

*Short Communication*

## Species Diversity and External Nest Characteristics of Stingless Bees in Meliponiculture

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### ABSTRACT

Stingless bee farming is a new and potential booming industry in Malaysia. A study was conducted on stingless bee species preferred by meliponiculturists in Malaysia. External nest characteristics of the stingless bee species were also described. Sampling of 161 stingless bee colonies at a bee farm in Kelantan, Malaysia (06°07'N, 102°19'E) revealed five species of stingless bees and one unidentified species. The species included *Trigona itama*, *Trigona thoracica*, *Trigona terminata*, *Trigona laeviceps*, and *Hypotrigona scintillans* and one unidentified meliponid that accounted for 83.2%, 11.2%, 2.5%, 1.9%, 0.6% and 0.6%, respectively. The external nest characteristics, including the height of tree trunk, the trunk circumference at the top and bottom, and the height of the entrance tube from the bottom, were measured together with the size and description of entrance tube for each species. It was apparent that of 17-32 known species of stingless bees in Malaysia, only *T. itama* and *T. thoracica* were mostly used in meliponiculture.

*Keywords:* Entrance, *Trigona*, honey, meliponiculture, nest, stingless bee

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### INTRODUCTION

Stingless bee beekeeping is known as meliponiculture. This activity, which is generally undertaken by traditional communities, has local characteristics according to regional and traditional knowledge. In Australia, interest in production and marketing of Australian

honey is expanding. Although the total annual honey production in Australia is currently small (i.e., with probably less than 100kg), there is potential for rapid growth. At present, the market wholesale price of honey is about AU \$50 per kg. In Asia, stingless bee beekeeping for pollination purpose is only beginning to take root in southern Asia, India and in SE Asia including Malaysia and the Philippines (Cortopassi-Laurino *et al.*, 2006).

Stingless bee farmers in the state of Kelantan, Malaysia, commercialize three types of stingless bee products, namely honey, bee bread and propolis. The current market price for stingless bee honey is RM35 per 300g, RM30 for 200g of bee bread and RM25 for 10ml of propolis, depending upon consumers' demands. At the moment, however, the stingless bee species of economic value and its external nest characteristics in Malaysia remain unexplored. Hence, this paper explores the subject matter mentioned and provides measurements of the extracted tree trunks from the forest with stingless bee colony in it.

## MATERIALS AND METHODS

Sampling was done at a bee farm located in the state of Kelantan, Malaysia (06°07'N, 102°19'E). Measurements of the height of tree trunks, height of the entrance tube from bottom, size and shape of the entrance tube were documented. In this study, five to ten specimens of stingless bees were caught in individual plastic bag [34.5cm

(h) x 24.6cm (w)] for each colony and they were brought back to Biology Laboratory, Universiti Malaysia Kelantan, Malaysia. At the laboratory, the bee specimens were killed using chloroform, pinned and oven dried at 40°C overnight. Once preserved, the specimens were identified with the taxonomy keys provided by Schwatz (1939), Sakagami *et al.* (1990) and taxonomic revisions by Rasmussen (2008).

## RESULTS AND DISCUSSION

A total of 161 colonies of stingless bees were measured and documented (Fig.1). Five species of stingless bee and an unidentified species were collected during the sampling. The five species were *Trigona (Geniotrigona) thoracica*, *Trigona (Heterotrigona) itama*, *Trigona (Lepidotrigona) terminata*, *Trigona (Lisotrigona) scintillans* and *Trigona (Tetragonula) laeviceps*. In particular, *T. itama* were highly preferred by bee farmers and this species contributed 83.2% of the total colonies in the farm, followed by *T. thoracica* (11.2%) (Table 1). The two species contributed 94.4% of the total stingless bee species in the farm. Stingless bees could be found throughout the world with more than 500 species estimated (Heard, 1988; Ruttner, 1988). In Malaysia, the number of stingless bee species varies between 17 to 32 species depending on the study areas (Norowi, 2010; Salim, *et al.*, 2012; Schwarz, 1939). However, within the diverse species in Malaysia, only two species were highly sought after by bee farmers for meliponiculture purposes.



Fig.1: Tree trunks with stingless bee colonies

TABLE 1  
Diversity of stingless bees in the farm

Species	Colonies (n) (%)
<i>Trigona (Geniotrigona) thoracica</i>	18 (11.2)
<i>Trigona (Heterotrigona) itama</i>	134 (83.2)
<i>Trigona (Lepidotrigona) terminata</i>	4 (2.5)
<i>Hyporigona (Lisotrigona) scintillans</i>	1 (0.6)
<i>Trigona (Tetragonula) laeviceps</i>	3 (1.9)
Unidentified	1 (0.6)
Total	161 (100)

Bee farmers extracted wild colonies nesting in the tree trunks before they transferred the colony into a bee box and subsequently sold. Each species of the stingless bees has specific nest requirements according to their sizes, population and habitat quality (Fonseca, 2012). Thus, the

tree trunks represent the preferences of the species towards specific nesting site. It was recorded that *T. thoracica* and *T. laeviceps* preferred tree trunk circumferences ranging from 82 cm to 129 cm, whereas *T. itama* and *T. terminata* preferred tree trunk circumferences ranging between 71 cm and to 164 cm (Table 2). Majority of the tree trunks are of rubbers trees with a few forest hardwood trees. Extraction of the wild colonies requires experience and a good estimation of the location of the brood within the tree trunks to avoid damages to the brood. To avoid damages to the brood during extraction, data on nest entrance and height of tree trunk from this study could be used as a reference point to cut or fell the tree trunk (Table 2). In this study, the nest

entrance of the stingless bee was found to be different according to the genus (Fig.2). The functions of the nest entrances are related to defense, foraging (Biesmeijer *et al.*, 2005) and physio-chemical regulation (Roubik, 2006). The narrow tube can be closed with resin or cerumen or externally coated with droplets of fresh resin where invaders like ants may be halted (Wittmann, 1989; Camargo, 1984). Among the five species, *T.*

*thoracica* was found to form mount-shape entrance with the widest entrance compared to all other species. However, the structure of the nest entrance or the thickness of the resin enclosing the internal nest are influenced by the age of nest, bee genetics and micro environment including predators, parasites, symbionts, rain, wind and sun (Roubik, 2006).

TABLE 2  
External nest characteristics of stingless bees by species

Species	Mean ± s.d (cm)			
	Height of tree trunk	Circumference of the tree trunk (top)	Circumference of the tree trunk (bottom)	Height of entrance from bottom
<i>T. thoracica</i>	108.7±43.7	105.3±23.7	111.6±17.5	54.7±29.8
<i>T. itama</i>	86.2±20.2	96.3±24.9	100.4±27.1	45.8±21.1
<i>T. terminata</i>	102.3±22.1	108.5±34.4	125±39.3	44.8±34.6
<i>H. scintillans</i>	45	69	110	45
<i>T. laeviceps</i>	70.3±42.2	84.3±1.52	101.7±18.9	37.7±37.8

TABLE 3  
Size and descriptions of entrance tube of the sampled stingless bees

Species	Entrance tube (mean ± s.d) (cm)			Shape	Color	Rigidity
	Length	Width	Tube Length			
<i>T. itama</i>	1.53 ± 0.47	2.04± 0.69	7.84± 7.39	F, R	Br, Lb	S, H
<i>T. throracica</i>	3.97 ± 1.29	4± 0.92	7.38± 3.65	M	Br, Bl	H
<i>T. terminata</i>	1.84± 0.38	1.96± 0.1	7± 2.02	F	Lb	S
<i>T. laeviceps</i>	1.85± 0.35	2.75± 0.75	4.25± 1.75	F	Bl	S,H
<i>H. scintillans</i>	NA*			R	Br	S

Entrance shape: F= funnel, M= mount, R= round-ringed; Color: Br=Brown, Bl=Black, Lb=Light Brown ; Rigidity: S=soft, H=hard;

\* NA: Not Available; entrance was accidentally destroyed

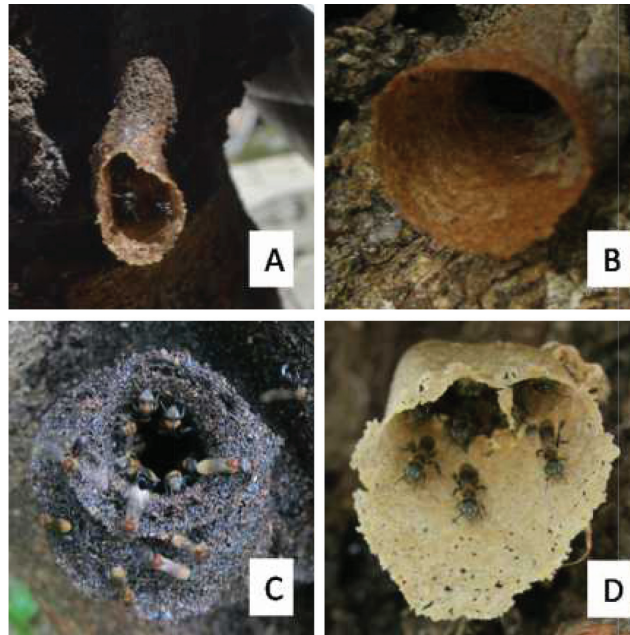


Fig.2: Shape of the entrance of the stingless bees' nest. A - Funnel shape entrance of *T. itama*; B - Round ringed entrance of *T. itama*; C - Entrance in shape of mount (*T. thoracica*), D - Funnel shape entrance of *T. terminata*

## CONCLUSION

From this study, five species of stingless bees and one unidentified bee species were sampled. The species were *T. itama*, *T. thoracica*, *T. terminata*, *T. laeviceps*, and *H. scintillans*. Meliponiculture in Malaysia is limited to two species of stingless bees, namely *T. itama* and *T. thoracica*. Although the extraction of wild is not sustainable in the long term, it is the authors' hope that in the future, colony propagation will be a good alternative with the expansion of the knowledge and research on the biology of stingless bees.

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