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Lepidotrigona Smith (Apidae: Meliponinae) in Sibolga, North Sumatra: Morphology, morphometric and nest entrance structure

Anggun Wicaksono[1*], Tri Atmowidi[2], Windra Priawandiputra[2]
[1]Department of Biologi Education, Faculty of Tarbiyah and Teacher Training,
Universitas Islam Negeri Raden Fatah Palembang
Jl. Prof. KH Zainal Abidin Fikry Km 3.5, Palembang, South Sumatra, Indonesia. 30126
[2]Department of Biology, Faculty of Mathematics and Natural Sciences, IPB University
Jl. Raya Dramaga, Bogor, West Java, Indonesia. 16680
*Email: anggunwicaksono_uin@radenfatah.ac.id

ABSTRACT. Stingless bees of the genus *Lepidotrigona* are difficult to distinguish morphologically due to their similar external characteristics. This study aims to characterize the morphological, morphometric, and nest entrance structures of *Lepidotrigona* collected from Sibolga, North Sumatra. The methods used in this research are qualitative and quantitative. The study was conducted at the Biosystematics and Animal Ecology Laboratory, IPB University. Identification of stingless bees based on morphological and morphometric characters of the head, thorax, wings, legs, and abdomen. The nest entrance character is described of the shape, texture, and color of the nest. Results showed that the morphometric measurements of the *Lepidotrigona* worker bees had 5.13±0.254 mm body length, 0.80±0.223 mm mandible length, and 0.29±0.013 mm mandible width. The mesoscutum was black with short and yellow hair were observed on the edge of mesoscutellum. On the lateral side of thorax exist pale-yellow hairs. The length of fore wings from tegula was 5.39±0.125 mm, the distance between the venations (M-Cu) bifurcation and basal tip of the marginal cell was 1.55±0.023 mm, and the number of hammuli in the hind wing is six. The hind tibia was black-brownish with long hair on the edges. The length of tibia was 1.67±0.399 mm, and tibia width was 0.72±0.025 mm. The dorsal abdomen had 4-5 tergits and the first tergit was yellow with two black spots. The nest entrance of *Lepidotrigona* colony was characterized by round-like funnel with a diameter of 16,2 mm and a length of 102 mm. The nest entrance is funnel-shaped and light brown in color with a soft and sticky texture. Based on the morphological, morphometric and nest entrance characteristics of the genus *Lepidotrigona*, it is closer to species of *Lepidotrigona terminata*.

Keywords: *Lepidotrigona*; morphology; morphometric; nest entrance; stingless bee

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INTRODUCTION

Stingless bees are widely distributed in various regions of the world, especially in tropical and subtropical climates (Michener 2007; Wang et al., 2020; Yao et al., 2024). In the Indo-Malayan region, several genera of stingless bees have been recorded, including *Pariotrigona*, *Heterotrigona*, *Homotrigona*, *Lepidotrigona*, *Lophotrigona*, *Odontotrigona*, *Platytrigona*, *Sundatrigona*, *Tetragonilla*, *Tetragonula* and *Tetrigona* (Rasmussen & Cameron, 2007; Rasmussen, 2008). Eusocial bee groups are widespread in tropical areas including Indonesia, with 46 species described in Indonesia. Stingless bees are generally found in forest areas and are also often found around residential areas (Sakagami *et al*., 1990; Chinh *et al*., 2006; Bänziger *et al*., 2011; Hamid *et al*., 2016). Stingless bees are eusocial insects which are currently the main commodity for beekeepers in producing honey and propolis which have high quality and economic value (Kelly *et al*., 2014; Wu *et al*., 2020; Janra *et al*., 2021; Popova *et al*., 2022; Wu *et al*., 2024). One type of stingless bee that is currently of interest to breeders is *Lepidotrigona* because it is difficult to find and cultivate.

Lepidotrigona belongs to the Apidae family which is widely distributed in several regions in Indonesia including Sumatra, Java, Kalimantan and Sulawesi (Suphaphimol *et a*l., 2020; Suprianto *et al*., 2020). The diversity of *Lepidotrigona* bees known in Indonesia is *L. javanica* (Java), *L. latebalteata* (Borneo), *L. nitidiventris* (Sumatra, Bornoe), *L. terminata* (Java, Sumatra, Sulawesi, Borneo), *L. troatachanterica* (Borneo, Sumatra), and *L. ventralis* (Java, Sumatra) (Rasmussen, 2008;

Smith, 2012; Attasopa *et al*., 2020). *Lepidotrigona* bees can be recognized on the thorax by the presence of yellow or white hairs that form a ring surrounding the outer part of the mesoscutum and mesoscutellum (Schwarz, 1937; Smith, 2012; Castillo *et al*., 2024). However taxonomically, species in the genus *Lepidotrigona* are very difficult to distinguish, because they have almost the same morphological characters especially in the character and color of the hairs in the mesoscutum and mesoscutellum (Smith, 2012; Suprianto *et al*., 2020).

Previous research on the taxonomy of the genus *Lepidotrigona* in Thailand includes *L. terminata* sp 1, *L. terminata* sp 2, *L. doipaensis*, *L. flavibasis* that cannot be separated from *L. terminata* (Smith), *L. doipaensis* (Schwarz) and *L. flavibasis* (Cockerell) on the outer hair character of the mesoscutum and mesoscutellum (Bänziger *et al*., 2011; Rang *et al*., 2024; Wu *et al*., 2024). *Lepidotrigona terminata* found in Sumatra is morphologically difficult to distinguish from species in the genus *Lepidotrigona* (Smith, 2012). Lack of data regarding species in the genus *Lepidotrigona* in Indonesia, especially in Sumatra, makes knowledge about the introduction of species unknown. Morphological similarities in some species in the genus *Lepidotrigona*, making the introduction of each species difficult. Different areas and environmental conditions can affect the morphological shape and size of the sting of bees (Sakagami, 1975; Sakagami *et al*., 1990). Therefore, research on morphological and morphometric studies of *Lepidotrigona* bees from Sumatra needs to be done to determine the character and introduction of its natural habitat.

The genus of *Lepidotrigona* can be found in primary forests, open forests, and also in residential areas, generally making nests on tree trunks and the ground surface (Inoue *et al*., 1985; Bänziger *et al*., 2011; Hamid *et al*., 2016). Generally, the genus *Lepidotrigona* has a round, elongated shape like a funnel with a soft and sticky texture at the nest entrance (Roubik, 2006; Duangphakdee *et al*., 2009). The nest of *L. terminata* is located in holes or crevices of trees and rocks with the nest entrance shaped like an elongated and rounded funnel (Leonhardt *et al*., 2009; Bänziger *et al*., 2011; Kelly *et al*., 2014). The nest entrance of *L. ventralis* is shaped like a thin, brownish funnel and is sticky like that of *Lepidotrigona terminata*. Meanwhile, the mouth of the nest is light brown, with a slightly soft and sticky texture (Chinh *et al*., 2006). Each stingless bee species has variations in nest structure and nest entrance shape (Kelly *et al*., 2014).

The recognition of stingless bee species can be known through morphological and morphometric studies. Morphology is the form and part of an organism, especially in animals and plants. The morphological form of a living creature is described in the form of the body or parts as a whole to determine the differences between species. Whereas, morphometry is a method for identifying species by describing through measurement, calculation or giving a score. Morfometry can be applied to determine the kinship of a species, differentiation of various species, and variations in species (Strauss & Bookstein, 1982). In addition, each stingless bee species has variations in the nest entrance (Kelly *et al*., 2014). Therefore, this study was conducted to provide a detailed description of the morphological and morphometric characteristics of *Lepidotrigona* from Sibolga, as well as to describe its nest entrance structure to support future taxonomic identification and conservation efforts.

MATERIALS AND METHODS

Study area. The samples of *Lepidotrigona* were collected from Sibolga, North Sumatra (1.752135, 98.770762) (Fig. 1). The study was conducted at the Biology Laboratory, Biosystematics and Animal Ecology, Department of Biology, Faculty of Mathematics and Natural Sciences, IPB University.

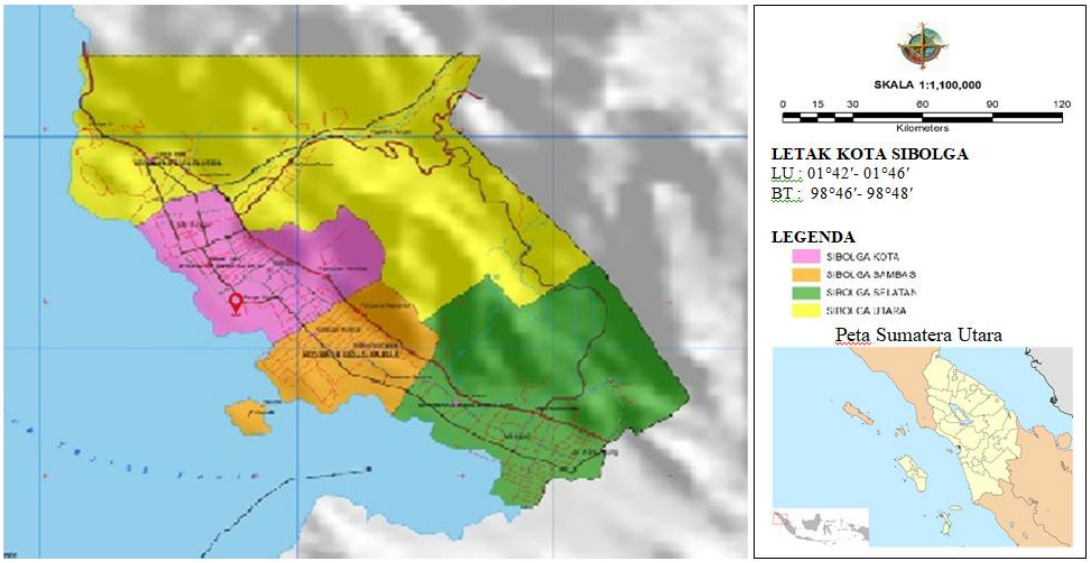


Fig. 1. Study site employed for the sampling of *Lepidotrigona* in Sibolga Ilir, North Sibolga District, North Sumatra, Indonesia (Badan Pusat Statistik Provinsi Sumatra Utara, 2010)

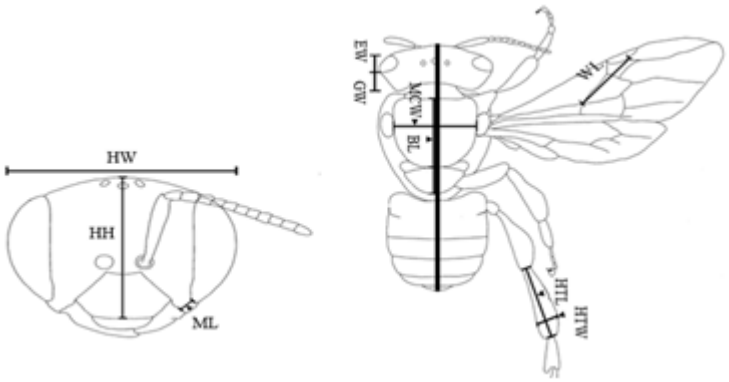
Methods. This type of research uses a qualitative and quantitative approach. The bees sampling was carried out using a purposive sampling technique, taking into account the sample of worker bees that leave carrying waste. Observation of morphological characteristics was carried out by direct observation of each part of the bee's body. Morphometric measurements of each part of the bee's body were carried out on a sample of individual bees.

Collection and mounting of bee specimens. *Lepidotrigona* bees are collected using insect nets from bees that come out of the nest. The collection of the stingless bees was conducted on two consecutive days. The catching activities were conducted three times per day at 07.00 am, 12.00 am, and 16.00 pm. The collected samples put into a glass bottle with 90% ethanol. Collection of 20 individual *Lepidotrigona* worker bees for the purposes of morphometric identification (Fig. 2). Ten (10) individuals were used for morphological identification purposes. Specimens collected are mounted. The specimens are then in the oven at dried at 35 °C for 48–73 hours and insects that have been preserved put in the freezer at -10 ºC for 5–12 hours, then left at room temperature for 2–3 days. Sampling was conducted under local research permit Number: 53/300/Kec-SI/X/2021 issued by the Head of the Sibolga Ilir area.

Identification of bee specimens. *Lepidotrigona* worker bee specimens were identified based on morphological and morphometric characters (Sakagami *et al*., 1990; Schwarz, 1939; Smith, 2012). Species determination was based on key morphological traits following Smith (2012), particularly the thoracic hair pattern, wing venation, and mandible dentition. Specimen verification was carried out at the *Zoologicum Bogoriense* (MZB) Museum, Cibinong Science Center BRIN, Indonesian. Measurement of morphometric characters using Nikon Model C-LEDS microscope combined with Optilab camera and *Image Raster* 3 software which has passed the calibration procedure. Measurements were made at the Laboratory of Biosystematics and Animal Ecology, Department of Biology, Faculty of Mathematics and Natural Sciences, IPB University.

Measurement of morphological and morphometric characteristics of *Lepidotrigona* bees is described according to (Schwarz, 1937; Schwarz, 1939; Sakagami, 1975; Sakagami *et al*., 1990; Smith, 2012). Morphometric characters measured were body length (BL), head width (HW), eye length and width (EL and EW), maximum and minimum interorbital distance (MOD and LOD), upper interocellar distance (UID), lower interocellar distance (IOD), ocellocular distance (OD), genna width (GW), malar length (ML), length and width of IV flagellomere (FL and FW), front wing length of tegula (WL1), length of distance between venation M-Cu (WL2) , Hind Tibia length (HTL), hind tibia width (HTB), width and length of the basal tube (BTL and BTW) (Sakagami, 1975). In addition,

measurements were made for head length (PK), length of clypeus (PC), longest and closest interocular distance (LID and CID), interpersonal distance (ID), antennocellar (ACe), antennocular (ACu), mandibular length and width (ML and MW), mesoscutum length and width (PMS and LMS) (Rasmussen, 2013), front wing length and width (FWL and FWW), back wing length and width (PSB and LSB), number of hamuli (JH) , femur length (FL), basal width and length(BL and BW) (Klakasikorn *et al*., 2005).



(a) (b)

Fig. 2. Morphometry size in some parts of the stingless bee's body character: maximum head width (HW), maximum head length (HH), malar length (ML) (a), compound eye width (EW), gena width (GW), body length (BL), mesoscutum width (MCW), distance between venations (WL2), length of tibia (HTL), and width of hind tibia (HTW) (b) (Sung *et al*., 2004)

Observation of the nest entrance structure. The nest entrance was characterized quantitatively by its diameter or width and length of the outer entrance. The characteristics of the nest entrance were described qualitatively, including shape, texture, ornamentation, and color of the nest and resin material. Measurements were made using calipers and a ruler or measuring tape. Observation entrance of nest is described according to (Duangphakdee *et al*., 2009; Leonhardt *et al*., 2009; Kelly *et al*., 2014) namely color (brown, light brown, or black), and texture (soft or hard). The location of the *Lepidotrigona* stingless bee nest is in a forest with large trees such as mahogany and some have been converted into plantations. The Siboga area is a coastal area with many types of mangrove plants.

Data analysis. The morphometric characteristics of worker bees of *Lepidotrigona*, including measurements of the head, thorax, abdomen, wings, and legs, are described quantitatively statistical analysis as mean ± SD. Morphological characteristics are described, particularly the thoracic hair pattern, mandibular dentition, wing venation, leg color, and tergites. The characteristics of the nest entrance are also described qualitatively shape, texture, and color of the nest and resin material.

RESULTS AND DISCUSSION

Morphological and morphometric characters of *Lepidotrigona*. Based on observations of morphological characters that have been described in worker bees of the genus *Lepidotrigona* closer to or similar to species *L. terminata*, *L. ventralis*, *L. nitridipenis*, and *L. Flavibasis* on the thorax in the form of hair color on the part of the mesoscutum and mesoscutellum. Morphological characteristics of several *Lepidotrigona* species can be recognized especially in the thoracic characteristics, especially in the mesoscutum section (Schwarz, 1939; Smith, 2012; Vijayakumar K, 2014; Attasopa *et al*., 2020). However, some opinions regarding the *Lepidotrigona* species also state that they have morphological characteristics that are difficult to distinguish within the *Lepidotrigona* group (Suprianto *et al*., 2020).

Some of the results of morphometric measurements of worker bees in this study were largely similar to the *L. terminata* and *L. ventralis* species groups. This is indicated by the average body length (5.13 ± 0.254 mm), which corresponds to the description of (Schwarz, 1939; Nagamitsu & Inoue, 1998), namely (5 - 5.50 mm) on *L. terminata*. Whereas the description of Chinh *et al*. (2006)

L. ventralis in Vietnam has a body length (5.1 - 5.2 mm). In this study, the body size of worker bees was greater than *L. ventralis arcifera* varieties in India (4.2 - 4.5 mm) (Vijayakumar K, 2014), (3.48 mm) and *L. flavibasis* (4.50 mm) (Sakagami, 1975).

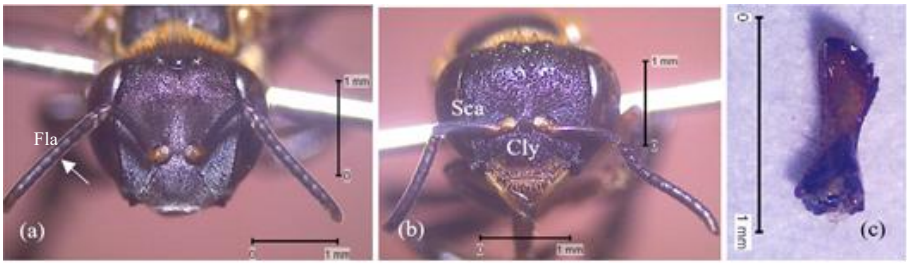


Fig. 3. Head of *Lepidotrigona* worker bee: head (frontal) and flagellomere (shown arrow) (a), clypeus (Cly) and scape (Sca) (b), and mandible with two teeth (c)

Morphometric measurements of the body of *Lepidotrigona* worker bees cover all parts of the head, thorax, legs, and abdomen. The measurement data show consistent results for several characters such as Clypeus Length (CL), Interantennal Distance (IAD), Interocellar Distance (IOD), Antennocellar Distance (AOD), Flagellomere IV Length (FL), Flagellomere IV Width (FW), Flagellomere IV Width (FW), and Malar Length (ML). The results of the morphometric measurements of the body of the *Lepidotrigona* can be seen in Table 1.

Table 1. Morphometric characters of *Lepidotrigona* worker bees

No	Characters	Length (mm)		
		Average (Min-Max)		SD
1	Body Length (BL)	5.13	4.57 – 5.48	0.254
2	Head Length (HL)	1.63	1.59 – 1.66	0.025
3	Head Width (HW)	2.07	2.03 – 2.10	0.026
4	Mandible Length (ML)	0.80	0.78 – 0.83	0.223
5	Mandible Width (MW)	0.29	0.25 – 0.31	0.013
6	Clypeus Length (CL)	0.47	0.45 – 0.50	0.019
7	Lower Interocullar Distance (LID)	1.32	1.30 – 1.35	0.017
8	Upper interocellar Distance (UID)	1.30	1.28 – 1.32	0.015
9	Eye Width (EW)	0.54	0.50 – 0.57	0.017
10	Eye Length (EL)	1.25	1.23 – 1.29	0.017
11	Maximum Interorbital Distance (MOD)	1.47	1.44 – 1.49	0.016
12	Minimum Interorbital Distance (LOD)	1.26	1,25 – 1.30	0.015
13	Interantennal Distance (IAD)	0.14	0.13 – 0.15	0.006
14	Interocellar Distance (IOD)	0.15	0.14 – 0.15	0.005
15	Ocellocular Distance (OOD)	0.33	0.32 – 0.35	0.010
16	Antennocellar Distance (AOD)	0.76	0.75 – 0.78	0.008
17	Antennocular Distance (AUD)	0.37	0.35 – 4.00	0.015
18	Genna Width (GW)	0.29	0.26 – 0.32	0.019
19	Flagellomere IV Length (FL)	0.14	0.13 – 0.15	0.006
20	Flagellomere IV Width (FW)	0.14	0.13 – 0.15	0.005
21	Malar Length (ML)	0.17	0.16 – 0.18	0.007
22	Mesoscutum Length (MCL)	1.13	1.03 – 1.18	0.034
23	Mesoscutum Width (MCW)	1.33	1.29 – 1.36	0.024
24	Front Wing Length from tegula (WL1)	5.39	5.10 – 5.53	0.125
25	Length of Distance Between Venations (WL2)	1.55	1.51 – 1.58	0.023
26	Front Wing Distance (FWD)	5.09	5.00 – 5.15	0.049
27	Front Wing Width (FWW)	1.86	1.77 – 1.93	0.044
28	Hind Wing Length (HWL)	3.53	3.40 – 3.65	0.067
29	Hind Wing Width (HWW)	0.85	0.81 – 0.91	0.031
30	Hammuli Number (HN)	6		
31	Hind Femur Length (HFL)	1.41	1.34 – 1.45	0.034
32	Hind Tibia Width (HTW)	0.72	0.68 – 0.77	0.025

No	Characters	Length (mm)		
		Average (Min-Max)		SD
33	Hind Tibia length (HTL)	1.67	1.79 – 1.95	0.399
34	Hind Basitarsus Length (HBW)	0.52	0.48 – 0.56	0.021
35	Hind Basitarsus length (HBL)	0.81	0.78 – 0.85	0.018

The width of the head of the *Lepidotrigona* worker bee is 2.07 ± 0.026 mm with a length of 1.63 ± 0.025 mm. clypeus is black and covered in pale white hair or silver with a length of 0.47 ± 0.019 mm (Fig. 3). The scape and antenna are blackish or brownish black with yellow hair at the edge of the flagellomere. Malar distance is longer than the width of the flagellomere. Flagellomere has 11 segments and has the same length and width. Genna width is narrower than eye width (Table 1). The length of madibula is 0.80 ± 0.223 mm and has two teeth.

Morphometry, head size in this study is in line with description (Schwarz, 1939; Nagamitsu & Inoue, 1998) similar to *L. terminata* such as HW and HL size (Table 1). The worker bee head size in this study was wider than *L. flavibasis* and *L. ventralis* (1.65-1.82 mm) (Vijayakumar K, 2014), however, smaller than *L. nitridipenis* (Nagamitsu & Inoue, 1998; Wu *et al*., 2024). The morphological character of the mesoscutum edge pattern is yellow hair with a straight pattern in the lateral and posterior sections. The center of the mesoscutum is black and has little hair or looks hairless (Fig. 4a). Even though the edge part of the horn is yellow hair that looks only half circle. The middle part of the propodeum is black with the lateral side with pale yellow or whitish hair that is seen thick on the part of the metepisternum (Fig. 4b), Brownish tegula (Fig. 4c).

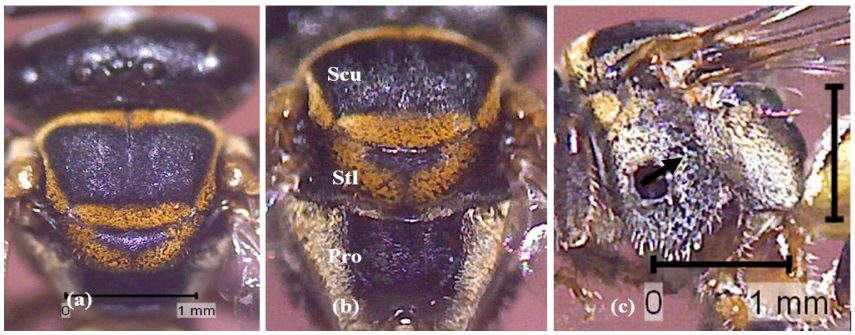


Fig. 4. Thorax part of *Lepidotrigona* worker bee: black mesonotum with yellow hair at the edges (a), mesoscutum (Scu), mesoscutellum (Stl) and propodeum (Pro) (b), metepisternum (shown arrow) pale yellow (c)

The thorax morphology of the worker bee in this study is more similar to *L. terminata* and *L. nitridipenis*, which have thick yellow hair like a ribbon on the outside of the mesoscutellum (Fig. 4b). Unlike *L. ventralis* and *L. flavibasis* which tend to appear black or only a few erect hairs are yellow, while *L. trochanterica* appears black. Mesoscutellum in this study is in the form of italic and not prominent as described in *L. terminata*. Whereas mesoscutellum on *L. ventralis* stands out (Schwarz, 1939). The central part of the hairless mesoscutum (glabrous) is similar to *L. terminata* and *L. ventralis* (Schwarz, 1939; Sakagami *et al*., 1990). The anterior venation in the front wing is blackish, while the stigma and venation are brownish in the middle. The front wing length is 5.09 ± 0.049 mm, width is 1.86 ± 0.044 mm, and the length of the distance between venations is 1.55 ± 0.023 mm (Fig. 4a). The anterior veneation of the back wing is brownish black and has consistently 6 pieces of hammuli. The rear wing length is 3.53 ± 0.067 mm and width are 0.85 ± 0.031 mm (Fig. 5b).

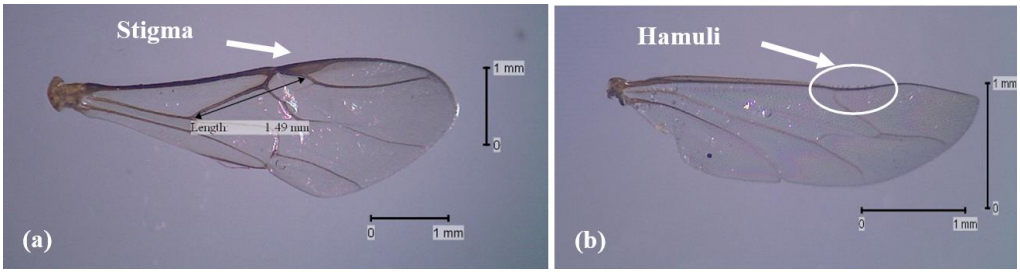


Fig. 5. Wing of worker bee *Lepidotrigona*: front wing; brownish stigma; WL2 (distance between venation M-Cu) (a), rear wing and hamuli number consistently 5(b)

Morphological measurements of the Hammuli consists of six. The genus *Lepidotrigona* has six hamuli on its hind wings (Trianto *et al*., 2024). Based on the description by Rachmawati *et al*. (2022), *L. terminata* in Baluran National Park, East Java, has six hamuli. Meanwhile, data on *L. terminata* hamuli consistently number eight in South Kalimantan (Purwanto *et al*., 2022) and *L. terminata* in Yogyakarta (Trianto & Purwanto, 2020), and *L. terminata* in Central Sulawesi (Hikmah *et al*., 2023). Environmental influences and adaptation can affect activity, thus impacting the morphological form and morphometric size of stingless bees. Another thing that significantly affects the shape of a tired body is temperature and altitude.

The front wing length of the worker bee tegula in this study (5.10-5.53 mm) (Fig. 5). In accordance with report Schwarz (1939), the front wing length of tegula on *L. terminata* is 5.50 mm. The front wing length (5.09 ± 0.049 mm), which is not much different from *L. terminata* (4.91 ± 0.03 mm) (Nagamitsu & Inoue, 1998). The length of *L. terminata* wings is longer than *L. ventralis* (4.25 mm) and *L. flavibasis* (4.50 mm) (Schwarz, 1939; Nagamitsu & Inoue, 1998; Vijayakumar K, 2014; Wu *et al*., 2024). In this study, tegula was light brown, which was different from *L. trochanterica*, *L. ventralis*, and *L. flavibasis* which appeared dark brown to blackish (Schwarz, 1939; Sakagami, 1975). The back legs of the *Lepidotrigona* worker bee are mostly blackish in color. The trochanter part is brownish yellow, the femur is black and slightly brownish in the halt (Fig. 6a). The tibia in the back is brownish-black with an upright stretch of edge. Rear basitarsus with long hair at the edges and black, slightly brownish at the base (Fig. 6c).

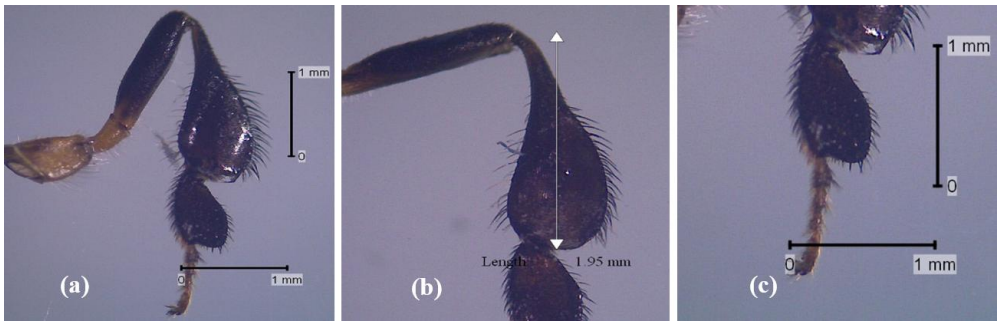


Fig. 6. Legs of *Lepidotrigona* worker bee: trochanter section, femur, tibia, and basitarsus (a), rear tibia length (HTL), and basitarsus (c)

The morphology of the worker bee's legs in this observation is in the description of (Sakagami, 1975), similar to *L. terminata* which has an overall blackish hind limb (Fig. 6). The front femur and tibia and the black middle femur, only small reddish brown basitarsus. Unlike the lower and middle back femur on *L. latebalteata* and *L. javanica* reddish brown and basitarsus black (Schwarz, 1939; Schwarz, 1937). In this study it was also different from *L. ventralis* with dark brown limbs and pale basitarsus (Sakagami, 1975). The frontal abdomen of the *Lepidotrigona* bee is mostly blackish in color. It has around 4-5 tergits, tergit 1 is yellow and there are 2 black spots or bumps. The overall ventral abdomen is yellow (Fig. 7).

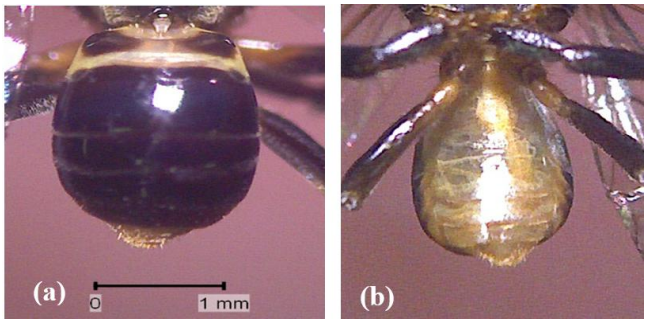


Fig. 7. Abdomen worker bees of *Lepidotrigona*: black and yellow ventral parts (a) and yellow dorsal parts (b)

The abdomen of the worker bee in this study was mostly black (Fig. 6). Tergit 1 is yellow and there are black spots or black spots, which are also owned by *L. terminata*, *L. javanica* and *L. ventralis* (Schwarz, 1937; Rasmussen, 2013). However, it is different from *L. ventralis* which has 6 tergits and is brownish to pale brown (Vijayakumar K, 2014). The frontal abdomen in this study also differs from *L. flavibasis* which is reddish to brownish (Schwarz, 1939; Wang *et al*., 2021), while *L. ventralis* is brownish and the basal portion is pale brown or dull (Sakagami, 1975). Based on the results of observations of morphology and morphometric measurements, Head (Body Length (BL), Mandible Length (ML), Mandible Width (MW), Thorax (Mesoscutum), Wings (Wing Length (HWL), Length of Tegula (WL 1), and Length of Distance Between Venations (WL2), Legs (Hind femur (HFL), Tibia (HTW and HTL), and Basitarsus), and Abdomen (Tergit). We concluded that these stingless bees in the genus *Lepidotrigona* which is close to the *Lepidotrigona terminata* species.

Characteristics of nest entrance. The nest entrance character of the *Lepidotrigona* has a diameter of 16.2 mm and a length of 102 mm. The nest entrance has a blackish brown color at the base that is the same as the batumen and has a hard texture. The mouth part of the nest has a light brown color, the texture is slightly soft, and sticky. Overall the entrance of the nest is rounded elongated like a funnel.

Fig. 8. Characteristics of *Lepidotrigona* honeycomb entrance: nest mouth diameter (a), and nest entrance length (b)

Characteristics of nest entrance in this study in accordance with the description of (Duangphakdee *et a*l., 2009; Leonhardt *et al*., 2009; Kelly *et al*., 2014), that the shape of the nest mouth of the genus *Lepidotrigona,* especially the funnel and rounded *terminata* varieties (Fig. 7) Hamid *et al*. (2016) reported that the mouth diameter of the nest on *L. terminata* in Malaysia was 22 mm. While Kelly *et al*. (2014) reported that *L. terminata* nest had a diameter of 18.4 mm with a length of 70 mm, light brown and soft. Rachmawati *et al*. (2022), *L. terminata* nest had a diameter of 12.8-14.8 mm, Chinh *et al*. (2006) reported that the entrance of *L. ventralis* nest was brownish funnel with a length of 72 mm, a diameter of 100 mm, thin and sticky as in *L. terminata*. In addition, Purwanto *et al*. (2022), explained that the nest entrance of *L. terminata* has a diameter of 11.3-23.5 mm and a length of 13.8-26 mm. This shows that the size and shape of the nest pin is not too much different in the genus *Lepidotrigona*. General of the *Lepidotrigona* genus has a soft texture and has sticky resins at the nest's mouth (Roubik, 2006; Duangphakdee *et a*l., 2009; Janra *et al*., 2021). However, based

on the shape and color of the entrance to the *Lepidotrigona terminata* nest, it is similar to *Heterotrigona itama* with a light brown cylindrical shape at the mouth of the nest, however differences in shape, color, diameter, and length of *Tetragonula laeviceps* (Purwanto *et al*., 2022; Rachmawati *et al*., 2022). The structure of the nest entrance is influenced by genetic variations in each stingless bee species. However, variations in the color of the nest entrance are influenced by environmental factors such as each bee species' resin preferences, weather, sunlight, and the microenvironment (Purwanto *et al.*, 2022). In addition, the variation of the elongated funnel-shaped entrance is related to the colony's defense system against predators, and also functions to regulate the microclimate and foraging activities of stingless bees (Duangphakdee *et al*., 2009).

CONCLUSION

Based on the results of observations and measurements, head (Body Length (BL), Mandible Length (ML), Mandible Width (MW) of worker bees had 5.13±0.254 mm body length (BL), 0.80±0.223 mm mandible length (ML), and 0.29±0.013 mm mandible width (MW). The characteristics of worker bees in the genus *Lepidotrigona* are mostly dominated by black and yellow, especially the thorax and abdomen. The mesoscutum was black with short and yellow hair were observed on the edge of mesoscutellum. Thorax has yellow hair like a ribbon on the outside of the mesoscutum and semicircular yellow hair on the outside of the mescellum. The length of fore wings from tegula was 5.39±0.125 mm, the distance between the venations (M-Cu) bifurcation and basal tip of the marginal cell was 1.55±0.023 mm. The hind tibia was black-brownish with long hair on the edges. The length of tibia was 1.67±0.399 mm, and tibia width was 0.72±0.025 mm. The dorsal abdomen had the first tergit was yellow with two black spots. The nest entrance of *Lepidotrigona* colony was characterized by round-like funnel with a diameter of 16.2 mm and a length of 102 mm. The character of the entrance of the nest is elongated or round tubular like a funnel, black to light brown on the mouth part of the nest with a soft and sticky texture. Based on morphological characters and bee morphometric measurements of the genus *Lepidotrigona*, it is *a terminata* species. These findings provide the first morphometric record of *Lepidotrigona terminata* from Sibolga, North Sumatra, and contribute baseline data for future taxonomic revision and meliponiculture development in Indonesia.

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