
The Indo-Malayan Species of Trigona

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Article III.—THE INDO-MALAYAN SPECIES OF *TRIGONA*

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FIGURES 1 TO 16

The present paper supplements one devoted to the Bornean Stingless Bees of the Genus *Trigona* (1937, pp. 281–329, Pls. II–VII). Due to the appearance of that paper, it has been my privilege to receive for identification (1) a large collection submitted by J. van der Vecht, including specimens obtained by himself and others mainly in Sumatra, Java, Borneo, and the Celebes; (2) a beautifully prepared collection made by H. T. Pagden in Malaya and accompanied by explanatory notes, many of which have been embodied in this paper; (3) a very comprehensive collection from many areas in Malaya and Borneo submitted by H. M. Pendlebury of the Federated Malay States Museum, in which are included not only the specimens obtained on his own numerous field trips but the donations also of others; (4) a collection made some years ago by F. Muir and kindly placed at my disposal by F. X. Williams;

and (5) a valued collection, containing interesting records from the Philippine Islands, French Indo-China, and Siam, kindly made available by Miss Grace Sandhouse of the U. S. National Museum. It is on these collections that the records and comments here offered are largely based.

The paper on the Bornean Stingless Bees above referred to contains a key to the forms of that island. The *Trigona* of the other islands and of the Asiatic mainland are for the most part either the same or rather closely related to those of Borneo. Nevertheless, a new key has been prepared for the present paper to cover the somewhat greater number of forms obtained from the larger area. It is hoped that, due to the fact that in their arrangement and details the two keys supplement rather than duplicate each other, they may offer a double check in the identification of specimens.

ACKNOWLEDGMENTS

I am greatly indebted to Miss Annette Bacon, the secretary of the entomological department, not only for accurately typing the rather lengthy manuscript of this paper but also for her keen vigilance in detecting infelicities or errors of my making. To her, too, I owe the clear drafting of the map showing the distribution of the *Trigona* fauna, indicated by aggregate number of forms, in the several countries of the area considered.

The drawings that illustrate this paper have been made with unusual fidelity and skill by Mrs. Shirley H. Risser. Most of them are devoted to the males as the workers were figured in an earlier paper (Schwarz, 1937, Pls. II to VII).

Except where there is mention to the contrary, the locality records throughout the present paper are based on the worker, the caste usually collected.

CLASSIFICATION OF THE FAUNA

The Indo-Malayan *Trigona* fall into relatively few subgenera, and not a few of the forms within the larger subgenera are so closely related that it is sometimes hard to decide whether two given forms are to be considered independent species or varieties of the same species. In general, when two or more forms show identity of structure

but difference of coloration, it has been my practice in this paper to consider them varieties of the same species. Where the coloration as well as the structure are the same but different gradations of size are represented, I have been inclined also to assign merely varietal importance to such gradations although some of these were de-

scribed as independent species originally. The difficulty of making a decision is enhanced when a bee is virtually identical in structure with another but differs from it in both color and size. In such cases I have been inclined, especially when no males are available and the decision has to be based solely on the worker, to regard the two—tentatively at least—as possibly specifically distinct. Among the forms of small size here assigned to the subgenus *Tetragona* the degrees of relationship are particularly hard to interpret. It may be that when the still unknown males of several of the forms are discovered, certain insects now assigned varietal rank on the basis of the worker will have to be given specific rank because of the distinctiveness of the male.

By far the largest number of forms from the Indo-Malayan region are assignable to the subgenus *Tetragona*. The most characteristic thing about *Tetragona* was at one time thought to be its narrow elongate, almost quadrangular abdomen, as evidenced in its type species, *clavipes*. Many species, however, which share with *clavipes* more fundamental characters—such as sculptureless chitin, an incompletely toothed mandible (the outer part of the apex edentate, the inner with two small teeth in the worker), and branched hairs on the hind tibiae—have the abdomen relatively broad. These seem to me properly to find place in *Tetragona* even if they be given a group recognition within that subgenus. All of the Indo-Malayan species here assigned to *Tetragona* have the abdomen relatively broad, not narrow or fingerlike. With one exception—*fimbriata* and its varieties—all of the Indo-Malayan species of *Tetragona* that have come to my attention have in the worker an oval bristleless (although usually sericeous) area at the base of the inner face of the hind metatarsus that contrasts with the bristle-covered surface of the rest of the inner face of this joint. This character is found in only a very few New World *Tetragona* but is of common occurrence in the New World subgenus *Trigona*.

Tetragona seems to me a composite of more or less intergrading groups that have, nevertheless, so much fundamentally in

common that they had better be considered as one subgenus. These groups are characterized in the worker as follows:—

I.—Bristles from apex to base on inner face of hind metatarsi; elongate narrow abdomen. (Includes the type species *clavipes* and several New World *Tetragona*.)

II.—A flat sericeous but bristleless area at base of inner face of hind metatarsi; elongate narrow abdomen. (New World species like *jaty* and *buchwaldi*.)

III.—A flat sericeous but bristleless area at base of inner face of hind metatarsi; relatively broad abdomen. (Applicable to most *Tetragona* from the Indo-Malayan region.)

IV.—Bristles from apex to base on inner face of hind metatarsi; relatively broad abdomen. (An Indo-Malayan species like *fimbriata*.)

Some of the Indo-Malayan species—for instance, *itama* (this applies also to *breviceps*, which is scarcely distinguishable from *itama*) and *erythrogastra*—differ from the majority of bees from the region in having in the worker only a single tooth instead of two teeth on the inner edge of the apex of the mandible. The worker of these bees is in other respects rather similar to the corresponding caste of the Indo-Malayan *Tetragona*, with which it shares the smooth chitin, the plumose hairs fringing the posterior contour of the third pair of tibiae, and the smooth area at the base of the inner face of the hind metatarsi. If only the worker were to be considered, one would feel inclined possibly to ignore the distinctive dentition of the mandible and assign a place to *itama* and *erythrogastra* within *Tetragona*. However, in the large series of *itama* before me there is a single male the structure of which is so unusual that consistency requires the according of subgeneric rank to at least *itama*. While the male of *erythrogastra* is as yet unknown, the rather close structural similarity between the worker of *itama* and the worker of *erythrogastra* prompts me to place both of these insects in the new subgenus *Heterotrigona*.

The next largest aggregate to *Tetragona* represented in the Indo-Malayan region is that which I have described in this paper

TABLE OF DISTRIBUTION OF THE INDO-MALAYAN *Trigona*

× indicates my own identifications or those of others that I have verified.
 ⊗ indicates published identifications of others that I have not verified.

	Ceylon and India	French Indo-China	Siam	Burma (including Tenasserim)	Malaya	Sumatra (including Bangka Is.)	Java	Borneo	Celebes	Philippine Islands	Taiwan (Formosa)
Subgenus <i>Heterotrigona</i>											
<i>erythrogastra</i>	×	×	..	⊗	..
<i>itama</i>	×	..	×	×	×	×
Subgenus <i>Tetragona</i>											
<i>apicalis</i> variety <i>apicalis</i>	×	×	⊗	×	×	×	×
<i>binghami</i>	×	×	×	..	×
<i>melanoleuca</i>	×	×	×	×	..	×
<i>peninsularis</i>	×	..	×	×	..	×
<i>atripes</i> variety <i>atripes</i>	×	⊗	×	×	..	×
<i>collina</i>	×	×	⊗	×	×	..	×
<i>fuscibasis</i>	×	×	×	..	×
<i>rufibasalis</i>	×	×	×	..	×	..	×	..
<i>biroi</i>	×	⊗	×	×	..	×
<i>canifrons</i>	×	⊗	×	×	..	×
<i>fimbriata</i> variety <i>fimbriata</i>	×	..	×	×	..	×
<i>aliceae</i>	×	..	×	×	..	×
<i>anamitica</i>	×	×	×	..	×
<i>ferrea</i>	×	..	×	×	..	×
<i>fusco-balteata</i> var. <i>fusco-balteata</i>	×	×	..	×	×	..	×	×	×	..
<i>pagdeni</i>	×	..	×	×	..	×
<i>pallidistigma</i>	×	..	×	×	..	×
<i>geissleri</i>	×	..	×	×	..	×
<i>haematoptera</i> variety <i>haematoptera</i>	×	×	..	×
<i>dulitae</i>	×	×	..	×
<i>hobbyi</i>	×	×	..	×
<i>iridipennis</i> variety <i>iridipennis</i>	×	×	×	⊗	×	×	×	×	⊗	×	..
<i>valdezi</i>	×	×	..	×	×	×	×	..	×	..
<i>melanocephala</i>	×	..	×	×	..	×
<i>melina</i>	×	..	×	×	..	×	×
<i>moorei</i>	×	×	..	×
<i>reepeni</i>	×	×	..	×
<i>sarawakensis</i> variety <i>sarawakensis</i>	×	×	×
<i>drescheri</i>	⊗	×	×
<i>smithii</i>	×	⊗	×	×	..	×
<i>thoracia</i> and varieties.....	×	⊗	×	×	..	×
Subgenus <i>Hypotrigona</i>											
<i>pendleburyi</i> variety <i>pendleburyi</i>	×	×
<i>klossi</i>	⊗	⊗	..	×	×
<i>scintillans</i>	×	×
Subgenus <i>Lepidotrigona</i>											
<i>nitidiventris</i> variety <i>nitidiventris</i>	×	×	..	×
<i>latipes</i>	×	×	..	×
<i>trochanterica</i>	×	×
<i>palavanica</i> (possibly variety of <i>nitidiventris</i>).....	×	×	..	×	..
<i>terminata</i> variety <i>terminata</i>	×	×	⊗	×	×	⊗
<i>javanica</i>	×	×	..	×
<i>lateballeata</i>	×	×	..	×
<i>ventralis</i> variety <i>ventralis</i>	⊗	×
<i>arcifera</i>	⊗	×
<i>doipaensis</i>	×	..	×	×	×	×
<i>flavibasis</i>	×	..	×	×	×	×
<i>hoosana</i>	×	×	×	×	×

as a new subgenus, *Lepidotrigona*. It is exceedingly close in many respects to the New World genus *Paratrigona* but has certain characters not shared by the latter.

Two remaining species—*scintillans* Cockerell and the newly described *pendleburyi*—may be interpreted as outpost species of the subgenus *Hypotrigona*. The type species *gribodoi* of this subgenus and the New World species assigned to *Hypotrigona* have the mesonotum tessellated. In that respect *scintillans* and *pendleburyi*, with their smooth chitin, differentiate themselves

from these but are in agreement with yet another African species, *bottegoi*, assigned by Cockerell to *Hypotrigona*. The abbreviated scutellum and long propodeum of *scintillans* and *pendleburyi*, the simple hairs on their hind tibiae, their rather large stigma compared with the marginal cell, and the paucity of the erect hairs are all characters that apply to *Hypotrigona*, and tentatively at least it seems best to place them there, pending the time when the discovery of their males may throw further light on their relationships.

DISTRIBUTION OF THE INDO-MALAYAN SPECIES

The accompanying table (p. 85) attempts to present the distribution, so far as it is known at present, of the Indo-Malayan *Trigona*. The records indicated by an × are those which I have been able personally to verify, those indicated by ⊗ are derived from the published identifications of others. Some of the published records have been excluded due to doubt whether the interpretations of their authors accord with my own. A few of the species have a wide distribution, notably so in the case of *iridipennis*, which, described from Ceylon, has an outpost far to the east in the Solomon Islands and occupies many intermediate points.

Glancing over the table, one is impressed with the relatively large number of forms that are known to occur in Malaya and Borneo as compared with the other areas. In part this may be ascribed to more intensive collecting but, on the other hand, I have had access to a large collection from Java and the paucity of Java's *Trigona* fauna is rather striking compared with that of Borneo. Friese (1914, p. 13) has recorded *vidua* from Java, but it is to be presumed that Friese's interpretation of *vidua* is equivalent to Cockerell's *itama*, an insect of which I have seen examples from Java. At any rate, specimens in the American Museum identified by Friese as *vidua* are identical with *itama*. While Java with its 9 forms has a poor representation of *Trigona*—only half the number, 18, known from Sumatra—even Sumatra is poorly populated compared with Malaya,

which has 29, and Borneo, which has 31 known forms. In striking contrast to the condition in the last mentioned areas is the paucity of forms in the Celebes (strictly speaking beyond the limits of the Indo-Malayan region) and in the Philippine Islands. The presence of only two known species in the Celebes¹ is doubtless a reflection of restricted collecting and other species will presumably be added in time, but the Philippine Islands should have offered ere this a larger representation of species if such are actually present. The type material of *biroi* Friese (1898, p. 429) included specimens from the Philippine Islands, and from these islands Brown (1906, p. 686) recorded *biroi* Friese and *laeviceps* Smith. Subsequently *biroi* was reported from the Philippine Islands by Friese (1909, p. 274) and by Cockerell (1919, p. 78; 1925, pp. 53, 55; 1925A, p. 175); and *iridipennis* has been reported by Cockerell (1929, p. 590) from Puerta Princesa in the Philippine island of Palawan. From this island was described *palawanica*, evidently a member of the subgenus *Lepidotrigona* and as yet known only from Palawan (Cockerell, 1915, pp. 2-3; 1919, pp. 77-78; 1920, pp. 228-229). The type material of Friese's *luteiventris*, here made a synonym of *erythrogastra* Cameron, also included specimens from Palawan. Finally, *dapitanensis* was described from the Philippine island of Mindanao by Cockerell (1925B, p. 492). Thus, excluding

¹ One of these, *fusco-balteata*, I have seen; the other *iridipennis* is reported by Friese (1914, p. 58).

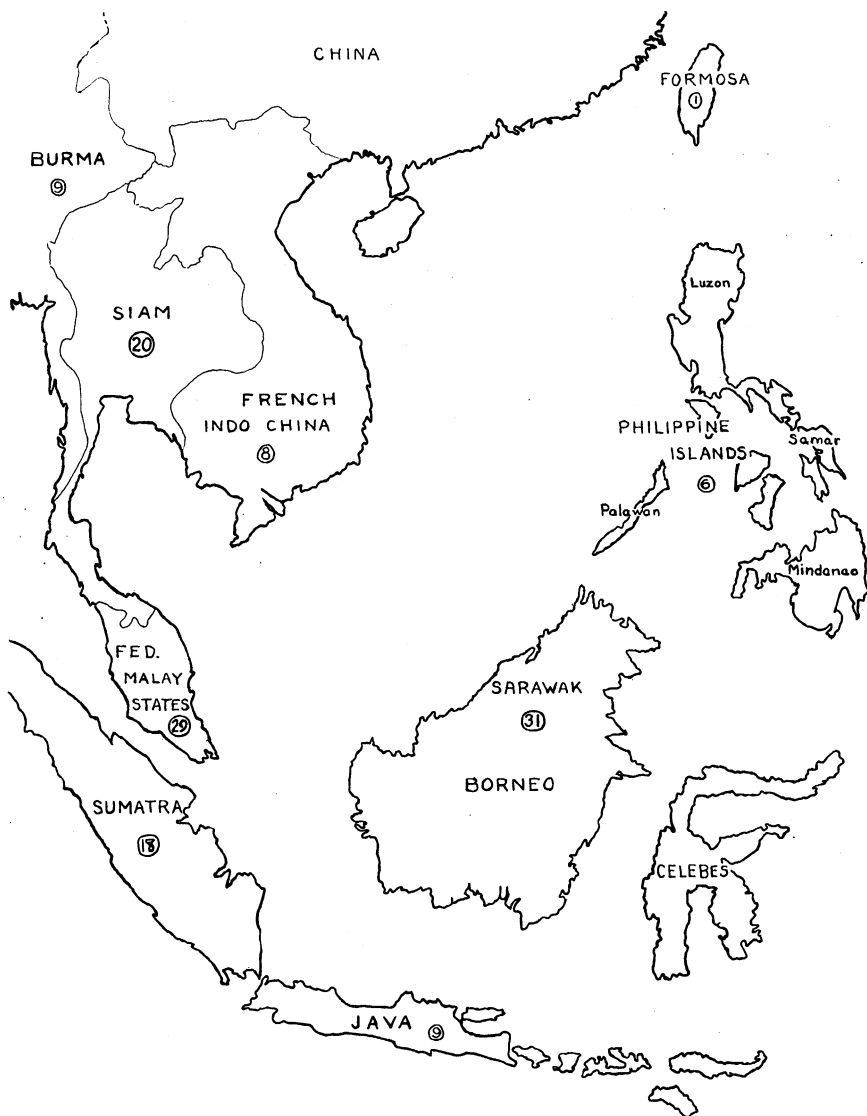


Fig. 1.—Map of Indo-Malayan region, with indication of the number of forms of *Trigona* represented in the different areas embraced in the region.
 Drafted by Miss Annette Bacon.

laeviceps as of doubtful determination, we have a total of four or five forms reported from the Philippines in the literature. To these may be added *iridipennis* variety *valdezi* and *fusco-balteata*.

Moving northward from the Philippine Islands, we find at least one representative of the subgenus *Lepidotrigona* in the Island of Taiwan, or Formosa. That the *Trigona* fauna of this island is probably even more restricted than that of the Philippine Islands seems to be indicated by the fact that in his three papers dealing with the apifauna of Formosa (Entomologist, 1911, XLIV, pp. 340-343; Entomologist, 1912, XLV, pp. 9-13; Amer. Mus. Novitates, 1927, No. 274, pp. 1-16) Cockerell makes no record of stingless bees.

As the number of reported species tends to shrink northward from Borneo, so there is a sharp reduction in the forms that occur westward of Malaya. The number of recorded *Trigona* from India and Ceylon is distinctly small. From Ceylon was described *iridipennis* Smith (1854, p. 413) and *praeterita* Walker (1860, p. 305), which in my estimation is a synonym of *iridipennis*. What Cockerell (1905, p. 220) re-

ferred to *canifrons* is also to be interpreted as *iridipennis*. With certainty, therefore, we can record only *iridipennis* from Ceylon.

Even more puzzling is the spotty representation of *Trigona* in India if the few reports of its occurrence are at all indicative of its scarcity. *Trigona iridipennis* has been reported by Cockerell (1929, p. 590) and the earlier reference that Smith (1859, p. 135) makes to *laeviceps* from India may be to this insect. I have myself confirmed its presence there on the basis of specimens nesting in satinwood that was shipped from India. Smith's *ruficornis* (1870, p. 194), which Bingham (1897, p. 563) renamed *smithii*, from Mainpurī, Northwest Provinces of India, is possibly the same as Cameron's *fusco-balteata* (1908, p. 194). Bingham (1897, p. 561) included India, on the authority of Smith, within the range of *vidua*, but the identity of *vidua* remains doubtful. Cockerell (1929, pp. 591-592) described *arcifera* (a member of what is here erected as the subgenus *Lepidotrigona*) from Testa Bridge, Himalayas, India. The number of reported forms is larger than for Ceylon but, when the size of India is taken into consideration, notably small.

HABITS

An early account of the nest of an Indo-Malayan *Trigona* is that given by C. S. P. Parish (1866, pp. 198-200). The occupants of the nest were determined by Smith as *Trigona laeviceps*, a species sometimes interpreted as synonymous with that author's *iridipennis*. According to Mr. Parish the nests of *Trigona laeviceps* are occasionally built in the ground, or in a hollow among rocks, or even in the hollow post of an old house but most frequently they are located in the hollow of a tree, from the bark of which the entrance tube protrudes. This, Parish states, may be only a small raised rim or "a wide-mouthed entrance which projects as much as a foot from the tree." The shape of this structure, he indicates, is commonly that of "the mouth of a large trumpet flattened horizontally" with "a perpendicular diameter of a foot or so, and a horizontal diameter of three or

four inches." Such a structure he figures in the illustrations accompanying his article. The interior of the nest was not examined.

Under the heading "The Indo-Australian *Trigona laeviceps* F. Smith and Her Nest," W. A. Schulz published (1907, pp. 65-73), an account that applies, in the opinion of Friese (1914, p. 44), to *Trigona iridipennis*. The account was based on the observations of Edward Jacobson, who first noted the insect building its nest in the hollow foot of a large Chinese flower-vase. Subsequently he came upon a nest of the species located in the ground. In contrast to the pretentious entrance described by Parish, this terrestrial nest had no protruding structure of wax but merely a hole level with the soil, measuring $\frac{1}{2}$ cm. by $\frac{1}{4}$ cm. However, a concealed tube lined with wax extended into the earth 10 cm. to the brood-chamber. Here the oval cells, of the color

of potato peels, were arranged not in combs but in clusters. A third nest was located in a wild fig tree, and two entrances were noted, one at the foot of the tree, the other half a meter above the earth, suggesting the likelihood of not one but two nests. The upper entrance was provided with a protruding irregular tube some 18 cm. in length. Yet another nest attributed to the same species was discovered by Jacobson in an earthen mound. Finally, the entrances to no less than four nests were noted between the stone steps of a stairway, but the nests in question were inaccessible. Jacobson establishes in the course of his comments that the nest entrance is protected from would-be intruders, such as ants, by a ring of sticky material at the orifice, in addition to which the nest occupants themselves guarded the entrance. The nest that Jacobson discovered in the earthen mound was shipped to the Museum in Leiden, where it was studied by Schulz, who gives a detailed account of it. Unlike most *Trigona* nests it lacked involucre and spongiosa. The colony—much decimated—consisted of 310 workers, 19 males, and a single queen, of which Schulz gives a description.

Two years after the appearance of the article just summarized, Schulz published yet another article (1909, pp. 338–341) in which under the designation *Trigona canifrons* Smith he offered further comments on the nest architecture of *iridipennis*. The nest on which his comments were based was discovered, also by Jacobson, in a bamboo stem that formed part of the roof of an outhouse. The nest was transferred to an observation box for study. When the *Trigona*, after a period of imprisonment to accustom them to their new surroundings, were permitted to emerge, most of them circled about the entrance in a flight of orientation, facing the nest. As soon as the door of the observation box was opened, the bees began house-cleaning, removing the dead bodies of their fellows and little yellowish-green pellets, which Jacobson inferred might be the excrement of the larvae. According to the account of Schulz this colony consisted of 2250 workers and 317 males. He failed to find the queen.

Friese (1914, pp. 43–58) reported further nest material supplied by the indefatigable Jacobson. Again the species concerned was interpreted as *iridipennis* and the nest in this instance was located in a drawer. Strange as such a place may seem as a nesting site, it is not a unique instance, for W. Van Name, too, came upon a nest that had been constructed in a drawer (see p. 113). A second nest observed by Jacobson and reported by Friese was built in the hollow of a rock. It had a short trumpet-shaped protruding tube, scarcely two inches long with an orifice having a perpendicular diameter of about an inch, and a horizontal diameter seemingly less. This exposed structure had, like the other comparable structures, a ring of sticky material about the rim and was lined with wax within. Numerous workers were on guard at the entrance. An observation of unusual interest made by Jacobson is that after the larva has devoured the food provided for it in the cell and has spun its cocoon, the adult *Trigona* bees remove most of the waxen material of the cell, leaving the cocoon exposed although still attached to the neighboring cocoons by a residue of wax that has escaped removal. This, as Rau has pointed out (1933, "Jungle Bees and Wasps of Barro Colorado Island," pp. 22–23) is likewise the practice of the New World *Trigona testacea* variety *cupira* (Smith) and a similar removal of the wax from cocoons of *duckei* Friese and of *ceophloeae* Schwarz has been noted (Schwarz, 1938, Bull. Amer. Mus. Nat. Hist., LXXIV, pp. 500–501, 507–508). Probably the practice is much more widespread than these few observations indicate.

A nest of *iridipennis* in "roots orchid" is recorded by Pagden (see p. 113 of present paper). Although all of the nests alluded to up to this point have been attributed ultimately to *iridipennis*, doubt may exist whether all are correctly assigned, especially as some of the nests were observed only from the outside. Even in the case of those nests which were collected with their inhabitants, it is possible that an error of interpretation was made, for it is difficult to separate the worker of *iridipennis* from some of the closely related forms. If all

the nests are correctly associated with *iridipennis*, an adaptability in the selection of nest sites comparable with that of the New World *Trigona testacea* and its varieties is revealed by this insect.

Of the nests of species other than *iridipennis* very little has been reported. A nest of *Trigona terminata* variety *javanica* (Gribodo) was viewed from the outside by Jacobson (Friese, 1914, p. 58). It was located in the interior of a thick tree-trunk. The protruding flight tube attached to the bark had a length of about 8 or 10 cm., was cylindrical in shape and had a funnellike orifice. This orifice was about 2 cm. in diameter and had a sticky resinous rim. The entire tube was constructed of a light brown resinous material, which was so soft that removal of the tube would have resulted in destruction of the tube. The color was approximately that of coffee with milk added, while in the case of *iridipennis* the resinous mass is much darker, often almost blackish brown.

Pagden reports that *fusco-balteata* nests in crevices in the timber of houses and particularly in the jalousies of houses (p. 108 of the present paper).

Trigona haematoptera variety *dulitae* was observed nesting in a dead tree (Schwarz, 1937, p. 321).

For an account of assemblages of *Trigona* outside of the nest, reference is made to pp. 107-108 of the present paper.

Of bearing on the habits of stingless bees is the interesting observation made by Pagden in the case of *Trigona fimbriata*, which was captured in flight while carrying clutched in its mandibles a creamy white larva. A possible explanation of this behavior is offered on p. 103. This observer also records that a sphecoid wasp, *Polemistus barabbas*, raids the nests of the little *Trigona fusco-balteata* to rob it of wax for the construction of its own nest.

Several species—*thoracica*, *moorei*, *fusco-balteata*, *iridipennis*, and *geissleri*—were caught at light, mostly by H. M. Pendlebury. When cognizance is taken of the fact that many stingless bees have the habit of

sealing up the entrance to their nest before nightfall, thus automatically shutting in the colony for the hours of darkness, one cannot help wondering regarding these nocturnal visitors of the lamp. Do they represent individuals that have returned from their foraging belatedly to find the door to the hive locked or are certain species or individuals of certain species habitually abroad during the hours of darkness? Some New World species as well as these Old World *Trigona* have been taken at light. I am inclined to think that the individuals so captured are not necessarily confined to those excluded from the nest through failure to observe the curfew. On one occasion during a stay on Barro Colorado Island, Canal Zone, when I was out before daylight, I was attacked by a small swarm of what proved to be *Trigona testacea* variety *cupira*. Dr. Lutz whom I was accompanying told me he had had the same experience repeatedly in traversing this area on other pre-sunrise tours of inspection.

Of floral visits there are several records, supplied in large part by H. T. Pagden, and also by P. J. Wester and M. Poilane. A plant particularly favored would seem to be *Mimosa pudica*. The plants recorded, with the species known to visit them, follow:—

<i>Mimosa pudica</i>	<i>Typha angustifolia</i>
<i>Trigona collina</i>	<i>Trigona iridipennis</i>
“ <i>biroi</i>	<i>Melicope triphylla</i>
“ <i>canifrons</i>	<i>Trigona biroi</i>
“ <i>itama</i>	<i>Nipa fruticans</i>
<i>Tephrosia candida</i>	<i>Trigona biroi</i>
<i>Trigona itama</i>	<i>Melastoma</i> sp.
“ <i>thoracica</i>	<i>Trigona erythrogastra</i>
<i>Citrus limon</i>	“ <i>itama</i>
<i>Trigona atripes</i>	“ <i>melina</i>
“ <i>thoracica</i>	<i>Mallotus</i> sp.
<i>Citrus</i> sp.	<i>Trigona canifrons</i>
<i>Trigona biroi</i>	

Of some economic significance is the fact that in the Solomon Islands *iridipennis* is said to pollinate coconuts, and that *iridipennis* variety *valdezi* has been collected from banana trees.

TERMINOLOGY

In the terminology used in connection with the male genitalia, I have been inclined to follow Franklin (1913, "The Bombidae of the New World," Trans. Amer. Ent. Soc., XXXVIII, pp. 223-225) as both his papers and mine deal with social Apoidea. This terminology has been previously employed also in a paper I wrote on the genus *Melipona* (1932, Bull. Amer. Mus. Nat. Hist., LXIII, Art. IV, pp. 231-460, Pls. i-x). The median dorsal organ that is here termed uncus is sometimes referred to as spatha. Unlike the homologous structure in the Bombidae it usually has no strong ventrad curvature toward the distal end but tends to be flat and shield-shaped although often of distinctive conformation from species to species. The stipites are very abbreviated compared with those of the bumble bees; at the surface of junction of the one stipites with the other on the ventral side each stipites is broadly rounded, but on the dorsal side the parts that approximate each other tend to be angular. The volsellae are long and narrow and rather inadequately provided with hairs on their often somewhat clavate apices. The sagittae are frequently rather

characteristically shaped although all tend to terminate in rather needlelike points. The cardo, even when traceable, tends to be vestigial, easily detached and lost in mounting the genitalia. The accompanying diagram (Fig. 2) will clarify the terminology used in this paper.

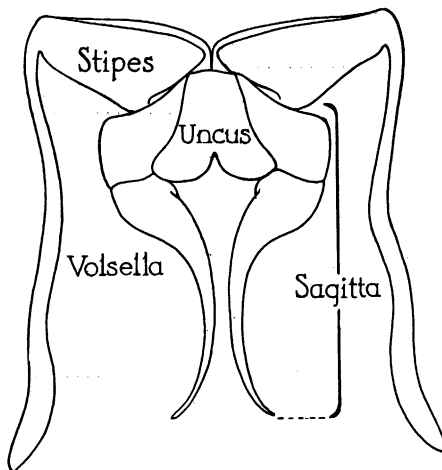


Fig. 2.—Diagram of genitalia of male, with specification of parts.
Drawn by Mrs. Shirley H. Risser.

KEY TO INDO-MALAYAN *TRIGONA* (WORKERS)

- 1.—The head and thorax either entirely smooth and polished, or with sculpturing so sparse and delicate that the shininess of the surface is usually dulled only, if at all, by the presence of hairs. 2.
The head and thorax roughened with an exceedingly dense tessellation that is devoid or virtually devoid of shiny interspaces. The mesonotum usually enclosed by a border of short thick scalelike or tomentose yellowish to whitish hairs. 34.
- 2.—The hairs fringing the hind tibiae posteriorly more or less feathery or finely branched. The inner face of the hind metatarsus in all but one instance (a species of large size and its varieties—see 8-10) with a flat, more or less oval, usually sericeous space near the base that is devoid of bristles in contrast to the bristle-covered apical part of the joint. Bees ranging in length from 2 1/4 to 9 mm. 3.
The hairs fringing the hind tibiae posteriorly simple, not branched, sometimes very short. The hind metatarsus with bristles from base to apex on its inner face. The scutellum short, not extended backward to over-roof the propodeum. Minute bees, 2 1/4 to 2 3/4 mm. in length. 32.
- 3.—The mandible with only one denticle or tooth at the inner edge of its apex. The scutellum short, not salient. The hind metatarsi wide, about two-thirds the width of their tibiae. The erect hairs on the vertex, the mesonotum, scutellum, and mesopleura black. 4.
The mandible with two denticles near the inner edge of its apex or with two well developed teeth. The hind metatarsi in the vast majority of cases only about one-half the width of the hind tibiae (for an exception see 11), sometimes even narrower. 5.
- 4.—The malar space fully twice as long as the scape is wide. The stigma and venation bright fulvous; only very feeble traces of the transverse cubital veins. The abdomen with at least some of the segments reddish. Length 6 to 7 1/2 mm. *erythrogastra* Cameron (p. 100).

- The malar space scarcely as long as the double width of the scape. The stigma and venation dull brownish; the transverse cubital veins rather strongly outlined. The abdomen blackish. Length 5 to 7 mm. *itama*, Cockerell (p. 96).
- 5.—The propodeum with hairs not only on its sides but also covering its middle or posterior aspect. A woolly or mosslike pubescence usually rather thickly covering the head (especially upper half), thorax, and last two or three tergites of abdomen, that on the head at least whitish. Black bee. Length 5 to 8 1/4 mm. *canifrons* Smith (p. 101).
The propodeum posteriorly with a hairless, highly polished area. 6.
- 6.—The clypeus with fairly long, erect black hairs (best seen when the head is viewed from the side) scattered over its entire surface in addition usually to appressed silvery-hairs. The mandible with two exceptionally large teeth on its inner side, the innermost of the two springing from a level somewhat less than one-half of the distance toward the base of the mandible. Wings more or less suffused with orange, their nervures and stigma a bright ferruginous. 7.
The clypeus usually without erect hairs or at most with a few longish black erect (perpendicular to clypeus) hairs along its apical margin (see 29–31) but otherwise covered, if at all, only by microscopic appressed hairs that are usually silvery to whitish. 11.
- 7.—The malar space long, subequal in length to the width of the mandible at the base. The width of the hind tibiae moderate, about one-third of their length. The hind metatarsi with a differentiated bristleless area at the base of their inner face. Length 6 to 7 mm. *haematoptera* Cockerell (p. 102).
The malar space relatively short, about as long as the scape is wide. The hind tibiae very wide, almost half as wide as the joint is long. The hind metatarsi very narrow compared to the tibiae, with their inner face covered with bristles from apex to base. Length 6 3/4 to 8 3/4 mm. 8.
- 8.—The thorax and abdomen wholly black or nearly so. *fimbriata* variety *anamitica* (Friese) p. 103.
The thorax (except for often darker mesonotum) rufo-testaceous; frequently the abdomen also more or less rufo-testaceous. 9.
- 9.—A narrow blackish stripe traversing the largely reddish tergites 1–5 of the abdomen transversely near the middle of each. *fimbriata* variety *aliceae* (Cockerell) p. 104.
The abdominal tergites otherwise. 10.
- 10.—The intermediate and posterior tibiae and their metatarsi black. *fimbriata* variety *fimbriata* Smith (p. 102).
These parts more reddish. *fimbriata* variety *ferrea* (Cockerell) p. 103.
- 11.—The malar space unusually long, nearly as long as the basal boundary of the clypeus is wide. The hind metatarsus very wide, fully two-thirds as wide as the hind tibia. The clypeus, supraclypeus, and basal half to two-thirds of scape, in contrast to the dark surrounding regions, usually fulvous or rufous, but often more or less clouded, sometimes almost black. Large bees, usually 8 to 9 mm. in length. *thoracica* Smith and varieties (p. 104).
The malar space not so developed. Hind metatarsi not more than half as wide as their tibiae. Smaller bees, under 8 mm. 12.
- 12.—The wing of rather uniform clarity throughout, without deepening of color in the basal half of the wing compared with the apical half. The erect hairs of the mesopleura and of the venter silvery to white. Small bees, 2 1/4 to 5 1/2 mm. in length 13.
At least the median cell almost invariably more or less strongly stained and often the entire basal half of the wing contrastingly dark compared with the frequently more or less milky apical half. If the median cell is only feebly stained or not at all, then at least the erect hairs on the mesopleura are dark brown to blackish. 24.
- 13.—The thorax black. 14.
The thorax and likewise at least the legs and abdomen honey-colored. 22.
- 14.—The malar space well developed, fully as long as the flagellum is wide. Scutellum short, not over-roofing the propodeum. Black bristles on anterior part of mesonotum and on scutellum. Length about 3 1/2 mm. *moorei* Schwarz (p. 106).
The malar space vestigial, rim of eye and basal part of mandible virtually in contact or very close to each other. Scutellum extended backward as far as the down-sloping propodeum. 15.
- 15.—Tegulae, legs predominantly, and abdomen at least on the three basal segments (usually on all the segments) bright ferruginous. Length 3 1/2 to 4 mm.; length of forewing, including tegula, about 5 mm. 16.
Tegulae, legs, and in most cases the abdomen predominantly black or dull brownish. 17.
- 16.—The fore and middle tibiae and all the femora ferruginous below as well as above (sometimes briefly blackened at the apex); the hind tibiae ferruginous on their inner as well as on their exterior face. *sarawakensis* variety *sarawakensis* Schwarz (p. 106).

- The fore and middle tibiae and the femora with a black stripe beneath and the hind tibiae with their inner face black except for a large fulvous spot. . . . *sarawakensis* variety *drescheri*, new variety (p. 106).
- 17.—Minute bees, 2 1/4 to 3 1/4 mm. in length. The hairs fringing the anterior contour of the hind tibiae usually silvery-gray. Color of abdomen very variable, sometimes pallid testaceous with more or less fuscous bands on the tergites, sometimes sepia brown to blackish. The forewing, including tegula, about 3 mm. in length. The mesonotum usually streaked with longitudinal hair bands. *fuscobalteata* Cameron (p. 107). Larger bees, usually 3 1/2 to 5 1/4 mm. in length, and with a wing length usually 4 1/4 to 5 1/4 mm. 18.
- 18.—The malar space slightly less vestigial, not so wide as the scape but nevertheless clearly separating eye and mandible. The erect hairs on the mesonotum and scutellum largely black. Length of forewing, including tegula, about 4 1/4 mm. *birai* Friese (p. 119). The malar space virtually obsolete, base of mandible grazing rim of eye. 19.
- 19.—Length of forewing, including tegula, about 5 1/4 mm. somewhat more robust. As a rule predominantly black hairs on mesonotum and scutellum. *geissleri* Cockerell (p. 117). Length of forewing, including tegula, under 5 mm. Color of hairs on upper surface of thorax variable, light hairs usually predominant, sometimes exclusively or nearly exclusively light. 20.
- 20.—The hairs fringing the anterior contour of the hind tibiae silvery-gray to light brown. The mesonotum streaked by six longitudinal hair bands (including the lateral fringes) separated from each other by five hairless areas that alternate with them. Length of forewing 4 1/4 mm. *fuscobalteata* variety *pagdeni*, new variety (p. 110). The hairs fringing the anterior contour of the hind tibiae black or dark brown. The mesonotum more often with the hairs rather evenly distributed over its surface. 21.
- 21.—Length of forewing, including tegula, about 4 1/4 mm. *iridipennis* variety *iridipennis* Smith (p. 111). Length of forewing, including tegula, about 4 3/4 mm. *iridipennis* variety *valdezi* (Cockerell) (p. 116).
- 22.—The head black except for the clypeus, labrum, mandibles, scape, and flagellum beneath. Length of forewing about 5 1/4 mm. *melanocephala* Gribodo (p. 120). The head usually wholly honey-colored to ferruginous, except that the flagellum is as a rule dark above. 23.
- 23.—Very small. 2 1/2 to 3 mm. in length. *pallidistigma* Cameron (p. 108). Conspicuously larger and more robust, 4 1/2 to 5 mm. in length. Forewing about 5 1/2 mm. *melina* Gribodo (p. 120).
- 24.—The malar space vestigial, the base of the mandible separated from the rim of the eye by rather less than the width of the scape. As a rule no erect black hairs growing more or less perpendicular to the clypeus along its apex. The scutellum extended backward very emphatically, somewhat beyond the end of the propodeum when the insect is viewed from the side. 25.
- The malar space well developed, longer than the scape is wide. The apex of the clypeus with upright black hairs. The two inner teeth of the mandible very large, the second one placed distinctly more basad than the first, springing from a level somewhat less than one-half the distance to the base of the mandible. The scutellum extended backward only slightly, not so far as the end of the propodeum. The contrast between the dark basal half and whitish apical half of the wing strong. The hairs on the abdominal sternites black or blackish. . . . 29.
- 25.—The two teeth on the inner edge of the mandible very large. The second or innermost of the two teeth, if measured along its base, has a lateral extension nearly as great as the edentate outer part of the apex of the mandible. It is placed far basad of the first tooth, springing from a level somewhat less than one-half the distance to the base of the mandible. The median cell only very slightly stained, nearly as transparent as the rest of the wing; the venation and stigma ferruginous. . . . *reepeni* Friese (p. 121). The two teeth on the inner edge of the mandible of moderate development, their combined lateral extension about one-third the width of the edentate outer portion of the apex of the mandible. The second or innermost tooth placed only a little basad of the first. At least the median cell definitely stained. . . . 26.
- 26.—The head (except for the flagellum above), the thorax, and usually some of the basal segments of the abdomen reddish yellow. The hairs on the mesopleura and on the abdominal sternites silvery. *atripes* variety *atripes* Smith (p. 121). The head and thorax mostly black or brownish black, as well as the abdomen. The erect hairs on the mesopleura and on the abdominal sternites black. 27.
- 27.—The veins in the basal half of the wing of approximately the same bright ferruginous as the apically located veins and stigma; contrast between basal and apical half of wing somewhat feeble. *atripes* variety *rufibasalis* (Cockerell) p. 125.

- The veins in the basal half of the wing deep brown in contrast to the bright ferruginous stigma and concolorous veins in the apical half. The median cell of iodine stain.....28.
- 28.—The tegulae black or blackish.....
atripes variety *collina* (Smith) p. 122.
 The tegulae testaceous.....*atripes* variety *fuscibasis* (Cockerell) p. 125.
- 29.—The face black.....*apicalis* variety *melanoleuca* (Cockerell) p. 129.
 The clypeus and usually at least the adjacent parts of the sides of the face (or more extensively) fulvous.....30.
- 30.—The head almost completely fulvous, with the black usually confined to a subtriangular area the base of which is the supraorbital line and the apex the space between the antennal sockets.....*apicalis* variety *binghami* Schwarz (p. 128).
 The fulvous maculations of the sides of the face not extending upward beyond the base of the clypeus, sometimes even rather obliterated, the entire upper part of the head being black.....31.
- 31.—The malar space distinctly shorter than the width of the mandible at the base. The abdomen usually dark, inclined to nigropiceous, although not infrequently suffused with red, especially on the apical tergites.....
apicalis variety *apicalis* Smith (p. 126).
 The malar space about as long as the mandible is wide at the base. Abdomen usually castaneous to bright orange red.....*apicalis* variety *peninsularis* Cockerell (p. 129).
- 32.—The malar space very short, the rim of the eye separated from the inner angle of the mandible by less than the width of the scape.....*scintillans* Cockerell (p. 130).
 The malar space very long, about three times the width of the scape or twice the width of the flagellum (Fig. 13A).....33.
- 33.—The femora blackish brown.....
pendleburyi, new species (p. 130).
 The femora (with the exception sometimes of the apex of the hind pair) wholly ferruginous.....*pendleburyi* variety *klossi*, new variety (p. 132).
- 34.—The hind tibiae very greatly expanded, at their widest fully half as wide as they are long and twice the width of the also very wide hind metatarsi; a little more than the apical half of the external face of these tibiae occupied by a deep and almost circular depression (Fig. 14). Length 5 1/2 to 7 mm.....35.
 The hind tibiae one-third as wide toward the apex as they are long. Length 3 1/4 to 5 1/2 mm.....37.
- 35.—The mesopleura, metapleura, scutellum, and propodeum red.....
nitidiventris variety *latipes* (Friese) p. 134.
 These parts black.....36.
- 36.—The hairs on the vertex fulvous.....*nitidiventris* variety *nitidiventris* Smith (p. 133).
 The hairs on the vertex black.....*nitidiventris* variety *trochanterica* (Cockerell) p. 133.
- 37.—The scales that border the mesonotum not extended to the scutellum, which has only rather long erect hairs. Tegulae usually brownish to blackish, sometimes testaceous. Length 3 1/4 to 4 mm.....38.
 A semicircular band of scalelike hairs rimming the hind margin of the scutellum and sometimes encroaching deeply on the hairless basal area of the scutellum. The apex of the clypeus with a fulvous transverse band. The tegulae fulvous. The apex of the abdomen wholly, the basal tergite partly fulvous to ivory-colored. Length 4 1/2 to 5 1/2 mm.....41.
- 38.—The posterior margin of hind tibiae fringed with silvery-gray hairs. Length of forewing about 4 1/4 mm. Usually a black spot on each side of the otherwise pale tergite 1 of abdomen.....
ventralis variety *ventralis* Smith (p. 134).
 The posterior margin of hind tibiae fringed with black to dark brownish hairs. Forewing 4 1/2 to 5 mm. in length. Tergite 1 with the dark area not confined to a spot on each side.....39.
- 39.—The hairs on the vertex and scutellum black. Tergite 1 wholly dark except for the basinlike depression at the base.....
ventralis variety *doipaensis*, new variety (p. 136).
 The hairs on the vertex and scutellum silvery-gray to slightly ochraceous. A semicircle of black partly enclosing the basal depression on the otherwise pale tergite 1 of abdomen.....40.
- 40.—Fore and middle tibiae and their metatarsi with blackish hairs on their external face. The apical tergite of abdomen brownish to blackish. Length of forewing about 4 1/2 mm.....
ventralis variety *flavibasis* (Cockerell) p. 134.
 The hairs on the external face of the fore and middle tibiae and their metatarsi silvery-gray. The apex of tergite 5 and all of tergite 6 a pale yellowish white. Length of wing slightly greater, about 5 mm.....
ventralis variety *hoosana*, new variety (p. 135).
- 41.—Legs extensively blackened, with usually fore and middle femora to some extent, fore and middle tibiae and metatarsi to a greater extent, and hind legs even more completely dark.....
terminata variety *terminata* Smith (p. 136).
 Legs more reddish.....42.
- 42.—Hind tibiae and metatarsi black.....
terminata variety *lateballeata* (Cameron) p. 139.
 Legs rufo-fuscous or rufo-ochraceous.....
terminata variety *javanica* (Gribodo) p. 140.

KEY TO INDO-MALAYAN *TRIGONA* (MALES)

Comparatively few of the males of Indo-Malayan *Trigona* are known. Some of these have rather distinctive structural characters—especially the armature of sternite 5 in certain species—but it is not possible to say at present whether these seemingly distinctive characters are approximated by the still undiscovered males of related species. The fragmentary key that follows is accordingly supplemented by descriptions of the males so far as known. It may be noted that, unlike their workers, the males of the subgenera *Tetragona* and *Heterotrigona* listed in this key lack a differentiated bristleless area at the base of the inner face of the hind metatarsi. In this respect they differ from the males of the New World subgenus *Trigona*, all of which, so far as known, have, like their workers, a smooth, usually sericeous area basally on this joint.

- 1.—The apex of the rather pear-shaped hind tibiae prolonged posteriorly into a prominent forward-curving spine (Fig. 3). A long fingerlike process at each lateral extremity of sternite 5 (Fig. 4A)

..... *itama* Cockerell (p. 98).

The hind tibiae simple. 2.

- 2.—The head and thorax dulled by an exceedingly dense tessellation. Scalelike pale hairs bordering not merely the mesonotum but also present on the axillae and on the scutellum, usually more particularly bordering the latter posteriorly. Sternite 5 with two long, medianly placed, mostly black spines, the ferruginous apex of which is briefly cleft (Fig. 16B)

..... *terminata* Smith (p. 137).

The integument smooth, shiny except when dulled by overlying hairs. 3.

- 3.—The distance from each lateral ocellus to the neighboring eye about twice the diameter of the ocellus. Antero-lateral angles of clypeus not quite contacting rim of eye or well separated from it. Hind tibiae rather broad. Wings inclined to be basally darker, sometimes strongly contrasting with the whitish apex. Larger bees, with a forewing 6–7 1/2 mm. in length. 4.

Each lateral ocellus separated from the adjacent eye only by about the width of its own diameter or a trifle more. Antero-lateral angles of clypeus grazing rim of eye. Wings approximately hyaline, without deepening of color in median cell or adjacent region of basal half of wing. Small bees; length of forewing 3–5 1/4 mm. 7.

- 4.—Malar space hair-fine. Scutellum extended backward as far as the propodeum. Sternite 5 ordinary. Sternite 6 with a median spine that is usually partly exposed. 5.

Length of malar space about one-half width of scape. Erect black hairs on apical part of clypeus. Scutellum short, barely extended backward, not nearly so far as the end of the propodeum. Contrast between dark basal half of wing and milkwhite apical half strong. Sternite 5 with a toothlike to spinelike prolongation at each of its lateral extremities; this toothlike prolongation juts out laterad sufficiently to be plainly revealed even when the insect is viewed from above (Fig. 12A). The following sternite broadly subtruncate. 6.

- 5.—Almost wholly pale ferruginous.

..... *atripes* variety *atripes* Smith (p. 122).

Almost wholly black.

..... *atripes* variety *collina* (Smith) p. 124.

- 6.—Clypeus and adjacent parts of sides of face ferruginous.

..... *apicalis* variety *apicalis* Smith (p. 127).

Clypeus and adjacent parts of face dark.

..... *apicalis*

variety *melanoleuca* (Cockerell) p. 129.

- 7.—The sagittae very broad-bladed over most of their extent, ending in a short black needlelike tip (Fig. 8C). The volsellae threadlike and pale corn-colored (Fig. 8C). The mesonotum and scutellum with predominantly black hairs. The hind tibiae with black hairs along their anterior margin and outer face but these less conspicuous than the rather dense dull gray appressed plumose hairs that thatch the posterior half of the joint. Wings with bright ferruginous venation and stigma; the forewing about 5 1/4 mm. in length.

..... *geissleri* Cockerell (p. 118).

The sagittae sinuous, more gradually tapering to a needlelike tip. The hairs of the mesonotum and scutellum often wholly or largely silvery-gray as are those of the hind tibiae. 8.

- 8.—The scape black. The hind tibiae with rather long hairs on their external surface and many of these erect. Tergite 7 of the abdomen beaklike, with steeply descending compressed sides; flattened on its basal half in dorsal aspect, this flattened area being triangular and bounded by carinae; downcurved, narrow, and ridgelike on its apical half in dorsal aspect, with a median longitudinal carina (Fig. 6A). 9.

The scape ferruginous. The hairs on the outer face of the hind tibiae largely appressed and relatively short. Tergite 7 of the abdomen rather uniformly convex, not emphatically compressed laterally (Fig. 6B). 10.

Hills, 4500 feet, Feb. 18, 1932, and 3700–4500 feet, Feb. 24, 1932 (H. M. Pendlebury). State of Selangor: Batu Carees, Oct. 25, 1906 (Agri. Dept.), Sept. 19, 1921, and Jan. 2, 1925 (H. M. Pendlebury); nr. Batu Carees, Aug. 22, 1926 (C. Dover); Genting Bidai, 2000 (C. B. Kloss); Kuala Lumpur, Dec. 10–20, 1909, and Jan. 6, 1910 (Agri. Dept.) and Aug. 13, 1922, July 6, 1924, Feb. 25, 1928, and Sept. 30, 1928 (H. M. Pendlebury); Sungei Chemubong, N. of Sg. Buloh, 150 feet, June 1921 (H. C. Abraham); 13th mile Sg. Buloh, Sept. 11, 1922 (H. M. Pendlebury); Kuala Lumpur, Tanglin Road, Jan. 29, 1928; Serdang, April 4, 1928 (H. T. Pagden), and Jan. 21, 1936, on *Mimosa pudica* (H. T. Pagden); Ulu Gombak, 12th mile from Kuala Lumpur, July 8, 1928, and July 28, 1929 (H. T. Pagden); Ulu Langat, Aug. 6, 1928 (H. T. Pagden); Bukit Kutu,¹ 3500 feet, April 16–19, 1926, Sept. 6, 1929, and March 14, 1931 (H. M. Pendlebury) and 3485 feet, Jan. 30, 1930 (H. T. Pagden); foot of Bukit Kutu, on *Melastoma*, Jan. 19, 1936 (H. T. Pagden). State of Pahang: Sungei Tahan, Nov. 22, 1921 (H. M. Pendlebury); Kuala Tahan, Nov. 22, 1921 (H. M. Pendlebury); Lubok Tamang, 3500 feet, June 15–16, 1923 (H. M. Pendlebury), and 3600 feet, May 25, 1931 (H. T. Pagden); Kuala Lipis, May 29, 1926 (H. M. Pendlebury); Jerantut-Batu Balai, March 18–19, 1927 (E. Seimund); Fraser's Hill, 4000 feet, Jan. 25, 1929, and Feb. 2, 1929 (H. M. Pendlebury), Sept. 30, 1929 (N. C. E. Miller), May 1935 (G. H. Lowe), and 4200 feet, June 18, 1931, and July 15, 1936 (H. M. Pendlebury); Cameron Highlands, 3600 feet, May 26, 1931 (H. T. Pagden), 4000–5000 feet, June 10, 1935 (H. M. Pendlebury), 4800 feet, June 22, 1935 (H. M. Pendlebury), 4500–4800 feet, June 23, 1935 (H. M. Pendlebury); Cameron Highlands, Tanah Rata, 4600 feet, May 25, 1931 (H. T. Pagden); Cameron Highlands, Tanah Rata to Padang, 4800 feet, May 30 to June 2, 1931 (H. M. Pendlebury); Cameron Highlands, Tanah Rata, 4800 feet, June 2, 1931 (H. M. Pendlebury).

¹ Mr. Pagden states that the meaning of Bukit Kutu is literally Hill of the Louse. It is one of the older hill stations and one of the most interesting collecting areas he has visited.

State of Selangor-State of Pahang: border the Gap, 2700 feet, May 25, 1926 (H. M. Pendlebury); Genting Sempak Hill Stream, Sept. 11, 1926 (C. Dover). Island of Singapore: Singapore (Baker), including a male; Bt. Timah, July 11, 1911; Mandai, Dec. 29, 1922 (H. C. Abraham). West Coast: Langkawi Island, April 14–21, 1928 (H. M. Pendlebury).

SUMATRA.—S. Bamban April 1912; T. Slamet, May 1912; Lao Kawar, 4600 feet, Dec. 23, 1929 (H. T. Pagden); Lampong Res., Bergen Est., 150 meters, March 28, 1937 (J. van der Vecht).

BANGKA ISLAND.—Pangkalpinang, March 1930 (J. van der Vecht).

W. JAVA.—Gng-Tjampea, 250 meters, May 5, 1935 (J. van der Vecht); Tapos on Mt. Gedeh, 800 meters, Aug. 1–16, 1936 (J. van der Vecht); Djasinga, Tjibarang-bang, 150 meters, Nov. 15, 1936 (E. van der Vecht).

E. JAVA.—Blawan Est., Idjen Plateau, 900–1500 meters, May 27, 1936 (H. Lucht).

W. BORNEO.—Pontianak (F. Muir); Bengkajang, Sengajan near Ledo, July 27, 1933 (H. R. A. Muller).

N. BORNEO.—Bettotan, nr. Sandakan, July 23 to Aug. 24, 1927 (C. B. Kloss and H. M. Pendlebury); nr. Kinabalu, Tenompok Pass, 4700 feet, March 18, 1929 (H. M. Pendlebury); Mt. Kinabalu, Kenokok, 3300 feet, April 23, 1929 (H. M. Pendlebury); nr. Kinabalu, Kabayau, May 9–11, 1929 (H. M. Pendlebury).

S. E. BORNEO.—Sembilang, Nov. 19, 1930 (J. van der Vecht).

C. BORNEO.—Palavau, 1903.

There is variability in the obscuration of the wing. The description of *itama* (1919, p. 79) reads "with dilute fuliginous wings" and this phrase is applied also in the description of the wings of *breviceps* (1919A, p. 244), but Cockerell (1919A, p. 241) designated a variety *a* of *itama* from the Island of Penang that had wings "somewhat darker than in typical *itama*." A series from Singapore, the type locality of *itama*, that was collected by Baker, inclines to the more transparent extreme. In contrast a series from Mt. Kinabalu, Kenokok, 3300 feet, in North Borneo, has

wings of rather pronounced smokiness, although a specimen taken near Kinabalu, at Kabayau, 600 feet, has wings that are approximately hyaline. Nearly hyaline, too, is another North Bornean series from Bettotan, near Sandakan, which is the type

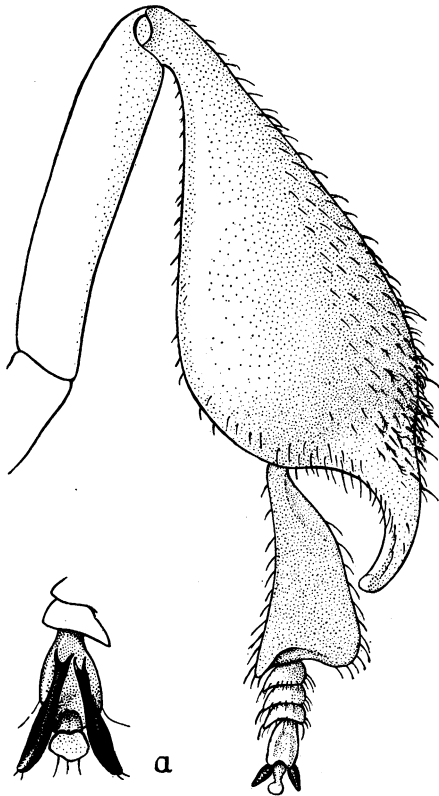


Fig. 3.—Hind leg of male of *Trigona* (*Heterotrigona*) *itama* Cockerell, with special reference to the tibia, metatarsus, and lower tarsal joints. Inserted figure *a* shows the last tarsal joint in greater detail, especially the long tarsal claws, briefly cleft at the apex when viewed from below, only the basal portion of which is visible in the larger figure.

Drawn by Mrs. Shirley H. Risser.

locality of *breviceps*. These Bettotan specimens differentiate themselves from the others in having a very slightly shorter wing length. The slight variability from place to place noted in the Bornean specimens is duplicated in the other areas considered. In general the stained wing is

more prevalent than the approximately hyaline wing but the line of division between the two extremes is obscured by intergrading specimens. While the length of the wing is fairly constant there are specimens from a few localities—Cameron Highlands, No. 4 Camp, 4800 feet, Pahang, and Doi Kui, Koh Ma, northern Siam—that exceed the others in wing length to about the slight extent that the Bettotan specimens fall short of the average. But the insignificance of this variability in wing length may be gauged by the fact that the difference between the specimens of maximum and of minimum expansion is only about that of the length of the stigma.

The specimen from S. Bamban in eastern Sumatra and that from Palavau in Borneo were identified by Friese as *vidua*, but their wings, which are faintly fuliginous, do not accord with Lepeletier's description of *vidua*: "Ailes rembrunies, leur bout d'un blanc de lait, peu transparent." It is possible that *vidua* is close to *apicalis* variety *melanoleuca* (Cockerell).

Between a hundred and two hundred specimens of *itama* are before me, all of them with one exception workers. The single male—a specimen kindly submitted by the U. S. National Museum and mislabeled *busara* Cockerell—is, I think, without a doubt assignable to *itama*. Along with it are workers with identical labeling—Singapore, Col. Baker—that are indubitably *itama*. The male specimen in question is of the same size as the workers and shares with them the strongly demarcated transverse cubital veins—a character unusual in stingless bees—the non-salient scutellum, and other characters. *Trigona busara*, on the other hand, which is a synonym of *canifrons* Smith, has the transverse cubital veins obsolete and the scutellum rather salient and differs in many other respects. I offer the following description of the male of *itama*:—

♂.—HEAD broad and short. The facial quadrangle narrower than in the worker and wider above than below, the large brown eyes being distinctly convergent below. The malar space much reduced compared to that of the worker, only a very narrow line separating the base of the mandible from the rim of the eye. The apicolateral extremities of the clypeus sepa-

rated from the rim of the eye by a space hardly greater. The mandibles short, barely more than contacting each other, fairly broad at the base, attenuated fingerlike toward the apex, which is edentate. The ocelli rather large and approximately in a straight line, the distance between the inner orbits of the lateral ocelli about twice that which separates each lateral ocellus from the adjacent eye. The region back of the ocelli slightly carinate as in the worker. The flagellum more than three times as long as the scape—all of the joints except the pedicel and the following joint, which is very minute, about one and one-half times as long as wide, except that the apical joint and the fourth joint of the antenna, when

like the thorax of the worker, that of the male lacks black hairs, all of the hairs being of a dull silvery-gray to slightly ochraceous and longest on the scutellum and the mesopleura. To each side of the polished and hairless middle area of the propodeum is a rather dense area of silvery-gray to whitish tomentum.

WINGS identical in length, coloration, and the emphasis of the venation with those of the worker from the same locality, being approximately hyaline, with fuscous and strong neuration, such usually obsolete veins as the trans-cubital being distinctly demarked. The number of hamuli in hind wing 7.

LEGS mahogany-hued. Particularly con-

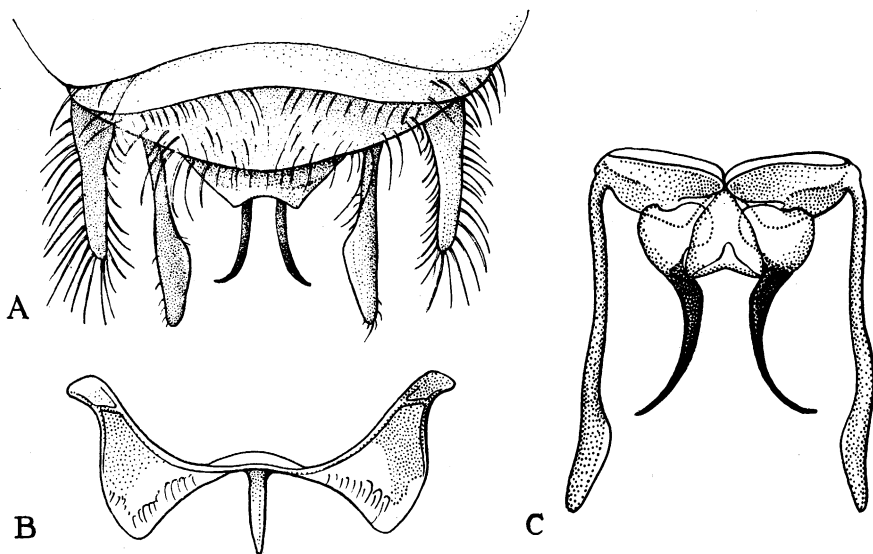


Fig. 4A.—Apical segments of the abdomen, viewed dorsally, of the male of *Trigona* (*Heterotrigona*) *itama* Cockerell, with the needlelike sagittae, flanked by the longer volsellae, and these in turn flanked by the peculiar fingerlike hair-fringed processes springing from each lateral extremity of sternite 5.

Fig. 4B.—Sternite 6 of the same insect.

Fig. 4C.—Genitalia, viewed dorsally, of the same insect.

Drawn by Mrs. Shirley H. Risser.

viewed from below, are twice as long as wide. The hair of the face silvery-gray and longer (not merely pruinose) than in the worker, downgrowing on the lower half of the face, upgrowing on the upper half and becoming gradually ochraceous toward the vertex, where the hairs are distinctly long, curved at the ends, and fulvous. The head black as in the worker, with only the antennal sockets and extreme base of scape brightened with ferruginous; the flagellum very dull reddish black below except for one or two of the basal segments, which are more vivid.

THORAX blackish like that of the worker and of similar structure, with the scutellum short, not extending backward over the propodeum. Un-

spicuous are the massive and peculiarly shaped hind tibiae (Fig. 3). These are of a width slightly greater than those of the worker and extraordinarily thickened, particularly anteriorly. They are somewhat pear-shaped and might be so described if they terminated normally but the apical extremity is unexpectedly prolonged into a crescentic, somewhat forward-pointing, long blunt spine that gives the hind tibiae a length about equivalent to the combined length of their coxae, trochanters, and femora. The hind metatarsi, in contrast to the condition in the worker, are rather narrow but, proportionate to their width, even more thickened than are their swollen tibiae; at the base, for instance,

these metatarsi are thicker than they are wide, somewhat concave in outline anteriorly, convex in outline posteriorly, with their apex about thrice as wide as their base. Hind claws (Fig. 3a) exceptionally long, much thickened at base (only part visible in Fig. 3) and briefly cleft at apex. Hair less abundant on the legs than is the case in the worker and silvery-gray except for the pale golden bristles on the inner face of the metatarsi. The tibiae and metatarsi of all of the legs with more and longer hairs along their posterior contour than anteriorly, forming a fringe that in the case of the hind tibiae is somewhat denser on the apical half of the joint but is much less developed than in the worker. Rather long hairs occur on the under side of the hind tibiae anteriorly.

ABDOMEN about as wide as the thorax, blackish, with some invasions of reddish, particularly on the basal tergites; smooth, like the head and thorax, except for minute tessellation narrowly along the apical rims of especially tergites 2-4, corresponding with the presence of microscopic appressed hairs. Tergite 5 with a few short black erect hairs; tergite 6 with much longer black erect hairs. The last three exposed sternites silvery-gray sericeous. Sternites 3 and 4 somewhat emarginate at the middle. Sternite 5 has at each of its lateral extremities a long fingerlike process, fringed with long pale hairs on the outer side and with much shorter pale hairs on the inner side (Fig. 4A). The length of these peculiar structures is only a little less than that of the scape but considerably shorter than that of the reddish-brown volsellae (Figs. 4A and 4C), which are expanded somewhat on the inner side shortly before the apical tip is reached but are on the whole threadlike. A few short pale hairs on the apical part of the volsellae. The long needlelike black sagittae (Fig. 4C) somewhat sharply elbowed on their dorsal side toward the base, their ventral contour curvilinear. The rather shield-shaped uncus somewhat emarginate along its distal end (Fig. 4C). Sternite 6 with a long, very narrow median spine and broad angular protrusions at each of its lateral extremities (Fig. 4B).

Length about 6 1/2 mm.; width about 2 mm.; length of forewing, including tegula, about 6 1/2 mm.

The reader is referred to the description of the male of *apicalis* (p. 127) and of *terminata* (pp. 137-139) for other examples of the armature of sternite 5.

Trigona (Heterotrigona) *erythrogastra* Cameron

Trigona erythrogastra CAMERON, 1902, Journ. Straits Asiatic Soc., XXXVII, pp. 129-130.

Trigona erythrogaster CAMERON, 1908, Entomologist, XLI, pp. 193, 194.

Trigona luteiventris FRIESE, 1908, 'Nova Guinea' (Expéd. sci. néerlandaise sous A. Wichmann), Zoologie, V, p. 358.

Trigona luteiventris COCKERELL, 1919, Philippine Journ. Sci., XIV, p. 77.

Trigona sandacana COCKERELL, 1919A, Annals and Mag. Nat. Hist., (9), III, pp. 242-243.

Trigona erythrogaster COCKERELL, 1920, Annals and Mag. Nat. Hist., (9), V, p. 115.

Trigona sandacana COCKERELL, 1920A, Philippine Journ. Sci., XVII, p. 228.

Trigona luteiventris COCKERELL, 1920A, Philippine Journ. Sci., XVII, p. 229.

Trigona erythrogastra COCKERELL, 1923, Annals and Mag. Nat. Hist., (9), XII, p. 242.

Trigona erythrogastra SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 291, 319-320, 323, 326, Pl. III, fig. K, Pl. VI, fig. V.

MALAYA.—State of Kēdah: nr. Jitra, Catchment Area, April 9, 1928 (H. M. Pendlebury). State of Perak: Gunong Kledang, 2646 feet, Nov. 1916; Batang Padang, Jor Camp, 2000 feet, Aug. 21, 1922 (E. Seimund), 1800 feet, March 13, 1924, and Jan. 22, 1925 (H. M. Pendlebury). State of Selangor: Kuala Lumpur, July 22, 1922 (H. M. Pendlebury); Ulu Gombak, 16th mile from Kuala Lumpur, March 23, 1928; 12th mile from Kuala Lumpur, July 28, 1929 (H. T. Pagden); Bukit Kutu, 3500 feet, Sept. 6, 1929 (H. M. Pendlebury); 3485 feet, Jan. 1, 1930 (H. T. Pagden), foot of hill on *Melastoma*, Jan. 19, 1936 (H. T. Pagden). State of Pahang: Jerantut-Kuantan Road, 101st mile, Aug. 30, 1926 (H. M. Pendlebury); Jerantut-Batu Balai, March 18, 1927 (E. Seimund); Kuala Lipis, May 29, 1928 (N. C. E. Miller); Ulu Sungai Triang, June 1930 (D. S. Inglis). State of Selangor-State of Pahang: Genting Sempak Hill Stream, Sept. 11, 1926 (C. Dover).

N. BORNEO.—Samawang, nr. Sandakan, jungle, July 1927 (C. B. Kloss and H. M. Pendlebury); Bettotan, nr. Sandakan, Aug. 2-19, 1927 (C. B. Kloss and H. M. Pendlebury).

W. BORNEO.—Manorg (F. Muir).

E. BORNEO.—Pelawan Besar, June 1937 (Mrs. M. E. Walsh).

Has been reported also from the Philippine Islands (Cockerell, 1920A, p. 229, as *luteiventris*).

The abdomen of *erythrogastra* was described by Cameron as follows: "the basal three segments of the abdomen rufo-testaceous, the others black, suffused with rufo-testaceous, especially at the sides." Fries

noted that the abdomen of his *luteiventris* was "reddish yellow, segments 5 and 6 browner." Cockerell's *sandacana* has the "abdomen fulvo-ferruginous, the apical part somewhat dusky." These three insects are structurally identical. I had at one time thought that *luteiventris* might be separated as a variety of *erythrogastra* on the basis of its somewhat more prevalently reddish abdomen but a series from a single locality, like Bettotan, shows so little stability in the brightness or cloudiness of the red, that it seems very difficult to draw any valid dividing line.

TETRAGONA LEPELETIER

Trigona (*Tetragona*) *canifrons* Smith

Trigona canifrons SMITH, 1857, Journ. Proc. Linn. Soc., Zool., II, p. 51.

Trigona canifrons SMITH, 1871, Journ. Linn. Soc., Zool., XI, p. 395.

Melipona canifrons DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 576.

? *Melipona canifrons* BINGHAM, 1897, 'Fauna of British India—Hymenoptera,' I, pp. 560, 562.

Trigona canifrons CAMERON, 1908, Entomologist, XLI, pp. 192, 194.

Trigona busara COCKERELL, 1918, Annals and Mag. Nat. Hist., (9), II, p. 387.

Trigona busara COCKERELL, 1919, Philippine Journ. Sci., XIV, pp. 78, 79.

Trigona busara COCKERELL, 1920A, Philippine Journ. Sci., XVII, p. 228.

Trigona canifrons COCKERELL, 1923, Annals and Mag. Nat. Hist., (9), XII, pp. 241, 242.

Trigona canifrons DOVER, 1929, Bul. Raffles Mus., No. II, p. 62.

Trigona canifrons FRIESE, 1933, Naturh. Maandblad, XXII, p. 46.

Trigona canifrons SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 282, 289, 307–308, 320, 326, Pl. II, fig. C, Pl. V, fig. Q.

SIAM.—Nakon Sri Tamarat, Khao Ram, 1500–2000 feet, March 2, 1922 (H. M. Pendlebury); Nakon Sri Tamarat, Khao Luang, 2000 feet, March 12, 1922 (H. M. Pendlebury); Trang, Banchong, April 22, 1924 (I. H. N. Evans).

MALAYA.—State of Selangor: Bukit Cherakah, July 18, 1921 (H. M. Pendlebury); 12th mile Hot Spring Klang Gates, Jan. 9, 1925 (H. M. Pendlebury); 12th mile Gombak Valley, Jan. 14, 1925 (H. M. Pendlebury); Sungai Pomsom, Ulu Langat, Sept. 2, 1928 (H. T. Pagden); Bukit Kutu, 200 feet, Sept. 21, 1932 (H. M. Pendlebury); 3300–3500, Sept. 23, 1932

(H. M. Pendlebury), 3485 feet, Jan. 30, 1930 (H. T. Pagden); Klang Gates Reservoir, Sept. 29, 1930; Kuala Lumpur, on *Mallotus* blossoms, March 5, 1933; Serdang, on *Mimosa pudica*, Jan. 21, 1936 (H. T. Pagden); Kanching, July 26, 1936 (H. T. Pagden). State of Pahang: Tembeling, Nov. 19, 1921 (H. M. Pendlebury); Kuala Tahan, Nov. 25, 1921 and Nov. 20, 1922 (H. M. Pendlebury); Sungei Tahan, Nov. 22, 1922 (H. M. Pendlebury); Kuala Lipis, May 29, 1926 (H. M. Pendlebury); Batu Balai-Jerantut, March 19, 1927 (E. Seimund); Chintamani, Aug. 21, 1935. State of Johore: Sungai Palong, May 15–23, 1930 (D. S. Inglis). Island of Singapore: Bukit Timah, July 26, 1911; Singapore (Baker).

S. SUMATRA.—Lampung Res., 450–650 meters, Mt. Tanggamoos, July 22–Aug. 5, 1935 (Mrs. M. E. Walsh); Kedaton, Wai Rilau, 150 meters, March 26, 1937 (J. van der Vecht); Bergen Est., 150 meters, March 28, 1937 (J. van der Vecht).

N. BORNEO.—Bettotan, nr. Sandakan, Aug. 19, 1927 (C. B. Kloss and H. M. Pendlebury); Sandakan (Baker).

E. BORNEO.—Pelawan Besar (Mrs. M. E. Walsh).

Has been reported also from Tenasserim (Bingham, 1897, p. 562).

As an evidence of the relative constancy in the number of hamuli on the lower wing, it may be stated that out of a total of 108 workers of *canifrons* that I examined 88 had 7 hamuli per wing, only 1 had 8 hamuli per wing, and only 1 had 6 hamuli per wing, while 18 were asymmetrical, 12 having 8 hamuli on one wing and 7 hamuli on the other wing, and 6 having 7 hamuli on one wing and 6 hamuli on the other wing. The number of hamuli per wing for the specimens considered as a whole was 7.03 and approximately 7 may be considered the average for the species.

Cockerell (1905, p. 220) recorded *canifrons* from Adelaide River, Australia, but the fact that he alludes to *biroi* as a possible synonym of *canifrons* and the further fact that later (1919A, p. 242) he compares *confusella* with *canifrons*, coupled with the fact that Cockerell's *busara*, described in 1918, is in my estimation a synonym of

canifrons would seem to indicate almost beyond doubt that Cockerell's Australian insect was not what I regard as *canifrons* but probably either *iridipennis* or a variety of *iridipennis*. Similarly the insect from Java that Schulz (1909, pp. 338-341) interpreted as *canifrons* is according to Friese (1914, p. 12) not that insect but also *iridipennis*. For the time being, at least, the known distribution of *canifrons* is that indicated in my table (p. 85).

***Trigona (Tetragona) haematoptera* Cockerell**

Trigona haematoptera COCKERELL, 1919, *Annals and Mag. Nat. Hist.*, (9), III, p. 243.

Trigona haematoptera COCKERELL, 1920A, *Philippine Journ. Sci.*, XVII, p. 228.

Trigona haematoptera variety *haematoptera* SCHWARZ, 1937, *Bul. Amer. Mus. Nat. Hist.*, LXXIII, Art. III, pp. 282, 291, 320, 327.

Trigona haematoptera variety *dulitae* SCHWARZ, 1937, *Bul. Amer. Mus. Nat. Hist.*, LXXIII, Art. III, pp. 282, 283, 291, 320-321, 328, Pl. II, fig. B, Pl. VI, fig. T.

N. BORNEO.—Bettotan, nr. Sandakan, July 28, 1927, Aug. 19, 1927 (C. B. Kloss and H. M. Pendlebury).

These specimens are in some ways intermediate between typical *haematoptera* and what I have described as *haematoptera* variety *dulitae* (1937, pp. 320-321). One of the five specimens even has the scape colored in the manner specified for *dulitae*, the other four have the scape as in typical *haematoptera*. The abdomen of these specimens is for the most part black as in the typical form although more or less castaneous on the basal segments.

See comments under *Trigona apicalis* variety *peninsularis* Cockerell (p. 130).

***Trigona (Tetragona) fimbriata* variety *fimbriata* Smith**

Trigona fimbriata SMITH, 1857, *Journ. Proc. Linn. Soc.*, Zool., II, p. 52.

Trigona fimbriata SMITH, 1871, *Journ. Linn. Soc.*, Zool., XI, p. 396.

Melipona fimbriata DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 578.

Trigona flavistigma CAMERON, 1902, *Journ. Straits Asiatic Society*, XXXVII, p. 130 (variety).

? *Melipona castanea* BINGHAM, 1903, 'Fasciculi Malayenses,' Zoology, Pts. I-II, Appendix VI.

Trigona flavistigma CAMERON, 1908, *Entomologist*, XLI, p. 192 (variety).

Trigona versicolor FRIESE, 1908, 'Nova Guinea'

(l'Expéd. scient. néerlandaise sous A. Wichmann), V, Zoologie, p. 358, Pl. xv, fig. 1 (variety).

Trigona fimbriata COCKERELL, 1919, *Philippine Journ. Sci.*, XIV, p. 79.

Trigona fimbriata COCKERELL, 1923, *Annals and Mag. Nat. Hist.*, (9), XII, p. 241.

Trigona flavistigma COCKERELL, 1923, *Annals and Mag. Nat. Hist.*, (9), XII, p. 241 (variety).

? *Trigona castanea* COCKERELL, 1929A, *Annals and Mag. Nat. Hist.*, (10), IV, p. 139.

Trigona fimbriata SCHWARZ, 1937, *Bul. Amer. Mus. Nat. Hist.*, LXXIII, Art. III, pp. 283, 289, 304-307, 326, 327, Pl. II, fig. A, Pl. IV, figs. P and P'.

MALAYA.—State of Kédah: Gunong Jérai or Kédah Peak, 3300-3950 feet, March 11-14, 1928, and 3950 feet, March 9, 1928 (H. M. Pendlebury), 3978 feet, April 20, 1930, and 4000 feet, Dec. 30, 1931 (H. T. Pagden). State of Perak: Larut Hills, 3700-4500 feet, Feb. 14, 1932, and 4500 feet, Feb. 21, 1932 (H. M. Pendlebury). State of Selangor: Gombak Valley, Oct. 17, 1921 (H. M. Pendlebury); Bukit Kutu, 3300 feet, Sept. 26, 1932 (H. M. Pendlebury), 3300-3500 feet, March 15-20, 1931 (H. M. Pendlebury), 3400 feet, March 13, 1931 (H. M. Pendlebury), 3400-3500 feet, March 17, 1931 (H. M. Pendlebury), 3500 feet, April 10-19, 1926, Sept. 7-11, 1929, and March 14-16, 1931 (H. M. Pendlebury); Ampang, June 14, 1936 (H. M. Pendlebury). State of Pahang: Kuala Teku, Aug.-Nov. 1920 (H. M. Pendlebury); Gunong Tahan, Wray's Camp, Nov. 1920 (J. Bangga); Beserah, May 31, 1926 (H. M. Pendlebury); Batu Balai, Jerantut, March 19, 1927 (E. Seimund); Kuala Lipis, May 29, 1928 (N. C. E. Miller); Fraser's Hill, 4000 feet, July 20, 1936, and 4200 feet, July 19, 1936 (H. M. Pendlebury). State of Selangor-State of Pahang: The Gap, 2700 feet, Jan. 1, 1915. East Coast: Tioman Island, June-July 1916 (H. C. R. and C. B. K.).

ISLAND OF BANGKA.—Pajong, Jan. 28, 1930 (J. van der Vecht).

N. BORNEO.—Samawang, nr. Sandakan, jungle, July 25, 1927 (C. B. Kloss and H. M. Pendlebury); Bettotan, nr. Sandakan, Aug. 3-13, 1927 (C. B. Kloss and H. M. Pendlebury).

The specimens here assigned to *fimbriata* constitute a fairly large series—in excess of

sixty specimens. There is considerable diversity among them, even among the specimens from the same locality and elevation and collected on the same day. About half the specimens have black stripes or at least cloudiness on the under side of the middle and hind femora, and are sometimes also briefly striped on the under side of the fore femora. Other specimens are without stripes or infuscation in these parts. The degree of darkening on the outer surface of the middle and hind tibiae and their basitarsi also varies considerably even among specimens that because of the identity of the data on their labels may have come from the same nest. Some have the thorax and abdomen so darkened that they approximate the variety *anamitica*.

The most distinctive of the specimens is the one from Tioman Island, which, like Cockerell's variety *ferrea* (1929A, pp. 139-140) from Siam, is "clear bright ferruginous with ferruginous hair on head and thorax." It has golden hairs even on the vertex, where the hair of *ferrea* is dark but the presence of golden hairs where one expects black is often due to a callow condition and much of the variability among the specimens of *fimbriata* is, I think, probably ascribable to the immaturity of certain of the specimens.

In connection with his specimens from Kédah Peak, Mr. Pagden has supplied this intriguing observation:

"A large *Trigona* which has rather strongly toothed mandibles was taken flying over the summit by the Trig. Station. The specimens taken here were carrying a creamy white larva in their jaws but dropped this as soon as caught, and the larva, being active, wriggled through my net and was lost in the undergrowth. I did all I could to get one of these larvae as the observation struck me as most unusual."

The observation is unusual. It is hard to find any explanation for it other than that it represented a purging of the nest. In this connection it is pertinent to recall that Tarlton Rayment observed *Trigona carbonaria* and *Trigona cassiae* busily carrying from their hives the spiny larvae and pupae of a small fly. The bees removed these intruders at the rate of fifty every

ten minutes and in a period of forty-eight hours had strewn about their hives several thousands of the immature flies. The number of ejected individuals was excessive due to the fact that the hives had been closed with wire gauze during their transport from the field to their place of permanent installation, with the result that many larvae had accumulated during the period of enforced imprisonment. The bees, Mr. Rayment explains, "could not remove their normal daily quota, and the pests accumulated" (Rayment, 1935, 'A Cluster of Bees,' pp. 540, 546, 548). Reference may also be made to the account that P. Rau gives of a nest of *Trigona (Lestrimellita) limão* on Barro Colorado Island. On the ground under the nest spout "where bits of refuse had been dropped by the bees, the earth for a considerable depth was heaving with the larvae of a Dipterous scavenger, *Hermetia illucens* L." (Rau, 1933, 'The Jungle Bees and Wasps of Barro Colorado Island,' p. 33). It seems possible that this accumulation of fly larvae may have represented originally ejections from the nest. The observation of Pagden is unusual in that the bees were apparently carrying the larvae some distance from the nest instead of merely throwing them out of their front door, but this does not necessarily invalidate the interpretation here offered, for different *Trigona* may vary in their habit just as they do in their structure.

Due to the great variability of *fimbriata* it has been independently described several times. In addition to the varieties noted in the present key, the insects described as *flavistigma* Cameron and *versicolor* Friese are assignable also to *fimbriata*. For a discussion of these see Schwarz (1937, pp. 304-307).

Trigona (Tetragona) *fimbriata* variety *anamitica* (Friese)

Trigona anamitica FRIESE, 1908, 'Nova Guinea' (Expéd. sci. néerlandaise sous A. Wichmann), Zool., V, pp. 358-359.

Trigona melanotricha COCKERELL, 1918, *Annals and Mag. Nat. Hist.*, (9), II, pp. 386, 387.

Trigona melanotricha COCKERELL, 1920A, *Philippine Journ. Sci.*, XVII, p. 228.

Trigona fimbriata variety *melanotricha* SCHWARZ, 1937, *Bul. Amer. Mus. Nat. Hist.*, LXXIII, Art. III, pp. 289, 305, 306, 327.

FRENCH INDO-CHINA.—Cochin China: Trang Bom, 30 miles N. W. of Saigon, July 11–16, 1932 (M. Poilane); Dinh Quan, low altitude forest, 46–53 K. M. from Colonial River (M. Poilane).

BORNEO.—Sandakan (Baker); Mangapoe, June 18–19, 1937 (Mrs. M. E. Walsh).

Friese in his original description alludes to *anamitica* as larger than *versicolor* (likewise a variety of *fimbriata*). The specimens here assigned to *anamitica* have the same head and leg dimensions and the same wing length as has a paratype of *versicolor* and they agree, too, in these respects with typical *fimbriata*, which is rather constant in respect to size from variety to variety. The illusion of greater size is very easily produced by greater distension of the abdomen in one specimen over another, and to this, I think, may be attributed Friese's notation with respect to *anamitica*. The present specimens differ somewhat in the coloration of the legs. Those from Trang Bom have black stripes on the under side of all of the femora, their middle and hind basitarsi tend to be black, and their middle and hind tibiae, if rarely predominantly black, are at least of a deep red. In the specimens from Dinh Quan, on the other hand, the legs are rather uniformly light brown with still paler hind tibiae. Although these specimens from Dinh Quan have the mesonotum black and the abdomen black, like the specimens from Trang Bom, their mesopleura and propodeum are brown in distinction to the black condition of these parts in the specimens from Trang Bom. Friese describes the legs of *anamitica* as "fuliginous" and later as "red-brown." In *melanotricha* Cockerell the legs are referred to as "black," but a specimen from Sandakan (the type locality) taken by Baker (the collector of the type) has dark reddish-brown legs that, except for the absence of the black stripe on the femora and the black metatarsi and tibiae, resemble in coloration the legs of the specimens from Trang Bom. The thorax of this specimen is black and the abdomen of so deep a blackish red that it borders on black. I think *melanotricha* is scarcely separable from *anamitica* as I interpret *anamitica*.

Trigona (Tetragona) fimbriata variety alicae (Cockerell)

Trigona alicae COCKERELL, 1929A, *Annals and Mag. Nat. Hist.*, (10), IV, pp. 139, 140.

Trigona fimbriata variety *alicae* SCHWARZ, 1937, *Bul. Amer. Mus. Nat. Hist.*, LXXIII, Art. III, pp. 305, 306–307.

SIAM.—Doi Angka, July 12, 1928 (H. M. Smith); Chieng Mai, Nov. 4, 1932 (H. M. Smith); Mekham, Nov. 8, 1932 (H. M. Smith); Valley of Melang, 600 meters, Dec. 31, 1932 (H. M. Smith); Khonka Valley, Jan. 26, 1933 (H. M. Smith); Khun Tan Mts., 3000 feet, May 1933 (H. M. Smith).

S. SUMATRA.—Benkoelen Res., Moearea Tenam, 250 meters, July 4–14, 1935 (M. E. Walsh).

The specimens from Siam here assigned to *alicae*—mostly from the northern or northwestern part of that country—have the erect hairs of the mesonotum black and many of them have dark stripes on the under side of the hind femora, but they agree with *alicae* in having a narrow black transverse stripe on all or most of the otherwise red abdominal tergites and seem in other respects so close to that variety that I have preferred so to designate them rather than to attempt further splitting.

Trigona (Tetragona) fimbriata variety kusutkana (Dover)

Trigona kusutkana DOVER, 1929, *Bul. Raffles Mus.*, No. II, pp. 62–64.

Through the kindness of Dr. H. M. Pendlebury, I have had the privilege of examining the holotype of *kusutkana*. It is an insect structurally identical with *fimbriata* Smith and very close in its coloration to *fimbriata* variety *alicae* Cockerell, a description of which was issued in the same month and year (July, 1929) as *kusutkana*. A second specimen (paratype), with data on the label identical with those of the holotype of *kusutkana*, approximates typical *fimbriata* in appearance and leaves one a little puzzled whether to consider *kusutkana* a callow of *fimbriata* or a valid variety of *fimbriata*.

Trigona (Tetragona) thoracica Smith

Trigona thoracica SMITH, 1857, *Journ. Proc. Linn. Soc.*, Zool., II, p. 50.

Trigona thoracica SMITH, 1871, Journ. Linn. Soc., Zool., XI, p. 395.

Melipona thoracica DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 584.

Melipona thoracica BINGHAM, 1897, 'Fauna of British India—Hymenoptera,' pp. 561, 564.

Trigona lacteifasciata CAMERON, 1902, Journ. Straits Asiatic Soc., XXXVII, p. 131 (variety).

Trigona lacteifasciata CAMERON, 1908, Entomologist, XLI, pp. 192–193 (variety).

Trigona ambusta COCKERELL, 1918, Annals and Mag. Nat. Hist., (9), II, p. 387.

Trigona ambusta COCKERELL, 1919, Philippine Journ. Sci., XIV, p. 78.

Trigona ambusta COCKERELL, 1920A, Philippine Journ. Sci., XVII, p. 228.

Trigona thoracica COCKERELL, 1923, Annals and Mag. Nat. Hist., (9), XII, pp. 240–242.

Trigona thoracica DOVER, 1929, Bul. Raffles Mus., No. II, p. 62.

Trigona ambusta COCKERELL, 1929A, Annals and Mag. Nat. Hist., (10), IV, p. 139.

Trigona borneënsis FRIESE, 1933, Naturh. Maandblad, XXII, p. 46 (variety).

Trigona thoracica variety *lacteifasciata* SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 283, 291, 317–319, 326 (variety).

Trigona thoracica variety *ambusta* SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 317–319, 327.

Trigona thoracica variety *borneënsis* SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 282, 317–319, 328, Pl. III, fig. J, Pl. VII, fig. W.

SIAM.—Nakon Sri Tamarat, Khao Ram, 750 feet, Feb. 27 (H. M. Pendlebury); Nakon Sri Tamarat, Khao Luang, 2000 feet, March 18, 1922 (H. M. Pendlebury); Banchong, April 25, 1924 (I. H. N. Evans); Ban Prakamp, Songkala Prov., July 18, 1928.

MALAYA.—State of Kēdah: Alor Star, Gunong Keriang, April 1, 1928 (H. M. Pendlebury); nr. Jitra, Catchment Area, April 7, 1928 (H. M. Pendlebury). State of Perak: Maxwell's Hill, Aug. 16, 1908; Batang Padang, Jor Camp, 1800 feet, Jan. 22, 1925 (H. M. Pendlebury); Kuala Kangsar, on flowers of *Tephrosia candida*, May 16, 1928 (H. T. Pagden); Maxwell's Garden, Taiping Hill, 3300 feet, Sept. 12, 1931 (H. T. Pagden); Taiping Hill, 3700 feet, Sept. 11–13, 1931 (H. T. Pagden); Larut Hills, 3000–3700 feet, Feb. 16, 1932 (H. M. Pendlebury). State of Selangor: Kuala Lumpur, April 23, 1909, June 12, 1909, Dec. 10, 1909, and Jan. 12, 1910 (Coll. Agri. Dept.), Sept. 3, 1921, Aug. 20, 1922, Sept. 6, 1922, Nov. 22, 1922, March

24, 1926, and Oct. 1928, at light (H. M. Pendlebury); Kuala Lumpur, Gombak Valley, Oct. 11, 1921 (H. M. Pendlebury); Kuala Lumpur, Batu Carees, Dec. 6, 1923, and Jan. 2, 1925 (H. M. Pendlebury); Kuala Lumpur, Welch Hill, Oct. 8, 1922 (H. M. Pendlebury); Dusun Tua, July 30, 1921 (H. M. Pendlebury); Serdang, on flowers of *Citrus limon*, April 25, 1928 (H. T. Pagden); Ulu Klang District, taken flying around a hot sulphur spring, Aug. 25, 1929 (H. T. Pagden); Bukit Kutu, 3485 feet, Jan. 30, 1930 (H. T. Pagden), 3300–3500 feet, March 15, 1931 (H. M. Pendlebury); Ampang Village, Sept. 1, 1936 (H. M. Pendlebury). State of Pahang: Gunong Tahan, Wray's Camp, 3300 feet, Nov. 1920; Kuala Tahan, Nov. 25, 1921 (H. M. Pendlebury); Kuala Teku, in Belukar, 500 feet, Dec. 7, 1921 (H. M. Pendlebury); Batu Balai-Jerantut, March 19, 1927 (E. Seimund); Kuala Lipis, May 29, 1928 (N. C. E. Miller); Fraser's Hill, 4000 feet, Jan. 27–29, 1929, and Feb. 2, 1929 (H. M. Pendlebury), Sept. 30, 1929 (N. C. E. Miller), May 1935 (G. H. Lowe), 4200 feet, June 18, 1931 (H. M. Pendlebury); nr. Karak, Chintamani Jungle, Aug. 22, 1935. Island of Singapore: Bt. Timah, June 30, 1911; Botanic Gardens, July 11, 1911.

S. SUMATRA.—Lampung Res., Pembangk, Sept. 9, 1932 (H. R. A. Muller); Ranau, July 24, 1933 (H. R. A. Muller); Benkoelen Res., Tandjongsokti, May 26–31, 1935 (Mrs. M. E. Walsh); Kedaton, 150 meters, March 27–28, 1937 (J. van der Vecht); Oosthaven, March 29, 1937 (J. van der Vecht).

N. BORNEO.—Bettotan, nr. Sandakan, July 28, 1927 (C. B. Kloss and H. M. Pendlebury); nr. Kinabalu, Kabayau, 600 feet, May 9, 1929 (H. M. Pendlebury).

E. BORNEO.—Babidjoelon, 150 meters, June 1937 (Mrs. M. E. Walsh).

Has also been reported from Tenasserim (Bingham, 1897, p. 564).

In an earlier paper (1937, pp. 317–319) I indicated the close relationship of *thoracica* and certain other bees, structurally identical with it, that have been described from the same general region. In going over the rather large series reported upon in the

present paper, gradations of variability were noted, but the very lack of fixity in this variability makes for caution in applying varietal names. The specimens from the localities in Sumatra above noted present no characters that would separate them as a group from the representatives from the mainland. The Bornean specimens noted are possibly on the average a little less melanistic, inclining to *lactefasciata* and *borneensis*, but among them are also specimens with rather dark abdomen and dark legs that qualify as typical *thoracica*. As indicative of the difficulty of establishing cleavages, it may be mentioned that there is variability in the extent to which the usually reddish clypeus is clouded or invaded by black, and in the more melanic specimens the mandibles are sometimes wholly black. The bristles on the vertex are sometimes wholly black, sometimes black more or less intermixed with fulvous. The legs, predominantly black, vary in the extent to which they are invaded by fulvous on the femora. The thorax, usually reddish, is sometimes clouded. The abdomen, in general predominantly black, is sometimes much invaded by red. The tomentum on the last two tergites may be bright fulvous or of a sooty appearance verging on black, or of intermixed character. These differences occur even in specimens from the same locality and, while specimens that are darkish in one part tend also to have other parts more or less correspondingly dark, the rule is by no means absolute, with the result that in many specimens there is an uneven development of melanism.

In all of the specimens, even those of more pronounced melanism, the wings are "flavo-hyaline" as specified in Smith's description although they tend to be somewhat milky on their apical one-third. In their coloration and in their length they closely resemble the wings of *fimbriata* Smith; but in *thoracica* the transverse cubital veins are rather clearly demarked, in *fimbriata* they are obsolete.

***Trigona (Tetragona) moorei* Schwarz**

Trigona moorei SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 283, 292, 321-322, 328, Pl. III, fig. G, Pl. IV, fig. N.

MALAYA.—Lubok Kedandong, north-west of Mt. Ophir, Lalang Belukar, 200 feet, Nov. 1920 (H. C. Abraham); Kuala Trengganu, at light, June 15, 1926 (C. B. Kloss).

This species has hitherto been known only from Mt. Dulit in Borneo. The two specimens before me, while structurally in agreement with the type, lack the maculations on the apex of the clypeus and on the apex of first abdominal tergite, and the maculation on the ultimate tergite is very feeble. One of them—the specimen from Lubok Kedandong—has the scape ferruginous.

***Trigona (Tetragona) sarawakensis*
variety *sarawakensis* Schwarz**

Trigona sarawakensis SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 283, 290, 313-315, 328, Pl. II, fig. E, Pl. IV, fig. M and M'.

SIAM.—Ta Salva, Kanburi, July 11, 1930.

N. BORNEO.—Mt. Kinabalu, Kenokok, 3300 feet, April 23, 1929 (H. M. Pendlebury).

W. JAVA.—East Priangan, Penandjoeng, July 1, 1936 (Mrs. M. E. Walsh).

The known distribution of this species, hitherto reported only from Sarawak, is extended considerably by the above records.

***Trigona (Tetragona) sarawakensis*
variety *drescheri*, new variety**

♀.—Agrees with the typical variety in having the fore and middle tibiae briefly tipped with black at the apex and the middle and hind metatarsi blackened on their external face but, in addition, has the following markings that are lacking in the typical variety:—a black stripe on the under side of all the femora (confined to the apical half in the case of the fore femora); a black stripe on the inner side of the fore and middle tibiae; the inner face of the hind tibiae black except for a large fulvous spot; a narrow black transverse stripe on each of the tergites except the first but so placed that they tend sometimes to be overlapped by the transparent rim of the preceding tergite and hence are easily misinterpreted as an apical stripe of that tergite. The hairs on the under side of the middle tibiae blackish.

M. JAVA.—South Banjoemas, Koebangkangkoeng, 25 meters, July 1935 (F. C. Drescher), holotype.

E. JAVA.—Mt. Goemitir, Nov. 3 (R. van der Veen), 1 paratype.

***Trigona (Tetragona) fusco-balteata*
variety *fusco-balteata* Cameron**

Figures 5A, 6A, 7A, and 8A

? *Trigona ruficornis* HORNE, 1870, Trans. Zool. Soc. London, VII, p. 3, p. 185.

? *Trigona ruficornis* SMITH, 1870, Trans. Zool. Soc. London, VII, p. 3, p. 194.

? *Melipona ruficornis* DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 583.

? *Melipona smithii* BINGHAM, 1897, 'Fauna of British India—Hymenoptera,' I, p. 563.

Trigona fusco-balteata CAMERON, 1908, Entomologist, pp. 192–193, 194, 195.

Trigona atomella COCKERELL, 1919, Annals and Mag. Nat. Hist., (9), III, pp. 243–244.

Trigona atomella COCKERELL, 1920, Annals and Mag. Nat. Hist., (9), V, p. 116.

Trigona atomella COCKERELL, 1929A, Annals and Mag. Nat. Hist., (10), IV, p. 590 ("found clinging to the leg of a large green cicada, *Platylomia spiculata* Nouh").

Trigona pygmaea FRIESE, 1933, Naturh. Maandblad, XXII, p. 147.

Melipona (Trigona) atomella YASUMATSU, 1935, Mushi, p. 94 (identified by Cockerell).

Trigona fusco-balteata SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 290, 310–311, 326.

Trigona atomella SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 310–311, 316, 328.

Trigona atomella COCKERELL, 1939, Occas. Papers Bishop Mus., XV, pp. 61, 64.

FRENCH INDO-CHINA.—Cochin China: Trang Bom, July 13, 1932 (M. Poilane).

MALAYA.—State of Perak: Batang Padang Tapah, swarming, March 7, 1925 (H. M. Pendlebury). State of Selangor: Gombak Valley, Oct. 11, 1921 (H. M. Pendlebury); Kuala Lumpur, June 18, 1921, males, June 26, 1921, male, June 28, 1921, male, July 28, 1921, male, July 22, 1922, nesting in bungalow, Sept. 9, 1922, Feb. 26, 1924, male, Feb. 28, 1924, May 23, 1926, male, June 5, 1926, male, Oct. 4, 1928, April 6, 1931, at light, and Sept. 27, 1931 (H. M. Pendlebury), Feb. 24, 1928 (H. T. Pagden); Kuala Lumpur, nr. L. Gardens, July 7, 1935 (H. M. Pendlebury); Kuala Lumpur, Tanglin Road, Jan. 17, 1928, and Jan. 19, 1928 (H. T. Pagden). State of Pahang: Sungei Tahan, Nov. 22, 1922 (H. M. Pendlebury). East Coast: Berserah, May 28, 1926 (H. M. Pendlebury).

N. E. SUMATRA.—Kateman, July 22, 1935 (C. J. H. Franssen).

W. BORNEO.—Telok Ayer (F. Muir); Pontianak, males (F. Muir).

N. BORNEO.—Bettotan, nr. Sandakan, July 23, 1927, and Aug. 19, 1927 (C. B. Kloss and H. M. Pendlebury); Kudat, Sept. 9–18, 1927 (C. B. Kloss and H. M. Pendlebury).

S. CELEBES.—Dec. 19, 1936, including 3 males (native collector).

W. CELEBES.—Paloe, Dec. 1936 (native collector).

PHILIPPINE ISLANDS.—Mindanao: Kolambugan (Baker). Palawan: Puerto Princessa (R. C. McGregor).

In a previous paper (1937, p. 311) I suggested that Cockerell's *atomella* might perhaps better be considered a variety of *fusco-balteata* than an independent species, but the series before me points to the likelihood that *atomella* is the more fully colored adult and *fusco-balteata* a callow stage of the same insect. The fact that the specimens collected on Feb. 24, 1928, were in a swarm indicates rather definitely that they were the population of a single nest. Yet they include, on the one hand, individuals that are assignable to *atomella* and, on the other, specimens of more or less pallid abdomen that in some instances at least come very close to Cameron's specimens of *fusco-balteata*. The contrasts and intergradations in the coloration of the abdomen of these specimens recall the observations which Salt made in connection with the Neotropical *Trigona nigra* variety *parastigma* (Cockerell).¹ Salt's insects were observed "flying rapidly within a limited space about six feet square, passing and repassing each other, wheeling, turning sharply at the sides, and darting swiftly back." These antics were performed by a large number of participating individuals at a height of four or five meters and were interpreted by Salt as a maturation flight. An analysis of those collected with a few swings of the net showed the following representation:—

Abdomen white above, remainder of the body black.....282.

¹ Since the identification of this material, I have had an opportunity to examine the type (No. 1663) of *paupera* Provancher. It is in my estimation the same as *parastigma*, which should, therefore, be relegated to the synonymy.

Abdomen white above except for dark apical fasciae of the segments..... 27.

Abdomen gray above with dark apical fasciae..... 15.

Entirely black..... 78.

The specimens before me of *fusco-balteata* taken by Pagden are far fewer but they, too, show a preponderance of specimens of lighter abdomen, of which there are 26 as against 10 of the darker form. The large representation of callow specimens in the aggregations of *fusco-balteata* and of *nigra* variety *paupera* seems to indicate that recently emerged stingless bees participate at an earlier age than *Apis mellifera* in activities outside of the hive.

Possibly *pallidistigma* Cameron is like *atomella* a callow of *fusco-balteata*.

Dr. Pagden, writing to me from Kuala Lumpur, states that "*fusco-balteata* is the commonest species out here. It nests in crevices in the timber of houses and particularly in the jalousies, locally called chicks, of houses. These are made usually of thin slats of nipah or bertam palm covered with dark green or blue cloth on the inner side. The bees enter the rolled up part and make a horrible mess of the cloth. A Specoid, *Polemistus barabbas* m., raids the nests in order to obtain wax for the construction of its own nest."

The specimens collected by H. M. Pendlebury at Batang Padang Tapah, were noted as "swarming."

In this connection it seems pertinent to quote Horne's account (1870, p. 185) of the behavior of what Smith described in the same issue (p. 194) as *ruficornis*, later renamed *smithii* (Bingham, 1897, p. 563). It is an insect very close to *fusco-balteata* and possibly, in view of the variability of *fusco-balteata*, the latter should be viewed as a synonym of *smithii*.

"This is one of the smallest honey-bees I have ever met with; and its habits are curious. I noticed it under the following circumstances; and I never again met with its nest, although the natives all know it. One evening, at Benares (April 4, 1863), as I was standing at my door I saw a swarm of from 400 to 500 of what I took to be midges rapidly flying about in a mazy kind of dance, occupying a space of five or six feet, and being about ten feet from the ground.

I brought out my insect-net and caught about one hundred in one sweep, when, to my surprise, they proved to be bees. On watching them I observed that they went in and out of a little hole in the wall close by, under a beam where was a hollow, and that many of their thighs were laden with pollen. . . .

"The bees continued to fly in the manner before described till dark, and did not desert their nest."

The specimens of *fusco-balteata* from S. Celebes and from the Philippine Islands have a wing length a shade longer than that of the specimens here reported from Malaya and from Borneo. Such variability in the wing length is to be noted also in *iridipennis* from locality to locality, the gradations being, however, so fine that it is often difficult to make categorical separations. I am unable to trace structural differences in the workers of *fusco-balteata* and of *iridipennis* but the males are separable by the characters given in the key (p. 95). Unlike the condition in the worker the male of *fusco-balteata* has the scape black, not ferruginous.

♂.—HEAD black, with the labrum, apical half of mandible, antennal sockets, and pedicel (somewhat) ferruginous but the scape as well as the flagellum black. Facial quadrangle much narrower below than above due to the convergence of the eyes. The malar space obsolete, base of mandible being in contact with the rim of the eye, which is also grazed by the apico-lateral angle of the clypeus. Mandibles slightly overlapping, somewhat broadened at the base but narrow and parallel-sided on apical one-half to two-thirds, the tip terminating in two denticles, the outer one slightly the larger. The ocelli nearly in a straight line, the lateral ones slightly more elevated and tilted toward the compound eyes from which each is separated by a trifle more than its own diameter. Scape shorter than in worker and about one-fourth as long as the flagellum; with the exception of joints 2 and 3, all of the joints of the antennae are distinctly longer than wide. Clypeus, sides of face, and front silvered over with microscopic appressed gray hairs. Erect silvery-gray hairs on vertex, inferior part of cheeks, and fringing the lower border of the mandible, the last mentioned being longer than the mandible is wide.

THORAX black, tegulae sometimes slightly rufo-piceous. Hairs silvery-gray, appressed as well as erect on mesopleura, a little longer on backward-extended scutellum than on mesonotum, and tomentose to each side of the bare middle area of the propodeum.

LEGS blackish to brownish with the tarsal joints beyond the metatarsus ferruginous. Hairs silvery-gray except for the slightly yellowish metatarsal brushes. The hairs on the under side of the middle tibiae distinctly longer than those of the outer face of the joint or the inconspicuous semi-appressed microscopic hairs on the outer face of the fore tibiae. The hairs on the hind tibiae not only relatively but actually

the width of their tibiae; their inner face with bristles from apex to base.

WINGS approximately clear as in the worker and of the same length. Number of hamuli in lower wing 5.

ABDOMEN variable, light brownish to blackish, almost completely glabrous over the tergites and shiny; the sternites largely silvery-gray sericeous. Tergite 7 (Fig. 6A) beaklike, with steeply

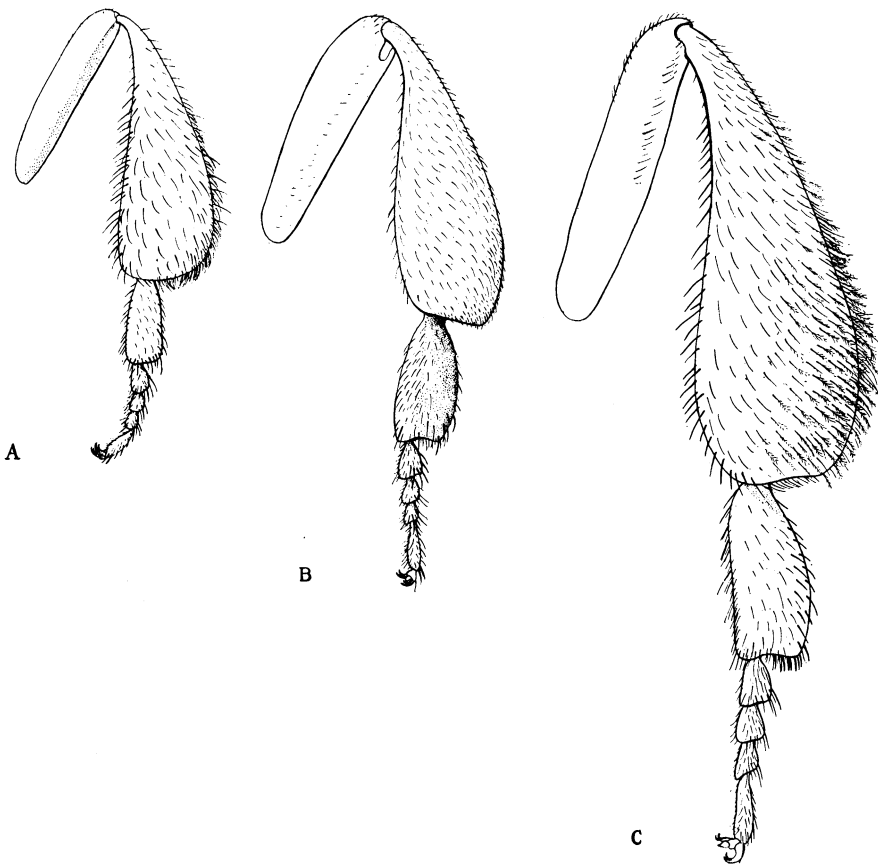


Fig. 5A.—Hind leg of male of *Trigona* (*Tetragona*) *fusco-balteata* Cameron.

Fig. 5B.—Hind leg of male of *Trigona* (*Tetragona*) *iridipennis* Smith.

Fig. 5C.—Hind leg of male of *Trigona* (*Tetragona*) *geissleri* Cockerell.

Drawn, with special reference to the tibiae, metatarsi, and lower tarsal joints, by Mrs. Shirley H. Risser.

longer than those on the corresponding joint of *iridipennis*, and dense along the posterior contour, sometimes plumose. The hind tibiae (Fig. 5A) about as wide as those of the worker, somewhat clavate, being gradually widened from base to apex, which is anteriorly rounded and recedes somewhat posteriorly; the posterior contour convex, the external face somewhat arched. The parallel-sided hind metatarsi barely one-half

descending compressed sides; flattened on its basal half in dorsal aspect, this flattened area being triangular and bounded by carinae; down-curved and ridgelike on its apical half, with median longitudinal carina. Sternite 6 with a small median spine (Fig. 7A). Genitalia (Fig. 8A) with the sagittae rather sinuous and tapering, similar to those of *iridipennis*, with sharp black curved somewhat shorter tips; toward the

base of the sagittae is a rather wide hyaline border that makes these sagittae appear broader than those of *iridipennis* (Fig. 8B). The volsellae pale yellow, threadlike, slightly incurved toward the narrow apex, which is crowned with a few hairs. The uncus (not shown in Fig. 8A) abruptly emarginate on its distal middle.

Length about 3 mm.; width of thorax about 1 mm.; length of forewing, including tegula, about 3 mm.

***Trigona (Tetragona) fusco-balteata*
variety *pagdeni*, new variety**

♂.—Structurally like male of typical *fusco-balteata*, from which it differs mainly through its greater size. Although the scape is black, as in the typical form, the flagellum is ferruginous below; the parts that are ferruginous in the typical form tend also to be ferruginous in *pagdeni*. The hind tibiae with the long erect hairs that characterize the typical variety, and the color and character of the hairs on the other

ent variety tends, like typical *fusco-balteata*, to have the abdomen and the legs more invaded by brown—sometimes they are wholly brown—than is usual on the average in *iridipennis*, but individual insects of both species are so variable in this respect, depending on their degree of maturity, that hard and fast distinctions are difficult to establish. The most dependable character for separating the worker of *fusco-balteata* and its variety from the worker of *iridipennis* and its variety—although an unsatisfactory one at best—would seem to be the coloration of the hairs fringing the anterior contour of the hind tibiae. Even this distinction may not be absolute, for it is difficult in the absence of males to be too positive in assigning workers, and some of

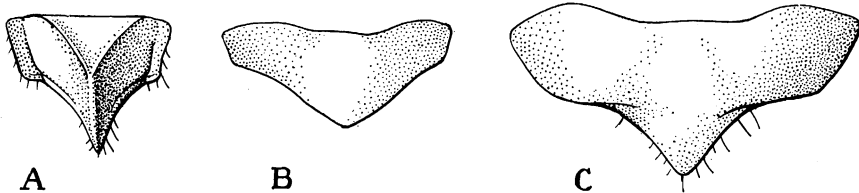


Fig. 6A.—Tergite 7 of male of *Trigona (Tetragona) fusco-balteata* Cameron.

Fig. 6B.—Tergite 7 of male of *Trigona (Tetragona) iridipennis* Smith.

Fig. 6C.—Tergite 7 of male of *Trigona (Tetragona) geissleri* Cockerell.

Drawn by Mrs. Shirley H. Risser.

parts also in substantial accord with those of the typical variety.

Length 4 to 4 1/4 mm.; width of thorax 1 1/4 to 1 1/2 mm.; length of forewing, including tegula, about 4 1/4 mm.

SIAM.—Nakon Sri Tamarat, July 5, 1928 (Hugh M. Smith), including males; Singora, June 1929 (Hugh M. Smith).

The above description is based on two males which are structurally like the male of *fusco-balteata* and differ from the male of *iridipennis* in respect to the separating characters set down in the key to that sex (p. 95).

From the same locality as these two males are sixty-nine workers, all of which, in contrast to the males, have the scape ferruginous. The worker of both typical *fusco-balteata* and the present variety are structurally like the worker of *iridipennis* and the present variety furthermore approximates *iridipennis* in size. The pres-

those that I have assigned to *iridipennis* on the basis of their darker fringing hairs may belong here. However, all of the specimens of small size, whether accompanied by males or not, that I have in this paper assigned to typical *fusco-balteata* have the hairs fringing the anterior contour of the tibiae silvery-gray; this, too, is for the most part the color of these hairs in the sixty-nine workers from Nakon Sri Tamarat, Siam, assigned to *fusco-balteata* variety *pagdeni*, although a few show a slightly deeper tint. In contrast, specimen after specimen in the long series assigned to *iridipennis* or to *iridipennis* variety *valdezi* has these hairs black. It is to be noted that the distinction I have attempted to draw is, if valid, applicable only to the worker, not to the male. In the male of *iridipennis*, as in the male of *fusco-balteata*, all the hairs of the hind tibiae, including

those located anteriorly, tend to be silvery-gray, although there is notable difference in the length of these hairs as between the one species and the other. In the workers from Nakon, here assigned to *pagdeni*, the hairs on the outer face of the hind tibiae are, like those fringing the joint, likewise exclusively or almost exclusively pale (in *iridipennis* they are apt to be blackish), and the hairs on the mesonotum and scutellum are exclusively or all but exclusively silvery-gray as are those of the mesopleura. One other character deserves some emphasis: the mesonotum of both typical *fusco-balteata* and of the variety *pagdeni* is not evenly covered with hair. The hairs are arranged in longitudinal bands that are rather clearly demarked by intervening hairless areas. Counting each of the lateral fringes of the mesonotum as a hair band, there is a total of six of these hair bands, separated alternately by five bands that are hairless. Almost invariably this is the condition in the specimens assigned to *fusco-balteata* and its variety. In *iridipennis*, on the other hand, it is the exception rather than the rule. But the distinction obviously is not absolute.

The specimens from Singora, Siam, included in the type material are all workers. They are of the same size and have the same wing length as the specimens from Nakon Sri Tamarat and like the latter have streak-like longitudinal hair bands traversing the mesonotum. But the hairs fringing the hind tibiae anteriorly tend to be a little darker on the average.

Trigona sapiens from the Solomon Islands was described on the basis of the worker (Cockerell, 1911, Proc. Linnean Soc. New South Wales, XXXVI, p. 176). Later (1929, pp. 242-243) Cockerell referred to the same species eleven workers from New Georgia, W. Solomons, and eight males from Gaudalcanal Island, in the Solomons, at the same time stating that *sapiens* "may not be separable from *T. laeviceps* Smith." Cockerell is, I believe, here using *laeviceps* as synonymous with *iridipennis*, for later in the same year (1929A, p. 590) in discussing *iridipennis* he commented as follows: "This (*iridipennis*) is the very common species I have fre-

quently referred to *T. laeviceps* Smith, since it has a polished vertex and goes exactly to that species in Bingham's table." I have not seen any of Cockerell's males from Gaudalcanal Island but the description contains a reference to their scape as black, which inclines me to believe that they may have been close to the males here described as *pagdeni*. It is, of course, possible that *sapiens* itself is no other than this putative new variety, but as the type material of *sapiens* contained only workers, the question remains in doubt. A single male with ferruginous scape was taken in the Solomon Islands with workers that seem to me scarcely separable from *iridipennis* (see p. 113) and so I conclude that both *iridipennis* (= *sapiens*) and *fusco-balteata* variety *pagdeni* may be represented in the Solomon Islands. The single male above referred to was secured by Pagden on Binkskin Island, which is near Bava Island.

Trigona (Tetragona) *iridipennis* variety *iridipennis* Smith

Figures 5B, 6B, 7B, and 8B

Trigona iridipennis SMITH, 1854, Catal. Hymen. Brit. Mus., II, p. 413.

? *Trigona laeviceps* SMITH, 1857A, Proc. Entom. Soc. London, pp. 98-99 (Trans. Entom. Soc. London, (2), IV).

? *Trigona laeviceps* SMITH, 1858, Journ. Proc. Linn. Soc., Zool., II, p. 51.

Trigona laeviceps SMITH, 1859, Journ. Proc. Linn. Soc., Zool., III, p. 135 (in part).

Trigona praeterita WALKER, 1860, Annals and Mag. Nat. Hist., (3), V, p. 305.

? *Trigona laeviceps* SMITH, 1865, Journ. Proc. Linn. Soc., Zool., VIII, p. 93.

Trigona laeviceps PARISH, 1866, Science Gossip, pp. 198-200 (nest).

Melipona iridipennis DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 579.

Melipona praeterita DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 582.

Trigona bengalensis CAMERON, 1896, Mem. and Proc. Manchester Lit. and Phil. Soc., XLI, pp. 143-144.

Melipona iridipennis BINGHAM, 1897, 'Fauna of British India—Hymenoptera,' I, pp. 560-561, 563-564.

? *Melipona praeterita* BINGHAM, 1897, 'Fauna of British India—Hymenoptera,' I, pp. 560-561, 564.

? *Trigona canifrons* COCKERELL, 1905, Annals and Mag. Nat. Hist., (7), XVI, p. 220.

? *Melipona laeviceps* BROWN, 1906, Philippine Journ. Sci., I, p. 686.

Trigona laeviceps SCHULZ, 1907, Zeitschr.

wissen. Insektenbiol., III, pp. 65-73 (nest, queen, male).¹

? *Trigona erythrostoma* CAMERON, 1908, Entomologist, XLI, pp. 192-193.

? *Trigona praeterita* FRIESE, 1908, 'Nova Guinea,' Zool., V, p. 355.

? *Trigona laeviceps* FRIESE, 1908, 'Nova Guinea,' Zool., V, p. 356.

Trigona canifrons SCHULZ, 1909, Zeitschr. wissen. Insektenbiol., V, pp. 338-341 (nest).¹

Trigona iridipennis FRIESE, 1914, Tijdschr. voor Entomol., LVII, pp. 12-13, 43-58 (nest).

Trigona penangensis COCKERELL, 1919, Philippine Journ. Sci., XIV, pp. 78-79, (variety).

Trigona iridipennis COCKERELL, 1919, Philippine Journ. Sci., XIV, p. 79.

Trigona iridipennis COCKERELL, 1919A, Annals and Mag. Nat. Hist., (9), III, p. 242.

? *Trigona laeviceps* COCKERELL, 1923, Annals and Mag. Nat. Hist., (9), XII, p. 241.

Trigona dapitanensis COCKERELL, 1925B, Annals and Mag. Nat. Hist., (9), XV, p. 492 (variety).

Trigona iridipennis COCKERELL, 1929A, Annals and Mag. Nat. Hist., (10), IV, pp. 590, 592.

Trigona iridipennis FRIESE, 1933, Naturh. Maandblad, XXII, p. 46.

Melipona irridipennis GEORGE, 1933, Journ. Univ. Bombay, I, Pt. 5, pp. 58-61. (Bionomics, morphology, and metamorphosis.)

Melipona irridipennis GEORGE, 1934, Journ. Univ. Bombay, II, Pt. 5, pp. 1-16. (Excretion during metamorphosis.)

Trigona erythrostoma SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 290, 310.

Trigona iridipennis SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 283, 290, 308-310, 316, 328, Pl. III, fig. H, Pl. IV, fig. O.

INDIA.—Bombay, Dec. 1904; Mangalore, Nov. 1926 (J. C. Bridwell); in satinwood from India, at quarantine in Boston, Mass., No. 4720, May 31, 1928 (Davis and Woodbury).

CEYLON.—Specimen determined by Green as "*canifrons*."

FRENCH INDO-CHINA.—Cochin China: Trang Bom, 30 miles N. W. of Saigon (M. Poilane).

SIAM.—Koh Tao, Sept. 17, 1928 (H. M. Smith).

MALAYA.—State of Kēdah: Bukit Panchor, July 10, 1929 (H. T. Pagden), Feb. 21, 1930 (R. P. Kelly). State of Perak: Bagan Tiang (Swee Lee Estate), Krian District, March 27, 1931, and Nov. 18, 1931 (H. T. Pagden), on both occasions taken at male flowers of *Typha angustifolia*

(identified by W. N. Sands), a reed which Mr. Pagden noted only in this locality and which he believes to be an introduced plant. State of Selangor: Kuala Lumpur, June 26, 1921, July 22, 1922, Nov. 12, 1922, at light, June 25, 1924, at light, July 20, 1924, April 11, 1926, including male, Aug. 11, 1926, at light, Aug. 16-19, 1926, May 10, 1931, July 10, 1932, and Nov. 9, 1933 (H. M. Pendlebury), Nov. 2, 1933 (Sulaiman); Kuala Lumpur, nr. L. Gardens, March 3, 1935 (H. M. Pendlebury); Kuala Lumpur, Tanglin Road, Feb. 12, 1928 (H. T. Pagden); Gombak Valley, Oct. 12, 1921, and Oct. 1, 1922 (H. M. Pendlebury); Setapak, Sept. 8, 1926 (C. Dover); Kanching, along banks of stream, Sept. 19, 1926 (C. Dover); 15 miles Kanching, Jan. 14, 1930 (H. M. Pendlebury). State of Pahang: Tahan River, left bank, 300 feet, Nov. 29, 1921 (H. M. Pendlebury); Kuala Teku, 500 feet, Dec. 5, 1921 (H. M. Pendlebury), 500-1000 feet, Nov. 25, 1922 (H. M. Pendlebury); Kuala Tahan, 300 feet, Nov. 22, 1921 (H. M. Pendlebury); 103rd mile Jerantut-Kuantan Road, June 2, 1926 (H. M. Pendlebury); Sungei Tahan, Nov. 22, 1922 (H. M. Pendlebury). West Coast: Langkawi Is., April 15-22, 1928 (H. M. Pendlebury); Pulau Jarak, April 6-12, 1932 (E. Seimund). East Coast: Pulau Perhentian, June 14, 1926 (C. B. Kloss).

S. SUMATRA.—Benkoelen, Manna, Sept. 1934, males (L. G. E. Kalshoven); Benkoelen Res., Benkoelen, 50 meters, May 10-18, 1935 (Mrs. M. E. Walsh); Oosthaven, March 20, 1937 (J. van der Vecht); Kedaton, Wai Rilau, 150 meters, March 26, 1937 (J. van der Vecht); Gn. Befeong, Soengeilangka Est., 400 meters, March 27, 1937 (J. van der Vecht); Bergen Est., Lampong Res., 150 meters, March 28, 1937 (J. van der Vecht).

BANGKA ISLAND.—Mt. Maras, 600 meters, June 15, 1930 (J. van der Vecht); Mt. Mangkol, near Troe, Dec. 1, 1935 (J. van der Vecht).

W. JAVA.—Buitenzorg (F. Muir), Aug. 1932 (H. R. A. Muller); Mt. Tjileueur near Buitenzorg, 250 meters, Dec. 30, 1934 (J. van der Vecht); Tapos on Mt. Gedeh, 800 meters, Aug. 1-16, 1936 (J. van der Vecht); Radjamandala, Sept.

¹ See Friese, 1914, "Die Bienenfauna von Java," Tijdschr. voor Entomol., LVII, p. 12, footnote.

1936 (E. Jacobson); Djasinga, Tjibarang-bang, 150 meters, Nov. 15, 1936 (E. van der Vecht), July 18, 1937 (J. van der Vecht).

M. JAVA.—South Banjoemas, Koebangkangkoeng, July 1927, males as well as workers (F. C. Drescher).

JAVA.—Doro, 800 to 1300 feet, April 1907 (F. Muir); Roban, May 1907 (F. Muir); Samarang, queen.

W. BORNEO.—Telok Ayer (F. Muir).

N. BORNEO.—Samawang, nr. Sandakan, jungle, July 12, 1927, and July 17, 1927 (C. B. Kloss and H. M. Pendlebury); Bettotan, nr. Sandakan, July 22–Aug. 24, 1927, Aug. 13, 1927, males (C. B. Kloss and H. M. Pendlebury).

PHILIPPINE ISLANDS.—Mindanao: Dapitan (Baker); Kolambugan (Baker); Padada, Nov. 27, 1937 (W. G. van Name), with the following field note: "These little bees built grapelike cells forming an irregular mass 6×4 inches in the drawer of a table. Some much longer cells in separate group. Wax tunnel also built in drawer." Palawan: Puerto Princesa, Sept. 16, 1925 (R. C. McGregor).

KEY ISLANDS.—1900 (Kühn).

Reported also from Burma and Tenasserim (Bingham, 1897, pp. 63–64).

A very few of the specimens have the abdomen brown. These I have interpreted as callows rather than as a variety of *iridipennis*. Even the type had the base and extreme apex of abdomen testaceous—see also comments under *fusco-balteata*.

Originally described from Ceylon, *iridipennis* is found on the Asiatic mainland and extends eastward along the island chain to establish its outpost in the Solomon Islands, for the insect described as *sapiens* from that area is probably to be interpreted as *iridipennis*.

Before me is a large series with the following label, "Solomon Islands, Binskin Is., near Bava Is., nest in roots orchid, Oct. 15, 1933 (H. T. Pagden)," which I should interpret as *iridipennis*. In general the hair on the vertex and bordering the scutellum tends to be lighter than in Smith's type of *iridipennis*, resembling in these respects specimens from Java and elsewhere, but the condition is bridged by intergrades.

Cockerell (1929, p. 243) described the scape of the males he examined from Guadalcanal Island in the Solomons as black—at variance with the condition in the worker (see *fusco-balteata* variety *pagdeni*, p. 110). The single male among the specimens from the Solomons taken by Pagden has the scape ferruginous, agreeing in this respect with other males of *iridipennis*. Among the nest occupants collected by Pagden in the Solomon Islands on Oct. 15, 1933, is also a queen, a description of which is appended.

The wing length in *iridipennis* shows gradations. The variety *valdezi* is primarily differentiated by the greater extension of its wings. Yet even among the specimens here referred to typical *iridipennis* there is not full standardization of wing length and some specimens tend to intergrade in the direction of *valdezi*. What Cockerell described as *dapitanensis* from the Island of Mindanao would seem to be one of these intermediate forms, of a wing length a small fraction of a mm. greater than that usual in typical *iridipennis*. A specimen from Dapitan (the type locality of *dapitanensis*) taken by Baker (the collector of the type) is before me. It corresponds closely with Cockerell's description, except that the wings are approximately as clear as they usually are in *iridipennis*, from which it is structurally not separable. The specimens obtained from satinwood that had been shipped from India are of a wing length shorter than usual.

♀ (Gravid).—HEAD nearly circular and relatively small, about as wide as the mesonotum but not extending slightly beyond the outer rims of the tegulae as is the case in the worker. The malar space notably greater than in the worker, its length subequal to the width of the scape. The mandible, like that of the worker, with two rather well-developed teeth on the inner half of its apex. Mandibles except black apical edge and basal prominences, labrum, clypeus, supra-clypeus, malar space, scape, and flagellum ferruginous; the sides of face contiguous to clypeus and a narrow extension along the inner margin of the eye diffusely dull reddish. The tomentum on the face rather sparser than in the worker, but the erect hairs on the vertex rather longer than in that cast.

THORAX with rather more abundant and longer hairs, with very long simple hairs projecting along the posterior border of the scutellum.

WINGS actually a little longer than those of the worker but relatively much shorter, their tips extending only about to the apex of the third tergite. Number of hamuli in lower wing of queen from Solomon Islands 5, but in queen from Samarang, Java, only 4.

LEGS reddish brown to partly blackish, with fewer and shorter hairs on femora than on tibiae. The hairs on the front tibiae also short, much shorter than those of the middle and hind tibiae, which, in contrast to the hairs of corresponding joints of the worker, are exclusively unbranched; the distribution of the hairs over the outer surface of these tibiae fairly dense and uniform. The hind basitarsi without a differentiated oval bristleless area on its underside such as characterizes the corresponding joint of the worker. (In the male, too, such a differentiated area is

for the most part short gray pile that is noticeably plumose on tergite 6. The under side of the abdomen covered with a similar gray pile of like density, with relatively few semi-erect hairs and these largely confined to the apex of the sternites.

Length about $6\frac{3}{4}$ mm.; width of thorax about $1\frac{3}{4}$ mm.; length of forewing about $4\frac{1}{2}$ mm.

Of the Solomon Island specimens Dr. Pagden writes me:—

"The bee is recorded as a pollinator of coconuts. It occurred on all the islands I visited during my two years there, but I collected specimens only on Tulagi (Govt. H. Q.), Gizo Island (Western Solomons),

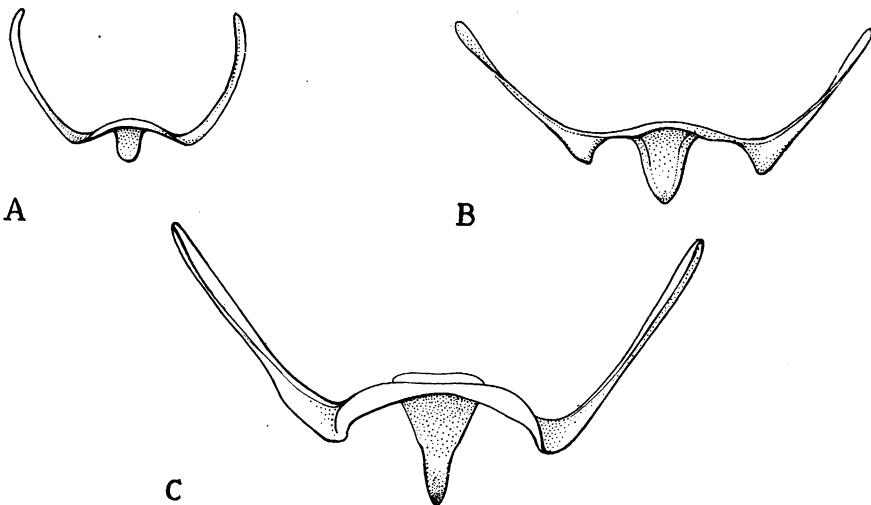


Fig. 7A.—Sternite 6 of male of *Trigona* (*Tetragona*) *fusco-balteata* Cameron.

Fig. 7B.—Sternite 6 of male of *Trigona* (*Tetragona*) *iridipennis* Smith.

Fig. 7C.—Sternite 6 of male of *Trigona* (*Tetragona*) *geissleri* Cockerell.

Drawn, in ventral view, by Mrs. Shirley H. Risser.

lacking.) The hind tibiae somewhat club-shaped but very gradually expanded toward the apex, their posterior contour only gently convex, the posterior extremity of the apex on a somewhat lower level than the rather rounded anterior part, the external face of the joint arched. The hind basitarsi rather parallel-sided, a little constricted at the base, approximately half the width of their tibiae.

ABDOMEN blackish with invasions of reddish brown, much distended, longer by about one-third than the combined length of the head and thorax and much wider than either. Tergite 1 and the basal two-thirds of tergite 2 smooth and shiny. The apical one-third of tergite 2 somewhat thinly covered with short pale hairs. Tergites 3–6 densely covered from base to apex with

Vella Lavella Island (W. Solomons), and Binskin Island (W. Solomons). The last is a small island called after the man who lives on it and who is one of the very early settlers, situated just off the coast of Bagga or Bava Island and a few miles from the coast of Vella Lavella Island. It was here that I took the male and queen from a nest constructed among the roots of an epiphytic orchid."

A description of the male of *iridipennis* follows:—

♂.—HEAD black, with the labrum, apical half of the mandible except for the red tip, the scape

and the following joint ferruginous. Facial quadrangle narrow below due to strong convergence of eyes. The apico-lateral angle of the clypeus grazing the rim of the eye. The malar space obsolete, base of mandible and rim of eye in contact. Mandibles overlapping, broad at base but narrow and almost parallel-sided on apical one-half to two-thirds, the tip consisting of two denticles of approximately equal size or the inner one somewhat the smaller. Ocelli almost in a straight line, middle ocellus only slightly anterior to the somewhat obliquely

little lighter, brownish to reddish black. The mesonotum covered with short silvery-gray hairs of rather uniform length, the backward-extended scutellum with coarser and longer silvery-gray hairs. The mesopleura with semi-erect silvery-gray hairs and the area to each side of the bare middle region of the propodeum with dense silvery-gray tomentum.

LEGS black (sometimes deep reddish-brown) with the tarsal joints beyond the metatarsus ferruginous and the trochanters sometimes ferruginous. Hairs silvery-gray except for those

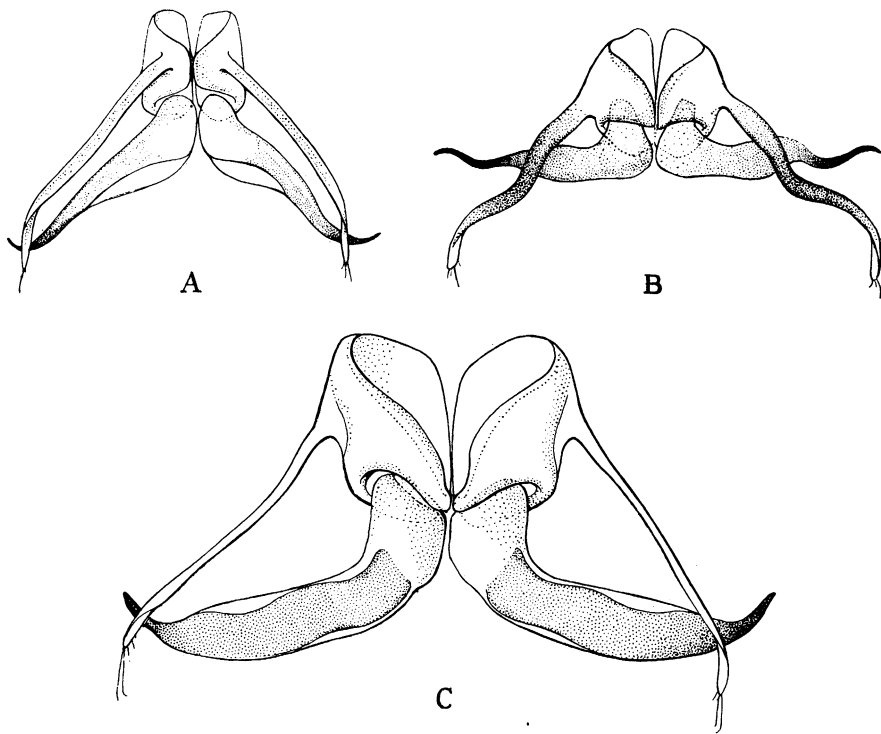


Fig. 8A.—Genitalia of male of *Trigona* (*Tetragona*) *fusco-balteata* Cameron.
 Fig. 8B.—Genitalia of male of *Trigona* (*Tetragona*) *iridipennis* Smith.
 Fig. 8C.—Genitalia of male of *Trigona* (*Tetragona*) *geissleri* Cockerell.
 Drawn, in dorsal view, by Mrs. Shirley H. Risser.

raised lateral ocelli, each of these distant from the adjacent compound eye by about its own diameter and tilted toward the compound eye. Flagellum about four times as long as the short scape; all of the joints of the antennae considerably longer than wide except for the short second and third joints. Clypeus, sides of face, and front silvered over with pruinose to tomentose gray hairs. Erect silvery-gray hairs on vertex, lower part of cheeks, and fringing inferior margin of mandible, the last-mentioned hairs being longer than the mandible is wide.

THORAX black, with the tegulae sometime a

of the metatarsal brushes, which are light golden. The hairs on the under side of the middle tibiae conspicuously longer than those of the outer side of the joint or those of the first tibiae. The hairs on the third tibiae likewise rather short, no strong concentration of tomentum toward the posterior half of the joint as in *geissleri* male. The hind tibiae (Fig. 5B) little narrower than in the worker, gradually widened toward the apex, which is rounded anteriorly and subtruncate diagonally; their posterior contour convex; their external face somewhat arched instead of, as in the worker, flat or depressed toward the

apex. The rather parallel-sided hind metatarsi about half the width of their tibiae and with bristles from apex to base along their inner face.

WINGS of about the same clarity and length as those of the worker. Number of hamuli in lower wing usually 5, rarely 4.

ABDOMEN blackish brown to black, shiny notwithstanding a few rather large blotchy punctures toward the sides of tergites 3-6, largely glabrous but with a few silvery-gray hairs on tergites 4-5 and silvery-gray sericeous for the most part on the venter. Tergite 7 (Fig. 6B) simple in character. Sternite 6 armed with a small median spine (Fig. 7B). Genitalia (Fig. 8B) with the sagittae rather sinuous and tapering, their sharp black tips strongly curvilinear and about one-third of the total length of the sagittae; the volsellae almost filiform, rather uniformly narrow and also sinuous, the apex, terminated by a few hairs, is ferruginous like the base, the more extensive intermediate region usually black.

Length 4 to 4 1/4 mm.; width of thorax about 1 1/2 mm.; length of forewing, about 4 1/4 mm.

Trigona (Tetragona) iridipennis variety valdezi (Cockerell)

Trigona valdezi COCKERELL, 1918, *Annals and Mag. Nat. Hist.*, (9), II, p. 387.

Trigona valdezi COCKERELL, 1919, *Philippine Journ. Sci.*, XIV, pp. 78, 79.

Trigona valdezi COCKERELL, 1929A, *Annals and Mag. Nat. Hist.*, (10), IV, p. 592.

Trigona valdezi SCHWARZ, 1937, *Bul. Amer. Mus. Nat. Hist.*, LXXIII, Art. III, p. 309.

Trigona valdezi COCKERELL, 1939, *Occas. Papers Bishop Mus.*, XV, pp. 61, 64.

FRENCH INDO-CHINA.—Cochin China: Trang Bom, 30 miles N. W. of Saigon, July 14, 1932, on banana tree (M. Poilane).

SIAM.—Nakon Sri Tamarat, Khao Luang, 2000 feet, March 12, 1922 (H. M. Pendlebury); Chieng Mai, March 1, 1924 (H. M. Smith); Ubon, March 25, 1929 (H. M. Smith); Koh Kut, May 20, 1929 (H. M. Smith).

MALAYA.—State of Kēdah: Gunong Jērai or Kēdah Peak, 3000 feet, March 7-8, 1928 (H. M. Pendlebury), 3000-3500 feet, March 15, 1928 (H. M. Pendlebury), 3300 feet, March 22, 1928 (H. M. Pendlebury), 4000 feet, Dec. 30, 1931 (H. T. Pagden). State of Perak: Batang Padang, Jor Camp, 1800 feet, Jan. 21, 1925 (H. M. Pendlebury); Batang Padang, Tapah, March 7, 1925 (H. M. Pendlebury). State of Selangor: Kuala Lumpur, Jan. 17, 1910 (Agricultural Dept.), July 22, 1922, Aug. 12, 1922, Sept. 25, 1922, and Sept. 6, 1931

(H. M. Pendlebury); Gombak Valley, Oct. 12-22, 1921, and Dec. 26, 1930 (H. M. Pendlebury); Bukit Kutu, 3500 feet, Sept. 13-14, 1929, and March 14, 1931 (H. M. Pendlebury); Tanjong Mas Est., Sepang, Jan. 20, 1928 (H. T. Pagden). State of Pahang: Kuala Tahan, 300 feet, Nov. 21, 1921 (H. M. Pendlebury); Sungei Tahan, Nov. 22, 1922 (H. M. Pendlebury); Tanah Rata, 5000 feet, May 24, 1931 (H. T. Pagden). State of Selangor: State of Pahang: nr. Genting Sempak Hill Stream, Sept. 11, 1926 (C. Dover). East Coast: Pulau Perhentian, June 14, 1926 (C. B. Kloss). West Coast: Langkawi Is., May 1, 1928.

S. SUMATRA.—Lampong Res., Pembangkop, Sept. 9, 1932 (H. R. A. Muller); Benkoelen Res., Manna, Sept. 1934 (L. G. E. Kalshoven); Ranau, Aug. 24, 1935 (H. R. A. Muller); Kedaton, 150 meters, March 24, 1937 (J. van der Vecht).

W. JAVA.—Mt. Pantjar near Buitenzorg, 300 meters, Sept. 27, 1936 (J. van der Vecht); Djasinga, Tjibarembang, 150 meters, Nov. 15, 1936 (E. van der Vecht).

W. BORNEO.—Bengkajang, Ledo at Sambas River, July 26, 1933 (H. R. A. Muller).

N. BORNEO.—Sandakan (Baker): Betoton, nr. Sandakan, April 3, 1927 (C. B. Kloss and H. M. Pendlebury); Samawang, nr. Sandakan, July 16, 1927 (C. B. Kloss and H. M. Pendlebury); Kudat, Sept. 10-15, 1927 (C. B. Kloss and H. M. Pendlebury); Mt. Kinabalu, Kenokok, 3300 feet, April 23, 1929 (H. M. Pendlebury); nr. Kinabalu, Kabayau, 600 feet, May 7, 1929 (H. M. Pendlebury). Labuan Is., Sept. 23, 1927.

PHILIPPINE ISLANDS.—Mindanao: Dayao (Baker); Iligan (Baker). Luzon Mt. Makiling (Baker).

Trigona iridipennis is an insect of somewhat variable size and wing length. What has been separated as *valdezi* does not seem to me structurally independent of *iridipennis* but rather a slightly longer-winged variety of that species. Cockerell (1929, p. 592) mentioned that the tegulae of *valdezi* vary from ferruginous (more or less callow specimens?) to practically black, and that "the abdomen also varies to nearly black." He noted, apparently as a distin-

guishing character, "the hind trochanters clear red, abruptly contrasting with the black femora." But many specimens of typical *iridipennis* are similarly maculated and some specimens that, on the basis of their wing length, I should assign to *valdezi* have dark trochanters.

Trigona (Tetragona) geissleri Cockerell

Figures 5C, 6C, 7C, 8C, and 9

Trigona geissleri FRIESE (specimens from Singtang, Borneo, thus named by Friese but presumably never described).

Trigona geissleri COCKERELL, 1918, *Annals and Mag. Nat. Hist.*, (9), II, pp. 385-387.

? *Trigona geissleri* var. *a* COCKERELL, 1919A, *Annals and Mag. Nat. Hist.*, (9), III, p. 242.

Trigona confusella COCKERELL, 1919A, *Annals and Mag. Nat. Hist.*, (9), III, p. 242.

? *Trigona geissleri* var. *a* COCKERELL, 1920A, *Philippine Journ. Sci.*, XVII, p. 228.

Trigona confusella SCHWARZ, 1937, *Bul. Amer. Mus. Nat. Hist.*, LXXIII, Art. III, pp. 282, 290, 311-313.

SIAM.—Nan, Jan. 14 (Alice Mackie).

MALAYA.—State of Kēdah: Kēdah Peak or Gunong Jērai, 3000 feet, March 8, 1928 (H. M. Pendlebury), 3300 feet, March 12, 1928, male, and March 22, 1928 (H. M. Pendlebury), 3800 feet, Dec. 30, 1931 (H. T. Pagden). State of Perak: Taiping Hill, 3700 feet, Sept. 11, 1931 (H. T. Pagden); Larut Hills, 4500 feet, Feb. 20-22, 1932 (H. M. Pendlebury). State of Selangor: Bukit Kutu, 500-1000 feet, April 12, 1926 (H. M. Pendlebury), 3300-3500 feet, March 22, 1931 (H. M. Pendlebury), 3500 feet, Sept. 7, 1928, male, and Sept. 11-13, 1929 (H. M. Pendlebury); Kuala Lumpur, on flowers of creeper, May 18, 1926 (H. M. Pendlebury), Entom. Lab., March 27, 1928 (H. T. Pagden). State of Pahang: Wray's Camp, 300 feet, Dec. 9, 1921 (H. M. Pendlebury), 3300 feet, Dec. 11, 1921 (H. M. Pendlebury); Gunong Tahan Padang, 4900 feet, Dec. 17, 1922 (H. M. Pendlebury), 5500 feet, Dec. 7, 1922, Dec. 11, 1922, at light, Dec. 23, 1922, Jan. 18, 1923, and Jan. 22, 1923 (H. M. Pendlebury); Cameron Highlands, Rhododendron Hill, 5200 feet, June 19-22, 1923 (H. M. Pendlebury); Cameron Highlands, Tanah Rata to Padang, May 30, 1931 (H. M. Pendlebury); Cameron Highlands, Tanah Rata, 4800 feet, June 2, 1931 (H.

M. Pendlebury); Cameron Highlands, G. Berembun summit, 6050 feet, March 14, 1924 (H. M. Pendlebury); Cameron Highlands, 4000-5000 feet, June 6, 1935, and June 17, 1935 (H. M. Pendlebury), 5000 feet, June 11, 1935 (H. M. Pendlebury); Fraser's Hill, 3500-4500 feet, Aug. 12, 1923 (H. M. Pendlebury), 4000 feet, Jan 27-29, 1929, May 28, 1932, males, and Oct. 25, 1933 (H. M. Pendlebury), May 1935 (G. H. Lowe), 4200 feet, May 26, 1926, June 27, 1931, July 6, 1931, and July 15, 1936 (H. M. Pendlebury). Singapore Island: Mandai, 50 feet, March 18, 1922 (H. C. Abraham).

BANGKA ISLAND—Mt. Pinang, Oct. 31, 1929 (J. van der Vecht); Batoe Roesa, Nov. 30, 1935 (J. van der Vecht).

Trigona geissleri occurs also in Borneo (Schwarz, 1937, pp. 311-313).

The worker of *geissleri* is structurally identical with that caste of *iridipennis* from which it differs mainly by its greater size and wing length and by the greater abundance of black hair on the scutellum. I should be tempted to consider it merely a large variety of *iridipennis*, representing yet another gradation of size beyond the variety *valdezi*, were it not for the negating character of five males that I interpret as probably belonging to *geissleri*. Two of these are from Bukit Kutu, two from Fraser's Hill, and one from Kēdah Peak. Unfortunately no workers were taken with them on the dates of their capture but the worker of *geissleri* was collected on other dates at the three places indicated. A sixth male, also from Fraser's Hill, was likewise secured without accompanying workers. Its genitalia are very different from those of the first five males and resemble those of *iridipennis*, from which the first five differ sharply. The structure of the hind leg of the five males that I interpret as probably *geissleri* still further tends to confirm the fact that these males belong to a different species from that represented by the sixth male. Yet either these five males or the single male might, on the basis of general structure, size, and coloration, qualify as the male of *geissleri*.

In the description that Cockerell (1919A, p. 242) gives of *confusella* (the equivalent

of *geissleri*) mention is made of "the clear light ferruginous stigma and nervures." Such venation characterizes the five males in question and is shared by many of the females here assigned to *geissleri*. In the single male the costal and subcostal veins and the stigma are blackish. For this reason I regard the five males as having a slightly better claim to rank as the male of *geissleri* than has the single male that structurally resembles the male of *iridipennis*. Among the workers, too, a number here assigned to *geissleri* have at least the costal and subcostal veins dark, but there are degrees of obscuration and it is not easy to separate the two groups—if there be two groups—among the workers with finality. Cockerell (1919A, p. 242) separated a worker from Sandakan, Borneo, that had "dusky sepia-coloured stigma and marginal nervure" as *Trigona geissleri* variety *a*. It may be that only the workers of wholly bright ferruginous venation and stigma are *geissleri*, and that those of somewhat more darkened venation, although structurally identical with and in all other respects so like *geissleri*, are not *geissleri* at all but the workers of the single male above referred to, which male is structurally so like *iridipennis* that it is perhaps to be viewed as merely a gradation in size in that species, with a wing length about as much longer than that of variety *valdezi* as variety *valdezi* is longer than that of typical *iridipennis*. But for the time being and pending the availability of adequate nest material, including both males and workers, it has seemed more conservative not to attempt to separate the workers above assigned to *geissleri* into two species.

There follows the description of the insect represented by five males, which I interpret as the male of *geissleri*.

♂.—HEAD black, with apical half of mandibles, labrum, scape, and the first joint or two succeeding, ferruginous; the other joints of antennae wholly or mainly black; clypeus sometimes dull reddish. Face much narrowed below, with the strongly convergent eyes contacted at their lower extremity by the apico-lateral angles of the clypeus. Malar space obsolete, base of mandible grazing rim of eye. Mandibles overlapping, narrow, parallel-sided beyond basal one-third to one-half, rather pointed at apical extremity with a small narrow denticle at inner

terminus of sloping apex instead of, as in worker, with two teeth. This inner tooth much smaller than the corresponding tooth on the male of *iridipennis*. The ocelli approximately in a straight line, the middle one barely anterior to the lateral ones, which are somewhat more elevated and tilted outward, each separated from the adjacent eye by scarcely more than its own diameter. Scape thicker and shorter than in worker; flagellum long, about four times as long as scape, all of the joints of which beyond the pedicel and the small succeeding joint are fully one and one-half times as long as wide, the fourth joint of the antenna being the longest. The front, clypeus, and sides of face silvery-gray pruinose to tomentose; the lower part of the cheeks with silvery-gray erect hairs, and similar hairs fringing the inferior margin of the mandible, these hairs much longer than the mandible is wide. Erect black hairs on vertex.

THORAX black, tegulae often somewhat reddish black to brownish. Erect hairs of mesonotum fairly dense, rather uniformly short, and including many that are black; the hairs on the backward-extended scutellum longer, coarser, and prevalently or exclusively black. All hairs on sides of thorax and beneath silvery-gray; also silvery-gray tomentose patches to each side of the bare middle area of the propodeum.

LEGS black, trochanters sometimes bright ferruginous but often wholly black. Hair on the under side of the trochanters and the under side of the femora silvery-gray, that on the inner face of the fore metatarsi more or less golden but the other erect hairs of the legs almost exclusively black or blackish. Erect hairs few on outer face of front tibiae, and these much shorter than those on outer face of front metatarsi; somewhat longer on under side of middle tibiae and middle metatarsi than on outer side of these joints. The hind tibiae (Fig. 5C) about as broad as those of the worker and rather flat, the posterior contour convex, the apex rounded; the anterior contour and the outer surface of these tibiae covered with black semi-erect to erect hairs that are less conspicuous, however, than the rather dense, dull gray, appressed plumose hairs that thatch the posterior half of the joint and tend to obscure the posterior contour. The hind metatarsi about one-half as wide as the associated tibiae, almost parallel-sided, slightly contracted at the base; their inner surface uniformly covered with bristles from base to apex.

WINGS of about same length as those of the worker of *geissleri*, clear, not basally darkened, and with bright ferruginous venation and stigma. Number of hamuli per lower wing, usually 5, sometimes 6.

ABDOMEN wholly black to reddish brown and as dark on the ventral as on the dorsal side. The tergites almost completely glabrous and shiny; at most a few inconspicuous hairs on the apical tergites and a few blotchy punctures toward the sides of tergites 3-6. Tergite 7 (Fig. 6C) with a somewhat beaklike and slightly undercurved apex. The sternites with silvery-gray hairs that

are for the most part appressed or semi-appressed. Sternite 6 with a rather long median spine (Fig. 7C). Sternite 7 somewhat conical with expanded base, vaguely patterned as in Fig. 9. The genitalia (Fig. 8C) with the sagittae rather curvilinear, particularly on their apical one-fourth, very broad-bladed and largely brown (except for usually an irregular hyaline border) over most of their length but ending in a short black needlelike tip. The pale corn-colored volsellae, in contrast, exceedingly narrow, barely wider toward the apex, from the tip of which spring a few fairly long hairs. Uncus (not shown in Fig. 8C) abruptly emarginate distally.

Length about 5 mm.; width of thorax about $1\frac{3}{4}$ mm.; length of forewing, including tegula, about $5\frac{1}{4}$ mm.

There follows a description of the male specimen from Fraser's Hill which is structurally so similar to *iridipennis*:—

HEAD black except for labrum, mandibles, scape, and two succeeding joints of antennae. Facial quadrangle narrowed below due to convergence of eyes, the apical rims of which graze the antero-lateral angles of the clypeus. Malar space obsolete. Mandible broadened at base but narrow and parallel-sided over one-half to two-thirds of its extent, terminating in two subequal denticles. The ocelli virtually in a straight line, the middle one only very slightly anterior to the lateral ones, which are somewhat more elevated and tilted each toward its neighboring eye, being separated from that eye by about the diameter of an ocellus. The flagellum about four times as long as the scape; except for the short second and third joints of the antennae, all the joints of the flagellum are distinctly longer than wide. The hairs silvery-gray, pruinose to tomentose on lower half of face, more tomentose and partly erect on front, erect on vertex and fringing the mandibles below, these hairs being considerably longer than the width of the mandible.

THORAX black, the tegulae slightly brownish black. The hairs silvery-gray, and short on the mesonotum, in the main silvery-gray but slightly sooty and much longer on the backward-extended scutellum, silvery-gray and for the most part feathery on the mesopleura and to each side of the bare middle area of the propodeum.

LEGS blackish to reddish-brown, with the tarsal joints ferruginous. Hairs almost exclusively silvery-gray, those on the outer face of the middle tibiae being short, appressed, or semi-appressed and simple (that is, without intermixture of plumose hairs). The hairs on the inner face of the middle tibiae and on tarsal joints longer than those on outer face of tibiae. The hind tibiae with short simple appressed pale hairs similar to those on corresponding joint of male of *iridipennis*. The posterior contour without a concentration of plumose hairs or anything resembling a definite fringe. Hind tibiae similar in shape to those of male of *iridipennis*, gradually

widened toward the apex, which is rounded anteriorly and subtruncate diagonally; their posterior contour convex; their external face somewhat arched. The somewhat parallel-sided hind metatarsi about one-half the width of the tibiae and with bristles from apex to base along their inner surface.

WINGS of about the same length as those of the worker of *geissleri*, hyaline basally as well as apically, the costal and subcostal veins and the stigma blackish (usually light ferruginous in the worker of *geissleri*). Number of hamuli in each lower wing 5.

ABDOMEN deep brownish-black, largely glabrous and shiny, a few large blotchy punctures toward the sides of tergites 3–6. A few microscopic appressed hairs narrowly along the apical rims of the tergites beyond tergite 1, and conspicuous erect silvery-gray hairs on tergite 5 and particularly tergite 6. The sternites silvery-gray sericeous, with semi-erect concolorous hairs on sternite 5. Sternite 6 with a strong median spine. The genitalia much like those of *iridipennis*; both sagittae and volsellae very long,

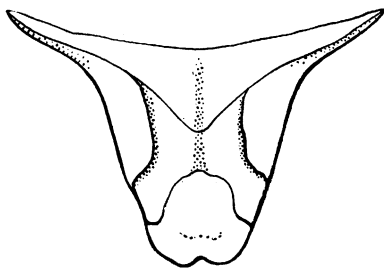


Fig. 9.—Sternite 7 of male of *Trigona (Tetragona) geissleri* Cockerell.

Drawn by Mrs. Shirley H. Risser.

the former sinuous and tapering and rather sharply curved at the apex, the latter likewise sinuous, threadlike, of rather uniform width, and dark, their somewhat lighter apex with a few fine hairs.

Length about 5 mm.; width of thorax about $1\frac{3}{4}$ mm.; length of forewing, including tegula, about $5\frac{1}{4}$ mm.

Trigona (Tetragona) biroi Friese

Trigona biroi FRIESE, 1898, Termés. Füzetek, XXI, pp. 428, 429.

Trigona biroi ASHMEAD, 1905, Proc. U. S. Nat. Mus., XXVIII, p. 957.

Trigona biroi BROWN, 1906, Philippine Journ. Sci., I, p. 686.

Trigona biroi FRIESE, 1909, Annales Musei Nat. Hungarici, VII, pp. 271–272, 274.

Trigona biroi COCKERELL, 1919, Philippine Journ. Sci., XIV, pp. 77–78, 79.

Trigona biroi COCKERELL, 1925, Philippine Journ. Sci., XXVI, pp. 53, 55.

Trigona biroi COCKERELL, 1925A, Philippine Journ. Sci., XXVII, p. 175.

PHILIPPINE ISLANDS.—Luzon: Lama, March 6, 1911 (C. V. Piper); Lamao, Province of Bataan, Feb. 26, 1916, on flowers of *Nipa fruticans* (P. J. Wester); Bur. Agri. P. I. (C. R. Jones).

Trigona biroi is structurally exceedingly close to *Trigona iridipennis*, with the typical form of which it agrees in wing length and general size. It is in my estimation not a variety of *iridipennis*, however, for it is separable from *iridipennis* by the slightly less obsolete malar space, which in *biroi* is narrower than the scape but clearly traceable, whereas in *iridipennis* the mandible grazes the rim of the eye on its inner side. The erect black hairs on the mesonotum and particularly the scutellum of *biroi* also assist in separating it from typical *iridipennis*, which usually has exclusively or at least predominantly silvery-gray hairs, a fringe of fuscous pubescence being unusual. Specimens of *geissleri*, on the other hand, usually have a predominance of black hairs on the scutellum, but the greater size of *geissleri* and its more obsolete malar space readily separate it from *biroi*.

Friese (1898, p. 429) described *biroi* from the Philippine Islands and New Guinea. Subsequently there are various records of it from the Philippine Islands without more specific reference to the place of capture. We know of its presence on the islands of Luzon and Samar through the reports of Cockerell, who likewise has listed the flowers that it visits: *Nipa fruticans*, *Citrus*, *Mimosa pudica*, and *Melicope triphylla*. The records given above do not extend its known distribution which, so far as we are aware at present, is limited to the Philippine Islands and—on the assumption that the type material was not composite—New Guinea.

Trigona (Tetragona) melanocephala Gribodo

Trigona melanocephala GRIBODO, 1893, *Bullet. Soc. Entom. Italiana*, XXV, p. 264.

Melipona melanocephala DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 580.

Trigona testaceinerva CAMERON, 1908, *Entomologist*, XLI, p. 195.

Trigona melanocephala COCKERELL, 1919, *Annals and Mag. Nat. Hist.*, (9), III, p. 242.

Trigona melanocephala COCKERELL, 1920A, *Philippine Journ. Sci.*, XVII, p. 228.

Trigona melanocephala SCHWARZ, 1937, *Bul. Amer. Mus. Nat. Hist.*, LXXIII, Art. III, pp. 282, 283, 290, 315, 326.

N. BORNEO.—Sandakan (Baker); Samawang, nr. Sandakan, jungle, July 15, 1927 (C. B. Kloss and H. M. Pendlebury); Bettotan, nr. Sandakan, Aug. 10, 1927 (C. B. Kloss and H. M. Pendlebury); nr. Kinabalu, Kabayau, 600 feet, May 9, 1929 (H. M. Pendlebury).

E. BORNEO.—Kariorang, April 1937 (Mrs. M. E. Walsh).

Trigona melanocephala is known as yet only from Borneo. *Trigona testaceinerva* Cameron, likewise described from Borneo, is in my estimation a synonym.

Trigona (Tetragona) melina Gribodo

Trigona melina GRIBODO, 1893, *Bullet. Soc. Entom. Italiana*, XXV, pp. 262–263.

Melipona melina DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 580.

Trigona melina FRIESE, 1908, 'Nova Guinea' (Expéd. sci. néerlandaise sous A. Wichmann), V, *Zoologie*, p. 357.

Trigona melina FRIESE, 1909, *Annales Musei Nat. Hungarici*, VII, pp. 272, 276.

Trigona melina COCKERELL, 1920A, *Philippine Journ. Sci.*, XVII, p. 228.

Trigona melina SCHWARZ, 1937, *Bul. Amer. Mus. Nat. Hist.*, LXXIII, Art. III, pp. 283, 291, 315, 316.

SIAM.—Ban Prakamp, Songkala Prov., July 18, 1928.

MALAYA.—State of Kédah: nr. Jitra, Catchment Area, April 8–9, 1928 (H. M. Pendlebury). State of Selangor: Gombak Valley, Oct. 16–23, 1921 (H. M. Pendlebury), 19–22 miles, April 6, 1924 (H. M. Pendlebury); 15th mile Kanching F. Res., July 5, 1924 (H. M. Pendlebury); Ulu Gombak, 12th mile from Kuala Lumpur, June 24, 1928 (H. T. Pagden); Bukit Kutu, 3500 feet, Sept. 14, 1929 (H. M. Pendlebury), foot of mountain, on *Melastoma*, Jan. 19, 1936 (H. T. Pagden). State of Pahang: Kuala Teku, Aug.–Nov. 1920, and Dec. 7, 1921 (H. M. Pendlebury).

N. BORNEO.—Sandakan (Baker).

W. BORNEO.—Mowong, Sept. 1907.

E. BORNEO.—Palawan Besar, May 1937 (Mrs. M. E. Walsh).

The wing length of these specimens is constant and a trifle longer than that of the closely related *melanocephala*.

***Trigona (Tetragona) reepeni* Friese**

Trigona reepeni FRIESE, 1918, Zool. Jahrb. Syst. Geogr. u. Biol., XLI, pp. 519–520.

Trigona reepeni COCKERELL, 1926, Annals and Mag. Nat. Hist., (9), XVIII, p. 224.

MALAYA.—State of Perak: Batang Padang, Jor Camp-L. Tamang, 7th mile, March 10, 1924 (H. M. Pendlebury). State of Pahang: Lubok Tamang, 3500 feet, June 13, 1923 (H. M. Pendlebury); Fraser's Hill, 4000 feet, Jan. 27, 1929 (H. M. Pendlebury).

I have before me two paratypes of *reepeni* from Taiping Hills as well as specimens (identified likewise by Friese) from Malakka. All of the specimens, while in other structural respects like *atripes* and its varieties, are characterized by the type of mandible noted in the key, which is shared likewise by *apicalis* and its allies, as well as by several other Malayan species.

***Trigona (Tetragona) atripes* variety *atripes* Smith**

Figure 10B

Trigona atripes SMITH, 1857, Journ. Proc. Linn. Soc., Zool., II, p. 50.

Trigona atripes SMITH, 1871, Journ. Linn. Soc., Zool., XI, p. 395.

Melipona atripes DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 576.

Melipona atripes BINGHAM, 1897, 'Fauna of British India—Hymenoptera,' I, pp. 560, 561.

Trigona atripes FRIESE, 1918, Zool. Jahrb. Syst. Geogr. u. Biol., XLI, p. 520, ♂.

Trigona atripes COCKERELL, 1919, Philippine Journ. Sci., XIV, pp. 78, 79.

Trigona atripes COCKERELL, 1923, Annals and Mag. Nat. Hist., (9), XII, p. 240.

Trigona atripes COCKERELL, 1929, Annals and Mag. Nat. Hist., (9), XX, p. 541.

MALAYA.—State of Kēdah: nr. Jitra, Catchment Area, April 4–7, 1928 (H. M. Pendlebury); Bukit Panchor, June 4, 1930 (H. T. Pagden). State of Perak: Jor Camp, 2000 feet, Aug. 25, 1922, and Sept. 6, 1922 (E. Seimund); Batang Padang, Jor Camp, 1800 feet, May 28, 1923, and March 10, 1924 (H. M. Pendlebury), 2000 feet, June 3, 1923 (H. M. Pendlebury); Taiping, Dec. 3, 1923 (M. R. Henderson). State of Selangor: Kuala Lumpur, Dec. 20, 1909, Jan. 17, 1910, July 24, 1921, Aug. 8, 1921, and Sept. 20, 1931 (H. M. Pendlebury); Gombak Valley, Oct. 12–13, 1921, and Aug. 5, 1922 (H. M. Pendlebury);

Sungei Chemubong, north of Sg. Buloh, June 1921 (H. C. Abraham); 13th mile Sg. Buloh, Sept. 11, 1922 (H. M. Pendlebury); 17th mile Kanching, Oct. 22, 1922 (H. M. Pendlebury); Genting Bidai, 2000 feet (C. B. Kloss); Serdang, on flowers of *Citrus limon*, April 25, 1928 (H. T. Pagden); Ulu Gombak, 12th mile from Kuala Lumpur, June 24, 1928 (H. T. Pagden); Ulu Langat, Aug. 19, 1928 (H. T. Pagden); Bukit Kutu, 200 feet, Sept. 21, 1932 (H. M. Pendlebury), 3300 feet, March 12, 1931, and Sept. 23, 1932 (H. M. Pendlebury), 3300–3500 feet, March 18–27, 1931 (H. M. Pendlebury), 3485 feet, Jan. 30, 1930 (H. T. Pagden), 3500 feet, April 17, 1926, and Sept. 6–12, 1929 (H. M. Pendlebury). State of Pahang: Kuala Tahan, 300 feet, Nov. 21, 1921, and Nov. 22, 1921 (H. M. Pendlebury); Lubok Tamang, 3500 feet, June 13, 1923, Oct. 20, 1923, and March 28, 1924 (H. M. Pendlebury), 4000 feet, Sept. 7, 1922 (E. Seimund); Fraser's Hill, 4000 feet, May 1935 (G. H. Lowe); Cameron Highlands, 4800 feet, June 24, 1935 (H. M. Pendlebury). Island of Penang (Baker).

E. SUMATRA.—Tandjong Slammat, May 1912, male (v. Buttel-Reepen).

Reported also from south Tenasserim (Bingham, 1897, p. 561).

In the original description of *atripes* nothing is said of the more or less darkened abdomen. Bingham (1897, p. 561) speaks of "the basal segments of the abdomen darkening to brown." The word "basal" would seem a slip of the pen for "apical." The specimens here noted tend to have tergite 1 and frequently tergites 2 and 3 lighter than at least tergites 4 and 5 and usually 6, and even in melanistic specimens, when most of the dorsal aspect of the abdomen is deep brown to black, tergite 1 is apt to remain reddish. Variability occurs in the coloration of the hind tibiae, which are often more or less clouded, especially above.

A specimen at Oxford, with a little disc-like label reading M. Ophir 76, would seem to be the type.

Except for a single male from Tandjong Slammat in eastern Sumatra collected by von Buttel-Reepen in May 1912, which

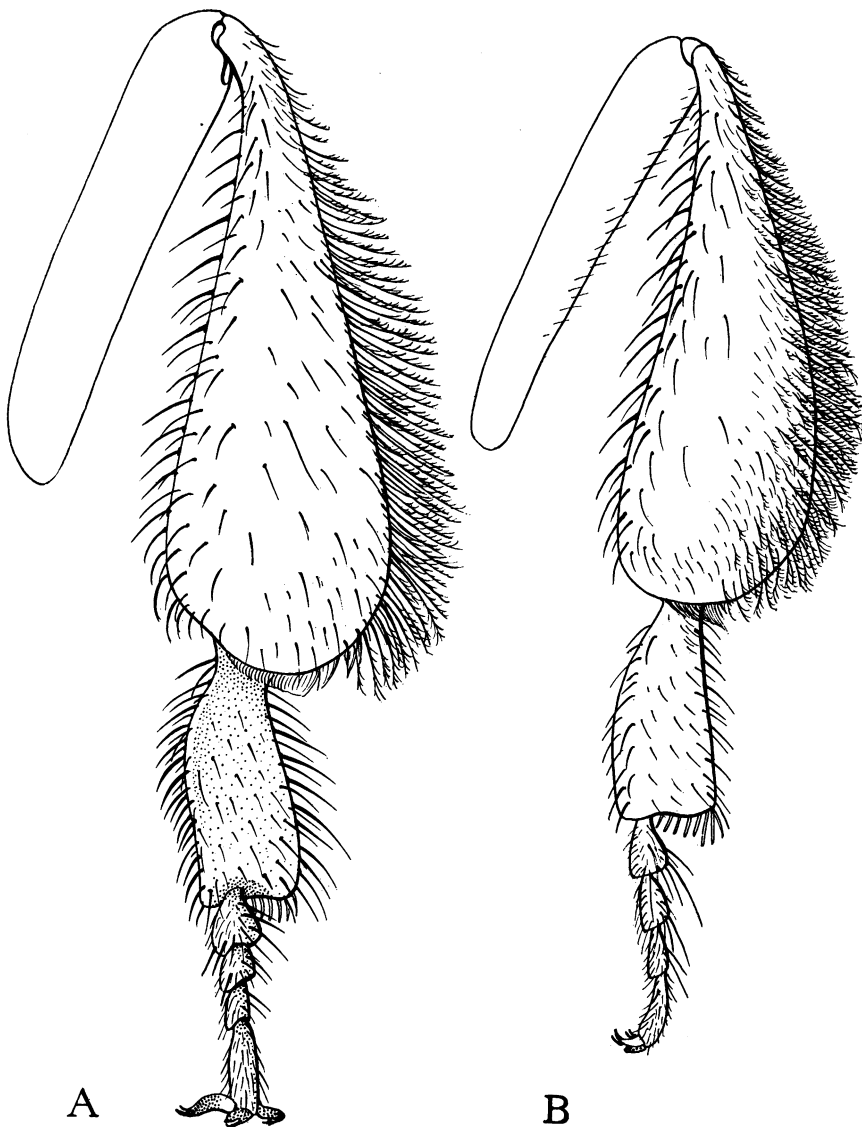


Fig. 10A.—Hind leg of male of *Trigona* (*Tetragona*) *apicalis* variety *apicalis* Smith.
 Fig. 10B.—Hind leg of male of *Trigona* (*Tetragona*) *atripes* variety *atripes* Smith.
 Drawn, with special reference to the tibiae, metatarsi, and lower tarsal joints, by Mrs. Shirley H. Risser.

Friese interpreted as the male of *atripes* (1918, p. 520) and "a variety differing a little in the color of its legs" reported from Penang Island (Cockerell, 1919, p. 78), all the published records seem to be from the Asiatic mainland. Friese's specimen from eastern Sumatra was subsequently acquired by The American Museum of Natural History. As pointed out in Friese's brief description, the insect is even more completely ferruginous than the worker, lacking all black marking on the legs and with merely the apical rims of tergites 2-5, which overlie respectively a narrow black line at the base of tergites 3-6, somewhat darkened. It is hard to know whether this limitation of maculation may be due to a callow state or whether it is typical. It is even barely possible, as no workers were taken with the male and in view of the fact that the record is unique for Sumatra, that this male is incorrectly assigned as to species. However, in size, wing length, breadth of hind tibiae, and structure of thorax it allies itself more closely with the worker of *atripes* than with that of any other species, and it agrees structurally with the male of *collina*, here made a variety of *atripes*. It seems probable, therefore, that the designation is correct. The specimen lacks genitalia. A description follows:—

♂.—HEAD ferruginous with facial quadrangle somewhat narrower than in the worker, especially below, due to the convergence of the eyes. The apico-lateral angles of the clypeus just failing to contact with the rim of the eye, being separated from the eye by a fine line of intervening chitin, which is about the degree of separation also between the lower extremity of the eye and the base of the mandible. The mandible somewhat broadened toward the base but narrow and rather parallel-sided on its apical two-thirds, the reddened tip obliquely receding inward and supplemented by a single distinct denticle at the inner edge. The extreme base of the otherwise pale ferruginous mandible barely darkened. The frontal suture deep, clearly traceable to the middle ocellus, which is barely anterior to the lateral ocelli; these slightly more elevated and tilted toward the nearest eye, from which each is separated by about twice its own diameter. The scape shorter and stouter than the corresponding joint of the worker and like the two short following joints ferruginous, the other joints of the flagellum blackish and somewhat longer than wide, with the result that the flagellum is a little short of

four times the length of the scape. The hairs of the head all silvery-gray, pruinose on lower half of face and cheeks, tomentose on upper half of face, with erect hairs on vertex, lower part of cheeks, and fringing inferior margin of mandibles, the length of the last mentioned hairs distinctly greater than the width of the mandible.

THORAX ferruginous, rather densely covered with silvery-gray hairs that are longer on the mesopleura and on the backward-projected scutellum than they are on the mesonotum.

LEGS, like the head and thorax, ferruginous, lacking dark markings (possibly due to a callow condition) but with black hairs as well as silvery-gray. Silvery-gray are: the hairs on the coxae, under side of trochanters, femora beneath, front tibiae above and beneath, and the plumose hairs on the outer face of the middle tibiae and those densely fringing the hind tibiae posteriorly. Black are: the simple, more bristlelike hairs on the middle tibiae, especially the long hairs on the under side of this joint, the similar hairs on the anterior contour of the hind tibiae and over their exterior face, as well as the bristles on the tarsal joints. The inner face of the metatarsi with reddish-yellow to brownish bristles. The hind tibiae (Fig. 10B) wide, virtually as wide as those of the worker of *atripes*, clavate, with the posterior contour strongly convex, the apex more rounded, and the exterior face a little more arched than in the worker. The hind metatarsi about one-half the width of their tibiae, parallel-sided, their inner face with bristles from base to apex.

WINGS as in worker, but in the single specimen at hand asymmetrical in the number of hamuli per wing, there being 6 in one forewing, 7 in the other.

ABDOMEN ferruginous except for the darkened apical rims on tergites 2-5, overlying respectively a linelike stripe at the base of tergites 3-6. Tergites largely glabrous and shiny, with a faint tessellation narrowly along the rims of the tergites beyond tergite 1. A few inconspicuous black hairs at the sides of tergites 2-4 near the apex and somewhat longer dark hairs sparsely present on tergites 5-6. The hairs on the under side of the abdomen silvery-gray, semi-erect down the middle, grouped in sericeous patches to each side of the middle. Sternite 6 with a rather prominent curved spine at its middle.

Size and wing length (about 6 mm.) approximately as in worker.

Trigona (Tetragona) *atripes* variety *collina* (Smith)

Figures 11A and 11B

Trigona collina SMITH, 1857, Journ. Proc. Linn. Soc., Zool., II, pp. 51-52.

Trigona collina SMITH, 1871, Journ. Linn. Soc., Zool., XI, p. 396.

Melipona collina DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 577.

? *Melipona collina* BINGHAM, 1897, 'Fauna of British India—Hymenoptera,' I, pp. 560, 562.

? *Trigona collina* CAMERON, 1908, Entomologist, XLI, p. 192.

Trigona collina COCKERELL, 1920, Annals and Mag. Nat. Hist., (9), V, p. 116.

Trigona collina COCKERELL, 1923, Annals and Mag. Nat. Hist., (9), XII, p. 241.

Trigona cambodiensis COCKERELL, 1926, Annals and Mag. Nat. Hist., (9), XVIII, p. 224 (variety?).

Trigona cambodiensis COCKERELL, 1929A, Annals and Mag. Nat. Hist., (10), IV, pp. 140, 141, 591 (variety?).

Trigona collina SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 283, 288, 297-298, 302, 326, Pl. II, fig. F, Pl. V, fig. S.

Trigona cambodiensis SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 297-298, 300 (variety?).

FRENCH INDO-CHINA.—Cochin China—Annam: Laonam and Blao, Prov. Haut Donai, 800-1200 meters, May 30-July 7, 1933 (M. Poilane).

SIAM.—Nakon Sri Tamarat, Khao Ram, 1200 feet, Feb. 26, 1922 (H. M. Pendlebury); Nakon Sri Tamarat, Khao Luang, 2000 feet, March 19-26, 1922 (H. M. Pendlebury); Nan River, above Nan, Jan. 29, 1928 (W. P. Cockerell); Khun Tan Mts., 3000 feet, Nov. 23, 1928 (H. M. Smith), 4000 feet, March 2, 1932 (H. M. Smith); Korat, March 28, 1929, male (H. M. Smith); Mesarieng, Jan. 28, 1933 (H. M. Smith); Bangkok, April 15, 1933 (H. M. Smith).

MALAYA.—State of Kēdah: Kēdah Peak or Gunong Jērai, 2000-2500 feet, March 7, 1928 (H. M. Pendlebury), 3000 feet, March 8, 1928 (H. M. Pendlebury); 3300-3950 feet, March 9, 1928 (H. M. Pendlebury). State of Perak: Batang Padang, Jor Camp, June 1923 (F. N. C.), Jor Camp, 1800 feet, Jan. 21, 1925 (H. M. Pendlebury), Jor Camp, 2000 feet, Aug. 21, 1922 (H. M. Pendlebury); Batang Padang, Jor Camp-Tamang, 7th mile, March 10, 1924 (H. M. Pendlebury). State of Selangor: Genting Sempak, 2000 feet (C. B. Kloss); Genting Bidai, 2000 feet (C. B. Kloss); Kuala Lumpur, Jan. 17, 1910 (Agri. Dept.); Kuala Lumpur, 14th mile S. Buloh, May 25, 1932 (H. M. Pendlebury); Bukit Kutu, foot of hill to 500 feet, Sept. 5, 1929 (H. M. Pendlebury), 3500 feet, Sept. 6, 1929 (H. M. Pendlebury); Ampang, Jan. 10, 1932 (H. M. Pendlebury); Serdang, on *Mimosa pudica*, Jan. 21, 1936 (H. T. Pagden).

State of Pahang: Semjunt, Kata Tangkat, June-July 1917; Kuala Teku, in Belukar, 500 feet, Dec. 7, 1921 (H. M. Pendlebury); Fraser's Hill, 4000 feet, Jan. 27, 1929, and May 31, 1932 (H. M. Pendlebury), and May 1935 (G. H. Lowe), 4200 feet, July 17, 1936 (H. M. Pendlebury); Ulu Sangai Triang, June 1930 (D. S. Inglis). State of Selangor-State of Pahang: nr. Genting Sempak Hill Stream, Sept. 11, 1926 (C. Dover). State of Johore: Sungai Palong, May 15-23, 1930 (D. S. Inglis). Island of Penang (Baker).

S. SUMATRA.—Kedaton, Wai Rilau, 150 meters, March 26, 1937 (J. van der Vecht).

N. BORNEO.—Samawang, nr. Sandakan, jungle, July 6-9, 1927 (C. B. Kloss and H. M. Pendlebury); Bettotan, nr. Sandakan, Aug. 4-22, 1927 (C. B. Kloss and H. M. Pendlebury).

Reported also from south Tenasserim (Bingham, 1897, p. 562).

Trigona cambodiensis Cockerell, of which there is a cotype from Angkor Wat in the American Museum, runs in the key of this paper to *collina* Smith. In all structural characters save possibly one, the two insects are identical. The one traceable structural difference is the obtuse median keel on the clypeus of *cambodiensis*, which is the result, however, of a dimplelike depression on each side of the clypeus rather than to a median elevation. The character is one that might be due to shrinkage in drying of the soft parts attached to the inner surface of the chitin. At best the distinction is a slight one, so slight indeed that a specimen from Nan, Siam, reported as *cambodiensis* has the flat clypeus of *collina*. The mandibles of the cotype of *cambodiensis* are of approximately the same shade of ferruginous as are those of specimens assigned to *collina*.

Different as *collina* is from *atripes* in its coloration, the workers as well as the males of both insects seem to be approximately in accord with each other in structure, size, and wing length. I have not had a chance, however, to compare the male genitalia of the two forms, and it is possible that these differ the one from the other.

♂.—Structurally like male of typical *atripes* but in its coloration, like the worker of variety

collina, almost wholly black, with black hairs. The clypeus is dull reddish on its lower half as is the mandible on its apical half; the scape is of a little brighter red. The erect simple hairs on the head, thorax, legs, and abdomen are all black, even those on the coxae, under side of trochanters, on the femora, and the ventral side of abdomen (which is likewise the case in the worker). The plumose hairs fringing the hind tibiae a little more brownish. Wings basally dark, apically milky, with the stigma and veins of the apical half ferruginous as in worker. Number of hamuli in each lower wing 6.

***Trigona (Tetragona) atripes* variety
fuscibasis (Cockerell)**

Trigona fuscibasis COCKERELL, 1920, *Annals and Mag. Nat. Hist.*, (9), V, pp. 115-116.

Trigona fuscibasis COCKERELL, 1920A, *Philippine Journ. Sci.*, XVII, p. 228.

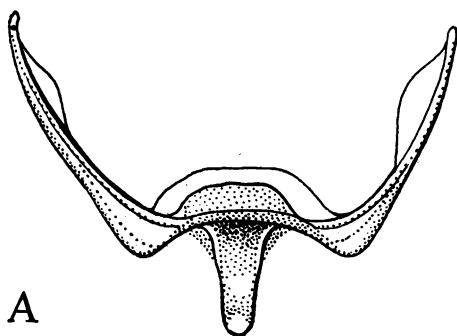
Trigona collina variety *fuscibasis* SCHWARZ, 1937, *Bul. Amer. Mus. Nat. Hist.*, LXXXIII, Art. III, pp. 288, 298, 301, 327.

These specimens have been assigned to the variety *fuscibasis* because their tegulae instead of being black incline to testaceous in varying degree. Some of them have also more or less reddish areas on the thorax. Several of the localities listed as well as the dates of capture accord with the data given for specimens of typical *collina*, and it is probable that *fuscibasis* instead of being a variety of *collina* is merely the callow stage of that insect. (See Schwarz, 1937, p. 298.)

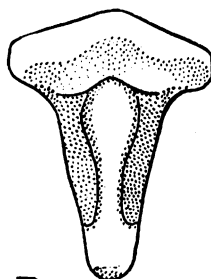
***Trigona (Tetragona) atripes* variety
rufibasalis (Cockerell)**

Trigona rufibasalis COCKERELL, 1918, *Annals and Mag. Nat. Hist.*, (9), II, p. 387.

Trigona rufibasalis var. *a* COCKERELL, 1920, *Annals and Mag. Nat. Hist.*, (9), V, p. 116.



A



B

Fig. 11A.—Sternite 6 of *Trigona (Tetragona) atripes* variety *collina* (Smith).

Fig. 11B.—Sternite 7 of the same insect.

Drawn by Mrs. Shirley H. Risser.

MALAYA.—State of Selangor: Bukit Kutu, 3500 feet, April 18, 1926, and Sept. 6, 1929 (H. M. Pendlebury). State of Pahang: Gunong Tahan, Wray's Camp, Nov. 1920 (H. Bangga); Sungei Tahan, Nov. 22, 1922 (H. M. Pendlebury). States of Selangor-Pahang: Genting Sempak Hill Stream, Sept. 11, 1926 (C. Dover). State of Johore: Mt. Ophir (type locality of variety *collina*), Aug. 11, 1905.

N. BORNEO.—Samawang, nr. Sandakan, July 9, 1927 (C. B. Kloss and H. M. Pendlebury); Bettotan, nr. Sandakan, July 31-Aug. 23, 1927 (C. B. Kloss and H. M. Pendlebury); Kudat, Sept. 3, 1927 (C. B. Kloss and H. M. Pendlebury).

Trigona rufibasalis COCKERELL, 1920A, *Philippine Journ. Sci.*, XVII, p. 228.

Trigona rufibasalis SCHWARZ, 1937, *Bul. Amer. Mus. Nat. Hist.*, LXXXIII, Art. III, pp. 283, 290, 311.

MALAYA.—State of Pahang: Kuala Tahan, 300 feet, Nov. 21, 1921 (H. M. Pendlebury).

N. BORNEO.—Samawang, nr. Sandakan, jungle, July 9-12, 1927 (C. B. Kloss and H. M. Pendlebury); Bettotan, nr. Sandakan, July 24, Aug. 3, Aug. 19, and Aug. 20, 1927 (C. B. Kloss and H. M. Pendlebury).

Bornean specimens come from localities where *collina* and *fuscibasis* were also obtained, and it is to be recalled that the type

material of *rufibasalis* itself also was collected in the same general region, namely, at Sandakan. The less emphatic darkening of the base of the forewing, which especially differentiates *rufibasalis* from *collina* and *fuscibasis*, is not to be attributed, I think, to a callow condition, for the specimens here assigned to *rufibasalis* show little or no evidences of the callow state in the coloration of their body. Indeed, they actually have darker scapes and mandibles than *collina* and *fuscibasis*, in this respect also differing somewhat even from the type of *rufibasalis*.

***Trigona (Tetragona) apicalis* variety
apicalis Smith**

Figures 10A and 12A, B, and C

Trigona apicalis SMITH, 1857, Journ. Proc. Linn. Soc., Zool., II, p. 51.

Trigona apicalis SMITH, 1871, Journ. Linn. Soc., Zool., XI, p. 395.

Melipona apicalis DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 575.

Melipona apicalis BINGHAM, 1897, 'Fauna of British India—Hymenoptera,' I, pp. 560–562. (In part only, the majority of the specimens of the Bingham collection in the British Museum being assignable to the variety *binghami*.)

Trigona collina WATERHOUSE, 1903, Trans. Entom. Soc. London, pp. 133–134, Pl. VI (nest and ♂).

Trigona apicalis COCKERELL, 1918, Annals and Mag. Nat. Hist., (9), II, p. 387 (in part).

Trigona apicalis COCKERELL, 1920, Annals and Mag. Nat. Hist., (9), V, p. 116.

Trigona apicalis COCKERELL, 1920A, Philippine Journ. Sci., XVII, p. 228.

Trigona apicalis COCKERELL, 1923, Annals and Mag. Nat. Hist., (9), XII, p. 241.

? *Trigona collina* DOVER, 1929, Bul. Raffles Mus., No. II, p. 62.

Trigona hemileuca COCKERELL, 1929A, Annals and Mag. Nat. Hist., (10), IV, pp. 140, 591.

? *Trigona apicalis* FRIESE, 1933, Naturh. Maandblad, XXII, pp. 45, 46.

Trigona sericea FRIESE, 1933, Naturh. Maandblad, XXII, pp. 45–46.

Trigona apicalis SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 282, 283, 288, 297, 300–302, 326.

Trigona sericea SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 301–302.

Trigona hemileuca SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 300, 302.

FRENCH INDO-CHINA.—Cochin China—Annam: Laonam and Blao, Prov. Haut Donai, 800–1200 meters, May 30–July 7, 1933 (M. Poilane).

SIAM.—Nakon Sri Tamarat, Khao

Luang, 2000 feet, March 18, 1922 (H. M. Pendlebury); Doi Angka, Dec. 8, 1928 (H. M. Smith); Korat, March 28, 1929, including male (H. M. Smith); Kanburi, Oct. 19, 1930; Mekham, Nov. 8, 1932 (H. M. Smith); Mesarieng, Jan. 23, 1933 (H. M. Smith).

MALAYA.—State of Kēdah: Kēdah Peak, 3300 feet, March 20, 1928 (H. M. Pendlebury); nr. Jitra, Catchment Area, April 7–11, 1928 (H. M. Pendlebury). State of Perak: Batang Padang, Jor Camp, 1800 feet, June 4, 1923, and Oct. 10, 1923 (H. M. Pendlebury), 2000 feet, Sept. 16, 1922 (E. Seimund); Larut Hills, 500–1000 feet, April 27, 1938 (H. M. Pendlebury). State of Selangor: Bukit Cherakah, July 18, 1921 (H. M. Pendlebury); Gombak Valley, Oct. 11–22, 1921 (H. M. Pendlebury), 19th–22nd mile, April 6, 1924 (H. M. Pendlebury); 17th mile Kanching, Oct. 22, 1922 (H. M. Pendlebury); Kanching, Dec. 28, 1930 (H. M. Pendlebury); Ampang, July 12, 1922 (H. M. Pendlebury); Ulu Gombak, March 4, 1928 (H. T. Pagden); Bukit Kutu, 3300 feet, March 12, 1931, and Oct. 2, 1932 (H. M. Pendlebury), 3400 feet, March 13, 1931 (H. M. Pendlebury), 3500 feet, April 19, 1926, and March 14, 1931 (H. M. Pendlebury), 3300–3500 feet, March 18–22, 1931 (H. M. Pendlebury). State of Pahang: Kuala Tahan, Nov. 22, 1923 (H. M. Pendlebury). West Coast: Langkawi Is., April 14–27, 1928 (H. M. Pendlebury). East Coast: Tioman Is., June–July 1916 (H. C. R. and C. B. K.). Singapore Island: Singapore, March 1907 (F. Muir); Bt. Timah, June 10, 1911; Botanic Garden, July 10, 1911, and June 25, 1926 (C. B. Kloss); Changi, Aug. 1911; Selitar, Aug. 1911.

S. SUMATRA.—Benkoelen, Manna, Sept. 1934 (L. G. E. Kalshoven).

W. JAVA.—Mt. Gedeh, Tapos, 800 meters, Aug. 1933 and Aug. 1–16, 1936, including three males (J. van der Vecht).

W. BORNEO.—Mowong, Sept. 1907 (F. Muir); Pontianak (F. Muir); May 1932 (J. van der Vecht).

E. BORNEO.—Kariorang, April 1937 (Mrs. M. E. Walsh).

N. BORNEO.—Samawang, nr. Sandakan, jungle, July 1927 (C. B. Kloss and H. M.

Pendlebury); Bettotan, nr. Sandakan, Aug. 15-22, 1927 (C. B. Kloss and H. M. Pendlebury); Kudat, Sept. 7-15, 1927 (C. B. Kloss and H. M. Pendlebury); Mt. Kinabalu, Kenokok, 3300 feet, April 22, 1929 (H. M. Pendlebury); nr. Kinabalu, Kabayau, 600 feet, May 8-10, 1929 (H. M. Pendlebury).

Reported also from Burma and Tenasserim (Bingham, 1897, p. 562).

Cockerell (1927, p. 541) described *Trigona apicalis peninsularis* from Batang Padang, Jor Camp, 1800 feet. Two of the specimens here assigned to typical *apicalis* come from this locality and elevation and one of them was collected on the same date (June 4, 1923) as the type of *peninsularis*.

In describing typical *apicalis* Smith (1857, p. 51) noted that the legs were "dark rufo-piceous; the posterior tibiae pale." In not a few of the specimens here reported upon all of the legs tend to be more or less bright ferruginous and that, too, is the condition in the male here described:—

♂.—HEAD black, the clypeus, sides of face adjacent to it, mandibles except extreme base, and antennae ferruginous. Facial quadrangle not so broad as in the worker, narrowed below due to the convergence of the eyes. The apico-lateral angle of the clypeus separated from the adjacent eye by about half the width of the scape. The malar space clearly demarked, the eye being separated from the base of the mandible by about half the width of the scape. The mandibles overlapping, fairly broad at the base, but narrow and parallel-sided on apical one-half to two-thirds, obtusely pointed at the tip and with a sharp denticle posterior to the tip on the inner edge. The ocelli approximately in a straight line, the middle one only a trifle anterior to the lateral ones, which are somewhat raised and tilted laterad, each ocellus being separated from the adjacent eye rather widely, the distance being about double the diameter of the ocellus. Scape thicker and shorter than in the worker; flagellum much longer than in that caste, fully four times as long as the scape; all the joints of the antennae except the second and third fully one and one-half times as long as wide. Silvery-gray pruinose to tomentose on clypeus, sides of face, front, and genae, and in addition erect blackish hairs as follows: on clypeus, especially anteriorly, front, vertex, inferior part of genae, and rather heavily bearding the under side of the mandible, the length of the last mentioned hairs being several times the width of the mandible.

THORAX in the main black, with the tegulae, pronotum, tubercles more or less ferruginous.

Covered with a low growth of dull grayish tomentum and in addition with erect blackish hairs that are longer on the mesopleura and scutellum than on the mesonotum. A dull gray tomentose patch to each side of the bare shiny middle area of the propodeum.

LEGS for the most part bright ferruginous, similar to those of the worker from the same locality (Mt. Gedeh, Tapos, W. Java). The hairs black, sparse on femora, long on inner face of middle tibiae, outer face of fore and middle tarsi, hind margin of hind metatarsi, and fringing the hind tibiae, the fringe along the posterior contour of these tibiae, like the shorter hairs on the outer face of the middle tibiae, in part plumose. The inner face of the hind metatarsi, unlike those of the worker, uniformly covered with short bristles from base to apex. Hind tibiae (Fig. 10A) wide, nearly as wide as those of worker and approximating them in shape, their apex somewhat more rounded with a small scalelike extension that is compounded of minute hairs in dense array. The hind metatarsi about one-half as wide as their tibiae and rather parallel-sided.

WINGS as in the worker, with the basal half dark, the apical half lacteous; the venation of the basal half blackish, the stigma and marginal vein bright ferruginous. Number of hamuli per lower wing 7-8. (In the worker I have found the number to vary from 6 to 9, with the average close to 7.)

ABDOMEN black, here and there suffused with red, more especially on the ventral side. Largely smooth and shiny but with the apical rims of tergites 2-5 microscopically tessellated, corresponding to the presence in these regions of ultra-minute appressed hairs. Erect black hairs sparsely present on tergite 5; longer, more numerous, and coarser black hairs on tergite 6. The sternites with semi-erect black hairs on their apical half and considerably longer black hairs fringing the toothlike extension at each lateral extremity of sternite 5; these toothlike extensions jut out laterad sufficiently to be plainly visible even when the insect is viewed from above (Fig. 12A). The last visible sternite broadly truncate, fringed along its apical edge with short black hairs (Fig. 12A). The genitalia (Figs. 12B and C) with long black needlelike sagittae that are of rather uniform narrowness, except at their broadened yellowish base, and somewhat curvilinear, especially toward the apex. The volsellae yellowish, their sinuous apical half somewhat broader than their narrow basal half, their tip somewhat pointed and with a few fine pale hairs. The shieldlike uncus broadly bilobed along its distal edge.

Of approximately the same size as the worker.

At least three of the known Indo-Malayan males of *Trigona*—those of *itama*, *terminata*, and *apicalis*—have sternite 5 rather distinctively armed. In *terminata* the two centrally located spines are far more emphatically developed than is the

small shoulder fringed with hairs at each lateral extremity (Fig. 16B) of the sternite, but in the undissected male of *terminata* these projections are nevertheless visible even when the insect is viewed from above and, although they are much smaller and of different shape, they have a rough resemblance to the homologous structures of *apicalis*. Another example of this type of

nite 5 which, as in *apicalis*, are so emphatic that they do not fail to attract attention even when the insect is viewed from its dorsal aspect. Another New World *Trigona* male that has sternite 5 very conspicuously extended at each lateral extremity is *droryana* Friese, which is a member of the subgenus *Plebeia*. Other examples might be cited.

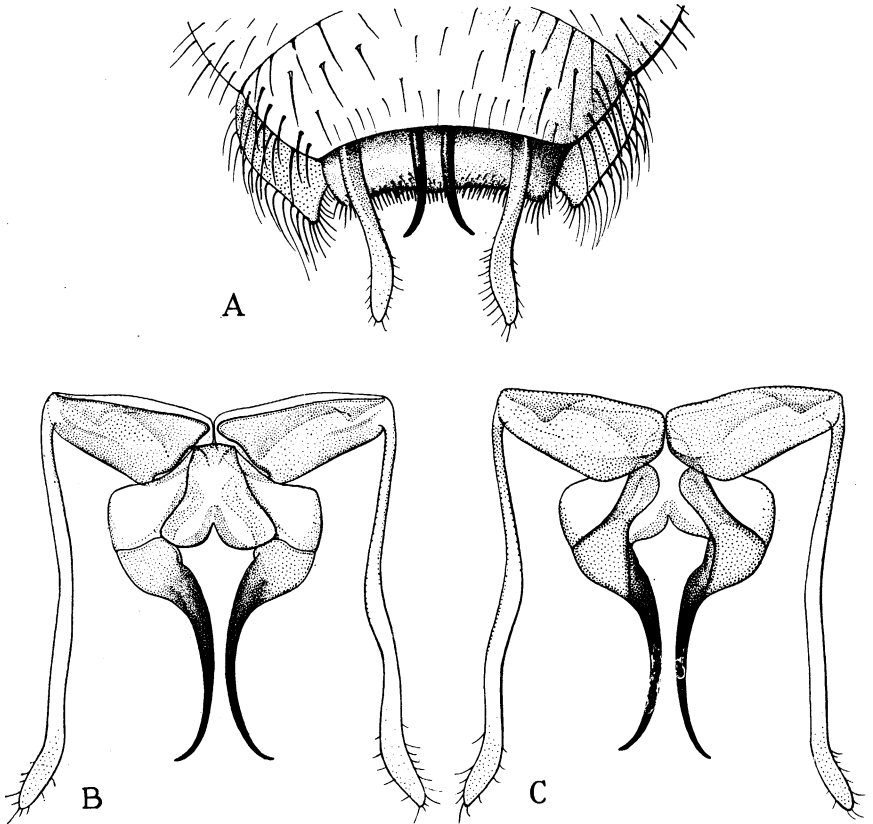


Fig. 12A.—Apical end of abdomen, viewed dorsally, of the male of *Trigona (Tetragona) apicalis* Smith, showing, in addition to the tips of the sagittae and volsellae, the toothlike to spinelike lateral expansions of sternite 5 and the rather truncate apical contour of sternite 6.

Fig. 12B and C.—Genitalia of the same insect, respectively in dorsal and in ventral view.
Drawn by Mrs. Shirley H. Risser.

armature is offered by the New World species *impunctata* Ducke, which I have placed in the subgenus *Paratrigona* (Schwarz, 1938, Bul. Amer. Mus. Nat. Hist., LXXIV, Art. VII, pp. 488–489). In *impunctata* there are shoulderlike projections at each lateral extremity of ster-

***Trigona (Tetragona) apicalis* variety *binghami* Schwarz**

Trigona apicalis variety *binghami* SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 288, 301, 303–304, 328, Pl. II, figs. D and D', Pl. V, figs. R and R', Pl. VII, fig. Z.

N. BORNEO.—Samawang, nr. Sandakan,

jungle, July 9-15, 1927 (C. B. Kloss and H. M. Pendlebury); Bettotan, nr. Sandakan, July 28-Aug. 6, 1927 (C. B. Kloss and H. M. Pendlebury); Kudat, Sept. 8, 1927 (C. B. Kloss and H. M. Pendlebury).

E. BORNEO.—Koriorang, 50 meters, April 1937 (Mrs. M. E. Walsh).

Reported also from Tenasserim and Upper Burma (Schwarz, 1937, p. 304).

***Trigona (Tetragona) apicalis* variety
melanoleuca (Cockerell)**

? *Melipona vidua* LEPELETIER, 1836, 'Histoire naturelle des Insectes—Hyménoptères,' I, p. 429.

? *Melipona vidua* DALLA TORRE, 1896, 'Catalogus Hymenopterorum' X, p. 585.

Trigona melanoleuca COCKERELL, 1929A, Annals and Mag. Nat. Hist., (10), IV, pp. 140-141.

Trigona melanoleuca SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 300, 302, 304.

SIAM.—Bangkok, April 15, 1933 (H. M. Smith).

MALAYA.—State of Perlis: Bukit Jerneh, March 17, 1936 (H. M. Pendlebury). State of Perak: Larut Hills, 3700-4000 feet, Feb. 12, 1932 (H. M. Pendlebury), 4500 feet, Feb. 20, 1932, and Feb. 22, 1932 (H. M. Pendlebury). State of Selangor: Bukit Kutu, 3500 feet, Sept. 6, 1929, and March 16-21, 1931 (H. M. Pendlebury), 3000-3500 feet, March 1931, male (H. M. Pendlebury); Kanching Forest Reserve, Jan. 26, 1930 (H. T. Pagden).¹ State of Pahang: Fraser's Hill, 4000 feet, Nov. 22, 1936 (H. M. Pendlebury). State of Selangor-State of Pahang: Semangko Pass, 2700 feet, March 1912.

S. SUMATRA.—Lamong Res., Bergen Est., 150 meters, March 28, 1937 (E. van der Vecht).

C. SUMATRA.—B. Baroe.

N. BORNEO.—Bettotan, nr. Sandakan, July 22, 1927 (C. B. Kloss and H. M. Pendlebury).

The insects here assigned to *melanoleuca* show diversity. Some of them—a series from Larut Hills and specimens from Bukit Jerneh—have the scape ferruginous or, in the case of the specimen from Fraser's Hill, at least cloudy instead of wholly or

largely black. The legs are sometimes reddish brown, with the hind tibiae more fulvous (specimens from Larut Hills), sometimes with blackish clouding on the coxae, trochanters, femora, and middle and hind basitarsi (specimen from Fraser's Hill), sometimes almost completely black to the inclusion of the hind tibiae (specimens from Bangkok, Bukit Kutu, and Bettotan). It is possible that those representing the extreme of melanism are close to or identical with what Lepeletier described as *vidua* from the Island of Timor. These dark extremes from Bukit Kutu and Bettotan, placed beside specimens from Larut Hills, which are closest to *apicalis* in their coloration, seem sufficiently contrasted to rank as a separate variety, but intergrading specimens from other regions make such a separation difficult and I have, therefore, included under *melanoleuca* all the specimens that, in other respects close to *apicalis*, differ from that insect by having the lower half of the face to the inclusion of the clypeus wholly or almost wholly blackish and the tegulae blackish instead of testaceous.

The dark coloration of the head of *melanoleuca* approximates that of *hobbyi* (p. 130).

♂.—The single male which I am assigning to this variety, while structurally like typical *apicalis*, has the sides of the face wholly black and the clypeus deep dark brown. The legs are mahogany-colored to blackish.

***Trigona (Tetragona) apicalis* variety
peninsularis Cockerell**

Trigona apicalis subspecies *peninsularis* COCKERELL, 1927, Annals and Mag. Nat. Hist., (9), XX, p. 541.

Trigona apicalis variety *peninsularis* SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, p. 302.

SIAM.—Patalung, No. Wongse, May 3, 1924 (I. H. N. Evans).

MALAYA.—State of Selangor: Gombak Valley, Oct. 12, 1921, and Oct. 13, 1921 (H. M. Pendlebury). State of Pahang: Wray's Hill, 900 feet, Dec. 9, 1921 (H. M. Pendlebury). State of Selangor-State of Pahang: nr. Genting Sempak Hill Stream, Sept. 11, 1926 (C. Dover).

Two of the localities above listed—Gom-

¹ The reserve consists almost entirely of a pure stand of *Dryobalanops aromatica* (Borneo camphor), according to Pagden.

bak Valley and Patalung—are also cited by Cockerell as the collecting sites of his co-types of *peninsularis*. One of the specimens from Gombak Valley was, indeed, supplied to me by Professor Cockerell and was determined by him as *peninsularis*. The specimens before me from Patalung correspond not only as to locality but also in respect to date and collector with Cockerell's citations of his type material. These specimens and all of the other specimens here assigned to *peninsularis* agree in having the malar space longer than in typical *apicalis*. It is about as long as the mandible is wide at the base whereas in typical *apicalis* the malar space is decidedly shorter than the width of the mandible at the base. As Cockerell has indicated, the abdomen of *peninsularis* is variable in coloration, but as a rule it is more distinctly red or brown than is the usually darker abdomen of the typical variety.

In all other structural respects except the length of the malar space the worker of *peninsularis* is so like that of typical *apicalis* that it seems best perhaps to continue to regard *peninsularis* as a variety of *apicalis* rather than as an independent species, but a final determination of the status of *peninsularis* awaits the discovery of the male of that insect.

The size of the head, structure of mandibles, and length of malar space in the worker of *peninsularis* are virtually identical with the condition in the worker of *haematoptera*, but the latter is one of the few Malayan *Trigona* that has erect hairs all over its clypeus, whereas *peninsularis* has at most a few hairs along the apex of the clypeus.

***Trigona* (*Tetragona*) *hobbyi* Schwarz**

Trigona hobbyi SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 283, 288, 298–300.

Trigona hobbyi was described from Borneo.

When the key to the present paper was prepared, the type of *hobbyi* was not accessible and hence it seemed hazardous to include it. Belonging to the *Trigona* with sharply contrasted dark basal and milk-white apical half of wing, it most clearly re-

sembles in its dark coloration *Trigona apicalis* variety *melanoleuca* but is readily separable from that insect by its greater malar space, which is nearly as long in *hobbyi* as the mandible is wide at the base.

HYPOTRIGONA COCKERELL

***Trigona* (*Hypotrigona*) *scintillans* Cockerell**

Trigona scintillans COCKERELL, 1920, Annals and Mag. Nat. Hist., (9), V, p. 116.

Trigona scintillans COCKERELL, 1920A, Philippine Journ. Sci., XVII, p. 228.

Trigona scintillans COCKERELL, 1929A, Annals and Mag. Nat. Hist., (10), IV, p. 590.

Trigona scintillans SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 289, 307, 327, Pl. VII, fig. X.

MALAYA.—State of Selangor: Bukit Kutu, 200 feet, Sept. 21, 1932 (H. M. Pendlebury).

This species, though rare, is one of wide if seemingly scattered distribution. It was described from Borneo (Cockerell, 1920, p. 116) and was subsequently reported from northern Siam and from French Indo-China (Cockerell, 1929, p. 590).

***Trigona* (*Hypotrigona*) *pendleburyi*, new species**

Figure 13A and B

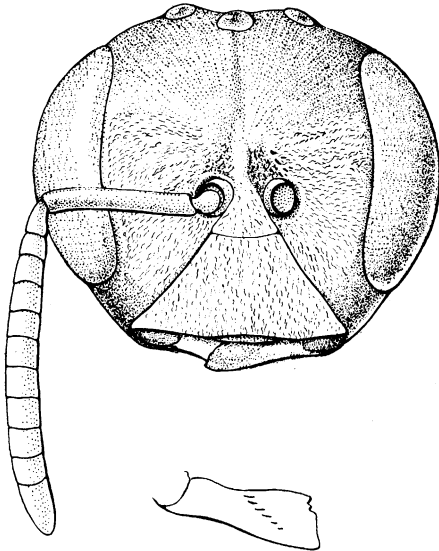
♀.—HEAD (Fig. 13A) somewhat wider than long, approximately as wide as the distance between the outer rim of one tegula and the outer rim of the other. Fairly shiny, especially on the upper half of the head, notwithstanding the presence of many appressed microscopic hairs that gives its mainly smooth surface a very feebly tessellated appearance here and there, more particularly on the clypeus. Eyes virtually parallel to each other, almost without convergence below, and relatively short. The malar space very long, only a little shorter than the distance between the compound eye and the lateral ocellus. The clypeus wide and short, fully twice as wide as long, and flat, virtually on a level with the sides of the face, its apico-lateral angles far removed from the eyes, its sides uninterruptedly oblique, its apex broadly subtruncate. The labrum simple. The mandible (insert of Fig. 13) edentate along the outer two-thirds of its apex but with two feeble denticles (seen only under high magnification) on the inner one-third, the penultimate denticle sometimes virtually obsolete. The frontal suture deep. The middle ocellus barely anterior to the lateral ocelli, which are separated from each other by a distance only a little greater than that which separates each lateral ocellus from the adjacent

eye. The scape about half as long as the flagellum and somewhat more slender. Head black, with the clypeus, labrum, and mandibles (except their black basal prominences) dark brownish to dull ferruginous; the flagellum rather uniformly darkish as is the scape, but the base of the scape tends to be light brownish like the antennal sockets. Head silvered over with appressed microscopic gray hairs that are denser on the lower half than on the upper half; very short inconspicuous erect gray hairs, not shown in Fig. 13A, on vertex, labrum, and inwardly on the under side of head.

THORAX black except for a ferruginous spot on the tubercles and the bright ferruginous tegulae.

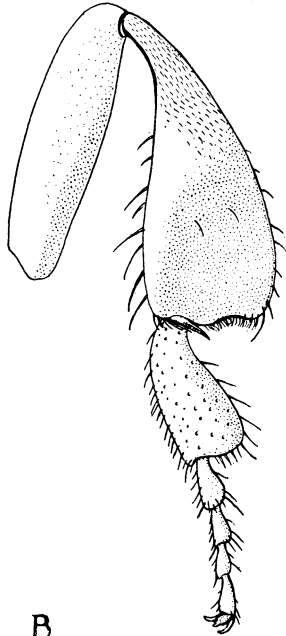
propodeum extended backward down-slopingly for a distance somewhat greater than the length of the scutellum.

LEGS.—The fore and middle legs from the base of the tibiae to the inclusion of all of the tarsal joints an unstained bright ferruginous as are also the tarsal joints (exclusive of the metatarsi) of the hind legs and the trochanters of all of the legs. The other joints brownish black to black. The hairs silvery-gray but sparse, erect hairs (as distinguished from the appressed downlike microscopic hairs) absent or virtually absent from the femora, the front tibiae, and the external surface of the middle tibiae although present on the under side of the middle tibiae and



A

Fig. 13A.—The head of the worker of *Trigona* (*Hypotrigona*) *pendleburyi*, with mandible inserted.



B

Fig. 13B.—The hind leg, with special reference to the tibia, metatarsus, and lower tarsal joints, of the same insect.

Drawn by Mrs. Shirley H. Risser.

Mesonotum and scutellum covered rather densely with appressed microscopic pale hairs that somewhat dull the sheen of the chitin and give it the appearance of being faintly tessellated. A deep fossa separates the mesonotum from the scutellum; the scutellum has a few horizontally growing hairs along its posterior edge. The mesopleura likewise with silvery hairs that are mostly appressed, but erect hairs occur toward the under surface; the integument of the mesopleura smooth and rather shiny. A patch of rather dense gray hairs to each side of the shiny hairless middle area of the propodeum. The

the under side of all of the trochanters. The hind tibiae (Fig. 13B) with exceedingly short, pale hairs along their posterior margin and similar hairs that are somewhat longer fringing their anterior margin. The inner surface of the hind metatarsi *without* a differentiated flat bristleless oval area at the base, being rather uniformly hairy. The hind tibiae clavate to pear-shaped in outline, slender at the base and rather broad at the apex, their greatest width being a little more than two-fifths of their length; the apex of these tibiae irregular in outline, consisting of a slight incurved angulation

posteriorly, a feeble angulation anteriorly, and a rounded contour between. The hind metatarsi only about one-half as wide as their tibiae.

WINGS hyaline and iridescent, the stigma, venation, and tegulae ferruginous. The hamuli in each lower wing vary from 5 to 6.

ABDOMEN rather compact, about as wide as the thorax but, unless distended, usually appearing a little shorter, deep reddish brown (especially on the basal segments) to black. The basal tergites shiny and virtually devoid of hair (a few inconspicuous pale microscopic appressed hairs along the apex of tergite 3 and sometimes also of 2). The very slightly dulled apex of the subsequent tergites (usually all that is revealed) with somewhat more conspicuous pale hairs, although these, too, are shorter than the erect hairs down the middle of the under side of the abdomen.

Length $2\frac{1}{2}$ to $2\frac{3}{4}$ mm.; width about $\frac{3}{4}$ mm.; length of forewing, including tegula, about 3 mm.

♀.—Unknown.

♂.—Unknown.

This little bee—one of the smallest reported from the Indo-Malayan region—is comparable in size with the diminutive *Trigona fusco-balteata* and *Trigona scintillans*. From both of these it sharply differentiates itself by its long malar space, which is merely vestigial in *fusco-balteata* and *scintillans*. With *scintillans* and the much larger and otherwise differentiated *fimbriata* the present bee shares the distinction of having no bristleless oval area at the base of the inner surface of the hind metatarsi.

MALAYA.—State of Pahang: Cameron Highlands, G. Tarbakar, 4500 feet, June 9, 1923 (H. M. Pendlebury); Cameron Highlands, Rhododendron Hill, 5000 feet (holotype) and 5200 feet, June 19, 1923, and June 22, 1923 (H. M. Pendlebury); Cameron Highlands, Bukit Lendong, 5000 feet, May 21, 1931 (H. M. Pendlebury); Lubok Tamang, 3500 feet, March 5, 1924, and 4000 feet, June 10, 1923 (H. M. Pendlebury); Fraser's Hill, 4600 feet, Pine Tree Hill, Oct. 25, 1932 (H. M. Pendlebury).

***Trigona (Hypotrigona) pendleburyi*
variety *klossi*, new variety**

♀.—Like *pendleburyi* structurally but the pale maculations more extensive. The clypeus, labrum, and mandibles (except their black basal prominences) bright ferruginous instead of brownish to dull ferruginous; the flagellum ferruginous to or virtually to the apex; the scutellum ferruginous (sometimes a basal dark spot) instead of wholly black; the front and middle

femora ferruginous like their tibiae and tarsi instead of black; the hind femora wholly ferruginous or slightly darkened only at the apex, and the basal part of the hind tibiae also ferruginous; the hind metatarsal joint usually ferruginous like the remaining joints; the venter usually ferruginous. In addition, this variety has the bright ferruginous tegulae and a ferruginous spot on the tubercles as well as the ferruginous trochanters noted for the typical variety.

MALAYA.—State of Selangor: Bukit Kutu, 200 feet, Sept. 21, 1932, including holotype (H. M. Pendlebury). State of Pahang: Kuala Teku, 500 feet, Dec. 8, 1921 (H. M. Pendlebury).

N. BORNEO.—Bettotan, nr. Sandakan, July 28, 1927, and Aug. 15, 1927 (C. B. Kloss and H. M. Pendlebury).

LEPIDOTRIGONA, NEW SUBGENUS

Type species *nitidiventris* Smith.

Lepidotrigona, like the New World subgenus *Paratrigona*, has sculpturing that is exclusively tessellate, such tessellation being present in the case of *Lepidotrigona* over the head, thorax, propodeum, apical abdominal tergites and also often on the apical rims of the intermediate tergites and more or less also on the legs. Unlike all *Paratrigona* workers with the exception of the rather aberrant *schröttkyi* (which in most respects seems a borderland species between *Paratrigona* and *Plebeia* rather than between *Paratrigona* and *Lepidotrigona*) members of the subgenus *Lepidotrigona* have in the worker merely two denticles toward the inner end of the apex of the mandible instead of a more or less distinctly quadridentate condition of the mandible. The scutellum of *Lepidotrigona* is not produced to over-roof or partly over-roof the propodeum, which extends backward down-slopingly for a distance distinctly greater than the length of the scutellum. In *Paratrigona* there is always a backward extension of the scutellum even though it be slight, as in *P. lineata* and *P. schröttkyi*. Maculation of the thorax is usual in most *Paratrigona*, but in *Lepidotrigona* there is, instead, an enclosing frame of short, thick, rather scalelike or tomentose pale to yellowish hairs bordering the mesonotum and sometimes the scutellum, which ornamentation, although occasionally blurred or even lacking in individual specimens, is on the whole so characteristic that it has suggested the name for the subgenus. The hind tibiae of *Lepidotrigona* workers are in some of the forms greatly expanded, in others less so, more nearly approaching the condition of some *Paratrigona*.

The tessellated sculpturing that characterizes *Lepidotrigona* and *Paratrigona* is shared also by most *Hypotrigona*, but that subgenus is usually readily separated from the other two by the character of its wings (Schwarz, 1938, Bul. Amer. Mus. Nat. Hist., LXXIV, Art. VII, p. 498, Pl. LX).

The only male of *Lepidotrigona* known to me is the one which I interpret as the male of *terminata* or possibly a new variety of *terminata* (p. 137). Several males of the Indo-Malayan *Trigona*—*apicalis* and *itama* in addition to the present insect—have distinctive armature on sternite 5, but in none of the species in which the male is known are the spines so medianly placed or so peculiarly cleft at the apex as in this putative male of *terminata*.

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

Figure 14

- Trigona nitidiventris* SMITH, 1857, Journ. Proc. Linn. Soc., Zool., II, pp. 50-51.
Trigona nitidiventris SMITH, 1871, Journ. Linn. Soc., Zool., XI, p. 395.
Melipona nitidiventris DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 582.
Trigona fulvopilosella CAMERON, 1908, Entomologist, XLI, pp. 192-193, 194.
? *Trigona palavanica* COCKERELL, 1915, Annals and Mag. Nat. Hist., (8), VI, pp. 2-3.
? *Trigona palavanica* COCKERELL, 1919, Philippine Journ. Sci., XIV, p. 77.
Trigona nitidiventris COCKERELL, 1920, Annals and Mag. Nat. Hist., (9), V, p. 115.
? *Trigona palavanica* COCKERELL, 1920A, Philippine Journ. Sci., XVII, p. 229.
Trigona nitidiventris COCKERELL, 1923, Annals and Mag. Nat. Hist., (9), XII, pp. 240-242.
Trigona nitidiventris SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 292-293.

MALAYA.—State of Perak: Jor Camp, 2000 feet, Aug. 21, 1922 (E. Seimund); Batang Padang, Jor Camp-L. Tamang, 7th mile, March 10, 1924 (H. M. Pendlebury). State of Selangor: Genting Bidai, 2000 feet (C. B. Kloss); Gombak Valley, Oct. 20, 1921 (H. M. Pendlebury); Bukit Kutu, 3485 feet, Jan. 30, 1930 (H. T. Pagden). State of Pahang: Sungei Tahan, Nov. 22, 1922 (H. M. Pendlebury); Fraser's Hill, 4200 feet, June 2, 1936 (H. M. Pendlebury). State of Selangor-State of Pahang: Sempak Hill Stream, Sept. 11, 1926 (C. Dover).

S. SUMATRA.—Kedaton, Wai Rilau, 150 meters, March 26, 1932 (J. van der Vecht).

The not clearly separable *fulvopilosella* was described from Borneo (Cameron, 1908, p. 194).

Judging from Cockerell's description of *palavanica*—"Hind tibiae and basitars i greatly expanded"—it would seem that that insect probably is structurally like *nitidiventris*, although possibly darker in respect to the coloration of its wings. The degree of expansion in the hind tibiae of the worker of *nitidiventris* is illustrated in figure 14.

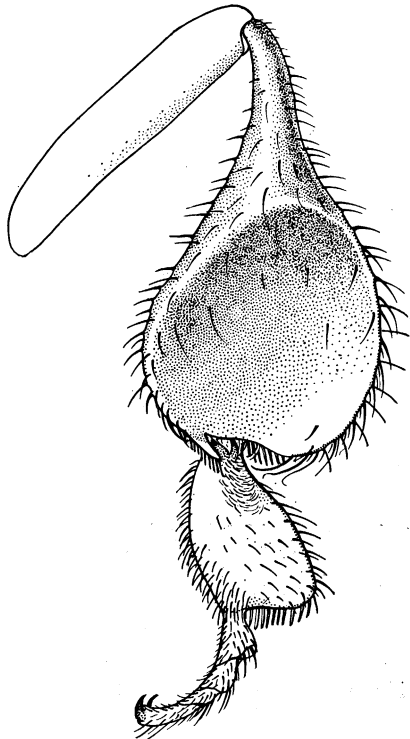


Fig. 14.—The hind leg of the worker of *Trigona* (*Lepidotrigona*) *nitidiventris* variety *nitidiventris* Smith.

Drawn, with special reference to the tibia, metatarsus, and lower tarsal joints, by Mrs. Shirley H. Risser.

***Trigona* (*Lepidotrigona*) *nitidiventris*
variety *trochanterica* (Cockerell)**

- Trigona trochanterica* COCKERELL, 1920, Annals and Mag. Nat. Hist., (9), V, p. 115.
Trigona trochanterica COCKERELL, 1920A, Philippine Journ. Sci., XVII, p. 228.
Trigona trochanterica SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 285, 287, 292-293, 327.

MALAYA.—State of Selangor: Bukit Kutu, 200 feet, Sept. 21, 1922 (H. M. Pendlebury). State of Pahang: Gunong

Tahan, Wray's Camp, Nov. 1920 (J. Bangga).

This insect was described from Borneo (Cockerell, 1920, p. 115).

There is only one specimen from each of the above localities of Malaya, and these are a little more melanistic than *trochanterica*. Nevertheless, on a conservative interpretation, they seem to me to be assignable to that variety. They share with *trochanterica* the black (as contrasted with fulvous) bristles on the vertex and have black bristles on the anterior part of the mesonotum and on the scutellum (no "short fulvous tomentum" as in the type specimen). Also their trochanters are black or clouded dark reddish, not "for the most part bright ferruginous." The tegulae are black not "dull ferruginous" and the venter ivory-colored rather than "clear red." The absence of the scalelike fulvous tomentum on the mesonotum is not unusual in *nitidiventris* and *ventralis*, and the other differences between the two specimens here assigned to *trochanterica* and the type of *trochanterica* seem to me mainly differences of degree.

***Trigona (Lepidotrigona) nitidiventris*
variety *latipes* (Fries)**

Trigona latipes FRIESE, 1900, Termés. Füzetek, XXIII, p. 384.

Trigona latipes SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 293-294.

MALAYA.—State of Perak: Jor Camp, 2000 feet, Aug. 21, 1922 (E. Seimund).

S. SUMATRA.—Benkoelen, Manna, Sept. 1934 (Kalshoven).

Trigona latipes was described on the basis of a single worker from Singapore. I have not seen the type but, as Fries refers to the bee as "ferruginea, capite mesonotoque nigris," it is to be assumed, I think, that the thorax with the exception of the mesonotum was ferruginous. In a metatopotype of *latipes* in the American Museum the mesopleura, metapleura, scutellum, and propodeum are red, and this is the condition, too, in the single specimen reported here from Jor Camp, Perak. In the specimens here assigned to typical *nitidiventris*, on the other hand, these parts are black.

There is structurally no difference be-

tween *latipes* and *nitidiventris*, so that the former is at most a variety of the latter. It is even possible that *latipes* is merely a callow, *nitidiventris* the fully matured individual. The fact that there is a specimen of *latipes* from Jor Camp and of typical *nitidiventris* from the same locality, with identical data, makes one a little suspicious that this may be the case.

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

Trigona ventralis SMITH, 1857, Journ. Proc. Linn. Soc., Zool., II, p. 50. (Specimens from Sarawak only.)

Trigona ventralis SMITH, 1871, Journ. Linn. Soc., Zool., XI, p. 395.

Melipona ventralis DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 584.

Melipona ventralis BINGHAM, 1897, 'Fauna of British India—Hymenoptera,' pp. 561, 562-563.

Trigona ventralis COCKERELL, 1923, Annals and Mag. Nat. Hist., (9), XII, p. 241.

Trigona ventralis SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 282, 283, 284, 285, 287, 294-295, 296, 326, Pl. III, fig. I, Pl. VII, fig. Y.

N. BORNEO.—Bettotan, nr. Sandakan, July 21, 1927 and Aug. 16, 1927 (C. B. Kloss and H. M. Pendlebury).

Trigona ventralis has been reported from Tenasserim (Bingham, 1897, pp. 562-563) but, as no mention is made in the accompanying description of the color of the hairs fringing the hind tibiae, it is possible that one of the varieties of *ventralis* other than the typical variety is involved. Smith's type material of *ventralis* was in all probability composite and the record Smith gives from Mount Ophir does not apply to *ventralis* as here interpreted or as represented by Smith's type material from Sarawak, Borneo (Schwarz, 1937, p. 294).

The specimens above reported from Bettotan have, like Cockerell's *arcifera* and *flavibasis*, a semicircular transverse dark brown band on tergite 1 instead of the two isolated dark spots usual in *ventralis*, but seem in all other respects too close to *ventralis* to justify separation from it even as a variety.

***Trigona (Lepidotrigona) ventralis*
variety *flavibasis* (Cockerell)**

? *Trigona arcifera* COCKERELL, 1929A, Annals and Mag. Nat. Hist., (10), IV, pp. 591-592.

Trigona flavibasis COCKERELL, 1929A, *Annals and Mag. Nat. Hist.*, (10), IV, p. 592.

SIAM.—Chieng Mai, Oct. 26, 1920; Pat Meeung, Jan. 18, 1928 (T. D. A. Cockrell).

MALAYA.—State of Perak: Perak, 1902; Jor Camp, 2000 feet, Aug. 21, 1922 (E. Seimund); Batang Padang, Jor Camp-L. Tamang, 7th mile, March 10, 1924 (H. M. Pendlebury). State of Selangor: Ampang For. Reserve, Oct. 28, 1928 (H. M. Pendlebury). State of Pahang: Fraser's Hill, Sept. 30, 1929 (N. C. E. Miller).

S. SUMATRA.—Kedaton, Wai Rilau, 150 meters, March 26, 1937 (J. van der Vecht).

JAVA.—Tjibodas Gedeh, 1400 meters, June 27, 1932 (H. R. A. Muller).

B. N. BORNEO.—Mt. Kinabalu, Kenok, 3200 feet, April 23–24, 1929 (H. M. Pendlebury).

Instead of the two blackish spots on the cream-colored first tergite, which is the usual condition in typical *ventralis*, the type of *flavibasis* and the specimens here assigned to *flavibasis* have a blackish semi-circular band on the apical half of this tergite (also present in *arcifera*, described from Testa Bridge in the Himalayas). The wing length of the type of *flavibasis* and of the present specimens is just a shade longer than that of the specimens here assigned to typical *ventralis*, but is distinctly shorter than in *terminata*. The most tangible difference between typical *ventralis* and *flavibasis* is, however, the coloration of the hairs fringing the hind tibiae—white in typical *ventralis* but black in *flavibasis* (also black in *arcifera*). In the key I prepared (1937, pp. 287–292) to the *Trigona* from Borneo, one of the indicated distinctions separating *ventralis* from *terminata* variety *lateballeata* was the color of the hairs fringing these tibiae, which were noted as pale in the case of *ventralis* but black for *terminata* variety *lateballeata*. This seemed at the time a valid distinction not only between *ventralis* and *terminata* variety *lateballeata* but also between *ventralis* and other varieties of *terminata*. However, as the present case indicates, *ventralis* sometimes assumes the livery of *terminata*. Notwithstanding the approximation of *ventralis* to *terminata* in this re-

spect, the two species are readily separable on the basis of their size, maculation, and usually by the distribution of the short scalelike hairs of the thorax. In the case of typical *ventralis* these scalelike hairs, when present, frame the mesonotum only, the scutellum being devoid of such thatching although it has rather long erect hairs. On the other hand, *terminata* varieties, in addition to the scalelike hairs of the mesonotum, have a semicircular band of such hairs rimming the hind margin of the scutellum and sometimes encroaching deeply on the hairless basal area.

One of the specimens from Sumatra and two from Borneo have the scalelike hairs of the mesonotum almost completely obliterated; in the specimen from Fraser's Hill they are very poorly developed, and this is the case also in the type specimen of *flavibasis*.

The type specimen has darker mandibles, legs, and tegulae than most of the specimens before me. These have the mandibles fulvous to testaceous, tegulae testaceous, legs testaceous to brownish black, abdomen often more or less reddish to brownish. Of two specimens from Kedaton in southern Sumatra one virtually duplicates the coloration of the type of *flavibasis*, the other is more reddish. I am under the impression that the specimens showing varying degrees of testaceous are probably emerging from the callow state but have not yet fully acquired the darker coloration. At any rate, I hesitate to describe them as yet another variety of *ventralis*. It is possible that these more reddish specimens come in any event very close to *arcifera*. Most of them have a slight suffusion of reddish on the clypeus and two or three of them have a faint pallid transverse line just before the apex as described for *arcifera*. The type of *flavibasis*, according to my measurement, is 3 1/2 mm. long and its several parts correspond in size approximately with those of *ventralis*, not with those of *terminata*.

Trigona (*Lepidotrigona*) *ventralis* variety *hoosana*, new variety

♀.—HEAD finely and densely tessellated, black except for the antennal sockets and the extreme base of scape, which are fulvous, and

the mandibles, which are more or less dull brownish, approximating the condition of *flavibasis*.¹ The face and the cheeks silvery-gray pruinose as in *flavibasis*, with silvery-gray erect hairs on the labrum, mandibles below, lower part of cheeks, front, and especially on vertex, duplicating the condition in *flavibasis*.

THORAX black, immaculate, finely and densely tessellated over most of its surface; bare middle area of propodeum with more superficial sculpturing and resulting semi-shininess. Erect silvery-gray hairs on mesonotum and particularly on the scutellum, where they are longer, and on the mesopleura. The pale scalelike hairs framing the mesonotum and thatching the mesopleura far denser and more abundant than in *flavibasis*.

LEGS largely or wholly black except for the ferruginous lower joints of the tarsi. For the most part with silvery-gray hairs, even on the external surface of the front and middle tibiae and their metatarsi, where *flavibasis* has blackish hairs. The metatarsal brushes golden to copper-colored. The hairs fringing the posterior contour of the hind tibiae black or blackish as in *flavibasis*.

WINGS of approximately the same clarity and with the same brownish venation and stigma as in *flavibasis*, but somewhat longer, about as much longer than those of *flavibasis* as the wings of *flavibasis* are longer than those of typical *ventralis*, although still considerably shorter than those of *terminata*.

ABDOMEN with a semicircular black band partly rimming the depressed area at the base of the otherwise ivory-colored tergite 1, similar to that of *flavibasis* but narrower. Differs from *flavibasis* in having the apex of tergite 5 and all of tergite 6 ivory-colored to faintly yellowish and the venter largely of corresponding hue. The ventral hairs, as in *flavibasis*, silvery-gray.

Length, about 3 3/4 to 4 mm.; width about 1 1/4 mm. Length of forewing about 5 mm. (about 4 1/2 mm. in *flavibasis*).

FORMOSA.—Taihorin, March 10 and May 10 (H. Sauter).

The specimens on which this variety is based are five in number and were labeled *Trigona ventralis* variety *hoosana* by Friese, from whom they were obtained. I cannot find in the literature any record of *hoosana* and assume, therefore, that, as in the case of Friese's *geissleri*, publication was not completed and that *hoosana* has remained until now a manuscript name. The variety *hoosana* is, as the description indicates, very close to variety *flavibasis* but differs especially in the greater length of the wing, in the lighter hairs on the tibiae and tarsi of the anterior and middle legs, and in hav-

ing the apical tergite and the apical part of tergite 5 pale yellowish white.

Trigona (Lepidotrigona) ventralis variety *doipaensis*, new variety

♀.—Structurally like typical *ventralis* but somewhat larger, with the head as wide and the forewing as long as in variety *flavibasis*. Differs from typical *ventralis* and from the varieties *flavibasis* and *hoosana* in having black, instead of silvery-gray or ochraceous, erect hairs on the vertex and on the scutellum, and from typical *ventralis* furthermore in having black hairs, instead of silvery-gray, fringing the hind tibiae. Hairs of the fore and middle tibiae likewise black. Silvery-gray hairs on following parts:—pruinose on face and cheeks; erect as well as appressed on mesopleura; scalelike bordering mesonotum, sparse on sides, slightly broader along anterior margin; tomentose on each side of bare middle area of propodeum; erect on under side of abdomen.

Black for the most part. Eyes brown. Reddish are:—labrum; mandibles except black apical border and basal prominences; a somewhat dulled stripe along apex of clypeus; antennal sockets, base of scape, flagellum below, strongly so on third antennal joint. Tegulae black; stigma and venation reddish brown. Legs black except for reddish tarsal joints beyond metatarsi. Abdomen unlike that of *ventralis* and its other varieties in that the pale area on tergite 1 occupies only the depressed basinlike part at the base, all the rest of the tergite being dark. Abdomen of holotype black above, tending to brownish on last two tergites; in the three paratypes chestnut brown to dark brown—possibly due to immaturity. Venter somewhat lighter brownish than the dorsal aspect.

Length 3 1/2 to 4 mm.; width of thorax about 1 1/4 mm.; length of forewing about 4 1/2 mm.

SIAM.—Doi Pa, Mai Deng, 750 meters, Dec. 29, 1932 (H. M. Smith).

Easily distinguished from the other varieties of *ventralis* by the erect black hairs on vertex and scutellum and the almost wholly dark tergite 1. In most other respects like the variety *flavibasis*.

Trigona (Lepidotrigona) terminata variety *terminata* Smith

Figures 15 and 16A, B, C, D, and E

Trigona terminata SMITH, 1878, Journ. Asiatic Soc. Bengal, XLVII, p. 169.

Melipona terminata DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 584.

Trigona ventralis form *terminata* BINGHAM, 1897, 'Fauna of British India—Hymenoptera,' I, p. 563.

Trigona fulvomarginata COCKERELL, 1929A, Annals and Mag. Nat. Hist., (10), IV, p. 591.

¹ In making the comparisons of this description I have used throughout the type itself of *flavibasis*.

Trigona terminata SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 295, 296.

Trigona fulvomarginata SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 295, 296.

FRENCH INDO-CHINA.—Cambodia: Angkor, Feb. 20, 1928 (W. P. Cockerell).

SIAM.—Nakon Sri Tamarat, Khao Luang, 2000 feet, March 12, 1922, and 2000–2500 feet, March 27, 1922 (H. M. Pendlebury); Ban Kiriwong, July 13, 1928 (H. M. Smith); Ta Salva, Kanburi, July 10, 1930; Mekham, Feb. 8, 1932 (H. M. Smith); Doi Rua Nuok, nr. Mesarieng (H. M. Smith); Khon Ka Valley, Jan. 26, 1933 (H. M. Smith).

MALAYA.—State of Perak: Batang Padang, Jor Camp-L. Tamang, 7th mile, March 10, 1924 (H. A. Pendlebury). State of Selangor: Sungai Chongka', Ulu Langat, on damp sand by the stream, Feb. 10, 1929 (H. T. Pagden); Bukit Kutu, 200 feet, Sept. 21, 1932 (H. M. Pendlebury); Bkt. Cheraka, Aug. 30, 1936 (H. T. Pagden). State of Pahang: Kuala Teku Jungle, 500–1200 feet, Nov. 25, 1922 (H. M. Pendlebury). State of Johore: Sungai Palong, May 15–23, 1930 (D. S. Inglis).

S. SUMATRA.—Benkoelen, Manna, Sept. 1934, males (L. G. E. Kalshoven); Lampong Res., Bergen Est., 150 meters, March 28, 1937 (J. van der Vecht).

E. JAVA.—Bondowoso Res., Blawan Est., Dec. 1935 (L. J. Tokopeus), May 23, 1926 (H. Lucht).

Trigona terminata was described from Tenasserim (Smith, 1878, p. 169).

Although the type specimen of *terminata* (79.22) in the British Museum lacks the fore and middle legs, the description of Smith would seem to leave little doubt that these legs as well as the hind pair were largely black, for the only joints which he mentions as ferruginous are the small joints of the tarsi. It seems to me that *fulvomarginata* is scarcely to be separated from typical *terminata*. Cockerell (1929A, p. 591) had not seen the type of *terminata* but surmised that it might have priority over *fulvomarginata*. Typical *terminata* as I interpret it has more extensively blackened legs than has the form *lateballeata* in which the fore femora and tibiae as well as

the middle femora and hind femora beneath and within are wholly or largely ferruginous, these parts tending to be wholly or largely black in typical *terminata*. Specimens from Mekham in north Siam have a somewhat wider head than have the other specimens.

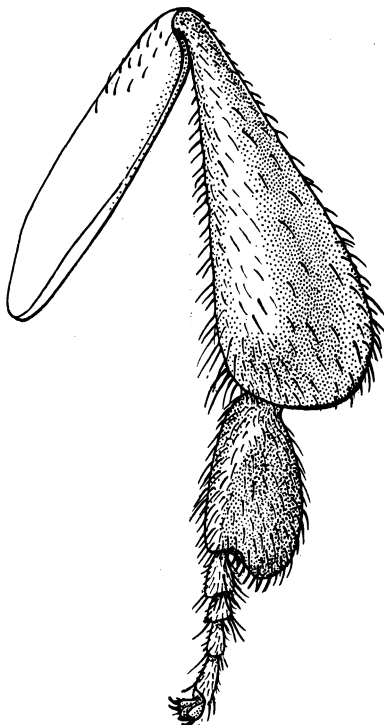


Fig. 15.—The hind leg of the male of *Trigona* (*Lepidotrigona*) *terminata* Smith.

Drawn, with special reference to the tibia, metatarsus, and lower tarsal joints, by Mrs. Shirley H. Risser.

The males collected in Sumatra are tentatively placed in *terminata* variety *terminata* but may be an independent variety. Due to the fact that these males are unaccompanied by workers, it is difficult definitely to assign them:—

♂.—HEAD. Tessellated. Facial quadrangle narrower, especially below, than in worker of *terminata* due to the convergence of the large eyes, the antero-lateral angles of the clypeus virtually contacting the rim of the eyes. The malar space emphatically reduced from the condition in the worker, obsolete on the inner side, widened toward the outer side, its length at

the middle subequal to the width of the single denticle at the inner apical end of the slightly overlapping mandibles. The mandibles somewhat broader on their basal half, narrower and parallel-sided on their apical half, with bluntly pointed tip, supplemented inward by a denticle. The eyes almost in a straight line, the middle ocellus only slightly anterior to the lateral ocelli, which are slightly more elevated and are tilted

Two of the specimens lack the pale transverse stripe along the apex of the clypeus characteristic of the worker; in the third specimen only the lateral extremities of the stripe have survived as sundered spots. Ferruginous are in addition: labrum, apical half of mandibles except for the deeper red tip, and basal half or one-third of scape, at least in front. The head for the most part silvery-gray pruinose with more or less con-

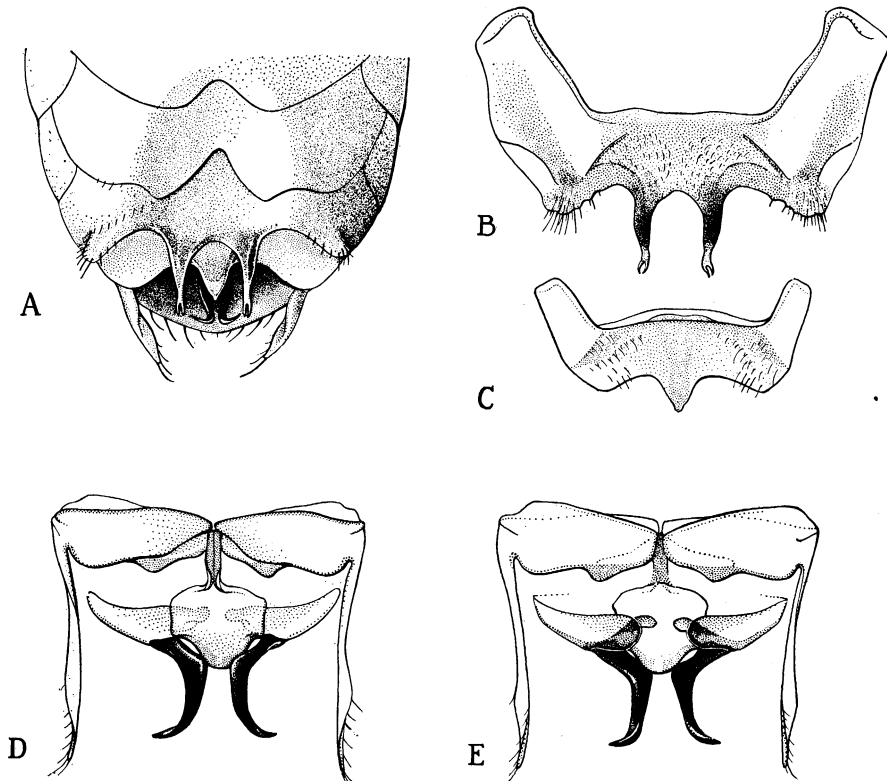


Fig. 16A.—The apical half of the abdomen of the male of *Trigona (Lepidotrigona) terminata* Smith, viewed ventrally, showing the characteristic spines with cleft apex that extend from the depressed middle region of sternite 5.

Fig. 16B.—Showing sternite 5 of the same insect in greater detail. The middle area (corresponding with the area of depression) is reddish in coloration as are the apices of the otherwise black spines and the exposed apico-lateral angles; the broad backward-directed and usually concealed sides of the sternite are for the most part hyaline but are traversed longitudinally by a broad blackish streak.

Fig. 16C.—Sternite 6 of the same insect.

Fig. 16D and E.—The genitalia of the same insect, respectively in dorsal and in ventral view. Drawn by Mrs. Shirley H. Risser.

each toward the nearest compound eye, being separated from that compound eye by about one and one-half times the diameter of an ocellus. The antennae longer than in the worker, all of the joints beyond the third being distinctly longer than wide, with joint 4 and the apical joint slightly longer than the others. The total length of the flagellum is fully four times that of the short scape. Maculations restricted.

colourous erect hairs on the front, vertex, inferior part of cheeks, and on lower edge of mandibles, those of the vertex inclined to ochraceous.

THORAX tessellated and black; tegulae ferruginous and a spot of ferruginous on the tubercles. The mesonotum framed with a narrow border of ochraceous scalelike appressed hairs, its dorsum seeming on first impression to be bare but really microscopically sericeous. The short,

non-salient scutellum also bordered posteriorly with scalelike pale hairs, which are abundantly represented likewise on the axillae. Erect hairs lacking on the scutellum except on the posterior edge, the dorsum of the scutellum being covered with microscopic appressed hairs. The mesopleura with rather short silvery-gray hairs, those on the anterior part scalelike; silvery-gray tomentum to each side of the bare middle area of the elongate down-sloping propodeum, which has feebler tessellation than the thorax.

LEGS for the most part black or blackish, with the trochanters, sometimes the basal part of the femora, the inner face of the hind metatarsi, and the small joints of all the tarsi ferruginous. Hairs (excepting golden metatarsal brushes) silvery-gray, simple, and for the most part short; those on the inner face of the middle tibiae, on the tarsal joints, on hind coxae, and fringing the anterior contour of the hind tibiae moderately long. The hind tibiae (Fig. 15) about three-fourths as wide as those of the worker, clavate, rather rounded at the apex, slightly convex over their external face, not hollowed on the apical half as in the worker. The hind metatarsi about two-thirds the width of the hind tibiae, shaped much as in the worker, with the posterior contour convex and with the apex unevenly divided by an emargination into a small toothlike anterior portion and a much larger obtusely angular posterior portion. The inner face of the hind metatarsi with bristles from apex to base.

WINGS subhyaline with dull brownish venation and stigma; 5-6 hamuli in each hind wing.

ABDOMEN a little narrower than thorax, smooth and shiny except on the apical rims of the tergites beyond tergite 1, which are delicately tessellated, the area of tessellation tending to broaden on the apical tergites. Largely black but the basinlike depression at base of tergite 1 cream-colored and the apex of the dorsal aspect of the abdomen reddish. Beneath, the abdomen is reddish on sternite 1, mottled with red on sternite 3, red apically on sternite 4, and red on the revealed parts of sternite 5 except for the largely black spines on this sternite; the rest of the venter black. Sternites 3-4 have progressively deep V-shaped emarginations at the middle. The median portion of sternites 4-5 is very deeply depressed, with the result that this part of the abdomen appears to be hollowed out (Fig. 16A). Sternite 5 (Fig. 16B) is unusual in its armature: from the apex of this sternite project parallel to each other two long, basically triangular, apically narrowed black spines (with reddish cleft tips) that are a little longer than the distance separating them. To each side of these spines and separated from them by a little more than the space intervening between the tips of the spines is an angulation fringed with pale hairs that is visible as a shoulderlike projection even when the insect is viewed from its dorsal side. Sternite 6 (Fig. 16C) more substantially constructed than is usual in *Trigona*, with a wide median tooth. The genitalia wide and relatively short (Fig. 16D and E). Ferruginous

basal part of sagittae very wide and short, the black spinelike extensions strongly elbowed on their dorsal side near the base, curvilinear on their ventral side, tapering to a point. The volsellae ferruginous, rather short, with a very slight contraction at their middle, their apex somewhat expanded, subclavate. The ferruginous stipites characterized by a little hump on the middle of their distal end. The apical contour of the shieldlike uncus broadly and emphatically convex, its base anchored to the stipites by a rodlike connection.

Length 5-5 1/2 mm.; width of thorax about 1 3/4 mm.; length of forewing, including tegula, about 5 1/2 mm.

In spite of their limited maculations, the size of these males and the presence of fulvous scalelike hairs on their axillae and scutellum incline me to believe that they are assignable to *terminata* rather than to *ventralis*.

Trigona (Lepidotrigona) *terminata* variety *latebaleata* (Cameron)

Trigona ventralis SMITH, 1857, Journ. Proc. Linn. Soc., Zool., II, p. 50. (Specimens from Mt. Ophir but not those from Sarawak.)

Trigona latebaleata CAMERON, 1902, Journ. Straits Branch Royal Asiatic Soc., XXXVII, pp. 130-131.

Trigona latibaleata CAMERON, 1908, Entomologist, XLI, p. 193.

Trigona terminata variety *latebaleata* SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, pp. 282, 284-285, 287-288, 294, 295-297, 326.

MALAYA.—State of Perak: Jor Camp, 2000 feet, Aug. 21, 1922 (E. Seimund). State of Selangor: Gombak Valley, Oct. 12, 1921 (H. M. Pendlebury). State of Negri Sembilan: Port Dickson, Dec. 25-31 (H. M. Pendlebury).

S. SUMATRA.—Gn. Betoeng, Soengeilangka Est., March 27, 1937 (J. van der Vecht).

N. BORNEO.—Bettotan, nr. Sandakan, July 26, 1927, Aug. 16, 1927, Aug. 23, 1927 (C. B. Kloss and H. M. Pendlebury); Kudat, Sept. 16, 1927 (C. B. Kloss and H. M. Pendlebury); Mt. Kinabalu, Kiau, 3000 feet, March 25, 1929 (H. M. Pendlebury); nr. Kinabalu, Kabayau, 600 feet, May 11, 1929 (H. M. Pendlebury).

S. BORNEO.—Gn. Selong, Tanggarang, July 5, 1937 (Mrs. M. E. Walsh).

S. E. BORNEO.—Rotabaroo, Nov. 14, 1930 (J. van der Vecht). The variety *late-*

balteata is difficult to separate from the typical variety due to intergrading specimens.

***Trigona terminata* variety *javanica*
(Gribodo)**

Trigona javanica GRIBODO, 1891, Bullet. Soc. Entomol. Italiana, XXIII, p. 109.

Trigona javanica FRIESE, 1914, Tijdschr. voor Entomol., LVII, pp. 12, 58 (nest).

Trigona javanica COCKERELL, 1929, Annals and Mag. Nat. Hist., (10), IV, p. 591.

Trigona javanica SCHWARZ, 1937, Bul. Amer. Mus. Nat. Hist., LXXIII, Art. III, p. 295.

I have not seen the type of *javanica* and the characters noted in the key are derived from Gribodo's description. It is possible that *latebalteata* Cameron is scarcely separable from it.

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