

The Types of Trigona Bee (Apidae: Meliponinae) in Three Different Habitat in South Sumatra

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Abstract: Bees are known to be useful directly or indirectly in human life and ecosystem. This study aims to obtain information about the types of Trigona bees in three different habitats in South Sumatra. This research uses a descriptive method with a purposive sampling technique. Identification is done by observing the morphological characters. Trigona bee samples were taken from three different habitats, namely the Indralaya Sriwijaya University campus, the village of Aurduri Muara Enim, and the village of Kota Agung Lahat. The research found three species of Trigona bees from three different habitats. The three species are from three subgenera, namely Tetragonula, Heterotrigona, and Lepidotrigona. The location of the habitat for the Indralaya Sriwijaya University campus was found *Tetragonula laeviceps*, and *Heterotrigona itama*. The habitat of the village of Aurduri Muara Enim was found *T. laeviceps* and *Lepidotrigona terminate*. The location of the habitat for the village of Kota Agung Lahat was found *T. laeviceps*. The most common type of Trigona bee and found in almost every type of habitat is *T. laeviceps*. *H. itama* is only found on the Indralaya Sriwijaya university campus, while *L. Terminate* is only found in the village of Aurduri Muara Enim. Conclusion Trigona bees from 3 different habitats in South Sumatra found as many as 3 subgeneruses, namely Tetragonula, Heterotrigona, and Lepidotrigona. The types of Trigona bees are *T. laeviceps*, *H.itama*, and *L. terminata*.

Keywords: Bees, Trigona, Habitat, Meliponinae, South Sumatra

Introduction

Bees are known to be useful directly or indirectly in human life. What are the characteristics of bees, where is the habitat of bees? It is certainly interesting to know? One type of bee that is not widely known for its various types and characteristics is the Trigona bee. Trigona bees (Order Hymenoptera: Apidae) usually live in groups to form a colony. This bee belongs to the bee group that has no sting. Trigona bees are found in tropical and subtropical regions such as South America, Australia, Africa, and Southeast Asia (Hamid et al., 2016; Fierro et al., 2012; Siqueira et al., 2012; Nkoba et al., 2012).

Trigona bees have long been informed that they exist in Indonesia and Malaysia (Rasmussen, 2019). Schwarz (1939) states that the various types

of Trigona bees are widely distributed in Indo-Malaya. Several types of Trigona bees are found in Indonesia, namely 41 types of Trigona bees on the island of Sumatra, 31 types of Trigona bees on the island of Kalimantan, and 9 types of Trigona bees on the island of Java. The distribution of Trigona in Indo-Malaya was found in four sub-genera, namely Heterotrigona, Tetragonula, Hypotrigona, and Lepidotrigona. Inoue et al. (1985) reported 22 species of Trigona bees in West Sumatra. Trigona bees can be found at various heights and various habitats. Putra et al., (2016) found 1 Trigona bee from 13 colonies at different altitudes on the island of Bali. Syafrizal et al., (2014) stated that the habitat of the Trigona bee is the Lempake education forest in Samarinda East Kalimantan. This forest includes secondary forest in the tropics. In this secondary forest, 9 species of Trigona bees were found.

Soegiarso (2013) reported that there are 7 types of *Trigona* bees in oil palm plantations, rubber plantations, and rubber forests in Jambi. Sadam et al., (2016) found 4 types of *Trigona* bees from 19 hives in Tanah Merah Samarinda.

Trigona bees have a very important role in the ecosystem. *Trigona* bees are a plant-pollinator insects (Tschardt et al., 2019; Normandin et al., 2017; Batista et al., 2003). The existence of *Trigona* bees is also influenced by biotic and abiotic factors in a habitat. The habitat of living things from one type to another does not necessarily have compatibility because each type of animal requires different habitat conditions (Sforcin & Bankova, 2011).

The results of observations of *Trigona* bees were also found in various places in South Sumatra. Information about the types of *Trigona* bees in several areas in South Sumatra that have different vegetation characteristics has not been widely reported. Therefore, the authors need to conduct research on the types of *Trigona* bees in three habitats in South Sumatra. This is important considering that basic data on *Trigona* bee species in South Sumatra are not yet available.

Materials and Methods

Research site

This research has been carried out in three different habitats, namely the Indralaya Sriwijaya University campus, the village of Aurduri Muara Enim, and the village of Agung Lahat City.

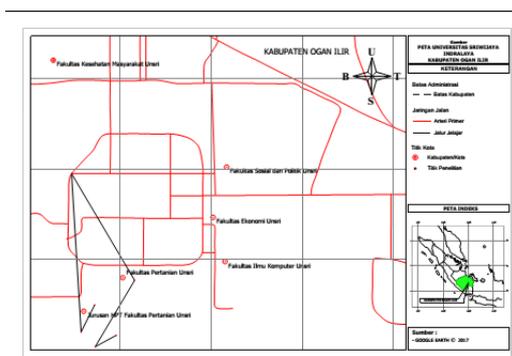


Figure 1. Location of the Indralaya Sriwijaya University campus

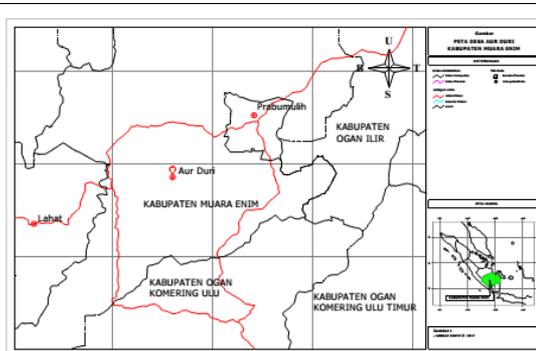


Figure 2. Location of the village of Aurduri Muara Enim

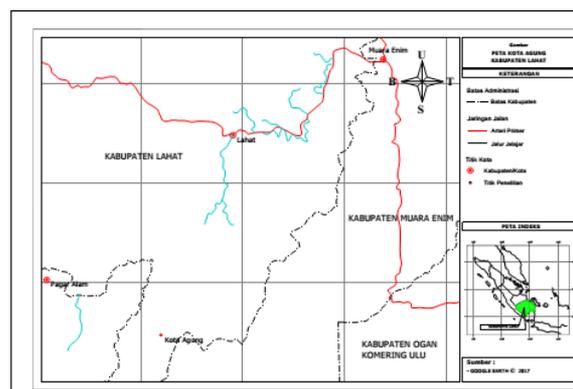


Figure 3. Location of the village of Kota Agung Lahat

Procedure

Trigona bee samples were taken at a predetermined research location. Samples were taken from both *Trigona* beehive boxes and unspoiled beehives in the trees.

The collection of *Trigona* bee sample

Bees are captured using a plastic bottle, the hole of the bottle is exposed to the entry and exit point of the bee from the hive or called the entrance. After a few bees enter, immediately the bottle is closed. Furthermore, the bee sample was put into a sample bottle containing 70% alcohol (Sadam, et al., 2016). The plastic bottle of *Trigona* bee catcher is given Apis honey and mixed with water in a 1: 1 proportion by spraying it on the inside of the bottle (Wille, 1962).

The *Trigona* bee samples were then preserved. Preservation of *Trigona* bees is carried out by wet and dry pickling. Any samples from the box are labeled with location, date, and collectors. Before the *Trigona* bee samples were identified, the bee

specimens were subjected to a mounting process so that the characteristics of the bees' bodies were easier to observe. The mounting process is done with how to insert a needle in the thorax and tidy up all parts of his body. Next bee specimens were oven at 35⁰C for seven days after which the specimens were loaded into the freezer at -15⁰C for seven days (Suriawanto, 2016). Special the Trigona bee small size is made wet, ie the sample is put into a bottle containing 70% alcohol solution. Furthermore, the bee samples were identified in several stages. First, individual bees were measured for body length from the anterior of the head to the posterior abdomen (mm), the body color patterns were also observed and recorded. The individual bee parts are then separated from their body parts which are used as characters in identification (Putra, et al., 2016). Bee morphology observations were calculated using a digital microscope connected to a computer. Morphological characteristics of each individual in each colony were seen. Each species was observed with as many as 5 individuals.

Data analysis

The data obtained were analyzed descriptively, namely by observing morphological characteristics such as body length, head width, limbs, and wings. Color identification was carried out as complementary data.

Results and Discussion

The Trigona bee species are found in three different habitats

Based on the research results, the researcher found 3 types of Trigona bees in three habitats. The three types of bees belong to the subgenus Tetragonula, Heterotrigona, and Lepidotrigona. The types of Trigona bees from each subgenus can be seen in Table 1.

Table 1. Types of bees of the Trigona genus found in three different habitats in South Sumatra.

Subgenus/Types	Location	Nesting place	Nest form
Tetragonula/ <i>Tetragonula laeviceps</i>	1, 2, and 3	Trunk dead tree, cavity wooden wall	The shape of the nest is like an oval or elliptical funnel, black in color, the edge of the wall is hard, untidy, and sticky.

Heterotrigona/ <i>Heterotrigona itama</i>	1	Trunk living tree, iron hole	The shape of the nest is like a round funnel, brownish in color, the edges of the walls are softer and tidier.
Lepidotrigona/ <i>Lepidotrigona terminata</i>	2	Cavity brick wall	The shape of the trumpet nest, the long entrance downwards widened, the edges of the walls are very thin, the outer surface is smooth, pale white, and more sticky.

Notes: 1. Indralaya Sriwijaya University Campus, 2. The village of Aurduri Muara Enim, and 3. The village of Kota Agung Lahat.

In addition to the types of bees in this study, plant vegetation was found as a source of food or nectar in the different habitats of Trigona bees. The plant vegetation includes 6 types of plants on the campus of Sriwijaya University Indralaya, namely water guava (*Syzygium aquaeum*), cherry (*Muntingia calabura*), mulberry (*Morus alba* L), acacia (*Acacia mangium*), coconut (*Cocos nucifera*), and cassava (*Manihot esculenta*), 4 types of plants in Aurduri Muara Enim village, namely rubber (*Hevea brasiliensis*), oil palm (*Elaeis guinensis*), banana (*Musa paradisiaca*), and mango (*Mangifera indica*) and 5 types of plants in Kota Agung Lahat village namely kapok randu (*Ceiba pentandra*), avocado (*Avocado fruitnfoliage*), chocolate (*Theobrama cacao*), guava (*Psidium guajava* L.), and coffee (*Coffea* sp).

The number of Trigona bees species found in these three different habitats is still very small when compared to the results of Soegiorso's (2013) research. Soegiorso (2013) reported that there are 9 types of Trigona bees in the Lempake educational forest. This difference may be due to the limited location coverage of each habitat in each study location, while Soegiorso (2013) has a wider location.

Trigona beehive is mostly found in open areas. Of the 14 hives obtained, the Trigona beehive has varying forms of entrances to the hive. Besides, Trigona beehives were found in cavities in wooden walls, iron cavities, brick wall cavities, live tree trunks, or dead tree trunks. Their hive can be found in all study areas (Eltz et al., 2003; Hamid et al., 2016). Putra, et al., (2016) stated that Trigona bees generally live in groups to form colonies in the wild to make nests in boxes made of wooden sticks, tubes made of bamboo sticks, rock gaps, wood cavities, and door gaps. *T. laeviceps* honeycomb has an

entrance shaped like an oval or elliptical funnel, black, the edges of the walls are hard, untidy, and more sticky. Unlike the nest, *H. itama* has an entrance that is shaped like a brown round funnel and the edges of the walls are softer and tidier. The beehive of *L. terminata* has a long trumpet-shaped entrance that is increasingly pointing downward, the edges of the walls are very thin, the outer surface is smooth, pale white, and more sticky. The color of *Trigona* honeycombs can change depending on the type of plant the resin is from.

Abiotic factors also affect the type of *Trigona* bees in a habitat. The results of measurements of physical factors of temperature and humidity varied in three different habitats. Air temperature affects pollinator insects. The energy required when insects forage is partly influenced by the ambient temperature (Heinrich, 1979). The temperature at each location varies with an average temperature range of 27.6 - 34.6°C. Likewise, air humidity, air humidity ranges from 78.2% - 82%. This shows that the three locations are effective for *Trigona* bee life. Faheem, et al (2004) stated that insect foraging activity is strongly influenced by environmental factors such as air temperature, humidity, light intensity, altitude, wind speed, and rainfall.

Description of the *Trigona* bee species originating from Indralaya.

From the Indralaya Sriwijaya University campus, 2 types of bees of the genus *Trigona* were found. The types of *Trigona* bees found were 1. *T. laeviceps*. *T. laeviceps* is a type of *Trigona* bee from the subgenus *Tetragonula* which was found in only one colony out of 4 existing colonies. *T. laeviceps* is characterized by a body length measuring 3.74 - 3.76 mm, blackish color on the head, thorax, and legs. On the head, there is a pair of antennae consisting of a brown scape, a pedicel the upper surface is blackish in color, and the flagella segments are blackish in color. This bee has a mandible with large teeth, a very short malar, and a brown clypeus. The thorax is black in the dorsal mesoscutum, there are blackish hairs. The wings are transparent, the anterior wing length of the tegula is 3.76 - 3.78 mm. Metasoma is brown in color, the first and the second tergum is pale while the fourth and fifth are darker. On the posterior leg in the anterior part, there is blackish hair and the basitarsus consists of scaly hairs, having a tibia size of 1.68-1.69 mm (Figure 4).

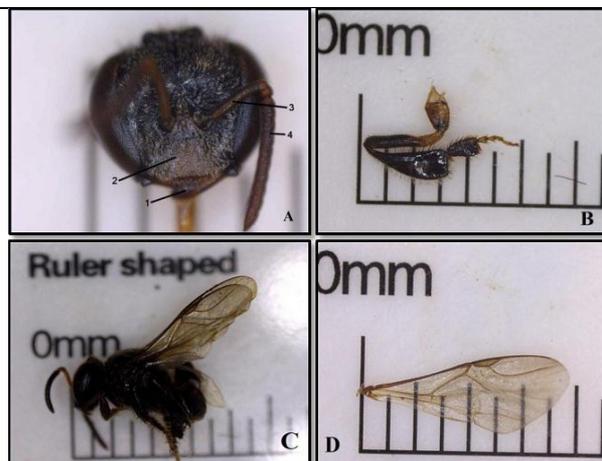


Figure 4. Morphology of *T. laeviceps* (A) Head 1. Mandible 2. Clypeus 3. Scape 4. Flagella, (B) Posterior limbs, (C) Body of *T. laeviceps* (D) Transparent colored anterior wings of *T. laeviceps* (Magnification 10x -300x).

2. *Heterotrigona itama*. *H. itama* one type of bee *Trigona* of the subgenus *Heterotrigona* mostly found on the Indralaya Sriwijaya university campus. This type of bee was found in 4 colonies. *H. itama* has a body length of 5.22 - 6.14 mm and its entire body is black. On the head, there is a pair of antennae consisting of a black scape and flagella. The clypeus is black. The mandible is black with single teeth inward. Malar is a little longer. The thorax is black, there are black hairs on the scutellum. Mesonotum is shiny but looks dull. Propodeum is hairless. The wings are brown. Tegula is black with a length of 5.63 - 6.17 mm. Metasoma black, there is hair on the fifth part of the tergum. The legs are black, on the posterior tibial surface are filled with black hair and a few golden hairs inward. Basitarsus is elliptical in shape with fine hairs on its surface. Tibia has a size of 2.22 - 2.44 mm (Figure 5).

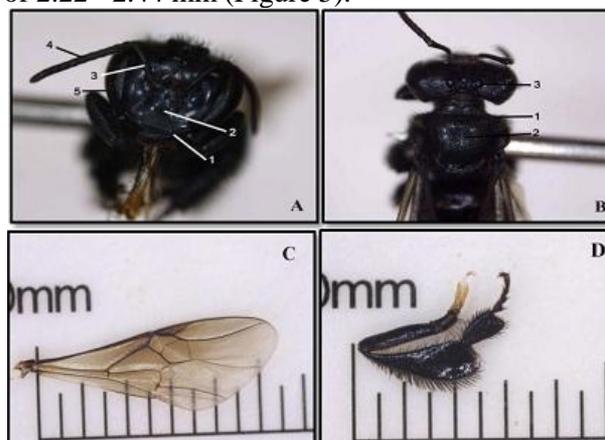


Figure 5 Morphology of *H. itama* (A) Head 1. Mandible 2. Clypeus 3. Scape 4. Flagella 5. Eyes (B) Thoracic 1. Scutellum has black hair, 2. Mesonotum is shiny (C) The anterior wings are brown (D) Posterior limb (Magnification 10x-300x).

Description of the *Trigona* bee species originating from Muara Enim

From the village of Aurduri Muara Enim, 2 species of *Trigona* bees from 2 subgenus were found. The types of *Trigona* bees found were 1. *T. laeviceps*. *T. laeviceps* and *L. terminata*. *T. laeviceps* found 2 colonies. *T. laeviceps* found from Muara Enim have the same morphological characteristics as *T. laeviceps* from the Sriwijaya University Indralaya campus, but his body size ranges from 4.01- 4.13 mm. *T. laeviceps* has a pair of antennae consisting of brown scape and Flagella are blackish-brown in color. Mandible with large teeth, very short, and malar clypeus is brown. Colored thorax black, especially the mesoscutum, and has black hairs. The wings are transparent in color, the anterior wing length of the tegula ranges from 3.62 - 4.61 mm. Metasoma is brown, while the first and second tergum is pale, while the fourth and fifth are darker in color. On the posterior limbs, on the anterior part, there are hairs of a blackish color. Basitarsus consists of hair that is scaly. The length of the tibia is 1.54 - 2.12 mm.

2. *Lepidotrigona terminata*. *L. terminata* is a type of *Trigona* bee from the subgenus *Lepidotrigona*. This bee was found in 2 colonies in Muara Enim. *L. terminata* has a body length ranging from 5.20 - 5.22 mm and has special characteristics in its body coloring. The head has a pair of antennae. The antenna consists of a yellow-brown scape and blackish-brown flagella. The clypeus is brown in color and has two small, short malar teeth. The thorax consists of the mesoscutum and mesoscutellum, the edges of which are surrounded by yellowish, thick, thorn-like hairs. Transparent dull wings, light brown tegula. The wing length ranges from 4.75 - 4.96 mm. The metasoma is brown, the first and the second is light brown, while the fifth is dark brown. The legs are black, on the edge of the hind limbs some hairs are not branched and the ends of the legs are wider (Figure 6).

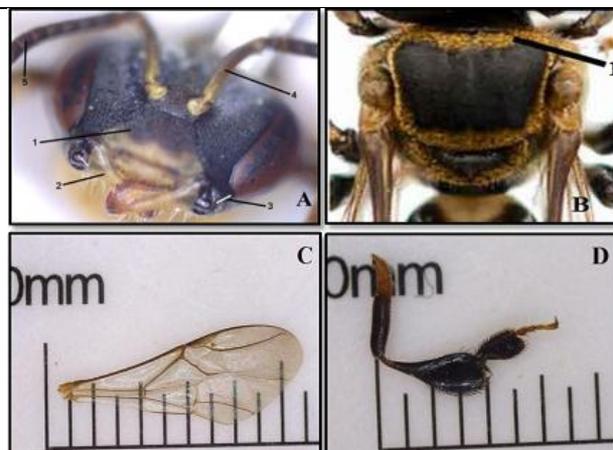


Figure 6. Morphology of *L. terminata* (A) Head 1. Clypeus 2. Mandible 3. Malar 4. Scape 5. Flagella (B) Thorax. Yellow scutellum (C) Transparent posterior wings (D) Posterior limbs (Magnification 10x-300x).

Description of the type of bee *Trigona* originating from Lahat.

At the location of Kota Agung Lahat only found 1 species of *Trigona* bee from the subgenus *Tetragonula*, namely *T. laeviceps*. *T. laeviceps* was found in 6 colonies during observation. *T. laeviceps* has the same characteristics as *T. laeviceps* at Unsri Indralaya and Muara Enim Campus. The difference between the two locations is in body size and body color. Trianto and Purwanto (2020) stated that bees have morphological and morphometric characters that vary among species, islands, and environmental types. *T. laeviceps* from Kota Agung Lahat is brownish-black and has a body length of 4.01 - 4.13 mm. The head contains a pair of antennae consisting of a brown scape and dark brown flagella segments. The mandible has large, very short malar teeth and brownish clypeus. The thorax is black, especially the dorsal mesoscutum and there are blackish hairs. The wings are transparent, the anterior wing length of the tegula is 3.87 - 4.05 mm. Metasoma is brown, the first and second tergum is pale, while the fourth and fifth tergum is darker. On the posterior leg in the anterior part, there is blackish hair. Basitarsus consists of scaly hair, has a tibia size of 1.60 - 1.67 mm (Figure 7).

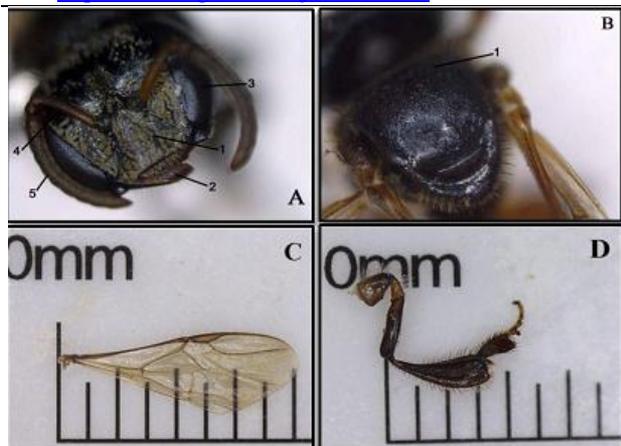


Figure 7. Morphology of *T. laeviceps* (A) Head 1. Clypeus 2. Mandible 3. Eyes 4. Scape 5. Flagella, (B) Thorax 1. Mesoscutum (C) Transparent anterior wings (D) Posterior limbs (Magnification 10x-300x).

Conclusion

Trigona bees were found from three different habitats in South Sumatra as many as 3 subgenera, namely *Tetragonula*, *Heterotrigona*, and *Lepidotrigona*. The types of Trigona bees found were *Tetragonula laeviceps*, *Heterotrigona itama*, and *Lepidotrigona terminata*. The type of Trigona bee that is most commonly found and found in each habitat is *T. laeviceps*. *H.itama* is only found on the Indralaya Sriwijaya university campus, while *L. terminate* is only found in the village of Aurduri Muara Enim.

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