



Title	Stingless Bees (Excl. Tetragonula) from the Continental Southeast Asia in the Collection of Berince P. Bishop Museum, Honolulu (Hymenoptera, Apidae) (With 14 Text-figures and 3 Tables)
Author(s)	SAKAGAMI, Shôichi F.
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**Stingless Bees (Excl. *Tetragonula*) from the Continental
Southeast Asia in the Collection of Berince P. Bishop
Museum, Honolulu (Hymenoptera, Apidae)¹⁾**

By

Shôichi F. Sakagami

Zoological Institute, Hokkaido University

(With 14 Text-figures and 3 Tables)

The present paper is a report on the stingless bees collected from various localities of the Continental Southeast Asia and deposited in Berince P. Bishop Museum. Among three major faunae of this Pantropic bee group, Indo-australian, Ethiopian and Neotropical, the Asiatic part of the first mentioned is the best clarified thanks to two excellent papers by Schwarz (1937, '39), with a supplement by Moure (1961). The present paper records some additional notes on the distribution and taxonomy of the species inhabiting this area, excluding the forms belonging to *Tetragonula*, which will be treated in a separate paper.

Before going further I would like to express my sincere thanks to Dr. J. L. Gressitt, B.P. Bishop Museum, for his kindness in placing the present material at my disposal and informing me of details about the localities where the specimens were collected, and to Prof. Yoshihiro Hirashima, Kyushu University, Fukuoka, for his effort in arranging the dispatchment of the material for me. Further my gratitude is also expressed to Dr. Rudolf Jander, University of Kansas, who collected some stingless bees in Malaya for me, which were valuable in completing the present paper.

Generic system adopted: There has been a controversy on the classificatory system of stingless bees among authorities. The most lumping system adopted by Schwarz (1948) admits only three genera, *Melipona*, *Lestrimelitta* and *Trigona*. Wille (1963) recognized five, adding *Meliponula* and *Dactylurina* to those mentioned above. On the other hand, Moure (1951, '61) divided the New World groups in 11 genera with 24 subgenera and the Old World groups in 23 genera. Different opinions mainly depend on how evaluate the taxonomic ranks of various groups. The main difference between Moure and Wille concerns whether the large group *Trigona* (sensu Schwarz) should be divided into separate genera or not.

1) Contributions to the knowledge of the Indopacific stingless bees. I.

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Thus the controversy has not been caused by different phyletic interpretations, which has yet not sufficiently be explored. At this situation a compromise between the two system is tentatively adopted here. It is still open to question whether numerous "genera" recognized by Moure, especially those erected for the Old World groups, really deserve the generic rank. But most, if not all, of his genera and subgenera seem represent real natural groups judging from an impressive correspondence between ethological observations (*e.g.* Sakagami and Zucchi 1966, '74, Sakagami, Camilo and Zucchi 1973) and morphological characters in some Neotropical groups recognized by him. Considering the huge group size with a marked intragroup differentiation of *Trigona* (*sensu* Schwarz), it may be convenient to split it a few genera. Concerning the Indomalayan fauna the two genera are admitted here.

Hypotrigona Cockerell 1934. Groups included: Indomalayan *Pariotrigona* Moure 1961, *Lisotrigona* Moure 1961; Ethiopian *Hypotrigona* Cockerell 1934, *Liotrigona* Moure 1961; Neotropical *Leurotrigona* Moure 1950, *Celetrigona* Moure 1950, *Dolichotrigona* 1950, *Trigonisca* Moure 1950.

As suggested by Moure (*op. cit.*), the resemblance among these groups could be the outcome of either a convergence by dwarfism or a real phyletic affinity. Until the problem would be solved they are regarded as the subgenera of the genus *Hypotrigona*.

Trigona Jurine 1803. Groups included: Indopacific *Homotrigona* Moure 1961, *Heterotrigona* Schwarz 1939, *Platytrigona* Moure 1961, *Lophotrigona* Moure 1961, *Geniotrigona* Moure 1961, *Odontotrigona* Moure 1961, *Trigonella* Sakagami et Moure **subgen. nov.**, *Tetragonula* Moure 1961, *Tetragonilla* Moure 1961, *Tetrigona* Moure, *Lepidotrigona* Schwarz 1939; Ethiopian *Dactylurina* Cockerell 1934; Neotropical *Cephalotrigona* Schwarz 1940, *Oxytrigona* Cockerell 1917, *Trigona* Jurine 1807, *Tetragona* Lepeletier et Serville 1828, *Frieseomelitta* H.v. Ihering 1912, *Geotrigona* Moure 1943, *Duckeola* Moure 1944, *Tetragonisca* Moure 1946, *Ptilotrigona* Moure 1951.

The genus delimited here corresponds to the complex, excluding *Hypotrigona*, placed by Moure (1946) in Tribe Trigonini, that is, the groups characterized by longitudinally raised inner surface of worker hind tibia and relatively less reduced wing venation. As in *Hypotrigona* all groups mentioned are tentatively regarded as the subgenera. There are obviously marked differences on the relative similarity among them. Concerning the Neotropical groups, Moure (1961) treated *Cephalotrigona* and *Oxytrigona* as independent genera while others as the subgenera of *Trigona*. Recently he raised *Tetragona* as a genus (Moure 1971). Here all these groups of *Trigona*-*Tetragona* complex are lumped together. Wille (*op. cit.*) considered *Dactylurina* as an independent genus based upon its particular nest structure. By its morphological resemblance to other groups mentioned, it is treated here as a subgenus of *Trigona*. Among Indomalayan subgenera, some of which reach Australia, *Heterotrigona*, *Homotrigona* and notably *Lepidotrigona* are rather isolated while other ones seem relatively close one another. For instance,

it is uncertain whether *Tetragonula* and *Tetragonilla* are subgenerically distinct for each other.¹⁾

A zoogeographical characteristic of the Indomalayan fauna is the absence of *Plebeia* complex, (Moure 1961) which is in my opinion another independent genus, distributed in the Neotropical, Ethiopian and Australian regions.

Infrageneric system adopted: Confronting the presence of a number of closely similar forms Schwarz (1939) used the following norms in determining the rank relation between two concerned forms based upon the worker caste: 1) Structurally identical but different in coloration=varieties of the same species, 2) Identical both in structure and coloration but with different gradations of size=varieties of the same species, 3) Identical in structure but different in both color and size=different species. In the present paper some forms treated by him as "varieties" are regarded as independent species, when two forms are sympatric and separated one another by a definite discontinuity in some characters. In case of allopatric difference in coloration, the forms are regarded as either subspecies or forma according to the degree of local segregation and the amount of available information.

Sources of material examined: The provenance of the specimens examined are given in Table 1. For each country the localities are arranged in the order of code numbers, given approximately from north to south, and their locations are mapped in Fig. 1. The dates of collection are given by months alone. Henceforth the capture records are cited by these code numbers, followed by the numbers of specimens examined in parentheses, all being workers unless specially mentioned. The synonymic lists include only the original description and important papers, and those published after Schwarz (1939). The locality names in Table 1 follows those given in the labels, not changed to the current usage.

Hypotrigona (Lisotrigona) scintillans (Cockerell)

Trigona scintillans Cockerell 1920: Ann. Mag. Nat. Hist (9)5: 116; 1929: Ibid. (10)4: 590.

Trigona (Hypotrigona) scintillans, Schwarz 1939: 130; Sakagami and Yoshikawa 1961: 440.

Lisotrigona scintillans, Moure 1961: 195.

Specimens examined: Laos 3(2); S.VietNam 1(3), 2(1), 6(1), 15(8); Thailand 13(3). The first records from Laos and S.VietNam.

This species was first described from N. Borneo, then recorded from N. Thailand (Mt. Pahtoop), Cambodia (Angkor) (Cockerell 1929), Malaya (Bukit Kutu, Schwarz 1939) and C. Thailand (Bangkok, Sakagami and Yoshikawa 1961). The coloration changes from pale to fairly dark, for instance, on mesosoma chestnut brown to blackish and on metasoma with partial or total melanism or not. With-

1) The adoption of the system cited was recently decided. My determination labels attached to the specimens sent back to Bishop Museum followed the system by Schwarz, admitting only the genus *Trigona* with four subgenera, *Tetragona*, *Hypotrigona*, *Heterotrigona* and *Lepidotrigona*.

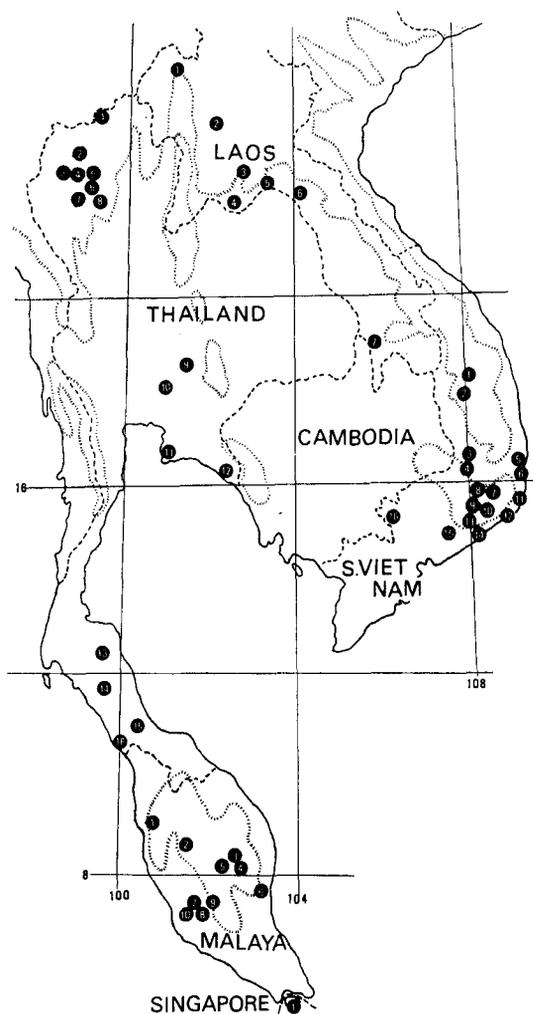


Fig. 1. Map showing localities where the specimens were collected (cf. Table 1). Some localities do not appear in the text because only *Tetragonula* specimens were collected there.

in the examined specimens, however, no definite local differentiation was noticed.

Trigona (Homotrigona) fimbriata Smith

Trigona fimbriata Smith 1857: J. Proc. Linn. Soc. Zool. 2: 52; Schwarz 1937: 304, with discussions on allied forms, *flavistigma* Cameron 1902, *versicolor* Friese 1908, *anamitica* Friese 1917, *melanotricha* Cockerell 1918, *aliceae* Cockerell 1929, *ferrea* Cockerell 1929.

Table 1. Provenance of the material examined

Country	Locality	Code number	Date	Collector
Laos	MuongSing, NW LuanPrabang, 650 m	1	1960 VI	S. Quate
	LaungPrabang, 300 m	2	" "	"
	Ban-Van-Heue, 20 km E Phou-Kow-Kuei	3	1965 V	J.A. Rondon
	Vientiane	4	1960 V~VI	S & L.W. Quate
	Borikhane Prov., Paksane	5a	" XI	Native Coll.
		b	1965 X~XI	"
	Borikhane Prov., Pakading (Pakkading)	6a	1965 X	"
	b	1966 IV	"	
	Sedone Prov., Pakse	7	1960 V	P.D. Ashlock
S. VietNam	Kontum	1	1960 V	L.W. Quate
	Pleiku	2	" "	"
	DakSong, 76 km SW BanMeThout, 870 m	3	" "	C.M. Yoshimoto
	BanMeThout, 500 m	4	" XII	"
	DaiLanh, N. NhaTrang	5	" XI~XII	"
	NhaTrang	6	" XI	"
	Dalat, 1,500 m	7	" IV~IX	J.L. Gressitt
	Fyan, 900~1,000 m (8a), & 1,200 m (8b)	8	1961VII~VIII	N.R. Spencer
	Chutte de Bobla 7 km W DiLinh	9	1960 IV	R.E. Leech
	DiLinh (Djiring), ca. 900 m	10	" IX~X	C.M. Yoshimoto
	NW PhangRang	11	" X	"
	PhangRang	12	1960 IX	"
	Bla0 (Balao), 5~600 m	13	" X	"
	PhanThiet	14	1940 XI	"
	Karyu Danar, 200 m	15	1960 II	N.R. Spencer
	BaDen, TayNinh, 150 m	16	" VII	R.E. Leech
Thailand	(NW) Chiangmai Prov., Fang	1	1958 IV	T.C. Maa
	" " " ChiangDao	2	" III~VI	"
	Chiangmai Prov., DoiPui, 1,360 m	3	" V	"
	" " Ban-Tin-Doi, 350 m	4	1957 XI	"
	(NW) Chiangmai	5	" "	"
	" " Chiangami Prov., DoiSuthep, 1,273 m	6	1958 III	"
	" " " MaeKlang, 340 m	7	1965 IV	P.D. Ashlock
	Lampang	8	1920 X	"
	(C) Pakchong, NE of Bangkok	9	1957 XII	J.L. Gressitt
	" Prachai~Saraburi, N. of Bangkok	10	" "	"
	(SE) Bangpra	11	" XI	"
	Chantaburi, Prew	12	1958 IV~V	T.C. Maa
	Banna, Nakhorn	13	" V	"
	Trang, Prov., Khaophappa-Khaochang	14a	1963 XII	G.A. Samuelson
		b	1964 I~III	"
	Sonkla Prov., BanPrakamp	15	1958 VII	J.L. Gressitt
Satun Prov., E. Boundary Satun Road	16	1964 I	G.A. Samuelson	

premature to discuss the subspecies of this species. Following notes were made on the examined specimens:

Among melanic individuals, two specimens from Laos possess the head with enlarged dark parts but their metasomal dorsum is relatively pale, being transitional to *aliceae* by the appearance of dark stripes. The specimens from Vietnam behave oppositely, with the less melanic head and darker metasoma. In two specimens, metasomal dorsum and legs are fairly pale and dark stripe on the inner side of hind tibia is absent, reproducing a condition exhibited by *ferrea*, the palest form. All Thai specimens are classified into *aliceae* by rufotestaceous general tone with black metasomal stripes. But the development of these stripes and other black bands on various body parts, especially along sutures, vary individually.

Trigona (Heterotrigona) itama Cockerell

Trigona itama Cockerell 1918: Ann. Mag. Nat. Hist. (9)2: 387; Schwarz 1937: 322.

Trigona (Heterotrigona) itama, Schwarz 1939: 96; Sakagami 1959: 119; Yoshikawa et al. 1969: 173.

Heterotrigona itama, Moure 1961: 202.

Specimens examined: Thailand 14(4); Malaya 4(4), 5(9), 9(2), 10(47).

Schwarz cites some variations in wing color and length. But the examined specimens possessed more or less the same color hue of wings, and the variation in wing length was small. The antennal alveolus and base of scape vary from pale to dark brown.

Trigona (Heterotrigona) erythrogastra Cameron

Trigona erythrogastra Cameron 1902: J. Str. Asiat. Soc. 37: 129; Schwarz 1937: 319.

Trigona (Heterotrigona) erythrogastra, Schwarz 1939: 100.

Heterotrigona erythrogastra, Moure 1961: 202.

Specimens examined: Malaya 4(3), 5(3).

A slight individual variation on the dark hue of apical terga (the posterior half of IV and the rest) was noted among the examined specimens.

Trigona (Lophotrigona) canifrons Smith

Trigona canifrons Smith 1857: J. Proc. Linn. Soc. Zool. 2: 51; Schwarz 1937: 307.

Trigona (Tetragona) canifrons, Schwarz 1939: 101; Yoshikawa et al. 1969: 173.

Lophotrigona canifrons, Moure 1961: 205.

Specimens examined: Thailand 13(6); Malaya 9(9).

Although the number of examined specimens is insufficient, the Thai specimens seem generally less melanic with a stronger chestnut brown tint, particularly on legs, clypeus, mandibles and mesosomal sides. Further the Thai specimens are slightly smaller as shown by the distribution of head width (16=1 mm), though

the number of hamuli was seven in all specimens.

Head width	45	46	47	48	49
Thailand	1	1	2	2	
Malaya				4	5

***Trigona (Geniotrigona) thoracica* Smith**

Trigona thoracica Smith 1857: J. Proc. Linn. Soc. 2: 50.

Trigona thoracica var. *lacteifasciata*, Schwarz 1937: 317.

Trigona (Tetragona) thoracica, Schwarz 1939: 104; Yoshikawa et al. 1969: 173.

Geniotrigona thoracica, Moure 1961: 212.

Specimens examined: Thailand 15(1), Singapore 1(1).

Schwarz (1939) mentioned a high variability of body coloration in this species.

The coloration of the specimens examined are as follows:

Singapore: Head black, clypeus, base and apex of scape, pedicel frontally reddish; mandibles dark reddish, paler medially; bristles on vertex black. Mesosoma dark reddish, tegulae pale reddish, wings flavo-hyaline, apically slightly milky, veins flavotestaceous. Legs black, fore coxa to femur reddish brown, fore tibia tending to dark chestnut; mid and hind coxae and trochanters reddish brown, mid and hind femora dark reddish. Metasoma black with reddish tint on tergum I. Thailand: Paler. Antennal flagellae frontally reddish, meso- and metasoma reddish, mesoscutum bright ferruginous, legs including corbicular disc rather reddish.

***Trigona (Trigonella* subgen. nov.) *moorei* Schwarz**

Trigona moorei Schwarz 1937: 321.

Trigona (Tetragona) moorei, Schwarz 1939: 106.

Trigona (Tetragona) matsumurai Sakagami 1959: 120 (syn. nov.).

Specimens examined: Malaya. 9(1). Further the following worker specimens were examined. Malaya. Kuala Tahan viii 26 1970 (3), viii 31 1970 (19); Kuala Tenbeling ix 30 1968 (27); Taman Negara viii 24 1970 (1), all R. Jander leg. in the Collection of Zoological Institute, Hokkaido University; Singapore ix 1932 (2, Holo- and paratype of *Trigona matsumurai*) in the Collection of Entomological Institute, Hokkaido University.

T. matsumurai was described by its paler coloration and larger body size compared with the original description of *T. moorei* by Schwarz. Examining a long series of the specimens from Malaya, it was confirmed that the coloration varied continuously from uniformly blackish to dark brown. The paler tendency is either general or partial. In partial case, the metasoma even tends to dark reddish, giving an obscurely bicolorous impression. The coloration of both legs and antennae also varies from jet black to dark brown. The two type specimens of *T. matsumurai* are thus within the variation range of other specimens examined,

many of which coincide with the original description of *T. moorei*. As to the body size, too, the Singapore specimens are involved within the variation range of the Malayan ones:

Head width (40=1 mm)	72	74	75	76	77	78	79	80
Kuala Tahan	1	1	2(1)	7(4)	8(3)	2	1	
Kuala Tenbeling			3(2)	1(1)	4(4)	15(9)	1(1)	2(1)
Taman Negara		1(1)						
Singapore		1(1)			1(1)			

Therefore, *T. matsumurai* is regarded as synonymous with *T. moorei*. The number of hamuli per wing ranges 6~7. Interestingly the specimens with six hamuli were more frequent in Kuala Tenbeling (in the Table those with six given in parentheses), in spite of the average body size larger than in Kuala Tahan.

Adopting the afore mentioned subgeneric system, *T. moorei* cannot be placed in any subgenera so far recognized, necessitating the erection of a new subgenus.

Trigonella Sakagami et Moure **subgen. nov.**

- a) Tegument smooth and polished, minutely punctured; yellow marks absent.
- b) Head distinctly broader than long (Fig. 2 A), slightly broader than mesosoma. Face slightly broader than eye length; inner orbits very slightly sinuate, a trifle converging below. Upper alveolar tangent well below mid-face; interalveolar distance very narrow, slightly narrower than diameter of alveolus, less than half of alveorbital distance. Frons on its upper half sulcate; lower half slightly roofed, above slightly ridged.
- c) Clypeus weakly bowed, without strong erect hairs, slightly broader than twice length; lateral portions of epistomal suture gently incurved.
- d) Mandibles bidentate, teeth small. Labrum simple. Malar area (Fig. 2 E_x) as long as flagellar diameter. Gena rounded, shorter than eye in profile.
- e) Vertex not raised, not carinate, about as wide as ocellar diameter, but two diameters behind orbitae; interocellar distance longer than ocellorbital one.
- f) Scape conspicuously shorter than alveocellar distance, ending well below lower tangent of median ocellus. Flagellar segments short, about as long as diameters; second segment longer than first, about as long as third. (Fig. 2 A).
- g) Prescutal and median sutures very weak. Parapsidal sutures very short, about half of ocellar diameter. Scutellum short, a trifle projected beyond metanotum (Fig. 2 B_x).
- h) Anterior wing longer than body; pterostigma small, parastigma less than width of pterostigma. Marginal cell four times longer than broad, narrow, at most closed apically, distance from apex to wing tip as great as its width. Bifurcation between *M* and *Cu* a little before *cu-an* (Fig. 2 D_x). Submarginal angle nearly 90°, *Cu* weak, *M* angled at first *m-cu*, first submarginal cell indicated, second one obsolete (Fig. 2 E_x). Hamuli seven per wing. Jugal lobe three fifth of vanal lobe, three fourths as long as cubital cell.

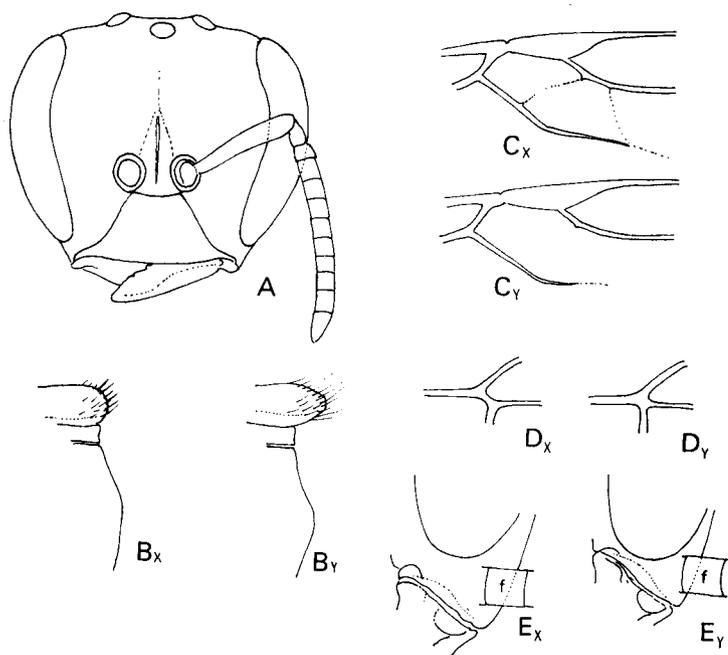


Fig. 2. *Trigona* (*Trigonella* subgen. nov.) *moorei* (x and y, *Trigonella* and *Tetragonula*). A. Head, frontal view, B. Mesoscutellum, C. Submarginal cell area, D. Bifurcation between *M* and *Cu* with *cu-an*, E. Malar area compared with flagellomere IV (f).

i) Hind tibia elongato-clavate, its maximum width slightly shorter than one-third of length; posterior margin recurved, distal corner distinctly angled. Hairs on posterior margin mostly plumose. Corbicula occupying distal two thirds. Inner face with a narrow bare posterior area. Penicillus and comb present, hairs relatively soft.

j) Hind basitarsus slightly broader than half width of hind tibia; a large sericeous area occupying more than one third of inner face.

k) Propodeum of moderate size, gently angled; basal area smooth and hairless. Metasoma slightly narrower than mesosoma, short and rather flat, sector shaped in transverse section, the anterior terga polished.

l) Small sized, body 3.5~4.0 mm long, fore wing about 4 mm long.

By the erection of this subgenus, the key to genera (interpreted as subgenera in the present paper) of the Oriental and Australian Regions by Moure (1961 p. 190) is emended as follows:

9. Scutellum well projected backward, overroofing propodeum as far as posterior propodeal slope; malar area linear or narrower than half diameter of third flagellar segment; vein *M* straight and ending shortly after first *m-cu**Tetragonula*, *Tetragonilla*

- Scutellum short, only slightly projecting over metanotum; malar area as long as diameter of third flagellar segment or longer; vein *M* strongly bent at first *m-cu* 11
- 11. Hind basitarsus very wide, conspicuously more than two thirds as wide as hind tibia; malar space more than twice the diameter of third flagellar segment; submarginal cells distinct; bifurcation between *M* and *Cu* coincided with origin of *cu-an*, hamuli nine per wing *Geniotrigona*
- Hind basitarsus not much more than half as wide as hind tibia; malar space as long as the diameter of third flagellar segment or less; submarginal cells indistinct to obsolete; bifurcation between *M* and *Cu* before origin of *cu-an*, hamuli six to seven per wing 11'
- 11'. Mandibular teeth of moderate size; malar space as long as the diameter of third flagellar segment; submarginal cells traceable, clypeus without erect black hairs. Small species *Trigonella*
- Mandibular teeth very large and robust; submarginal cells indistinct, clypeus with erect black hairs. Medium to large species.....12 (*Odontotrigona*, *Tetrigona*)

By the possession of 1) Smooth tegument, 2) Plumose hairs on hind tibia, 3) Sericeous area on hind basitarsus, 4) Bidentate mandibles and 5) Smooth and polished propodeum, *Trigonella* is distinguished from some side branch Oriental groups such as *Lepidotrigona* (by 1, 2, 3), *Homotrigona* (by 3), *Heterotrigona* (by 4), *Lophotrigona* and *Platytrigona* (by 5). Among other groups, *Trigonella* superficially resembles the forms of *T. iridipennis* complex (dark forms of *Tetragonula*) by its small size, blackish coloration and short flagellomeres, but readily distinguished by longer malar area, less specialized mesoscutellum and weaker wing vein reduction (Fig. 2). The relatively large head and stout hairs on vertex and mesoscutellum are also characteristic. The distinction from the groups with similar scutellar structure is made by the key given above.

Trigona (Tetragonilla) atripes Smith

Trigona atripes Smith 1857: J. Proc. Linn. Soc. Zool. 2: 50.

Trigona (Tetragona) atripes var. *atripes*, Schwarz 1939: 121.

Tetragonilla atripes, Moure 1961: 211.

Trigona (Tetragona) atripes atripes, Yoshikawa et al. 1969: 173.

Specimens examined: Thailand 14b(3); Malaya 3(1), 9(1), 10(1). The first record from Thailand.

Schwarz (1939) recognized four varieties of *atripes*, *atripes*, *collina* (= *cambodiensis*), *fuscibasis* and *rufibasalis*. While the last three forms are all blackish and closely similar for each other, *T. atripes* is strikingly different by its ferruginous coloration. No gradation has so far been found between dark and red types. Therefore *T. atripes* and *T. collina* are regarded as two independent species.

Trigona (Tetragonilla) collina Smith

Trigona collina Smith 1857: J. Proc. Linn. Soc. Zool. 2: 51; Schwarz 1937: 297.

Trigona (Tetragona) atripes var. *collina*, Schwarz 1939: 123; 1951: 63; Sakagami 1960: 146; Sakagami and Yoshikawa 1961: 437.

Tetragonilla collina, Moure 1961: 211.

Trigona (Tetragona) atripes collina, Yoshikawa et al. 1969: 173.

Specimens examined: Laos 1(2), 5b(6), 7(1); S. VietNam 1(1), 2(11), 6a(10), 8a(4), 8b(2), 10(18), 13(1), 14(1); Thailand 1(41), 2(3), 3(1), 4(2), 6(5), 7(1), 8(1), 10(1), 11(1), 12(2), 13(1), 14a(6), 14b(5); Malaya 9(1), 10(1+2).

This is one of the commonest and most widespread species in Southeast Asia. Body coloration ranges from blackish to dark brown. Supraclypeus and clypeus vary from nearly as dark as the face above to distinctly pale. Tegulae were in all examined specimens dark brown to black, not testaceous (=var. *fuscibasis* Cockerell). Another variety, *rufibasalis* Cockerell, regarded by Moure (1961) as an independent species by a less contrasting wing coloration and a larger size, was not represented in the examined specimens. Two workers from Malaya, Loc. 10 (shown with +2) possessed wings the basal half of which was slightly paler. But the difference is subtle and their body size does not differ from other *collina* specimens from the same locality. This species seems to exhibit an increase of body size from Malaya and S. Thailand via S. VietNam to N. Thailand and Laos.

Trigona (Tetrigona) apicalis Smith

Trigona apicalis Smith 1857: J. Proc. Linn. Soc. Zool. 2: 51; Schwarz 1937: 300.

Trigona hemileuca Cockerell 1929: Ann. Mag. Nat. Hist. (10) 4: 140.

Trigona (Tetragona) apicalis var. *apicalis*, Schwarz 1939: 126; Sakagami 1960: 146; Sakagami and Yoshikawa 1961: 439.

Tetrigona apicalis, Moure 1961: 216.

Trigona (Tetragona) apicalis apicalis, Yoshikawa et al. 1969: 173.

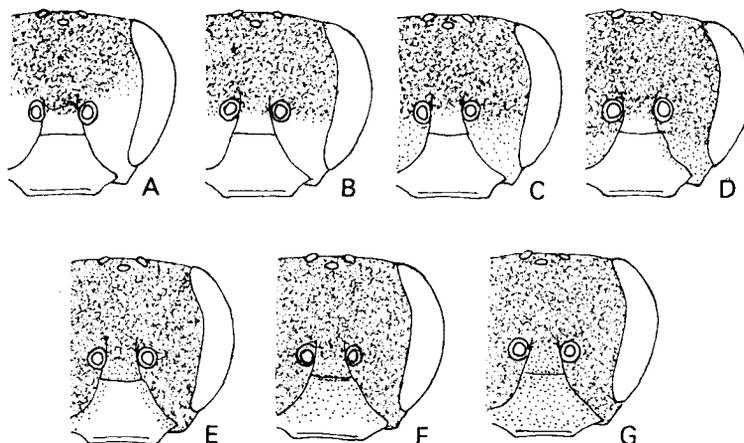


Fig. 3. Variation of facial coloration in *Trigona apicalis*.

Specimens examined: Laos 4(7), 5b(3), 6a(3); S.VietNam 7(1), 8a(22), 8b(38), 10(1+2); Thailand 1(2), 2(2), 7(6), 14a(5), 14b(13); Malaya 1(2), 4(3), 8(2).

Schwarz (1939) distinguished four varieties, *apicalis*, *melanoleuca*, *peninsularis* and *binghami*. As given successively *melanoleuca* and *peninsularis* are regarded as independent species. *T. apicalis* var. *binghami* Schwarz was recorded from Borneo, Upper Burma and Tenasserim, as a conspicuously paler form with the head testaceous yellow except malar space and facial mark which are blackish. No individuals representing these conditions were found in the specimens examined. The variation trend of head coloration (Fig. 3) was traced as follows:

Color type	A	B	C	D	E	F	G
S. VietNam	10	51	2				
Laos	1	6	1	1			
N. Thailand		1	6	1	1		
S. Thailand		1	3	7	1	2	4
Malaya				1	4	1	1

Except for S.VietNam the number of available specimens is still insufficient, but a clinal melanism from S. VietNam via Laos and N. Thailand to S. Thailand and Malaya is distinct. The same tendency is recognized in the coloration of other body parts. For instance, the coloration of legs, mainly based upon hind femur, shows the following trend:

Color hue	Testaceous	Chestnut brown	Deep chestnut brown	Nearly blackish
S. VietNam	31	25		
Laos	1	4		7
N. Thailand	1	3		4
S. Thailand		8		8
Malaya		2		5

It must be solved by further research whether the coloration of this species becomes paler in the eastern (Borneo) and western (Upper Burma and Tenasserim) areas of the distribution range as suggested by *binghami* or the latter is merely a color aberrant. Moure (1961) proposed to retain *T. hemileuca*, described from Thailand, as a northeastern subspecies. But the continuous gradation mentioned above makes such distinction less likely. As in *T. collina* the body size increases from south to north as shown below together with two allied species;

Head width (16=1 mm)	39	40	41	42	43	44	45
Laos				2	3	3	4
N. Thailand				7	1	2	
S. VietNam			2	5	19	26	10
S. Thailand			5	3	5	4	
Malaya		1	3	2	1		
<i>melanoleuca</i>			2	1			
<i>peninsularis</i>				3	6	7	

The specimens from S. Thailand (Loc. 14) have in average slightly narrow

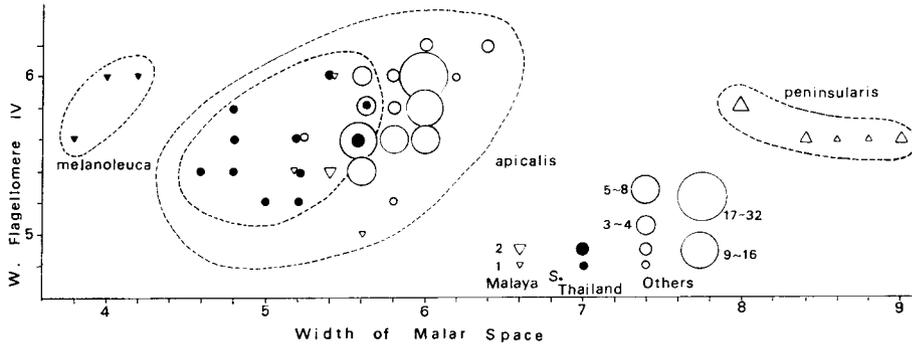


Fig. 4. Relation between width of malar area and flagellomere IV (80=1 mm) in three *Trigona* species

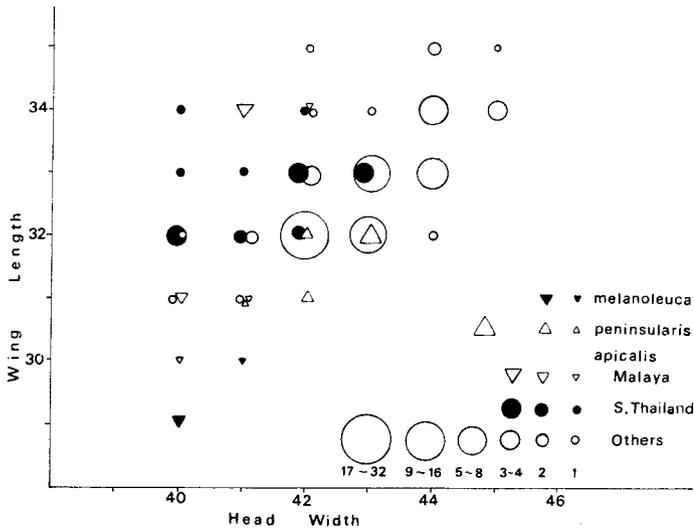


Fig. 5. Relation between head width and wing length (=distance between *M-Cu* bifurcation and basal tip of marginal cell) (16=1 mm) in three *Trigona* species

malar space, giving a mild deviation from the main trend (Fig. 4). Otherwise they are identical with those from other localities, except having, together with the specimens from Malaya (Fig. 5), relatively long wings.

Trigona (Trigona) melanoleuca Cockerell

Trigona melanoleuca Cockerell 1929: Ann. Mag. Nat. Hist. (10)4: 140; Schwarz 1937: 302.

Trigona (Trigona) apicalis var. *melanoleuca*, Schwarz 1939: 129.

Tetrigona melanoleuca, Moure 1961: 216.

Specimens examined: Laos 6b(2), Thailand 13(1). The first record from Laos.

This taxon was considered by Schwarz as a variety of *T. apicalis*. Later Moure (1961) regarded it as an independent species in having shorter malar space (Figs. 4, 6 C_m), longer and erect hairs on scape (Fig. 6 A_m), darker coloration and smaller size (cf. *T. apicalis*, table). Beside these features the following differences from *T. apicalis* were noted, though all being rather subtle: 1) Hind basitarsus with apex less projected and distal margin less incurved (Fig. 6 B_m). 2) Wings slightly shorter (Fig. 5). 3) Punctures on face below, clypeus and malar space slightly denser. 4) Head slightly narrower in relation with mesosoma.

Coloration is distinctly darker. In the specimen from Thailand the face is type F (Fig. 3), pronotum deep chestnut brown, tegulae, mesoscutum, mesoscutellum and metasoma blackish, legs also nearly blackish. Interestingly, two specimens from Laos are darker, with scape blackish except apices, and in one

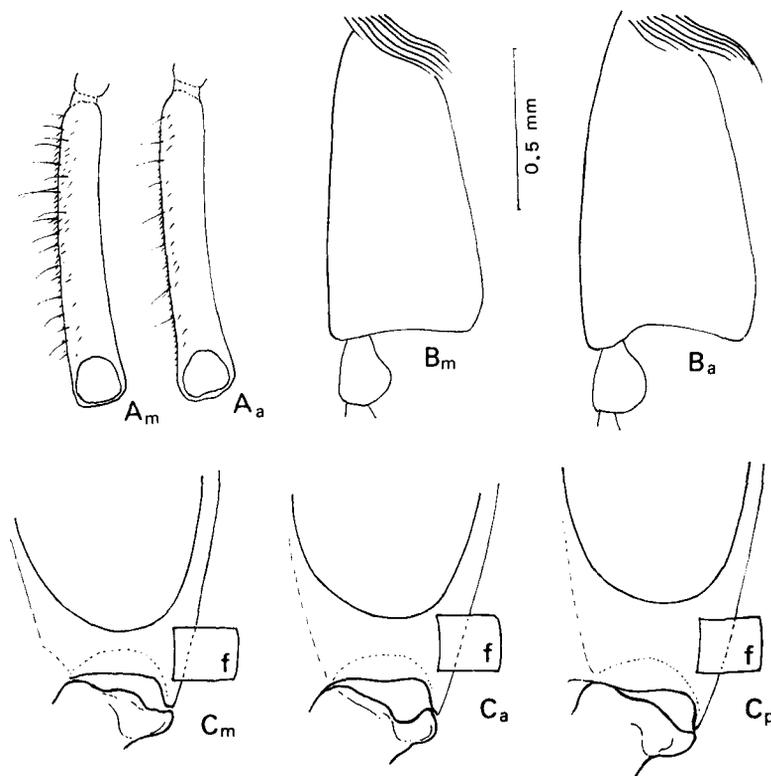


Fig. 6. Morphological characters in three *Tetrigona* species (m=*melanoleuca*, a=*apicalis*, p=*peninsularis*). A. Scape, B. Hind basitarsus, C. Malar area compared with flagellomere IV (f).

specimen even supraclypeus below blackish.

By the discovery from Laos this species was recognized as sympatric with *T. apicalis* through a considerable range, though seemingly rarer anywhere.

***Trigona (Tetrigona) peninsularis* Cockerell**

Trigona apicalis ssp. *peninsularis* Cockerell 1927: Ann. Mag. Nat. Hist. (9)20: 541.

Trigona apicalis var. *peninsularis*, Schwarz 1937: 302.

Trigona (Tetragona) apicalis var. *peninsularis*, Schwarz 1939: 129.

Tetrigona peninsularis, Moure 1961: 216.

Specimens examined: Thailand 6(14), 13(1); Malaya 8(1).

As mentioned by Moure (1961) this taxon is also regarded as an independent species sympatric with *T. apicalis* by its broader malar space (Figs. 4, 6 C_p). Otherwise there is no structural difference from *T. apicalis*, but wings are relatively shorter (Fig. 5). In contrast to *T. melanoleuca* the coloration is relatively paler. Face is type D (Fig. 3) in the Malayan specimen and B in all S. Thai specimens.

***Trigona (Lepidotrigona) nitidiventris* Smith**

Trigona nitidiventris Smith 1857: J. Proc. Linn. Soc. Zool. 2: 50; Schwarz 1939: 292.

Trigona (Lepidotrigona) nitidiventris, Schwarz 1939: 133.

Lepidotrigona nitidiventris, Moure 1961: 199.

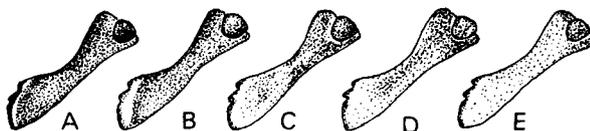


Fig. 7 Variation of mandibular coloration in *T. nitidiventris*.

Specimens examined: Thailand 14a(2); Malaya 4(2), 9(7), 10(1). The first record from Thailand.

The coloration of specimens examined: Black. Alveoli, scape basally pale testaceous; pedicel, flagella, tegulae, fore femur below ferrugino-testaceous. Basal depression of tergum I pale flavotestaceous with ivory tint. Hairs on vertex and scalelike mesosomal tomentum fulvous. The following parts are variable: 1) Mandibles with types A~D (Fig. 7). 2) Clypeus. A (Black below narrowly paler), B (Chestnut brown), C (Pale brown). 3) Legs quite variable. Fore trochanters, A (Blackish brown), B (Dark brown), C (Testaceous). 3) Metasomal dorsum. A (Dark ferrugino-testaceous), B (Ferruginous), C (Pale testaceous, with apical terga paler). 4) Metasomal venter. A (Dark ferrugino-testaceous), B (Testaceous), C (Pale flavotestaceous). The variation among the specimens examined are:

Specimens	Mandibles	Clypeus	Trochanters	Metasomal dorsum	Metasomal venter
S. Thailand	B	A	A	A	C
	D	A	A	A	B
Malaya, Pahang	A	A	A	A	C
	D	A	B	A	C
Malaya, Selangor	B	A	B	A	B
	C	A	B	B	A
	C	A	C	A	B
	C	A	B	B	C
	C	B	B	C	C
	D	B	B	B	C
	D	A	C	C	C
	?	?	B	B	C

No specimens corresponding to the varieties recognized by Schwarz (1937, 1939), *trochanterica* Cockerell, *latipes* Friese, *fulvopilosella* Cameron, were involved. All these seem to belong the same species. Some could be retained as subspecies but a considerable variability within a small sample suggests the necessity of further variation analysis.

Trigona (Lepidotrigona) terminata Smith

Trigona terminata Smith 1878: J. Asiat. Soc. Bengal 47: 169; Schwarz 1937: 295, 6.

Trigona (Tetragona) terminata var. *terminata* (with other varr.), Schwarz 1939: 136; Sakagami 1960: 146; Sakagami and Yoshikawa 1961: 440.

Lepidotrigona terminata and allied forms, Moure 1961: 199.

Trigona (Tetragona) terminata terminata Yoshikawa et al. 1969: 174.

Specimens examined: Laos 2(1), 5b(6), DongDok XII 6 65(1). S. VietNam 1(5), 4(4), 10(1), 12(1, callow), 13(3), 15(35 workers, 1 ♂, all callows); Thailand 2(2), 9(2), 13(5), 14a(1); Malaya 3(1), 4(3), 9(1). The first record from S. VietNam.

Schwarz (1939) recognized three varieties of *T. terminata* based upon the coloration, particularly of legs: *terminata* Smith with extensively blackened legs (Cambodia, Thailand, Malaya, S. Sumatra, Java), *javanica* Gribodo 1891 with rufofuscous to rufo-ochraceous legs (Java) and *latebaleata* Cameron (1902) of intermediate coloration with black hind tibia and basitarsus (Malaya, S. Sumatra, Borneo). The coloration of legs is, however, very variable. Each segment can differentiate in dark and pale parts, or such contrast can be rather inconspicuous, in extreme case giving a concolorous appearance. Color hue of these parts can be of different intensities, absolutely as well as relatively. Applying the key by Schwarz to the present material, the specimens are classified as follows:

	<i>terminata</i>	<i>latebaleata</i>	<i>javanica</i>
Laos	7		1
S. VietNam	13		
N. Thailand	2		
C. Thailand			2
S. Thailand	3		3
Malaya	3	1	2

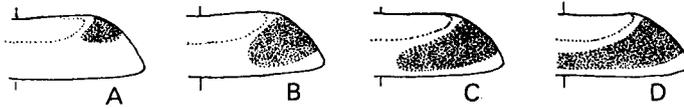


Fig. 8. Color variation on metasomal tergum I in *T. terminata*.

Further variation analysis may prove the occurrence of some geographical differentiation in coloration. At the present it is better to regard these varieties as mere color forms. The coloration of other body parts is also variable. The pattern of metasomal tergum I was classified in A~D (Fig. 8) and the melanization of terga II~IV into A (Rufo-ferruginous), B (Dark brown), C (Blackish brown), D (nearly blackish). The frequency distributions in the examined specimens are:

	Tergum I				Tergum II~IV		
	A	B	C	D	B	C	D
Laos		3	4		2	2	4
S. VietNam			4	9		1	12
N. Thailand	1	1			1	1	
C. Thailand			2			2	
S. Thailand	1	1	4		1	1	4
Malaya		1	4	1	2	3	1

The variations exhibit no clear geographical gradient though an advanced melanism in S. VietNam is traced. The wing length seems relatively shorter in Laos, while longer in Malaya (Fig. 9), but further analysis is required. Some notes on a single callow male are given in comparison with those of *T. ventralis*.

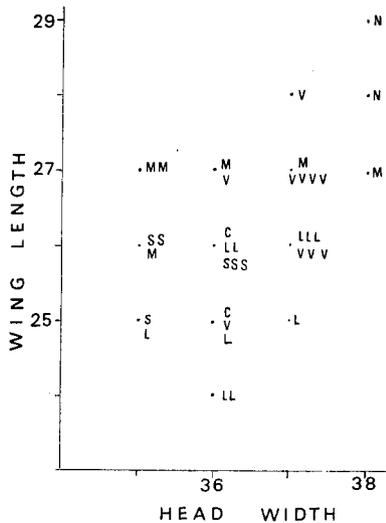


Fig. 9. Relation between head width and wing length (cf. Fig. 5, legend, 16=1mm) in *T. terminata*. M-Malaya, S C, N-S. C. N. Thailand, V-S. VietNam, L-Laos. Each letter represents one worker.

***Trigona (Lepidotrigona) ventralis* Smith**

Trigona ventralis Smith 1857: J. Proc. Linn. Soc. Zool. 2: 50 (partim); Schwarz 1937: 294.

Trigona flavibasis Cockerell 1929: Ann. Mag. Nat. Hist. (10)4: 592.

Trigona (Lepidotrigona) ventralis var. *ventralis* Schwarz 1939: 134, with varr. *flavibasis*, 134, *hoosana* 135, *doipaensis* 136.

Lepidotrigona ventralis, *flavibasis*, *doipaensis*, *hoosana*, *arcifera*, Moure 1961: 199.

Trigona (Lepidotrigona) ventralis flavibasis, Yoshikawa et al. 1969: 174.

Specimens examined: Laos 2(10), 3(4); S. VietNam 4(1), 7(53+5 callows, 3 ♂), 8a(1), 8b(23), 9(1), 10(32); Thailand 1(197), 2(38), 3(3), 6(6), 12(1), 14a(1), 14b(2); Malaya 9(2). In addition the following worker specimens were examined. Malaya Kuala Tahan, ix 24~29 1968, R. Jander (10), Fraser's Hill ix 13 1966, S.F. Sakagami and K. Yoshikawa leg. (1), viii 16 1970, R. Jander leg (1); Cambodia Bogor Plateau, ca. 1,000 m, x 30 1966, S. F. Sakagami and K. Yoshikawa leg (1). The first records from Laos, S. VietNam and Cambodia.

This species is quite variable. Schwarz (1939) recognized four varieties (Table 2). He assumed *T. arcifera* Cockerell from Testa Bridge, Himalayas, as synonymous with *T. ventralis* var. *flavibasis*, but according to Moure (1961) the type specimen of *T. arcifera* runs to *T. hoosana*.

Variation analysis of workers: Using the material at my disposal, variation trends of some characters were analysed. In all continental specimens, 1) Hair fringes of hind tibia as well as hairs on mid and hind tibiae and basitarsi brown to blackish, even in some extreme case ochraceous to pale brown, never being silvery gray (*ventralis*), 2) Apical half of tergum V and the whole VI brownish to nearly blackish, sometimes, only apically pale orange brown but never pale yellow white (*hoosana*). Other characters analysed are:

I. Body size. Head width and wing length (cf. Fig. 5, legend) were

Table 2. Distinction of varieties in *T. ventralis* according to Schwarz (1939)

Character	<i>ventralis</i>	<i>hoosana</i>	<i>flavibasis</i>	<i>doipaensis</i>
Wing length (mm)	4.25	5.00	4.50	4.50
Hair fringes of				
H. tibia	Silvery grayDark brown to blackish.....		
Vertex and ScutellumSilvery gray to ochraceous.....			Black
Hairs of mid and hind tibiae and basitarsiSilvery gray.....		Black.....
Coloration of Tergum I	A dark spot on each side, otherwise paleA dark semicircle..... partly enclosing basal depression, otherwise pale		Wholly dark except for basin like basal depression
Terga V (apically) ~VII	?	Pale yellow to yellow white	Brown to blackish.....

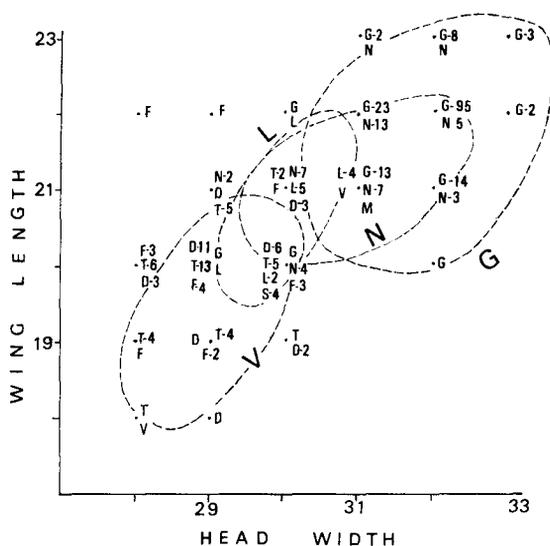


Fig. 10. Relation between head width and wing length (cf. Fig. 5, legend, 16=1 mm) in *T. ventralis*. N-N. Thailand excluding Fang (G), V-S. VietNam excluding Dalat (T), DiLinh (D) and Fyan (F), M-Malaya, L-Laos. Numerals indicate the number of workers. Letters without numerals represent each a single worker.

measured. As an approximately orthometric relation exists between them, (Fig. 10), only the head width is used (16 units=1 mm).

II and III. Coloration of hairs on vertex and scutellum. Arbitrarily divided into A. Ochraceous to pale brown, B. Brownish, C. Dark brown to nearly blackish.

IV. Coloration of hairs on mid and hind tibiae. Arbitrarily divided into A. Ochraceous to pale brown, B. Brown to dark brown, C. Blackish brown to nearly blackish. A distinct correlation exists between two characters so that only the first one is used.

V. Coloration of metasomal tergum I. Quite variable. An increased melanisation¹⁾ is realized by four independent but intimately linked trends: a) Extension of circumfoveal stripe, b) Appearance and extension of marginal dark area, c) Appearance and extension of median forward projection of circumfoveal stripe, d) General darkening of fovea. Various patterns were arbitrarily divided into ten types, each with a few subtypes (Fig. 11). The palest type, A, expected in *T. v. ventralis* in Borneo, did not appear in any continental specimens.

The examined specimens were grouped according to the provenance (cf. Fig. 1 and Table 1).

1) This does not necessarily mean that melanic type is a more specialized condition than paler one.

Table 3. Variations in workers of *Trigona ventralis* (Locality groups and variation types explained in text)

Locality group		Ia	Ib	II	IIIa	IIIb	IIIc	IIId	IV	V	VI	VII
I. Head width (16=1 mm)	28					11	5	3	1			
	29	1	2	1		22	7	14				7
	30	2	11	8		8	4	11		1	4	5
	31	38	21	4	1							1
	32	118	9									
	33	5										
	T	164	43	13	1	41	16	28	1	1	4	13
II. Hairs of vertex	A	6	12	14	1	52	12	32	1	1	2	11
	B	27	6			1	2	1			2	1
	C	164	27				9					
	T	197	45	14	1	53	23	33	1	1	4	12
III. Hairs of scutellum	A	1	7	14	1	44	11	22	1	1	3	11
	B	12	8			8	3	2				1
	C	183	30			1	9	8			1	
	T	196	45	14		53	23	32	1	1	4	12
IV. Hairs of mid tibia	A					9		19			3	8
	B	20	19	3		38	4	14	1	1	1	4
	C	171	26	11	1	6	19					
	T	191	45	14	1	53	23	33	1	1	4	12
V. Tergum I Color	A		1									2
	B	1	2	7		2			1		1	11
	C		2	2		6					3	
	D					17	1	8				
	E	138	35			3	3	4		1		
	F	12	1	1		14	1	6				
	G					2	10	2				
	H	6				1						
	I				1	4	2	8				
	J	39	3	4		4	5	5				
	T	196	44	14	1	53	22	33	1	1	4	13

Chiangmai). Therefore the demes in this area are not homogenous, showing a sporadic appearance of *flavibasis* type individuals. This accords with the fact that *flavibasis* was described from this area (Doi Suthep, loc. 6). Among the specimens examined, five workers, two from Doi Suthep and three from Doi Pui (loc. 3) were *flavibasis* type (Hairs on vertex and scutellar fringe degree A and tergum I type A~D) and the body size was relatively small (Head width 29 units in two workers and 30 in three ones, cf. Table 3).

3) Although still insufficient in the number of examined specimens, the southern Thai and Malayan demes (VI and VII) are distinctly paler and smaller, exhibiting the *flavibasis* trend. Probably the same is expected in Cambodia and lowlands

of southern S. VietNam. The demes in Laos are *flavibasis* type but somewhat intermediate in hair coloration.

4) The specimens collected from the mountainous area of central S. VietNam are noteworthy. They are very small and characterized by an ample variation range in coloration, exhibiting a bimodal tendency. Further the variation trend is different even among three localities closely nearby, being the most melanic in Fyan (IIIc, loc. 8), relatively paler in Dalat (IIIb, loc. 7) and intermediate in DiLinh (IIIId, loc. 9, 10). In the darkest individuals the melanization of tergum I is much more advanced than in the northern Thai specimens, even the basal fovea becoming nearly blackish (Fig. 11, G). No correlation exists between melanism and body size in all three localities. From the collection data it is unknown whether the dark and pale forms represent the assemblages of different ecological requirements or not.

5) Consequently *doipaensis* and *flavibasis* are retained as the names for two continental subspecies:

T. ventralis doipaensis: The demes of the northern Thailand, larger, hairs of vertex and scutellum dark to blackish brown.

T. v. flavibasis: The demes of Indochina, S. Thailand and Malaya. Smaller, hairs of vertex and scutellum ochraceous to pale brown.

Until more precise studies are carried out, the demes of the Vietnamese Highlands are tentatively classified into *flavibasis*, including the melanic form with dark fovea of metasomal tergum I (*nigribasis forma nov.* Fig 11, G). *T. arcifera* described from Himalayas might represent a third continental subspecies.

Male: Male of this species has so far been unknown.

Body 4.5 mm, Fore wing 4.0 mm.

Coloration: Head and mesosomal dorsum black; face below antennae chestnut brown except black band along epistomal suture, boundary between black and pale areas not sharp; genae and malar areas black, the former with slight brownish tint; labrum pale brown to brown; mandibles dark to blackish brown, apically paler. Antennae blackish brown, alveolus, scape basally and apically, and pedicel reddish brown. Tegulae blackish brown, centrally brownish in two specimens, reddish brown in the other. Pleura blackish brown, below with slight chestnut brown tint; propodeum black, centrally below slightly chestnut brown. Metasoma deep chestnut brown, terga II~IV posteriorly broadly blackish, venter medially brownish. Tergum I laterally creamy yellow, basal fovea creamy yellow with median dark projection in one specimen and pale brown in the other two (J_1 and F_1 in Fig. 11). Legs deep chestnut brown, fore and mid distitarsi and hind tibia to tarsi paler. Wings hyaline, veins and pterostigma brownish.

Pilosity: Hairs on head and mesosomal dorsum distinctly longer than in workers. Head above with dense, suberect and yellowish hairs, on vertex stouter and rather ochraceous, erect and partly curved apically, on gena sparser, shorter above. Lower half of head with dense plumose whitish hairs, contrasting to the upper part (Fig. 12 A). Hairs on mesosomal dorsum moderately long, yellowish,

scutellar fringe long with hairs apically curved. Hairs on mesosomal sides similar but nearly whitish. (Tomental hairs absent in all three specimens, nevertheless not much worn). Propodeum medially glabrous, but outsides of median depression of declivity with sparse short hairs; flanks with short plumose whitish hairs. Metasoma glabrous, marginal area of terga II~IV with dense, short, erect and yellowish hairs, gradually longer onward, terga V~VII with similar hairs, also sparsely on anterior part; hairs longer and stouter on VI~VII laterally. Sterna medially and marginally, especially lateromarginally, with dense short hairs, longer lateranteriorly. Hairs on legs yellowish to ochraceous, posterior fringe of hind tibia dark brown. On hind tibia above hairs shorter than in fringe, homogenously dense (denser than in *terminata*, Fig. 12 B); below on posterior half hairs very short, semierect, homogenously dense; on anterior half medially glabrous, along median ridge and anterior margin with sparser, longer and stouter hairs. On hind basitarsus above hairs sparser than in *terminata*, below with bristle like hairs, sparser marginally.

Sculpture: Head and mesosoma microscopically tessellate, slightly coarser on scutellum. Glabrous parts of propodeum polished with dense, weak punctures, sparser along median depression on declivity which being smooth, base of horizontal area distinctly reticulate. Metasomal terga I~II smooth and polished, with tessellate marginal area. On tergum III onward premarginal area gradually tessellate, becoming rougher on VI~VII. Legs tessellate, anterior slope of hind tibia below relatively smooth.

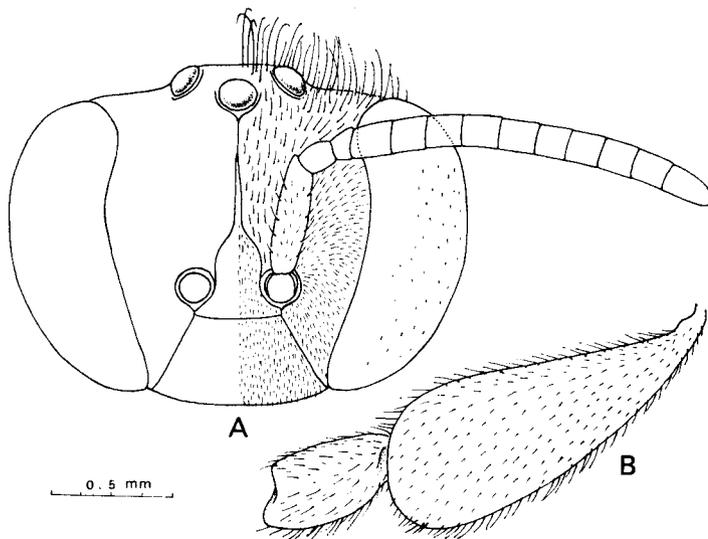


Fig. 12. Head (A) and left hind tibia and basitarsus (B) of male of *T. ventralis*.

Structure: Head broader than long (46: 72, Fig. 12 A), inner orbits distinctly sinuate, converging above and below. Upper, maximum and lower interorbital distance, eye length and maximum eye width 42: 46: 30: 47: 23. Middle of mid ocellus on tangent of anterior rim of posterior ocelli. Ocellar area moderately raised, slightly depressed and neatly shining around ocelli. Interocellar distance, ocellorbital distance and diameter of mid ocellus 14: 9: 8. Inter alveolar distance, diameter of alveolus and alveorbital distance 6: 8: 8. Ocelloclypeal distance, alveocellar distance and clypeal length 37: 27: 13. Supraclypeus slightly raised, laterally slightly incurved. Clypeus imperceptibly bowed, lateral margins virtually straight, anterior margin gently curved laterally, lateranterior extremity nearly reaching eye. Malar area very short, length to width of flagellomere IV 14: 55. Mandibles distinctly tapering apically, bidentate, second tooth rather remote from first one. Scape distinctly shorter than alveocellar distance (20: 27), relative ratio of length of flagellomere I~IV and width of IV 21: 71: 60: 55: 53.

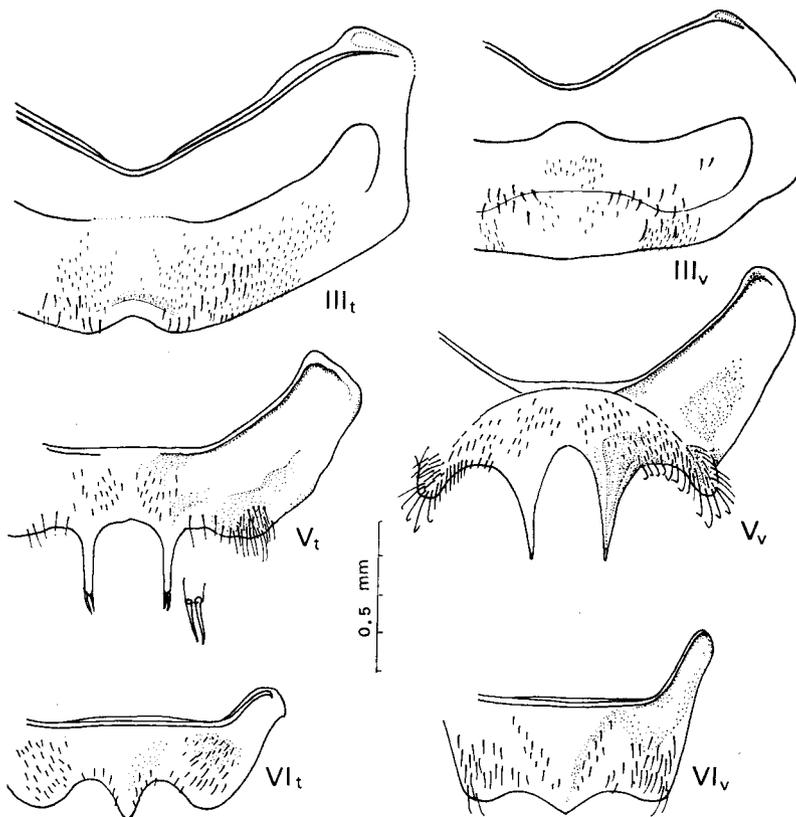


Fig. 13. Male metasomal sterna III, V and VI of *T. terminata* (t) and *T. ventralis* (v).

Mesonotum slightly more convex than in worker (= *terminata*), lateroposteriorly longitudinally depressed (= *terminata*); mesoscutellum scarcely overroofing metanotum, basally depressed and medially convex, both more than in worker (= *terminata*).

Propodeum bowed, declivity depressed medially. Hind tibia (Fig. 12 B) with length/width ratio 58/21; anterior margin nearly straight, apically slightly curved, posterior margin gently curved, apically rounded, outer surface slightly convex (more than in *terminata*). Hind basitarsus with length (to apex)/width ratio 26/15, anterior margin nearly straight, posterior margin conspicuously curved, apically roundly projected, surface gently convex. Apical tergum gently curved, not particularly differentiated, venter mediolongitudinally depressed.

Metasomal sterna and genitalia: Described in comparison with a single callow specimen of *terminata* (cf. p. 65)

	<i>terminata</i>	<i>ventralis</i>
Sternum III (Fig. 13, III)	Mediapically distinctly emarginate. Fine setae denser. Stout bristles also on mediapical area	Mediapically not emarginate. Both fine setae and stout bristles sparser
Sternum IV	Mediapically conspicuously emarginate. Setae on median part sparser and normal	Mediapically distinctly convex. Setae on median part denser and hooked
Sternum V (Figs. 13 V)	Mediapical emargination round. Submedian projection finger like, with two stout apical spines (described as cleft by Schwarz). Laterapically mildly convex, only apically bristled	Mediapical emargination acute. Submedian projection triangular, apex pointed without spine. Laterapically distinctly projected, with dense bristles on whole surface
Sternum VI (Figs. 13 VI)	Apodemal lobe shorter. Mediapically distinctly projected. Submedian emargination distinct. Median part only marginally bristled. Lateral bristles shorter and sparser	Apodemal lobe longer. Mediapical projection and submedian emargination inconspicuous. Median part with bristles premarginally. Lateral bristles longer and denser
Genitalia (Fig. 14)	Gonocoxite longer (9×24), gonostylus shorter (31), subapically slightly swollen, apical bristles longer. Penis valve shorter (15× basally 3.5)	Gonocoxite shorter (10×20), gonostylus longer (34), subapically not swollen, apical bristles shorter. Penis valve longer (24×4)

By hair coloration the described males belong to *T. v. flavibasis*.

Schwarz (1939) described the males not accompanied by workers as those of *T. terminata*. The comparison of males accompanied by workers in my study revealed the validity of his interpretation. Both species possess quite deformed metasomal sternum V whereas sternum VI is less modified. In many genera and subgenera of stingless bees, the males are still not discovered or accurately described. But in most well known cases, sternum VI is more or less transformed into a fine, strongly curved and medially flexed sclerite, usually with a conspicuous

mediapical projection. But *Lepidotrigona* retains, together with *Homotrigona* (Sakagami 1963), the original plate like form of sternum VI. Apparently these two subgenera deviate from other Indomalayan subgenera of *Trigona* (cf. p.) in some other characters, too. The deviation is much more conspicuous in *Lepidotrigona*. Probably this group separated at very early time from the main stock and have kept the primitive condition of sternum VI, beside specializations of some other characters, especially highly modified hind tibia.

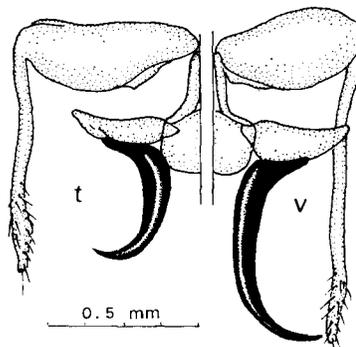


Fig. 14. Male genitalia (dorsal view) of *T. terminata* (t) and *T. ventralis* (v).

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