

## Short Communication



# New Distribution Record of *Tetrigona apicalis* (Smith, 1857) (Hymenoptera: Apidae: Meliponini) in Ujung Kulon National Park, Indonesia

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## ABSTRACT

Ujung Kulon National Park (UKNP) is located in the western part of Java Island, Indonesia. This national park was designated a Natural World Heritage Site by UNESCO in 1992. The stingless bee species, *Tetrigona apicalis* (Apidae: Meliponini), has not previously been documented in specific locations on Java Island. In this study, we found a new distribution record of *T. apicalis* in UKNP. Here, we described of its nest-entrance characteristics, morphological features, and morphometry. The colony of bee species was found in the forest of Mount Honje, UKNP, Indonesia, at an altitude of 883 m asl. The nest is located in a Tiliaceae tree cavity at a height of 420 cm from the ground surface. The shape of the nest entrance of the bee species was irregular, with a longitudinal diameter of 3.2 cm and a vertical diameter of 5.7 cm, and it had a light brown color. Locally, this bee is known as *teuwel meunyan*, referring to a traditional incense burner due to the aromatic scent associated with its use in religious rituals. The findings contribute to the current knowledge of the distribution of *T. apicalis* on Java Island, particularly within UKNP, and provide data for future conservation and sustainable utilization efforts.

## 1. Introduction

Stingless bees (Meliponini: Apidae) with a total of 605 species identified (Engel *et al.* 2023) are distributed across the Neotropical, Afrotropical, and Indo-Malaya regions (Grüter 2020). In Indonesia, 46 species of stingless bees have been recorded belonging to ten genera, namely *Austroplebiae*, *Geniotrigona*, *Heterotrigona*, *Homotrigona*, *Lepidotrigona*, *Lisotrigona*, *Papuatrigona*, *Pariotrigona*, *Tetragonula*, and *Wallacetrigona* (Rasmussen *et al.* 2017; Kahono *et al.* 2018). To date, ten stingless bee species have been recorded on Java Island, including *Tetrigona apicalis*, *Tetrigona vidua*, *Lepidotrigona javanica*, *Lepidotrigona*

*terminata*, *Lepidotrigona ventralis*, *Tetragonula drescheri*, and *Tetragonula laeviceps* (Kahono *et al.* 2018), *Tetragonula fucobalteata*, and *Heterotrigona itama* (Trianto & Purwanto 2022; Miharja *et al.* 2024). The genus *Tetrigona* is distributed across tropical regions of Southeast Asia, including Myanmar, Laos, Vietnam, Cambodia, Thailand, Singapore, and Indonesia. Moure (1961) reported five species that belong to the genus *Tetrigona*, i.e., *T. apicalis*, *T. binghami*, *T. melanoleuca*, *T. peninsularis*, and *T. vidua* (Jalil 2017). In Indonesia, *T. apicalis* was first described by Smith in 1857, and its distribution spans from Borneo (Kalimantan), Sumatra, and Java (no specific location of Java) (Rasmussen 2008; Jalil 2017). In Peninsular Malaysia, *T. apicalis* is commonly found in forested areas and is particularly valued for its role in propolis production (Mohamed *et al.* 2020). Studies have demonstrated that ethanolic

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extracts of propolis (EEP) derived from *T. apicalis* possess high antioxidant activity and have been shown to inhibit the proliferation of MCF7 cells, a human breast cancer cell line (Mohamed *et al.* 2020). The general structure of a stingless consists of a nest entrance, brood cells, food storage (honey and pollen pots), and layers of cerumen and bitumen (Vit *et al.* 2018; Grüter 2020). The nest entrance of *T. apicalis* is influenced by rainwater (Purwanto *et al.* 2022) and is useful as a rain-tight entrance tube (Sakagami *et al.* 1984). As a eusocial insect, *Tetrigona* exhibits a well-organized colony structure consisting of a queen, workers, and drones. The worker caste is further divided based on age and task specialization within the colony, including nursing, foraging, and guarding, with observable morphological differences among these functional groups (Grüter 2020).

In West Java, *T. apicalis* is referred to as "teuwel meunyan" due to the distinctive aroma of the outer nest, which, when burned, resembles the scent of incense used in religious rituals. Nest of *T. apicalis* holds sacred significance within the Sundanese tribe of Indonesia, where it is considered a medium for worship in several traditions. It is associated with protection, well-being, and a connection to supernatural forces. In certain traditional cultures, stingless bee nests are believed to possess spiritual protective powers, often linked to cosmological and mythological beliefs (Carvalho *et al.* 2018; Quezada-Eua'an 2018). Honeycombs are often burned in rituals as incense, believed to offer protection, ward off negative energy from evil spirits, or facilitate communication with divine entities. For instance, the Kayapo people of Brazil utilize cerumen and honey in their religious ceremonies (Quezada-Euán 2018). Similarly, indigenous communities in northwest Argentina use honey as an offering to Pachamama (Mother Earth) and the goddess of fertility, reflecting its cultural significance in Andean traditions (Flores *et al.* 2018; Grüter *et al.* 2020).

The high demand for *T. apicalis* nests and honey among the local community around Ujung Kulon National Park (UKNP) has led to widespread and uncontrolled colony harvesting. This practice has significant pressure on wild *T. apicalis* populations, particularly because most harvesting methods destroy the nests. The removal of colonies from their natural habitats has an impact on ecological and genetic risks and an increase of inbreeding (Caballero *et al.* 2025). Human activities involving the extraction of honey from native bee colonies in forest ecosystems pose a significant

threat to the survival of bee populations (Freitas *et al.* 2009). Additionally, both intact colonies and nest entrances of this species are sold outside the region. This activity poses a significant threat to the sustainability of *T. apicalis*, a species that is already becoming rare in Java Island. Despite its cultural importance, there have been no recent studies specifically describing the nest structure or morphological characteristics of *T. apicalis* in Java. Therefore, the findings of this study provide valuable data on the native species richness of Java, particularly in this national park. This report was the first documented distribution of *T. apicalis* in UKNP, Banten, Indonesia. The nest-entrance characteristics, morphological features, and morphometric analysis of its bee species were described.

## 2. Materials and Methods

### 2.1. Observation of Nesting Site, Nest-Entrance Characteristics, and Specimen Collection of *Tetrigona apicalis*

Observation of stingless bee colonies was conducted at Honje Mountain within the area of Ujung Kulon National Park, Banten, Indonesia, in December 2024. We recorded nest altitude, GPS coordinates, nest tree species, nest height from the ground, and nest-entrance characteristics (shape, diameter, and color). We collected of worker bees (50 individuals) from the colony using a sweep net. The collected bee specimens were preserved in 96% ethanol for identification, morphological analysis, and morphometric measurements.

### 2.2. Identification, Morphological Description, and Morphometric Measurement of *Tetrigona apicalis*

Bee specimens were identified based on Sakagami (1978), Sakagami and Inoue (1987), Sakagami *et al.* (1990), and Smith (2012), and morphological features of the bee species were described. Identification of the specimens was performed at the laboratory of Animal Biosystematics and Ecology, Department of Biology, Bogor Agricultural University. Morphometric measurement of *T. apicalis* ( $n = 10$ ) using 28 body characters, i.e., body length (BL), head length (HL), head width (HW), mandible length (ML), mandible width (MW), eye width (EW), eye length (EL), interocellar distance (IOD), gena width (GW), flagellomere IV length (FL), flagellomere IV width (FW), malar length (MAL), hind femur length (HFL), hind tibia width (HTW), hind tibia length (HTL), hind basitarsus width

(HTB), and hind basitarsus length (HBL). Morphometric measurements were taken using a Nikon Model C-LEDS stereo microscope equipped with an Optilab camera and analyzed with Image Raster software.

### 3. Results

#### 3.1. Nesting Site, Nest-Entrance Characteristics of *Tetrigona apicalis*

Nest of *T. apicalis* (Figure 1) was found in a tree cavity of kisigeung (Sundanese name) (Tiliaceae)

at an altitude of 883 m asl of Mount Honje, UKNP, Java, Indonesia. The nest is situated 420 cm above the ground, with an irregular shape and a light brown entrance. The opening of the nest entrance was 9 cm in vertical diameter and 3.2 cm in longitudinal diameter, and the length of the funnel was 5.7 cm.

#### 3.2. Morphology of *Tetrigona apicalis*

The worker of *T. apicalis* collected from Mount Honje, UKNP, exhibited black setae on the body, with a shiny tegument and fine spots on the head, thorax,



Figure 1. The nest of *Tetrigona apicalis* in tree cavity of kisigeung tree (arrow) and nest-entrance of this bee species (insert)



and abdomen, and all exhibited a black coloration (Figure 2A). The body length (BL) measured was  $6.85 \pm 0.50$  mm. The mandibles were wider at the base and featured two distinct teeth (Figure 2E). The

clypeus was covered by black setae, particularly in the apical region. The malar area (MAL) was medium in size and conspicuous, measuring  $1.63 \pm 0.38$  mm in diameter. The gena (GW) was  $0.77 \pm 0.17$  mm in width,



Figure 2. Worker of *T. apicalis*: whole body (lateral view) (A), head (frontal view) (B), clypeus and frons (dorsal view), ocelli (dorsal view) (C), gena (lateral view) (D), mandibles (E), mesoscutum (dorsal view) (F), propodium (dorsal view) (G), thorax (lateral view) (H), abdomen (dorsal view) (I), abdomen segments (lateral view) (J), hind wing (K), fore wing (L), hamuli (M), hind tibia (N), left hind-tibia (O), and hind basitarsus (P)

slightly wider than the compound eyes when viewed from the side (Figure 2B). Both the compound eyes and ocelli were blackish, while the antennal sockets were gray. The scape was ferruginous at the apex, the pedicel and first flagellomere were ferruginous, and the second to tenth flagellomeres were blackish-brown. The mesonotum was black and covered by black setae along the interior edge (Figure 2F). The scutellum projected slightly, partially covering the propodeum (Figure 2H). The propodeum was of medium size, with its basal area exhibiting a glossy black coloration (Figure 2G). The fore wings were distinctly bicolored, with the basal half being blackish-brown and the apical half semitransparent (Figure 2L). The underside near the wing base was brown with dark brown veins, while the upper tips of the wings were white with orange veins (Figure 2L). There were seven hamuli on the hindwings (Figure 2M). The hind tibia was subclavate, nearly three times longer than its inner width, featuring a narrow, prominent pubescent area and a glabrous posterior margin, with dense hair covering the posterior edge. The hind basitarsus (Figure 2P) displayed a large,

scaly basal area on its inner surface. The abdomen (Figure 2I) was black, with the anterior tergite being shiny on the disc (anterior median) and speckled along the edge.

### 3.3. Morphometry of *Tetrigona apicalis*

The body length of *T. apicalis* found in Mount Honje, UKNP was  $6.85 \pm 0.050$  mm, the head width and mandibular length of  $2.87 \pm 0.59$  mm and  $1.95 \pm 0.19$  mm, respectively. The other morphometry of the bee species were: mesoscutum length was  $2.52 \pm 0.52$  mm, mesoscutum width was  $2.29 \pm 0.53$  mm, mesoscutellum length was  $0.66 \pm 0.31$  mm, mesoscutellum width was  $1.51 \pm 0.23$  mm, propodeum width was  $1.51 \pm 0.42$  mm, and propodeum length was  $1.44 \pm 0.34$  mm. The wing characters were fore-wing length was  $6.20 \pm 0.57$  mm, fore-wing width was  $2.59 \pm 0.28$  mm, hind-wing length was  $5.13 \pm 0.18$  mm, hind-wing width was  $1.39 \pm 0.04$  mm, hamuli number was 7, hind-femur length was  $2.21 \pm 0.25$  mm, and hind basitarsus length was  $1.38 \pm 0.28$  mm (Table 1).

Tables 1. Morphometrics of *Tetrigona apicalis* in Mount Honje, Ujung Kulon National Park, Banten, Indonesia

Body characters	Length (mm)			
	Minimum	Maximum	Mean	Standart deviation
Body length (BL)	5.85	7.85	6.85	0.50
Head length (HL)	1.48	3.42	2.45	0.74
Head width (HW)	1.78	3.96	2.87	0.59
Mandible length (ML)	1.63	2.27	1.95	0.19
Mandible width (MW)	0.53	0.75	0.64	0.08
Eye width (EW)	0.37	0.88	0.63	0.22
Eye length (EL)	1.38	2.51	1.95	0.43
Interocellar distance (IOD)	1.46	4.17	2.82	0.80
Gena width (GW)	0.44	1.10	0.77	0.17
Length of flagellomere IV (FL)	1.87	3.97	2.92	0.87
Width of flagellomere IV (FW)	0.16	0.40	0.28	0.08
Malar length (MAL)	1.14	2.12	1.63	0.38
Mesoscutum length (MSL)	1.80	3.24	2.52	0.52
Mesoscutum width (MSW)	1.42	3.15	2.29	0.53
Mesoscutellum length (MTL)	0.23	1.09	0.66	0.31
Mesoscutellum width (MTW)	1.13	1.89	1.51	0.23
Propodeum width (PW)	0.85	2.17	1.51	0.42
Propodeum lenght (PL)	0.86	2.01	1.44	0.34
Fore wing length (FWL)	5.29	7.11	6.20	0.57
Fore wing width (FWW)	2.15	3.03	2.59	0.28
Hind wing length (HWL)	4.83	5.42	5.13	0.18
Hind wing width (HWW)	1.31	1.46	1.39	0.04
Hamuli number (HN)	7.00	7.00	7.00	0.00
Hind femur length (HFL)	1.81	2.61	2.21	0.25
Hind tibia width (HTW)	0.91	1.46	1.19	0.17
Hind tibia length (HTL)	2.52	2.77	2.65	0.08
Hind basitarsus width (HTB)	0.44	0.85	0.65	0.17
Hind basitarsus length (HBL)	1.00	1.75	1.38	0.28

#### 4. Discussion

In this study, the body length of *T. apicalis* ( $6.85 \pm 0.050$  mm) was similar to the body length recorded by Purwanto *et al.* (2022) in Kalimantan (7.5 mm) and Jalil (2017) in the Malaysian Peninsula (5.5–10 mm), and Syed Salleh *et al.* (2021) reported in Malaysia (6.82 to 7.30 mm). The head width and mandibular length of *T. apicalis* collected from Mount Honje ( $2.87 \pm 0.59$  mm and  $1.95 \pm 0.19$  mm, respectively) indicated larger compared to *T. apicalis* in Peninsular Malaysia (2.74 mm and 1.94 mm, respectively) (Raihana & Wulandari 2018). The specimen of *T. apicalis* collected from UKNP also showed larger in gena width ( $0.77 \pm 0.17$  mm), malar space ( $0.63 \pm 0.38$  mm), and hind tibia width ( $1.19 \pm 0.17$  mm) (Table 1) compared to the sample reported by Purwanto *et al.* (2022) from Kalimantan ( $0.51 \pm 0.004$  mm,  $0.36 \pm 0.012$  mm, and  $0.96 \pm 0.005$ , respectively). However, the hind basitarsus width of the bee specimen ( $0.65 \pm 0.17$  mm) was smaller than the Kalimantan sample (0.747 mm) reported by Purwanto *et al.* (2022). Hind tibia length of the current study ( $2.65 \pm 0.08$  mm) was also smaller than reported by Raihana & Wulandari (2018) in Peninsular Malaysia (2.86 mm).

Species of *T. apicalis* was distinguished from *T. vidua* by several clear morphological characteristics, such as slightly bicolored wings with a darker color in the basal area and transparent in the apex, a light brown tergite of the last abdomen, the mesoscutum and scutellum of the thorax are covered by dense and lighter-colored setae, and tibiae are lighter in color. In contrast, *T. vidua* has a smaller body size, a uniformly black thorax and abdominal tergites, a large and rounded head, forelegs and tibiae are entirely black, and wings are monochromatic, generally transparent and lacking any distinct color pattern (Jalil 2017; Rasmussen *et al.* 2017).

Our result showed the first distribution report of *T. apicalis* in the highlands of Mount Honje in UKNP, Banten, Indonesia. Additionally, information from the local community of bee hunters indicates that the distribution of *T. apicalis* was primarily in highland areas, specifically Mount Honje and Mount Tilu of UKNP, characterized by dense and humid tropical rainforest vegetation and high rainfall. We suppose that the distribution of *T. apicalis* in Java was in its natural habitat at an altitude of more than 700 m asl with a temperature of 24–29°C. The presence of *T. apicalis* in UKNP must be a serious concern, especially the

threat from bee colony hunters. Local communities, particularly the Sundanese people, collect of honey and the nest entrances of bee species used as natural incense in the religious practices. Additionally, both intact colonies and the outer nest entrance are sold to outside regions. These activities have a significant threat to the sustainability of *T. apicalis*, a species that is already becoming rare on Java Island. Limited reports of *T. apicalis* distribution in Java make a conservation of the bee species is very important.

In conclusion, the bee species of *T. apicalis* was found in the UKNP forest at an altitude of 833 m asl. The nest is located in a tree cavity of Tiliaceae, about 420 cm from the ground surface. The shape of the nest-entrance was irregular, with a longitudinal diameter of 3.2 cm and a vertical diameter of 5.7 cm, and it had a light brown color. To date, no recent studies have specifically described the nest-entrance and morphological characteristics of *T. apicalis* in Java. Therefore, this study provides valuable data on the native species richness of Java. This study was the first documented report of the nest, morphological features, and morphometrics of *T. apicalis* in the tropical rainforest in Java, Indonesia.

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