a consequence of the high deforestation rate, which reaches 1.53% each year in Guatemala (Tuy et al. 2009). Also, as was pointed out for Yucatán (Villanueva et al. 2005), the stingless bee beekeeping practice itself may be in decline in Guatemala.

Therefore, the potential loss of the stingless bee diversity as well as that of the meliponiculture hampers the use of the great diversity of honeys for medical or food complement purposes. Moreover, the lack of quality standards for the honey prevents the marketing of the product.

It is therefore necessary to promote programs aiming to preserve the species habitats as well as programs to enhance the practice of meliponiculture to transform it in a certifiably hygienic and productive activity. That initiative has to be complemented by continuing studies on honey composition, as well as by educating people on improving meliponiculture techniques.

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