

THE GENUS MELIPONA

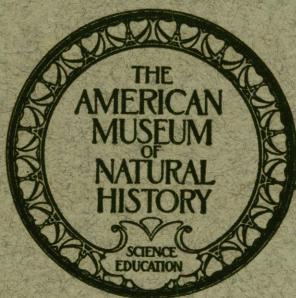
The Type Genus of the Meliponidae or Stingless Bees

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INTRODUCTION

HISTORICAL RÉSUMÉ

The insects considered in this paper are those ordinarily referred to as *Melipona* and are regarded by many as constituting a division within the Meliponidæ or stingless bees of the tropics. The precise limits of the genus are difficult to define, and the intergrading species linking *Melipona* in the restricted sense with *Trigona* present so many difficulties of interpretation that it has seemed wiser to a minority of writers not to attempt to make divisions and to recognize only one embracing genus, *Melipona*. In doing so they veer back to the conception of Illiger,¹ who named and described the genus in 1806, including in it by specific reference two such contrasted insects as *favosa*, a true *Melipona* in the limited sense, and *amalthea*,² later considered the type species of *Trigona*. Jurine, apparently in ignorance of the work of Illiger, erected the genus *Trigona* in the following year (1807), assigning to it among others the very two insects that Illiger had previously placed in *Melipona*. Thus *Trigona*, as originally conceived, was about as expansive as Illiger's *Melipona* and no more than a synonym of it.

Klug (1807) resisted the temptation of splitting *Melipona*: "In the case of this genus," he writes, "I was in the beginning surprised to find associated in one genus such seemingly diverse creatures as *Melipona favosa*, *citriperda*, *postica*, and *angustula*. But the more painstakingly I examined these little creatures, the more I was impressed with the excellence of the genus of Illiger, and now regard the erection of this genus as a new proof of the entomological discernment of its author."

It was Latreille who first attempted to separate the insects lumped in this manner into two distinct groups. In his 'Genera Crustaceorum et Insectorum' (1809) he distinguished *Trigona* from *Melipona* by its

¹While to Illiger goes the credit for naming the genus, recognition of the structural distinctiveness of the Meliponidæ was anticipated by Latreille, who in 1804 assigned insects of this group to a subdivision of *Apis*.

²Strictly speaking, Fabricius' interpretation of *amalthea*, based on a meliponid structurally very close to Olivier's insect if not identical with it.

toothed mandibles. That other characters seemed to Latreille wholly subordinate in importance to the mandibles is indicated by the fact that in 1811 Latreille assigned the virtually edentate *postica* to *Melipona* even though "it has the appearance of our *Trigona*."

Authors influenced by the distinctions that Latreille attempted to establish have now and then been puzzled when, confronted by a specimen that superficially looked like a *Melipona*, they found to their surprise that its mandibles did not conform to the Latreille stipulations for that genus. One of the first to face this quandary was Bennett, 1831, who, notwithstanding the partly toothed condition of the mandible in his *beecheii*, decided to place the insect in *Melipona*. Say, 1837, on the other hand, placed his *ligata*, which seems to be very close to *beecheii*, in *Trigona*. Pierre Huber (1839), confronted with the same problem, was also inclined to assign his "domestic *Melipona*" of Mexico¹ to *Trigona* but took the precaution of referring the matter to Latreille himself "as a true master in this matter." Latreille replied by letter, and it is interesting to note that the difficulties presented by the specimen led him to revise his views somewhat regarding the line of cleavage between the two genera.

"The species you sent me," he writes, "and which I have carefully studied, is a true *Melipona*, but its mandibles present a remarkable difference. It is perhaps only a variety of *Melipona scutellaris* of my Memoir on the Bees. In the apiary *Melipona* (*Apis favosa* Fabricius) these organs have really no very noticeable dentition: only their internal edge has near the superior angle a slight emargination preceded by a feeble angular projection. In another *Melipona* from Brazil [Latreille may have been referring to *interrupta*] the internal edge has two slight notches and two very short denticles. THESE DENTICLES ARE STRONGER AND MORE ACUTE IN YOUR *Melipona* FROM MEXICO."

Equally interesting is Latreille's reference, also from the same letter, to *Trigona*:

"The *Trigona*," he says, "as I have been able to verify in the case of a large individual, have mandibles terminated by five very apparent and very sharp teeth. The three lower ones correspond to the fore part of the mandibles, and the two others to the teeth which you observed in the *Melipona* from Mexico. Thus the mandibles of the *Melipona* approach those of the honey bee, but with this difference, that a part of their internal edge is more or less *bidentate*, a circumstance which gives

¹Huber's "domestic *Melipona*," which Darwin referred to in his 'Origin of Species' as *Melipona domestica*, is, I believe, in all probability the same insect as that previously described as *beecheii*.

them some analogy with the mandibles of the *Trigona*; and the mandibles of the latter genus always have the internal edge completely dentated, and the teeth are five in number."

This letter of Latreille, unfortunately dateless, was cited in an address by Huber delivered in 1836 and published in 1839. If it represents the final opinion of Latreille, it limits *Trigona* to a small group of insects and, strictly interpreted, admits into *Melipona* a host of insects usually classed as *Trigona*.

The revised viewpoint of Latreille was either unknown or neglected by subsequent writers, and the insect (*beecheii*) that had bewildered Bennett, and later Huber, continued, though under yet another name, to trouble Poey (1851), who rejected the generic determination made by Guérin in the case of *fulvipes* and assigned that insect (which he corrupted into *fulvipeda*) to *Trigona*, on the basis of its partly dentated mandibles. Poey's son, 1855, adhered to the generic name adopted by the father. Friese, 1916, listed his variety *fulvipes obscuripes* as a *Melipona* but fifty pages beyond described it as a *Trigona*. Notwithstanding the contradictory character of its mandibles, *fulvipes*, here made a subspecies of *beecheii*, is, however, generally regarded as a *Melipona*.

One may conclude from these examples that the distinction originally laid down by Latreille is not wholly satisfactory. Even his revised interpretation of later years—which has been generally ignored—offers no adequate line of cleavage between *Melipona* and *Trigona*.

In 1817 Lamarck attempted to nullify the distinctions established by Latreille in again merging *Melipona* and *Trigona*. Indeed the encompassing nature of his interpretation may be gauged by the fact that he agrees only diffidently to the separation of *Melipona* from *Apis*. The second edition of Lamarck's 'Natural History of the Invertebrates,' published in 1835, hands down unchanged his viewpoint of 1817.

With Lepeletier de Saint-Fargeau (1825) the pendulum swings back again, and divisions within the Meliponidæ are recognized. The angle of approach is, however, not that of Latreille. The shape of the abdomen replaces the toothed or edentate condition of the mandibles as the character of fundamental importance. *Trigona*, as Lepeletier reminds us, is derived from two Greek words signifying TRIANGLE. Members of the Meliponidæ that have the abdomen short, triangular, strongly carinated on the venter are, according to Lepeletier, *Trigona*; those having the abdomen convex above and only slightly carinate below are *Melipona*; those having the abdomen elongate, almost quadrangular, the dorsal part forming an obtuse angle, belong to yet another genus, *Tetragona*.

Although Lepeletier retained these main divisions in his 'Histoire naturelle des Insectes—Hyménoptères' (1836), he recognized but a single genus, *Melipona*, of which these divisions were constituent parts.

Distinctions based solely on the shape of the abdomen, like those founded exclusively on the character of the mandible, have their pitfalls; witness the fact that Guérin described as a *Trigona* so *Melipona*-like an insect as *orbignyi*, apparently because its abdomen was "short, triangular." One suspects, too, that Spinola (1853) fell into a similar error in describing his *ghilianii* as a *Trigona*. His description suggests a *Melipona*, probably *marginata*, which sometimes has the axillæ maculated but the scutellum dark, according in this respect with the specification for *ghilianii*.

The need for supplementary characters to validate the subdivision of the Meliponidæ into two genera was recognized by Spinola (1840) whose opinion it was that "The constant accord of two independent characters is in itself of such importance for the rational method that I cannot conceive how one could reject divisions established on this so solid double basis, provided there were no other fact of greater importance to offset it."

Such a supplementary character, reinforcing the distinction based on the toothed as contrasted with the non-toothed condition of the mandibles, Spinola believed he had found in the structure of the internal face of the hind tibiæ. He thus summarizes it:

"In the *Melipona* workers, the internal face of the hind tibiæ is uniformly level and finely pubescent, but this pubescence is in no part sufficiently strong and compact to serve as a brush.

"In the *Trigona* workers, the internal face of the hind tibiæ presents a median and longitudinal elevation which extends always from the extremity near the femora and attains sometimes the apical margin; the entire raised surface is clothed with a short, stiff, silky pubescence, perfectly resembling that of the tarsal brushes; the hairs of the rest of the internal face of the tibiæ are, on the other hand, sparse, fine, longish, and flexible."

The distinction is an interesting one and deserving of a great deal more attention than it has received. Nevertheless the "constant accord" between the presence of a broad elevated area on the inner face of the tibiæ such as his diagram reveals and the toothed condition associated with *Trigona* is not nearly so constant as Spinola believed. It applies to the type species of *Trigona* and its near relatives, but there are many species ordinarily classed as *Trigona* in which the inner face of the

hind tibiae resembles that of *Melipona*, more accurately described as longitudinally carinate along its anterior third than "uniformly level."

Between 1836 and 1860 writers continued to allude to Meliponidae under all or merely one or two of the proposed generic names but without emphasis upon distinguishing characters other than those already proposed. Say (1837 and 1859) placed one of his species (*bilineata*) in *Trigona*, protesting, however, that the name "is almost too much like *Trigonia* of Conchology." In describing his *ligata* as a *Trigona* he seems to have contemplated the possibility of its being placed in *Melipona* and, if my interpretation be right, that it is a form intermediate between *beecheii* and its subspecies *fulvipes*, the proper place for it is in *Melipona*. Spinola (1840), although he alluded to the three divisions of Lepeletier, gave recognition to only two of them—*Melipona* and *Trigona*—in the tabulation of the species on which his studies were based. In *Trigona* he included *clavipes* (= *elongata* Lepeletier), which, according to the interpretation of Lepeletier, belongs in *Tetragona*. Klug (1843) continued to recognize only one genus, *Melipona*. Guérin-Méneville (1844?) lists both *Melipona* and *Trigona*, in so far as one can judge following the distinctions of Lepeletier, although he questions the validity of certain of Lepeletier's species. Goudot (1846) contributed a paper on observations made in New Granada in which he recognized by specific reference not only *Melipona* and *Trigona* but also *Tetragona*. On the other hand, Poey (1851) accepted the genera *Melipona* and *Trigona*, but spoke of *Tetragona* as not being generally recognized. In accord with Latreille's original conception, he regarded *Melipona* as having edentate and *Trigona* as having denticulated mandibles. He furthermore associated with *Trigona* the abdomen of triangular shape that the name implies, adding that Latreille's failure to emphasize this character may have been due to the fact that some species have a quadrangular abdomen. But if so, one might ask, what is the value of the character mentioned, or may not the quadrangular shape rank equally with the triangular? Smith (1854) listed under *Melipona* and *Trigona*, respectively, such Meliponidae as he thought were assignable to each. In *Trigona* he included several *Tetragona*, thus ignoring that genus or by implication denying its validity. But Desmarest (1860) recognized not only *Melipona* and *Trigona* but also *Tetragona*, adhering to the definitions of Lepeletier. Walker (1860) described a *Trigona*, but made no reference to the character of the genus.

Westwood (1861), in contrasting the architecture of the nest of *Trigona carbonaria* from Queensland with that of Brazilian Meliponidae,

indicated that "this structural modification was so great as to suggest a doubt whether *Trigona carbonaria* had been rightly placed in the genus *Trigona*." Although Westwood refrained from assigning to *carbonaria* a new generic name, his attitude is of interest in that it adumbrates the stand taken by von Ihering (1912), who erected a new genus, *Friesenmelitta*, mainly on the basis of what he believed to be the individual nest structure of a South American species, *silvestrii*.

While in his earlier papers Smith assigned specimens to one genus or another without making clear his interpretation of the generic limits, in 1863 he indicated what he believed to be the main line of cleavage between *Melipona* and *Trigona*, and his interpretation is of especial interest because it introduces new characters. It was Smith's conclusion that the two groups can be "readily separated." The character on which he especially relied is that of the relative length of the wings, all of the other characters that he instanced tending to overlap or being subordinate to this. Stingless bees that have the wings "one-fifth shorter than the body" are *Melipona*; those that have the wings "longer than the body" are *Trigona*. While this is one of the best diagnostic characters suggested, the contraction or expansion of the abdomen makes its accurate application difficult. There are many individual specimens of *Melipona* in which the wings extend beyond the abdomen, and this is true even of species with relatively elongate abdomen, like *interrupta*. The stigma of *Trigona*, Smith defined as "distinct, with its inferior margin rounded." He says nothing of the stigma of *Melipona*, but Latreille (1811), in commenting on *postica* had already indicated the more limited development of the stigma in *Melipona* than in *Trigona*. To some extent Smith placed reliance, too, on the mandibular structure, though his line of cleavage was not precisely that of Latreille. According to Smith, *Melipona* never has the mandibles dentate (his own *fasciculata*, 1854, would under this ruling have to be thrust out of *Melipona*), but *Trigona* may have the mandibles "serrated, denticulated, or sometimes edentate,"—a definition that opens the gate wide to a claimant like *postica*, which Latreille had placed in *Melipona* notwithstanding its admittedly *Trigona*-like appearance. Girard (1879), who adopted Smith's definition in toto, nevertheless placed *postica* in *Melipona*. In his paper of 1863 Smith utterly rejected Lepeletier's *Tetragona*: "St. Fargeau has given to one of his divisions of the genus *Trigona* the generic title of *Tetragona*, but the only characteristic difference is the elongated, almost quadrangular, form of the abdomen of the worker bee; this character, if allowed to be of generic value, would frequently throw

the sexes into different genera; the genus *Tetragona* therefore cannot be retained."

During the succeeding three decades a number of writers used the term *Trigona*. Of these may be mentioned Smith (1864, 1866, 1868, 1870, 1878), Parish (1866), Peckolt¹ (1868), Packard (1869, 1869A), Horne (1870), Hermann Müller (1873, 1874), Girard (1874-1879), although Girard also designated as *Melipona* some species ordinarily considered *Trigona*, Fritz Müller (1874, 1874A, 1875), Raveret-Wattel (1875), Drory (1877), Cresson (1878), Gribodo (1879), Tomaschek (1879-80), Gronen (1881, 1882), Taschenberg (1883,² 1892), Hockings (1884), Howard (1884), Magretti (1884), Kirby (1885), Holmberg (1887), de Saussure (1891), Schletterer (1891), du Buysson and Marshall (1892), and Gribodo (1891, 1893). Girard (1876A) challenged the distinction made by Latreille on the basis of the structure of the mandibles but beyond commenting on the fact that in general *Trigona* "are notably smaller than the *Melipona*" offered no additional evidence for their separation. Holmberg and Gribodo, however, attempted further to define the two putative major groups of the Meliponidæ. Although Holmberg (1887) relied on some of the morphological distinctions made in the past, like the dentate or edentate character of the mandibles, the carinated or non-carinated condition of the venter, he supplemented these by conclusions drawn from the biology of the two groups. Not only did he try to separate *Melipona* from *Trigona*; he indicated differences of nest construction within *Trigona* itself, as follows:

- a) Entrance of the nest in the form of a short, wide cone, radially striated. . . *Melipona*.
- aa) Entrance of the nest not presenting a similar form.
 - b) The nest suspended from branches.
 - bb) Not hung from branches; constructed in a cavity.
 - c) The entrance formed by a large, irregular, spongy mass of wax.
 - cc) The entrance in the form of a tube that is almost regular and more or less extensive.
 - d) The nest located in the ground.
 - dd) The nest located in a tree trunk.

Holmberg based his classifications on comparatively limited nest material found in Misiones, Argentina. His classification suffers not only from this fact but fundamentally from the circumstance that certain species are so adaptable that there is no constancy in their choice of a

¹Cited by Smith.

²In this paper Taschenberg treats *Trigona* as a subdivision of *Melipona*.

nest-site. Thus *testacea*,¹ to mention one of the most versatile builders, is said to construct its nest in hollow trees, in the nests of termite species, and in hollows in the earth,—a range of choice so wide that individual nests of this species would fit into several different places of Holmberg's table.

Gribodo (1893), applying the old morphologic distinctions, found some difficulty in deciding whether certain of the species he described should be assigned to *Melipona* or to *Trigona*. One of these, *prosopiformis*, he assigned diffidently to *Melipona* because it had a convex abdomen without trace of carina, edentate mandibles,² and a stigma of limited extension.³ At the same time Gribodo confessed that the small size of *prosopiformis* and its appearance accord rather with *Trigona*. Similar doubts assailed him in interpreting what he records as *Trigona? minima*, which was of small size and had a developed stigma and little hair—all *Trigona*-like attributes in Gribodo's conception—but which, on the other hand, lacked a ventral carina and had no teeth on the mandibles. An abundance of hair thus becomes by implication one of the attributes of *Melipona*. Indeed such was Gribodo's perplexity regarding *minima* that he suggested the suppression of both *Trigona* and its subgenus (*Tetragona*) and the substitution of but a single genus, *Melipona*. In spite of this suggestion, however, he immediately proceeded to describe several new species as *Trigona*.

Although, as has been indicated, a fairly large number of authors continued to use the term *Trigona* more or less loosely during the three decades from 1863 (the date of Smith's paper) to 1893 (the date of Gribodo's paper), the term *Tetragona* fell into desuetude. Only four authors—Gronen⁴ (1881), Holmberg (1887), Taschenberg (1883 and 1892), and Gribodo (1893)—seem to have employed it in this interval. A fifth, Raveret-Wattel (1875), alludes to *Tetragona* in a footnote, commenting that it is "merged nowadays with *Trigona*." As an offset to those who made free use of the later generic names was a conservative group that continued to designate as *Melipona* insects regarded by others

¹The long-neglected name, *testacea* Klug, is here revived for the bee that Friese and Ducke have erroneously determined as *pallida* Latreille. Cockerell has pointed out that a specimen in the Museum at Oxford labeled *pallida* in Latreille's own handwriting is no other than the bee that Friese in 1900 described as a new species, *kohli*. If additional proof were needed to substantiate the identity of Latreille's *pallida* and Friese's *kohli*, it would be found in the drawing of the mandible that Latreille supplied (1811, Pl. xx, fig. F) for his *pallida*. This drawing shows a five-toothed condition of that organ, corresponding with the mandible of *kohli* and very different from the only partly toothed condition of the mandible of *testacea*. The identity of *testacea* is fortunately made virtually indisputable by the colored figure that Klug supplied (1807A).

²The mandibles in perfect specimens are not edentate but, on the contrary, fully dentated. Because of the small size of the teeth, these are inconspicuous, and in worn specimens the mandibles may present a virtually edentate appearance.

³The stigma is well rounded below and does not seem out of accord with that of other *Trigona*.

⁴Gronen employs the term *Tetragona* only casually, with an implied protest at the attempt of Lepeletier to make a separation.

as *Trigona*. In this group may be placed such writers as Puls (1868, 1869), Gerstaecker¹ (1875), Provancher (1889), Lucas (1889), Stadelmann (1895). A convert to the group of conservatives was Hermann Müller, who, notwithstanding the fact that he recognized *Trigona* in 1873 and in the early part of 1874, reversed himself later in 1874 and affirmed in 1875 that the separation of *Trigona* from *Melipona* probably was invalid.

The number of writers grouped in each of the rival camps would indicate that the issue is a real one: nevertheless, a standing vote on the interpretations made from 1863 to 1893 would have resulted in favor of those recognizing more than one genus in the Meliponidæ.

Between 1894-1896 Dalla Torre published his monumental 'Catalogus Hymenopterorum.' In it he recognized but a single genus, *Melipona*, with the subgenera *Trigona* and *Tetragona*. To emphasize his viewpoint he gave recognition of authorship not only to the original describer but also to him who transferred a given species from *Trigona* or *Tetragona* to *Melipona*.

It is indicative of the persistence and strength of the belief that *Melipona* and *Trigona* are to be regarded as separate genera that, notwithstanding the high authority of Dalla Torre, only a minority of authors adopted his interpretation during the succeeding two decades. The immediate effect of Dalla Torre's classification is perhaps to be seen in Bingham's account of the Hymenoptera of India ('Fauna of British India,' Vol. I), which made its appearance in 1897, just after the 'Catalogus' had been issued. Bingham left no doubt as to his stand, listing as *Melipona* every Eastern species he described and shifting to that genus every other stingless bee that he had occasion to mention. The range of *Melipona* he gave as "Both hemispheres." This is the attitude, too, of Theobald (1906), who, disregarding the remark of Smith that nature herself has separated *Melipona* and *Trigona* by limiting the former to the New World, stated that: "The genus *Melipona* has a very wide distribution in America, Africa, Asia and Australia." The viewpoint of Theobald may possibly have been influenced by Bingham, for the identification of the insect (*beccarii*) on which Theobald's discussion is in part based was made by Bingham, who referred it to *Melipona*. In 1903, Bingham described two Eastern bees as *Melipona*. In this instance, however, he placed them under a division heading that reads, "*Melipona* subgenus *Trigona*." Du Buysson (1901) had previously, like Dalla Torre, given subgeneric rank to *Trigona*, referring to *lineata* as *Melipona (Trigona) lineata*, and Ducke

¹Cited by Bertkau.

(1902) subdivided the Meliponidæ of Para into two subgenera, *Melipona* and *Trigona*. In the same year (1903) Vachal put in *Melipona* certain species from the Congo but in doing so apparently recognized as of subgeneric rank both *Trigona* and *Tetragona*, placing these names in parentheses between the generic name and the specific name. Like Bingham, Nurse (1907) described a new Indian species as *Melipona*. Meade-Waldo (1913) indicated his full accord with the viewpoint of Dalla Torre when, in pointing out that *mellarius* and *perilampoides* were synonyms of *punctata*, originally described by Smith as a *Trigona*, he used the term *Melipona punctata* Dalla Torre. Meade-Waldo might have carried the name back to *testaceicornis*, the progenitor of all of these synonyms, representing an insect that Cockerell, in sharp contrast to Meade-Waldo, designated as the type of a new genus.

Opposing the tendency to recognize but one genus, *Melipona*, and either to ignore *Trigona* or reduce it to subgeneric rank, is a larger group of investigators who between 1897 and 1917 continued to use the term *Trigona* as that of a distinct genus. This group includes such names as: Magretti (1898), Friese (1898, 1900, 1900A, 1901, 1902, 1903, 1908, 1909, 1909A, 1911, 1912, 1914, 1916, 1916A), Kriechbaumer (1900), Ashmead (1900), Waterhouse (1900, 1903), Cameron (1901, 1902, 1908), Silvestri (1902, 1903, 1911), von Ihering (1903, 1912), Schulz (1903, 1903A, 1905, 1905A, 1907, 1909), Buttel-Reepen (1903, 1915), Holmberg (1903), Cockerell (1905, 1910, 1910A, 1911, 1911A, 1912, 1912A, 1912B, 1913, 1914, 1915, 1915A, 1917), Handlirsch (1906–1908), Strand (1909, 1910, 1911, 1911A, 1912, 1912A, 1914, 1915, 1917), Schrottky (1911, 1914).

Certain papers that appeared in the two decades after Dalla Torre's work require more detailed mention because of the attempt made therein to disentangle the Meliponidæ. During the years 1902–1903, in particular, a forward step was achieved through the publication of important papers by Ducke, von Ihering, and Friese. In 1902 Ducke brought out his study of the Meliponidæ of Para, in which he recognized two subgenera, *Melipona* and *Trigona*. Some of the characters that he listed had been used by earlier writers (including the *Osmia*-like appearance of *Melipona*, originally suggested by Smith), but other characters were new. Ducke made his distinctions in the form of a key:

- 1.—Abdomen with a uniformly oval convexity, habitus reminding one of *Podalirius* and *Osmia*. Body of middling size to large, 6–13 mm. in length, robust, thorax width $2\frac{1}{2}$ to $5\frac{1}{2}$ mm. Mandibles untoothed, hind tibiæ elongately triangular, externally smooth and on their apical half concave. Metatarsus

broader than half of the width of the tibiae. Wings somewhat shorter than the body Subgenus *Melipona*.

Abdomen sometimes short and triangular, sometimes elongate, sometimes almost rectangular, never with a uniform oval convexity. Habitus of the creatures not in the remotest way suggestive of *Podalirius* and *Osmia*; in the case of a number of species, on the contrary, very suggestive of *Tetrapedia*. Body small to fairly large, $1\frac{3}{4}$ to 10 mm. in length, in the case of the larger species always of elongate form. Thorax width $\frac{2}{3}$ to 3 mm. Mandibles toothed or untoothed. Hind tibiae and the associated metatarsi very variable in shape according to the several species. Wings longer or at least as long as the body. Subgenus *Trigona*.

Ducke was considering merely the Meliponidæ of Para. In this fauna occurs, however, *Melipona interrupta fasciculata*, which in perfect specimens has the mandibles dentated on the inner half of the apex. While Ducke's designation for *Melipona*—"mandibles untoothed"—may apply to specimens of *interrupta* in which the teeth have been worn down, it fails to indicate the normal condition for that species, and the key is to this extent misleading although helpful in many other ways. Notwithstanding the fact that in this key he designated *Trigona* a subgenus, he seems later to have entertained some doubt as to the propriety of subordinating it, for in his discussion of the 'Hymenoptera of Northeastern Brazil' (1910) he referred to the "genus (or subgenus) *Trigona* Jurine," and his *atroalba*, described in the previous year (1909), and *argentata* (Lepeletier) in 1906, are designated by him *Trigona* without qualification.

In 1903, a year after Ducke's paper, the important work by von Ihering on the 'Biology of the Stingless Bees of Brazil' made its appearance. In it the author attempted to separate *Melipona* from *Trigona* on the basis of differences in their life history. We have seen that a somewhat related effort had been made by Holmberg in 1887, but the more comprehensive data available to von Ihering enabled him to draw conclusions with a greater approach to finality. Von Ihering brought out what he believed at the time to be fundamental differences, as follows: *Melipona* species do not have queen cells of specialized size, all the casts emerging from cells of like dimensions, whereas in the case of *Trigona* the queens are reared in large oval cells that are located along the rim; the virgin queens of *Melipona* make their appearance with undeveloped genital organs, whereas the queens of *Trigona* emerge in a much more advanced stage of maturity; the virgin queens of *Melipona* are as a rule smaller than the workers of the same species while the queens

of *Trigona* are generally larger in all their bodily dimensions than the associated workers.¹

These differences with respect to the queens and their cells are supplemented, according to von Ihering, by differences in the architecture of the nest. *Melipona* species construct the "batumens" or horizontal plates that mark the upper and lower limits of the nest out of earth,² while *Trigona* species make them of wax, resin, and a substance known as cerumen which does not melt when held in a flame. Contrary to *Trigona* the species of *Melipona* are apt also to intermingle earth with wax in constructing their honey-pots, and the material surrounding the exit hole is in the case of *Melipona* also earthen, rarely so in the case of *Trigona*. The emergence hole of all the *Melipona* nests investigated by von Ihering was ornamented with radial striations. It will be recalled that it was this structural feature of the nest on which Holmberg relied in separating *Melipona* and *Trigona*.

Other distinctions occur, but, like some of those already instanced, they are not absolute. *Melipona* species, von Ihering indicated, all build as a rule in hollow trees, although some, like *marginata*, occasionally nest in the walls of buildings³ or, like *vicina*,⁴ even establish their colonies in the earth. While many *Trigona* also seek hollows in trees, the nest-sites of this division of the Meliponidæ are of varied character. Furthermore the emergence hole is in the case of the *Melipona* and some of the *Trigona* a narrow, round opening, permitting egress to only one bee at a time, while in the case of other *Trigona* this exit is excessively wide. The wax lamellæ enclosing the broad cells consist in the case of the *Melipona* species often of only two or three concentric layers, in the case of the *Trigona* species not infrequently of ten or more.

The honey and pollen containers of many *Trigona* are intermingled rather irregularly, whereas in *Melipona* nests the pollen-pots are close to the brood-cells and the honey-pots follow distally. These provision receptacles are larger in the case of *Melipona* nests and usually have thicker walls than those of *Trigona*. The thicker walls, von Ihering surmised, may be due to differences of habit in the two genera, *Trigona* being known to destroy its receptacles periodically; while *Melipona*, so far as his observations would seem to indicate, retains them perma-

¹Fritz Müller (1875), in commenting on the virgin queens of *fulvipes*, stated: "Only in *Melipona* such small females seem to occur. Whether out of their number the queen originates or whether they constitute a company of vestal virgins (parthenogenetic females) still remains to be determined."

²According to Fritz Müller (1875) all *Melipona* employ earth in part at least for stopping up cracks; "on the other hand, out of our numerous *Trigona* species I have thus far detected only one, *Tr. cupira* Sm., in the act of gathering earth."

³Also *orbigny* according to Silvestri, 1902, and a variety of *T. mosquito* observed by Lutz, 1931.

⁴This is true also of the closely related *santhilarii* (here considered a synonym of *quinquefasciata*) as noted by Bertoni (1912) and von Ihering (1912).

nently. Von Ihering added, however, that possibly some *Trigona* build permanent containers, and hence the distinction he draws may not be absolute.

In the brood-combs of *Trigona* there are, as a rule, openings to afford quicker passage between one comb and another; in the combs of *Melipona* such communication holes are, according to von Ihering, absent. Cells from which the brood has emerged are never used a second time, but, whereas *Melipona* species usually remove the cell completely, top, bottom, and sides, *Trigona* species leave the bottom standing temporarily, with the result that the foundations of contiguous cells are to be seen as a continuous sheet of wax.

There are, von Ihering went on to indicate, what might be described as temperamental differences. *Melipona* species, if their nest is disturbed, will fly buzzing about the intruder or, in the case of *marginata*, even against his head, but they do not lay violent hold upon him. A few *Trigona* share this milder disposition of *Melipona*, but others show resentment by entering the hair, the ears, nose, and even the eyes, some of them biting their victim. The aggressive species are in general those that have unconcealed nests and a wide emergence hole. *Melipona* colonies are usually relatively small, with a range of from 500 to 4000 individuals; those of *Trigona* are usually vast, varying from 300 to 80,000. A number of individuals are usually gathered about the emergence hole in *Trigona* nests while a single bee stands guard in the colonies of *Melipona*.¹ *Melipona* species confine their diet to honey; some *Trigona* species, on the other hand, consume also plant and animal juices of all kinds.²

It may seem to the reader perhaps that a disproportionate amount of space has been given to von Ihering's paper, but, as such a large section of it is devoted to what von Ihering believed to be contrasting elements in the biology of *Melipona* and *Trigona*, a fuller treatment than that accorded other studies seemed to be justified. Many of the distinctions that von Ihering set up are, as he himself indicates, overstepped by this or that member of the respective groups. Even those distinctions which at the time he thought absolute, seemed to him later on to be not so constant as his earlier observations had led him to believe. One of the most fundamental distinctions he attempted to draw was that in *Melipona* nests the cells are of uniform size, while in those of

¹A nest of a subspecies of *Trigona mosquito* observed at Barro Colorado, Canal Zone, was guarded by a single portress (Lutz, 1931).

²This distinction does not hold. As reported in the present paper, Tate found *Melipona fasciata* variety *cramptoni* subvariety *davidæ* on meat, while Lutz observed *Melipona interrupta oblitescens* sucking fluids from a dead snake.

Trigona specialized royal cells occur. In 1912, however, von Ihering found the nest of a species usually classed as a *Trigona*, namely, Smith's *capitata*, in which he could discover no differentiated queen cells.¹ In such other essential respects as the construction of the batumen plate out of earth and the erection of provision containers of huge size, the nest of *capitata* examined by von Ihering was similarly in accord with those of *Melipona* species.

One cannot help feeling that the discovery of such *Melipona*-like attributes in the architecture of a *Trigona* species paved the way for von Ihering's conversion soon thereafter to the viewpoint that only a single genus exists in the Meliponidæ.² It is especially worthy of note, therefore, that Salt, 1929, found in a nest of *capitata* subspecies *zexmenix* two queen cells, which "were situated with the male and worker cells in the tiers but were readily distinguishable by their larger size and rounded instead of flat ends." The upper and lower batumen plates, Salt reported, "were of hard and brittle cerumen containing much earth" and "the honey-pots were large, 3.5 or 4 cm. long and 2.5 cm. in diameter."³ The fact that Salt found differentiated queen cells seems to me of far more significance than that von Ihering failed to find them, and under the circumstances von Ihering's conclusion that, had the young queens that were present in his nest emerged from royal cells, vestiges of such cells would have been found, lacks finality. It is in order to point out, too, that, unlike *Melipona* queens, the queen of *capitata* is larger than the associated worker, having, according to Dücke, a thorax-width of 3½ mm. compared to a thorax-width of 2½-3 mm. in the worker. This in itself makes one suspicious whether a cell adequate in size for the worker would prove a fitting compartment for the queen.

From Salt's observations it is evident that the nest of *capitata* has like that of other *Trigona* a differentiated royal cell. As the distinction holds in this instance, it is in order to ask whether it may not hold also in the case of other *Trigona* where differentiated royal cells are as yet unknown. Dücke (1925) expressed as a probability that all the Meliponidæ that he placed in his Group I have cells of approximately uniform size. His Group I includes the following species: *fraissei*, *muelleri*, *graeffei*, *ducke*, *longitarsis*, *longicornis*. Yet of only two of these bees (*ducke* and *muelleri*) has the nest been seen, according to Dücke's own statement, and of only one, *muelleri*, again on Dücke's authority, is

¹Bertoni (1911) commented on a nest of *capitata* but made no allusion to the uniformity of the cells.

²The reference is to the paper published in 1911, which from internal evidence was apparently written subsequent to the paper published in 1912.

³Those reported by von Ihering (1912) were even larger, some of them being 52 × 40 mm.

the queen known. Curiously enough, the thorax-width of this queen is given as $1\frac{1}{4}$ mm.¹ in contrast to $\frac{3}{4}$ to 1 mm. for the worker, and this diversity of size in the casts would seem to imply a similar diversity of size in the cells from which they sprang. Von Ihering's comment that no queen cells were observed in the nest of *muelleri* seems to be the main basis for Ducke's conjecture that royal cells are lacking in his Group I. Finally Ducke places among the Meliponidæ that have undifferentiated royal cells the species *silvestrii*. But this would seem to be an error, for Silvestri himself notes (1902) that the cell of the queen is "a little larger." Even the instances which Ducke cites as probable exceptions to the usual condition in *Trigona* would seem, therefore, probably to be orthodox.

Except for the erection of *Tetragona* there had been no attempt up to 1903 morphologically to subdivide the complicated group lumped as *Trigona*, but in that year Friese separated *Lestrimelitta* as a subgenus of *Trigona*. Between 1903 and 1908 Friese did not issue any papers on the Meliponidæ, but with resumption of publication on this family we find him making further attempts at grouping. Thus in 1908, in his survey of the *Trigona* of New Guinea and some other regions of the East, he attempted to align certain of the insects, placing *melina* near *genalis*, and *luteiventris* near *flaviventris*. In the following year (1909) in his account of the African species he attempted a definite classification. Stating that the form of the third tibiæ constitutes a good character, and that in addition the yellow maculations and the color of the hairs are worthy of attention, he arranged the *Trigona* of Africa in six groups characterized as follows:

1. Group *beccarii* (abdomen with yellow markings)
2. Group *tomentosa* (composed of the species of largest individual size)
3. Group *erythra*
4. Group *leudliana*
5. Group *staudingeri*
6. Group *medecassa* (composed of the species of smallest individual size).

In the same year (1909) Friese published a further paper on some of the species of New Guinea, including a few also from Australia and other parts of the East. In it he arranged the species in four groups designated as follows:

1. Group *cincta* (thorax maculated with yellow)
2. Group *carbonaria* (entirely black)
3. Group *laeviceps* (abdomen red)
4. Group *mellipes*.

¹The dimension is probably a citation from von Ihering, who described the queen of *muelleri* in 1912 and who gives the thorax-width of the queen as $1\frac{1}{4}$ mm.

Distinctions thus based on color do not seem sufficiently fundamental.

The erection of *Lestrimelitta* as a subgenus by Friese in 1903 was followed by the establishment of *Frieseomelitta* (spelled also *Frieseomelitta*) by von Ihering (1912) based on one of Friese's own species, *silvestrii*, the biology of which seemed to von Ihering to be so distinctive that he was prompted to give the insect generic rank. In nests of *silvestrii* the individual cells are not arranged in combs but instead are connected with one another by small wax stems to form an irregular cluster.¹ In addition to what he considered its peculiar nest structure, von Ihering mentioned certain morphological characters that he thought entitled *silvestrii* to generic distinction. He stressed the elongation of the femora and tibiae, particularly the hind ones, and the color of the clypeus and the wings. Although he referred to *Frieseomelitta* as a new genus, he expressed the surmise that it might survive as a subgenus of *Trigona*.

The architecture of the nest of *silvestrii* was, however, less individual than von Ihering had at first believed. In a paper issued in 1911, but evidently prepared subsequent to the one in which the nest of *silvestrii* is described, von Ihering pointed out that *Trigona muelleri* also arranges its cells in clusters, that *timida* on the authority of Bertoni has a comparable nest structure, and that similar clusters of individual cells in contrast to true combs occur in the nests of certain Old World species like *canifrons* and *laeviceps*.² Nevertheless the last two examples were known to von Ihering when he erected the new genus *Frieseomelitta* for *silvestrii*, and, had I not experienced in my own attitude toward the Meliponidae similar pendulum swings, I should find it a little difficult to account for the complete about-face that he adopts in this later contribution, wherein he relegates even *Melipona* to the rank merely of a subgenus. His change of attitude is summarized in the following paragraphs:

"If we confine ourselves to the Brazilian representatives of the *Trigona*, the nests here considered that have a cluster-like arrangement of the brood cells are obviously to be interpreted as the primitive type. We know, in addition, species the nests of which, although they contain combs, have these combs small and irregularly arranged, and finally those the numerous large brood combs of which are enveloped by a complicated mesh-work of wax lamellæ known as the involucre. In addi-

¹According to Taschenberg (1892) Drory had in 1874 recognized as a distinctive nest type the cluster-like arrangement of the cells in *Trigona cilipes*.

²Ducke (1925) lists no less than seven New World species, the nests of which reveal an irregular arrangement of the cells: *timida*, *silvestrii*, *varia*, *minima*, *schrottkyi*, *duckei*, *muelleri*.

tion may be mentioned as secondary modifications the batumen plates that shut off the hollow within the tree-trunk both above and below, the flight tube of variegated shape, and other peculiarities that I have previously described. A special peculiarity of many South American *Trigona* is the rearing of the queen in a royal cell. Such enlarged brood cells of the female insects do not occur, so far as we know at present, among those species that have a cluster-like arrangement of the brood cells. There are, however, other species of *Trigona* with combs and involucrum among which nevertheless the construction of royal cells is not undertaken, and from this 'Formenkreis' have been evolved the *Melipona*, to which I was formerly inclined to accord recognition as a distinct genus whereas the fuller data now before me prompt me to give them merely the rank of a subgenus within a genus that in biological respects presents extremely many forms.

"My experiences tend to the conclusion that the construction of the combs as well as the rearing in royal cells of females capable of mating are secondary manifestations that have evolved within the *Trigona*."

In stating that "such enlarged brood cells of the female insects do not occur, so far as we know at present, among those species that have a cluster-like arrangement of the brood cells," Ihering, like Ducke, seems to have overlooked the report of Silvestri (1902) regarding the somewhat larger queen cells in *silvestrii*, the nests of which are of the cluster type. Ihering's further statement that there are "other species of *Trigona* with combs and involucrum among which nevertheless the construction of royal cells is not undertaken" seems to rest on the misapprehension that the cells of *capitata* are undifferentiated,—an assumption which, as already shown, has been negatived by the investigations of Salt. The undifferentiated queen cells in *Melipona* in the restricted sense and the differentiated queen cells in *Trigona* as commonly conceived would still seem possibly to constitute a valid cleavage in the biology of these two groups.

In 1916 Ducke issued his comprehensive work on the Meliponidæ of Brazil,—a landmark in the study of this group. Ducke relied much on the identifications of Friese although not slavishly. One evidence of his independence is the stand he took that there is but one genus, *Melipona*. All of the species that Friese and others had designated as *Trigona* were listed by Ducke under the older generic name. His reason for amalgamating the two putative groups is given in the Introduction to his work, and it is in order to quote the paragraph in full:

"It has been the custom to place the stingless bees in two genera, *Melipona* and *Trigona*. In recent years, however, Dr. H. von Ihering

established definite transition stages in the ethology of the two supposed genera, from which he concluded that the genus *Melipona* of authors was no more than a group of species—the most highly evolved from all points of view—of the genus *Trigona*. In the present work we shall see that, likewise in respect to morphology, species occur that are perfect intermediates between the two supposed genera, fully confirming the conclusions based on ethology. In all certainty, therefore, the stingless bees constitute a single genus, which according to the rules of priority ought to bear the older name *Melipona*, although in its original conception this name covered only a small number of the species of a large genus, the greater number of the forms of which were until now designated under the generic name of *Trigona*."

Ducke's desire to obliterate *Trigona* did not find favor with writers of the decade succeeding the publication of his monograph of 1916. During this period Cockerell with characteristic industry brought out no less than fifteen papers in which species of Meliponidæ found mention, yet in none of them is there a disposition to amalgamate the two major groups or even to subordinate *Trigona* as a subgenus of *Melipona*. In fact, Cockerell indicated his belief in the necessity for further divisions by erecting the subgenus *Oxytrigona* in 1917 and the genus *Nannotrigona* in 1922. Of *Oxytrigona* he says: "These bees of the '*coccofago*' group, with their very broad heads and remarkable habits, may be described as a distinct subgenus (*Oxytrigona* subg. n.) with *mediorufa* as the type." His genus *Nannotrigona* he defines as follows: "Small black species with very coarsely rugose thorax and the scutellum elongate, produced into two sharp angles or teeth." Cockerell designated *testaceicornis* as the type species of *Nannotrigona*. Nor did Friese give up the use of the term *Trigona*, maintaining it in papers issued in 1916, 1916A, 1919, and 1925, while Strand (1917), Morstatt¹ (1920), and Brèthes (1920) also continued to recognize *Trigona*. In fact, I know of no author writing in the decade 1916 to 1926, other than Ducke, who abandoned the old division. In 1927, however, Bischoff accepted Ducke's amalgamation of the two genera as probably correct.

In 'Notes on the Distribution and Bibliography of North American Bees of the Families Apidæ, Meliponidæ, Bombidæ, Euglossidæ, and Anthophoridæ' by Lutz and Cockerell, issued in 1920, an invaluable survey of the literature of the stingless bees of Central America and Mexico is presented. Not only were *Melipona* and *Trigona* retained in

¹Morstatt like Holmberg furnished a classification based on nesting habits, but, as his paper dealt exclusively with African species, the classification is confined to biological distinctions within *Trigona*.

this work as independent genera, but *Tetragona* and *Oxytrigona* were recognized as subgenera of *Trigona*.¹

The position taken by Ducke (1916) that there is but a single genus in the Meliponidæ was not adopted by other writers, but perhaps the divergence of viewpoint is not so fundamental as it seems. Even Ducke, while insisting on generic unity and without going to the length of bestowing subgeneric rank, indicated in his key that the Meliponidæ could be allocated in different groups, and when, in 1925, he presented an amended and somewhat amplified version in German of the account in Portuguese of 1916, he arranged the Meliponidæ in six groups, each designated by a Roman number and with subdivisions sometimes within a group, as follows:

I. Marginal cell broad at the base, with a wide opening at the apex. Hind tibiæ with their outer edge serrated. When one of these characters is inconspicuous, the other is the more strongly developed. The body very small to small, black, brown or rust-yellow, always without pure yellow markings. Head large. Abdomen short and depressed, almost always shorter than the thorax. Hind tibiæ with a distinct corbicula, at the outer apical end produced as a tooth or a strongly protruding angle.

Group I.

II. Marginal cell (as in the case of most bees) narrow, closed at the end. Hind tibiæ not serrate, flat, without a trace of corbicula, the associated metatarsus long and gradually narrowed toward the end. Body fairly elongate, of intermediate size, normally dark brown, smooth, shiny, very sparsely covered with hair. . . . Group II.

III. Marginal cell narrow, closed. Hind tibiæ with a distinct corbicula, their outer edge without a trace of serration.

1.—Distinctly elongate small to large species with broad head and narrow abdomen. When the abdomen is short, then the hind metatarsi are broad or broader than the hind tibiæ. The supraorbital line and genæ rarely broad.

Group III.

2.—Small or very small, rarely almost of intermediate size, more or less robust species of definitely outlined form, with short depressed abdomen and short antennæ and legs. Without hairs or with only a feeble development of them. Sculpturing often strong. The posterior rim of the scutellum usually more or less distinctly projecting beyond the propodeum. Hind tibiæ triangular, their outer edge terminating in a tooth or in a distinct angle. . . . Group IV.

3 and 4 present characters of species intermediate between IV and V and between IV and VI, respectively, and need not now be cited.

5.—Of intermediate size to large (elongate or compressed) species, without sculpturing or with feeble granular punctation. Thorax with fairly dense hair. Head of the width of the thorax, or a little wider, but occasionally with the supra-orbital line expanded and with the genæ broad; the clypeus never conspicuously short and broad. Scutellum of ordinary convexity, extending only a trifle beyond the propodeum. Abdomen depressed or moderately convex. The

¹To these Central American representatives there can be added, in the light of later knowledge, *Lestrimelitta*, of which I have recently seen an example from Panama as well as one from Guatemala.

hind tibiæ gradually (or sometimes very strongly) widened, rounded at the end even when an angle occurs above at the base of the excavation. Group V.

6 presents characters of a species intermediate between V and VI.

7.—Body of intermediate size to large, always very robust; (even when of elongate form), 6–13 mm. long, width of thorax, $2\frac{1}{2}$ to $5\frac{1}{2}$ mm. At least the thorax thickly covered with hair. Mandibles always toothless. Scutellum convex, almost triangular with rounded tip. Abdomen oval, strongly convex. Hind tibiæ fairly long, triangular, on their outer side smooth and excavated on the apical half, the outer margin prolonged at its tip into an angle. Hind metatarsi more than half as broad as the tibiæ. Wings not completely attaining the tip of the body. Habitus reminiscent of certain species of solitary bees, especially of the genus *Podalirius* (= *Anthophora*). Group VI.

In the course of the years the initial attempts to separate *Melipona* from *Trigona* on the basis of a single character, like the structure of the mandibles or the shape of the abdomen, had succumbed to a recognition of the fact that only by employing several characters could the degrees of affinity within the Meliponidæ be adequately determined. From Spinola and especially from Smith onward we note, therefore, a tendency to recognize combinations of characters as the more reliable test. Ducke's key (1925) to the six groups and their subdivisions repeatedly relies, as we have seen, on a combination of characters to effect a separation, but the most consistent and painstaking attempt of this kind to arrange the family systematically is that of Lutz (1924) in his chapter 'Some Characters of American Meliponidæ,' which forms part of a larger work, 'Apparently Non-selective Characters and Combinations of Characters.'

Lutz selected forty-three named forms of Meliponidæ that gave "as representative a sample as possible of the family." The characters that he used "were selected partly on the basis of their probable utility to the insects and partly on the basis of usefulness in identifying the species." They comprised the following, with the possibilities for divergence indicated in the tabulation on the right:

Mouth-parts.	long or short.
Mandibles.	fully toothed or not.
Shape of hind tibiæ.	triangular, oval, bowl, or club.
Apex of hind tibiæ.	evenly rounded, subtruncate to undulating, with an inward-pointing angle near the hind corner, with an outward-pointing angle at the hind corner.
Tibial hairs.	branched or not.
Mesonotum.	punctate or not.
Scutellum.	emarginate or not.
Scutellum.	hairy or naked.

"If any condition of one of these characters can be combined with any condition of every other character," states Lutz, "it is simple mathematics to conclude that $2 \times 2 \times 4 \times 4 \times 2 \times 2 \times 2 \times 2$, or 1024, different combinations are possible," although not more than 43 of these 1024 combinations could be represented in the forty-three species selected. As a matter of fact, only 11 of the 1024 possibilities were represented. Lutz estimated the chance—the pure chance—of a given combination of characters occurring in two or more species and, where the chance was ridiculously "slim," felt justified in believing that the species that had such characters in common were blood relations of one another. Thus, the association of long mouth-parts with all of the nine species having a punctate mesonotum (for which on the basis of pure chance the expectation would be only 1 in 500) is most easily explained by a common heritage. Not quite so clear-cut an association, according to Lutz, is that between fully toothed mandibles, type of tibial apex, and branched tibial hairs, for, while most of the fully toothed species have the tibial hairs branched, one of them has the hairs plain; furthermore, several species with incompletely toothed mandibles have branched tibial hairs. The complexities of the task begin to present themselves when conditions like these are confronted. Nevertheless, Lutz felt that the Meliponidæ could be separated into groups and even supplied a provisional outline of their phylogeny, which is here reproduced (p. 252).

It is interesting to compare the provisional phylogenetic diagram prepared by Lutz with the six groups into which Ducke divided the Meliponidæ. Fundamental differences of viewpoint make their appearance at once. Ducke seems to view *Melipona* in the restricted sense as the most advanced group of the Meliponidæ; Lutz, on the other hand, places *Melipona* tentatively at the base of the family, but permits flexibility in interpreting his diagram. This is made clear in the following passage from his paper:

"I do not know whether this diagram is a true picture of the phylogeny of these particular combinations or not. There are facts in the biology, wing-venation, etc., of these bees that indicate *Melipona* as the starting-point of the family, but it may be that *Lestrimelitta* with its nearly cylindrical tibiae and relatively short mouth-parts is closer to the primitive stock. In the latter case the phylogenetic history may be traced from there without changing the diagram. Also, although *Melipona* is so like *Trigona* in most characters that good authorities have united the two genera, even an amateur can distinguish them by differ-

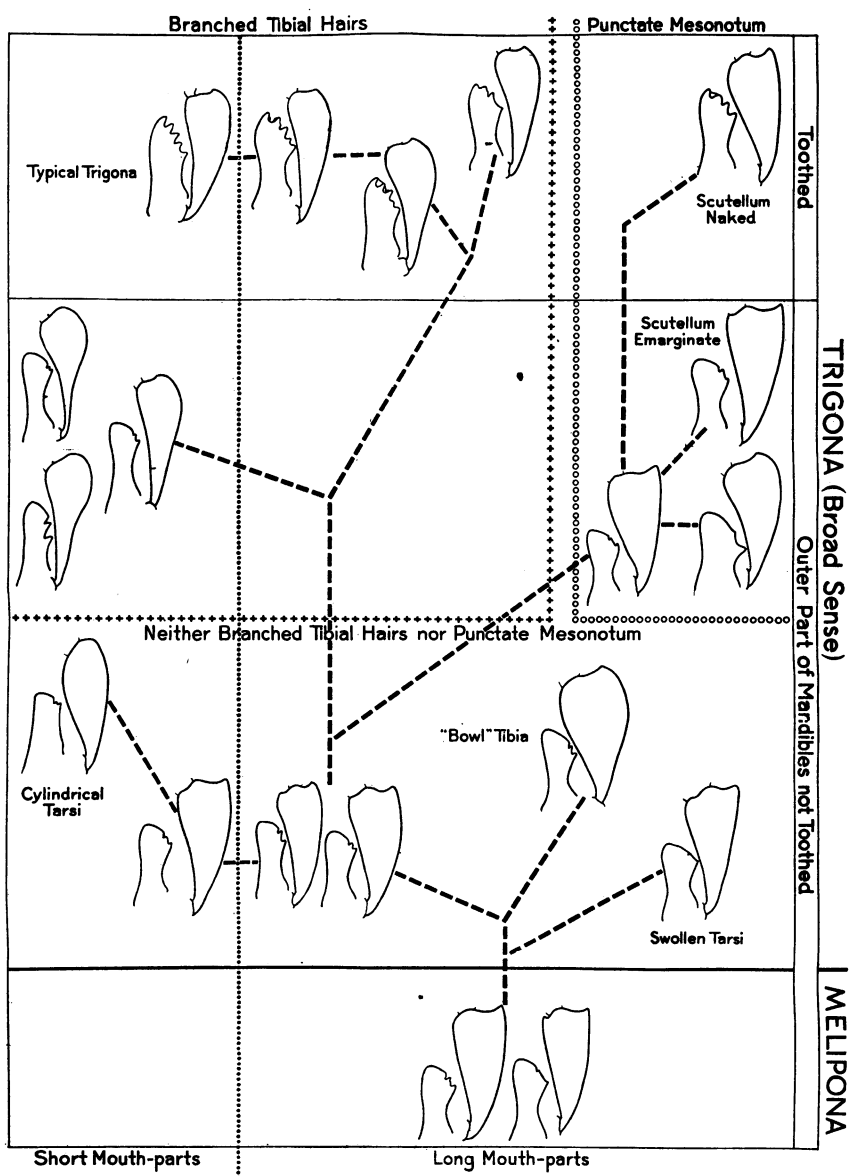


Fig. 1. Provisional outline of the phylogeny of the Meliponinae prepared by Lutz (1924) on the basis of the characters he used in studying the relationships within the family.

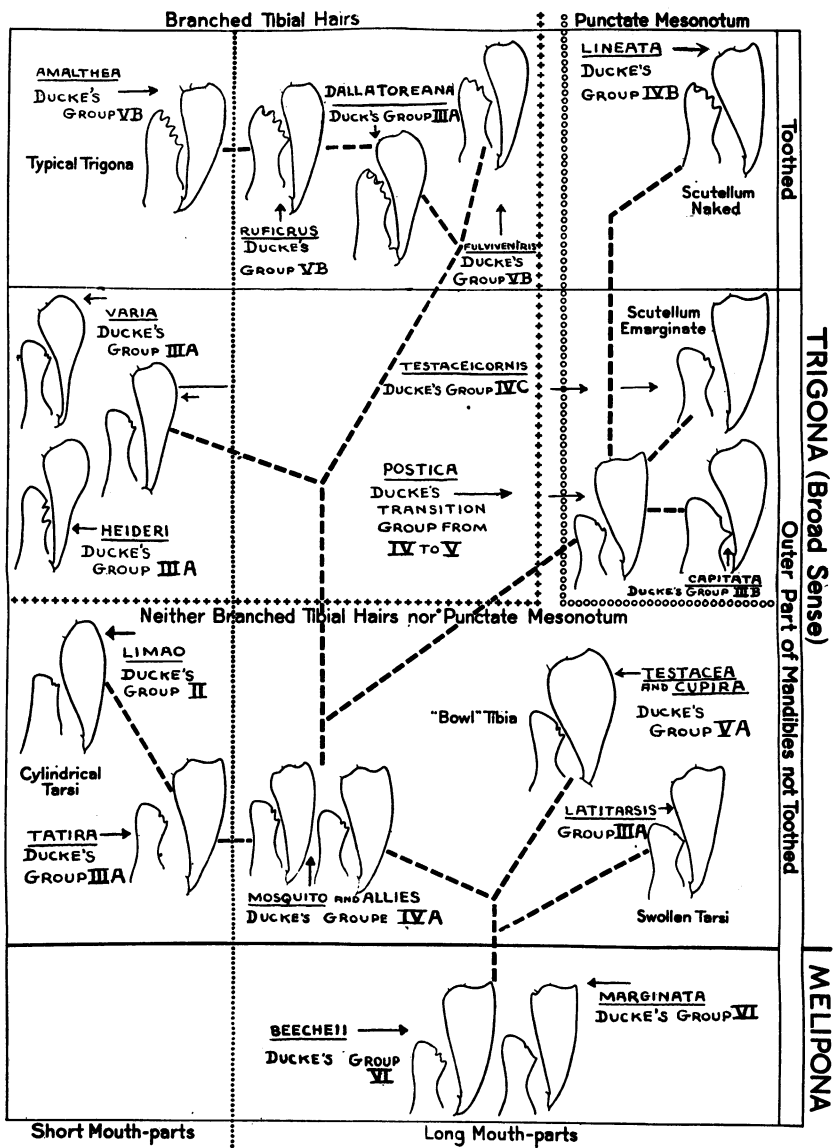


Fig. 2. The same diagram as Fig. 1, showing the position that the six different groups into which Ducke divided the Meliponidæ would occupy in this arrangement.

ences in their general appearance. It is conceivable, but not probable, that we have here an extreme case of biphyletic origin of an apparently homogeneous group."

Differing as to the probable place of *Melipona* in the developmental scheme of the family, the two authors disagree in some respects almost as fundamentally regarding the composition of the groups within the family. The reader is referred to the diagram on p. 253. It represents the provisional phylogenetic scheme proposed by Lutz, but on it have been added subsequently the names of the species depicted, as well as the group, designated by a Roman number, in which Ducke would place each of these. Ducke's Group VI (*Melipona* in the limited sense) preserves complete cohesion in Lutz's diagram. This is necessarily true also of Ducke's Group II, which consists of a single species, *limao*. Ducke's Group IV shows a semblance of continuity in the diagram, although the elements are not cohesive. Ducke's Group I is not represented in the diagram, which "does not profess to be an analysis of the entire family Meliponidæ." It is in the case of Group III and Group V that complete disruption of the elements assembled by Ducke results when the attempt is made to fit them into the diagram of Lutz.

If the several rectangles of Lutz's diagram may be interpreted as enclosing more or less cohesive groups, there are to be recognized in the material he studied seven assemblages as follows:

Group A.—*Melipona* in the limited sense

Group B.—*Trigona* with tibial hairs simple, mesonotum non-punctate, long mouth-parts

Group C.—*Trigona* with tibial hairs simple, mesonotum non-punctate, short mouth-parts

Group D.—*Trigona* with tibial hairs simple, mesonotum punctate, long mouth-parts

Group E.—*Trigona* with tibial hairs branched, only partly dentated mandibles, short mouth-parts

Group F.—*Trigona* with tibial hairs branched, fully dentated mandibles, short mouth-parts

Group G.—*Trigona* with tibial hairs branched, fully dentated mandibles, long mouth-parts.

The number of groups revealed by the diagram is nearly the same as that of Ducke, but the characters emphasized are wholly different. The possession of branched tibial hairs as against simple tibial hairs is one of the major divisions of Lutz's diagram; it is not introduced even as a character of secondary importance in Ducke's classifications. Another cleavage of Lutz, on the basis of long or short mouth-parts, is not

considered by Ducke. A third character to which Lutz gives emphasis, the punctate mesonotum, is ignored by Ducke, who, in his Group III as well as in his Group IV, makes provision for bees that represent both the impunctate and the punctate condition. One of the characters on which Ducke relied, namely, venation, is left out of Lutz's paper because, as Lutz has expressed himself to me, "the venation has so broken down in the course of evolution that it may have reached a point where its variation is not a reliable index of relationship." Ducke relied, too, on the serrate or non-serrate character of the hind margin of the third tibiæ, on the shape of the abdomen, on the shape of the hind tibiæ, on the projection of the hind margin of the scutellum beyond the propodeum or its failure to project, as well as on size and other factors to separate the Meliponidæ.

In general it seems to me that the distinctions drawn by Lutz are the more fundamental, and the present paper and others that I am hoping to prepare in the course of time will attempt to arrange the New World representatives of the family under the divisions that he established for a limited number of these. Some further subdivisions may seem desirable in view of the larger fauna now available. There are also some minor differences of interpretation, but in the main my studies up to the point to which they have been carried, confirm the conclusions he reached.

In the diagram I have so often referred to, Lutz used lines of different strength to indicate the relative importance of the characters on which the divisions were based. The lightest line of all, is that separating the Meliponidæ with long mouth-parts from those with short mouth-parts. "Long" and "short" are relative terms, not absolute like "present" or "absent." Their significance in Lutz's paper is indicated in the following citation:

"As a pure convention, we may say that labial palpi shorter than the mentum are 'short'; otherwise they are 'long.' In the same way, we may say that maxillæ or a glossa less than 1.25 times the length of the mentum are 'short'; otherwise they are 'long.'"

Sometimes a species will have two of the mentioned mouth-parts long, the other short, making it difficult rigidly to place it either in one group or the other. Where other characters tend to indicate close relationship, it would be my inclination to lift the barrier between long and short. In particular do I apply this to *Trigona* in the limited sense, namely, that division of the Meliponidæ that has fully toothed mandibles and plumose hairs fringing the hind tibiæ. In the diagram *amalthea*

(Friese's *fuscipennis*) qualifies as a full-fledged member of the group with "short" mouth-parts, having the glossa, labial palpi, and maxillæ "short." On the other hand, *ruficrus* and *dallatorreana* with two of these parts long and *fulviventris* with all three parts long are on the other side of the barrier. Yet the relationship between these sundered bees is in other respects so close that Ducke makes *fuscipennis* Friese (here considered the equivalent of Olivier's *amallthea*) merely a subspecies of *ruficrus*. In my estimation they should all find place in one subdivision of the Meliponidæ instead of being assorted into two groups.

MELIPONA AND ITS NEAR RELATIVES

• The evidence presented in the historical résumé has tended to show that the preponderance of opinion favors a division of the Meliponidæ into groups. Smith has indicated that nature herself has divided them, confining *Melipona* to the western hemisphere.¹ Lutz has expressed the opinion that "a detailed study of a variety of characters and of their combinations shows that the at-first-sight chaotic jumble is really capable of an orderly arrangement into definite groups having apparently definite relations one to another." Ducke, while contending for a single genus, recognizes groups within that genus.

To subdivide the Meliponidæ seems not only logical but justified on the grounds of convenience. They constitute a large, unwieldy group, and their study is unnecessarily encumbered if no recognition is given to the subdivisions within the family, even though these subdivisions may have hazy boundary lines and the borderland species be hard to assign with finality.

While approving of the attempt to subdivide the Meliponidæ, the difficulties are admittedly great. For instance, certain insects that have been classed as *Trigona* are more closely related structurally to *Melipona* than they are to *amallthea*, the type species of *Trigona*, distinguished in

¹Several writers are nevertheless apparently of the belief that *Melipona* occurs in the Old World. Thus Spinola (1853) described a *Melipona bocandei* from Guinea, even comparing it with a South American species *janosa*. However, Spinola's differentiation of *Melipona* and *Trigona* cannot be trusted. He described as *Trigona ghilianii* what others have interpreted as a *Melipona* and in describing his *peltata* he assigned it to *Trigona* doubtfully. Dalla Torre (1896) has placed *bocandei* in Brazil, misled apparently by the fact that other insects recorded by Spinola in his paper were taken by Ghiliani in the State of Para.

Cockerell (1918) described a *Melipona chrysura* ♂ from Nigeria. He concluded his description with the comment, "Nearest to *Trigona* or *Melipona tomentosa* Friese, but larger, and differing in the detail of coloration."

Yet another author, Alfken (1929) has described a *Melipona alinderi* from British East Africa. He too compared his species with *tomentosa*, which he designated a *Melipona*.

The hind tibiae of *tomentosa* are different in structure from those of *Melipona* as here defined, and its developed stigma accords with that of *Trigona* rather than with that of *Melipona*. Alfken described the hind tibiae of his *alinderi* as being rounded on the outer and on the inner extremity, which would seem to differentiate it also from *Melipona* as defined in this paper. Regarding Cockerell's *chrysura* it is more difficult to speak with finality; the associated worker, when discovered, may aid in the interpretation.

the worker by the branched hairs that fringe its hind tibiae and by fully dentated mandibles. Particularly is this true of Lutz's Group B, which is more or less equivalent to Ducke's IV A, and includes bees of the general type of Smith's *mosquito*, described as a *Trigona*. For convenience of reference we may designate it the *mosquito* group. Workers of the *mosquito* group are in accord with workers of *Melipona* proper in such essential respects as the general structure of the hind tibiae, the non-branched character of the hairs fringing the hind tibiae, the absence of dentition on the outer half of the apex of the mandible, the long mouth-parts, the structure of the scutellum, the general shape of the abdomen, etc. They are, of course, easily separated from their larger relatives because of diminutive size, but that is a very superficial character. Hardly less superficial is the distinction based on the hairs of their face and thorax. Usually their face is rather uniformly covered with hair, there being no sharp division into an upper hirsute half, and a lower glabrous or inconspicuously hirsute half, as is usual in *Melipona*. The hairs on the mesonotum are short and less dense in the *mosquito* group, making the long hairs on the scutellum the more conspicuous by contrast. Several members of this group have the mesonotum smooth, the propodeum strongly shiny, but the distinction is not absolute, one of the exceptions being *schrottkyi*. Nevertheless, even when there is sculpturing on the propodeum, it is not of the dense character that one usually notes in *Melipona*, though at least one species of *Melipona*, namely, *flavipennis*, has merely light sculpturing.

The most important structural distinction is that to which Gribodo (1893) alluded in connection with his description of *minima*, namely, the stigma, which in the *mosquito* group is well developed, rounded below, rather lanceolate, whereas in *Melipona* the stigma is rather poorly developed, being more nearly linear in appearance, elongate, and tapering to a point apically. Even here the distinction is sometimes one of degree. While in *interrupta*, *quinquefasciata*, and *beecheii* the stigma is distinctly thin and elongate, in some other *Melipona* it is less so; finally, in the case of a borderland species like *caerulea*, one reaches a point where a clear-cut decision is hard to make. The length of the wing may also aid in separating the two groups, being relatively longer in the *mosquito* group, the forewing always extending well beyond the tip of the abdomen even when this is stretched to its capacity.

Fortunately reliance need not be placed wholly or even mainly on structural differences in keeping the *mosquito* group and other *Trigona* distinct from *Melipona*. It will be recalled that one of the distinctions

that von Ihering (1903) drew between *Melipona* and *Trigona* was the presence of undifferentiated royal cells in the nests of the former and of differentiated royal cells in the nests of the latter. Although von Ihering, Silvestri, and (according to Ducke) also Marianno¹ make no mention of royal cells in discussing the nest of *mosquito*, I think Ducke is justified in his conclusion that differentiated royal cells exist in this species, otherwise surely von Ihering in 1903 would not have regarded the presence or the absence of the differentiated royal cells as perhaps the main line of cleavage in the biology of the two principal groups of the Meliponidæ or would have taken some cognizance (as he did later in the case of *capitata*, *silvestrii*, etc.) of what he believed to be (although it would seem erroneously) exceptions to the general rule. Differentiated queen cells occur in the nest of *schrottkyi*, which Ducke places in the *mosquito* group.

Probably correlated with the construction of the royal cell is another character that deserves, I think, especial emphasis. In the species that have been referred generally to *Trigona* the queen (even the virgin) is larger than the workers, especially if the criterion be the width of the thorax. On the other hand, in *Melipona* in the limited sense the unfertilized queen is below the average size of the workers, and has a thorax narrower than that of the worker. Viewed from this standpoint the *mosquito* group, notwithstanding the many structural characters that it has in common with *Melipona* proper, belongs rather to the *Trigona* division of the family.

In a previous paragraph *caerulea* has been referred to as a borderland species. The extent to which this is the case may be inferred from the fact that Friese described it originally as a *Melipona* and later under a different specific name (*cyanescens*) as a *Trigona*. Ducke makes it a species intermediate between his Group IV (which includes as one of its divisions what is here termed the *mosquito* group) and his Group VI (*Melipona* in the restricted sense). From all other Meliponidæ it differentiates itself by the metallic sheen of its chitin.

Where should it be placed? At first I was inclined to put it with *Melipona*, and, should its biology when it is investigated prove to be that of the insects so classed, I should still be inclined to place it there. Morphologically it seems a little closer to the *mosquito* group to which I have assigned it tentatively. The grounds for this decision are as follows: its stigma is fuller than is the case in species of *Melipona* in the restricted sense, its propodeum less densely sculptured; the maculations

¹I have not had access to the paper of Marianno.

of its thorax and legs are suggestive of the condition in certain members of the *mosquito* group; the hair of its mesonotum, though longer than in the *mosquito* group, is relatively sparse; and in size it accords more nearly with the larger species of the *mosquito* group than it does with the much larger *Melipona*. It has, therefore, been left out of the present paper.

While doubts assail one in definitely assigning *caerulea*, no such doubts exist in the case of *prosopiformis*, which Gribodo incorrectly, I think, described as a *Melipona*. From the insects here recognized as typical *Melipona* it differentiates itself in the following respects: head at least as long as broad; head and thorax glabrous; mandibles (in perfect specimens) completely dentated. It belongs in what has in this paper been designated Lutz's Group D, being a close relative of Lepeletier's *lineata*.

The claim of *prosopiformis* to be included in *Melipona* subgenus *Melipona* is easily rejected. On the other hand, another borderland species, *quadripunctata*, with its intergrading forms *bipartita* and *basalis*, comes very close to *Melipona* as herein defined. Ducke has pointed out that it can be excluded on the basis of its much longer wings and less convex abdomen. It may be added, too, that the hind tibiae of its worker are a little different from those of *Melipona* workers, a trifle more rounded on their inner lateral margin and with the basal convexity greatly reduced, the broad surface of the joint being flattened to concave, thus distantly suggesting the extremely widened and spoonlike hind tibiae of *testacea*, of *cupira*, and their allies.

DEFINITION OF *Melipona* SUBGENUS *Melipona*

As here defined *Melipona* (subgenus *Melipona*) is distinguished by the possession of the following characters in the worker:

Medium-sized to large bees, 6 mm. to 15 mm. Head broader than long. Mandibles edentate or at most dentate on the inner half of the apex of the mandible. At least the upper half of the face with abundant hair, the lower half of the face usually glabrous or approaching a glabrous condition.

The mesonotum, mesopleura, and scutellum covered more or less densely with rather long hairs. The propodeum as a rule densely tessellated.

The hind tibiae of an elongate triangular shape, the outer apical angle definite and down-pointing or out-pointing, not rounded or with the angle inwardly placed. The basal part of the hind tibiae convex, the apical part more concave. Simple, as distinguished from plumose, hairs fringing the hind tibiae.

The wings as a rule relatively short, usually not attaining the tip of the abdomen, or at most extending only slightly beyond it. The stigma poorly developed, rather narrow and linear, tapering to a point apically, not rounded below.

The abdomen as a rule convex ventrally as well as dorsally, rather robust, giving the insect an *Osmia*-like shape.

Emphasis has been laid upon the worker because it is that cast that is alone available for comparison in so many cases, the queen and the male being often unknown. What has been said, however, of the incomplete development of the stigma in the worker applies equally to the sexual forms so far as they are known; and in the queen at least the wings are much shorter even than those of the worker, being, in fact, in certain species distinctly degenerate. While there is less accord in the hind tibiae of the queens of *Melipona* than is the case in the workers, it is probable that the hind tibiae of the workers represent the more fundamental condition.

The virgin queens of *Melipona* do not exceed the worker in size, being usually smaller, with a thorax narrower than that of the worker; whereas in other Meliponidæ, so far as known, the queen has a thorax wider than that of the worker and is a bulkier insect. This reversal in the relationship of the size of the worker and of the queen is probably correlated with the fact that in *Melipona* the queen cells are undifferentiated from those of the worker, whereas in *Trigona* the royal cell is easily recognized by its size. The divergent stature of the queens seems therefore a fundamental distinction between the two groups. It holds even in the case of *capitata*, which von Ihering believed, it would seem erroneously, to emerge from a cell no larger than that of its worker. The queen of *capitata*, like the royal member of other *Trigona*, is readily separated from the worker by her greater size.

ACKNOWLEDGMENTS

In his paper of 1924 Lutz stated, "A discussion of the taxonomy is reserved for a later paper." At the time he had hopes of rounding out his studies by an examination of all of the available species of the Meliponidæ, but, due to the responsibilities of his curatorship at the American Museum and of the directorship of his field station and also because of the increasing fascination he found in experimental biology, the task of monographing the Meliponidæ was put off. Then, with characteristic generosity he yielded to another the opportunity that he himself could have embraced with far more satisfactory results. Throughout the

preparation of this paper I have had the benefit of his friendly counsel. Many a time when I had lost my sense of direction in the maze of material through which I was groping my way, he has been my compass. His name ought to appear as joint author of this paper, but he has resisted my strong insistence that such recognition be given. Those familiar with his earlier paper will be in a position to judge the large extent to which my conclusions have based themselves on his. Another member of the American Museum's entomological staff, Mr. A. J. Mutchler, has been of immeasurable aid to my work, and many an excellent suggestion he has made has been embodied in this paper.

While I gladly pay first tribute to Dr. Lutz, there are many others to whom grateful acknowledgment is also due. In all of the museums I have visited I have had the considerate coöperation of those in charge. Mr. Rohwer and Miss Sandhouse at Washington have spared no pains in furthering my work, not only offering to me the facilities of the National Museum for the study of identified material but generously loaning to me the vast collections of unidentified Meliponidæ over which they had disposal. Credit to the particular collectors is given in connection with each species, but I should be remiss if I did not in this introduction particularly stress my gratitude for the wealth of material collected by W. M. Mann while on the Mulford Expedition. Again and again I have drawn upon the riches of his collection for an elucidation of problems that presented themselves. Among the specimens loaned by the National Museum were also those taken by L. O. Howard, A. Busck, J. C. Crawford, C. H. T. Townsend, A. H. Jennings, F. Knab, H. Osborn, G. P. Goll, S. F. Blake, Schwarz and Barber, M. A. Carriker, and others. Not all of these collectors took *Melipona* in the restricted sense, but their capture of other Meliponidæ entitles them to mention here.

Rivalling in importance the material received through the National Museum is that which was generously loaned by the Entomological Department of Cornell University and by the Academy of Sciences in Philadelphia. The field work done by the several expeditions sent out by Cornell has yielded a particularly rich representation of Meliponidæ. In the expedition of 1919-1920 to the west coast of South America and thence into Brazil, Professor J. C. Bradley and Dr. W. T. M. Forbes participated, and for part of the time Messrs. Harris and Williamson joined them. It is hard to apportion the individual credit in such cases, and often I have had to content myself by crediting the catch to the expedition as a whole. In 1927 Dr. W. T. M. Forbes and Dr. P. P. Babiý made an expedition to Guiana that yielded valuable study material, and I am indebted,

too, for the opportunity of studying specimens taken by Professor Bradley in Central America. The names of Crawford (Baker Collection) and Hammar are attached to many a specimen loaned by Cornell and are a pleasant reminder of the extent of my indebtedness both to the individuals and the institution.

The bees loaned by the Academy of Sciences of Philadelphia include the comprehensive collection of Brazilian specimens gathered years ago by H. H. Smith, which furnish a splendid basis for the study of the intricate fauna of that country. Mr. J. A. G. Rehn of the Academy, who has had occasion to trace the itinerary of Smith in connection with the study of the Orthoptera taken by that collector, has been of great aid to me in determining the location of places that do not appear on the maps, or that because of their duplication from state to state could not be assigned by me with certainty. I am also indebted to Mr. Rehn for specimens of his own collecting. To Mr. Cresson of the Academy my thanks are due for kindly giving me access to the types described by his father and for many other attentions.

Two collections of particular aid in the study of the Meliponidæ have been those loaned by the University of Michigan and by Dr. T. H. Frison of the University of Illinois. The names of Dr. F. M. Gaige and Dr. T. H. Hubbell predominate on Central American specimens loaned by the University of Michigan. The collection loaned by Dr. Frison consists largely of specimens gathered by H. Parish in the course of his South American travels. I feel that especial thanks are due the owners of these two collections, not only for their generosity in originally lending them to Dr. Lutz, but for their patience in permitting the American Museum to retain them notwithstanding the delays that have marked my work on this group.

Of more recent acquisition for the purpose of this study but because of the interest of the region especially valued, is a collection of Meliponidæ made by Dr. G. Salt during his sojourn in Colombia. The fact that Dr. Salt has made thorough investigations of the biology of the bees he submitted has given double zest to the task of identifying them. Not only has he generously released the specimens of his own collecting, but he has included with them specimens taken by Dr. J. Bequaert on the Rio Negro as well as in Honduras and elsewhere, and specimens taken by Mr. Herbert Lang in British Guiana. Among individual collectors who have kindly submitted material from their collections should be mentioned also Mr. S. W. Bromley.

Last, but by no means least, are the collections of the American Museum, especially the comprehensive material gathered by Dr. Lutz during his visits to Panama. Panamanian specimens have been contributed, too, by Mr. C. H. Curran of the Museum's department of entomology, and by Mr. T. Hallinan. From Guatemala the Museum possesses series collected by Lichy René, and from Mexico by M. Digue. To Professor William Morton Wheeler the Museum is indebted for specimens from British Guiana, and this collection has been recently supplemented by the catch of Miss A. Mackie and Mr. and Mrs. J. Ogilvie, donated through the kind offices of Professor Cockerell, whose friendly encouragement of the preparation of the present paper was further manifested by the loan of a specimen of Smith's *mandacaia*. Of special help has been the American Museum's large collection of specimens identified by Dr. H. Friese, including many duplicates. In this collection are a number of specimens bearing either his paratype or metatype labels.

The aid which I have received from individuals in this country has been supplemented in a whole-hearted manner by scientists abroad. During my sojourn in England I was privileged to examine the Latreille and Smith collections at Oxford, where my stay was made thoroughly delightful through the warm hospitality of Professor and Mrs. Poulton. To Professor Poulton's assistant in the Museum, Mr. Hamm, I am also indebted for many kindnesses. At the British Museum, thanks to the thoughtful provision of Mr. J. Waterston, I enjoyed splendid working facilities during a sojourn of from two to three weeks that was devoted to a study of the types of Smith and other identified material, and I am indebted not only to Mr. Waterston but to Major Austin, Mr. Arrow, Miss Cheesman, and others for their courtesy and helpfulness. At the Museum in Paris I was made to feel particularly at home, and I take this opportunity to express more fully than I could at the time with my limited command of French the gratitude that I have for the attentions received. To Professor Bouvier I am obligated for the many privileges I enjoyed, while to Monsieur H. Bertrand, who, in the absence of Monsieur Lucien Berland, gave me access to the collections of Hymenoptera and who smoothed the path for me at every turn, I am also warmly grateful.

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To Miss Francesca R. LaMonte, Assistant Curator in the American Museum's Department of Ichthyology, I am indebted for aid in the translation of certain passages from Italian writers on the Meliponidæ.

To the library department of the American Museum—and especially to Miss Gay, Miss Gunz, Miss Titcomb, and Miss Van Vleet—I am especially grateful for their assistance in ferreting out volumes of pertinence to the investigation.

To the secretaries of the Museum's department of entomology, Mrs. Stevens and Miss Olson, I am obligated for the care they have exercised in the accurate typing of my somewhat indecipherable script and furthermore for improving upon the original in cases where my too great absorption with the matter made me careless as to the expression.

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Finally to all who have written about the Meliponidæ I am necessarily under heavy obligation. If the present work has value, it is largely due to the basis supplied by those who have worked upon the group in the past.

My acknowledgments have required many paragraphs, yet even so there are probably some to whom I have failed to render thanks. If such there be, I wish to make partial amends by tacitly including them.

MICROSCOPE USED

The studies here reported upon were made through a binocular giving a magnification of twenty-four diameters.

SYSTEMATIC ACCOUNT OF THE SPECIES OF *MELIPONA* SUBGENUS *MELIPONA*

Many species of *Melipona* have been described at one time or another, often without indication of their near relationship to other members of the group. Morphologically many of the so-called species are very similar or show only trifling differences, while intergradations in the color of the chitin or of the hairs, or in the distribution of the hairs link in one system insects that at first glance seem quite contrasted. When *Melipona* that are structurally identical or that intergrade within narrowly separated structural limits are grouped and the members of each such group are designated by subspecific names, the number of species shrinks considerably and a more ordered survey is obtained. That was the method of Ducke (and also of Cockerell for some subspecies of *fasciata*, etc.), and it is the method here adopted. Cockerell well summarizes the close relationships within the Meliponidæ in his paper of 1919: "These insects (*Melipona*), as also the species of the allied genus *Trigona*, present a great number of races or very closely allied species,

as do the ants. The group of *Melipona fasciata*, for example, with its local forms in Brazil, British Guiana, Trinidad, Panama, Costa Rica, etc., recalls the condition found among the ants of such a genus as *Camponotus*. The several forms are also related to one another in much the same degree as the 'representative species' in the islands of an archipelago, as the birds of the Galapagos Islands, or the Lesser Antilles."

KEY TO THE WORKERS OF *Melipona*¹

- 1.—At least the lower half of the face highly polished, strongly shiny, devoid or virtually devoid of hair.....2.
The lower half of the face as well as usually the upper half dull or semidull due to dense sculpturing.....4.
- 2.—The abdomen black (sometimes deep brown), unbanded or at most with a faint, brown line on the apex of the basal tergites, with exclusively black hair not only on the tergites of the abdomen but on the sternites as well. Robust. Length 11 to 13½ mm.....*flavipennis* (p. 270).
The abdomen black or red, with broad bands (sometimes widely interrupted medianly). The abdominal tergites almost hairless. All the sternites except the apical abdominal sternite with grayish-white hairs.....3.
- 3.—The front usually with dark hairs. The clypeus with very feeble, almost negligible punctation. The vertex and mesonotum relatively shiny. The broad apical rims of the tergites dull in contrast to the moderately shiny basal portion of each tergite. Length 9½ to 10½ mm.
quadrifasciata and subspecies (p. 275).
The region between the antennæ and ocelli with grayish-white to snow-white hairs. The punctation of the clypeus sparse but relatively strong. The vertex and mesonotum rather devoid of shininess, rather densely if finely tessellated. The abdomen uniformly shiny. Length 7½ to 8 mm.
mandaçaia (p. 282).
- 4.—The inner half of the apex of the mandibles subdivided by a strong emargination into two distinct, contiguous teeth. The antero-lateral angles of the mesonotum with a rust-red patch of hair, contrasting rather sharply with the other thoracic hairs. The abdomen as a rule rather elongate.....5.
The apex of the mandible sometimes with a small, median denticle, widely separated from the inner angle of the mandible. Frequently, however, this interruption in the contour has been leveled down, justifying the usual impression that the mandible is edentate. Hairs of the mesonotum sometimes of intermixed character but not sharply differentiated in the shoulder region. Abdomen usually more compact.....7.
- 5.—Progressively wide, continuous bands on tergites 1 to 5 of the abdomen, those on 3, 4, and 5 being so wide that the greater part of these tergites is yellow. The legs fulvous varied more or less with black..*quinquefasciata* (p. 320).
The bands on tergites 1-5 sometimes continuous, sometimes very widely interrupted. When they are continuous, they are of rather uniform width from tergite to tergite, merely bordering the apex of each tergite and leaving a vastly wider basal area of black.....6.

¹Friese's *rufipes*, which is recognized by Ducke as an independent species, and Ducke's *subnitida* have been omitted from this key because of doubt as to their precise character.

- 6.—Larger, 11 to 13½ mm., and in extreme cases (subspecies *grandis*) said to attain 15 mm. The outer apical angle of the hind tibiae prolonged downward, spinelike. The scutellum usually wholly black, at most with an abbreviated yellow line on the posterior rim. The apical tergite usually with numerous plumose, white hairs, that as a rule are long and conspicuous but sometimes very short and sparse, and even absent. (South America northward to Panama)..... *interrupta* and subspecies (p. 285).

Smaller, 7¾ to 11 mm. The outer apical corner of the hind tibiae more laterally directed, with often a small toothlike formation. The scutellum wholly or mostly yellow, in rare instances black above but with the posterior border extensively yellow. The hairs on the apical tergite, though as a rule white and sometimes abundant, not conspicuously branched, simple. (Central America, Mexico, and West Indies.)

beecheii and its subspecies *fulvipes* (p. 307).

- 7.—The face very broad, the distance between the compound eyes at the level of the middle ocellus being notably greater than the length of the eye. The clypeus with widely separated, distinct although shallow punctures scattered over its tessellated surface. The compound eyes rather strongly convergent below. The region behind the ocelli rather strongly raised and that between the ocelli and the compound eyes flattened to slightly depressed. The outer angle of the hind tibiae with usually a small, spinelike prolongation. The thorax, including the scutellum, black and without maculations. In one subspecies the tergites are wholly black, in another the bands have deep emarginations above, reducing their breadth, but in most specimens of the majority of the subspecies, at least tergites 2-4 have rich, conspicuous, yellow bands occupying their apical half (when the abdomen is telescoped, these tergites may even fail to show basal black, appearing almost wholly yellow). Almost invariably the yellow bands enclose a dark, upcurved line on each side..... *favosa* and subspecies (p. 327).

The distance between the compound eyes at the level of the anterior ocellus about equal to or less than the length of the eye. The abdominal tergites immaculate or maculated; but the bands on tergites 2-4, when they occur, relatively narrow, rimming merely the apex, not occupying the apical half of the segment..... 8.

- 8.—The malar space exceedingly reduced, the rim of the eye virtually in contact with the mandible near its inner angle. The distance between the compound eyes at the level of the anterior ocellus less than the length of the eye. The spread of the ocelli measured from the outer rim of one lateral ocellus to the outer rim of the other twice or a little more than twice the distance between the outer rim of the lateral ocellus and the nearest point of the eye..... 9.

The malar space more distinct, eye and mandible clearly separated even if narrowly. The distance between the compound eyes at the level of the anterior ocellus about equal to the length of the eye. The spread of the ocelli, measured from the outer rim of one lateral ocellus to the outer rim of the other, less than twice the distance between the outer rim of the lateral ocellus and the nearest point of the eye. *fasciata* and subspecies (p. 348).

- 9.—The tergites of the abdomen black and immaculate, or at most with a dull vestige of a band on one or two tergites; especially distinguished by having

a rather even, woolly to velvet-like covering of erect, medium-length hairs that sometimes very nearly conceal the chitin. Medium-sized bees, 8½ to 10 mm. *schencki* and subspecies (p. 421).

The tergites not nearly so strikingly hirsute, never velvety in appearance, sometimes even rather glabrous viewed from above, with the chitin of the abdomen always plainly visible. The tergites usually banded but not always. Smaller, 6 to 9 mm. 10.

- 10.—The middle ocellus unusually small, almost specklike compared with the lateral ones. *concinna* (p. 417).

The middle ocellus frequently oval in shape but only a little smaller or about the same size as the lateral ones. 11.

- 11.—The mesonotum with strong or feeble tessellation or, more rarely, with the tessellation completely obliterated, leaving a polished surface with scattered, rather feeble punctation. Length 6 to 7½ mm., and in rare instances up to 8 mm. *marginata* and subspecies (p. 428).

The mesonotum densely, distinctly, and strongly punctated as distinguished from tessellated, with shiny interspaces between the punctures. Length 8½ to 9 mm. *puncticollis* and subspecies (p. 413).

KEY TO THE QUEENS OF *Melipona*¹

- 1.—The malar space relatively abbreviated, its shortest length² about half as long as the mandible is wide at its base; in some species even more drastically reduced. 2.

The malar space long, either a little shorter than the width of the mandible at its base or more often equal to or longer than the maximum width of the mandible. 4.

- 2.—The malar space at its shortest about one-third as long as the mandible is wide at its base. The head narrower than the mesonotum. The distance from one eye to the other at the level of the median ocellus a trifle less than the length of the eye. The mandibles with a median denticle but without subdivision of their inner half into two contiguous teeth. *schencki* (p. 421).

The malar space at its shortest about half as long as the mandible is wide at its base. The head wider than the mesonotum. The distance from one eye to the other at the level of the median ocellus greater than the length of the eye. The facial quadrangle wider than long. 3.

- 3.—Larger, 10 to 10¼ mm. (virgin), with the mesonotum, legs, and abdomen prevailing black. The inner half of the mandible feebly bifid.

interrupta as represented by subspecies *salti* (p. 293).

Smaller, 8 to 9 mm. (virgin), with the abdomen reddish brown, indistinctly banded with yellow, and the legs prevailing yellowish. The inner half of the mandible with distinct, contiguous teeth. *beecheii* (p. 307).

- 4.—The hind tibiae broad, comparable in breadth with those of the worker, rather excavated or flattened, with a fairly distinct angle posteriorly at the apex.

flavipennis (p. 270).

¹The queens of *quinquefasciata*, *puncticollis*, *rufipes*, *subnitida*, *concinna*, and *mandacai* are unknown. A specimen of the queen of *marginata* was not available. In some instances the key could not be based on individuals of the typical subspecies, but it may be assumed that the structural characters that apply to other subspecies of a particular species will hold approximately also for the typical subspecies.

²This is not intended to imply variability in the length of the malar space but irregularity in its contours, and the shortest length means the shortest measurable distance.

- The hind tibiae relatively narrow, elongate oval in shape, the apex rounded posteriorly, not angular. 5.
- 5.—The mandibles very broad and nearly flat, their apex approximately as broad as their basal portion. The lower half of the face as well as the upper half hairy. *fasciata* as represented by subspecies *rufiventris* (p. 383).
- The mandibles convex, and narrower at the apex than at the base. The lower half of the face glabrous. 6.
- 6.—The lower half of the face highly shiny and immaculate, with only a few fine punctures on the clypeus. The region on each side of the ocelli rather sharply depressed and bounded posteriorly by a distinct curvilinear carina that extends from the summit of the eye to the nearest lateral ocellus.
- quadrifasciata* as represented by subspecies *anthidioides* (p. 279).
- The lower half of the face less shiny. The clypeus faintly tessellated and in addition with conspicuous, although scattered, punctures. In the typical subspecies, at least, the lower half of the face is extensively maculated with yellow. The region on each side of the ocelli very slightly flattened and with at most an ill-defined carina extending vaguely from the summit of the eye to the nearest lateral ocellus.
- favosa* as represented by subspecies *favosa* (p. 328).

KEY TO THE MALES OF *Melipona*¹

- 1.—At least the lower half of the face highly polished, hairless; the clypeus and sides of face often immaculate or with indistinct and fragmentary stripes. The facial quadrangle broad. The malar space distinct even though short. The hind tibiae without a spinelike prolongation at the apex. 2.
- The lower half of the face as well as usually the upper half dull or semidull due to more or less dense sculpturing. The clypeus and sides of the face, or merely the clypeus, usually more or less extensively maculated. 4.
- 2.—The abdomen black (sometimes deep brown) without yellow bands, the apical rims of the tergites narrow, smooth, and shiny. The ocelli arranged in virtually a straight line, the vertex immediately in back of them barely raised. The scape with a few, widely separated, but rather strong punctures. The hind tibiae broad. *flavipennis* (p. 270).
- The abdomen black or reddish, with broad, apical bands, sometimes medianly interrupted. 3.
- 3.—The top part of the head rather shiny to each side of the sharply raised area back of the ocelli. The banded apical portion of each abdominal tergite with denser sculpturing than the basal portion and hence less shiny. The hind tibiae with a fairly distinct outer angle.
- quadrifasciata* and subspecies (p. 275).
- The top part of the head with very little sheen. The tergites of the abdomen uniformly shiny throughout. The hind tibiae completely rounded at the apex.
- mandaçaia* (*bahiana*) (p. 282).
- 4.—The hind tibiae rather resembling those of the worker; triangular in outline, attaining their greatest breadth at the apex, the outer corner of which is sharply angular or with a spinelike prolongation. 5.

¹So far as possible structural characters have been selected in the hope that these might apply not only to the known males but also to such subspecies within a species as are at present represented in collections only by workers. The males of the species *rufipes*, *puncticollis*, *concinnulla*, and *subnitida* are unknown and no attempt has been made to interpret them.

- The hind tibiae very different from those of the worker; more oval in outline, with the apex rather rounded. 7.
- 5.—Progressively wide, continuous bands on tergites 1 to 5 of the abdomen, those on 3, 4, and 5 being so wide that the greater part of these tergites (sometimes practically all of the visible part) is yellow. The apical tergite black, with black hairs. The legs prevallingly fulvous; the hind tibiae relatively narrow, with a well-developed spine at the apex. *quinquefasciata* (p. 320).
- The bands on tergites 1-5 sometimes continuous, sometimes very widely interrupted. When they are continuous, they are of rather uniform width from tergite to tergite, merely bordering the apex of each tergite and leaving a vastly wider basal area of black. 6.
- 6.—The hind tibiae angulate at the apex, with at most a small, toothlike formation at the outer angle. The inner half of the mandible subdivided into two distinct teeth. The scutellum sometimes wholly yellow, sometimes black above with the posterior border yellow. Tergite 6 with simple hairs. About 9 mm. *beecheii* and its subspecies *fulvipes* (pp. 307 and 316).
- The hind tibiae with a sharp, distinct spine at the outer angle of the apex. The inner half of the mandible usually not distinctly subdivided into two teeth, often subedentate. The scutellum black. Tergite 6 with strongly plumose hairs. Larger, 10 to 12 mm.
- interrupta* (subspecies *salti* and *mañaosensis*) (pp. 293 and 301).
- 7.—The face very narrow, particularly below, the clypeus filling the space between the eyes, with its lateral extremities in contact with or barely separated from the rim of the eye. The lateral ocelli rather close to the eye, the distance between the eye and the outer rim of the nearest lateral ocellus being about one-third to one-fourth that from the outer rim of one lateral ocellus to the outer rim of the other. The malar space exceedingly short, reduced to the vanishing point at its inner end, where the inner angle of the mandible is virtually in contact with the rim of the eye. 8.
- The face relatively wider, the lateral angles of the clypeus distinctly, if narrowly, separated from the rim of the eye. The lateral ocelli relatively far from the eye, the distance between the eye and the outer rim of the nearest lateral ocellus being about one half that from the outer rim of one lateral ocellus to the outer rim of the other. 9.
- 8.—The abdominal tergites densely and conspicuously hirsute, the hair tending to conceal the dark chitin beneath. Medium-sized *Melipona*, $8\frac{1}{2}$ to $9\frac{1}{2}$ mm.
- schencki* (p. 421).
- The hair on the tergites relatively scant, nowhere concealing the chitin. The abdomen red or black, usually with bands along the apices of the tergites. Small *Melipona*, 6 to 7 mm. *marginata* (p. 428).
- 9.—The eyes very strongly convergent below. Malar space abbreviated. The clypeus usually maculated extensively but the sides of the face (except in the highly maculated subspecies *favosa*, in which the region between the clypeus and the eye is entirely yellow) very rarely with any yellow. The clypeus usually with strong although shallow punctures scattered sparsely over its tessellated surface, these punctures being not always so conspicuous as in the usually dark clypeus of the worker. The abdomen sometimes presumably wholly black (*peruviana*, the male of which is as yet unknown) but in the other

subspecies usually with heavy, yellow, apical bands, each of which is about co-equal in width with the basal black of the tergite and, if the abdomen is compressed, appears to occupy most of the tergite. Length $7\frac{1}{2}$ to $8\frac{1}{2}$ mm.

favosa and subspecies (p. 327).

The eyes not so sharply in-slanting below. Malar space distinct, eye and mandible well separated. Superimposed punctation on the tessellated clypeus lacking, or not sparse and distinct. Abdomen presumably in accord with that of the worker, sometimes black, sometimes red, and either with apical bands or without. When the bands occur, it may be assumed that they are like those on the tergites of the worker always relatively slender, never broadening out to occupy a space co-equal with the unmaculated basal part of the tergite.¹

fasciata (as represented by subspecies *rufiventris*, p. 383).

Melipona flavipennis Smith

INTRODUCTORY COMMENTS.—Unlike several of the other species of *Melipona* that are represented by a number of subspecies, *flavipennis* shows relative constancy in its characters and only one form has thus far received recognition.

Melipona flavipennis Smith

Melipona flavipennis SMITH, 1854, 'Catal. Hymen. British Mus.,' part 2, pp. 406–407.

Melipona titania GRIBODO, 1893, Bull. della Società entomol. Italiana, XXV, pp. 251–253.

Melipona opposita GRIBODO, 1893, Bull. della Società, entomol. Italiana, XXV, pp. 253–254.

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

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

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

Melipona titania DUCKE, 1902, Zool. Jahrb. System. Geogr. und Biol., 1903, XVII, pp. 294–295.

Melipona flavipennis SCHULZ, 1903, Sitzungsber. Math.-Phys. Klasse der K. B. Akad. der Wiss., München, 1904, XXXIII, pp. 816–817.

Melipona flavipennis DUCKE, 1916, 'Enumeração dos Hymenopteros colligidos pela Comissão e Revisão das espécies de abelhas do Brasil.' Comissão de Linhas Telegraficas Estrategicas de Matto Grosso ao Amazonas, Publicação No. 35, Anexo No. 5, Historia Natural—Zoologia, pp. 170–171.

Melipona flavipennis COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 205.

Melipona flavipennis LUTZ AND COCKERELL, 1920, Bull. Amer. Mus. Nat. Hist., XLII, Art. 15, p. 493.

Melipona flavipennis DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, pp. 445–446.

¹The fact that relatively few males of the subspecies of *fasciata* are known and only one (that of the subspecies *rufiventris*) is available in the present collections makes necessary the qualifications that have been noted in the above summary of attributes.

♀.—The facial quadrangle almost square; the eyes parallel (Pl. IV, fig. E). The face and head smooth and shiny. The clypeus with a few fine, scattered punctures and a very few erect, scattered, short, black hairs, noticeable only when the clypeus is viewed from the side. The hair on the front and on the vertex black and long, reducing a little the sheen on the impunctate or approximately impunctate surface beneath. The genæ with a thin covering of short, erect, black hairs. The malar space about one-third as long as the mandible is wide at its base. The mandibles emarginate on the inner half of their apex. The ocelli rather linear in arrangement, just below the supraorbital line. The scape with fairly distinct, scattered punctures. The chitin of the head prevalingly black, varied sometimes with ill-defined chestnut-brown areas on the clypeus, on the genæ, on the apex of the mandibles (except for the usually black apical edge), and on the scape in front; the flagellum is black above, ferruginous beneath.

The shiny black immaculate mesonotum is semiconcealed, especially along its anterior third and along its sides, by a rather dense thatch of erect, black hairs. Similar black hairs in a dense mat completely conceal the mesopleura. The scutellum rather smooth above, slightly granular along its sides, covered with long, erect, black to brownish hairs. The metapleura and propodeum less densely covered with dark hair, rather strongly shiny.¹

The legs variable, often chestnut-colored with black usually at the apex of the femora and tibiæ, and on the hind basitarsus. The hair on the legs, like that of the rest of the body, black, except on the basitarsi and other tarsal joints within, where it varies from golden to bronze. The hind basitarsi broadly rounded behind, about three-fourths of the width of the hind tibiæ at their apex (plate VII, figure F).

Wings strongly orange to orange-yellow with the tegulæ of similar color.

The abdominal tergites with faint, microscopic, transverse ridges and irregular granulation; covered with black hairs that are of intermediate length except at the sides of the base of tergite 1 and on tergites 5 and 6, where the hairs are longer. The venter granular, covered with black hairs that are rather longer than those on the tergites. The chitin of the abdomen black; sternite 1 often chestnut-colored and the basal tergites sometimes with a faint, bandlike, brown line along their apex. On the whole, however, this insect presents a prevalingly or exclusively black appearance.

Length $11\frac{1}{2}$ to $13\frac{1}{2}$ mm.; width of thorax $4\frac{3}{4}$ to $5\frac{1}{2}$ mm.; length of forewing, including tegulæ, 9 to 10 mm.

♀ (Virgin).—Head somewhat smaller than that of the worker (plate I, figure E). The malar space longer than in the worker, not much shorter than the width of the mandible at the base. The joints of the flagellum rather longer than in the worker. The head shiny as in the worker, with either dark or stramineous hairs (the specimens with stramineous hairs probably callows, the chitin being incompletely darkened, even largely brownish on the head).

The thorax narrower and shorter than in the worker, polished as in that cast, and clothed with dark or with stramineous hairs. (One of the specimens with hairs of the latter color has the scutellum and propodeum yellowish red, indicating probably its callow state.)

The legs chestnut-colored. Their hairs inclined to golden-brown, more especially those on the hind legs; or with prevalingly stramineous hairs. The hind tibiæ

¹In what appear to be callow specimens the hair on the head, thorax, legs, and under side of abdomen is more or less straw-yellow.

unusually broad compared with the corresponding joint in other queens, their posterior apical edge rather rectangular (plate VII, D). The broad external surface of the joint is slightly concave toward the apex and covered with scattered hairs, not merely fringed laterally. The apex of the joint lacks the characteristic comb that is attached to the anterior end of the third tibiæ in the worker. The hind basitarsi are elongate, their sides parallel to subparallel, differing strikingly from the broadly rounded basitarsi of the worker, and much more nearly resembling those of the male.

An orange-colored circular depression on each side of tergite 1, with a channel-like outlet at its upper end (plate X, figure I). These depressions each occupy about one-third of the width of the tergite and the basal half of its length. The basal tergite with hair confined to its apex, glabrous basally. The hair on the abdomen usually dark, sometimes stramineous. The chitin prevailing black except for the orange spots noted.

Length about 11 mm. to $11\frac{1}{2}$ mm.; width of thorax $\frac{3}{4}$ to $\frac{1}{2}$ mm.; length of forewing, including tegulæ, about $8\frac{1}{2}$ mm.

♂.—Of the same general appearance as the worker and the queen, almost wholly black with black hair.

Face relatively wide for males, approaching the square (plate II, figure E). The clypeus nearly as long as it is wide, with the lateral angles extending much closer to the eye than is the case in the worker or the queen. Malar space reduced, its shortest length possibly a fourth of the width of the mandibles at their base. The mandibles broad at the base, with a somewhat hourglass-like contraction two-thirds of the way to the apex, and the apex itself, which is of slightly irregular outline, rather less than half the width of the base. The face polished as in the other casts. The scape somewhat shorter and stouter, and with distinct, scattered punctures. Clypeus, mandibles, and labrum reddish brown. Dull reddish vestiges of stripes traceable usually along the inner margin of the eye and sometimes even vaguely along the middle of the polished clypeus, which is devoid of hair.

The mesonotum polished, the mesopleura with punctures, which, however, are usually concealed by the dense covering of black (in callow specimens more or less stramineous) hairs.

The legs darker than is the case in the associated workers, usually mostly black, with reddish spots at the apices of the tibiæ and a vague, reddish stripe usually margining the hind basitarsi posteriorly; the other tarsal joints, as well as sometimes also the front basitarsi, reddish to brownish. The hind tibiæ (plate VII, figure E) with their posterior contour more oval than is the case in the queen but in other respects rather resembling that joint of the royal cast. The hind basitarsus in shape much more nearly resembling the corresponding joint of the queen than it does that of the worker, but not quite so narrow and elongate; at its apex the hind basitarsus of the male has a width equal to about one-third of its length, whereas in the queen the apex of the basitarsus is in width about one-fourth the length of the joint. The hair on the legs prevailing black, more stramineous in the reddish-legged, callow specimens.

The abdomen with sculpturing and hair comparable to that of the worker. The smooth basal half of tergite 2 more frequently revealed than not.

The genitalia are depicted on plate IX, figure A, B, C, D.

Length $11\frac{1}{2}$ to $12\frac{1}{2}$ mm.; $\frac{3}{4}$ to 5 mm.; length of forewing, including tegulæ, $9\frac{1}{2}$ to 10 mm.

TYPE.—Located in the British Museum (Natural History Division).

DISCUSSION.—This species was described by Smith in 1854 on the basis of a male from Para, Brazil. In 1893 Gribodo described doubtfully as a new species (*opposita*) a male from French Guiana which, while closely allied to *flavipennis*, seemed to him to present some differences. In the same paper Gribodo described as a new species (*titania*) a worker from the Argentine because it departed from Smith's description of the male of *flavipennis* in respect to the sculpturing and pubescence of the abdomen. Both *opposita* and *titania* were subsequently made synonyms of *flavipennis*, which, broadly interpreted, is a species with its northern limit extending at least to Costa Rica and its southern limit at least to Rincão in the State of São Paulo.¹

It is hardly to be supposed that differences do not occur throughout this wide range. In the collections under investigation there are male specimens only from the Napo River in Peru. These have been compared with Smith's type in the British Museum, and certain differences were observed. Thus, the third tibiae of these Peruvian specimens is flattened out posteriorly into an almost corbicula-like depression that extends more than halfway up the joint; in Smith's type this depressed area is confined to the region close to the apex. The hind basitarsi of these Peruvian specimens are a little more parallel-sided, less sharply curved toward the base than is the case in Smith's type. On the second abdominal tergite when exposed, just above the hair band, there are at each side strong, deep, conspicuous punctures; in Smith's type these punctures are feeble, almost negligible. Nevertheless, these are differences of degree rather than fundamental differences, and a representation from other regions would be desirable before a separation of these specimens even as a distinct subspecies is decided upon. The workers from the Napo River do not differentiate themselves from other workers of *flavipennis*.

The queen of *flavipennis* has not hitherto been described. Four specimens, two taken on June 14 and two on June 20, 1920, at Napo River, Peru, are virgin queens of this species. Their abdomen is not swollen as is usual in gravid queens. Two of them are about 11 mm. in length, which is rather short for a worker of *flavipennis*; the third is about 11½ mm.; the fourth, because of injury to the apex of the abdomen, cannot be accurately measured, but it, too, is small. Their forewings are approximately 8½ mm. in length, which is slightly under the minimum

¹Ducke has questioned the accuracy of the locality label on Gribodo's specimen from "Argentina (Rioja)," and that locality has, therefore, not been included in the estimate of the southward range of *flavipennis*.

for workers. The most conspicuous structural peculiarity is the depression on each side of tergite 1 of the abdomen (plate X, figure I). Comparable bilateral depressions are present also at the base of tergite 1 in the case of queens of *fasciata* subspecies, and this condition is revealed not only in the virgin queens but has survived also in a gravid female of *fasciata rufiventris*. In a gravid queen of *Melipona schencki* described elsewhere in this paper the possible vestiges of a similar depression are still traceable as an orange discoloration on each side of the otherwise dark-colored and more strongly sculptured tergite.

Schulz (1905), in describing the queen of *Melipona marginata*, says: "The spiracles of segment 1 appear as small, brown eminences (Höcker) on each side at the beginning of the descending part." In *flavipennis*, too, the spiracles of segment 1 are brownish and slightly protuberant, and similarly they occupy a position just below the dorsal surface. In contrast the corresponding spiracles in the worker and in the male are located just outside of the edge of the basal concavity at a point halfway toward the junction of the abdomen with the thorax. In the queens of *schencki* and *beecheii* subspecies *beecheii* the spiracle occupies a similar position. In the queens of *interrupta* and *quadri-fasciata anthidioides* its position is slightly more laterad than is the case in the worker. When the abdomen of the queen of *flavipennis* is viewed in profile, the contour above the spiracle reveals itself as pronouncedly convex.

DISTRIBUTION.—*M. flavipennis* has previously been reported from: Costa Rica (Cockerell, 1919); Bolivia (Cockerell, 1919); Ecuador (Schulz, 1903, and Cockerell, 1919); Dutch Guiana (Schulz, 1903); French Guiana (Gribodo, 1893); State of Para, Brazil (Smith, 1854, and Ducke, 1902, 1916, 1925); State of Amazonas, Brazil (Ducke, 1916, 1925); Acre-Territorium, Brazil (Ducke, 1916, 1925); northwestern part of the State of Matto Grosso, Brazil (Ducke, 1916, 1925); State of São Paulo, Brazil (Ducke, 1916, 1925); Argentina (Gribodo, 1893),—according to Ducke (1916, 1925) Argentina is an erroneous locality designation.

The collections under examination contain specimens from two regions—Peru and Canal Zone—from which *flavipennis* has not previously been reported. The detailed records follow:

BOLIVIA.—Riberalta, January (W. M. Mann).

PERU.—Napo River, June 14–20, 1920, including ♂♂, ♀♀, and ♀♀ (H. Parish); Hacienda San Juan, Colony of the Perené, June 27, 1920; El Campamiento, Colony of the Perené, June, 1920 (Cornell University Expedition).

BRAZIL.—State of Matto Grosso: Chapada (probably Sant' Anna do Chapada, near Cuyaba), March (H. H. Smith). State of Para: Santarém (H. H. Smith).

CANAL ZONE.—Barro Colorado, November 12, 1923 (Lutz), January 10, 1929 (C. H. Curran).

COSTA RICA.—Prov. Limon: Suretka, April 26, 1924 (J. C. Bradley).

***Melipona quadrifasciata* Lepeletier**

INTRODUCTORY COMMENTS.—The typical subspecies is differentiated from *anthidioides* by the characters given in the key, but intermediate forms, which are commented upon in the DISCUSSION of *anthidioides*, occasionally occur.

KEY TO *quadrifasciata* AND ITS SUBSPECIES

The ground color of the abdominal tergites almost invariably red to castaneous. Broad, uninterrupted bands on tergites 3-5. The band on tergite 2 sometimes complete, sometimes interrupted.....*quadrifasciata* (p. 275).
The ground color of the abdominal tergites black, with widely interrupted bands on tergites 2-5.....*anthidioides* (p. 279).

***Melipona quadrifasciata* subspecies *quadrifasciata* (Lepeletier)**

Melipona quadrifasciata LEPELETIER, 1836, 'Hist. natur. des Insectes, Hyménop.,' I, p. 416.

Melipona quadrifasciata BLANCHARD, 1840, 'Hist. natur. des Insectes,' III, p. 403.

Melipona fasciata KLUG (nec Latreille), in Spinola, 1840, Annales des Sciences natur.—Zool. (2) XIII, p. 124.

Melipona quadrifasciata SMITH, 1854, 'Catal. Hymen. British Mus.,' part 2, p. 404.

"*Melipona Mandasaya*," HOLMBERG, 1887, Boletín de la Acad. Nacion. de Ciencias en Cordoba (Rep. Argentina), X, p. 258.

Trigona quadrifasciata HOLMBERG, 1887, Boletín de la Acad. Nacion. de Ciencias en Cordoba (Rep. Argentina), X, p. 283.

Melipona quadrifasciata GRIBODO, 1893, Bull. della Società entomol. Italiana, XXV, pp. 258-259.

Melipona quadrifasciata DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 583.

Melipona quadrifasciata HOLMBERG, 1903, Anales del Museo Nacion. de Buenos Aires, (3) II, p. 382.

Melipona quadrifasciata BERTONI, 1911, Anales del Museo Nacion. de Hist. Nat. de Buenos Aires, 1912, XXII (3rd Series, XV), p. 140.

Melipona quadrifasciata DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., pp. 166-168.

Melipona quadrifasciata callura COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 196.

Melipona quadrifasciata bicolor FRIESE (nec Lepeletier), see Cockerell, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 196.

Melipona quadrifasciata COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 197.

Melipona quadrifasciata DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, pp. 443-444.

♀.—Black, with usually reddish-brown abdomen broadly banded with yellow, and shiny lower half of face. Banded part of tergites duller than the base.

The facial quadrangle broader than long, the eyes converging below (plate IV, figure F, as depicted for *M. quadrifasciata anthidioides*). The malar space a little less than half as long as the mandible is wide at its base. The clypeus at its widest only a little greater than the measurement from its base to its apex and, like the supra-clypeal area and the sides of the face to about the level of the antennæ, highly polished and reflective, with only a few scattered, faint punctures. The front finely punctate-tessellate, verging on and sometimes grading into a punctate condition. The sides of the face with a slight depression at the level of the antennæ. The region between the lateral ocelli and the compound eyes strongly depressed, impunctate, and shiny. That part of the vertex immediately in back of the ocelli strongly raised and rather coarse in its sculpturing. No hair on the lower half of the head other than a thin fringe of variable color (usually black) on the lower edge of the mandibles, and usually black hairs on the labrum and on the cheeks. The face above the antennæ to the inclusion of the vertex covered rather thickly with longish hairs that are upward-directed, plumose, and, while in the main dark, sometimes have light admixture in the region between the antennæ and the ocelli; they are longer and usually more uniformly dark on the vertex. Appressed pile, silvery in some lights, on the cheeks, in addition to sparse, down-slanting, black hairs. The integument of the head in the main black, but the clypeus, the mandibles (especially on their apical half), the scape, and even the sides of the face sometimes more or less castaneous. The flagellum black above, ferruginous below.

The mesonotum finely tessellate-punctate, a little more strongly so anteriorly than posteriorly, where the tessellation has sometimes entirely or almost entirely disappeared and is replaced by a shiny surface dotted with minute, sparse, and feeble punctures. The mesopleura with relatively dense, strong but minute punctures. The scutellum with only a few sparse punctures above, shiny, but with relatively more punctures along the back and on its sides. The scutellum is sometimes castaneous in contrast to the rest of the thorax, which is black. The thorax is rather densely covered above and on the sides with long dark hairs; on the propodeum there is a thin, sparse covering of lighter hairs that do not in the least conceal the strongly tessellated, semidull surface.

The legs are black, varied with castaneous; their hair black except for silvery, appressed pile on the under side of the hind tibiæ and light golden hairs on the under side of all the tarsi, and on the outer side also as a rule in the case of the joints apical to the basitarsi. The hind tibiæ (plate VII, figure I, as depicted for *M. quadrifasciata anthidioides*) subtriangular in outline, with a rather strong angle on the outer side of their apex; their surface convex above but becoming concave toward the apex. The hind basitarsi at their broadest about three-fourths of the width of the hind tibiæ at their apex; the hind basitarsi are rather broadly rounded behind and more or less emarginate at their apex.

The wings are more or less strongly suffused with orange; their venation is ferruginous. The tegulæ intergrade between black and ferruginous, being sometimes black with a ferruginous pupil.

The abdomen above is for the most part bare and shiny. There is a fairly abundant growth of dark or mostly dark hairs, medium to long, on tergite 1, and the lateral margins of the last three tergites and the apex of the last tergite have black hairs. The sternites bear silvery hairs. Almost invariably the ground color of the abdomen is red to castaneous. Tergite 1 with widely separated lateral spots, with a narrow, inconspicuous band, or immaculate. Tergites 2-5 have broad, yellow bands, that are usually complete, an interruption, if it occurs, being as a rule confined to the band on tergite 2, as specified in the description of Lepeletier. The sculpturing of the abdomen is exceedingly fine, consisting of microscopic, transverse ridges interspersed here and there with sparse shallow punctures. On the castaneous or reddish parts this sculpturing is so delicate that the surface retains a high degree of shininess. On the banded portion of the tergites, however, the transverse ridges are denser and stronger, and these apical bands are more or less dull in contrast to the basal part of the tergites.

Length 8 mm. (extreme case) to $10\frac{1}{2}$ mm.; width of thorax $3\frac{3}{4}$ (extreme case) to $4\frac{3}{4}$ mm.; length of forewing, including tegulae, 7 to 8 mm.

♀.—See the description of the queen of *quadrifasciata* subspecies *anthidioides*.

♂ (A callow).—In structure very similar to the worker except for the usual primary and secondary sexual differences.

The head somewhat smaller (plate II, figure F, as depicted for *M. quadrifasciata anthidioides*). The region between the lateral ocelli and the compound eyes is excavated as in the worker and, again paralleling the worker, there is an almost ridge-like elevation of that part of the vertex that is in back of the ocelli. As in the worker, there is a slight depression on each side of the face at the level of the antennae. The malar space is a little shorter than in the worker; the mandibles narrower than in the worker, only about half the width at the apex that they are at the base; the eyes convergent as in the worker; and the sculpturing of the face as in that cast. The ocelli remote from the eye, the distance between the two lateral ocelli measured from the outer rim of one to the outer rim of the other subequal to the distance separating each lateral ocellus from the nearest eye.

The hind tibiae (plate VII, figure H, as depicted for *M. quadrifasciata anthidioides*) narrower than in the worker but with a generally subtriangular shape and a somewhat less developed outer apical angle; the concavity near the outer apical end of the joint not so extensive; a rather copious growth of hairs on the outer surface as well as fringing the sides of the hind tibiae. The hind basitarsi about three-fourths the breadth of the hind tibiae with the posterior curvature not so pronounced as in the worker, a little more parallel-sided.

It is to be assumed that in the fully developed male the hairs of the head, thorax, and legs are dark as in the male of the subspecies *anthidioides*. In the specimen here described, which is a callow, the hair on these parts is throughout light, varying from pale ochraceous on the vertex and thorax to virtually pure white on the front, legs (except for golden hairs on tarsi within), and apical tergites.

The genitalia (for the subspecies *anthidioides*) are depicted in plate X, figures D, E, F, G.

TYPE.—The two specimens marked type in the Lepeletier collection in the Museum of Natural History in Paris bear the designation, "les Missions," corresponding with "contrée des Missions" mentioned by

Lepeletier in connection with his description. The description of Lepeletier fits them admirably, with the exception of the reference to the hairs on the head. These are spoken of as few in number (*peu nombreux*), but while absent from the lower half of the face in the specimens at Paris, they are abundant on the front. In spite of this inadequate phrase, there can be little doubt that the insects designated "type" are what Lepeletier described as *quadrifasciata*.

DISCUSSION.—The insects assignable to *quadrifasciata* in the collections before me have abdominal bands of faded yellowish white. These bands are paler than those of the type specimens and it may be that they present the more usual condition. There is some variability, too, in the depth of the red color of the abdomen, but the difficulty of setting up distinctions on this basis is brought out by the fact that specimens even within a single state—as evidenced by examples before me from Rio Grande do Sul—may show slight differences in coloration from locality to locality. Specimens from Curityba, State of Parana, were designated by Friese *quadrifasciata* variety *bicolor* Lepeletier. Cockerell (1919), in questioning the accuracy of this interpretation, renamed the insect *Melipona quadrifasciata callura*. The male on which the description given for that sex in the present paper is based, was likewise obtained at Curityba and identified by Friese as *M. quadrifasciata* variety *bicolor*. As indicated in the description, its hairs are throughout light. It is not likely that this is a sexual character, for the male of *M. quadrifasciata* subspecies *anthidioides* has dark hair like the worker. Among the material here considered is a worker from Vaccaria that differs from other specimens of the same locality in having not only the lighter red abdomen characteristic of *callura* but pale hairs like the male here discussed. It is almost certainly a callow and confirms the suspicion that the male from Curityba is also a callow. I am inclined similarly to attribute the pale red abdomen of Cockerell's worker from Curityba to immaturity.

DISTRIBUTION.—Ducke (1925) speaks of the typical subspecies of *quadrifasciata* as a subtropical form. It occurs in the Brazilian states of São Paulo, Santa Catharina, Rio Grande do Sul, as well as in Paraguay (Bertoni, 1911; Ducke, 1916, 1925) and in Argentina (Holmberg, 1887, 1903). To these may be added the State of Parana on the basis of the insect renamed by Cockerell *quadrifasciata callura* and a specimen in the U. S. National Museum from Curityba. In the collections that form the basis of the present report there is a large series from Vaccaria, State of Rio Grande do Sul, loaned by Cornell University, as well as specimens

bearing merely the name of that state without more specific locality; also a few specimens identified by Friese from the following states—Santa Catharina: Blumenau, 1897 (Virgil); São Paulo, 1897 (von Ihering).

***Melipona quadrifasciata* subspecies *anthidioides* (Lepeletier)**

Melipona anthidioides LEPELETIER, 1836, 'Hist. natur. des Insectes, Hyménop.,' I, pp. 417–418; Atlas, Pl. XII, figs. 1, 1a, 1b.

Melipona vicina LEPELETIER, 1836, 'Hist. natur. des Insectes, Hyménop.,' I, p. 417. (Intermediate between *quadrifasciata* and *anthidioides*.)

Melipona interrupta KLUG (nec Latreille), in Spinola, 1840, Annales des Sciences natur., (2) XIII, pp. 124, 130–131, Pl. II, figs. 3A, 3B, 3C.

Melipona anthidioides SMITH, 1854, 'Catal. Hymen. British Mus.,' part 2, p. 404.

Melipona anthidioides DESMAREST, in Chenu, 1860, 'Encycl. hist. nat. Annelles,' Pl. IX, fig. 1.

Melipona anthidioides SMITH, 1863, Trans. Entom. Soc. London, (3) I, p. 499, Pl. XX, figs. 2 and 14.

Melipona anthidioides DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, pp. 575, 583; *Melipona vicina*, idem, p. 585.

Melipona anthidioides VON IHERING, 1903, Zool. Jahrb. System. Geogr. und Biol., 1904, XIX, pp. 183, 187–195, 204, Pl. X, figs. 1a♀, 1b♂, 1c♀, and 1d (gravid ♀).

?*Melipona vicina* VON IHERING, 1903, Zool. Jahrb. System. Geogr. und Biol., 1904, XIX, p. 195. (With exceptional nest habits.)

Melipona quadrifasciata subspecies *anthidioides* DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., p. 168.

Melipona anthidioides COCKERELL, 1919, Proc. U. S. Nat. Mus., 1920, LV, p. 196.

Melipona anthidioides integrrior COCKERELL, 1919, Proc. U. S. Nat. Mus., 1920, LV, p. 196. (Intermediate form between *quadrifasciata* and *anthidioides*.)

Melipona quadrifasciata subspecies *anthidioides* DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, p. 444.

Melipona anthidioides BISCHOFF, 1927, 'Biologie der Hymenopteren,' p. 276.

♀.—Like the typical subspecies except that the tergites of abdomen are black or largely black instead of reddish brown and that the bands on all of the first five tergites are so widely interrupted medianly that the maculations appear on tergite 1 merely as lateral spots (sometimes indeed being wholly absent) and on the following four tergites usually only as lateral lines (Plate IV, figure F; Plate VII, figure I.)

♀.—The head (plate I, figure F) smaller than that of the worker (the plastic characters of the worker are set down in the description of typical *quadrifasciata*). The eyes very conspicuously shorter and narrower than in the worker, only about two and one half times as long as the notably long malar space. The mandibles broader basally than apically, with a faint trace of a median denticle at the apex as in the worker. The sides of the face with a slight depression at the level of the antennæ. The sculpturing of the front even finer than in the worker, with only faint punctation traceable. The formation of the vertex as described for the worker and the color of the hair of the head dark as in that cast (in the only specimen of the queen available there is, however, no appressed pile on the cheeks, a condition that may be due to wear, as many of the longer, down-slanting, dark hairs are also missing

in this region). The flagellum longer and more slender, its apical joint longer by about a half than the joint preceding it.

The mesonotum smooth, devoid of the fine, tessellate-punctate sculpturing noted in the worker. The propodeum, too, approximating a polished and impunctate condition, but the mesopleura with only a little less strong punctation than in the worker. The hair and chitin of the thorax mainly black as in the worker.

The legs mainly blackish brown, grading into castaneous on the tarsal joints. The coloration of the hairs in the main dark with the exceptions as noted for the worker and, in addition, with short, downy, pale hairs on the under side of the femora. The hind tibiae (plate VII, figure G) much narrower than in the worker or the male and of different shape, not triangular, and rounded rather than sharply angular at the outer apical tip of the joint; the entire joint rather densely covered with hair. The hind basitarsi narrow, not in the least rounded posteriorly, rather parallel-sided but tapering slightly toward the apex. The two succeeding joints of the hind tarsi also elongate, not so cordate as in the worker or male.

The abdomen differently marked than is that of the worker; brownish black at the apex of each of the tergites beyond the first and with the extreme basal portion of some of the distended tergites also dark but with the intermediate region and sometimes also the basal region yellowish to yellowish brown. The hair of the tergites, like that of the sternites, pale yellowish, long and fairly abundant at the apex of tergites 3-5, long and rather abundant on all of tergite 6, and confined to the extreme sides on tergites 1-2.

Length $10\frac{1}{2}$ mm. (the abdomen accounts for 7 mm. of this total); width of thorax $3\frac{1}{2}$ mm.; length of forewing, including tegulae, $6\frac{1}{4}$ mm.

[In a specimen described by Ducke (1925) the chitin and hair were throughout a nearly uniform reddish brown. The thorax and abdomen were strongly shiny with feeble punctation, and the width of the thorax was $3\frac{1}{4}$ mm. Ducke questioned whether the color of the chitin and hairs, so at variance with those of the worker, could represent a constant condition.]

♂.—For the structural characters see the description of the male under *quadrifasciata*. Color of hair and maculations as in the worker except that the sixth tergite of male conforms with those preceding it. (Plate II, figure F; plate VII, figure H.)

The genitalia are depicted in plate X, figures D, E, F, G.

TYPE.—There are two type specimens—one a worker, the other a male (agreeing with the specification of Lepeletier)—in the Paris Museum of Natural History. These specimens are labeled "Ouest Capit^e des Mines." In Lepeletier's description the locality mentioned is merely "Capitainerie des Mines," without reference to the western part of Minas Geraes. *M. anthidioides integrior* Cockerell (No. 21663) is in the U. S. National Museum.

DISCUSSION.—Ducke (1916, 1925) has made *Melipona vicina* a synonym of *Melipona quadrifasciata*. The type of *vicina* seems to be no

longer in existence; at any rate I failed to find it in the Paris Museum.¹ So far as Lepeletier's description can be relied upon, *vicina* would seem to have a fair claim to be associated with *anthidioides*, for like *anthidioides* the ground color of the dorsum of its abdomen is black, whereas in *quadrifasciata* the ground color of the abdomen is reddish to brownish. Lepeletier's descriptions of these insects are presented successively in this order: *quadrifasciata*, *vicina*, and *anthidioides*. Under the suggested interpretation, therefore, *anthidioides*, represented by type material, would become a synonym of *vicina*, of which the type material apparently no longer exists. I hesitate to take such a step, however, especially as in some respects (such as the only slightly interrupted instead of broadly interrupted bands on tergites 3-5) *vicina* may be regarded as intermediate between *quadrifasciata*, in which these bands are entire, and *anthidioides*, in which they are reduced to lateral lines.² A similarly intermediate form is that described by Professor Cockerell (1919) as *M. anthidioides integrior*. This has the "band on the second abdominal segment with hardly more than its middle fifth missing; that on the third to fifth very narrowly or scarcely interrupted." Notwithstanding the generally black ground color of its abdomen, the tergites are brownish toward the sides, and the relation of *integrior* may be slightly closer to the typical subspecies than to the subspecies *anthidioides*. This impression is strengthened by the fact that Paraguay, from which it is reported, is within the range of typical *quadrifasciata* (Bertoni, 1911; Ducke, 1916, 1925).

Spinola's impression that Klug's *interrupta* is the same as *anthidioides* is probably correct, for the figures he gives of the genitalia have the characteristically long sagittæ. Lack of accord in some other respects between his drawings and those here offered seems of less importance.

Ducke (1916, 1925) has alluded to the circumstance that in *anthidioides* the yellow maculations are usually strong and distinct. This is true of several of the specimens of *anthidioides* under examination, but exceptions to the common condition are presented in a series from Ypiranga, State of São Paulo, which have the faded, pale bands noted in the DISCUSSION of *quadrifasciata*.

DISTRIBUTION.—The subspecies *anthidioides*, so far as records are available, would seem to have its concentration to the north of the territory occupied by the typical subspecies of *quadrifasciata*. Yet in

¹Lepeletier mentions as the depository of his type "Musée royal de France."

²Von Ihering (1903) reported a nest of what he interpreted as *vicina*. This nest, in contradistinction to the usual arboreal nest of *anthidioides*, was located in the ground. Should such a distinction of habit be constant, it would constitute a difference far more important than the comparatively trivial one based on the development of the abdominal bands. Could von Ihering's *vicina* be *quinquefasciata*?

the State of São Paulo, at least, the two forms overlap in their distribution, *quadrifasciata* having been reported from Jundiahy, north of the city of São Paulo, and *anthidioides*, as the present specimens indicate, occurring far to the southwest of that city, in Ypiranga.

M. anthidioides was described from Minas Geraes. Ducke (1925) asserts that it is abundant from at least the middle of that state to the city of São Paulo. It also occurs in the State of Rio de Janeiro, having been reported by Cockerell, 1919, from Rio de Janeiro itself and by Ducke (1925) from Petropolis. There is a single specimen from the latter locality likewise in the collections under examination. It was secured October 24–27, 1919, by R. C. Harris. Another specimen (without indication of the collector) was taken at Espirito Santo, but whether this locality indicates the state of that name, which is contiguous to Rio de Janeiro and Minas Geraes and which, therefore, might well harbor this subspecies, or whether it is one of the numerous places in Minas Geraes and in São Paulo that are called Espirito Santo this and Espirito Santo that, it would be difficult to say.

Melipona mandaçaia Smith

INTRODUCTORY COMMENTS.—Like *flavipennis*, another *Melipona* described by Smith, *mandaçaia* has not been subdivided into different subspecies, although it is possible that the yellow supraclypeal area of *bahiana* (here considered a synonym) may, if not due to immaturity, have at least varietal value. The species is very close to *quadrifasciata*, but structurally seems rather too independent to be incorporated in *quadrifasciata* as a subspecies.

Melipona Mandaçaia SMITH, 1863, Trans. Entom. Soc. London, (3) I, p. 505.

Trigona Mandaçaia PECKOLT, 1868, Trans. Entom. Soc. London, p. 133.

Melipona mandaçaia DALLA TORRE, 1896, 'Catal. Hymenopterorum,' X, p. 580.

Melipona bahiana DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., p. 169.

Melipona mandaçaia COCKERELL, 1919, Proc. U. S. Nat. Mus., 1920, p. 197.

Melipona bahiana DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, pp. 444–445.

♀.—Head much broader than long, the facial dimensions being about as in *quadrifasciata*, with the distance between the summits of the eyes greater than the length of the eye. The malar space about half as long as the mandible is wide at its base. The clypeus and the contiguous region of the face polished, with sparse punctures that are stronger than the ultra-minute punctures on the clypeus of *quadrifasciata*. The supraclypeal area finely tessellate-punctate. The front and vertex finely tessellated, semidull. The head virtually immaculate: the clypeus with sometimes a little yellow at the base and, according to Ducke, with yellow also sometimes in the supraclypeal region (*bahiana*). The mandibles black, their apex (except for the

narrow edge) and the basal prominence rufo-piceous. The flagellum beyond the third joint light red to brownish beneath, black above; the scape and two basal joints black. The front between the base of the antennæ and the ocelli clothed densely with grayish-white to snow-white hairs, contrasting with the black hairs on the vertex.

The mesonotum immaculate, semidull due to a fine, dense, uniform tessellation, almost of the same character as that on the propodeum. The scutellum, in contrast, rather shiny. The sculpturing of the mesopleura not clearly revealed under the covering of matted hairs but it seems, where traceable, to consist of strong and relatively dense punctures. The hairs on the mesonotum and pleura black.

The specimen on which the present description is based has the legs incompletely colored and is almost certainly not representative in this respect. Smith's description reads: "The articulation of the anterior and intermediate legs rufo-piceous, as well as the apical joint of their tarsi; the posterior legs have the femora at their apex beneath, the inferior margin, and the apex of the tibiæ and tarsi rufo-piceous; the pubescence on the legs black." The hairs on the under side of all the tarsi are light golden, and the minute, microscopic, appressed hairs on the under side of the hind tibiæ are, as usual, silvery. The hind tibiæ subtriangular in outline, with a rather strong angle on the outer side of their apex; their surface convex above but becoming concave toward the apex. The hind basitarsi at their broadest about two-thirds to three-fourths of the width of the hind tibiæ at their apex; the hind basitarsi are rounded behind and somewhat emarginate at their apex.

The wings hyaline, with the stigma and veins orange-colored to ferruginous. The tegulæ dark, with a light brown pupil.

The abdomen much more uniformly shiny than that of *quadrifasciata*, the apical half of each of the tergites being as devoid of tessellation as the basal half. Indeed, the tergites of abdomen are virtually sculptureless. On segment 1, which is immaculate, there is a tuft of dark hairs on each side of the basal concavity and there are a few black hairs over the dorsal surface of this segment. On tergite 6 the black hairs are fairly dense. With the exception of a few black hairs concentrated at the extreme sides of tergite 5, all of the tergites other than 1 and 6 are hairless. The hairs of the venter are pale except for those on the last sternite, which are black. Tergites 2-5 also differentiate themselves from the basal and apical tergites, which are immaculate, in having usually very broad, yellow apical bands extending from extremity to extremity.

Length $7\frac{1}{2}$ to 8 mm.; width of thorax $3\frac{1}{2}$ mm.; length of forewing, including tegulæ, 7 mm.

♀.—Unknown.

♂.—According to Ducke, in his description of *bahiana*, the hind tibiæ are completely rounded at their apex and are somewhat narrower than in *M. quadrifasciata* (Ducke's comparison is by implication with *anthidioides*, as the male of the typical subspecies of *quadrifasciata* was unknown to him).

TYPE.—In the British Museum—Natural History Division. A paratype is in the collection of Professor T. D. A. Cockerell, who kindly loaned it to me to enable me to supplement my too fragmentary notes made on the type specimen in London. Part of the type material of Ducke's *bahiana*, including probably the male allotype, is in the Museu Paulista, and part is in the collection of Dr. A. Lutz.

DISCUSSION.—I suspect that *mandaçaia* is the same insect that Ducke has described as *bahiana*. It runs to *bahiana* in Ducke's key (1925) and, although lacking a yellow maculation in the supraclypeal area (Stirnschildchen), agrees with Ducke's description virtually in every other respect. The thick covering of hairs on the front, referred to by Smith as snow-white, seems to me to incline in the specimen labeled "type" rather to gray-white, which is the phrase Ducke employs for the corresponding hairs in his *bahiana* (Stirn mit auffalender grauweisser Behaarung). But Ducke, too, indicates its conspicuousness in the employment of the word "auffalend." The description Ducke gives of the bands on tergites 2-5 of *bahiana* "very broad, uninterrupted, rich yellow" applies to the abdominal maculations of Smith's type of *mandaçaia* and also to the Smith specimen noted by Cockerell (1919), which had "abdominal bands extremely broad, yellow, covering all but basal third or less of segments." Probably the ornamentation is in most cases of this replete character but apparently not always so, for Smith adds to his description this comment: "The fasciæ on the abdomen vary in width as well as in depth of colouring; in some specimens they are scarcely visible, in consequence of the segments having contracted and drawn their bases inward."

Ducke has pointed out that *bahiana* differs from *quadrifasciata* subspecies *anthidioides* (and for that matter also from the typical subspecies) through smaller size, reduced shininess of thorax and upper part of head, and uniformly shining tergites of abdomen; and these distinctions apply likewise to Smith's insect. The fact that *mandaçaia*, described from Brazil, appears neither as a valid species or subspecies nor as a synonym in Ducke's embracing account of the Brazilian meliponids, indicates, I think, that he was not familiar with its character and so described as new what is seemingly scarcely separable from Smith's species. The close relationship of *quadrifasciata* subspecies to *mandaçaia* is emphasized by the fact that the name Smith selected for his species is based on the popular name "mandassaia" applied to *quadrifasciata*.

The male, according to Ducke, has the apex of its hind tibiæ rounded. This serves to differentiate it from the male of *quadrifasciata anthidioides* as represented in the Lepeletier material in Paris, for that insect has the apex of the third tibiæ rather sharply angulated outwardly (although not prolonged into a tooth). The hind tibia of the male of *quadrifasciata anthidioides* is depicted on plate VII, figure H.

DISTRIBUTION.—Unfortunately the type locality of *mandaçaia* is given merely as "Brazil." Ducke's *bahiana* was obtained from Barra

in the State of Bahia. Barra is located on the Rio São Francisco in what Ducke described as a region of dry climate.

***Melipona interrupta* Latreille**

INTRODUCTORY COMMENTS.—The type of *Melipona interrupta*, which was described from French Guiana, is unfortunately no longer in existence, and the description itself, while sufficiently precise to leave no doubt as to the species involved, unfortunately does not make clear beyond a doubt the characters of the typical subspecies. Moreover, the colored figure published in the same volume as the description serves only to make a clean-cut interpretation the more difficult, for at variance with the description and indeed with the very name of the insect, it shows the abdominal bands uninterrupted. Influenced perhaps by this illustration, some authors have interpreted Smith's *fasciculata* from Para, Brazil (in which the bands on the tergites are continuous or only briefly interrupted) as the equivalent of *interrupta*. In the present paper *fasciculata* is, however, regarded as an independent subspecies of *interrupta*.

Typical *interrupta*, one may reasonably infer, is somewhat closer to another form of the Guianas, namely, *interrupta oblitescens*, differing from it mainly in having reddish (fulvous?) hair on the summit of the head and on the mesonotum instead of the whitish hairs that are present in these parts in *oblitescens*. From British Guiana there are in the American Museum collection four specimens that Professor Cockerell has made metatypes of his *oblitescens*. One or two of these metatypes that, departing from the original description, have the band on tergite 1 uninterrupted, come rather close to Latreille's description of *interrupta*, which states that the band on the first segment of the abdomen is the only one that is entire. More often, however, specimens of *interrupta* from the states along the northern border of South America have even the band on tergite 1 broken and widely interrupted. This is true not only of most specimens of subspecies *oblitescens* from the Guianas but of subspecies *salti* from Colombia. The interrupted character of the bands on the tergites subsequent to the first is even more pronounced and again accords with what from Latreille's description may be inferred to be the condition in typical *interrupta*, in which these bands "are interrupted in their middle, and are still shorter as they approach the posterior extremity of the body."

There are no specimens from French Guiana in the material here considered. Fortunately, however, Gribodo (1893) had specimens from

that region and in discussing them throws light on the probable character of typical *interrupta*. Some of his comments have been embodied in the description of the typical subspecies that follows.

Most of the distinctions hitherto attempted within *interrupta* have been on the basis of the extent and character of the maculations. As the following key indicates, a further separation may be made if recognition be given to the color of the apical fringes of hair on certain of the abdominal tergites. It may be that insects thus distinguished should receive merely a varietal name,¹ involving the use of quadrinomials. However, it is rather difficult to evaluate the relative importance as between the extent of the maculations and the color of the hairs, and hence each subdivision of *interrupta* has here been dignified with a trinomial designation.

KEY TO THE WORKERS OF *Melipona interrupta* AND ITS SUBSPECIES

- 1.—The maculations of the face relatively fine, the median longitudinal line that bisects the clypeus slender, often incomplete in length, sometimes all but absent. 2.
 The maculations of the face heavy, the median line down the clypeus shaftlike, joining a broad, transverse line at the apex of the clypeus and a shorter but also rather broad, transverse line at the base of the clypeus; the lines along the inner orbits of the eye with a large, clavate expansion below that fills the lower half of the region between the clypeus and the inner orbit of the eye. *grandis* (p. 305).
- 2.—The hairs that fringe the hind tibiae laterally, pale. 3.
 These fringing hairs black. A distinct carina separating the vertical part of segment 1 from the dorsal part. *sicophanta* (p. 303).
- 3.—The flat-lying hairs that form a fringe along the apex of tergites 3 and 4 and usually also of tergite 2 entirely or prevailing pale. 4.
 The fringing hairs on tergites 3 and 4 and sometimes those on 2, black or prevailing black. The hair on the vertex yellowish with a few black hairs intermixed. The hair on the mesonotum yellowish (except for the usual rust-red patches in the antero-lateral angles) instead of white. The fasciae on tergites 1-2 usually complete or nearly complete, those on tergites 3-5 more widely interrupted. *mañaosensis*, new subspecies (p. 301).
- 4.—The bands on tergites 1-5 complete or only very slightly interrupted. 5.
 The band on tergite 1 sometimes entire, often more or less broken or widely interrupted; the bands on the other tergites widely interrupted, usually reduced to short, lateral stripes, sometimes being scarcely traceable to wholly absent on tergite 5 and even on tergite 4. 6.
- 5.—The bands not only complete but broad, of a rich yellow ochre; a yellow maculation usually on each side of the pronotum and an abbreviated stripe posteriorly on the scutellum. *tripplaridis* (p. 304).

¹Throughout this paper the term variety is used to designate a degree of separation subordinate to that indicated by the term subspecies.

The bands usually complete, sometimes briefly interrupted, but in all cases thin and fine, cream-colored to pale yellow. Thoracic maculations lacking.

fasciculata (p. 299).

- 6.—The hair on the vertex and mesonotum whitish, sharply contrasting with the rust-red patches in the antero-lateral angles of the mesonotum. 7.

The hair on vertex and mesonotum reddish to strongly fulvous.

interrupta (p. 287).

- 7.—The median longitudinal line on the clypeus usually well developed, extending completely or nearly completely from apex to base; the maculations on the apex of the clypeus not confined to the lateral angles but extended along the margin to unite at right angles with the median line. Pronotum with a yellow maculation on each side and scutellum often with a brief yellow line on its rim posteriorly. *saltii*, new subspecies (p. 293).

The clypeus with merely a vestige of the longitudinal line, reduced usually to a triangle at the apex of the clypeus. No continuous transverse line at the apex, merely a slanting stripe along each of the lateral angles. Thoracic maculations lacking. *oblitescens* (p. 291).

Melipona interrupta subspecies **interrupta** (Latreille)

Melipona interrupta LATREILLE, 1811, 'Recueil d'Observ. de Zool. et d'Anat. comparée faites par Humboldt et Bonpland,' I, pp. 291–292.

Melipona interrupta SMITH, 1854, 'Catal. Hymen. British Museum,' part 2, p. 404. (Cayenne specimens.)

Melipona interrupta GRIBODO, 1893, Bull. della Società entomol. Italiana, XXV, pp. 256–257.

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

The bracketed paragraphs of the following description contain structural characters that are believed to apply to the typical subspecies as they are characteristic of other subspecies of the *interrupta* group:

♂.—[The face broad (plate IV, figure D, as depicted for *M. interrupta saltii*). The distance from one eye to the other at the level of the middle ocellus about equal to the length of the eye. The spread of the ocelli measured from the outer rims of the lateral ones barely twice the distance separating each lateral ocellus from the corresponding eye. The eyes rather straight, the inner orbits almost parallel to each other, barely converging below. The malar space much reduced; at the narrowest part, near the inner angle of the mandible, the rim of the eye is separated only a little more than linearly from the base of the mandible. The outer half to two-thirds of the apical edge of the mandible curvilinear but edentate, the inner half to one-third with two well-developed teeth, of which the more median one is itself sometimes faintly sub-bidentate. The face dull due to a dense, strong tessellation, faintly shiny on the vertex and cheeks. The head very similar to that of *beecheii*, the eyes possibly a little more straight-sided.]

Latreille's description reads: "The antennæ are brown; with the upper surface of the first joint of deeper hue. The labrum is of a bright yellowish red. The mandibles are brown above with the base and apex blackish. The anterior part of the head has a line on each side extending along the inner margin of the eye; another line,

but shorter and less distinct, on the middle of the clypeus; a maculation in each of the angles of the apex of the clypeus a very pale yellowish red." The extent to which the maculations of the clypeus are reduced may be gauged furthermore from the brief descriptive summary that precedes the detailed description, in which the clypeus is referred to as "almost entirely black." The hair of the head is briefly described by Latreille as reddish "on the summit" (vertex). Nothing is said of the character of the hairs on the face, nor does Gribodo (1893) amplify the statement. In other subspecies there are more or less appressed, short, pale, feathery hairs on the lower half of the face, sometimes completely covering the clypeus, sometimes present only on the sides and base of it; longer, feathery hairs, up-slanting, on the front; scanty, down-slanting, pale hairs on the cheeks; longer, usually golden, hairs fringing the under side of the mandibles. This description of the hairs of the face applies to specimens from Moengo, Dutch Guiana, which are believed to be very close to, if not identical with, subspecies *interrupta*. The hair on the front of these Moengo specimens inclines to ochraceous.

[The mesonotum and mesopleura rather similar in sculpturing, bearing shallow punctures superimposed on dense tessellation. The punctures are dense anteriorly on the mesonotum, a little less dense on the sides of the mesonotum, and sparse on the middle and posteriorly; they have a tendency to arrange themselves in chains. The scutellum devoid of tessellation, strongly shiny notwithstanding the fact that it bears distinct, scattered punctures that become more closely grouped at the apex and along the sides. The metapleura and propodeum densely but finely tessellated, with usually superimposed punctures scattered over the propodeum.]

The scutellum like the mesonotum and pleura wholly black. A conspicuous patch of rust-red hairs in the antero-lateral angles of the mesonotum is present in workers (and so far as known in the males, but not in the queens so far as known) of all the subspecies of *interrupta*, and it would be strange indeed if this character were lacking in the typical subspecies. Latreille makes no mention of these distinctive patches, contenting himself with the statement that the thorax has reddish pile. Gribodo in referring to specimens (like Latreille's type, obtained from French Guiana) which he interprets as *interrupta* is more detailed: "In my specimens it [the hair on the thorax] is instead somewhat reddish on the shoulder in front up to the tegulæ, but thence on the dorsum it is of a reddish gray (*grigio rossastro*) to the flanks, and on the breast it is gray."

The wings are tinged with yellowish according to Latreille. Gribodo's specimens, in addition to being tinged with yellowish, were somewhat smoky, but he attributed the effect possibly to long submersion in alcohol. In the Moengo specimens the yellowish wings are relatively clear, of a little deeper stain in the median and the marginal cells.

"The legs," according to Latreille, "are blackish, with the tarsi, the lower extremity of the femora, a part of the tibiæ, clear brown; the hind tibiæ are even almost completely of this color." Some variability occurs in the color of the legs of specimens even within a subspecies, and in the possibility that Latreille's description is too limiting even for typical *interrupta*, the following summary for *interrupta* as a whole may be of service:

[The coxæ, trochanters, femora, and tibiæ largely black, sometimes with more or less reddish staining. In some instances nearly all the joints of the legs are chestnut-colored. The reddish staining is usual on the basal half of the hind tibiæ (upper side);

on the under side of this joint the red area extends farther toward the apex, sometimes even crowding out the black although as a rule sharply delimited by it. The front and middle basitarsi generally dark; the hind basitarsi with usually a central dark area, rimmed with ferruginous. The other tarsal joints ferruginous, now and then splashed with black; the apical half of the tarsal claws black. The hind tibiae (plate V, figure F, as depicted for *M. interrupta salti*) broadly subtriangular, with a spinelike downward prolongation of the outer apical angle. The hind basitarsi rounded posteriorly, about three-fourths as wide as the hind tibiae.]

With respect to the coloration of the hairs of the legs Latreille says: "The pile that clothes the inner surface of the tibiae and tarsi is still more reddish or almost ferruginous." But in the specimens that Gribodo believed to be the typical subspecies the hair of the tarsi was "gray or a rather pale brown" (*grigi o bruni abbastanza pallidi*). [Neither author says anything in this connection regarding the other hairs of the legs. In all of the members of *interrupta* except *sicophanta* the hairs on the legs of the worker, including those fringing the hind tibiae, are whitish except for usually pale golden hairs anteriorly beneath on the front and middle tibiae and above and beneath on the apical tarsal joint, and hairs of deeper gold to copper as a rule on the under side of the middle trochanters and on the inner surface of the basitarsi and the following three tarsal joints.] The specimens from Moengo have whitish hairs on those parts of the legs where white hairs occur in the other subspecies.

[Tergites 1-4 dull with a dense, fine, uniform tessellation; the tessellation of tergites 5-6 of lighter impress, with resulting shininess especially on tergite 5.]

The abdomen black, robust, and rather elongate, with widely interrupted bands on the tergites, especially as the apex of the abdomen is approached. Of the hairs on the tergites Latreille says only: "The second segment and the succeeding ones are a little ciliate on their posterior margin; these cilia are grayish; the anus has upon its margins short, black hairs." Gribodo rounds out the description: "It should be noted that in this species there are only a few short and fine hairs on the first segment of the abdomen; on the fourth but especially on the fifth and the sixth there are abundant and long, gray, plumose hairs, mixed with large, black bristles." The hair on the venter is grayish white.

The length of the Moengo specimens is $13\frac{1}{2}$ mm.; width of thorax $4\frac{3}{4}$ mm.; length of forewing, including tegulae, 10 mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—Apparently no longer in existence. The specimens from French Guiana (the type locality of *interrupta*) that Gribodo discussed as *interrupta* are presumably at the Museum in Genoa, where according to Horn (1926) the Hymenoptera of Gribodo were deposited.

DISCUSSION.—In the above description has been embodied much that would ordinarily be reserved for the DISCUSSION, in order that Latreille's specifications might be rounded out by the comments of Gribodo (1893). Both Latreille and Gribodo neglect the structural characters. It is to be assumed that these are virtually the same as in the other subspecies of *interrupta*, for, with the possible exception of

grandis and *sicophanta*, the structure is relatively constant in *interrupta*. Nevertheless, to enable the reader readily to differentiate between characters reported from Latreille and Gribodo on the one hand, and those supplied inferentially on the other, the latter have been placed in separate paragraphs surrounded by brackets.

While there are no specimens from French Guiana in the collections considered, there are two specimens from Dutch Guiana that are certainly more nearly related to typical *interrupta* than they are to the prevalent form of Dutch Guiana, *oblitescens*. These two specimens were taken at Moengo on the Cottica River, a locality in the northeastern part of the state and not very far from the border of French Guiana. They have strongly fulvous hairs on the vertex and mesonotum, recalling the specification "reddish" of Latreille, and even the hairs on the front and on the mesopleura incline to yellow rather than white. There are rust-red patches of hair in the antero-lateral angles of the mesonotum of these specimens. In respect to their abdominal maculations they differ from each other. Although in both the band on tergite 1 is virtually complete, as specified for typical *interrupta*, the bands on tergites 2-5 are much more widely interrupted in one of the specimens than in the other. On the apex of tergites 2-4 (also to some extent on 1) these specimens have a fringe of pale hairs, as specified by Latreille, but the black hairs on their anus are long, not short as reported by Latreille. Only on tergite 6 is there an abundance of pale, branched hairs, intermixed with black, bristle-like hairs. The presence of such light, plumose hairs also on tergites 4 and 5, reported by Gribodo, is not substantiated by the present specimens unless Gribodo's remarks be interpreted as applying to the apical fringes. Tergite 1 has light hairs of an erect character. The hairs on the dorsum of tergites 2-5 are rather short and inconspicuous. In the main light, they appear dark when the insect is viewed from certain angles. The black hairs become longer and more abundant as the apex is approached, and are especially conspicuous on the apico-lateral margins. There are also black hairs on the apical sternite. The sculpturing of these two specimens, which are so close to the description of typical *interrupta*, is of the same character as that described in the bracketed paragraphs and strengthens the belief that the typical form, which these specimens may even represent, does not depart structurally from what have been designated its subspecies.

DISTRIBUTION.—Described from French Guiana. Specimens very close to, and possibly identical with, the typical form are here reported from Moengo, Cottica River, Dutch Guiana, May 13, 1927 and May 15, 1927 (Cornell University Expedition).

Melipona interrupta subspecies **oblitescens** Cockerell

Melipona interrupta SCHULZ, 1903, Sitzungsber. Math.-Phys. Klasse der K. B. Akad. der Wissens., München, XXXIII, (published 1904), p. 815. (Dutch Guiana specimens.)

Melipona interrupta DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., p. 162.

Melipona interrupta oblitescens COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 205.

Melipona interrupta oblitescens COCKERELL, 1920B, Bull. Amer. Mus. Nat. Hist., XLII, p. 460.

Melipona interrupta DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, p. 440. (Dutch Guiana specimens.)

♀.—The structural characters are set down in the bracketed paragraphs of the description of *M. interrupta* subspecies *interrupta*, to which *oblitescens* is apparently in most respects very similar. It differs principally in having almost pure white instead of "reddish" or "reddish gray" hair on the vertex and on the mesonotum (except for the usual rust-red patches in the antero-lateral angles).

"Large pale supraclypeal mark, but clypeal stripe reduced to a triangle on lower margin."

The coloration of the legs is that indicated in a bracketed paragraph of the description of *M. interrupta* subspecies *interrupta*, and the hair on the legs accords with the generalized description given under subspecies *interrupta*.

So far as one may judge from Latreille's description of *interrupta*—and the Moengo specimens sustain this interpretation—the abdominal maculations of *oblitescens* are even more restricted than those of the typical subspecies. The band on tergite 1 is usually "broken into fragments," although sometimes entire, as described for the typical subspecies, and in other cases (a large series from the Mt. Duida region of Venezuela) reduced to two widely sundered, lateral spots. The bands on tergites 2-5 are "reduced to lateral marks," even these remnants being sometimes absent or virtually absent on tergites 4 and 5. There are flat-lying fringes of light, plumose hairs along the apical margin of tergites 2-4, as described by Latreille for the typical subspecies. There are black hairs—but at variance with Latreille's statement for typical *interrupta* they are long rather than short—on the apico-lateral margins of the abdomen; and such black hairs are sparsely represented also on the sides of the intermediate tergites. Plumose, light hairs intermixed with longer, more bristle-like, black hairs occur on tergite 6, but, contrary to Gribodo's observations for typical *interrupta*, there are in *oblitescens* no plumose hairs on tergites 4 or 5—if exception be made of a few such hairs at the extreme sides. On tergite 1 there are erect but not very conspicuous, pale hairs (although on each side of the basal concavity longer and more conspicuous hairs occur); on tergites 2-4 there are short, inconspicuous, appressed, pale hairs; on tergite 5, in addition to a sparse representation of these short, pale hairs, there are a few short, erect, black hairs, seen only when the insect is viewed from the side. The venter has pale hairs except for the apical sternite, the hairs of which are, as a rule, reddish golden with longer, black hairs intermixed.

Length 11 to 12 mm.; width of thorax 4 mm.; length of forewing, including tegulae, 9 to 9¼ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—The type has been generously donated to the American Museum by Professor T. D. A. Cockerell. Metatypes from British Guiana—Kaieteur and Tukeit—in the collection of the American Museum.

DISCUSSION.—Schulz (1903) called attention to the wide interruption of the bands in specimens from Dutch Guiana, adding: "It is for the future to establish whether these Guiana specimens are in all cases thus maculated and are therefore separable subspecifically from those of Para and the lower Amazon." Later (1919) Professor Cockerell erected *oblitescens* on the basis of a specimen from Dutch Guiana that evidenced the characters pointed out by Schulz, and the relative constancy to this type among specimens from the same general region finds exemplification, furthermore, not only in the specimens from Dutch Guiana here listed, but also in specimens from British Guiana. *M. interrupta oblitescens* is apparently somewhat intermediate between true *interrupta* and the subspecies *fasciculata* from the State of Para, resembling the former rather more in respect to the widely interrupted character of its bands but sharing with the latter the "hoary pubescence" on vertex and mesonotum. It is also very closely related to the new subspecies, *salti*. The specimens from Kamakusa and Carvoeiro and the series from the Mt. Duida region listed below have the band on tergite 1, like those on the subsequent tergites, reduced in practically all instances to small lateral maculations; tergite 5 more often than not lacks the maculations altogether, and in many cases this is true also of tergite 4.

DISTRIBUTION.—Described from Dutch Guiana. Specimens in the collections under examination assignable to *oblitescens* are from the following localities:

DUTCH GUIANA.—Paramaribo, April 4, 1927 (Cornell University Expedition); Sint Barbara Plan., Surinam River, April 14, 1927 (Cornell University Expedition); Ongeljik, May 2, 1927 (Cornell University Expedition).

BRITISH GUIANA.—Kaieteur, July 17–19, 1911 (F. E. Lutz); Tukeit, July 21, 1911 and August 17, 1911 (F. E. Lutz); Kamakusa, October 25, 1922 and January, 1923 (H. Lang).

BRAZIL.—Carvoeiro, near the junction of the Rio Branco with the Rio Negro, August 26, 1924 (J. Bequaert).

VENEZUELA.—Rio Cassiquiare, September 28–30, 1928 (G. H. H. Tate); Mt. Duida Region, October 2, 1928 (C. B. Hitchcock) and November 4, 1928 (G. H. H. Tate); Summit of Mt. Duida, December 1, 1928 (G. H. H. Tate).

HABITS.—Some of the specimens from the Mt. Duida region were taken while sucking moisture from laundry.

Melipona interrupta subspecies **salti**, new subspecies

Melipona interrupta, Latreille, variety *salti*, SCHWARZ, in Salt's 'Contrib. to Ethology of Meliponinae,' 1929, Trans. Entomol. Soc. London, LXXVII, pp. 434-437. (Biology sans descrip.)

♀.—The structural characters are those indicated in the description of *interrupta* subspecies *interrupta*. The subspecies *salti* is very close to the subspecies *oblitescens*, with which it agrees in respect to the color of the hairs on the head, thorax, and legs, and also with regard to the widely interrupted abdominal bands.

Its facial maculations (plate IV, figure D) are similar to those of the subspecies *triplaridis* and present an intermediate condition between the reduced facial maculations of *oblitescens* and the heavy ornamentation of *grandis*. The median line on the clypeus is more slender than in *grandis* but extends from the apex almost to the base, not being confined to the apical half or third as in *oblitescens*. The maculations in the antero-lateral angles of the clypeus are united with the longitudinal maculation by a narrow transverse line extending along the apex of the clypeus, not sundered from it as in *oblitescens*; the supraclypeal triangle is strongly developed; and the lines along the inner margin of the eyes have a tendency in some specimens (especially those from Sevilla) to assume a clavate expansion at their lower extremity, somewhat as in *grandis*. The antennæ are rather lighter on the under side than is the case in *oblitescens*: the scape is striped with yellow from the base to or almost to the apex; the flagellum is ferruginous on its under side and the apical joint of the flagellum is wholly ferruginous, as is usual in the subspecies of *interrupta*.

Again differing from *oblitescens* but allying itself now with *triplaridis* just to the north in Panama, *salti* has a pronotum not wholly black but patterned with pale yellow, and, again suggestive of *triplaridis*, it has usually (but not in all cases) a faint streak at least of pale yellow posteriorly on the rim of the scutellum. The pattern on the pronotum consists of a patch of yellow on each side of the central black area, these patches being flanked in turn by black and then succeeded by the usually partly yellow lateral extremities.

The legs rather variable in their coloration. Light brown frequently replaces black on the coxæ and trochanters, the under side of the hind femora, the apex of the hind tibiæ, and the hind basitarsi. It is difficult to decide to what extent this variability may be due to a callow condition. (Plate V, figure F.)

The band on tergite 1 is usually briefly interrupted at the middle but is otherwise as a rule not disintegrated. On tergites 2 to 5 there are merely abbreviated vestiges of the stripes at each lateral extremity, those on 4 and 5 being often faint to absent. The hair on tergites 1-4 is, like that described for the corresponding tergites of *oblitescens*, pale, and on 2-4 at least short and appressed. On tergite 5, on the other hand, there are pale, plumose hairs not merely on the sides but also on the middle, although these hairs are not so dense as on tergite 6 nor intermingled, as on that segment, with long, black bristles. There are rather fewer black hairs on the apico-lateral angles than is the case in *oblitescens*. The apical fringes of tergites 2-4 are pale, but exceptionally short and inconspicuous, offering in this respect not only a contrast to *grandis*, in which the fringes are long, but also to the type and metatypes of *oblitescens*, in which the fringes are of intermediate length. The hair on the apical sternite is reddish golden with sometimes a few black hairs intermixed.

The structural characters are those indicated in the bracketed paragraphs of the description of the typical subspecies.

Length 11–13 mm.; width of thorax 4 to $4\frac{1}{4}$ mm.; length of forewing, including tegulae, 9 to $9\frac{1}{2}$ mm.

♀ (Virgin).—Smaller, shiny on thorax and abdomen instead of dull, and different in general appearance from the worker.

The head (plate I, figure D) smaller than in the worker. The clypeus relatively narrower and longer than in that cast, its apico-lateral angles widely separated from the eye, the distance being only a trifle less than the width of the mandible at its base. The malar space longer than in the worker, the shortest distance from the apex of the eye to the base of the mandible about one-half the width of the mandible at its base. The mandibles shorter than in the worker, slightly sickle-shaped; much less distinctly toothed on their inner apical half than are those of the worker. The antennae very long and slender, all of the joints beyond the second being about two and one half to three times as long as wide except the narrow apical joint, which is more nearly four times as long as wide. The eyes much shorter and narrower than in the worker; the facial quadrangle broader than long. The clypeus, sides of face, and front with rather unexpectedly dense sculpturing, these parts being dull compared to the shininess of the thorax and abdomen. (This dullness is in contrast to the condition of the virgin queen of the closely related *beecheii*, the head of which is lightly sculptured, with a shininess on its front and even on its clypeus comparable to that of its mesonotum.) The face of the virgin queen of *interrupta* subspecies *salti* is densely but very finely tessellated. The superimposed punctures (which do not, however, obliterate the pattern of the tessellation) are also rather dense, especially so on the clypeus and front. The malar space is devoid of tessellation and shiny, notwithstanding the presence of a few elongate but shallow punctures on its inner half. The supraclypeal area and the contiguous part of the base of the clypeus are the most elevated parts of the face. As in the worker and male, there is a strong longitudinal carina extending upward from the supraclypeal area. (In the queen of *beecheii* before me such a carina is not traceable.) The tessellation on each side of this carina is especially fine. The mandibles, except for their dark apical rims, and the labrum ferruginous (most of the Sevilla specimens) or deep chestnut-red (Rio Frio specimens). Clypeus and supraclypeal area pale yellowish, the clypeus usually with two parallel, dark stripes (most of the Sevilla specimens) or cloudy red with a dark area more or less like the condition shown in plate I, figure D (Rio Frio specimens). The maculations on the sides of the face—strongly clavate below, vaguer in outline as they extend upward—range from pale yellow to red, corresponding to the color of the clypeus. The antennae ferruginous both above and below, in contrast to those of the worker and male; in the Rio Frio queens they are of a deeper red. The hair on the lower half of the face very short, appressed, and yellowish; that on the front somewhat longer, simple, more or less appressed, strongly yellowish, nowhere concealing the sculpturing, strikingly sparse when compared with the dense thatch of plumose hairs on the front of the worker. The hairs on the vertex longer, erect, yellowish, not so conspicuously branched as those in the corresponding region of the worker.

The hairs on the mesonotum a faded yellow, longish, at no point dense enough to conceal the shiny mesonotum, which is virtually devoid of tessellation, permitting the punctures to stand out the more distinctly. On the mesopleura the tessellation has to some extent survived and those parts are less shiny than the mesonotum. The hair

on the mesopleura of much the same faded yellow as that on the mesonotum. The lateral extremities of the pronotum a pale ferruginous (Sevilla specimens) with the maculation extended inward over the adjacent region of the pronotum. The tegulae also ferruginous. The posterior rim of the scutellum beneath and the densely if finely tessellated propodeum ferruginous. (As all of the virgin queens from both localities have the propodeum ferruginous, it may be that this is the usual condition and not due to a possibly callow state.)

The legs are black, more or less variegated with brown, the brownish areas being usually on the coxae and trochanters (in the Sevilla specimens these are ferruginous), on the femora beneath, at the base of the front and middle tibiae, more or less on the apices of the tibiae (but the base of the hind tibiae, in contrast to the red condition in the worker, is black). The tarsal joints are ferruginous to brownish, those apical to the basitarsi narrowly dark at the base. The hind tibiae (plate V, figure D) much narrower than in the worker and in the male, being of nearly uniform width, only a trifle wider at the apex than at the base, flattened to slightly concave (more concave than in the queen of *beecheii*) at the outer apical extremity, and with a few scattered, coarse, granular punctures. There is no spinelike prolongation on the hind tibiae, which are inconspicuously and obtusely angulate posteriorly. The hind basitarsi relatively long, narrow, and parallel-sided, not strongly curvilinear posteriorly as in the worker and male. The hairs on the legs for the most part faded yellow to gray, with more golden to slightly brownish hairs anteriorly beneath on the front and middle tibiae, on the under side of the middle trochanters, on the under side of the basitarsi, and on the other tarsal joints. The hind tibiae have longish hairs on their exterior surface as well as on their sides.

The wings much shorter than in the worker, extending usually only to the middle of tergite 3.

The abdomen shiny, so faintly tessellated on the two or three basal tergites as to seem at first glance devoid of such sculpturing, but the scattered, shallow punctures on these tergites fairly conspicuous. The surface of tergites 4-5 dotted over sparsely with somewhat granular punctation; punctures of this character are denser but finer on tergite 6. The three basal tergites with only a few short, scattered hairs other than those on each side of the basal concavity; viewed from above, these tergites seem glabrous. The three apical tergites, on the other hand, have long, thin, unbranched hairs of a grayish ochraceous tinge, similar in color to those on the venter. (In the queen of *beecheii*, by contrast, all of the tergites, not merely the apical ones, are rather uniformly covered with hair.) Unlike the condition in the worker, the hair on the apical sternite is of the same light hue as that on the other sternites, and dark hairs are lacking on the apico-lateral borders of the abdomen. There are no abdominal maculations, but the transparent apical rims are of a light yellowish-brown in contrast to the deeper, brownish-black coloration of the bases of the tergites.

Length 10 to 10¼ mm.; width of thorax 3¼ to 3½ mm.; length of forewing, including tegulae, 6 to 6½ mm.

In the gravid ♀ the length of the swollen abdomen approximates 9½ mm., and the length of the insect exceeds 14 mm.

♂.—The eyes very large and bulging, the face very long and narrow, scarcely wider toward its apex than the width of the eye at its broadest (plate II, figure D). Eyes very slightly convergent below, almost parallel-sided. The lateral ocellus close to the eye, the distance between its outer rim and the eye being less than a third that

measured from the outer rim of one lateral ocellus to the outer rim of the other. Malar space hair-fine, the eye being almost in contact with the inner angle of the mandible. The antero-lateral angle of the clypeus very narrowly separated from the eye,—by about the length of the short third antennal joint at its shortest. The labrum kidney-shaped apically, with transversely striate punctures basally and sparse, scattered punctures medianly and apically. Mandibles somewhat hourglass-shaped, with a median narrowing, their apical edge—in contrast to the condition in the worker and queen of *salti* and even in the male of the closely related *beecheii*—with at most one DISTINCT tooth at the extreme inner edge, not two teeth on the inner half as in the other sex. In respect to the dentition of the mandible there is some variability even among the males of a single nest, specimens occurring in which the condition is virtually edentate, while in others (a distinct minority) there is, in addition to the innermost tooth, a feeble undulation of the surface suggesting an uncompleted penultimate tooth. The scape shorter than in the worker; the flagellum longer than in the worker, but, in spite of its additional segment, not so long as in the queen; joint 4, is, barring the scape, the longest joint of all. Face very densely tessellated up to the ocelli, dull, with superimposed punctures on the clypeus; the vertex feebly shiny in spite of its distinct sculpturing; cheeks faintly sculptured, almost smooth, and shiny. The clypeus with more or less short, pale, appressed hair, though appearing usually glabrous when viewed from above. A dense, almost concealing thatch of up-slanting, plumose, white hairs between the antennæ and the ocelli. The hair on the vertex long, up-standing, plumose, but of variable color, being in some cases white as in the worker, in other cases sooty due to intermixed black and brown hairs. There are pale, down-slanting hairs on the cheeks and long, pale hairs fringing the lower edge of the mandibles. The maculations are strong on the clypeus and sides of the face. The median longitudinal line of the clypeus runs from apex to base (almost invariably), bisecting at its lower end the transverse maculation that extends along the apex of the clypeus and more broadly upward along the antero-lateral angles. In a few of the specimens from Rio Frio the apical maculation is interrupted. At its upper end the median longitudinal line of the clypeus joins the large supraclypeal maculation. Along the base of the clypeus there is sometimes also a transverse line of yellow. The maculations on the sides of the face—broad below, narrow above—extend along the inner margin of the eyes well toward the level of the ocelli. The scape is striped in front from base to apex with strong yellow. The flagellum is ferruginous below, darker above, except that the last two joints are usually ferruginous above as well as below. The labrum is sometimes ferruginous but more often partly or wholly black. The mandibles are black on their basal two-thirds, ferruginous on their apical third.

The thorax has the sculpturing noted for the worker in a bracketed paragraph of the description of the subspecies *interrupta*. The hair in the antero-lateral angles of the mesonotum often rust-red as in the worker but sometimes replaced more or less by black hair, particularly in specimens that have such black hair in varying proportions on the vertex. The hair on mesonotum and pleura otherwise pale. The lateral extremities of the pronotum more or less pale usually, the light color not infrequently extended over the adjacent region of the pronotum.

Legs mainly black above the tarsi, slightly brown occasionally on the coxæ and trochanters; brown to ferruginous usually on the apex of all the tibiae; ferruginous usually on the basitarsi (the fore and middle ones sometimes darker basally) and on the other tarsal joints except for basal spots of black. The hairs on the legs are gray-

ish except for the golden hairs in the regions where these occur in the worker and queen. There is much more similarity between the hind tibiae and hind basitarsi of the male (plate V, figure E) and of the worker (plate V, figure F) than there is between those of the queen (plate V, figure D) and of the worker (plate V, figure F). In the male the hind tibiae, though broad, are somewhat narrower than in the worker, with a more limited but nevertheless distinct concavity on the outer apical half of their exterior surface. The spinal elongation of the outer angle of the hind tibiae is even more strongly developed than is the corresponding character in the worker. There are hairs over the external surface of the hind tibiae as in the queen. The hind basitarsi are broad and posteriorly rounded as in the worker.

The pale band along the apex of tergite 1 usually approaches completeness as in the worker; the pale stripes on each side of tergites 2-4 much less widely severed, as a rule, than in the worker, sometimes extended rather far inward. The maculations on tergite 5 restricted to the sides if not indeed absent. The sculpturing of the tergites similar to that of the worker and the concentration of the conspicuous, pale, plumose hairs on tergite 5 and especially tergite 6 similar to the condition in the worker, but the intermixed black hairs, usual on tergite 6 of the worker, are often sparse to absent in that tergite of the male, and the fringes on tergites 2-4 are of negligible length to absent.

The genitalia are depicted on plate VIII, figures B, C, D, E, F.

Length 10 to 12 mm.; width of thorax $3\frac{3}{4}$ to 4 mm.; length of forewing, including tegulae, 9 to $9\frac{1}{4}$ mm.

TYPE.—Type and allotypes in the American Museum; paratypes in the American Museum and in the collection of Dr. George Salt.

DISCUSSION.—All of the specimens described as *salti* are from localities in the northern part of the State of Colombia. All of the workers differentiate themselves from *oblitescens* by the fuller facial maculations noted in the description and, furthermore, through the yellow pattern on their pronotum. Although the queens and males lack the pattern of yellow that characterizes the pronotum of the worker, the lateral extremities of their pronotum are usually more or less light in color. The stripe posteriorly on the rim of the scutellum characterizes especially the workers (twenty-six in number) from Sevilla, and three of the five workers from Rio Frio. It is not traceable in the three or four workers from other Colombian localities.

Many of the workers from Sevilla, some of the males from Sevilla, and all of the queens not only from Sevilla but also from Rio Frio have the propodeum more or less ferruginous instead of black. Probably in the case of the workers and males at least, such specimens are to be considered callows and hence reference to such coloration has in the case of the worker and of the male been omitted from the descriptions. These callows, if they be callows, are not confined to the specimens taken at Sevilla on any one day but are represented among the captures of one nest taken at intervals of seven days over a period of two weeks.

As noted elsewhere in this paper, the queens of *flavipennis*, *beecheii*, and *schencki* are in accord in having the spiracles of segment 1 just below the dorsal surface, which is at variance with their position in the worker. In *interrupta* subspecies *salti*, on the other hand, the position of these spiracles more nearly agrees with what we find to be the case in the worker and the male, in which the spiracle is placed just outside the edge of the basal concavity at a point about halfway toward the junction of the abdomen with the thorax. The conspicuous circular depression on each side of tergite 1—so striking in the virgin queens of *flavipennis* (plate X, figure I)—has at best a very feeble and inconspicuous counterpart in the queens of *salti*. By tilting these queens it is possible to trace a feeble median groove at the base of tergite 1, and at some distance to each side of this groove usually another somewhat similar groove is detectable. These lateral grooves are more developed in the queens from Rio Frio taken October 11 than they are in the queens of Sevilla taken July 30 and August 5. It is in order to point out that in the queen of *flavipennis*, too, there is a median groove, although this is dwarfed and negligible when compared with the lateral grooves and the rounded depressions into which they widen out.

The subspecies *salti* has affiliations with its nearest neighbors of the *interrupta* complex. It shares with *oblitescens* to the east the whitish coloration of the hair on vertex and thorax and the widely interrupted abdominal bands. Its fuller facial maculations and the yellow maculations on its pronotum and usually also posteriorly on the scutellum, however, link it likewise with the otherwise rather different *triplaridis* from Panama. Its facial maculations are intermediate, too, between *oblitescens* on the east and *grandis* to the south.

Among the specimens from Sevilla is a lateral gynandromorph,—the first, I believe, to be reported from the genus *Melipona*, although I recorded (1929) the occurrence of a gynandromorph of *Trigona testacea* variety *rhumbleri* (Friese).

DISTRIBUTION.—Known only from localities in northern Colombia, as follows: Sevilla, Magdalena, July 30, 1927, August 5, 1927, ♂♂, ♀♀, and ♂♀, and August 12, 1927, ♂♂, and 1♀; Rio Frio, Magdalena, January 11, 1927, June 2, 1927, June 26, 1927, December 5, 1926, December 31, 1926, ♂♀, and October 11, 1927, ♀♀ and ♂♂; 500 ft. hills east of Rio Frio, Magdalena, May 22, 1927, ♀; Aracataca, February 28, 1927, ♀; Mamatoco, 500 ft., Santa Marta, February 18, 1927, ♀. All of these specimens were collected by Dr. George Salt, who generously sent them to the American Museum. The subspecies is named

after him. The reader is referred to Dr. Salt's fascinating paper, 'A Contribution to the Ethology of the Meliponinae' (Trans. Entom. Soc. of London, 1929, pp. 431-470), in which the author presents in detail his careful observations on the biology of *interrupta salti* as well as that of many other Meliponidæ.

Melipona interrupta subspecies fasciculata (Smith)

Melipona fasciculata SMITH, 1854, 'Catal. Hymen. British Mus.,' part 2, p. 406.

Melipona fasciculata BATES, 1863, 'The Naturalist on the Amazon River,' II, pp. 43-45.

Melipona interrupta variety *fasciculata* GRIBODO, 1893, Bull. della Società entomol. Italiana, XXV, pp. 256-257.

Melipona fasciculata DALLA TORRE, 1896, 'Catal. Hymenopterorum,' X, p. 579.

Melipona interrupta DUCKE, 1902, Zool. Jahrb. System. Geogr. und Biol., XVII, 1903, pp. 293-294.

?*Melipona interrupta* DUCKE, 1907, Revue d'Entom., XXVI, p. 89.

Melipona interrupta DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., pp. 161-163. (In part.)

Melipona interrupta COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 199.

Melipona interrupta DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, pp. 439-440. (In part.)

♂.—The structural characters are set down in the bracketed paragraphs of the description of *M. interrupta* subspecies *interrupta*.

The facial maculations are more strongly developed than in either the typical subspecies or in *oblitescens* but a little less so than in *salti*. The median longitudinal stripe on the clypeus extends usually quite or nearly from base to apex; there are slanting maculations in the antero-lateral angles of the clypeus, a strong supraclypeal triangle, and linear maculations along the inner orbits of the eye for usually more than half their length. Labrum and mandibles yellowish ferruginous, except for the black apical rim and basal prominences of the latter. Scape in front with a more or less yellowish-ferruginous stripe; flagellum black above, brownish to ferruginous below although the apical joint or two are wholly or largely ferruginous.

The head and thorax with pale to whitish hairs (except for the rust-colored tufts in the antero-lateral angles of the mesonotum), agreeing in these respects with the subspecies *oblitescens* but not with typical *interrupta*. The chitin of the thorax wholly black, in agreement with the condition in typical *interrupta* and *oblitescens*; no maculations on the pronotum as in *salti*.

The coloration of the legs is that indicated in a bracketed paragraph of the description of *M. interrupta* subspecies *interrupta*, with the emphasis especially on the displacement of black by reddish, and the hair on the legs accords with the generalized description given under *interrupta*.

What especially distinguishes *fasciculata* from the subspecies previously described is the complete or nearly complete character of the bands on tergites 1-5. In no case are these reduced to widely separated lateral stripes. These bands are narrow and cream-colored, not rather broad and more decidedly yellow as in the other subspecies

with continuous bands (*tripilaridis*). Whitish, erect hairs on each side of the basal concavity. Short, appressed, inconspicuous, pale hairs over most of the tergites. On tergite 5 a few pale, plumose hairs (sometimes absent) and erect, black hairs, best seen when the abdomen is viewed from the side. On tergite 6 there is a heavy, conspicuous growth of white, plumose hairs intermixed with longer, black hairs, only faintly branched and rather spinelike in appearance. These hairs are also conspicuous on the apical margins of the abdomen. Tergites 2-4 with a fringe of flat-lying, pale, plumose hairs, sometimes with varying amounts of black hair (see the Discussion). The venter with white hairs except on the apical sternite, the hairs of which are ferruginous flanked by longer, black hairs.

Length 11 to 12 mm.; width of thorax 4 to $4\frac{1}{4}$ mm.; length of forewing, including tegulae, 9 to $9\frac{1}{4}$ mm.

♀.—Unknown.

♂.—Description of the male combined with that of the worker by Ducke, 1925, and a little difficult to disentangle. Labrum and mandibles, it is stated, are usually largely black and the hair of the apical abdominal segment conspicuously long, standing out fringelike. "Hind tibiae without a distinct excavation" (Ducke, 1902).

TYPE.—In British Museum—Natural History Division.

DISCUSSION.—Ducke (1916, 1925) merges *fasciculata* with typical *interrupta*, but Smith's insect would seem to have a valid title to independence as a subspecies both because of the lighter color of its thoracic hairs and the fuller development of its abdominal bands. This impression is based on an examination of the type in the British Museum, supplemented by a study of specimens from the type locality, Para. In all of these specimens the bands are complete or virtually complete, and tergites 2-4 have apically, in addition, a flat-lying fringe of pale, plumose hairs. Up the Amazon as far as Obidos, the form with white fringes on tergites 2-4 predominates. Only a little beyond, however, in Oriximina, the white fringes on tergites 3-4, at least, are largely invaded (sometimes even all but replaced) by unbranched, black hairs. These Oriximina specimens are in a way the connecting link between *fasciculata* from the Lower Amazon and *mañaosensis*, presently to be described.

DISTRIBUTION.—Ducke, who makes *fasciculata* a synonym of *interrupta* (1910, 1916, 1925), includes in the range of *interrupta* not only the State of Para, in which *fasciculata* abounds, but also such Brazilian states as Maranhão, Goyaz (northeastern part) and Matto Grosso (northern and central parts). From these three states no specimens are available in the present collections and it is impossible to judge, therefore, whether, in the more restricted interpretation here adopted, specimens from these states should be included in *fasciculata* or assigned possibly to some other subspecies. In redescribing *interrupta* Ducke (1916, 1925) specifies the presence of fringes of white hairs on the

tergites. He definitely says white and neglects to mention black, so that it may be assumed, I think, that what is here recognized as a separate subspecies, *mañaosensis*, was not represented among his specimens. The specimens of *fasciculata* in the present collections come from the following localities, all in the State of Para:

Para (Baker), June (H. H. Smith), May, 1901 (Ducke); Igarapé-Assú, June 26, 1919 (Parish); Santarém¹ (H. H. Smith); Obidos, August 14-19, 1919 (Parish).

***Melipona interrupta* subspecies *mañaosensis*, new subspecies**

♀.—The structural characters are set down in the bracketed paragraphs of the description of *M. interrupta* subspecies *interrupta*.

The facial maculations like those of the subspecies *fasciculata*. The hair on the vertex not so purely whitish as in *fasciculata* and *oblitescens*, more inclined to yellowish with some interspersed black hairs (but the hairs of the occiput white). In other respects the hair of the face and of the head approximates that of *fasciculata*.

The thorax immaculate. The hair on the mesonotum yellowish (except for the rust-red patches in the antero-lateral angles), approaching the hue of typical *interrupta*. Hair on mesopleura slightly ochraceous, grading almost imperceptibly into white on the under side of the thorax.

The color of the legs and of the hairs of the legs as described in a bracketed paragraph for typical *interrupta*.

The narrow, pale band on tergite 1 complete or barely interrupted; the similar band on tergite 2 sometimes nearly complete, sometimes more or less broadly interrupted; the maculations on tergites 3-5 consist of narrow, linear stripes at each lateral extreme, widely separated from each other medianly. It is through the hairs on the tergites that this subspecies differentiates itself especially. Rather close to typical *interrupta* in the coloration of its thoracic hairs, it departs from Latreille's specifications for typical *interrupta* as well as from the condition in all of the subspecies thus far considered in having largely or wholly black fringes instead of white apically on tergites 3-4 and more or less also on tergite 2. While plumose, white hairs are present on tergite 6, they appear to be outnumbered by the bristle-like, black hairs. The hairs on the venter whitish except those on the last sternite, which are black.

Length $10\frac{3}{4}$ to 13 mm.; breadth of thorax $3\frac{3}{4}$ to $4\frac{1}{2}$ mm.; length of forewing, including tegulae, $8\frac{3}{4}$ to $9\frac{1}{4}$ mm.

♀.—Unknown.

♂.—For the structural characters see the description of the male of *interrupta* subspecies *salti*, with which this subspecies agrees except that the hind basitarsi are a little more parallel-sided, a little less rounded posteriorly. The sculpturing of the face in the single specimen available is unfortunately concealed by some sticky substance that also makes the color of the hair impossible to interpret. On the vertex, however, the hair is yellow, with some intermixed black hairs as in the worker. The maculations of the face only a trifle less developed than in the male of *salti*, the slanting maculations in the antero-lateral angles strong but the line along the apex connecting

¹It is of interest to note that Bates, 1863, reported *fasciculata* from Santarém.

these maculations with the median longitudinal stripe feeble to absent (a condition found, however, also in some males of *salti*).

The thorax immaculate. The hair on the mesonotum strongly and distinctly yellow, with the result that the rust-red patches of the antero-lateral angles are not in such sharp relief and, when viewed from the side, seem almost to blend with the yellow hairs. The mesopleura also covered with yellow hairs grading into subdued white on the under side of the thorax.

The coloration of the legs and of the hairs of the legs accords with that described for the male of *salti*.

The pale, narrow bands of tergites 1-2 virtually complete, those on 3-4 narrowly interrupted, that on 5 a little more widely interrupted, the intervening black about equal to each of the sundered fragments of the band. Upright, pale hairs on each side of the basal concavity. The fringing hairs apically on tergites 2-4, characteristic of the worker, are absent. The short, inconspicuous hairs on tergites 1-5 (seen only when the insect is viewed from the side) wholly black. In contrast with the almost glabrous condition of these tergites, there is on tergite 6 a dense, concealing growth of plumose black to dark brown hairs, with somewhat shorter, black hairs at the lateral margins of tergite 5 and dark hairs of diminishing size bordering the lateral margins also of the other segments (in the male of *salti* the hairs on the tergites are white or predominantly white). The penultimate sternite with golden hairs, the apical sternite with black hairs; the other sternites with white hairs.

Length 12 mm.; breadth of thorax 4 mm.; length of forewing, including tegulæ, 9 mm.

TYPE.—Type, allotype, and paratypes in the collection of The American Museum of Natural History; additional paratypes in the collections of Dr. George Salt and of Dr. J. Bequaert; one paratype in the collection of Dr. T. H. Frison; one paratype (type number 905) at Cornell University.

DISCUSSION.—The description has indicated the points of resemblance and also of contrast between *mañaosensis* and other subspecies of *interrupta*. The most distinctive characteristic of *mañaosensis* worker, the black fringing hairs on tergites 3 and 4 and to a less extent of tergite 2, is, however, shared presumably by Gribodo's *sicophanta*, for while Gribodo does not mention the fringes, he makes it clear that all of the hairs on the tergites are black. From *sicophanta*, however, *mañaosensis* can readily be separated structurally through the absence of a distinct transverse carina on segment 1, which in *sicophanta* separates the dorsal portion of the segment from the portion anterior and vertical to it, and among other things especially by the color of the hairs on the leg. In *mañaosensis* the hairs on the tibiæ are, as in other subspecies of *interrupta*, light; in *sicophanta*, on the other hand, they are black, including those fringing the hind tibiæ.

Specimens from Oriximina occupy a position somewhat intermediate between *fasciculata* and *mañaosensis*. There are five specimens

from this locality in the material before me. They have with one exception the abdominal bands complete or nearly complete as in *fasciculata* and even in the exceptional specimen the interruption is less wide than in *mañaosensis*. However, the fringes on tergites 3-4 consist in large part or entirely of black hairs and the hair on the vertex and thorax, while for the most part matted through dampness, seems to be yellowish (in agreement with *mañaosensis*) rather than white.

DISTRIBUTION.—The range of this subspecies, in so far as the present specimens indicate, is from the confluence of the Rio Negro with the Amazon to somewhat beyond the confluence of the Rio Madeira with the Amazon. The only two localities represented are: Mañaos, September 11, 1924 (J. Bequaert) and September 7-9, 1920 (Cornell University Expedition), and Itacoatiara, November 22, 1919 (Parish).

***Melipona interrupta* subspecies *sicophanta* (Gribodo)**

Melipona sicophanta GRIBODO, 1893, Bull. della Società entomol. Italiana, XXV, pp. 257-258.

♀.—“Related to and very like *M. interrupta* Latreille, differs in that the first abdominal segment at the base (before the dorsal portion) has a distinct transverse carina. Of medium size, robust, nigro-piceous, with little hair. Face below the antennæ of a dark dulled ferruginous; the flagellum of the antennæ underneath and apically piceous. The tergites of the abdomen banded with whitish ochraceous; the bands (especially the last one) not at all completed in the middle. Face about the antennæ, sides of the thorax and breast, coxæ, trochanters, and femora, as well as the first segment of the abdomen (scantly) and the venter with gray hairs. The vertex and the dorsum of the thorax with dark griseous-fuscous hairs. The tibiæ, the tarsi, and the tergites of the abdomen (the basal ones scantily, the apical ones rather densely) covered with black bristles. The face very finely and densely granular, dull. The scutellum usually swollen and produced, the dorsal area of the metathorax being obsolete. The abdomen subopaque; wings gray, venation fuscous.

“Length, 10-11 mm.”

♀.—Unknown.

♂.—Unknown.

TYPE.—Gribodo's description was based on three workers in his own collection. According to Horn (1926) the Hymenoptera of Gribodo (and presumably among them these three type specimens) were acquired by the Museum of Genoa.

DISCUSSION.—This insect is not represented in the present collections. Ducke (1916, 1925) makes it a synonym of *interrupta* notwithstanding the presence of a structural character (the carina on the first segment of the abdomen) to which Gribodo attached great importance and notwithstanding, too, the less emphasized but in some ways equally

distinctive coloration of its hairs. So far as one may judge from the description, it is at least as individual in its characters as is *interrupta grandis*, to which Ducke assigns subspecific rank. By way of bringing out its distinctiveness, the comments with which Gribodo supplements his description may be quoted:

As I have emphasized, this species has a very important character to distinguish it from its relatives, namely, the presence of a fine but very distinct, raised, carina-like edge, which separates the vertical part of the first abdominal segment from the horizontal part. It is a suture analogous to that which occurs, for example, in that very position, in many species of the genus *Odynerus* (on which were erected the subgenera *Protodynerus* and *Ancistrocerus*).

It differentiates itself furthermore by various details of coloration, the face, however, preserving the same coloration although a trifle darker. I find worthy of mention the black color of the hairs, or rather the bristles and eyelash-like hairs of the tibiae (only the hind tibiae have some very short, ochraceous hairs on their internal face and the tarsi some thin, fulvous hairs although dim on their internal face).

It is to be noted also that in the three specimens there are lacking completely (although the specimens are in good condition) the plumose hairs of the last abdominal segment; there are present only the black bristles.

DISTRIBUTION.—The specimens on which Gribodo's description is based were from Cayenne.

***Melipona interrupta* subspecies *triplaridis* (Cockerell)**

Melipona fulvipes triplaridis COCKERELL, 1925A, Annals and Mag. Nat. Hist., (9) XVI, p. 421.

Melipona fulvipes triplaridis COCKERELL, 1928, Psyche, XXXV, pp. 171, 173.

♀.—The structural characters are those indicated in the bracketed paragraphs of the description of *interrupta* subspecies *interrupta*.

The facial maculations about as developed as in *salti*. Except for a very few fulvous hairs immediately in back of the ocelli, the hair of the vertex, like that of the front and of the mesopleura, is white in contrast with the strongly yellow tinge of the hair on the mesonotum. (In *fasciculata*, *oblitescens*, and *salti* the hair is decidedly less contrasted.) The rust-red hairs of the antero-lateral angles are frequently extended, with only slight dilution of their strong coloration, along the sides of the mesonotum, and are present also on the tubercles. The scutellum has a yellow, transverse line at the apex, in contrast to the wholly black scutellum of other representatives of *interrupta*, with the exception of *salti* (sometimes). Like *salti*, too, *triplaridis* has a yellow spot or stripe on each side of the pronotum.

For a description of the legs see a bracketed paragraph in the description of *interrupta* subspecies *interrupta*. In *triplaridis* the legs incline to the dark extreme there indicated.

What especially differentiates *triplaridis* from its relatives, is the character of the bands on the tergites. Instead of the fine, narrow, not infrequently interrupted, cream-colored bands of the South American representatives of *interrupta*, the Panamanian *triplaridis* has broadly developed, continuous bands of a strong yellow to

orange color. These bands (at least on tergites 2-5) are especially broad at the middle, slant off from this point toward the sides but broaden again at each lateral extremity (which is true also of *Melipona beecheii*). The short hairs on tergites 2-4 of *triplaridis*, even when viewed in profile, appear more often fulvous than black. On tergite 5 there are usually a few black hairs of intermediate length as well as whitish, plumose hairs, but the tergite that is conspicuously clothed with feathery, white hairs and intermixed long, slightly branched, black hairs is the sixth.

Length $11\frac{1}{4}$ to $12\frac{1}{4}$ mm.; width of thorax $3\frac{3}{4}$ to 4 mm.; length of forewing, including tegulae, 9 to $9\frac{1}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—Described from specimens collected by W. M. Wheeler, at Balboa, Panama Canal Zone, at flowers of *Triplaris cumingiana*.

DISCUSSION.—This insect occupies a somewhat intermediate position not only geographically but faunally between the Central American *beecheii* and its subspecies, the West Indian *fulvipes* on the one hand, and the South American *interrupta* and its subspecies on the other. It shares the fully banded condition of the tergites characteristic of the *beecheii-fulvipes* group but is in size and in respect to the development of the spinelike elongation of the outer apical angle of the tibiae rather more like *interrupta*. I have accordingly transferred it to *interrupta* although it was originally described as a subspecies of *fulvipes*. As explained elsewhere in this paper, *interrupta* and *beecheii* are very closely related. Indeed some specimens of *beecheii* show an approach to *triplaridis* in respect to this tibial angle, though in no specimen of *beecheii* that I have examined is the angle quite so spinelike as in *triplaridis* or in other subspecies of *interrupta*. Cockerell calls attention to the fact that the apex of the abdomen has "much white hair." This hair is dense and of the plumose, branched type in contrast to the unbranched hairs on the apical tergites of *beecheii* (if one excepts the fringes). On the other hand, such branched hairs are usually characteristic of *interrupta* (though of limited development in the subspecies *grandis* and absent in *sicophanta*).

DISTRIBUTION.—Described by Cockerell from Balboa, in the Canal Zone, and thus far known only from the Panama region, the present specimens being from Ancon, December, 1915, and February, 1916 (T. Hallinan); Balboa, October–November, 1914, and January, 1915 (T. Hallinan); Barro Colorado Island, November 9–10, 1923 (F. E. Lutz), December 23, 1928 and January 3, 1929 (C. H. Curran).

***Melipona interrupta* subspecies *grandis* (Guérin)**

Melipona grandis GUÉRIN, 1844?, 'Iconogr. du Règne animal de G. Cuvier,' III, p. 463.

Melipona grandis SMITH, 1854, 'Catal. Hymen. British Mus.,' part 2, p. 405.

¹ *Anthidium pictifrons* PACKARD, 1869, Annual Rept. Peabody Acad. of Sciences, p. 59.

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

Melipona interrupta aequatorialis SCHULZ, 1903, Sitzungsber. Math.-Phys. Klasse der K. B. Akad. der Wissens., München, (pub. 1904), XXXIII, pp. 815-816.

Melipona interrupta subspecies *grandis* DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., p. 163.

Melipona interrupta subspecies *grandis* DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, pp. 440-441.

♀.—On the average somewhat larger than the other representatives of *interrupta*. The facial maculations much heavier and more extensive. The lines along the inner orbit of the eye widen out below into a rather clublike expansion, while the figure on the clypeus itself with its strong central shaft and upcurved apical band suggests an anchor. In contrast to the strongly maculated face, the abdomen has the bands as sharply reduced as in *interrupta obliquesens* and other subspecies of restricted maculation. Only the band on tergite 1 approaches completeness, and in one of the specimens marked "type" in the Natural History Museum of Paris even this band is widely interrupted. At most lateral spots on the tergites subsequent to the first.

Instead of light hair, *grandis* has on the vertex hair of a yellow tinge and the hair on the mesonotum, too, except for the rust-red hue in the antero-lateral angles, inclines to yellow. The hairs fringing the tergites apically are white, and longer and denser than in other subspecies of *interrupta*.

The tessellation of the mesonotum, mesopleura, and that on all of the abdominal tergites beyond tergite 2 relatively faint, with resulting greater shininess on these parts than is the case in the other subspecies.

Length 12 to 15 mm. (the 15 mm. are specified by Guérin), width of thorax $4\frac{1}{4}$ to $4\frac{3}{4}$ mm.; length of forewing, including tegulae, 10 to $10\frac{1}{2}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—Guérin reported Bolivia as the type locality of his species. The type specimens in Paris are labeled: "Bolivia (Chiquitos). D'Orbigny, 1834."

Schulze's *interrupta aequatorialis* from Archidona, Ecuador (R. Haensch), is rightly regarded as a synonym of *grandis*. These are two type specimens of *aequatorialis* in the British Museum, and the only part of Guérin's description of *grandis* that does not seem quite to fit them is that referring to the median linear maculation on the clypeus, which Guérin designates as "small," whereas it is in fact, as his own type illustrates, well developed.

DISCUSSION.—Even within *interrupta grandis* geographical differences seem to be asserting themselves. Thus in a series from Bolivia tergite 5 is covered only with light hairs and tergite 6 is virtually devoid (in many specimens absolutely devoid) of black hairs among the plumose, whitish hairs. In specimens from the Putumayo District of Peru white

hairs are still almost exclusively present on tergite 5, but on tergite 6 there is a heavier encroachment of black, bristle-like hairs and the plumose, white hairs are mostly of stunted growth and sparse. Finally in specimens from Teffé, State of Amazonas, Brazil, and from Iquitos and Puerto Bermudez, Peru, there are exclusively black hairs on tergite 5, and black hairs also largely predominate on tergite 6.

Melipona interrupta subspecies *grandis* is among the largest members of the Meliponidæ. None of the specimens here reported upon, however, attain the size indicated by Guérin, namely, 15 mm. An undescribed *Melipona* of even greater size, 15 to 16 mm., is reported under the name of Uruçu by Martin (1930) from the western part of the State of Ceara, Brazil. This name is very like Urussú, the popular name in Brazil for members of the *fasciata* group.

DISTRIBUTION.—*Melipona interrupta* subspecies *grandis* has been reported from: Bolivia (Guérin 1844?); Ecuador, (Schulz, 1903); Colombia, southeastern part (Ducke, 1925); State of Amazonas, Brazil (Ducke, 1916, 1925); Acre Territorium, Brazil (Ducke, 1916, 1925); State of Matto Grosso, Brazil, northwestern part (Ducke, 1916, 1925).

The following localities are represented among specimens under examination:

BOLIVIA.—Ixiamas, December (Wm. M. Mann); Tumupasa, December (Wm. M. Mann); Rio Negro, January (Wm. M. Mann); Cavinás Beni, January (Wm. M. Mann); Ivon Beni, February (Wm. M. Mann). All of these specimens have light hairs on tergite 5 and exclusively or almost exclusively light hairs on tergite 6.

PERU.—Putumayo District: La Chorrera, August 17, 1920 (Cornell University Expedition); El Oriente, August 18–19, 1920 (Cornell University Expedition); La Sombra, August 22, 1920 (Cornell University Expedition); La Sombra to El Encanto, August 23, 1920 (Cornell University Expedition); El Encanto, August 25, 1920 (Cornell University Expedition). All of these specimens have light or mostly light hairs on tergite 5 but a larger proportion of black hairs than the preceding group on tergite 6.

PERU.—Puerto Bermudez, Rio Pichis, July 17, 1920, (Cornell University Expedition); Iquitos, May 17, 1920 (H. Parish). In these specimens black hairs are exclusively present on tergite 5.

BRAZIL.—State of Amazonas: Teffé, January 12, 1920 (H. Parish). In these specimens, too, black hairs are exclusively present on tergite 5.

Melipona beecheii Bennett

INTRODUCTORY COMMENTS.—Typical *beecheii* and its subspecies *fulvipes*, usually separable without difficulty by the color of the legs and other characters, nevertheless present through their intergrades a rather difficult complex and, instead of providing a key, it seems preferable to refer the reader to the DISCUSSION of each of the subspecies.

Melipona beechii subspecies **beechii** (Bennett)

Melipona Beecheii BENNETT, 1831, in Beechey's 'Narrative of a Voyage to the Pacific and Beering's Strait,' II, pp. 357-365 and Pl.

Trigona ligata SAY, 1837, Journ. Nat. Hist. Bost. Soc. Nat. Hist., I, pp. 415-416.

"*Melipone domestique*" PIERRE HUBER, 1839, Mémoires de la Soc. de Phys. et d'Hist. naturelle de Genève, VIII, pp. 1-26, Pls. I-III.

Melipona zonulata KLUG, cited by Spinola, 1840, Annales des Sciences natur., (2) XIII, p. 123. (Mexican specimens.)

Trigona ligata SAY, 1859, in Leconte's 'Complete Writings of T. Say,' II, p. 789.

Melipona domestica DARWIN, 1859, in Francis Darwin's 'More Letters of Charles Darwin,' 1903, I, p. 121.

Melipona beechii (sic) DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 576; and *Melipona ligata* DALLA TORRE, idem, p. 580.

Melipona nigripes FRIESE, 1900, Természettudományi Füzetek, XXIII, p. 381.

Melipona fulvipes DU BUYSSON, 1901, Ann. de la Soc. entom. de France, LXX, pp. 153-156, Pls. IV-V.

Melipona ligata COCKERELL, 1904, Annals and Mag. Nat. Hist., (7) XIV, p. 23.

Melipona fulvipes variety *nigripes* FRIESE. (Labeled specimens dated 1910.)

Melipona fulvipes COCKERELL, 1912B, Annals and Mag. Nat. Hist., (8) X, p. 315.

Melipona fulvipes FRIESE, 1916, Entomol. Zeit. Stettin, LXXVII, p. 299.

Trigona ligata FRIESE, 1916, Entomol. Zeit. Stettin, LXXVII, p. 289.

Melipona fulvipes variety *obscuripes* FRIESE, 1916, Entomol. Zeit. Stettin, LXXVII, p. 299 (Variety.)

Trigona fulvipes variety *obscuripes* FRIESE, 1916, Entomol. Zeit. Stettin, LXXVII, p. 348. (Variety.)

Melipona fulvipes DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., pp. 578-579. (Mexican specimens.)

Melipona fulvipes COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 201. (Specimens from Costa Rica and Mexico.)

Melipona fulvipes variety *a* COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 200. (Transition form to subspecies *fulvipes*.)

Melipona ligata COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 201.

Melipona fulvipes LUTZ AND COCKERELL, 1920, Bull. Amer. Mus. Nat. Hist., XLII, Art. 15, pp. 493-494.

Melipona fulvipes obscuripes LUTZ AND COCKERELL, 1920, Bull. Amer. Mus. Nat. Hist., XLII, Art. 15, p. 494. (Variety.)

Melipona ligata LUTZ AND COCKERELL, 1920, Bull. Amer. Mus. Nat. Hist., XLII, Art. 15, p. 494.

Melipona fulvipes obscuripes LUTZ, 1924, Annals N. Y. Acad. Sciences, XXIX, p. 209. (Variety.)

Melipona fulvipes DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, p. 443. (Mexican specimens.)

♀.—Black, with largely black legs (often brown—Cockerell's *fulvipes* variety *a*) and with narrow, rather uniform, uninterrupted yellow bands on the tergites apically.

The face broad (plate IV, figure C). The distance from one eye to the other at the level of the middle ocellus a trifle less than the length of the eye. The spread of

the ocelli measured from the outer rims of the lateral ones about twice the distance separating each lateral ocellus from the nearest eye. The eyes slightly convergent below. The malar space much reduced; at its narrowest part, near the inner angle of the mandible, the rim of the eye is separated from the mandible barely more than linearly. The outer half to two-thirds of the apical edge of the mandible curvilinear but edentate, the inner half to one-third with two well-developed teeth, of which the more median one is itself sometimes slightly bidentate. The face dull due to a dense, strong tessellation; on the vertex the sculpturing is of lighter impress, imparting to this region a semishininess. Cheeks also faintly shiny. The head very similar to that of *interrupta*, the eyes a little more in-slanting below, less parallel-sided. The labrum fulvous to reddish brown; the mandibles also fulvous to reddish brown, with the apex usually more deeply reddish, its edge rimmed with black, the basal prominences black or deep brown. The clypeus, according to Bennett, "with three black maculations: the two lateral ones elongate, the one of the apex rounded." (This is more or less the condition in a specimen from San Mateo, Costa Rica, designated by Friese *M. fulvipes* variety *obscuripes*.) More often continental specimens of *beecheii* have the maculations on the clypeus much reduced, the yellow confined to a median longitudinal line and to the apico-lateral angles; sometimes the maculations are even absent or all but absent. A supraclypeal triangle of pale yellow almost invariably present. The sides of the face with maculations that, usually broad below, taper to a point on the inner margin of the eye at about two-thirds to three-quarters of the distance to the summit of the eye. As a rule the brownish scape has a pale stripe in front (especially basally); the flagellum is reddish to light brown in front, of a deeper brown in back, except for the apical joint, which is in the greater number of cases wholly red, and, except sometimes also for the penultimate apical joint, which may be partly or wholly red. The hair on the face branched, and whitish rather than gray (sometimes of darker hue on the upper half of the face). The hair is down-slanting, relatively short, and semiappressed on the lower half of the face; and up-slanting, longer, and more erect on the upper half of the face. The hair on the vertex sometimes white, sometimes faintly yellow. On the cheeks there is appressed, pale pile and, in addition, there are longer, down-slanting, unbranched, whitish hairs. The hairs fringing the lower side of the mandibles are golden.

The hair on the mesonotum variable, sometimes with a faint yellow tinge, more often strongly yellow or rufescent. In each of the antero-lateral angles of the mesonotum there is a large, dense, rust-red patch. The hair on the pleura is white. The axillæ usually black, sometimes yellow. The scutellum usually black or reddish brown basally, but almost invariably yellow or yellowish red apically and on the posterior and lateral borders. The mesonotum covered with a distinct, if fine, tessellation over which are sown, with greater density basally than apically, numerous small shallow punctures. The sculpturing on the mesopleura similar but rather finer. The scutellum shallowly punctured above, shiny, posteriorly and on its lateral borders more coarse and granular. The propodeum with relatively strong, dense tessellation (ultra minute and fine at the center) and scantily covered with scattered, whitish hairs.

The coxæ, trochanters, femora, and tibiæ deep brown to black. Front and middle basitarsi intergrade between black and fulvous, frequently lighter apically than basally; hind basitarsi with a large, basal, black spot, otherwise largely or wholly fulvous. Other tarsal joints largely or wholly fulvous, claws on their apical half or two-thirds darker. Sometimes there are variable amounts of reddish to brownish

staining on the legs, grading into what Cockerell has designated *fulvipes* variety *a*. The hair on the legs is whitish except for the underside of the tarsi, where golden to copper-colored hairs replace the white. The hind tibiae (plate V, figure C) triangular in shape; their external surface convex basally and along its inner side, concave along its outer side on the apical half; the outer apical angle sharp with a small, toothlike formation (in some specimens rather more pronounced) due to an emargination of the apex below. The hind basitarsi rounded posteriorly.

The wings transparent but with a yellowish tinge that is a little stronger basally. The venation fulvous to ferruginous; tegulae often ferruginous, though sometimes dark.

The abdomen black on the dorsal side, more or less reddish brown basally on the ventral side, with the hind margins of the five anterior sternites whitish-flavescent. Each of the tergites has rimming its apex a narrow, uninterrupted, yellow band that is usually carried over to the sides of the venter. The bands on tergites 2-5 are as a rule slightly thicker at their center than at their sides. Tergite 6 usually without a band, though sometimes, by way of substitution, with a vague, reddish discoloration. The tergites rather delicately and uniformly tessellated, semishiny. The hairs on tergites 2-4 are short but dense and with a yellowish or rufescent to brownish tinge. On tergite 1 the hair is longer, more erect, and somewhat lighter in hue; on tergite 5 there are sometimes erect, black hairs (best seen in profile), on the apical tergite the hair is not only as a rule longer than on the tergites that precede it but occasionally intermixed with black at the anal tip. There are dense, flat-lying fringes of whitish hair on the apex of tergites 2-5. Sternite 1 relatively bare; all of the other sternites rather densely clothed with whitish hairs.

Length $8\frac{1}{2}$ -11 mm.; width of thorax $3\frac{1}{4}$ to $3\frac{1}{2}$ mm.; length of forewing, including tegulae, $7\frac{1}{2}$ to $8\frac{1}{2}$ mm.

♀ (Virgin).—The head (plate I, figure C) smaller than in the worker. The malar space more developed; its shortest length about half the width of the mandibles at their base. The antennae very long, the joints beyond 2 about two and one-fourth to two and three-fourths times as long as wide except for the slender apical joint, which is about three times as long as wide. The mandibles slightly sickle-shaped; their apex not nearly so broad as in the worker but with two teeth on the inner half much the same as in that cast. The sculpturing of the head and face much finer and less dense than in the worker or male. The labrum and the mandibles except for their apical rim and basal prominence, fulvous, but the maculations on the clypeus and the sides of the face more vague than in the worker, giving to the lower half of the face a more or less pale brownish-yellow aspect, as described by Guérin for the subspecies *fulvipes*. The upper half of the head (in the specimen from Mexico, identified by Friese as *fulvipes*, on which this description is based) castaneous.

Castaneous, too, is the thorax, except for the pronotum, the posterior rim of the scutellum, and the tegulae, which all incline to fulvous. The thorax is, as usual, narrower (about $2\frac{3}{4}$ mm.) than in the worker and its sculpturing is exceedingly dainty, with resulting shininess. The queen, if one may judge from the present specimen, lacks the rust-red hairs in the antero-lateral angles of the mesonotum, all of the hairs of the thorax like those of the head being whitish.

The legs are fulvous and lack (in the specimen at least on which this description is based) black markings. (Du Buysson, 1901, says the legs of the virgin queen are more reddish than those of the worker, and du Buysson's description, like the present

one, was based on Mexican specimens.) The hind tibiae (plate V, figure A) narrow, their surface convex to flat, without corbicula and without apical widening into a conspicuous angle, with at most a very feeble, obtuse angle that almost approaches a rounded condition (in contrast not only to the condition in the worker but also in the male). Their surface, like that of the other tibiae, is covered with light, silky hairs. The hind basitarsi are narrow, about half the width of the tibiae at their apex and parallel-sided to slightly tapering downward, not posteriorly rounded as in the worker and the male.

The wings exceedingly short, the forewing slightly less than 5 mm. in length in the specimen at hand (Poey's queens of *fulvipes* had a wing length of $5\frac{1}{2}$ mm.). The coloration of the wings according to du Buysson (1901), more reddish, but this is not the case in the specimen here considered.

The globular abdomen, described by Guérin for *fulvipes* as brown black, is, in the specimen on which the present description is based, castaneous except for the apical bands of the tergites. (But the lighter coloration in the present specimen may be due to the fact that it is a virgin queen, for du Buysson says: "The old queen is similar to the young, but her tegument is brownish, so that she appears almost entirely brownish-black.") The bands are of a faded yellow, their boundaries indistinct, with the result that the color contrast between the basal portion and the apical of each tergite is much less impressive than in the worker and in the male. The sculpturing on the abdomen less dense than in the worker and male. The hair on tergites 1-5 of rather uniform length and silky, that on tergite 1 being shorter than in the worker and semirecumbent (in the worker it is erect on this tergite); that on tergites 2-5 longer than in the worker and also semirecumbent. The hairs on tergite 6 are longer than those on the other tergites, but are like the latter wholly light yellowish in color. The hairs on the venter very similar to those on the dorsum. Both the abdominal hairs and those on the legs have a pale yellow tinge (reddish golden according to du Buysson) when compared with the more distinctly white hairs of the head and thorax.

The stature of the queen is small, given as 9 mm. by du Buysson (for the virgin), and only 8 mm. in the specimen (also a virgin) here considered. The length of the abdomen in the gravid queen is, according to du Buysson, 10 mm. as against 5 mm. in the virgin.

♂.—The face (plate II, figure C) much narrower than in the worker; the eyes larger and virtually parallel, only very slightly convergent below. The base of the mandible virtually contiguous to the lower rim of the eye. The clypeus somewhat longer than in the worker, its length only a little shorter than its greatest width. The mandibles slightly hourglass-shaped, with a supra-median, waistlike narrowing; the outer half of the apex faintly grooved near the outer edge but edentate, the inner half with two distinct, acute teeth. The facial maculations a little fuller than those of the worker, and at least in the specimens from Guadalajara, Mexico, on which this description is based, yellow replaces fulvous in the labrum and on the mandibles, the apical rim of which is red. (Du Buysson's male from the State of Jalisco also had the mandibles maculated with yellow.) In these males, too, the side-facial stripes terminate about halfway up the inner margin of the eye. The sculpturing of the head and the hair of the head as in the worker.

The males from Guadalajara have the thorax wholly black except for the posterior rim of the scutellum, thus according with Guérin's description of the worker of the subspecies *fulvipes*. The fore legs in these specimens are darker than is generally the

case in the insular *fulvipes*, but the hind legs are fulvous to reddish. The hind tibiae and hind basitarsi resemble much more closely the corresponding joints of the worker than they do those of the queen. Although the hind tibiae are a trifle narrower than those of the worker and have scattered hairs on their outer surface in addition to the fringing hairs, in shape they are very similar to those of the worker, with much the same modeling of their surface and with a sharp angle at apex. (Plate V, figure B.)

The genitalia of the male are figured on plate VIII, figures G-J.

Length about 9 mm.; width of thorax $3\frac{1}{2}$ mm.; length of forewing, including tegulae, $7\frac{1}{2}$ mm.

TYPE.—Two nests of *beecheii* were brought back by Captain Beechey. One of these was "forwarded to M. Huber, eminently distinguished for his highly interesting observations on the manners of bees"; the other was presented to the Linnæan Society. The Latin description of the species appears in the form of a footnote to an account of the nest, and no indication is given where the type was placed. Huber's "*Melipone domestique*," described in 1839, was based on material obtained from Tempico, but it is in my estimation probably the same insect as *beecheii* or a form intermediate between *beecheii* and its subspecies *fulvipes*. It is not indicated where the type material was placed.

It is probable that the type of Say's *ligata* is no longer in existence.

Melipona nigripes, which is here interpreted as a synonym of *beecheii*, was described by Friese in 1900 on the basis of workers from Guatemala, taken by Stoll. There is a specimen in the American Museum bearing a printed label "Guatemala, 1890, Stoll," with Friese's identification *M. fulvipes* variety *nigripes* (dated 1910). Undoubtedly the specimen is part of the original type material of *nigripes*, and the entry of 1910 is to be interpreted as a belated recognition of the relationship between *nigripes* and *fulvipes*,—not, I think, as the original designation of the insect.

Of what Friese described in 1916 as *M. fulvipes* variety *obscuripes*, but which is little more than a variety of his own *nigripes* and which in the nomenclature here adopted should assume the name *M. beecheii* subspecies *beecheii* variety *obscuripes*, there are in the American Museum two metatypes,—one from San José, Costa Rica, the other from San Mateo, Costa Rica.

DISCUSSION.—Almost universally the insect here discussed has passed under the name of *fulvipes*. In my estimation *fulvipes* should be restricted to the mainly insular form, differentiated from the continental *beecheii* especially by the fulvous color of its legs. There are, however, intergrading forms on the continent, one of which was designated by Cockerell *fulvipes* variety *a*. Say's *ligata*, doubtfully described as a

Trigona, was in all probability an intermediate form between *beecheii* and *fulvipes*, its "feet dull honey-yellow." If because of these intermediates, the stand be taken that *fulvipes* and the continental representatives form essentially one inextricably interlinked group, the only alternative is to make *fulvipes* a synonym of *beecheii*, which was described eight years before Guérin's insect. The previous neglect of *beecheii* is probably to be ascribed to the rarity of the work in which it was described, namely, 'Narrative of a Voyage to the Pacific and Beering's Strait, to co-operate with the Polar Expeditions: performed in His Majesty's Ship "Blossom," under the command of Captain F. W. Beechey, R.N., F.R.S., etc., in the years 1825, 26, 27, 28.' It is in the appendix to Vol. II, p. 363, of this work that the description of *beecheii* appears as a footnote to a section headed, "Some Account of the Habits of a Mexican Bee." Fortunately the description lists not only the color of the chitin and the hairs, but, what is more important, it refers to the structure of the mandibles. Of the *Melipona* north of Panama the structure of the left mandible as described applies only to what has hitherto been referred to as *fulvipes* or as a variety of *fulvipes*. To make it apply to any other meliponid one would have to seek among the various species of *Trigona*, but it is obvious from the description that an insect of *Melipona*-like appearance is involved. Because the description of *beecheii* has been generally ignored, it seems in order to reprint it herewith as well as the text comments that precede it.

. . . Mr. Latreille has gone further, by subdividing the American bees into two genera: *Melipona*, in which the mandibles are not toothed; and *Trigona*, in which these organs are dentate. Of the propriety of this subdivision, which hitherto seemed to be supported by the general appearance of the insects referred to each group, the examination of the bee whose nest has just been described has given rise to considerable doubts. In it one of the mandibles is toothed, and the other is nearly entire. Its technical characters, therefore, are intermediate between the two genera, with a leaning toward *Trigona*; but its general appearance is entirely that of a *Melipona*, approaching very closely to that of *Melipona favosa*, Latr., *Apis favosa*, Fab. That it cannot be that species, or any of the nearly related ones described by M. Latreille in the *Observations Zoologiques*, is evident from the dentation of its mandible, and it may, therefore, be regarded as new to science.

The Latin description then follows:

"MELIPONA BEECHEII.—Mel. nigrescens, margine postico segmentorum abdominis quinque anteriorum flavo: mandibulâ sinistrâ apice bi- vel tri-dentatâ.

DESCR.—Corpus totum nigrescens, praeter abdominis segmentorum margines.

Mandibula sinistra apice bi- vel tri-dentata, dextera submutica: ambae pallidè refescentibrunneæ, basi apiceque tantum brunneo-nigris.

Clypeus, albido-villosus, maculis tribus nigris: duæ laterales elongatæ, unica apicalis rotundata.

Antennæ articulo primo brunneo-fusco, pallidiori: reliquis saturatioribus.

Facies infernè albido-, supernè fusco-, villosa.

Thorax totus rufescenti-tomentosus.

Abdomen rufescenti-pubescent: segmentorum quinque anteriorum margines postici flavi.

Venter albido-villosus: segmentorum quinque anteriorum margines postici albido-flavescentes.

Pectus albido-tomentosum.

Femora tibiæque nigræ, albido-villosæ, tibiæ posticæ maculâ mediâ rufescenti-brunnæ.

Tarsi fulvi, anticè albido-, posticè et ad apices, rufo-villosi.

Alæ dilutè rufescentes, nervis rufescentibus."

A translation of this description is appended herewith:

MELIPONA BEECHEII.—A black *Melipona*, with the hind margin of the five anterior segments of the abdomen yellow: left mandible with the apex bi- or tri-dentate.

Descr.—Entire body black, except for the margins of the segments of the abdomen.

Left mandible with its apex bi- or tri-dentate, the right mandible submutic: both pallidly rufescent-brown, with the base and apex somewhat brownish black.

Clypeus with white hair and with three black maculations: the two lateral ones elongate, the apical one rounded.

Antennæ with the first joint brownish-fuscous, more pallid; the remaining joints of a richer color.

Face below with white hairs, above with fuscous.

Entire thorax with rufescent hair.

Abdomen with rufescent hairs: hind margins of the five anterior segments flavous.

Venter with white hairs: hind margins of the five anterior segments whitish-flavescent.

Pectus with white hairs.

Femora and tibiæ black, clad with white hairs, a median maculation of the hind tibiæ rufescent-brown.

Tarsi fulvous, the hairs in front whitish, those in back and at the apices reddish.

Wings faintly rufescent, venation rufescent.

Different as the largely black-legged *beecheii* is from the fulvous-legged insular type, it represents the culmination of a condition foreshadowed by what Cockerell called variety *a* of *fulvipes*, but which should now be termed variety *a* of *beecheii*. Specimens from Guadaluajara, Mexico, even present the condition wherein the fore legs and middle legs are dark brown but the hind legs are reddish, while a series from Yucatan presents even more puzzling intergrades and has been assigned to *fulvipes*. The series from Guatemala here assigned to *beecheii* has the hair on the mesonotum strongly yellow to rufescent.

The close relationship of the continental *beecheii* to the mainly insular *fulvipes* is furthermore indicated by the virgin queen of *beecheii*

whose fulvous legs accord with those of the worker of *fulvipes* rather than with those of her own workers. While the example above described may represent an extreme, du Buysson (1901), in discussing virgin queens from Zacoalco, State of Jalisco (Mexico), calls attention to the fact that their legs are more reddish than those of the worker. Due to the fact that the abdomen of the queen here described is not distended, I believe her to be a virgin queen. It is interesting to note that, although this queen has the spiracles of the first abdominal segment in a position corresponding to that in the queen of *flavipennis* (described elsewhere in this paper), there is no certain evidence of the pitlike hollows on tergite 1 that are such conspicuous structural characters in that insect. There is, it is true, a small depression on one side of the extreme base, not matched, however, by a corresponding depression at the other side, and attributable, therefore, possibly to an external injury. In describing the virgin queen du Buysson (1901) alludes to a large, black-brown spot on each side of the red segment 1, but mentions no structural peculiarity in connection with this segment.

Friese's *Melipona fulvipes* variety *obscuripes*¹ is, in my estimation, more correctly considered merely a variety of *beecheii*, from which it differs only in the lighter coloration (cream-colored to "nearly white") of the abdominal bands. The metatypes from San Mateo and San José have a black area merely at the base of the hind metatarsi, all of the rest of this joint being reddish brown (Friese's description reads: "tarsal joints 2-5 of the hind legs brown," with the implication that the basitarsus is black). The hair on the mesonotum is strongly yellow in one of the specimens, whitish in the other.

An insect rather harder to place is Cockerell's *Melipona solani*, based on a single individual taken at Quirigua, Guatemala. It was originally described as "black, with the general build and structure of *M. fulvipes*" and as "allied to *M. fulvipes*, but easily known by the lack of yellow bands on the abdomen and of yellow face-markings." The "mixed dark fuscous and ferruginous" hairs on the head and thorax above, the "partly black" hairs on the legs, and the black hairs on the dark abdomen are not shared by specimens of typical *beecheii* or of *fulvipes*, and the condition described is more suggestive of some of the subspecies of *fasciata*. Indeed its closer affiliation would seem to be with that group, for in his paper of 1919 Cockerell speaks of *solani* as "very closely related" to his *M. fasciata costaricensis* and as "the end of a series of forms deviating from *M. fasciata*." I have not seen the type.

¹Friese (1916) listed this insect as a *Melipona* and then fifty pages beyond described it as a *Trigona*. The generic place of *beecheii* and *fulvipes* has been a source of perplexity to other writers as well. The reader is referred in this connection to the Introduction.

Melipona beecheii is a close relative of *Melipona interrupta*. The differences in the male genitalia of the two species are indicated on plate VIII, figures C.-J. As for the external characters, the spine at the outer apical angle of the hind tibiae of the worker is less developed in *beecheii* and its subspecies *fulvipes* than is the case in *interrupta* and its subspecies, although some variability in this character may be noted in *beecheii*. Members of *interrupta* are of larger size and more corpulent, too, than *beecheii*. The very close relationship of the two in plastic characters is, however, emphasized by the fact that *triplaridis*, originally described as a variety of *fulvipes*, is here assigned to *interrupta*.

Almost equally close is the relationship between *beecheii* and *quinquefasciata*. In fact, superficially they bear a rather closer resemblance to each other than do *interrupta* and *beecheii*. In respect to their size and the color of the thoracic hairs the likeness is particularly close, while the color of the legs of *quinquefasciata* recalls the condition in *beecheii* subspecies *fulvipes*. Indeed so close are *beecheii* and *quinquefasciata* structurally that, although the more decidedly spinelike character of the apex of the hind tibiae in *quinquefasciata* might have been cited in differentiating them in the key to the species (see p. 265) greater reliance was placed on a much more superficial character, the width of the abdominal bands. It is interesting that two species superficially, and in most of their characters also fundamentally, so alike should have such a discontinuous distribution, severed as they are by the also very closely related but superficially rather more contrasted *interrupta* and its subspecies.

DISTRIBUTION.—Known from Mexico, Nicaragua, Guatemala, and Costa Rica (variety *obscuripes*).

In the collection under examination the following localities are represented:

MEXICO.—State of Jalisco: Guadalajara ♂♂ (Crawford), environment of Guadalajara, ♀♀, 1901 (M. Diguët); ♂, with merely the designation Mexico. Mazatlan (presumably this is the locality of that name in the State of Oaxaca, but possibly the place in Sinaloa).

NICARAGUA.—State of Managua: Managua (Baker).

GUATEMALA.—The Guatemala specimens in the American Museum were taken during March and April, 1923, at an elevation of 300 meters, in the environment presumably of Chiquimulilla, from which they were sent by the collector, Lichy René.

COSTA RICA.—Mt. Redondo, 1903; San José, 1903 (*obscuripes*); San Mateo, March and May, 1921 (*obscuripes*).

***Melipona beecheii* subspecies *fulvipes* (Guérin)**

Melipona fulvipes GUÉRIN, April, 1835, 'Iconogr. du Règne anim. de G. Cuvier,' II, Pl. LXXV, figs. 6, 6a-6l.

Melipona zonulata KLUG, cited by Spinola, 1840, *Annales des Sciences natur.* (2) XIII, pp. 123 (Cuban specimen), 130.

Melipona fulvipes GUÉRIN, 1844? *Iconogr. du Règne anim. de G. Cuvier*, III, Insects, pp. 462-463.

Trigona fulvipes (sic) FELIPE POEY, 1851, 'Memorias sobre la Hist. natur. de la Isla de Cuba,' I, pp. 122-176, 441-442, Pls. VI, XIV, and XXII, figs. 3-6.

Melipona fulvipes SMITH, 1854, *Catal. Hymen. British Mus.*, part 2, p. 406.

Trigona fulvipes ANDRÉ POEY, 1855, *Bull. de la Soc. d'Acclimat.*, II, pp. 334-336.

Melipona fulvipes LUCAS, 1856, in Sagra: 'Hist. fis., polit., natural de la Isla de Cuba,' VII, p. 781.

Melipona fulvipes LUCAS, 1857, in Sagra: 'Hist. phys., polit. et naturelle de l'Ile de Cuba,' VII, p. 781.

Melipona fulvipes SMITH, 1863, *Trans. Entom. Soc. London*, (3) I, p. 499, Pl. xx, figs. 1 and 1a (♀), fig. 1 b (♂).

Melipona fulvipes CRESSON, 1865, *Hymenop. of Cuba*, p. 195.

Melipona fulvipes FR. MÜLLER, 1875, *Zool. Garten*, XVI, pp. 291-297.

Trigona fulvipes, GIRARD, 1879, 'Traité élémentaire d'Entomol.', II, p. 711.

Melipona fulvipes FOX, 1891, *Trans. American Entom. Soc.*, XVIII, p. 348.

Melipona fulvipes DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, pp. 578-579.

Melipona fulvipes DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., p. 166 (Cuban specimens).

Melipona fulvipes COCKERELL, 1919, *Proc. U. S. Nat. Museum*, 1920, LV, p. 201. (Specimens from Belize, Izamal ?, Cuba, Jamaica.)

Melipona fulvipes LUTZ AND COCKERELL, 1920, *Bull. Amer. Mus. Nat. Hist.*, XLII, Art. 15, pp. 493, 494. (Belize specimens.)

Melipona fulvipes DUCKE, 1925, *Zool. Jahrb. System. Geogr. und Biol.*, XLIX, p. 443. (Cuban specimens.)

♂.—A smaller insect than typical *beecheii*, with usually more extensively maculated face and almost wholly fulvous instead of largely dark legs.

The clypeus (described by Guérin as having a small median line of yellow that is dilated slightly below) is in most specimens from Cuba and Jamaica wholly pale yellow except for two large, imbedded, subparallel, longitudinal spots of usually reddish brown. The side-facial maculations are as a rule also more strongly developed than in typical *beecheii*, the supraclypeal yellow more defined. Hair on vertex pale yellowish to whitish.

The integument of the pronotum almost invariably yellow clouded with red (in typical *beecheii* black). The scutellum more often reddish basally rather than black, rimmed with lighter yellow along its sides and posteriorly; the axillæ almost invariably yellowish or reddish. When the axillæ are yellow, there are not infrequently also narrow, abbreviated, yellow stripes connecting with them on the sides of the mesonotum. Hair on thorax above pale yellowish to whitish.

The legs wholly fulvous except for dark markings on some or all of the following parts: hind coxæ, apices of femora and of tibiæ, base of third basitarsi. In the case of the hind tibiæ the black area, when present, may occur on the underside as well as on the upper, with sometimes a basad streak of black extending narrowly along the under rim. The small, toothlike formation on the outer apical edge of the hind tibiæ rather less developed than in typical *beecheii*.

A distinct yellow band along the apex of tergite 6, similar to that on the other five tergites, almost invariably present. Tergite 5 usually without dark hairs.

Length $7\frac{3}{4}$ to 10 mm. (10 mm. is the size given by Guérin); width of thorax 3 to $3\frac{1}{4}$ mm.; length of forewing, including tegulae, $6\frac{3}{4}$ to $7\frac{1}{2}$ mm.

♀.—“The female has the abdomen elongate and the wings very short; the entire fore part of the head beneath the antennae is of a pale yellowish-brown, as well as the antennae and the mandibles. All the hairs of the head, of the thorax, and of the abdomen, are yellowish cinereous. The abdomen is of a blackish brown, the border of each segment is of a pale yellow blending with the color of the base, and the venter is entirely testaceous. The legs are of a paler, fulvous yellow. Length 11 mm.” [Translated from the original description of Guérin in the absence of a queen among the insular material of the present collections.]

♂.—Smaller and less robust than the corresponding sex of typical *beecheii*. The plastic characters like those of typical *beecheii*, and the maculations, too, practically identical, possibly a little fuller on the clypeus and sometimes with a slightly greater spread of yellow over the scutellum than is the case in the typical subspecies. Differentiated from the typical subspecies especially by the fact that all the legs are wholly or virtually wholly fulvous, with at most faintly developed, darker spots on some or all of the joints where such deepening of color is noted for the worker of *fulvipes*.

Length $7\frac{3}{4}$ to $9\frac{1}{4}$; width of thorax 3 mm.; length of forewing, including tegulae, about 7 mm. or slightly more.

TYPE.—Guérin's type of *fulvipes*, according to du Buysson, 1901, is in the Museum in Paris.

DISCUSSION.—Guérin described *fulvipes* from Cuba, but some of the elements of his description seem almost more applicable to the continental specimens (typical *beecheii*) than to the insular, although the word *fulvipes* itself emphasizes a coloration more characteristic of the Cuban and Jamaican insects than it is of the darker-legged mainland representatives (typical *beecheii*). Guérin's allusion to the hair on the face of the worker as ash gray (*gris cendré*) and that on the vertex and much of the thorax as yellowish is less applicable to most of the Cuban and Jamaican specimens here considered than is Poey's (1851) characterization of the hair as white and very whitish (*blancuzco*).

Poey has written voluminously about *fulvipes* (which he called *fulvipeda*), but notwithstanding his detailed presentation, accompanied by many figures, some of his statements are erroneous. Reading his account one carries away the impression that the “female offers no external differences” from the male, that all of the sexes have the same number of antennal joints, and other basic misinformation. His measurements for the female throughout accord with those for the male. The explanation of the error is, as Fritz Müller, 1875, has pointed out, that Poey mistook for males what were really virgin queens. Poey sub-

mitted a large series of specimens of *fulvipes* to Guérin and a smaller series to Spinola, and in both cases these authors designated as queens what Poey believed to be males. Du Buysson (1901) has given a dependable account (accompanied by drawings) of the differences between the worker, the male, and the queen (both virgin and gravid) in the case of *beecheii*, and his statement that the male is of the same size as the worker, "with which it is easily confused," is much nearer the truth than Poey's tabulation of identical measurements for the putative male and the queen. The males that furnish the basis for the description of that sex in the present paper average only a little smaller than a series of workers likewise from Cuba. According to Poey (1851) the live worker of *fulvipes* is 12 mm. in length and dead specimens are 11 mm. Specimens from Cuba here considered are in no case more than 10 mm., while a large series from Jamaica includes workers ranging down to $7\frac{3}{4}$ mm. in length. Du Buysson gives the variation in length of the worker of what is here interpreted as *beecheii* as 8.5 to 11 mm.

The close relationship of the mainly insular subspecies *fulvipes* to the continental subspecies *beecheii* is emphasized by a series of workers from Chichen Itza, Yucatan, for which I am indebted to Dr. J. Bequaert. Just as geographically the peninsula of Yucatan bridges to some extent the gap between Cuba and Central America, so these insects from Yucatan constitute a link between subspecies *fulvipes* of the islands and subspecies *beecheii* of the mainland. They are of about the size of *fulvipes*, averaging smaller than typical *beecheii*, and they share with *fulvipes* also the following characters: the more fully maculated face and the banded sixth tergite. Most of them have some yellow on the pronotum but the maculation is not so extensive as is usual in the insular subspecies. Several of the specimens would furthermore qualify as *fulvipes* through the fulvous color of their legs, but others in the same series have some of the joints of the fore and middle legs darkened and in these respects suggest Cockerell's *fulvipes* variety *a*, which in this paper has been linked with typical *beecheii*. Furthermore, some of the specimens have the scutellum black above with merely a rim of yellow, in other specimens this central and basal region is dark red, while in a third division the whole scutellum is a rather uniform yellow. Thus in respect to this character, too, attempted distinctions between the continental subspecies and the insular tend to break down. In general, however, these insects seem to me a little closer to subspecies *fulvipes* than to subspecies *beecheii*. While this is true of the workers, the single male from the same locality is so closely in accord with a series of that sex from Guadalajara

that, were it not for the accompanying workers, one would be more inclined to place it in typical *beecheii* than in the subspecies *fulvipes*.

Even more conclusively *fulvipes* are a series of workers in the U. S. National Museum that were collected August 22, 1896, at Belize, British Honduras, which in spite of their continental habitat belong indubitably to the mainly insular subspecies.

DISTRIBUTION.—The subspecies *fulvipes* as here defined is found on the islands of Cuba and Jamaica, and occurs also in British Honduras. Forms to be regarded as intergrades between the continental *beecheii* and the mainly insular *fulvipes* are to be found on the mainland and may possibly also occur on the islands.

In the collections under examination the following localities are represented:

CUBA.—Santiago, April 10, 1926 (Bromley); Havana (Baker); Cabanas, September 5-8, 1913 (F. E. Lutz); Zaza del Media, September 30, 1913 (F. E. Lutz); seven kilometers north of Vinales, September 16-22, 1913, ♂♂ and ♀ (F. E. Lutz); Guantamo.

JAMAICA.—Specimens loaned by Academy of Natural Sciences of Philadelphia. (Fox, 1891, reported "numerous specimens taken from a nest near Kingston.")

BRITISH HONDURAS.—Belize (National Museum specimens).

***Melipona quinquefasciata* Lepeletier**

INTRODUCTORY COMMENTS.—Although variability occurs in *quinquefasciata*, intergrading forms even within a single locality have made difficult the attempt to give subspecific valuations.

***Melipona quinquefasciata* Lepeletier**

Melipona quinquefasciata LEPELETIER, 1836, 'Hist. natur. des Insectes, Hyménop.,' I, p. 418.

Melipona Sant-Hilarii LEPELETIER, 1836, 'Hist. natur. des Insectes, Hyménop.,' I, p. 420.

Melipona angulata KLUG, cited by Spinola, 1840, Annales des Sciences natur., (2) XIII, p. 123.

?*Melipona liturata* KLUG, cited by Spinola, 1840, Annales des Sciences natur., zool., (2) XIII, p. 124.

?*Melipona liturata* KLUG, 1843, Bericht über Verh. Akad. Wissen., Berlin, p. 220.

Melipona quinquefasciata SMITH, 1854, 'Catal. Hymen. British Mus.,' part 2, p. 405.

Melipona Sant. Hilarii SMITH, 1854, 'Catal. Hymen. British Mus.,' part 2, p. 405.

Melipona quinquefasciata HOLMBERG, 1887, 'Viaje à Misiones,' p. 288.

Melipona quinquefasciata DALLA TORRE, 1896, 'Catal. Hymenopterorum,' X, p. 583.

Melipona santhilarii DALLA TORRE, 1896, 'Catal. Hymenopterorum,' X, p. 583.

Melipona quinquefasciata HOLMBERG, 1903, Anales del Museo Nacion de Buenos Aires, (3) II, p. 382.

Melipona paraguayaca STRAND, 1910, Zool. Jahrb. System. Geogr. und Biol., XXIX, pp. 555-556.

Melipona santhilarii (sic) BERTONI, 1911, Anales del Museo Nacion. de Buenos Aires, 1912, XXII [(3) XV], p. 140.

Melipona santhilari (sic) VON IHERING, 1912, Zeitschr. wissen. Insekten., VIII, p. 3.

Melipona santhilarii DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., pp. 163-165, Pl. VII, fig. 24 (hind tibia).

Melipona paraguayaca STRAND, cited by Cockerell, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 200.

Melipona quinquefasciata SCHROTTKY, cited by Cockerell, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 200.

Melipona santhilarii FRIESE, cited by Cockerell, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 200.

Melipona santhilarii SCHROTTKY, cited by Cockerell, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 200.

Melipona santhilari DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, pp. 441-442, Pl. IV, fig. 24 (hind tibia).

?*Melipona paraguayaca* BISCHOFF, 1927, 'Biologie der Hymenopteren,' p. 286. (See DISCUSSION under *quinquefasciata* in present paper.)

Melipona santhilari BISCHOFF, 1927, 'Biologie der Hymenopteren,' p. 287.

♀.—The head (plate III, figure D) considerably broader than long, about as wide as the thorax, and dull with a rather uniformly dense tessellation. The malar space short, only a little more than linear. The mandibles with the outer half of their apical edge smooth, though curved in outline; on the inner half a sharp, deep emargination that distinctly subdivides this half into two elements, of which the more centrally placed one is relatively broad and often faintly bidentate, the other slightly more acute. The facial maculations variable, sometimes vague with one or another of the stripes reduced or missing. As a rule there is a thin, yellow stripe down the middle of the clypeus extending from base to apex, but sometimes this stripe fails to attain one or both extremities, sometimes it is faint and interrupted, and sometimes even wholly absent. A thin line of yellow usually extends along the lower half of the inner orbit of each of the eyes, but this maculation also may be faint to absent. Usually there are clearly traceable, linear maculations in the lateral angles of the clypeus that extend slantingly to the apex and are sometimes continued thence more thinly along the straight apical edge. The supraclypeal area often more or less yellow. The labrum is ferruginous, the mandibles likewise ferruginous except for a narrow apical edging of black and the basal prominences. The scape usually with a more or less extensive yellow area at the base of the outer side, sometimes with yellow both at base and apex. The flagellum dark brown to black but usually with a ferruginous stripe or with ferruginous discolorations anteriorly, and with the two apical segments in many cases entirely red. The hair on the clypeus relatively short and gray, somewhat longer on the sides of the face and distinctly longer on the upper half of the face, where it sometimes grades from gray into ochraceous or brown as the ocelli are approached, to become reddish on the vertex (as described by Lepeletier, and by Strand for *paraguayaca*) or brownish (as described by Ducke, 1925) or in some instances even wholly black. The hair on the labrum and cheeks, and that fringing the mandibles below, light.

The integument of the pronotum as a rule testaceous to yellow; that of the scutellum also testaceous to deep yellowish with the hind rim usually of lighter yellow; the prothorax on the sides and below often with brownish stains. The sculpturing of the mesonotum and the mesopleura is similar to that of the face, consisting of a dense, strong, dull tessellation with numerous, small, shallow punctures superimposed and more dense anteriorly. The propodeum, too, is similarly sculptured and dull in character. The scutellum somewhat coarsely and cancellately tessellate-punctate, but it preserves a slight sheen in contrast to the dull mesonotum. The hair on the mesonotum dense, usually of a fulvous to reddish color (but sometimes gray) and with bright fox-red patches in the antero-lateral angles. The pleura with yellowish hair above that merges into gray below.

The legs largely testaceous, with usually a variable amount of black. When the dark markings are clearly developed, the condition is that described by Strand for *paraguayaca*: "Fore legs each with a dark spot or half-ring on the tip (of the tibiae), the middle legs in addition with a black longitudinal stripe on the outer side of the metatarsi (located on their posterior half); on the hind legs the apical third of the outer side of the tibiae is deep black, while on the inner side the black covers scarcely one-fifth of the length of the joint although it extends along the under rim as a narrow band almost to the base; the upper rim of the hind tibiae throughout its entire length narrowly reddish; the hind metatarsi on their outer side deep black with a narrow reddish rim (wider anteriorly than posteriorly)." In addition, dark markings frequently are present on the femora (particularly on the under side) and the coxae may be dark-spotted or wholly brownish or black. From this condition there are intergrades, even among specimens from a single locality, to an extreme distinguished by the total absence of dark markings on the legs. The hairs of the legs are pale except on the under side of the tarsi, where pale hairs are replaced by golden. The hind tibiae (plate V, figure H) are triangular in outline, with their outer apical angle produced spinelike.

The wings are transparent but lightly stained with yellow; in the median cell and the upper part of the marginal cell the yellow tinge is somewhat stronger. The venation yellowish to ferruginous; the tegulae ferruginous.

The abdomen moderately long. The first four tergites dull due to a dense but fine tessellation, the last two more lightly tessellated and semishiny. The first five tergites with well-developed, uninterrupted apical bands, that on tergite 1 relatively narrow but widened gradually toward the sides, that on tergite 2 somewhat wider, rather uniform throughout its extent without a gradual median narrowing, although sometimes with a small, abrupt, V-shaped emargination at its middle. The bands on tergites 3-5 broad (sometimes, when the segments are telescoped, appearing to occupy all of the tergite except a narrow basal band, but actually occupying only the apical two-thirds, as becomes evident when the abdomen is extended). The bands on tergites 3-5 are usually broadest at their middle, tapering off slightly to the sides, thus reversing the condition of tergite 1 (and sometimes also of tergite 2). The underside of the abdomen with the basal portion usually more or less extensively brownish yellow and with the apical half of its sternites usually stained brownish. Tergite 1 with erect tufts of whitish hair on each side and scattered, erect, light hairs over its surface. The succeeding tergites with semirecumbent, light hairs that are replaced on the last two tergites (sometimes on the last three) by more erect, longer, black hairs; these are especially abundant and long on tergite 6. The under side of the abdomen covered with silvery hairs, except on the apical tergite, the hairs of which are black.

Length 9 to 10½ mm.; width of thorax 3½ to 4 mm.; length of forewing, including tegulae, 7½ to 8 mm.

♀.—See DISCUSSION, p. 326.

♂.—The face (plate III, figure C) distinctly narrower than in the worker; the eyes much larger, subparallel-sided, only very slightly convergent below. The malar space negligible, the base of the mandible virtually in contact with lower rim of eye. The mandibles untoothed,¹ blackish on their basal half, ferruginous with darker edging on their apical half. The labrum variable: brown, ferruginous, or yellow. The facial maculations more developed than in the worker, the median line on the clypeus broadened, the slanting lines in the lower lateral angles of the clypeus extended sometimes along the apical rim to unite with the median shaft, which connects at its upper end with a line of yellow bordering the base of the clypeus. The supraclypeal mark broadly developed, occupying the space between the bases of the antennae. The lateral face-marks clavate below, tapering upward along the inner margin of the eye and terminating at varying distances above the base of the antennae. The scape with a yellow stripe in front running from base to apex; the flagellum with ferruginous predominating over black. The maculations, the sculpturing, and the hair of the thorax and abdomen as in the worker. The legs similar in color and markings to those of the worker, but the hind tibiae narrower (plate V, figure G), though with a well-developed, spinelike prolongation (more conspicuous than in the worker) at their apex, and with short, light hairs over their surface in addition to longer, fringing hairs.

The genitalia are depicted on plate VIII, figures K, L, M, N.

Length 9½ to 10½ mm.; width of thorax 3½ mm.; length of wing, including tegulae, 7½ to 8 mm.

TYPE.—There are in the Lepeletier collection in the Paris Museum four specimens bearing a type label and designated *quinquefasciata*. But the assignment is evidently untrustworthy, for neither the locality label nor the date correspond with the requirements of the description. Lepeletier indicated that the type material of *quinquefasciata* came from "Contrée des Missions" and a variety from "Capitainerie de Saint Paul"; the spurious type material, on the other hand, is from Cayenne and was collected by Leprieur in 1839,—three years after *quinquefasciata* was described by Lepeletier! Moreover, the insects do not accord with Lepeletier's description of *quinquefasciata*, for their legs are black, varied with deep chestnut-brown instead of largely testaceous.

In the Lepeletier collection in the Paris Museum there are, furthermore, specimens bearing a type label which are designated *santhilarii* (here considered a synonym of *quinquefasciata*). I believe these specimens to be correctly determined, but unfortunately as type material they have no more sanctity than the spurious types of *quinquefasciata*. The localities represented include "Nord Capitainerie de St. Paul,"

¹In the related species *interrupta*, as represented by the subspecies *salti*, the male is likewise at variance with the worker in having the inner half of the mandibles devoid of two distinct teeth. The male of *beecheii*, on the other hand, is in agreement with the worker in this respect.

"Sud de la Capitainerie de Goyaz," and "Ouest Capitainerie des Mines," whereas Lepeletier's type material of *santhilarii* came from Rio de Janeiro.

DISCUSSION.—As to the true character of *quinquefasciata* there has been considerable difference of opinion. Friese has identified as *quinquefasciata* the insect that Guérin described as *orbignyi*, and Silvestri (1902) in redescribing *quinquefasciata* seems also to have had before him Guérin's bee. Strand (1910) has pointed out that there is no justification for this interpretation of *quinquefasciata*, which is questioned also by Duce (1925). Certainly Lepeletier's description of *quinquefasciata* fits *orbignyi* very inadequately. Duce (1925) lists among the synonyms of *orbignyi* not only Friese's interpretation of *quinquefasciata* but also that of Bertoni. Probably this assignment in Bertoni's case as in Friese's is based on unpublished identifications. That Bertoni believed *santhilarii* to be distinct from *quinquefasciata* is certain, for in commenting on the former (1911) he mentions its "neighbor," *quinquefasciata*, and speaks of the biology of the one as differing from that of the other.

Very different from that of Bertoni is the conception of Schrottky, who has identified—partly as *quinquefasciata*, partly as *santhilarii*—specimens from Asuncion that according to Cockerell (1919) are probably all one species and that agree essentially with what Strand described from the same locality (as well as from other places in Paraguay) as *paraguayaca*. This is the insect identified by Friese as *santhilarii* and also recognized by Duce as such.

Inadequate as the description of *quinquefasciata* is, and perhaps difficult therefore to apply with finality, I think there are strong reasons for accepting the interpretation of Schrottky as the correct one. One of these reasons is that the description fits the insect he conceived of as *quinquefasciata* in a more satisfactory manner than it does any other species, and another is that the region from which *quinquefasciata* was described is very close to that from which Schrottky's specimens and those of Strand were obtained. Lepeletier's *quinquefasciata* came from the "contrée des Missions" in Brazil. Almost certainly this is the area in the western half of the present Brazilian state of Rio Grande do Sul which was occupied by the Jesuit missions. The state in northern Argentina that forms a rather narrow wedge between Paraguay and Rio Grande do Sul bears the name of Misiones in commemoration of the activities of this order in the same general region.

The conclusion that the form from western Rio Grande do Sul links up with that in Paraguay is strengthened by an examination of speci-

mens from the intermediate State of Misiones, which fortunately are available in the collection under examination. To these the excellent description of Strand applies for the most part admirably, but some of the differences that he thought might exist between *quinquefasciata* and his own *paraguayaca* (as, for instance, the length of the stripe on the clypeus) are bridged by variability among these Misiones specimens (all from one locality, Posadas, and with identical data).

The facial maculations are indeed exceedingly variable in *quinquefasciata*. Specimens even occur (Franca, State of São Paulo, and several from Bello Horizonte, State of Minas Geraes) in which the line on the clypeus is only barely traceable or entirely absent, while the stripe along the inner margin of the eyes is often so faint that it is easily overlooked. This may have been to some extent the condition in the specimen Lepeletier had before him, accounting for the omission by him of all mention of these maculations bordering the eyes, or again the omission may have been due to the inadequacy that characterizes the description in so many other respects,—witness the limitation, for instance, of his comments to the middle and hind legs, although the fore legs would seem to be equally entitled to mention. In the legs, too, be it said, the extent to which the prevailing testaceous color is invaded by black varies considerably even among specimens from a single locality, so that it does not seem wise to attempt too sharp a demarcation. Furthermore, it seems not improbable that Lepeletier described *quinquefasciata* from a callow specimen. Allusions to the head as brown, and to the thorax below also as brown, point to such a possibility.

It seems likely, then, that *quinquefasciata* is the same insect that Strand described with some diffidence as a new species, *paraguayaca*. What shall be said with reference to the possible identity of *quinquefasciata* and *santhilarii*? Although both of these insects are represented by alleged types in the Paris Museum, the localities do not accord with those in Lepeletier's descriptions. *M. santhilarii* was described from "Province de Rio Janeiro." Unfortunately there is no representation from this state among the specimens of *quinquefasciata* under examination. On the other hand, there is no good reason for believing that *quinquefasciata* does not extend there, as it is found in the adjoining states of São Paulo¹ and Minas Geraes, and such differences as can be traced between the descriptions of *quinquefasciata* and *santhilarii* can be reconciled, I think, by applying the reasoning followed in the previous

¹Lepeletier designated a variety of *quinquefasciata* from São Paulo as *Paulo major* but he gives no other data to distinguish it from *quinquefasciata* proper than its slightly greater size (*un peu plus grande*). This seems a negligible basis for considering the insect distinct.

paragraph. The description of the antennæ as given in *quinquefasciata* ("brownish black; their anterior part testaceous, as well as the tip") represents the more usual condition in this species. On the other hand, the description of the abdominal bands as given in *santhilarii* applies unmistakably to the insect here recognized as *quinquefasciata*, and these bands are the most characteristic maculations of that insect. Both *quinquefasciata* and *santhilarii* are described as having red hair on the head. Strictly speaking, it is only the conspicuous, longish hairs on the top of the head that are usually of this color, those on the face itself being of lighter hue. The hair on the head like the facial maculations is in the last analysis very variable. In the case of specimens from Minas Geraes at least, there is frequently a strong tendency toward brown or black among the hairs on the vertex; in several instances the hair in this region is exclusively black. However, among specimens crowned with reddish hair from a given locality (Posadas, State of Misiones, for instance) dark-crowned exceptions occur, and it is almost impossible to establish fixed varietal limits where such instability manifests itself.

It is open to question whether the insect referred to by Klug (1843) as *liturata* should be placed here or in *interrupta*. Klug refers to it as a "Mandury bee" and according to Ducke (1925) that is the popular name applied to both *santhilarii* and *interrupta*. Smith, on the other hand, described a *mondury*, which allies itself with *rufiventris*, and he gives as the popular name of this insect Mondury.

M. quinquefasciata is very closely related to *M. interrupta* Latreille as well as to *M. beecheii* Bennett. The reader is referred to the DISCUSSION under *M. beecheii* (p. 316).

In his interesting volume, 'Biologie der Hymenopteren,' H. Bischoff (1927) reproduces on p. 286, a photograph of a queen and worker designated *Melipona paraguayaca* Strand, which in the present paper is made a synonym of *quinquefasciata*. I find it difficult on the basis at least of the worker that is figured to associate these photographs with *quinquefasciata*. They seem more suggestive of *quadrifasciata*. However, excellent as these photographs seem to be, they cannot reveal the insect in its details, and it is possible that the character of the abdominal maculations is concealed, due to the fact that the worker is emitting wax. At any rate, I think it preferable in interpreting *paraguayaca* to abide by the description given by Strand, the more so as the inclusion of the queen in the photograph of Bischoff raises the doubt whether the insects figured belong to the original type material, in which no mention is made of a queen.

- 4.—The maculations specklike to absent on tergite 1, reduced to lateral stripes with a very wide median gap on tergite 2; a medianly interrupted band that is emarginate on each side above on tergites 3 and 4, and a short, medianly interrupted stripe on tergite 5. *lunulata* (p. 343).
 The maculations more developed. On tergite 1 there is a stripe at each lateral extremity; on tergite 2 a broad band with usually a very brief median interruption. The bands on tergites 3–5 broad and usually uninterrupted. As a rule, fine upcurved dark lines imbedded laterally in the yellow bands on tergites 2–4. 5.
- 5.—The hair on the thorax entirely dark brownish-black to black. The short hairs on the abdominal tergites black, as are also the longer hairs on the apical margins of the abdomen viewed from above. *baeri* (p. 341).
 The mesonotum with exclusively fox-red hairs. 6.
- 6.—Hair on the vertex fox-red. The apical margins of the abdomen, viewed from above, with exclusively light hairs. *phenax* (p. 339).
 Hair on the vertex black or predominantly black. The apical margins of the abdomen, viewed from above, usually without admixture of light hairs, prevailing or wholly black. *orbigny* (p. 336).

KEY TO THE MALES OF THE SUBSPECIES OF *favosa*¹

- 1.—The legs prevailing dark, black to deep reddish-brown. 2.
 Legs mostly bright fulvous or ferruginous with almost no black. *variegatipes* (p. 346).
- 2.—Hair on the vertex fox-red, rarely with a few black hairs intermixed. The hairs on the apical margins of the abdomen, viewed from above, mainly or wholly light. *phenax* (p. 339).
 Hair on the vertex dark. The hairs on the apical margins of the abdomen, viewed from above, black. 3.
- 3.—Hair on mesonotum and mesopleura, fox-red or tawny. *orbigny* (p. 336).
 Hair on mesonotum and mesopleura dark brownish black to black. *baeri* (p. 341).

Melipona favosa subspecies *favosa* (Fabricius)

- Apis favosa* FABRICIUS, 1798, 'Suppl. Entom. syst.,' p. 275.
Apis favosa LATREILLE, 1802, 'Hist. natur. des Insectes,' III, p. 386.
Apis favosa LATREILLE, 1802, 'Hist. natur. des Fourmis,' p. 438.
Apis favosa LATREILLE, 1804, *Annales du Muséum nat. d'Hist. nat.*, IV, p. 393, Pl. LXIX, figs. 6, 8.
Apis favosa FABRICIUS, 1804, 'Syst. Piezatorum,' p. 371.
Apis favosa COQUEBERT, 1804, 'Illustr. Iconograph. Insect.,' III, p. 96, Pl. XXII, fig. 3.
Apis favosa LATREILLE, 1804, *Ann. Mus. d'Hist. nat.*, V, p. 174, Pl. XIII, fig. 12.
Apis favosa LATREILLE, 1805, 'Hist. nat. des Crust. et des Insectes,' XIV, p. 67.
Melipona favosa ILLIGER, 1806, *Magazin für Insektenkunde*, V, p. 157.
Melipona favosa ILLIGER, 1807, *Magazin für Insektenkunde*, VI, p. 199.
Trigona favosa JURINE, 1807, 'Nouv. Méth. class. Hymén.,' I, p. 246.
Melipona favosa KLUG, 1807, *Magazin für Insektenkunde*, VI, p. 226.
Melipona favosa KLUG, 1808, *Magazin Ges. naturf. Fr. Berlin*, II, p. 58.
Melipona favosa LATREILLE, 1809, 'Gen. Crust. et Insect.,' IV, p. 182.

¹So far as known.

Melipona favosa LATREILLE, 1811, 'Recueil d'Observ. de Zool. et d'Anat. comparée faites par Humboldt et Bonpland,' I, p. 289, Pl. xx, fig. 1.

Melipona favosa LAMARCK, 1817, 'Hist. nat. des Anim. sans Vert.,' IV, p. 52.

Trigona (Melipona) favosa LEPELETIER, 1825, 'Encyclop. methodique, Insect.,' X, p. 710.

Melipona favosa LAMARCK, 1835, 'Hist. nat. des Anim. sans Vert.,' IV, p. 272.

Melipona favosa LEPELETIER, 1836, 'Hist. nat. des Insectes, Hyménop.,' I, p. 419.

Melipona mutata LEPELETIER, 1836, 'Hist. nat. des Insectes, Hyménop.,' I, p. 419.

Melipona favosa SPINOLA, 1840, *Annales des Sciences natur.*, (2) XIII, p. 124.

Melipona favosa SMITH, 1854, 'Catal. Hymen. British Mus.,' part 2, p. 403.

Melipona mutata SMITH, 1854, 'Catal. Hymen. British. Mus.,' part 2, p. 404.

Melipona favosa DALLA TORRE, 1896, 'Catal. Hymenopterorum,' p. 578.

Melipona favosa COCKERELL, 1919, *Proc. U. S. Nat. Museum*, 1920, LV, p. 195.

Melipona schausi COCKERELL, 1919, *Proc. U. S. Nat. Museum*, 1920, LV, p. 195.

(Variety.)

Melipona schausi convolvuli COCKERELL, 1919, *Proc. U. S. Nat. Museum*, 1920, LV, p. 199. (Variety.)

Melipona favosa COCKERELL, 1922, *Proc. U. S. Nat. Museum*, LX, Art. 18, p. 10.

Melipona favosa variety *favosa* SCHWARZ, in *Salt*, 1929, *Trans. Entomol. Soc. London*, LXXVII, pp. 437-438. (Biology.)

♂.—The face (plate III, figure E) very broad. The distance between the eyes at their summit considerably greater than the length of the eye. The eyes rather strongly converging below. The malar space short but distinct, about one-third as long as the mandibles are broad at the base. The face dull due to a dense, on the whole uniform, tessellation; shallow punctures, usually quite conspicuous, sparsely sown over the clypeus. The malar spaces shiny; shiny patches in front of the ocelli and to the side of the lateral ocelli, but the vertex immediately in back of the ocelli elevated and rather coarsely sculptured, the ocelli themselves being at a higher elevation than the region between them and the top of the eye. The maculations of the face especially distinguish the typical subspecies of *favosa*. The clypeus is entirely yellow except for two subparallel, longitudinal stripes that fail to reach the base and usually fail also to attain the apex of the clypeus. Sides of face sometimes possibly immaculate (there is no mention of side-facial maculations in the original description of Fabricius, 1798, and Coquebert, 1804, in his figure, fails to represent them). Usually, however, there are yellow or at least obscure testaceous maculations filling the space between the clypeus and the inner margin of the eye. These maculations are subtriangular, with their tip slightly above the base of the antennæ and "more or less notched opposite the antennal sockets," as described by Cockerell for *schausi*. There is a supraclypeal triangle, and a minute, yellow spot, too, on the malar space. The labrum and mandibles, except for the black apical edge and basal prominences of the latter, are reddish to reddish yellow. The scape black with usually a red spot at the base; the flagellum black above, ferruginous below, except for the apical joint, which is usually ferruginous both above and below. Lower half of face glabrous. Front covered densely with plumose, up-slanting, whitish hair (sometimes a little inclined to yellow, Trinidad specimens); "top of head with hair partly black and partly red" (Cockerell's *schausi* and specimens from Trinidad) or wholly fox-red hairs on

the vertex, followed by white hairs on the occiput (specimens from Colombia); the hairs are especially abundant and long on the raised area in back of the ocelli. Cheeks with erect to down-slanting, pale hairs, labrum with pale hairs, mandibles fringed below with pale hairs.

The thorax above covered with long, fox-red hairs that are more dense on the basal third of the mesonotum and on the scutellum than in the intervening region of the mesonotum. The pleura also densely covered with fox-red hairs that grade into white as the underside of the thorax is approached. Propodeum scantily clad with hairs of grayish to ochraceous hue. The mesonotum with a fine, microscopic tessellation that is stronger on the basal third than toward the middle and apically, where the surface becomes faintly shiny; a few shallow punctures, rather indistinct, are traceable, superimposed on the tessellation. The scutellum finely punctate, sometimes slightly granular along the sides. The punctuation on the rather shiny mesopleura, in so far as it is traceable under the heavy thatch of hair, is rather dense above, more sparse but in chainlike groupings below. The tessellation on the propodeum dense. The entire thorax without maculations except for a minute yellow spot on each of the axillæ in the variety *schausi*.

The coxæ, trochanters, femora, tibiæ, front and middle basitarsi black, with more or less reddish-brown staining, especially on the hind tibiæ; the hind basitarsi black except for a narrow rim of ferruginous; the other tarsal joints ferruginous except in specimens from Colombia, which have largely dark brown to black tarsal joints. The hair on the coxæ, trochanters, and femora white, on the other joints variable, with often a preponderance of black (see the DISCUSSION). The hind tibiæ (plate VI, figure H) triangular in outline, their surface convex basally, flat to concave apically, the outer apical angle slightly prolonged into a subspine-like termination.

The wings almost hyaline with yellow staining, especially at their base. The veins toward the upper margin and at the base of the forewing of a reddish-orange stain, those in the lower part of the wing and toward the apex more yellow. The tegulæ orange-red.

The abdomen subglobose, rather compact, with yellow bands on the first five tergites, that on tergite 1 with a very broad, median interruption that reduces it to a line on each side, that on tergite 2 also interrupted medianly but not so broadly [sometimes even entire, *Melipona favosa* subspecies *favosa* variety *convolvuli* (Cockerell)]. Those on tergites 3-5 as a rule only subinterrupted or not at all, but occasionally quite distinctly so (see the DISCUSSION). The bands on tergites 2-4 usually with an upcurved, dark line on each side. Sculpturing on tergites exceedingly fine, consisting of microscopic tessellation, often more or less vague or obliterated, with resulting shininess, especially on the two apical tergites. In addition, the tergites have some indistinct, scattered punctuation. Long, rather erect, pale hairs on each side of the basal concavity. The other hairs on the basal segments pale (as a rule) and inconspicuous, so that the abdomen, viewed from above, seems somewhat glabrous; toward the apex the hairs are longer, especially on the apical margins of the abdomen, and variable in color (see DISCUSSION). The hairs on the venter are silvery gray.

Length 7 mm. to 8 mm.; width of thorax 3 to $3\frac{1}{2}$ mm.; length of forewing, including tegulæ, 6 mm. to 7 mm.

♀ (Gravid).—Head much smaller and narrower than in the worker. The eyes narrow and short, about two and a half times the length of the malar space and about

five-eighths as long as the distance separating the eyes measured at their summits. The malar space unexpectedly long compared with that of the worker, longer than the mandible is wide at the base. The clypeus with the tessellation considerably finer than is the case in the worker or male, approaching a subpolished condition, but with the sparse, scattered punctation (as distinguished from the tessellation) well defined and strong. The clypeus and the adjacent regions of the sides of the face hairless, relatively shiny. The clypeus pale yellow except for two brownish-yellow, subparallel, longitudinal bars. The labrum and supraclypeal area of the same pale yellow, likewise the sockets of the antennæ. The sides of the face at the level of the supraclypeal area also of the same pale yellow; the sides of the face on each side of the clypeus of a brownish yellow corresponding with that of the two longitudinal stripes on the clypeus itself. The mandibles dark brown, verging on black, about twice as wide at the base as at the apex. The hair on the front fairly dense but not so long as on the vertex. The antennæ long and slender.

The sculpturing of the mesonotum similar to that of the worker, although there is a slightly greater tendency for the tessellation to disintegrate and to be replaced by punctures.

The hind tibiæ narrower than those of the worker, elongate oval in shape, rounded posteriorly at the apex, not angulate, and covered with hair. The hind basitarsi subparallel-sided, rather down-tapering. The legs dark except for the tarsal joints, which incline slightly to reddish.

The wings, as Salt (1929) has pointed out, "ridiculously small" compared with the swollen abdomen.

The tergites lack the bright maculations characteristic of the worker and male, being prevailingly reddish brown. Tergite 2 pale yellow along its extreme base (exposed like that of the subsequent tergites of the specimen here described due to the great distention of the abdomen). The tergites following tergite 2 with a smooth, pale, somewhat depressed, hairless area on each side of the extreme base, and in the case of tergite 3, at least, with a narrow, smooth, pale, hairless transverse band as well about one-third of the distance from the base. The first two tergites virtually hairless (tergite 2 has hairs on each side), the other tergites with a rather dense covering of hair except on the smooth, pale areas above-mentioned, the hairs being short at the base and longer at the apex of each tergite.

The hair of rather lusterless character on all parts of the body, dull stramineous or gray to faintly brown, a little darker on the legs but without the contrasts that occur in the worker. (Possibly immersion in alcohol has somewhat affected the color.)

Length $12\frac{1}{2}$ mm. (of which the abdomen occupies $8\frac{3}{4}$ mm.); width of thorax about 3 mm.; length of forewing, including tegulæ, $5\frac{3}{4}$ mm.

(The above description of the queen is based on a specimen from Sevillana, Colombia, taken by Salt, June 12, 1927 and numbered N 344. Latreille, 1804, had what he interpreted as a female of *favosa* but he gave no description of it.)

♂.—See DISCUSSION.

TYPE.—The specimen at Oxford labeled *Apis favosa* may be the type (see DISCUSSION). The type material of *schausi* (No. 21662) and of *schausi convolvuli* is in the National Museum in Washington.

DISCUSSION.—Friese has interpreted as *favosa* what is generally regarded as *marginata*, and Ducke (1916, 1925) has placed Friese's

favosa under the synonymy of *marginata*, thus: "*Melipona favosa* Friese i.l. (an Fab.?)." In the Natural History Museum in Paris what is *Melipona interrupta* has been designated *favosa*. I feel convinced, however, that the insect above described is identical with or exceedingly close to *favosa*. The description of Fabricius is brief and rather inadequate. He says: "Labium [Fabricius regularly uses labium in the now antiquated sense of clypeus] yellow with two dark lines. Antennæ ferruginous with the first joint longer, black. Thorax with ferruginous hair. Abdomen subglobose, black, with yellow margins to the segments. Legs blackish." There is not any part of this description that does not apply to the insect here presented as the claimant. The yellow clypeus with two dark lines is a combination very rare among workers of *Melipona* in the limited sense.¹ The rule is a black clypeus with more or less extended yellow maculations, or no maculations at all. Hence Fabricius' description of the clypeus assumes in this case almost diagnostic value. Fabricius' insect was from French Guiana. The specimens figuring in the redescription here offered are from northern South America,—French Guiana, Colombia, Venezuela, and Trinidad Island.

In the University Museum at Oxford, there is a badly mutilated specimen (without abdomen, head glued on, much of pile missing from thorax, etc.) that nevertheless accords, in so far as its characters have survived, with the insect here discussed. The label that this defective specimen bears reads "*Apis favosa ouvrière*" (*favosa* was originally described by Fabricius as an *Apis*). I believe there is strong likelihood that this is the very specimen to which Smith (1854) refers as "type sp. in Coll. West." Smith's comment follows a bibliographical reference to Latreille, and it is of special interest, therefore, to note that the handwriting on the label of the specimen at Oxford, where the Westwood collection was deposited, is that of Latreille.² Smith's abbreviation "West." refers, I think, almost certainly to Westwood.³

Latreille's comments (1811) on a specimen of *favosa* brought from French Guiana by M. Richard further sustain the interpretation here offered, as does the redescription of Lepeletier (1836) based on a specimen or specimens from French Guiana in the Musée de M. le Général Dejean (including probably the specimen now at Oxford).

¹It is shared by *Melipona becheii* subspecies *fulvipes* Guérin of the West Indies.

²Latreille regularly spells out the word "ouvrière" instead of using the symbol. His penmanship is easy to recognize, and the clew to it is the wording, "écriture de Latreille," noted on one of the specimens in the collection at Oxford.

³Through the kindness of Professor Poulton my attention was called to a note in the handwriting of Westwood which gives the history of the Latreille specimens at Oxford: "Latreille's collection of bees purchased by Dejean (renamed in part by St. Fargeau) passed into the hands of Serville after whose death I obtained it in its present state, I. O. W."

The colored figure (plate XXII, figure 3) published by Coquebert (1804) also supports in the main the present viewpoint, although in one respect there is lack of accord,—the sides of the face are depicted by Coquebert as black. Fabricius does not mention the sides of the face, and it may be, therefore, that Coquebert properly interprets Fabricius' conception. In the specimen at Oxford, which I believe to be the very one that Smith referred to as the type, the face on each side of the clypeus is, as Cockerell (1922) has pointed out, "obscure testaceous."

I think it reasonable to conclude, too, that *Melipona mutata* Lepeletier, likewise described from French Guiana, is no other than the insect here considered. In fact, Lepeletier himself questioned whether *mutata* is not *favosa*. Again I lay emphasis on the reference in the description to two brownish spots ("maculis duabus piceis") on an otherwise light clypeus ("ore pallide rufo"). When speaking of the clypeus in other species—*quinquefasciata* and *santhilarii*, for instance—Lepeletier mentioned the median "perpendicular line" on the clypeus, and the probability seems to me great that, had this been the condition in *mutata* also, he would not have shifted his form of expression so radically in describing it. These three descriptions—*quinquefasciata*, *mutata*, and *santhilarii*—it may be recalled appear on successive pages of Lepeletier's account (1836) of the Meliponidæ. Lepeletier spoke of lines near the eyes of *mutata*—a condition perhaps intermediate between that depicted by Coquebert for *favosa* on the one hand and that described by Latreille and Lepeletier for *favosa* on the other. In the Paris Museum of Natural History there is a specimen marked "type of *mutata*," that has a label reading, "Brazil—A. St. Hilaire 1815." It is one of the subspecies of *fasciata* but obviously is not the specimen on which Lepeletier's description of *mutata* was based, which, as stated, came from French Guiana.¹

Melipona schausi Cockerell is so close to *favosa* as here conceived that a separation of the one from the other is difficult. I can find only one or two characters in the specimens before me to which the description of *schausi* would not apply. The axillæ of *schausi* have a "conspicuous small yellow spot." This the specimens under examination lack. The mandibles of *schausi* are "not denticulate." In the specimens here considered there is a minute denticle at the middle of the apical edge of the mandible. However, the absence of such a denticle in *schausi* is easily accounted for by wear, and indeed wherever there is a large series available among the subspecies of *favosa*, specimens may be found in which the little tooth has been worn away, that being, in fact, the more

¹Lepeletier mentions as the depository of *mutata*: "Musée de M. Serville."

usual condition. *M. schausi* is from French Guiana, from which *favosa* was described.

Slight changes, hard to separate even into distinct varieties, apparently occur in *favosa* subspecies *favosa* throughout its range in northern South America. Thus Cockerell's *convolvuli* from Bolivar, Venezuela, has "the same face-marks, etc., but abdominal bands considerably broader, and that on the second segment not interrupted." In one of the Trinidad specimens loaned by the Academy of Natural Sciences of Philadelphia this condition is approximated but not in the other. In two Trinidad specimens in the U. S. National Museum (H. M. Rohwer, May 20, 1925) the band on tergite 2 is not only interrupted medianly but is more or less fragmentary. Moreover, Latreille (1811) noted variability in the extent of the bands even among French Guiana specimens: "The posterior border of the first five segments of the abdomen is occupied by a yellow or by a reddish yellow band; the first is sometimes interrupted, and the third and fourth are larger." The word "sometimes" indicates a condition of instability even within a single region. Of two specimens from Mamatoco, Colombia, one, taken at a level of 500 feet, has the band on tergite 2 only very slightly interrupted, while the other, taken in the same locality and on the same day but without specification of the level, has not only the bands on tergites 1-2 widely interrupted but a distinct separation medianly of the bands also on tergites 3-5. This is also the condition in the only specimen from Rio Frio, Colombia, and the only specimen from Cienaga, Colombia.

Another point of variability is the coloration of the legs. Fabricius makes no allusion to the legs in his brief description, but Latreille (1811) is somewhat more explicit: "The tibiae behind, in whole or in part, and the last joints of the tarsi are a clearer brown or a trifle reddish." Specimens before me from Venezuela have the lower tarsal joints mostly ferruginous, but in all of the specimens from Colombia there is a preponderance of blackish coloration on these joints, only the apical half of the apical joint giving clear evidences of a ferruginous coloration.

Still more variable is the coloration of the hair of the legs, characterized—so far as the material available would indicate—by an increase of darker coloration in the specimens of the western part of the range of typical *favosa*. Thus Latreille (1811) compares the hair of the legs in his French Guiana specimens to that on the under side of the abdomen, alluding to its coloration as "somewhat reddish gray." The hair on the legs of Cockerell's *schausi* is "mainly white, red on inner side of tarsi." Both the Venezuela specimens and those from Colombia here reported

upon have white hairs on the coxæ, trochanters, and femora. The other joints of the Venezuela specimens show a struggle for ascendancy between light and dark, there being mostly black hairs intermixed with a few gray hairs on the front and middle tibiæ and basitarsi, and a rather sharper division into a light fringe anteriorly and a dark fringe posteriorly on the third tibiæ. Such an intermediate form with respect to the color of the hairs on the third tibiæ is Cockerell's variety *convolvuli* from Venezuela. In the Colombia specimens the anterior fringe of the hind tibiæ as well as the posterior is composed largely of dark hairs, and this is true, too, of a single specimen from Valera, Venezuela, in the U. S. National Museum and of the two specimens from Trinidad in that museum.

Finally the color of the abdominal hairs is variable. In the Venezuela specimens the apical margins of the abdomen, viewed from above, usually show both dark and light hairs in variable proportions (not so *convolvuli*, however). On the other hand, the Colombian specimens have only light hairs on the apical margins, although this condition is shared also by Cockerell's *schausi* from French Guiana. In the color of the hairs on the head, thorax, legs, and abdomen—but not in their facial maculations—the Colombian specimens thus resemble the condition of the subspecies *phenax* from near-by Panama.

Specimens from Colombia average larger than those from Venezuela in the collections under examination and are a little more robust, too, than the type of *schausi*.

The difficulty of giving even varietal recognition to these slight differences in the workers when there is sometimes lack of uniformity even among the specimens from a single region is obvious, but the difficulty is even more strikingly illustrated in the case of the males. There are before me two U. S. National Museum specimens from San Pablo de Mendoza, Trujillo, Venezuela, both collected by Pittier on, respectively, November 17 and November 19, 1922. Both have the clypeus and the sides of the face maculated like those of the typical subspecies of *favosa*, and this distinctive ornamentation and the further fact that the specimens come from a state where that subspecies is known to occur would prompt one to place them in *favosa* subspecies *favosa*. But the abdominal maculations of the one—showing a restriction in the development of the bands even more excessive than in the subspecies *lunulata*—and the brownish-black hairs on the mesonotum, mesopleura, and scutellum of the other—according with what has been indicated for the subspecies *baeri*—leave one bewildered. Had they been secured in widely separated

regions, there would have been little hesitation in assigning each to a separate subspecies; but, coming as they do from the same locality, it is not beyond the bounds of possibility that they may be inmates of the same nest. Without any accompanying workers, it is hazardous to try to interpret them, but notwithstanding their sharply aberrant character, they are probably closer to the subspecies *favosa* than to any other subspecies. The specimen with the dark hairs has a cuneiform maculation on each side of tergite 1. These maculations are extended inward so far that they nearly unite. This specimen differentiates itself further by having maculations not only on the tergites but distinct bands, medianly interrupted, on several of the sternites as well.

DISTRIBUTION.—In northern South America, in the countries bordering the Caribbean. There are in the material under examination specimens from St. Parime, Venezuela (identified by Frieese as *Melipona orbignyi*), and from Trinidad, Venezuela (collection of Academy of Natural Sciences of Philadelphia and F. Andrews, June 13, 1925). The Colombian specimens are from Savillano, Magdalena, June 12, 1927; Cienaga, Magdalena, February 6, 1927; Rio Frio, Magdalena, December 12, 1926; Mamatoco, Santa Marta, February 18, 1927. All of the Colombian specimens were taken by Dr. George Salt. In the Paris Museum there is a specimen from Colombia collected by Parzudacki in 1842, and in the same institution is a specimen from as far south as Chiquitos, Bolivia (the country from which the subspecies *orbignyi* was described). The fact that there are in the Paris Museum collection also specimens of *orbignyi* from Chiquitos makes one wonder whether the unique example of typical *favosa* bearing that locality designation is not attributable to a confusion in labeling, although aberrant specimens may occur among the examples of a single locality, as is indicated in the discussion above of the two males from San Pablo de Mendoza.

***Melipona favosa* subspecies *orbignyi* (Guérin)**

Trigona fasciata GUÉRIN (nec Latreille), April, 1835, 'Iconogr. du Règne animal de G. Cuvier,' II, Pl. LXXV, fig. 7.

Trigona orbignyi GUÉRIN, 1844?, 'Iconogr. du Règne animal de G. Cuvier,' III, Insectes, pp. 463-464.

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

Melipona quinquefasciata SILVESTRI (nec Lepeletier), 1902, Riv. Patol. veg., X, pp. 123-124, Pl. I, fig. 5 (hind tibiae), Pl. III, fig. 38 (nest entrance).

Melipona quinquefasciata FRIESE (nec Lepeletier). Several specimens determined by Frieese in the collection of the American Museum.

Melipona quinquefasciata STRAND (nec Lepeletier), 1909, Deutsche entom. Zeitschr., Berlin, 1909, p. 235. (Strand, 1910, alludes to prior erroneous interpretation

on his part of *quinquefasciata*; presumably the reference is to the paper of 1909. based on identification of Friese.)

Melipona orbignyi STRAND, 1910, Zool. Jahrb. System. Geogr. und Biol., XXIX, pp. 556-557.

Melipona orbignyi COCKERELL, 1913A, Annals and Mag. Nat. Hist., (8) XII, p. 372.

Melipona quinquefasciata BERTONI (nec Lepeletier), cited by Ducke, 1916, 'Enumeração dos Hymenopteros,' etc., p. 165.

Melipona orbignyi DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., pp. 165-166.

Melipona orbignyi COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 195.

Melipona quinquefasciata orbignyi FRIESE, 1919, cited by Cockerell, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 195.

Melipona quinquefasciata SILVESTRI, 1923, reproduction of figure of nest entrance, in Wheeler's 'Social Life Among the Insects,' 1923, p. 124.

Melipona nigrifula FRIESE (Sans descrip.). Specimens thus named by Friese in American Museum collection—at most a variety of subspecies *orbignyi*.

Melipona orbignyi DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, pp. 442-443.

Melipona quinquefasciata BERTONI (nec Lepeletier), cited by Ducke, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, p. 442.

♀.—Like *favosa* but devoid or virtually devoid of maculation on the face. Mandibles more or less, labrum, and sometimes the borders of the clypeus reddish brown, as is the scape beneath. The hair on the head much darker than described for typical *favosa*; deep, dark gray in the region between the antennæ and the ocelli, black or predominantly black on the vertex, and black on the cheeks. The sculpturing as already described for *favosa*; scattered, shallow punctures on the clypeus, dulled in the case of *favosa* by the yellow maculation, are in the dark-faced *orbignyi* and the other subspecies of *favosa* much more manifest. The hair on the legs much as described for typical *favosa*, but wholly black on the tibiæ instead of with light admixture (however, Colombia specimens of what is here included in typical *favosa* sometimes have the tibial hairs wholly black). Almost exclusively dark, too, are the short hairs on the tergites, and the apical margins of the abdomen viewed from above are usually without admixture of light hair. The venter, however, is covered with light hair, and in all other respects, barring the departures noted, *orbignyi* accords with *favosa*.

Length about $7\frac{1}{2}$ mm.; width of thorax about $3\frac{1}{2}$ mm.; length of forewing, including tegulæ, about $6\frac{1}{2}$ mm.

♀.—Unknown.

♂.—Head (plate III, figure A) smaller than that of the worker, subtriangular, with the eyes even more strongly convergent below. Malar space reduced, at its narrowest point eye and mandible are very narrowly separated from each other. Labrum with rather distinct punctures. Mandibles with a supramedian waistlike narrowing within, with resulting hourglass-like shape. Face below the antennæ bare as in the worker (but the mandibles fringed with rather long, black hairs and the labrum sparsely clothed with short hairs). Face above the antennæ with hair similar in color and in character to that in the worker. Maculation of face very variable. Usually the base and the basal half or two-thirds of the sides of the clypeus are rimmed with yellow and from the middle of the base a longitudinal stripe stretches downward

without attaining the darkened apical region. In some specimens, however, the entire clypeus is yellow except for two parallel, blackish, longitudinal lines (duplicating the condition in the worker of subspecies *favosa*); and, to take the other extreme, there is one specimen before me without any yellow whatever on the clypeus. None of the specimens have the sides of the face maculated, as is the case usually even in the workers of subspecies *favosa*. The labrum is usually more or less reddish, but the mandibles are not extensively red, as a rule so only at the apical extremity. The hind tibiae elongate oval in shape, much narrower than in the worker of *orbignyi*, only about as wide as the rather parallel-sided basitarsi, their surface mostly rather convex but with a rather groovelike concavity posteriorly on the apical half, and covered with black hair. The abdominal stripes rather fuller than in the worker,—that on tergite 1 often less broadly interrupted medianly, that on tergite 2 very slightly interrupted or merely emarginate above at the middle.

Length about $7\frac{1}{2}$ mm.; width of thorax about $3\frac{1}{4}$ mm. to $3\frac{1}{2}$ mm.; length of forewing about $6\frac{1}{2}$ mm.

TYPE.—There is in the Natural History Museum in Paris a specimen from Chiquitos, Bolivia, that is labeled "type" and that accords well with Guérin's description.

DISCUSSION.—Strand (1910) has pointed out the want of accord between Guérin's description and the illustration that Guérin furnishes. In the latter, tergite 2 is incorrectly depicted as immaculate. *M. favosa orbignyi* can be separated from *favosa* proper by the black hair of its vertex, by the absence of maculations on the sides of the face, and in the case of the worker apparently also by the absence or virtual absence of maculations on the clypeus. The last-mentioned distinction is included because in the large series of *orbignyi* workers before me I find nothing resembling the facial ornamentation of *favosa* proper, but the variability in the clypeal maculation of the male of *orbignyi* raises doubt whether now and then variation may not occur on this part even in the worker.

Among the specimens here assigned to *orbignyi* are two from the State of Maranhão (Alcantara) and one from the State of Ceará. The specimens were taken by Ducke and were labeled by Friesse "*M. nigritula*." It is hardly to be inferred that these are the same as Friesse's *M. flavolineata* variety *nigritula*, very briefly described in 1903 from Para, and presumably Friesse assigned this name to them tentatively; perhaps forgetful of the fact that he had previously employed the name *nigritula* for another insect. The abdominal maculations are rather dimmed in these specimens and obsolescent, but traceable through the microscope, even the black lines within the yellow bands being then apparent. I prefer to consider them as at most a variety of *orbignyi* rather than as yet another subspecies of *favosa*.

In his key Ducke (1916, 1925) places *interrupta*, *santhilarii* (= *quinquefasciata*), and *orbignyi* in a group which he differentiates among other

characters by the spinelike prolongation of the outer angle of the hind tibiae. He states that this character is much more emphasized in the male. Undoubtedly, however, Ducke was including the male of *orbignyi* merely by inference, for later in describing *orbignyi* he says, "male unknown." The male, as the present description indicates, has hind tibiae wholly different from those of the worker, the joint being rounded at the apex and utterly devoid of a spine.

DISTRIBUTION.—This insect has previously been reported from Bolivia, Paraguay, Argentina, and Brazil. (Forms of it that in this paper are made subspecies of *favosa* have been reported from other countries.) The specimens here discussed as *M. favosa orbignyi* come from the following localities:

BRAZIL.—State of Matto Grosso: Corumba,¹ December 14–23, 1919 (R. G. Harris); State of Maranhão: Alcantara, October 1, 1903 (Ducke); State of Ceará, April, 1909 (Ducke).

PARAGUAY.—Villa Rica, 1900 (Burgdorf).

***Melipona favosa* subspecies *phenax* (Cockerell)**

Melipona phenax COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 195.

Melipona orbignyi jenningsi COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 199.

Melipona orbignyi phenax COCKERELL, 1928, Psyche, XXXV, pp. 171, 172, 173.

♀.—Like *favosa* subspecies *orbignyi* this subspecies has the face devoid or virtually devoid of maculations; these, when present, confined to a vague line of yellow or brown bordering the base of the clypeus. Mandibles more or less, labrum, and antennæ beneath usually reddish brown. The face below the antennæ bare. Above the antennæ the hair is gray to ochraceous and abundant, becoming more strongly tinged with yellow as the ocelli are approached and being bright tawny on the vertex. Genæ with shorter, light hairs. Legs below the femora with dark hairs on their outer surface. The short, fine hairs on the abdominal tergites, best seen when the insect is viewed from the side, are light in hue, and exclusively light, too, are the hairs on the apical margins of the abdomen. The sculpturing is that described for *favosa* proper.

Length $7\frac{1}{2}$ to $8\frac{1}{2}$ mm.; width of thorax $3\frac{1}{2}$ mm.; length of forewing, including tegulae, about $6\frac{1}{2}$ mm.

♀.—Unknown.

♂.—Structurally similar to the male of *favosa* subspecies *orbignyi*. In the maculation of its clypeus also of similar character, though in the fifteen specimens under examination not attaining the extremes of variability noted in the case of the *orbignyi* males. Usually the "upper margin of clypeus clear pale yellow, the edge of the dark against this yellow bilobed," but in a number of specimens the median thickening in the maculation that produces the bilobed condition is extended downward, often more or less vaguely, as a line that terminates in some cases not far from the apex of

¹It is in the large series from this place that the males with the variable amount of yellow on the clypeus occur, showing the inconstancy in this respect within a single locality, possibly even within a single nest.

the clypeus. In some instances the sides of the clypeus and not merely the base are also largely rimmed with yellow, and in certain specimens a yellow supraclypeal triangle is present as well. Sides of the face without maculation. The labrum and the mandibles maculated like those of *orbignyi*. The hair above the antennæ usually as described for the worker of *phenax*, but occasionally there are a few black hairs intermixed with the tawny ones on the vertex. Hair on cheeks also light as are the hairs on the dorsum of the abdomen. Those on the apical margins of the abdomen not always exclusively light, not infrequently with more or less scant, dark admixture. Abdominal bands similar to those of the worker but as a rule slightly fuller than in that cast, with usually merely an emargination above at the middle or a very slight interruption on tergite 2, as in male of *orbignyi*. (Plate VI, figure G, hind tibia.)

The genitalia are figured on plate IX, figures M, N, O, P.

Length $7\frac{1}{2}$ to $8\frac{1}{2}$ mm.; width of thorax 3 to $3\frac{1}{2}$ mm.; length of forewing, including tegulæ, about $6\frac{1}{2}$ mm.

TYPE.—In the U. S. National Museum are the type (No. 21661) and a paratype of *phenax*, which were collected by C. F. Baker in Ecuador. The allotype (No. 21669), originally described as *orbignyi jenningsi*, is from Las Cascadas, Panama, and is also in the U. S. National Museum.

DISCUSSION.—Cockerell (1919) originally described the male from Panama as an independent variety, *jenningsi*, but more recently (1928) he has made *jenningsi*, a synonym of his *phenax* from Ecuador (described from the worker) under the designation *Melipona orbignyi phenax* (Cockerell). In his key of 1919 Cockerell notes the presence in *orbignyi* of "a large yellow spot on inner side" of the hind tibiæ near the end and the absence of such a spot in *phenax*. In females from Panama associated with males from the locality that accord with Cockerell's description of *jenningsi* and that are therefore assignable to *phenax*, I find usually a large red maculation at the base of the hind tibiæ on the outer side and a rather fainter red maculation of corresponding or greater extent on the inner side, agreeing in this respect with specimens of *favosa* as well as with specimens of its several subspecies. In some instances these red maculations extend almost to the apex of the joint, but they are of very variable length.

The subspecies *phenax* has, like subspecies *favosa* and subspecies *orbignyi*, rich tawny hair on the dorsum and sides of the thorax. In respect to the color of its facial and abdominal hairs *phenax* leans strongly to *favosa* proper. The worker of *phenax*, in so far as may be judged from the large series under examination, differentiates itself from the *favosa* worker, as represented by the specimens at hand from Venezuela, in having on the vertex wholly tawny hair without admixture of black, and wholly white hair without black admixture on the apical margins of the abdomen. Even these distinctions break down, however, in the case

of the Colombian specimens here classed as *favosa*, which like *phenax* have no black hairs on the vertex or on the apical margins of the abdomen. Like *orbignyi*, from which it differs in the color of the hair on its face, vertex, and abdomen above, *phenax* may be separated from *favosa* by the fact that it has the sides of the face immaculate, and the maculations of the clypeus usually wholly absent in the worker and usually of limited extent in the male. In the male specimens of *phenax* before me the punctures on the labrum are rather stronger and more sharply defined than in the corresponding sex of *orbignyi*, and the shallow punctures on the clypeus stand out on the average a little more clearly in both sexes of *phenax* than they do in the specimens assigned to *orbignyi*, but there is some variability in this character even within a single series.

DISTRIBUTION.—*Melipona favosa* subspecies *phenax* is known from Ecuador and from Panama, a rather curious distribution when cognizance is taken of the fact that in the intervening state of Colombia *favosa* proper is found. There are in the collections under examination large series from these places in the Canal Zone: Balboa, January 28, 1915 (♂♂), July 25, 1914, October 12, 1914, November 20, 1914 (T. Hallinan), November 4–7, 1923 (F. E. Lutz); Ancon, February 3, 1916, February 28, 1914 (T. Hallinan), November 4–21, 1923 (F. E. Lutz); Farfan, January 23, 1916 and February 28, 1915 (T. Hallinan); Corozal, January 31, 1929 (C. H. Curran).

FIELD NOTES.—The following field notes are of interest:

Specimens taken at Ancon, November 21, 1923: "Had nests in walls of frame houses. Entrances at edge of windows. A little mud around the hole sometimes for an inch or two from the hole. Usually a bee on guard at the hole."—Lutz.

Specimen taken November 7, 1923: "At a yellow 'morning glory' near the Ancon Hospital."—Lutz.

Specimen taken at Farfan, February 28, 1915: "In bat cave."—Hallinan.

***Melinopa favosa* subspecies *baeri* (Vachal)**

?*Melipona favosa* HOLMBERG, 1887, 'Viaje á Misiones,' p. 288.

?*Melipona favosa* HOLMBERG, 1903, Anales del Museo Nacional de Buenos Aires,

(3) II, p. 382. (Specimens from Tucuman.)

Melipona Baeri VACHAL, 1904, Revue d'Entomologie, XXIII, p. 9.

Melipona baeri COCKERELL, 1919, Proc. U. S. Nat. Mus., 1920, LV, p. 196.

Melipona quinquefasciata variety *baeri* FRIESE, 1919, cited by Cockerell, Proc. U. S. Nat. Museum, 1920, LV, p. 196.

Melipona baeri pallescens COCKERELL, 1919, Proc. U. S. Nat. Mus., 1920, LV, p. 196.

Melipona quinquefasciata var. *pallescens* FRIESE, 1919, cited by Cockerell, Proc. U. S. Nat. Museum, 1920, LV, p. 196.

*Melipona quadrifasciata*¹ variety *bicolor* (Lepelletier) FRIESE, 1919, cited by Cockerell, Proc. U. S. Nat. Museum, 1920, LV, p. 196.

♀.—Like *favosa* in its structural characters. Labrum, mandibles largely, base of clypeus sometimes, and front side of antennæ on the last nine segments, brown. The hair between the antennæ and ocelli dark gray, black on the vertex, almost invariably black on the cheeks. The hair on the thorax entirely dark brownish-black to black; black on the outer surface of the joints below the femora, black or mostly black also on the femora, trochanters, and coxæ. The short hairs on the abdominal tergites black, as are also the longer hairs on the apical margins of the abdomen viewed from above. The apical sternite with black hairs. All of the other sternites with the usual light hairs. Abdominal maculations rather variable. Sometimes, as described in the case of the type: "band on first segment widely interrupted, those on following segments less and less so, that on fifth scarcely interrupted." But specimens from the same locality as those according with this description may have the bands on segments 3-5 continuous. Bands in most instances of the usual chrome-yellow, those on tergites 2-4 as a rule (but not always) enclosing the usual upcurved, fine, black line, but sometimes these bands are of a pale yellowish-white with the upcurved, black lines indefinite or absent (Friesse's *baeri pallescens*).

Length $7\frac{1}{2}$ to $8\frac{1}{2}$ mm.; width of thorax $3\frac{3}{4}$ to $3\frac{1}{2}$ mm.; length of forewing, including tegulæ, $6\frac{1}{2}$ to $6\frac{3}{4}$ mm.

♀.—Unknown.

♂.—Structurally accords with the male of *favosa orbignyi*. Mandibles more or less, labrum, and anterior side of flagellum reddish brown. Clypeus largely yellow with two subparallel, longitudinal, black marks and sometimes brownish discoloration of the yellow toward the apex. Sides of face in one specimen with faint yellow maculations adjacent to the clypeus; in the other specimens the region between the clypeus and the inner margin of the eye wholly black. A spot of yellow or brown on the narrow malar space. Hair as indicated in the case of the worker except that the last sternite has in the specimens at hand no black hairs. Variability in the maculation of the abdomen paralleling that described for the worker; but the maculations do not terminate with the band on tergite 5, there being two spots also on tergite 6.

Length $7\frac{1}{2}$ to 8 mm.; width of thorax 3 to $3\frac{3}{4}$ mm.; length of forewing, including tegulæ, $6\frac{1}{4}$ to $6\frac{1}{2}$ mm.

TYPE.—The description was based on four specimens collected by M. G. A. Baer, which may have been returned to him, as Vachal's usual phrase of ownership ("my collection") is not used in connection with them.

DISCUSSION.—This subspecies can at once be separated from *favosa* and the other subspecies of *favosa* by the prevailing black to brownish-black color of the hairs on its thorax. A close relative is the subspecies *lunulata*, which is a link between *baeri* and *orbignyi* in respect to the coloration of the hairs on the mesonotum. With *orbignyi* as well as *lunulata* the subspecies *baeri* shares the distinction of having dark hair

¹Possibly this should read *quinquefasciata*. It is thus recorded in the index to the Proc. U. S. Nat. Museum, 1920, LV.

on the vertex, on the tergites of abdomen, and on the apical margins of the abdomen. There are before me eight workers and three males. It is possible that a larger series would reveal much greater variability than is indicated in the above descriptions. In the case of the male particularly it is not improbable that the maculation of the clypeus is not always so complete as indicated. The presence of faint and abbreviated maculations on the sides of the face in one of the specimens (from Salta, Argentina) represents the only instance that has come to my attention where a subspecies of *favosa* approaches the facial maculations of the typical subspecies.

What Friese designated *quinquefasciata* variety *pallescens*¹ and Cockerell (1919) recognized as a valid variety of *baeri*, seem to me to be probably only callow specimens of *baeri*. It is noteworthy that Friese's specimens of *baeri* and *pallescens*, of which there are several in The American Museum of Natural History as well as at the U. S. National Museum, were alike secured at Tarata, Bolivia, and bear identical data. The specimens labeled *pallescens* have castaneous discoloration on the legs and on other parts of the body where one would expect black and much paler abdominal bands, but these are often earmarks of the callow, and taken in connection with the identity of the data suggest that the specimens should be so considered.

DISTRIBUTION.—The subspecies *baeri* was described by Vachal from the state of Tucuman, Argentina, the localities given being La Criolla and Tapia. From the state immediately to the north of Tucuman, namely, Salta, there is in the material before me a specimen (♂) taken March, 1905, in the city of Salta by Steinbach. There are also specimens from the following localities in Bolivia: Tarata, 1900 (♂♂ and ♀♀); Rosario, Lake Rogagua, October 28–November 9, 1921 (W. M. Mann); Reyes, November (Lopez). Of these localities Lake Rogagua and Reyes are in the state of Beni, so that the range of this subspecies seems to be at least from northern Argentina to at least the more northern part of Bolivia.

***Melipona favosa* subspecies *lunulata* (Friese)**

Melipona lunulata FRIESE, 1900, Természetrájsi Füzetek, XXIII, p. 381.

♀.—Intermediate between *baeri* and *orbignyi* in respect to the color of the hairs on the mesonotum. These are described by Friese as fuliginous; in the specimens here designated *lunulata* they present a mixture of black and fulvous or light gray. The hair on the mesopleura more purely fulvous, but not quite as vividly so as in *orbignyi*. The abdominal maculations of variable extent but usually much reduced, those on tergite 1 being in most of the specimens merely specklike or even wholly

¹It appears thus on the label although Friese himself did not publish the name.

absent. The maculations on tergite 2 reduced to lateral spots broadly separated the one from the other. The following three tergites banded, with usually a median interruption more or less broad, but sometimes entire. The band on tergite 5 narrow, failing to reach the sides of the tergite. The black lines that are usual in the abdominal bands of other subspecies of *favosa* are in *lunulata* usually replaced by a more extensive invasion of black that emarginates the bands above instead of being imbedded in them, and gives them the crescentic appearance noted by Friese. In his specimen the lunulate shape of the maculations was apparently characteristic of tergite 3 only, but not uncommonly it is also the condition on tergites 2 and 4.

The wings are of a slightly deeper tint and the hairs on the intermediate tergites longer than in *favosa* or subspecies of *favosa* other than *peruviana*.

Length $7\frac{1}{2}$ to $8\frac{1}{2}$ mm.; width of thorax $3\frac{1}{2}$ mm.; length of forewing, including tegulae, 7 to $7\frac{1}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—Friese based his description on a single specimen from Bolivia (Yungas), without indicating the depository.

DISCUSSION.—For a time the temptation was strong to merge this insect with *baeri*, applying the latitude of Vachal's description of *baeri*, which refers to the hair on the dorsum as blackish or brownish. But it is to be assumed that by brownish or blackish Vachal intended to describe not the intermixed colors represented in the specimens here discussed but a condition of unmixed dark hairs that range from brown to black. Independently of the condition of the mesonotum, the more distinctly fulvous hairs on the pleura would seem to separate *lunulata* from *baeri*, in which the hairs on the pleura are dark, and give *lunulata* an intermediate position between *orbignyi* and *baeri*. But while intermediate between these subspecies in this respect, it is in other respects a connecting link between *favosa* and certain of its subspecies on the one hand and the subspecies *peruviana* on the other, sharing with the latter the slightly deeper tint of the wings and the rather longer hair on the intermediate tergites of the abdomen.

DISTRIBUTION.—So far as may be judged from the material available, Bolivia would seem to be the meeting ground of the subspecies *orbignyi* and *baeri*, both of which are represented within its confines. No mention is made of *baeri* by Ducke (1916, 1925) in his monograph of the Brazilian meliponids, nor are there in the material at hand specimens from that country that are assignable to *baeri*. The presence in Bolivia of such a form as *lunulata* is what might be expected, and it is not improbable, too, that such a link occurs likewise in Argentina, from which both *orbignyi* and *baeri* have been reported. The following localities for *lunulata* are represented in the material at hand: Espia Rio Bopi, Bolivia (Wm. M. Mann) and Canamina, Bolivia (Wm. M. Mann).

***Melipona favosa* subspecies *peruviana* (Friese)**

Melipona peruviana FRIESE, 1900, Természetrájsi Füzetek, XXIII, pp. 382-383

Melipona peruviana COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p.

205.

♀.—Black, virtually devoid of yellow maculations (confined to traces of yellow framing the clypeus irregularly in two specimens; Friese's description makes no mention of these insignificant vestiges of color and the metatype before me lacks them). The lower half of the head bare except for the short to intermediate, black hairs on the cheeks and a short fringe on the labrum. The face above the antennæ and the vertex densely covered with long, black hairs. The hair long, dense, and black to dusky grayish-brown on the anterior third of the mesonotum, along the sides of the mesonotum, on the pleura, and scutellum; hair more sparse to absent on the posterior two-thirds of the mesonotum. Propodeum bare. Legs with black hairs. The wings rather strongly and uniformly stained with orange, their venation reddish yellow. The tegulæ black, often with invasions of reddish, especially posteriorly. Hair black and of intermediate length on the abdominal tergites; the sternites have light hair of a gray to yellowish tinge.

Length $7\frac{1}{2}$ to 8 mm.; width at thorax $3\frac{1}{2}$ to $3\frac{3}{4}$ mm.; length of forewing, including tegulæ, 7 to $7\frac{1}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—Friese's description was based on two workers from Peru (Callanga). Friese does not mention his depository. Metatypes from Huancabamba, Peru, were acquired by the U. S. National Museum and by the American Museum. It is on one of the Huancabamba specimens that the above redescription is largely based.

DISCUSSION.—This insect conforms rather closely to typical *favosa* in its structural characters; but the immaculate condition of its abdomen differentiates it rather sharply from the brightly banded *favosa* and from all of the other subspecies of *favosa* except *variegatipes*. The posterior part of the mesonotum is rather more devoid of sculpturing and more shiny in the specimens of *peruviana* before me (including the metatype) than is the case in *favosa*, but it is doubtful whether this is a well stabilized character, for there are individual specimens among the subspecies of *favosa* that approach this condition. The reader is referred in this connection to the DISCUSSION of *variegatipes*. The wings are slightly more tinted in the specimens of *peruviana* than in typical *favosa*, but not more so than in the subspecies *lunulata*, which likewise accords with *peruviana* in having longer hair on the intermediate tergites than is the case in the other subspecies of *favosa*.

Apart from members of its own species, the only meliponid with which *peruviana* may conceivably be confused is *Melipona flavipennis*, which it resembles superficially due to its immaculate condition and dark

pile. It can be readily separated, however, by its much smaller size, its convergent eyes, and by the dull appearance of its face and propodeum in contrast to the shininess of these parts in *flavipennis*. The lighter color of the hairs of the ventral abdominal segments of *peruviana* is not mentioned in Friese's description. These light abdominal hairs appear in all of the members of *favosa* (in the subspecies *variegatipes* they are fulvous) and constitute yet another point of differentiation from *flavipennis*, in which the ventral hairs like the dorsal are black.

DISTRIBUTION.—So far as known, this insect occurs only in Peru. The labels on the metatypes in the U. S. National Museum and in the American Museum read, "Huancabamba, N. Peru, 3000 m., H. Rolle." In addition there are three specimens in the collections under examination from Huacapistana, Rio Tarma, Peru, June 1-2, 1920 (Cornell University Expedition).

***Melipona favosa* subspecies *variegatipes* (Gribodo)**

Melipona variegatipes GRIBODO, 1893, Bull. della Società entomol. Italiana, XXV, p. 254.

Melipona variegatipes COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 204.

Melipona variegatipes variety *lautipes* COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 204.

Melipona variegatipes LUTZ AND COCKERELL, 1920, Bull. Amer. Mus. Nat. Hist., XLII, p. 494.

Melipona variegatipes lautipes LUTZ AND COCKERELL, 1920, Bull. Amer. Mus. Nat. Hist., XLII, p. 494.

♀.—The lower half of the face, especially the clypeus, obscurely fusco-ferruginous to reddish. The clypeus a little lighter along the apical margin (sometimes, according to Gribodo, even subivory-colored) and with a very faint, almost extinguished, vertical, hair-fine stripe down the middle. The mandibles reddish (in the specimen before me even the apical rim is red, though darker than the rest of the mandible, the basal prominence being black). A clearly defined, reddish-yellow spot on the malar space (this spot receives no mention in the original description; it occurs also in subspecies *favosa*). The scape in front, the flagellum beneath, the apical joint of the flagellum both above and beneath, reddish. The lower half of the face glabrous except for fulvous hairs on the labrum and a fringe of fulvous hairs along the lower edge of the mandibles. The up-slanting hairs of the upper half of the face and the longish, erect hairs on the vertex fulvous. Shorter, ochraceous hairs on the cheeks.

The thorax, including the scutellum, as in all the subspecies of *favosa*, black without maculations. The hair of the mesonotum and that of the pleura fulvous to fox-red.

The legs prevailing light fulvous (much as in *beecheii fulvipes*) with brief, dark markings at the apex of the femora and at the apex of the front and middle tibiae. The apex of the hind tibiae more extensively black (up to one half or nearly one half

of the joint). The hind basitarsi with their posterior half or two-thirds darkened. The apical half of the tarsal claws darkened, deep red rather than black. The hairs of the legs rather uniform in coloring, grading from light yellowish into golden yellow, even the hairs fringing the hind tibiae being, in the specimen on which this redescription is based, wholly yellowish without dark admixture.

The wings rather evenly and strongly stained with yellow; the venation reddish to brownish; the tegulae ferruginous with a faint, translucent pupil.

The short, rather dense hairs on the abdominal tergites are described by Gribodo as "moderately fulvous" and appear so when viewed from above. When the abdomen is viewed from the side, however, the hairs on tergites 2-5 appear to be black. There is a tuft of pale yellowish hairs on each side of the basal concavity. The hairs of the venter, like those of the apical tergite, incline strongly to yellow. The abdominal tergites at first glance would be described as wholly black. On closer examination there is traceable a vaguely outlined apical margin of dull, deep red, scarcely differentiated from the basal black, on tergites 1-5. The sternites ferruginous.

Length, according to Gribodo, 8 mm., the present specimen less than 7 mm.; width of thorax 3 mm.; length of forewing, including tegulae, 7 mm.

♀.—Unknown.

♂.—"Differs in having a somewhat more slender body, the face darker, the legs less spotted with black." [Quoted from the description of the male given by Gribodo.]

TYPE.—Gribodo's description was based on two workers and one male in his own collection. According to Horn (1926) the Hymenoptera of Gribodo (and presumably among them the type material of *variegatipes*) were acquired by the Museum of Genoa. The type (No. 21678) of *Melipona variegatipes lautipes* Cockerell is at the National Museum.

DISCUSSION.—Gribodo's *variegatipes* might almost rank as a distinct species, for it stands apart from all the other subspecies of *favosa* in respect to the coloration of its legs. A similar difference, however, obtains between the insular *beecheii fulvipes* and the continental *beecheii*, and in structure *variegatipes* so closely accords with *favosa* that consistency demands its inclusion in that species. While the sculpturing of its thorax is a little finer, with resulting shininess, than that of some of the other subspecies of *favosa*, the difference is scarcely sufficient to be stressed.

Not only in the coloration of its legs but in that of the hairs of its venter *variegatipes* departs from most of the other members of its group.¹ Indeed fulvous hairs over the under side of the abdomen are a rarity not only in the *favosa* subspecies but in other species and subspecies of *Melipona*. They occur, however, in a Brazilian species, *rufipes* Friese. Ducke in redescribing *rufipes* speaks of it as very similar to *marginata* "especially in its build . . . but without any yellow maculations what-

¹Probably there are intergrades to the condition of *variegatipes* among typical *favosa*, for Latreille's French Guiana specimen of *favosa* had on the venter hair that was "somewhat reddish gray."

ever, face broader, abdomen with a much more strongly developed covering of hair." All of these distinctions would apply also if a contrast were drawn between *variegatipes* and *marginata* and make one wonder whether the relationship between *rufipes* and *variegatipes* is not closer than that between *rufipes* and *marginata*. There are no specimens of *rufipes* in the collections under examination.

Specimens with ferruginous legs lacking "the characteristic '*variegatipes*' markings" have been named variety *lautipes* by Cockerell, 1919, with the comment: "It is doubtless recessive to the typical form, with which it occurs in small numbers."

DISTRIBUTION.—Described from Guadeloupe and subsequently discovered also on Dominica and Montserrat (Cockerell, 1919). May possibly extend to other islands of the Leeward and Windward groups.

***Melipona fasciata* Latreille**

INTRODUCTORY COMMENTS.—It seems desirable to preface discussion of the multiple forms that constitute this species by a general word regarding them. The insects here considered as subspecies of *fasciata* have been described under many specific and varietal names, but three names at least have predominated in the literature: *fasciata* Latreille, *scutellaris* Latreille, and *lateralis* Erichson. To each of these so-called species have been assigned in the past various subspecies and varieties.

Ducke (1916, 1925), who arranged all of the meliponids of this type as subspecies under *scutellaris*, indicated that they show structural differences as well as differences of coloration. Thus he designated *abunensis* as having a larger malar space, broader face, and wider tibiae than any of its near relatives, and alluded to *rufiventris* as having the most reduced malar space. Friese (1903) said of *seminigra* that it has a longer malar space than *fuscipes*. Seeing that *abunensis*, *rufiventris*, *seminigra*, and *fuscipes* are all here considered subspecies of *fasciata*, the question may be raised how such differences of structure can be reconciled with a conception of unity. The answer is that these differences are in some instances at least apparent rather than real. *M. rufiventris*, which according to Ducke has the "shortest malar space," is also "the least robust." Its malar space seems to me approximately half as long as its mandibles are wide at the base, and this is very nearly the relationship as between malar space and mandibles in the large *abunensis*. While differences in the relative length of the malar space may occur, I believe that the gradations are so fine that they cannot be given specific value, ranging from a little more than half the width to a little less than half the width of the mandibles at their base.

The width of the tibiae seems to me to vary among the several subspecies only in proportion to the size of the insect or, if differences occur, they are virtually negligible.

On the other hand, with respect to the relative width of the face, there is slight variability. Taking the length of the eye as the standard of comparison, I find that this is about equal to the distance separating one eye from the other at the level of the anterior ocellus in *merrillæ*, *seminigra*, *lateralis*, *lateralis kangarumensis*, *eburnea*, *paraensis*, *cramptoni*, *fasciata*, *melanopleura*, *indecisa*, *belizæ*, *mimetica*, *trinitatis*, *scutellaris*. The distance between the eyes as thus measured is slightly less than the eye in *rufiventris*, *pseudocentris*, *fuscata*, *melanoventer*. It is somewhat greater than the eye in *boliviana*, *abunensis*, *nigrescens*, *rufescens*. At best, however, the extremes are but slight departures from the mean. In *boliviana*—to take the subspecies which according to my measurements has the greatest relative breadth of the face at the level of the anterior ocellus—the relationship is about as $6\frac{1}{2}$ is to $6\frac{1}{4}$. In *rufiventris*, representing the other extreme, where the breadth of the face at the level of the anterior ocellus relative to the length of the eye is the least, the relationship is about as $5\frac{1}{4}$ is to 6.

More helpful are distinctions based on the sculpturing. In some individuals it is exceedingly light, with resulting shininess, especially in the abdominal region, in others the surface is more roughened and duller. Representing the minimum of sculpturing with shiny mesonotum and rather delicately tessellated tergites, is *boliviana*; at the other extreme is *rufescens*, with dull thorax and coarse and granular sculpturing on the abdomen above. Yet there are many intermediate forms grading into these extremes. The shiny thorax of *boliviana* is rivaled, for instance, by that of *mimetica*, but the abdomen of *mimetica* is less shiny than that of *boliviana*: the tergites of a subspecies like *seminigra* are, on the other hand, as nearly free from sculpturing as those of *boliviana*, but the mesonotum of *seminigra* is dull. In like manner, the heavily sculptured tergites of *rufescens* are approached in dullness if not in coarseness by specimens of *paraensis* and *cramptoni*.

The relative absence or abundance of hair on the abdomen constitutes yet another example of intergrading. At the one extreme are *rufescens* and *eburnea*, the former with a rather uniform covering of longish, erect hairs on all the tergites, the latter with an especially heavy growth on tergites 4 and 5, but also with a fair abundance of hairs on tergites 3 and 6. Intermediate between this condition and the largely hairless tergites of subspecies like *seminigra*, *abunensis*, *mimetica*, etc.,

are subspecies like *belizeæ* and *melanoventer*, in which hairs occur on all the tergites though not of quite comparable density or length. Almost claiming independence because of its conspicuously plumose hairs on tergites 4-5, is *eburnea*. Nevertheless, *rufescens* also has branched hairs on its tergites although they are less strongly feathery, and even in *melanopleura* and *belizeæ* diminutive, plumose hairs on tergites 4 and 5 are still readily traceable in many specimens. Thus, there seems to be no sharp break between subspecies that have branched hairs on some of the tergites and those in which simple hairs obtain.

From the key provided for the subspecies of *fasciata* it is possible to get some impression of the numerous differences—in their extremes certainly sufficiently striking—that obtain between these insects with respect to the color of the hairs, the color of the chitin, and the absence, the partial development, or the full development of their maculations. It is sometimes difficult to determine where a particular specimen belongs, to such an extent do aberrant individuals nullify the attempt to prescribe definite limits. The intergrading and overlapping forms in this species make precise delimitations almost impossible, and sometimes one wonders whether the individuals of each nest do not represent a different variety, at least, from those of a neighboring nest. Because the differences are often so minute, it has seemed desirable to describe the subspecies of *fasciata* in rather greater detail than was thought necessary in the case of subspecies of some of the other species.

The description of *Melipona fasciata* precedes by a number of pages that of *scutellaris* although both appeared in the same work ('Voyage de Humboldt et Bonpland,' 1811). Hence the name *scutellaris* employed by Ducke (1916, 1925) for the insects here considered is replaced by the earlier name.

KEY TO THE WORKERS OF *fasciata* AND ITS SUBSPECIES¹

- 1.—The hair on the vertex and the erect hairs on the mesonotum (as distinguished from occasional inconspicuous appressed hairs in this region) exclusively black, brownish black, or black intermixed with light. 2.
 Either the vertex or the mesonotum, usually both, with exclusively or nearly exclusively fulvous to pale hairs. 13.
- 2.—The abdomen prevailing black, with or without apical bands. 3.
 The abdomen prevailing red, light brown, or castaneous, with or without apical bands. 9.
- 3.—The tergites with a reddish-brown margining of their apices, scarcely to be differentiated from the basal black; no clear evidence of banding. The mesopleura extensively covered with black hair above, whitish below. . . . 4.

¹From this key *fuscipes* has been omitted because of doubt as to its character.

- The tergites with entire or at least partly complete bands. The mesopleura sometimes with black hair but often with hair of lighter hue. 5.
- 4.—Tergites 3-5 fringed apically with a dense, flat-lying array of copper-colored to pale hairs in contrast to the black and more erect hairs on the other parts of the tergites. Face immaculate or with at most an obsolescent median stripe on the clypeus. *indecis*a (p. 362).
- Tergites 3-5 without such fringes. Face maculated. *fuscata* (p. 363).
- 5.—The pleura with predominantly black hair on their upper half or two-thirds. . 6.
- The pleura with for the most part light or fulvous hairs, sometimes in addition a small patch of fuscous hairs below the tegulæ. 7.
- 6.—The face below the antennæ devoid of hair and rather shiny notwithstanding its sculpturing. The clypeus a deep chestnut-color with a faint, reddish, median, longitudinal stripe; lateral face-marks absent; the mandibles a little darker than the clypeus, inclined to black, especially basally. The mesonotum devoid or virtually devoid of sculpturing, distinctly shiny. The abdomen also shiny, the tessellation being almost negligible on the tergites beyond the basal tergite and the punctuation of a scattered character. Bands very thin and cream-colored, strongest at the middle, weak to absent on the sides. Apical sternite with black hairs, all the others with light. *boliviana*, n. subsp. (p. 370).
- The face below the antennæ dull due to the much denser sculpturing. Clypeus deep red, rimmed with black at the base, yellowish red along its apical margin, and with a faint median stripe; a dull, yellowish-red stripe along the inner margin of each eye; mandibles light ferruginous at the base, a deeper red on the apical half or third. The mesonotum finely sculptured, not strongly shiny. The two basal tergites dull with an exceedingly dense, almost granular, microscopic tessellation; the other tergites rather more finely tessellated but at best semidull. The abdominal bands fine but usually continuous from end to end. The venter with more or less black hair on the four apical sternites. *nigrescens* (p. 365).
- 7.—The abdominal bands feeble, pale yellow on the sides, grading medianly into brown. The mesopleura with fuscous hair immediately below the tegulæ of the forewings, succeeded by fulvous a little lower down, and then in turn by white as the under side of the thorax is approached. The hair on the mesonotum mostly black to brownish black. 8.
- The abdominal bands cream-colored and strongly developed; tergite 1 usually yellowish red at the base. Mesopleura with largely white hair, the upper part with a more or less extensive fulvous patch. The mesonotum with much light hair intermixed with the black. *lateralis* (p. 372).
- 8.—Antennæ black. *fasciata* (p. 353).
- Antennæ black above, reddish beneath. *fasciata* var. *costaricensis* (p. 353).
- 9.—The hair on the apical part of the abdomen mostly ferruginous, sometimes a few intermixed, dark hairs at the sides of one or more of the last three tergites; the hair on the apical sternite ferruginous. *abunensis* (p. 369).
- At least the long hairs of the tergites black; the hair on the apical sternite black. 10.
- 10.—The hair on the mesopleura extensively black. The apical rims of the tergites usually narrowly brownish, more deeply colored than the yellowish-red to

light brownish basal part, their usually dark character intensified by fringes of rather long, black hair banding the apices of tergites 3-5 in addition to a denser but less conspicuous fringe of short, reddish hairs, especially on apex of tergites 3-4. Fine, appressed, golden to pale hairs on the tergites in addition to the more erect, longer, black hair. . . . *melanopleura* (p. 357).

The hair on the mesopleura fulvous above, white below. The tergites without dark apices or a bandlike arrangement of the hairs. Sometimes largely devoid of hair. . . . 11.

- 11.—Black hairs concentrated on the lateral margins, especially at the apex, the tergites otherwise largely glabrous and shiny. Tergites 1-5 without bands and of a clear, bright red. . . . *seminigra* (p. 367).

At least the last two tergites with fairly abundant, black hairs over their surface. . . . 12.

- 12.—Tergites 1-5 with distinct, yellow bands that are broad at the middle, more emarginate at the sides. The black hairs on tergites 3-4 short and inconspicuous compared with those on tergites 5-6, and usually noticed only when the insect is viewed from the side. The clypeus reddish, infuscated at the base, its median stripe and the lateral face-marks evanescent, virtually extinguished. The axillæ darker than or concolorous with the scutellum.

lateralis var. *kangarumensis* (p. 372).

The tergites with narrow, often obliterated bands, that on tergite 5 usually missing. The black hairs on tergites 3-4 only a little less conspicuous than those on tergites 5-6. The clypeus reddish, infuscated at the base, the median stripe and the lateral face-marks distinct. The axillæ paler (more whitish) than the yellowish scutellum. . . . *trinitatis* (p. 375).

- 13.—Tergites black or, rarely, of a deep reddish-black, usually with apical bands but not always. . . . 14.

Tergites bright reddish to castaneous, with or without apical bands. . . . 19.

- 14.—Several or all of the tergites rather densely covered with longish, mostly or wholly fulvous hairs. The abdominal bands well developed. . . . 15.

The hairs on the tergites for the most part or wholly black, the basal tergites in some subspecies virtually glabrous. . . . 16.

- 15.—Tergites 1-5 rather uniformly covered with relatively long, erect, fulvous hairs that show a very gradual increase in length from the basal segments to the more apical ones. The tergites roughened by a dense, strong tessellation and, especially on tergites 3-5, by the addition of a coarse punctation granular in appearance. Sides of face maculated, clypeus usually reddish with a pale median stripe. . . . *rufescens* (p. 406).

Basal tergites less hairy. Tergites 4 and 5 covered conspicuously with plumose hairs, interspersed with which, particularly at the sides, there are on tergite 5 rather longer, erect, black or dark brown hairs of less feathery character, almost spinelike in appearance. Face dark except for an indistinct median stripe. . . . *eburnea* (p. 403).

- 16.—Tergites 1-2, like the other tergites of the abdomen, covered with black hairs. The face maculated but the abdomen devoid of banding or with only a brownish discoloration along apices of tergites. *melanoventer*, n. subsp. (p. 397).

Tergites 1-2 virtually glabrous. The tergites usually banded. . . . 17.

- 17.—The legs largely bright ferruginous. Clypeus usually light reddish with a creamy-white median stripe and the lateral corners broadly of the same

- color; inner orbits with a narrow, cream-colored band, usually club-shaped below. *cramptoni* (p. 379).
- The legs for the most part dark. 18.
- 18.—The front with blackish hairs. The vertex with blackish hairs and fulvous hairs in varying proportions, the black often predominating, but fulvous hairs at least on the occiput. The face black, with a subdued median stripe and occasionally dull brownish, fragmentary stripes obscurely along the inner margin of the eyes. The mandibles dark. Five linear bands on the tergites, sometimes very indistinct to absent. Tergites rather dull, deep reddish-black to pure black. *paraensis* (p. 392).
- The hair on the front and vertex wholly fulvous. The clypeus reddish with a median, cream-colored stripe. Lateral face-marks distinct. The mandibles reddish yellow. The cream-colored bands on the first five tergites distinct and sharp. The abdomen above shiny; often brown on tergite 1, the other tergites as a rule basally black. *scutellaris* (p. 400).
- 19.—The head with very pale hair, including that of the front. The mesonotum very shiny, almost devoid of sculpturing. The dorsum of the abdomen shiny, virtually glabrous except for the bristle-like hairs on the apico-lateral margins. *mimetica* (p. 411).
- The vertex and mesonotum with hair of a more strongly yellow to fulvous hue. 20.
- 20.—The front with dark grayish to brownish-black hair. The face immaculate. The hair on the tergites of abdomen rather long and abundant, especially so on tergites 4-6, where black, bristle-like hairs predominate. *belizeæ*, n. subsp (p. 360).
- Not having this combination of characters. 21.
- 21.—The abdomen light red, with or without bands, and with many fine hairs on the tergites in addition to the longer hairs on the apico-lateral margins. Usually rather small, 8 to 10 mm. *rufiventris* and varieties (p. 383).
- The abdomen deep red to castaneous, with black bristles along the apico-lateral margins, but tergites otherwise rather glabrous and shiny. Larger, 10 mm. to 11½ mm. 22.
- 22.—The clypeus light reddish with a median longitudinal cream-colored maculation bisecting it and with a more or less vague cream-colored apical border. A well-developed cream-colored maculation (club-shaped below) along the inner orbit of the eye. The legs mostly light red, strongly contrasting with the blackish markings on the apices of the femora and of the tibiæ and on the basitarsi. *pseudocentris* (p. 377).
- The clypeus and sides of face dark chestnut brown, with fragmentary dull vestiges of maculations or more often wholly immaculate. The legs very dark reddish to black. *merrillæ* (p. 382).

***Melipona fasciata* subspecies *fasciata* (Latreille)**

Melipona fasciata LATREILLE, 1811, 'Recueil d'Observ. de Zool. et d'Anat. comparée faites par Humboldt et Bonpland,' I, pp. 173-174, pp. 291-292, Pl. xvi, fig. 13.

?*Melipona fasciata* GERMAR, 1815, Magaz. für Entom., I, Heft 2, p. 115. (Cited by Dalla Torre.)

?*Melipona fasciata* SMITH, 1854, 'Catal. Hymen. British Mus.,' part 2, p. 404. (From Brazil; almost certainly not typical *fasciata*.)

?*Melipona fasciata* GRONEN, 1881, Zool. Garten, XXII, pp. 331-332. (From New Granada = Colombia; possibly *indecisa* Cockerell.)

Melipona fasciata DALLA TORRE, 1896, 'Catal. Hymenopterum,' X, p. 578.

Melipona fuscata FRIESE, 1916, Stettiner Entomol. Zeitung, LXXVII, p. 299. (Collected in San Carlos, Costa Rica, and I think undoubtedly the same as specimens from that locality bearing date of 1902, wrongly identified by Friese as *fuscata*.)

?*Melipona fasciata* FRIESE, cited by Cockerell, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 198. (From Brazil, almost certainly not typical *fasciata*.)

Melipona fasciata COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 167.

Melipona fasciata costaricensis COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, pp. 198, 201, 206.

Melipona fasciata LUTZ AND COCKERELL, 1920, Bull. Amer. Mus. Nat. Hist., XLII, Art. 15, p. 493. (In part.)

Melipona fasciata costaricensis LUTZ AND COCKERELL, 1920, Bull. Amer. Mus. Nat. Hist., XLII, Art. 15, p. 493.

Melipona fasciata costaricensis COCKERELL, 1920B, Bull. Amer. Mus. Nat. Hist., XLII, p. 459.

♂.—The head (plate IV, figure B, as depicted for *M. fasciata rufiventris*) broader than long; the eyes very slightly converging below, the length of the eye about equal to the distance from eye to eye at the level of the median ocellus (see INTRODUCTORY comments). The malar space distinct; the distance from the eye to the mandible about one half of the width of the mandible measured at the base. The apex of the mandible divided into two halves by a nicklike interruption at the middle; the outer half with a smooth edge, the inner half also with a smooth edge that is slightly emarginate, however, along its entire length so that there is an angle or denticle at each of its extremities. The clypeus and face dull with a dense, fine tessellation; the tessellation on the top of the head especially fine, with semishiny spaces on the outer side of the lateral ocelli, but relatively strong and coarse punctures in the region behind the middle ocellus; the sculpturing on the malar space ill-defined with resulting shininess. The mandibles of a deep brownish-black to chestnut color, inclined to red toward the apex, which is margined with black, and black, too, are the basal prominences and a narrow margin along the sides. The labrum deep reddish. The clypeus dull, deep, reddish brown apically with a vaguely defined, horseshoe-shaped rimming of black along its basal border and a hair-fine, faint, almost extinguished vestige of a stripe bisecting it longitudinally. (This median stripe fades out before attaining either the apex or the base of the clypeus, and because of its feeble and negligible character does not seem out of accord with Latreille's statement that the clypeus is without maculations, especially when regard is had for the fact that throughout his description of *fasciata* Latreille draws contrasts with *favosa*, which has the most strongly maculated face of all the *Melipona*.) Maculations along the inner margin of the eye, characteristic of some of the subspecies of *fasciata*, are lacking in the typical subspecies, although a chestnut-colored lightening of the otherwise black chitin as the eye is approached suggests a possible vestige of a maculated condition. Like the faint clypeal stripe these vestiges are so obscure that at first glance the face would be described merely as black. The antennæ as a rule wholly black, sometimes dull brown below. The clypeus bare. Light, plumose hairs, short and semiappressed, on the

portion of the face above the antennæ as well as on the sides of the face below the antennæ, but these are in the typical subspecies of *fasciata* rather less conspicuous than the longer, dark hairs, of which there are a few between the antennæ although the major growth is on the front and on the vertex. On the cheeks there is a somewhat dense covering of appressed, pale, plumose hairs, almost scalelike in appearance, as well as of down-slanting, light hairs. The mandibles are fringed below with golden-brownish hairs, and there are also a few hairs of this color on the labrum.

The long hair on the mesonotum and scutellum mostly black to brownish black, with now and then intermixed fulvous hairs on the sides; some semiappressed, pale, plumose hairs appearing below the dark growth. On the mesopleura there is a fuscous patch immediately below the tegulæ, which grades into fulvous a little lower down and is succeeded in turn by white as the under side of the thorax is approached. The mesonotum finely tessellated; the mesopleura with distinct, widely separated, small but clear punctures. The scutellum above virtually devoid of sculpturing and shiny; but its posterior rim has many well-defined punctures that are particularly conspicuous because they show up black and granular on the usually yellow hind rim. The tessellation on the propodeum rather strong and dense, but excessively fine at the shiny center, which is rather devoid of the pale, branched hairs otherwise fairly abundant on the propodeum and metapleura. The scutellum variable in color, often wholly dull yellow, sometimes reddish, sometimes black, but its hind rim is as a rule yellow even when the scutellum above is dark.

The legs are deep reddish-brown to black, the reddish brown being usually most apparent on the front and middle tibiæ (except for their narrowly black apex), on the hind femora (except for the blackened apex and sometimes darkened under surface), at the base of the hind tibiæ, on the outer angle of the hind basitarsi, and in somewhat lighter hue on the apical joint of all the tarsi (the claws largely black). Light hairs on all the coxæ, trochanters, and femora. Dark hairs on the tibiæ and all of the tarsi externally except the apical joint, which is exclusively golden-haired. The under side of the hind tibiæ with short, silvery pile; the under side of the basitarsi and more or less that of the other tarsal joints with golden to copper-colored bristles. The hind tibiæ (plate VI, figure C, as depicted for *M. fasciata rufiventris*) broad, subtriangular, with the outer apical angle distinct, subtooth-like but not spinelike. The outer surface of the hind tibiæ convex only on the basal half, rather concave on the apical half. The hind basitarsi broadly rounded behind, emarginate below, with the external angle rather toothlike.

The wings hyaline, stained with yellow, the stain being deepest in the median cell and sometimes also in the upper half of the marginal. The tegulæ light ferruginous to yellowish brown.

The abdomen is black above with usually five feebly developed and interrupted, narrow bands, each extending just before the apical rim of its tergite. The apical tergite usually bandless, and some of the other tergites with the band occasionally completely effaced, approaching the condition of the subspecies *fuscata*. Usually, however, the bands are distinct and pale yellow or cream color at each of their lateral extremities although they tend to become brownish and indistinct over a median portion of variable extent. Where their shape is traceable, they appear as a fine undulating line. The basal portion of the venter with yellowish-brown discoloration; some of the sternites beyond occasionally with dull, ill-defined, brownish banding. The tergites with fine, dense tessellation that has a tendency to arrange itself in

microscopic, transverse ridges, most readily traceable on tergites 1-2. On the tergites beyond 2, the sculpturing is exceedingly delicate and these tergites would appear even more shiny if their surface were not obscured by a rather abundant though scattered growth of black, erect hairs, present only on the sides of the first two tergites, these basal tergites being therefore virtually glabrous. Characteristic of typical *fasciata* and the three subspecies most closely related to it (*melanopleura*, *indecisa*, and *belizeæ*) is a dense, curtain-like fringe of flat-lying, fulvous hairs at the apex of tergites 2-5 (especially conspicuous on 3-4) that is overlaid with a thinner fringe of longer, rather bristle-like, black hairs. There is a tuft of erect, pale hairs on each side of the basal concavity of the abdomen, this concavity being as a rule light yellow to brownish, much the same in color as the basal part, at least, of the venter. The sternites rather granular, the hairs on all but the two apical sternites pale; on the penultimate sternite they are sometimes ferruginous, on the apical sternite they are black.

Length 9 to 10 mm.; width of thorax $3\frac{1}{2}$ to $3\frac{3}{4}$ mm.; length of forewing, including tegulæ, $7\frac{3}{4}$ to $8\frac{1}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—Probably no longer in existence; not in the Latreille collection at Oxford.

DISCUSSION.—The insect described by Latreille as *Melipona fasciata* was collected, presumably by Bonpland, at Vera Cruz, Mexico,¹ in the course of the travels in the New World pursued by Humboldt and Bonpland during 1799-1803. The description unfortunately, like so many of the earlier descriptions, is brief and not wholly specific. Yet there emerge from it a few details that enable one to determine the character of *fasciata* at least with reasonable probability.

For the interpretation of typical *fasciata* it is logical to seek an insect north of Panama, and, in the absence of specimens from the type locality, I believe a close approximation to Latreille's bee may be found in a series before me from Suretka, Province of Limon, Costa Rica, on which the present redescription is based. All of the specimens in this series bear identical data and are presumably specimens from a single nest. For the most part they have the dark antennæ specified by Latreille, although in some of the specimens an approach to brownish on the underside of the antennæ is noticeable. The abdominal bands, too, grading in the same specimen from pale yellow to brown and presenting a rather dull (terne) appearance, agree well with the specifications of Latreille: "Of a pale yellow and a little brown." The hair on the thorax above is mainly black with some brown in addition to appressed, whitish admixture, the ensemble perhaps justifying the phrase that Latreille applies to the thoracic hairs: "approaching dark brown." In the virtually immaculate condition of

¹Dalla Torre, 1896, erroneously gives the locality as Cayenne.

the face (a faint, thin, reddish streak down the middle of the clypeus being so inconspicuous as scarcely to justify mention) these insects accord also with the description of Latreille. The color of the scutellum in these specimens ranges all the way from pale yellow to black, duplicating the range of variability noted by Ducke for *fuscata*, and to be observed also in *lateralis* and particularly in its variety *kangarumensis*.

One of the specimens from Suretka differs from the others in that the abdomen is largely reddish brown. Among specimens from Pozo Azul, Costa Rica, similar diversity has been found. Cockerell assigned the dark specimens from this locality to *M. fasciata costaricensis*, but those in which the abdomen was ferruginous to another subspecies, *melanopleura*, stating, however, that possibly *melanopleura* was "no more than a dimorphic variation of *costaricensis*."

The subspecies *melanopleura* will be discussed later. At this point it remains to be stated only that *costaricensis* seems to differ very little from the insect here conceived of as *fasciata*. The thoracic hairs of *costaricensis* are a little more prevailing black. The antennæ are described by Latreille as black for typical *fasciata*; in Cockerell's *costaricensis* the flagellum is "bright ferruginous beneath." Yet, as was pointed out, intermediates occur even in the series from Suretka, and, if these specimens be, as here interpreted, *fasciata*, then *costaricensis* is at best a not very clearly separated variety of it.

DISTRIBUTION.—Mexico and Central America. The specimens from Suretka, Province of Limon, Costa Rica, were all taken April 26, 1924, by J. C. Bradley. Two specimens from San Carlos, Costa Rica, taken in 1902, and labeled by Friese "*fuscata*," have likewise been included here. There is also a small series from Honduras, taken by Joseph Bequaert, which includes the following localities: El Canal, Pto. Castilla, March 28, 1924; Corocito, April 3, 1924; Prieta, April 4, 1924. There is a single specimen from Navarro Farm, Costa Rica, March, 1924 (H. W. Atkinson), in connection with which the reader is referred to the DISCUSSION under *melanopleura*.

Melipona fasciata subspecies (?) **melanopleura** Cockerell

Melipona fasciata subspecies *melanopleura* COCKERELL, 1919, Proc. U. S. Nat. Museum, LV, p. 201.

Melipona fasciata melanopleura LUTZ AND COCKERELL, 1920, Bull. Amer. Mus. Nat. Hist., XLII, Art. 15, p. 493.

♀.—The head dark, for the most part black. The clypeus of a deep mahogany-brown, infuscated at the base, and with a faint streak, hardly more than hair-width and ferruginous, traversing it longitudinally. The labrum and mandibles mahogany-

colored, the apical rim of the latter edged with black and the basal prominences black; sometimes also mahogany-colored bands along the inner margin of the eyes. The usual, rather appressed, short, pale, plumose hairs on the front and sides of the face but inconspicuous compared with the much longer, up-slanting growth of black hairs. Black, too, are the upright hairs on the vertex; and even the hairs fringing the lower surface of the mandibles, as well as those on the labrum, are sometimes of a reddish brown so deep that it verges on black. Black hairs growing at right angles between the antennæ. The hairs on the cheeks are for the most part light (they are wholly so in the type), although occasional dark hairs occur even here, especially as the top of the eye is approached. The scape fuscous, very briefly light red at the base and apex. The first one or two joints of the flagellum more or less dark below as well as above; the other joints dark above, ferruginous below.

The pronotum reddish brown, grading sometimes into black. Wholly black, too, without trace of lateral stripes, is the mesonotum, and of the same funereal appearance are usually the axillæ and scutellum, although now and then grading into dark red and with lighter rim posteriorly. The dark appearance of the thorax like that of the head is enhanced by the presence of exclusively (or "mostly") black hairs not only on the mesonotum but also on the upper half or two-thirds of the mesopleura, scutellum, and axillæ. The lower half or third of the mesopleura, the tubercles, metapleura, and propodeum with contrasting light hairs, those on the propodeum as usual less dense and more obviously plumose than on the thorax proper.

The legs dark, mahogany-colored, with usually a black streak on the under surface of the femora, black apices on the front and middle tibiæ, supplemented usually in the case of the middle tibiæ by a black streak running lengthwise along the apical half of the outer surface of the joint, largely black hind tibiæ (only the basal half or third red on the outside; the red area on the under side more extensive, rimmed narrowly with black), largely black middle and hind basitarsi, narrowly edged with mahogany color, and some black also on the intermediate tarsal joints (those preceding the apical one) and on the apical half of the claws. (The black markings on the legs are in the type specimen poorly developed to absent.) The hairs on the coxæ, under side of trochanters, and under side of femora white; those of the upper surface of the femora a little deeper in hue, yellowish to even brownish. The outside of the front and middle tibiæ with short, semierect, bristle-like hairs; beneath, the hairs are longer and variable from black to golden brown. The lateral fringes of the hind tibiæ black; on the under side of the hind tibiæ there are the usual microscopic, silvery hairs. The basitarsi and intermediate tarsal joints with black hairs on the outside; the tarsal brushes within deep golden to copper-colored; the apical tarsal joint with reddish hairs.

Wings of the usual type in *fasciata*, transparent but stained with yellow, more deeply so in the median cell; the venation ferruginous, the costal and subcostal veins and stigma a deeper red. The tegulæ ferruginous.

The abdomen usually light brown both ventrally and dorsally but very variable. As a rule there are black or at least dark margins only along the apex of the tergites (emphasized by fringes of black hairs), but in some specimens the apical tergites are wholly black, and the condition is even presented within a series from the same locality (Mt. Redondo, Costa Rica) where only the two basal tergites are light brown, all the others being black. In addition to these replacements of light brown by black, *melanopleura* has usually obscure, pale bands just above the dark apical margins

mentioned. A tuft of erect hairs on each side of the basal concavity, but, rather exceptionally, these tufts are not pure white but sooty due to intermixed darker hairs or to the darker extremity of basally light hairs. Except for this and an apical fringe on tergite 2 of a character presently to be mentioned, tergites 1 and 2 are virtually glabrous. The subsequent tergites increasingly hairy. On tergites 3-5 there is an abundance of short, appressed reddish hairs with interspersed, more erect but sparser, short, black hairs. At the apex of these tergites the black hairs are longer and more bristle-like and usually arrange themselves in rather dense fringes, in some cases tending to conceal a rather characteristic fringe of even denser but shorter fulvous hairs that lie beneath the black fringe. Such an overlying dark fringe occurs usually even on the otherwise virtually glabrous tergite 2, though the fulvous fringe and frequently also the black one thin out toward the middle of this tergite. Tergite 6 relatively bare with few short hairs of either color but bordered apico-laterally with long, black, bristle-like hairs. Similar black bristles extend along the sides of tergite 5 and even tergite 4. The ultimate and penultimate sternites with black or reddish brown hairs and even the two sternites basad of these with occasionally a few dark hairs amid the white, but in lesser number than is the case in *nigrescens*.

Length about 10 mm.; width of thorax $3\frac{1}{2}$ mm. to 4 mm.; length of forewing, including tegulae, 8 mm. to $8\frac{1}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—The type is Cat. No. 21673 in the U. S. National Museum. It is from Costa Rica (M. A. Carriker, Jr.).

DISCUSSION.—Professor Cockerell in describing this subspecies has expressed the opinion that "it is possibly no more than a dimorphic variation of *costaricensis*" (here considered at most a variety of the subspecies *fasciata*). There would seem to be great instability in the coloration of the abdomen of *melanopleura*, and one specimen at least, with four of its tergites black and only the two basal ones clear light brown, shows how far *melanopleura* may progress in the direction of typical *fasciata*. The specimens of *costaricensis* and *melanopleura* that Professor Cockerell (1919) discussed were taken in the same locality, Pozo Azul. In similar manner out of three specimens obtained at Navarro Farm, Costa Rica, in March, 1924, two are assignable to *melanopleura*, the third to typical *fasciata*. While it seems possible that within a single nest the two extremes, *fasciata* and *melanopleura*, might be obtained, some ten or twelve specimens of the closely related subspecies *belizæ*, from Belize, British Honduras, have a wholly light brown abdomen and offer no intergrading forms. Judgment must, therefore, be suspended until adequate nest material can be obtained, and for the time being *melanopleura* is still given the rank of a subspecies.

Except for the light brown abdomen and the slightly darker color of the hairs of the mesonotum, I find little that separates *melanopleura*

from typical *fasciata*. The recumbent, short, reddish hairs on the tergites of *melanopleura* might be cited as an additional distinction, but even these assume a decidedly darker hue on the black tergites of the specimens of *melanopleura* with bicolored abdomen. The subspecies *belizæ*, also a close relative, is easily differentiated by the fulvous hairs of its thorax.

A series from Cacao, Trece Aguas, Alta Vera Paz, Guatemala, collected by G. P. Goll in May, 1907, and identified by Cockerell (1919) as *fuscipes* Friese, comes very close to Cockerell's *melanopleura*, differing perhaps chiefly in having a yellow, instead of black, scutellum and yellow axillæ. In certain other closely related subspecies—*fasciata*, *lateralis kangarumensis*, etc.—a similar range of variability occurs in the coloration of the scutellum.

DISTRIBUTION.—Described by Cockerell from Pozo Azul, Costa Rica. There is a series from Mt. Redondo, Costa Rica, obtained in 1903 and loaned by The Academy of Natural Sciences of Philadelphia, and two specimens from Navarro Farm, Costa Rica, March, 1924 (H. W. Atkinson), loaned by the U. S. National Museum.

***Melipona fasciata* subspecies *belizæ* (new subspecies)**

♀.—The head dark, for the most part black. The clypeus of a deep mahogany-brown, infuscated at the base, and sometimes with a faint streak, at most of hair-width and ferruginous, traversing it longitudinally (but more often even this faint vestige of a stripe is lacking). The labrum frequently light brownish; the mandibles mahogany-brown (sometimes rather extensively black) with the apical edge narrowly rimmed with black and the basal prominences black. Obscure mahogany-colored bands along the lower part of the inner orbit of the eyes sometimes present. The scape with a light brownish stripe in front. The first joint of the flagellum black above and below; the other joints black above, reddish brown below, except for the apical joint, which is usually reddish brown both above and below. The front and sides of the face with inconspicuous, appressed, pale, plumose pile and, in addition, much longer and more conspicuous, dull fulvous to brownish, up-slanting hairs. On the cheeks (particularly the upper part) there is appressed, pale, scalelike pile, and, in addition, there are longer, down-slanting whitish hairs. The hairs fringing the under side of the mandibles yellowish to brownish. The hair on the vertex predominantly fulvous with a few black hairs immediately in back of the ocelli and near the summit of each compound eye.

The pronotum cream-colored to ferruginous. The axillæ and scutellum corn-yellow. (In what are probably callow specimens some ill-defined yellowish areas occasionally also on the pleura, which are normally black like the mesonotum.) The mesonotum, axillæ, scutellum, and most of the mesopleura clothed with hairs of a warm, rich fulvous, only gradually grading into white on the mesopleura below. The metapleura and propodeum with ochraceous hairs, those on the propodeum somewhat more abundant than in most subspecies.

The legs light brown (not so dark as in *melanopleura*) with black or deep brown markings. These are similar to those described for *melanopleura*, occurring on the apices of the femora and tibiae (in the case of the front and middle tibiae sometimes supplemented by a black streak extending halfway up the outer surface of the joint), on the middle and hind basitarsi (where they occupy the entire external surface except for a narrow rimming of brown), and spattered over the intermediate tarsal joints (especially those of the hind pair of legs). The coxae, especially the hind pair, frequently with dark markings. The hair of the coxae, trochanters below, and femora below white, slightly more yellowish to golden on the femora above. The front tibiae with largely golden hair (relatively long) both above and below; sometimes with a very few short, blackish bristles. The hair of the middle tibiae less exclusively golden, with short, black, bristle-like hairs more abundant than on the first pair, particularly on the black apical part of the joint. The hind tibiae with some golden hairs, often predominant over the black, in the anterior fringe but with black hairs in the posterior fringe. Beneath, the hind tibiae are covered with microscopic, flat-lying, silvery hairs. The outer surface of the basitarsi and intermediate tarsal joints dark-haired; the brushes and bristles within golden; the hairs of the apical tarsal joints golden.

Wings hyaline, stained with yellow, the staining deepest in the median cell. The venation ferruginous; the costal and subcostal veins, but not the stigma, of a somewhat deeper red. The tegulae ferruginous.

The abdomen in coloration similar to that of *melanopleura* but, so far as the specimens available indicate, without the transitions to black noted in that subspecies(?) and even without emphatic darkening of the apical rims of the tergites. Faint yellowish bands also traceable along the apex of tergites 1-5, immediately before the slightly darkened rims. Dense fringes of pale fulvous hair, overlaid by sparser fringes of black, bristle-like hairs along the apices of tergites 2-5 (most strongly developed on 3-4), similar to those of typical *fasciata* and *melanopleura*. A fulvous tuft of hairs on each side of the basal concavity and erect hairs of a reddish tinge on tergite 2. The erect hairs on tergites 3-6 for the most part long, black, and bristle-like, especially so on the apico-lateral margins, and rather dense. In some specimens reddish hairs are rather strongly intermixed with the black on tergite 3. The hairs of the penultimate sternite reddish, those of the apical sternite black and red; the basal and intermediate sternites with pale hairs.

Length 9 mm.; width of thorax $3\frac{1}{2}$ to $3\frac{3}{4}$ mm.; length of forewing, including tegulae, about $7\frac{1}{2}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—The type and four paratypes in The American Museum of Natural History; also five paratypes (type number 906) in Cornell University.

DISCUSSION.—This subspecies is closely related to *melanopleura*, from which it differs chiefly in having fulvous instead of dark hairs on the vertex and on the thorax. Other differences are brought out in the description. The specimens are a trifle smaller than typical *fasciata* and *melanopleura*, the wings especially seeming relatively short.

The specimens on which the description was based include several that were labeled by Friese *xanthopus*, one or two even with a type label.

An endeavor was made to locate Friese's description, but search has failed to reveal it, and I am forced to the conclusion that *xanthopus* is merely a manuscript name.

DISTRIBUTION.—Known, so far as the present material would indicate, only from British Honduras, where it was taken at Belize (Baker collection, Cornell University) and at Manatee.

***Melipona fasciata* subspecies *indecisa* Cockerell**

Melipona fasciata indecisa COCKERELL, 1919, Proc. U. S. Nat. Museum, LV, p. 206.

♀.—Head dark. The clypeus, mandibles, and labrum dark red. The clypeus immaculate in the paratype and two other individuals from the same locality as the type, but with an indistinct vestige of a median longitudinal line in the type itself. The front with short, appressed, inconspicuous, pale pile and much more conspicuous, long, up-slanting, black hairs. The hair on the vertex black.

The hair on the mesonotum and scutellum prevalingly black though with some intermixed gray to ochraceous. A patch of black hair below the tegulæ, grading into brownish farther down on the pleura, and finally into white on the ventral side. The integument of the scutellum usually black like that of the mesonotum but sometimes rufous.

The coxæ, trochanters, and femora mahogany-colored, a dark streak running lengthwise on the under side of the hind femora. The tibiæ of darker hue, scarcely differentiated from black, but with a mahogany-colored spot at the base of the hind tibiæ. The tarsi mostly dark, the hind metatarsus usually with a mahogany-colored edging posteriorly, the apical joint of the tarsi ferruginous; the claws, as usual, dark on their apical half. The hair mainly light on the joints above the tibiæ; mainly dark on the tibiæ and joints below the tibiæ. The hairs fringing the hind tibiæ exclusively black; the microscopic hairs on the under side of the hind tibiæ, as usual, silvery; the metatarsal brushes deep copper-colored.

Wings hyaline, stained with yellow, particularly at the base. Venation ferruginous, darker on costal and subcostal veins.

The ground color of the tergites black (tergite 1 inclines to deep, dark red). The tergites without apical bands; a dull, indistinct, red line along the margin of tergite 2 and sometimes of tergite 3, is scarcely to be differentiated from the basal black of these tergites. A tuft of light hairs on each side of the basal concavity. Tergites 1-2 otherwise rather glabrous. The semierect hairs of tergites 3-6 black, increasing in length and conspicuousness toward the apex of the abdomen. Fringing the apex of tergites 3-5 is a dense array of flat-lying, copper-colored to pale hairs. The hairs on the venter pale except on the apical sternite, the hairs of which are black, and on the penultimate sternite, the hairs of which are sometimes red.

♀.—Unknown.

♂.—Unknown.

TYPE.—The type material (No. 21680) in the U. S. National Museum consists of the type and a paratype, both from Lagunita de Aroa, Venezuela, where they were collected at an elevation of 2000 feet by M. A. Carriker.

DISCUSSION.—Like certain of the Central American subspecies,—*fasciata*, *melanopleura*, *belizex*,—this subspecies is distinguished by the dense fringe of flat-lying hairs at the apex of tergites 3–5. It is very nearly related to subspecies *fasciata*, differing from it among other things in the more complete extinction of the abdominal bands, a condition recalling that of *fuscata*.

DISTRIBUTION.—Venezuela.

Melipona fasciata subspecies fuscata (Lepeletier)

Melipona fuscata LEPELETIER, 1836, 'Hist. nat. des Insectes, Hyménop.,' I, p. 424.

?*Melipona fuscata* SPINOLA, 1840, *Annales des Sciences natur.*, (2) XIII, p. 130. (From "Cayenne"; almost certainly not *fuscata*.)

?*Trigona fuscata* SMITH, 1854, 'Catal. Hymen. British Mus.,' part 2, p. 413.

Melipona fuscata DALLA TORRE, 1896, 'Catal. Hymenopterorum,' X, p. 579.

Melipona fuscata SCHULZ, 1903, *Sitzungsber. Math.-Phys. Klasse der K. B. Akad. der Wissens.*, München, 1904, XXXIII, pp. 817–818. (Peruvian record.)

Melipona scutellaris subspecies *fuscata* DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., p. 151. (At least Iquitos specimens in all probability.)

Melipona scutellaris illota COCKERELL, 1919, *Proc. U. S. Nat. Museum*, 1920, LV, p. 203. (Callow specimen.)

Melipona scutellaris subspecies *fuscata* DUCKE, 1925, *Zool. Jahrb. System. Geogr. und Biol.*, XLIX, p. 432. (At least Peruvian specimens in all probability.)

Lepeletier's description reads in translation as follows:

♂.—"Antennæ black, brown only below. Head and thorax black; their hairs black. Abdomen of a blackish brown; its hairs black; lower border of each of the segments brownish red. Legs of a brownish red. Wings transparent, a trifle reddened; nervures reddish."

♀.—Unknown.

♂.—Unknown.

TYPE.—Probably no longer in existence. The type of *illota*, here regarded as a synonym, is in the U. S. National Museum. It is No. 21676 and was collected by Rosenberg at Palcazu, Peru.

DISCUSSION.—In the absence of Lepeletier's type, which was described from Peru, it is somewhat difficult to arrive at a clear-cut conclusion regarding the precise character of the insect involved, and, in view of the fine distinctions that must be applied in order to keep distinct typical *fasciata* and its dark-haired relatives—*fuscata*, *nigrescens*, *indecisa*, and *lateralis*,—it has seemed advisable not to amplify Lepeletier's description by the inclusion of characters possibly foreign to his type but to reserve for the DISCUSSION the interpretation of *fuscata*.

The most significant element in Lepeletier's description is the allusion to the lower border of each of the segments as brownish red (*bord inférieur de chacun des segments d'un testacé brunâtre*). Ducke (1925)

has interpreted this as implying an absence of a banded condition; “. . . abdomen (with the exception of the base of segment 1) usually black (sometimes the chitin of some of the body parts inclines to brownish red, most frequently on the apical rims of the abdominal segments.)” This is the interpretation also adopted here. There is a specimen in the collections under examination from El Encanto in the Putumayo District of Peru. It has merely a reddish-brown tinting of the apices of its tergites, sometimes barely to be differentiated from the prevailing black into which these brownish rims blend. If Lepeletier’s description of the hair of the thorax as black is to be applied not merely to the dorsal region but also to the mesopleura, this specimen allies itself in this respect, too, with *fuscata*. As it was secured, like the type, in Peru, I should have had little hesitation in accepting it as the basis for a re-description of *fuscata* were it not for the fact that it has maculations on the face, whereas Lepeletier’s description reads: “head black.” Nevertheless the maculations are rather pale and subdued and may therefore not have seemed to Lepeletier to deserve emphasis. The maculations on the sides of the face in the El Encanto specimen are broad and rather clavate below, but narrow abruptly to extend upward for about three-fourths of the length of the eye along the inner orbit. The clypeus has a brief median stripe and its antero-lateral angles are maculated. Even the mandibles are yellowish on the basal half, reddish on the apical half (in this respect resembling *nigrescens*).

In the U. S. National Museum is yet another Peruvian specimen—from Moscas, where it was secured by D. Weiss. This specimen accords closely with the Putumayo specimen above alluded to. In spite of the golden-brown color (rather than black) of the hairs on the vertex and pleura of Cockerell’s *illota* (also described from Peru) and the lighter brown color, variegated with black, of its legs, I believe that *illota* is probably merely an immature specimen of the insect here proposed as *fuscata*. There is a specimen in the collections here reported upon that shows definite evidence of immaturity (such as the pale instead of black propodeum). This specimen comes from Puerto Bermudez in Peru and is in all essentials so like *illota* that it strengthens the belief that the type of *illota*, too, is a callow.

All of these Peruvian specimens lack definite banding on the abdomen, but have the brownish-red apical edging mentioned in Lepeletier’s description. The legs, although variegated with black, might not inaptly be referred to as “brownish red,” for the coxæ, trochanters, femora, and the base of the hind tibiæ are of that color. I believe that

fuscata should be sought in Peru, from which it was described, and the insect here discussed seems to me best to accord with what is indicated for *fuscata* in Lepeletier's description.

Friese's Costa Rica specimens of *fuscata*, listed in 1916, are, I believe, typical *fasciata*.

DISTRIBUTION.—As here delimited, known thus far with certainty only from Peru.

The specimen from El Encanto in the Putumayo District of Peru was taken August 23, 1920, by the Cornell University Expedition; the Puerto Bermudez specimen was collected July 14, 1920, likewise by the Cornell University Expedition.

***Melipona fasciata* subspecies *nigrescens* (Friese)**

Melipona nigrescens FRIESE, 1900, Természetrájsi Füzetek, XXIII, p. 381.

♂.—Clypeus reddish brown with a narrow, pale median stripe; antero-lateral angles faintly yellow. Indistinct, yellowish-red lateral face-marks, broad and rather clavate below, narrowing abruptly and extending along inner orbit of eye for three-fourths of its length. Labrum yellowish red; mandibles yellowish red on basal half or two-thirds, a deeper red apically, their apical rim and basal prominences black. Semiappressed, plumose pile of light hue on sides of face and front in addition to up-slanting, black hairs. Long, erect, black hairs also on vertex. The genæ, especially on their upper half, with a rather dense covering of flat-lying, plumose, light, pubescent pile (almost scalelike in appearance) in addition to scattered, down-slanting hairs, which may be dark or light or intermixed. The hairs fringing the lower edge of the mandibles dark or prevalingly dark.

Brownish to black are the hairs also on the mesonotum and scutellum as well as those on the mesopleura. On the thorax below there is sooty gray hair; the hair on the metapleura and propodeum is ochraceous. The scutellum, like the mesonotum, black, but the axillæ in two of the three specimens here considered have a faint, pale mark.

The legs deep-brown to black with a fairly well defined, reddish-brown area at the base of the hind tibiæ. The lower joints of the tarsi brown, occasionally splashed with black; the hind basitarsi narrowly rimmed with brown. The hairs on the joints above the tibiæ mainly light but sometimes with occasional dark hairs intermixed; the hairs on the tibiæ and tarsi dark except that there is the customary short, silvery pile on the under side of the hind tibiæ and that the hairs on the under side of the tarsi, which are rather darker than in the related subspecies, have in some lights a deep bronze reflection.

The wings about as in *fasciata*. The tegulæ ferruginous to yellowish brown.

The first sternite yellowish red. The abdomen above black, the first five tergites bearing along their apex a narrow but usually distinct, undulating, pale band that is broadest at the middle and rather curvilinearly emarginate above at the sides (in one of the specimens the bands on tergites 4 and 5 are blurred). A tuft of sooty hairs on each side of the basal concavity. Short, erect, inconspicuous, black hairs on all the tergites, rather longer on tergite 1 than on the tergites immediately following. Long, bristle-like, black hairs on the apico-lateral margins. The shorter hairs are visible

when the abdomen is viewed from the side. The last four sternites with more or less black hair, the apical one and sometimes the penultimate sternite having exclusively black hairs.

Length 10 to 11 mm.; width of thorax $4\frac{1}{4}$ to $4\frac{1}{2}$ mm.; length of forewing, including tegulae, $8\frac{1}{2}$ to 9 mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—Friese's description was based on six specimens,—five from Popayan, Colombia, and one from Caucathal, Colombia, in the collection of the Museum in Budapest. Two specimens taken subsequently (1908) at Popayan, the type locality, and identified by Friese as *nigrescens* are in the collection of The American Museum of Natural History.

DISCUSSION.—From typical *fasciata* the present subspecies may be distinguished by its more brightly colored, yellowish-red mandibles, by the indistinct, yellowish-red, lateral face-marks (absent in *fasciata*), by the greater extension of the dark hairs on the mesopleura, and by the uninterrupted, pale yellow bands (those of *fasciata* dimming medianly into reddish brown).

From *lateralis* it can be differentiated most readily by the color of the hairs on the mesopleura, which are black instead of light with a tawny patch, and by the generally deep brownish to black hair (instead of intermixed light and dark hairs) on the vertex and the dorsum of the thorax. The abdominal bands are rather more slender and undulating, and the presence of some black hairs on the sternites preceding the apical sternite serves further to differentiate *nigrescens* from *lateralis*. The presence of hairs on tergites 1-2 of *nigrescens* is in contrast to the virtually glabrous condition (except for the tufts of hair on each side of the basal concavity) not only in *lateralis* but in *fasciata*.

Its relationship to *fuscata* as here interpreted is very close; for it shares the facial maculations, the tint of the wings, and in general the color of the hairs of that insect. But the presence of the bands on the abdomen of *nigrescens* and the merely reddish-brown tinting of the apical rims in *fuscata* furnish a possible line of cleavage between *fuscata* from Peru and *nigrescens* from Colombia.

The characters mentioned in the key will serve to show its affiliation to, as well as its independence from, *boliviana*.

Alone of all the subspecies of *fasciata* with black abdomen that have come to my attention, *nigrescens* has black hairs on the last four sternites, though it is possible that, were larger series available, aberrant specimens bridging this condition might be found among the related subspecies. The subspecies (?) *melanopleura*, belonging to the division with red or

light brown abdomen, occasionally has some black hairs on the two sternites preceding the apical one.

DISTRIBUTION.—Known only from Colombia, where it has been taken at the following places: Popayan, May 25, 1908, and June 15, 1908 (Fasse?), San Antonio, August 14, 1908, and Caucathal.

***Melipona fasciata* subspecies *seminigra* (Friese)**

Melipona seminigra FRIESE, 1903, Zeitschr. für Hymenop. und Diptera, III, pp. 359–360.

Melipona scutellaris subspecies *seminigra* DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., pp. 151–152.

Melipona seminigra COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 201.

Melipona scutellaris subspecies *seminigra* DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, p. 432.

♀.—The clypeus, supraclypeal area, sides of face (broadly below, taperingly above) and the mandibles except for their narrow, black apical edge, a rich castaneous; the rest of the head black. The clypeus sometimes with a faint bisecting line of yellow. The scape and the two basal segments of the flagellum more or less castaneous to black; the flagellum shiny black on its upper side, ferruginous to brown beneath. The clypeus and the adjacent parts of the sides of the face devoid of hair. The region between the antennæ and the ocelli with semiappressed, short, pale, plumose hairs and, in addition, a dense growth of longer, up-slanting, black hairs. A few black hairs growing at right angles to the face in the space between the antennæ. The vertex with long, erect, black hairs followed by a patch of white hairs on the occiput (these occipital hairs are red in specimens from the Rio Negro–Rio Branco). The cheeks with pale, appressed, scalelike hairs and, in addition, longer, down-slanting, whitish hairs. The hairs fringing the lower border of the mandibles pale to reddish.

A scanty distribution of pale, semiappressed hair on the mesonotum and, in addition, much more conspicuous and abundant long, erect, black hairs. Black, too, are the hairs on the scutellum, but the posterior border is fringed with white hairs or yellowish red (Rio Negro–Rio Branco specimens). The hair of the mesopleura largely whitish but with a more or less extensive patch of bright fulvous that at its upper edge, immediately below the tegulæ, sometimes grades into black. The hair on the metapleura and propodeum whitish and plumose. In Friese's original description (1903) the scutellum is referred to as being of reddish color; Ducke (1916, 1925) says that at least on its middle it is yellowish; in the specimens before me the axillæ are black, the scutellum yellow except for its often darker apex or apical rim.

Friese, 1903, described the legs as black; Ducke alludes to them as sometimes partly red, with the hair on the hind tibiæ always black. In the specimens here considered the femora and tibiæ are deep reddish-brown, with black apices; the basitarsi are largely black, and all but the ferruginous apical tarsal joints also show a predominance of black. The coxæ, trochanters, and femora of all the legs have pale hairs. On the outer surface of the front and middle tibiæ there are short, semierect, black hairs; longer, pale to light brown hairs are on the inner surface. The fringing hairs of the hind tibiæ are black, and black, too, are the hairs on the outer surface of all the tarsal joints except the apical one, which has pale to reddish hairs.

The wings of the type usual in *fasciata*. The tegulae ferruginous.

The abdomen is bright ferruginous and distinctly shiny due to the almost complete absence of hair over much of its surface. There is a patch of erect, pale hairs on each side of the concavity at the base, and there are thin patches of black hair at the extreme sides of each of the tergites, these hairs becoming progressively longer as the apex of the abdomen is approached. The venter is covered with pale hairs, except on the apical sternite, where the hairs are black. In specimens from the Rio Negro-Rio Branco the hairs on the sternites are more yellowish, even grading into bright flame-color on the sternite or two sternites preceding the apical one.

Length $10\frac{1}{2}$ to 11 mm.; width of thorax 4 to $4\frac{1}{2}$ mm.; length of forewing, including tegulae, $8\frac{1}{4}$ to $8\frac{3}{4}$ mm.

(For comments on alleged structural differences in *seminigra* see the DISCUSSION.)

♀.—Unknown.

♂.—Unknown.

TYPE.—Friese described *seminigra* on the basis of five specimens taken by Ducke at Obidos on July 26, 1902. One of the specimens in the American Museum collection has on the label data corresponding in all details with the above as to date, place, and collector, and I assume, therefore, that it is part of the original type material. Another specimen from Obidos determined by Friese is in the National Museum (Cockerell, 1919).

DISCUSSION.—Friese speaks of the malar space as being longer in this species than in the related subspecies *fuscipes*. I have compared with *seminigra* specimens from Guayaquil, Ecuador, which Friese considers *fuscipes* (but which Cockerell has separated from *fuscipes* as *mimetica*). It is true that the malar space is ACTUALLY shorter in these Guayaquil bees, but I doubt whether it is RELATIVELY shorter. The subspecies *seminigra* is more robust than is *mimetica* and that explains, I think, the seemingly greater length of its malar space.

DISTRIBUTION.—Ducke delimits the distribution of this subspecies as follows: "Known only from the north side of the lower Amazon (drier region) but of frequent occurrence there; is found especially in open places and in more sunny woods."

It is possible, therefore, that under a strict interpretation of *seminigra* the specimens from the Rio Negro-Rio Branco region included in the above description should be considered rather a variety of *seminigra*, but the differences are of so slight a character that I prefer to ignore them.

Two specimens in the present collections bearing the identification labels of Friese are from the State of Para: Obidos, July 26, 1902 (Ducke); Alemquer, 1904 (Ducke).

The specimens that distinguish themselves by reddish occipital hairs and reddish hairs on the penultimate sternite come from the

following localities in the State of Amazonas: Lower Rio Negro, August 21, 1924 (J. Bequaert); Carvoeiro, near the junction of the Rio Negro and the Rio Branco, August 26, 1924 (J. Bequaert); near Carmo, Rio Branco, August 30, 1924 (J. Bequaert).

***Melipona fasciata* subspecies *abunensis* (Cockerell)**

Melipona abundensis COCKERELL, 1912, *Psyche*, XIX, p. 48.

Melipona scutellaris subspecies *abunensis* DÜCKE, 1916, 'Enumeração dos Hymenopteros,' etc., pp. 153-154.

Melipona abundensis COCKERELL, 1919, *Proc. U.S. Nat. Museum*, 1920, LV, p. 201.

Melipona scutellaris subspecies *abunensis* DÜCKE, 1925, *Zool. Jahrb. System. Geogr. und Biol.*, XLIX, pp. 434-435.

♀.—Head black, clypeus and adjacent sides of face sometimes deep chestnut, with or without "a feebly indicated median dark red stripe" on clypeus. Face otherwise immaculate except for sometimes a yellow maculation on the malar space. The mandibles and labrum black or castaneous (specimens from the same locality may illustrate both extremes). The lower half of the face bare; the front with semi-appressed, plumose, light hairs and longer, up-slanting, dark hairs; the vertex, with erect, long, black hairs, followed on the occiput by light hairs ("light fulvous" in the description of Cockerell). The cheeks with scalelike, appressed, light hairs in addition to longer, down-slanting, white hairs. The labrum, and especially the under side of the mandibles, fringed thinly with long, ochraceous hairs. Scape black, red at extreme base; the two basal segments of the flagellum partly darkened beneath as well as above; all the other segments of the flagellum shiny black above, reddish beneath.

The mesonotum more finely sculptured than in many other subspecies, justifying Cockerell's term "shiny black"; it does not, however, quite attain the smoothness that is indicated for the subspecies *boliviana*. Short, appressed, pale hairs on the mesonotum in addition to longer, more conspicuous, black hairs. According to Cockerell "more than the posterior half" of the mesothorax is bare, but in the specimens here assigned to *abundensis* this is not the case. "The scutello-mesothoracic suture with black hair in front and pale behind." The dark reddish to black scutellum with black hairs except on the posterior rim, which is fringed by light hairs ("pale fulvous"). Hair of mesopleura pale except for a black patch below the tegulae. Hair of metapleura and propodeum pale and plumose.

The wings described as "orange-ferruginous, with ferruginous nervures," of the type usual in *fasciata*. Tegulae ferruginous.

Legs black (sometimes a very deep brown), except for the last tarsal joint and the claws on their basal half, where light brown replaces black. The hair on the coxae, trochanters, and femora pale, the white fringes of the under side of the femora longer on the front and middle pair than on the hind pair. The hairs on the front and middle tibiae black both on the outer and on the inner side; the hairs fringing the hind tibiae also black (those on the under side, as usual, short and silvery). All the tarsi except the apical joint with black hair on the outside, golden to copper-colored hair on the inside; the apical joint golden-haired both without and within.

Abdomen bright chestnut-red, without bands. A dark streak on each side of the basal concavity and, in addition, a tuft of erect, white hairs. At first glance the ab-

domen above appears largely glabrous, but on closer examination short, fine, scattered ferruginous hairs become manifest. They are coarser and more numerous at the sides of the tergites and become long and conspicuous on the last two tergites. While in the main these hairs are ferruginous, there are a very few dark hairs sometimes on the sides of the last three segments. Pale hairs on the venter except for the last two or sometimes three sternites, the hairs of which are red.

Length 10 to 10¼ mm.; width of thorax 4 mm.; length of forewing, including tegulæ, 8¼ mm. to 8½ mm.

(For comments on alleged structural differences in *abunensis* see the DISCUSSION.)

♀.—Unknown.

♂.—Unknown.

TYPE.—The type material was collected along the Abuna River by the Stanford Expedition to Brazil under J. C. Branner.

DISCUSSION.—Cockerell (1912) speaks of the head as "broad" and the malar space as "large." Dücke (1925) says that the malar space is "much larger than in any other form of the species (*scutellaris*, here considered a synonym of *fasciata*)" and that the face and tibiæ are "broader than in the most robust individuals of other forms." Measurements I have made with a micrometer scale seem to indicate, however, that the malar space is no longer than in *nigrescens* or *boliviana*, while the breadth of the face at the level of the middle ocellus compared with the length of the eye is slightly greater in *boliviana*, and in *nigrescens* duplicates the proportions of *abunensis*. The hind tibiæ in each of these subspecies seem to me to be of fairly uniform breadth.

DISTRIBUTION.—In addition to the type locality Dücke (1925) mentions the forests of the Pirocúluina and Serra do Norte (possibly the same as São João da Serra do Norte) in Matto Grosso. A specimen from the last-mentioned locality, bearing Dücke's identification label, is among the material here considered. It was caught by Ribeiro.

The subspecies occurs also in Bolivia. Three specimens, collected by W. M. Mann while on the Mulford Biological Expedition of 1921–22, are from Ivon Beni, Bolivia. This is a locality on the upper part of the Rio Beni, not far from the Rio Abuna, that forms the northern boundary of Bolivia and is the type locality of *abunensis*.

Melipona fasciata subspecies boliviana, new subspecies

♀.—More shiny than any of the subspecies of *fasciata* thus far considered.

The lower half of the face very finely tessellated and semishiny, the front with an ultra-fine tessellation, the vertex with the usual punctures in the slightly elevated region behind the ocelli. The face below the level of the antennæ largely devoid of hair. The mandibles thinly fringed below with longish, golden hairs, and the labrum with hairs of intermixed character, the longer ones black, the shorter ones light. Low, rather appressed, plumose pile on the upper half of the face in addition to

black hairs of intermediate length growing at right angles between the antennæ, longer, upward-growing, black hairs on the front, and still longer, erect, black hairs on the vertex. The genæ with a dense covering of very short, appressed, plumose, whitish hairs, scalelike in appearance, and longer, down-slanting, pale hairs, with now and then a few darker hairs intermixed. The lower half of the face mahogany-colored, the upper half black. The mandibles for the most part a little darker than the clypeus, which is traversed medianly by a thin, reddish-yellow, longitudinal stripe that does not quite reach its apex or base. No lateral face-marks. The scape black and shiny, slightly reddish brown at the base; the first two joints of the flagellum black and shiny; the other joints shiny and black above, dull brown below.

The mesonotum smooth and polished, a very few scattered punctures anteriorly. The mesopleura also polished with the sparse but distinct punctures usual in this region in *fasciata*. The scutellum polished above but the posterior rim with granular punctation similar to that described in the case of typical *fasciata*. The mesonotum with low, semiappressed, light hair and more conspicuous, erect, long, black hair (as noted by Ducke for *fuscata*). The scutellum mostly with long, dark hair but with a posterior fringe of long, light hair (as noted for *lateralis*). The hair on the mesopleura above black, grading into white on the underside of the thorax. The hair on the metapleura and propodeum (which is as strongly sculptured as in the typical subspecies) pale, relatively sparse, and plumose. The chitin of the thorax black, barring the scutellum, which is dark reddish-brown except for its yellowish posterior tip. The axillæ incline to be a trifle lighter than the scutellum, but their coloration is somewhat variable and possibly that of the scutellum may also prove to be variable, as is the case in *fasciata*, in *fuscata* (according to Ducke), and in *lateralis*.

The legs with light hairs on coxæ, trochanters, and femora, and dark hairs on the tibiæ and tarsi, except for the usual golden to copper-colored hairs on the inner surface of the tarsi and the short, silvery hairs on the inner surface of the hind tibiæ. The wings transparent, tinged with yellow; the venation yellowish except for the costal and subcostal veins, which are deep reddish-brown.

The wings of the type usual in *fasciata*. The tegulæ ferruginous.

Tergite 1 semidull with a fine but dense tessellation, and a few scattered, faint punctures. Tergite 2 finely tessellated basally and with sparse punctures interspersed; apically more nearly smooth with elongate, shallow, groovelike punctures directed lengthwise. The other tergites with very fine, almost obliterated, transverse, microscopic ridges and scattered punctation, occasionally elongate and blotchy like that on tergite 2. All of the tergites beyond tergite 1 shiny, due to the nearly polished condition of their surface, and the scanty growth of mostly short, dark hair. The hair is long only on the sides of the apical tergites, especially tergite 5; on each side of the basal concavity of segment 1 there is a tuft of long, whitish hairs. The venter is covered with light hairs, except the apical sternite on which the hairs are black. The chitin of the tergites is deep reddish-brown to black. Just before the apical rim of tergites 1-5 (sometimes only on 1-3 or 1-4) there are narrow, pale bands that are fairly distinct medianly but become dull and vague toward each side (reversing the condition noted in typical *fasciata* from Costa Rica). The first segment of the venter yellowish brown. The several sternites reddish brown, shiny and faintly ridged on their usually telescoped and concealed basal half, coarsely granular and deep yellowish-brown on their apical halves, their rims smooth as are those of the tergites.

Length, 10 to 11 mm.; width of thorax $3\frac{3}{4}$ to 4 mm.; length of forewing, including tegulæ, $8\frac{1}{2}$ to $8\frac{3}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—The holotype and one paratype are at the National Museum; the other paratype is at The American Museum of Natural History.

DISCUSSION.—This form distinguishes itself not only by the slightly different character of its abdominal maculations but by its remarkably delicate sculpturing. It is very close to an insect from Itaituba assigned by Ducke to *fuscata*, but differs from it in having the mesonotum polished, not noticeably tessellated, and in the presence of the fine, pale bands on the abdominal tergites. Ducke records *fuscata* from Bolivia, and it is possible that the specimens so classified belong to what is here considered a new subspecies. The differences between *boliviana* and *nigrescens* are indicated in the key.

DISTRIBUTION.—Rio Colorado, Bolivia, September (Wm. M. Mann); Tumupasa, Bolivia, December (Wm. M. Mann).

***Melipona fasciata* subspecies *lateralis* (Erichson)
and its variety *kangarumensis* Cockerell**

Melipona lateralis ERICHSON, 1848, in Schomburgk's 'Reisen in British Guiana in den Jahren 1840–1844,' III, p. 592.

Melipona lateralis SMITH, 1854, 'Catal. Hymen. British Mus.,' part 2, p. 406.

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

Melipona fasciata FRIESE (nec Latreille). (Several specimens determined by Friese in the collection of the American Museum.)

Melipona scutellaris subsp. *flavofasciata* DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., p. 150.

Melipona intermixta COCKERELL, 1918B, Bull. Amer. Mus. Nat. Hist., XXXVIII, pp. 687, 688.

Melipona lateralis lateralis COCKERELL, 1920B, Bull. Amer. Mus. Nat. Hist., XLII, pp. 460–461.

Melipona lateralis intermixta COCKERELL, 1920B, Bull. Amer. Mus. Nat. Hist., XLII, p. 461.

Melipona lateralis kangarumensis COCKERELL, 1920B, Bull. Amer. Mus. Nat. Hist., XLII, p. 461. (Variety.)

Melipona scutellaris subspecies *flavofasciata* DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, p. 431.

♀.—Clypeus dull ferruginous, narrowly rimmed along its base and sides with black, the extreme sides of its apical margin sometimes yellowish; there is a faint suggestion of a median stripe. The lateral face-marks with their lower end very broad and reddish, their upward extension sometimes traceable as a narrow, whitish stripe along the inner orbits to near the middle of the front. Labrum ferruginous. Mandibles sometimes ferruginous, but more often chestnut-colored, deepening into black. The antennæ ferruginous below. The front and vertex with black hairs. These are the more conspicuous and are the only ones mentioned by Erichson, but, in addition to

the erect, black hairs, there is semiappressed, hoary, plumose pubescence on the sides of the face and on the front and, following the black hairs on the vertex, a dense growth of whitish to pale ochraceous, branched hairs on the occiput.

The hairs on the mesonotum and scutellum, according to Erichson, are black. Erichson in this case emphasized only the more obvious, neglecting to mention that intermixed with the black to blackish-brown hairs on the thorax above are ochraceous to white hairs, the white hairs being of a fluffy character and abundant anteriorly on the mesonotum in addition to fringing the scutellum posteriorly. This is the condition in *flavofasciata* and *intermixta*. The mesopleura, according to Erichson, with dense, yellow hair, the under side of the thorax being gray. As a rule the mesopleura have in the main whitish hairs, but on their upper part there is usually a spot or patch of rust-colored to fulvous hairs, specimens even from the same locality showing some variability in the extent and intensity of the coloration of these hairs. The scutellum variable, blackish or fusco-testaceous to dull yellow or honey-colored.

Legs black, suffused with reddish. The hairs on the coxæ, trochanters, and femora white; on the outer side of the front and middle tibiæ there are short, semi-erect, black hairs, on the under side the hairs vary from light to dark; the hairs fringing the hind tibiæ black; the hairs on the outside of all the joints except the apical joint of the tarsi black, within golden to dark copper-colored.

The wings of the type usual in *fasciata*. The tegulæ ferruginous.

The first tergite before the apical band red. The ground color of the other tergites black (typical *lateralis*) or clear ferruginous (variety *kangarumensis*)—see Discussion. The five abdominal bands pale, rather broad, uninterrupted, and feebly undulating. Black, rather bristle-like hairs on the apical tergites and usually black hairs also on the apical sternite. Other sternites with light hair.

Length 10 to 12 mm.; width of thorax 4 to $4\frac{1}{4}$ mm.; length of forewing, including tegulæ, $8\frac{1}{4}$ to $8\frac{3}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—The specimens of W. F. Erichson were placed in the Zoological Museum in Berlin, including no doubt *lateralis*. Ducke's *flavofasciata*, it is to be assumed, is represented by type material in the National Museum of Rio de Janeiro, and it is possible that there is type material, too, in other museums, for Ducke (1925) states in a general footnote to his work (p. 357): "Innumerable duplicates have been distributed among the chief museums of the world and have been sent also to Professor Friese." The type of *intermixta* (No. 21665) is in the U. S. National Museum.

DISCUSSION.—Cockerell (1920B) in publishing an English translation of Erichson's *Melipona lateral*is made accessible a description that was previously neglected because of the rarity of the work in which it appeared ('Reisen in British Guiana in den Jahren 1840-1844' by Richard Schomburgk). In discussing *lateralis* Cockerell states: "On the whole, I believe that *M. lateral*is is the valid and prior name for *inter*-

mixta but it probably applies to a race differing in some respects from those at present known." Accordingly he retained his *intermixta* as a variety of *lateralis*, which in the arrangement here adopted is itself made a subspecies of *fasciata*. I believe that the putative differences are probably explained by the inadequacy of the earlier description, but if Erichson's specifications be accepted without challenge, his insect represents an aberration from the much more prevalent condition represented by Ducke's *flavofasciata* and its equivalent, Cockerell's *intermixta*. Erichson says nothing regarding the color of the scutellum, but it may perhaps be assumed that, had it been distinctly lighter than the rest of the thorax, he would have made mention of it. The type of *intermixta* (No. 21665) has a fusco-testaceous scutellum scarcely to be differentiated from that of *flavofasciata*, described as black.

It is a matter of regret that the specific locality where *lateralis* was collected does not appear in the record. It is possible, however, that it was Bartica (or Bartica Grove, as Richard Schomburgk called it). From here several of the expeditions of the brothers Schomburgk started, and it was here that Richard tarried to await the arrival of his brother before they both set forth on their journey up the Essequibo. While at Bartica, Richard Schomburgk found valuable allies among the Mission boys, an industrious group that enriched the collections "with many an insect that they brought back from their excursions into the woods, to which they hurried, armed with their little bows and arrows, as soon as they had any free time." So little mention is made in Schomburgk's work of the collecting of insects that a reference of this kind possesses rather more value as evidence than would be the case if the allusions were many. Should my surmise be correct, the type locality of *lateralis* would be virtually that of *intermixta*, which was described from specimens obtained by Beebe at the Penal Settlement in the Bartica District. By a curious coincidence this prison had just been established at the time Richard Schomburgk visited the near-by Bartica Grove for the last time.

As described by Cockerell, *kangarumensis* differentiates itself from his *intermixta* by the clear ferruginous ground color of its abdomen. But even in the case of *intermixta*, Cockerell noted that "The ground color of the first three abdominal tergites varies; in the lighter forms that of the first is pale fulvous with the shoulders blackish, of the second and third clear ferruginous." In a large series from Kamakusa, British Guiana, there are specimens that would qualify as *kangarumensis*, while in others the ground color of the basal tergites is red and that of the apical tergites black. It is only a step from this condition to the

uniform black ground color (beyond tergite 1) of *lateralis* as described by Erichson, and indeed one or two of the Kamakusa specimens very nearly attain this extreme. (See in this connection the DISCUSSION of *melanopleura* and especially that of *fuscipes*.) There is variability, too, in the proportion of black and gray hairs on the vertex and mesonotum, some specimens having very few black hairs and grading into what I believe to be Ducke's interpretation of *fuscipes*. Finally, the color of the scutellum ranges from black to yellow, the combination of black axillæ and yellow scutellum being one of the intergrading stages.

In connection with the variability in the color of the scutellum not only in the variety *kangarumensis* but in *lateralis* itself, it is of interest to mention that Ducke (1925) in his interpretation of Lepeletier's *fuscata*, which he placed close to his own *flavofasciata* (here made a synonym of *lateralis*), provided for variation in that insect of the coloration of the scutellum, which, generally black, may be sometimes "dirty yellow." It has also been noted that Costa Rica specimens of typical *fasciata* show a like variability in the coloration of the scutellum.

DISTRIBUTION.—*M. fasciata lateralis* was described from British Guiana as was Cockerell's *intermixta*. Ducke's *flavofasciata* was based on insects from localities not only in Guiana but also in northern Brazil. In the present collections there are specimens of *lateralis* from the following regions:

BRAZIL.—State of Amazonas: Carino, Rio Branco, August 31, 1924 (J. Bequaert); Faro, December, 1905 (Ducke); Porto America, Rio Putumayo, August 30–September 2, 1920 (Cornell University Expedition).

BRITISH GUIANA.—Kartabo, Bartica District, November, 1920 (Cornell University Expedition).

DUTCH GUIANA.—Locality not indicated.

The variety *kangarumensis*, originally described from Kangaruma, British Guiana, and from "Savannah a little west of Brazilian border and Ireng River" and from "near Mt. Weitipu," Brazil, is represented in the present collections by material from the following localities:

BRAZIL.—State of Amazonas: Sororoco, Rio Branco, September 1, 1924 (J. Bequaert).

BRITISH GUIANA.—Kamakusa, October 25, 1922 and January 1923 (H. Lang).

***Melipona fasciata* subspecies *trinitatis* Cockerell**

Melipona fasciata subspecies *trinitatis* COCKERELL, 1919, Proc. U. S. Nat. Museum, LV, 1920, pp. 201–202.

♀.—The clypeus reddish brown, infuscated at the base and with a narrow, dark line, slightly clavate at each extremity, bordering the apex. A usually completed, longitudinal, cream-colored stripe down the middle of the clypeus, cream-colored to

ferruginous maculations placed slantingly in the antero-lateral angles and sometimes extended just above the dark apical line along the lower rim of the clypeus, and a cream-colored stripe, clouded here and there with brown and widened clublike below, along the inner orbit of each eye. These maculations very similar to those of *rufiventris* as depicted on plate IV, figure B. The malar space largely black as are the basal prominences of the mandibles and their apical rim. The basal half of the mandibles otherwise cream-colored in contrast to their reddish apical half. The labrum ferruginous. The scape dark with a dull red stripe in front; the flagellum more or less dark below as well as above on the two basal joints, but red below on the remaining joints, the apical one red above as well. Pale, short, plumose pile on the front and the sides of the face but, as usual, more or less concealed or at least made inconspicuous by the longer, up-slanting hairs, which are black like those on the vertex. The hairs on the occiput, however, silvery to ochraceous. Pale, appressed, scalelike hairs on the genæ in addition to longer, down-slanting, silvery hairs. The hairs fringing the lower edge of the mandibles silvery to slightly ferruginous.

The pronotum with a reddish brown integument. The scutellum with a diluted, rather watery yellow integument, somewhat clouded, in contrast to the more whitish axillæ. The mesopleura with pale fulvous hair above, sometimes merely patchlike, succeeded by whitish hair below, rather resembling the condition in *lateralis*. The hair of the mesonotum and scutellum sooty yellow to brownish due to intermixed dark hairs. The black hairs most concentrated toward the center of the mesonotum, where they constitute in some specimens a black patch. The propodeum with ochraceous, plumose hairs.

The legs deep chestnut-red with black areas usually on the following parts: a dark spot at the apex of all the femora, a dark stripe below on the hind femora, more rarely also on the middle femora; a dark spot at the apex of the front and middle tibiæ, enclosing a reddish transparent spot; the hind tibiæ more extensively black at the apex; a dark longitudinal line on the outside of the middle tibiæ; the middle and hind basitarsi except for a narrow border of chestnut-red posteriorly; splashes of black on the black on the other tarsal joints of the hind legs but the terminal tarsal joint unspotted ferruginous except for the black apical half of the claws. The hair of the legs on the joints above the femora pale, on the femora and the joints below the femora black except for the usual silvery, microscopic hairs on the under side of the hind tibiæ and the ferruginous to copper-colored hairs on the terminal tarsal joint. The basitarsal brushes a very deep copper color, verging on black.

The wings of the type usual in *fasciata*. The tegulæ ferruginous.

The basal tergite pale yellowish to cream-colored, its basal concavity, however, narrowly rimmed with black and each of its shoulders darkened. The subsequent tergites yellowish brown to light castaneous, sometimes slightly mottled or clouded. Narrow, cream-colored bands usually present along the apex of tergites 1-4, that on tergite 1 being the narrowest and that on tergite 2 better developed usually than those on tergites 3-4; sometimes there is a faint trace of a band also on tergite 5. Tergite 1 hairless except for the pale patch to each side of the basal concavity. Tergite 2 virtually glabrous, only a few black hairs on each side. The remaining tergites with erect, black hairs that increase somewhat in length and abundance as the apex is approached, being especially dense and conspicuous on the apico-lateral borders. The basal sternite glabrous, the subsequent sternites with silvery hairs, except the apical sternite the hairs of which are black.

Length 10 mm.; width of thorax 4 to $4\frac{1}{4}$ mm.; length of forewing, including tegulæ, $8\frac{1}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—The type (No. 21674) in the U. S. National Museum represents part of a series collected by A. Busck at Port of Spain, Trinidad.

DISCUSSION.—This insect at first glance is apt to be confused with *lateralis* variety *kangarumensis* from which, however, it is separable on the basis of the characters given in the key to the subspecies of *fasciata*.

DISTRIBUTION.—Known as yet only from Trinidad.

***Melipona fasciata* subspecies *pseudocentris* (Cockerell)**

Melipona pseudocentris COCKERELL, 1912, *Psyche*, XIX, pp. 47–48.

Melipona scutellaris subspecies *rufiventris* variety *pseudocentris*, DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., p. 155.

Melipona pseudocentris COCKERELL, 1919, *Proc. U. S. Nat. Museum*, 1920, LV, p. 202a.

Melipona pseudocentris COCKERELL, 1920B, *Bull. Amer. Mus. Nat. Hist.*, XLII, p. 461.

Melipona pseudocentris LUTZ, 1924, *Annals N. Y. Acad. Sciences*, XXIX, p. 207, Fig. 17C (mandible), p. 209.

Melipona scutellaris subspecies *rufiventris* variety *pseudocentris* DUCKE, 1925, *Zool. Jahrb. System. Geogr. und Biol.*, XLIX, p. 435.

♀.—"Clypeus light ferruginous, the upper border infuscated, a median stripe and the lateral corners cream-colored; a crescentic cream-colored supraclypeal mark, bordered above by ferruginous; cream-colored lateral face-marks, broad below, narrowing above, level of middle of front." The mandibles pale on their basal two-thirds, more reddened toward the apex, which is edged with black; basal prominences of mandibles black; labrum pale to slightly ferruginous. Scape ferruginous, or at least ferruginous in front; flagellum more variable, sometimes wholly dark, even the "conspicuously red" third antennal joint being in such cases sooty in appearance; in other instances the flagellum is dark above, ferruginous below, the third antennal joint being more strongly red than the others and in its coloration much like the scape. Whitish, semiappressed, plumose hairs on the sides of the face and on the front in addition to up-slanting, more yellowish hairs. Long, erect, pale fulvous hairs on vertex. The cheeks with pale, flat-lying, scalelike pubescence in addition to down-slanting, pale hairs. The hairs fringing the lower edge of the mandibles pale.

The mesonotum and scutellum with fulvous hair. The mesopleura with bright orange-fulvous hair above, grading into whitish below. The metapleura and propodeum with plumose, ochraceous hairs. As in the subspecies *rufiventris*, the pronotum is cream-colored to ferruginous, there are stripes of this hue bordering the sides of the mesonotum, and the axillæ and scutellum are pale to ferruginous except for the black-dotted posterior margin. In what are probably callow specimens the upper half of the mesopleura (corresponding to the area covered by the hair-patch of bright orange-fulvous hue) as well as the metapleura and propodeum are frequently fulvous; in more fully developed specimens the mesopleura are black and the propodeum black or dark red.

The legs largely fulvous to light red but usually there are sooty stains or black areas at the apices of the femora and of the tibiæ (particularly the hind ones) and the middle and hind basitarsi may be black except for a rimming of ferruginous. The hairs on the coxæ, trochanters, and those fringing the femora below are whitish; those on the femora above rather more yellowish. The hairs on the front and middle tibiæ yellowish to golden, even sometimes red on the anterior part of these joints. The hairs fringing the hind tibiæ rather variable: usually wholly yellowish on the anterior fringe, often wholly so also on the posterior fringe but sometimes more or less replaced by black hairs. The hair on the outer side of the tarsal joints deep yellowish to reddish, on the under side the bristles are deep golden-red to copper.

The wings of the type usual in *fasciata*. The tegulæ ferruginous.

The abdomen bright chestnut-red, usually without bands or with the banding very indistinct and suppressed. (Certain Peruvian specimens transcend these limitations—see DISCUSSION.) A tuft of erect, pale hairs on each side of the basal concavity. The apico-lateral margins of the abdomen with coarse, conspicuous, black bristles and the extreme sides of the intermediate tergites with small, black bunches of bristles, but the tergites in other respects rather devoid of conspicuous hairs, appearing fairly shiny and glabrous when viewed from above although minute, mostly pale hairs become evident when the insect is examined at an angle. The hairs on the venter pale except for those on the apical sternite and sometimes the apical part of the penultimate sternite, the hairs of which are bright ferruginous to luminous copper-colored.

Length $9\frac{3}{4}$ to "about $11\frac{1}{2}$ mm." (type); width of thorax about 4 to $4\frac{1}{2}$ mm.; length of forewing, including tegulæ, $8\frac{1}{4}$ to $8\frac{3}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—The type material (from Mañaos) was collected by the Stanford Expedition to Brazil under J. C. Branner. A metatype from Kangaruma, British Guiana, is in The American Museum of Natural History.

DISCUSSION.—Ducke (1916 and 1925) makes *pseudocentris* a variety of *rufiventris*. The coloration of its legs and the color of the hairs of its head, thorax, and for the most part of its legs indicate close affiliations with *rufiventris*. On the other hand, its larger size and the rather glabrous condition of the dorsum of its abdomen (except for the black bristles on the apico-lateral margins) point to a relationship with *seminigra* (see also DISCUSSION under *merrillæ*). It seems wiser under the circumstances to give *pseudocentris* coequal rank with *rufiventris* and *seminigra* instead of subordinating it to the one or the other. The closest relative of *pseudocentris* is, however, *cramptoni* variety *duidæ*.

Two specimens from Peru are doubtfully included in this subspecies. They seem to be callows and the precise character of the fully colored insect can only be inferred. These specimens have sharp and distinct cream-colored bands along the apex of tergites 2–5, and one of them has in addition a band on tergite 1 and a cream-colored maculation on the

anus. It may be, however, that in the fully developed state these bands would be subdued. Hence Peru has been tentatively included in the range of *pseudocentris*.

DISTRIBUTION.—Described from Mañaos. The specimens in the collections under examination are from the following localities:

BRAZIL.—State of Amazonas: Flores, near Mañaos, July 29, 1924 and August 4, 1924 (J. Bequaert); Vista Alegre, Rio Branco, September 6, 1924 (J. Bequaert); Faro, July, 1903 (Ducke) and December, 1905.

BRITISH GUIANA.—Kangaruma, July 13, 1911 (F. E. Lutz); Kamakusa (H. Lang); Tumatumari, Potaro River, June 29, 1927 (Cornell University Expedition).

PERU.—La Chorrera, Putumayo District, August 20, 1920 (Cornell University Expedition); La Sombra, August 20, 1922 (Cornell University Expedition).

***Melipona fasciata* subspecies *cramptoni* Cockerell
and its variety *duidæ*, new variety**

Melipona fasciata cramptoni COCKERELL, 1920B, Bull. Amer. Mus. Nat. Hist., XLII, pp. 459-460.

♀.—The clypeus light ferruginous, the upper border infuscated, a creamy white, median, longitudinal stripe bisecting it; the lateral angles of the clypeus also broadly of the same color, sometimes slightly duller. A usually cream-colored (sometimes ferruginous) band, completely or incompletely clavate below, extending along the inner margin of the eye, terminating somewhat below the level of the ocelli; "the area mesad of the band more or less reddish" according to the original description, but in all of the specimens here reported upon black and even in the type material of *cramptoni* confined to the part near the clypeus, representing a partial replacement by red of the usually wholly cream-colored clavate expansion of these bands at their lower extremity. The supraclypeal area with a cream-colored maculation, sometimes capped above by red. The mandibles largely ferruginous, more decidedly red toward the apex, which is narrowly rimmed with black. Scape bright reddish in front, or with a reddish stripe that is sometimes distinct only on the lower half. The first joint of the flagellum usually dark above and below, the other joints dark above, sometimes reddish below (in the type material of *cramptoni* and in some of the specimens here reported upon there is little distinction between the upper and the lower surface), the second joint of the flagellum below usually of the same bright red as the scape. The shorter hairs of the front and of the sides of the face plumose, semi-appressed, and pale; the longer, up-slanting hairs of the front "mixed pale fulvous and dark fuscous" in the type material of *cramptoni*, but of an unmixed fulvous in specimens from the Mt. Duida region and from Tumatumari (variety *duidæ*). The hair of the vertex and occiput mainly ferruginous but slightly fuscous, especially at the sides near the top of the eye (this is true not only of the type material of *cramptoni* but also of the variety *duidæ*). The cheeks with a pale, appressed, scalelike pubescence and, in addition, longer, down-slanting, pale hairs. The hairs fringing the lower edge of the mandibles pale to ferruginous.

Mesonotum and scutellum covered with bright fulvous hair, that of the upper half of the mesopleura in typical *cramptoni* of a deeper tinge, "becoming dark reddish brown (some of the hairs nearly black but the general effect a warm, rich color)."

A deepening of the color occurs also in typical *cramptoni* on "anterior corners and posterior middle of mesothorax, and disc of scutellum" or at least there are interspersed dark hairs in these areas. In the specimens from the Mt. Duida region (variety *duidæ*) the coloration is more uniformly fulvous without intermixed black hairs or brownish areas. The lower parts of the pleura with white hairs in both *cramptoni* and *duidæ*. The axillæ and scutellum pale yellow to ferruginous, the posterior border with granular, black punctation.

The legs prevailingly bright ferruginous. In the type material of *cramptoni* and some of the specimens from the Mt. Duida region they are wholly so or with at most a faint clouding of the red on the basitarsi and at the apex of some of the femora and tibiæ. In other specimens from the Mt. Duida region and from Tumatumari there are sharply contrasting black markings at the apical extremities of the femora and tibiæ and on the middle and hind basitarsi. White hairs fringe the under side of the coxæ, trochanters, and femora in both *cramptoni* and its variety. Most of the other hairs of the legs are golden, even those fringing the hind tibiæ being prevailingly of this color. When black hairs occur, they are usually more numerous on the posterior than on the anterior fringe of the hind tibiæ.

The wings stained approximately as in other subspecies of *fasciata*, possibly a very little darker. The costal, subcostal vein, and stigma deep reddish-brown. The tegulæ light ferruginous.

The abdominal tergites black with narrow, usually entire, bands on tergites 1-4, and usually also an entire or fragmentary band on tergite 5 (sometimes tergite 5 lacks a fascia; in both *cramptoni* and *duidæ* this variability may be noted). The bands of *cramptoni* "pale," according to the original description, but relatively deep in tone when compared with the light bands of subspecies like *lateralis* and *eburnea*, the bands of the type material of *cramptoni* as well as of *duidæ* ranging from ferruginous to brownish yellow. A tuft of pale hairs on each side of the pale yellow basal concavity. The first two tergites otherwise virtually glabrous but nevertheless dull and lusterless. The other tergites, too, viewed from above, appear glabrous though more shiny, but closer examination shows that they are sparsely covered with short, black hairs. On the apico-lateral margins there are long, conspicuous, bristle-like, black hairs. Beneath, the abdomen is entirely bright ferruginous, a little paler than the color of the legs. The hairs of the sternites are pale, except those of the apical sternite and sometimes of the penultimate sternite, which are fox-red.

Length 10-11 mm.; width of thorax $4\frac{1}{2}$ to $4\frac{3}{4}$ mm.; length of forewing, including tegulæ, $8\frac{1}{4}$ to $8\frac{3}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—The holotype and four paratypes of *cramptoni* in the collection of The American Museum of Natural History. They bear the designation, "Ireng River to Roraima, Brazil," August 13, 1911 and August 15, 1911.

The holotype and six paratypes of *cramptoni* variety *duidæ* also in the collection of the American Museum. A single paratype (from Tumatumari, British Guiana) at Cornell University (type number 907).

DISCUSSION.—Professor Cockerell in the comments that follow his description differentiates *cramptoni* from two of the Central American

relatives of *fasciata*, namely, *panamica*¹ and *costaricensis*,² and from one of the South American subspecies, *barticensis*(= *paraensis*). A closer relative of *cramptoni*, is, however, in my estimation Cockerell's *pseudocentris*. The size of the insects, their facial maculations, the color of their scape and flagellum, the color of their legs even to the inclusion of the darker markings as noted for specimens of *cramptoni* variety *duidæ*, and the color of the cephalic and thoracic hairs as delimited in *duidæ*, might virtually be interchanged between insects of the one subspecies and the other without affecting in the least the character of either. It is in the abdomen only that difference occurs, *cramptoni* and its variety *duidæ* having a black abdomen with yellow bands, *pseudocentris* a deep red abdomen without bands or with the bands indistinct and suppressed. In a more essential respect, however, namely, the paucity of the hairs on the tergites (except along the apico-lateral margins of the abdomen) the two subspecies are in accord.

So close indeed is the relationship between *pseudocentris* and *duidæ* that one hesitates whether to make *duidæ* a variety of *pseudocentris* or of *cramptoni*, the claims being about equally strong, as between the one and the other. The fact that both *duidæ* and *pseudocentris* were collected on the same day (June 29, 1927) at Tumatumari even raises the question whether, in line with what was noted in the case of *kangarumensis* from Kamakusa, the form with red abdomen does not grade into the black form. Were a larger series available from Tumatumari than the single example of each form, this suspicion might be resolved into a certainty.

For differences between *melanoventer* on the one hand, and *cramptoni* and its variety *duidæ* on the other, the reader is referred to the DISCUSSION under *melanoventer*.

The relationship between *cramptoni* and *duidæ* is very close and yet, so far as the small series of each indicates, the differences are constant. These differences consist mainly of the presence of some dark hairs on *cramptoni* in areas where there are unmixed fulvous hairs in *duidæ* and the definite, black markings on the red legs of at least many of the specimens from the Mt. Duida region and from Tumatumari. These black markings are very vague or wholly lacking in the type material of *cramptoni*.

DISTRIBUTION.—It is interesting to find that *cramptoni*, which was taken in Brazil on the journey from the Ireng River to Roraima, is represented by a variety (*duidæ*) in the Mt. Duida region of Venezuela.

¹Here considered a synonym of subspecies *paraensis*.

²Here considered at most a variety of the typical subspecies.

The specimens from this region were taken at what the collector, Mr. G. H. H. Tate, has designated Middle Camp on his way from Esmeraldo to Mt. Duida. His specimens were secured November 4-7, 1928. Those taken on the latter date were "at drying meat." There is only one other specimen in the collections that is assignable to the variety *dividæ*, a single individual (type number 907) taken by the Cornell University Expedition at Tumatumari, Potaro River, British Guiana, June 29, 1927.

***Melipona fasciata* subspecies *merrillæ* (Cockerell)**

Melipona pseudocentris variety *merrillæ* COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, pp. 202-203.

♂.—The clypeus and sides of the face deep reddish-brown, at first glance seeming immaculate; on closer observation there is usually traceable a faint and narrow ferruginous to yellowish streak bisecting the clypeus longitudinally and a cloudy reddish area in the space between the clypeus and the eye,—a vestige of the clavate face-mark that occurs in *pseudocentris*. The mandibles deep reddish-brown, sometimes even black for most of their extent, toward the apex of a somewhat lighter red but the apical edge narrowly margined with black. The labrum dark reddish-brown. The scape dark brown, indistinctly striped with red in front; the flagellum dark above, usually ferruginous below beyond the first joint. The color and character of the hair as noted in the description of *pseudocentris* except that in some specimens there are a few black hairs intermixed with the fulvous hairs of the vertex and the yellowish hairs of the front are occasionally wholly displaced by dark hair (specimens from the Rio Branco).

The hair of the thorax like that of *pseudocentris* mainly fulvous but in some specimens (two from Mañaos, two from the Rio Branco) with some black hair intermixed on the mesonotum and even on the scutellum. The pronotum ferruginous to honey-colored (of deeper hue than the usually cream-colored pronotum of *pseudocentris*) and in the type specimen maculated with black. The mesonotum without lateral stripes. The axillæ and scutellum ferruginous to honey-colored, the axillæ occasionally clouded.

The legs much darker than in *pseudocentris*, dark reddish to almost black. Usually even in the darker specimens there is a deepening of color at the apices of the femora, at the apices of the hind tibiæ, and on the middle and hind basitarsi. Cockerell's description, "hind tibiæ not at all bicolored," applies only to some of the present specimens, in others there is a distinct dark red basal area contrasting with the black apex. Such a contrast, while absent in the type, is revealed in one of the paratypes. The hairs on the coxæ, trochanters, and femora below white, on the femora above more yellowish, according with *pseudocentris*, but the lower joints of the leg with darker hair than occurs in that subspecies. Thus the semierect hairs on the outer surface of the front and middle tibiæ are blackish and this is the color, too, of the hairs on the outer surface of the basitarsi and of the intermediate tarsal joints; the apical tarsal joints have reddish hair, and the bristles on the under side of all the tarsal joints are a deep copper-red.

The wings of the type usual in *fasciata*. The tegulæ ferruginous.

The abdomen bright chestnut-red, usually without bands or with the banding very indistinct and suppressed. A tuft of erect, pale hairs on each side of the basal concavity, but tergites 1 and 2 otherwise virtually hairless. The apico-lateral margins of the abdomen with coarse, conspicuous, black bristles and small tufts of such bristles at the extreme sides of the intermediate tergites as well. The dorsal surface of the abdomen appears rather hairless, especially when viewed from above. Looked at from an angle, minute hairs, of which many are erect and black, become evident, especially on tergites 3-4; on tergites 5-6 these hairs are somewhat longer although sparse. The hairs of the basal sternites light to strongly ochraceous, the hairs of the apical sternite black, those of the penultimate and sometimes (Rio Branco specimens) of the sternite immediately preceding the penultimate bright copper-colored to flame-red.

Length 10 to 11 mm.; width of thorax 4 mm.; length of forewing, including tegulæ, $8\frac{1}{4}$ to $8\frac{3}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—The type and two paratypes are in the U. S. National Museum, the type bearing Cat. No. 21675.

DISCUSSION.—This meliponid was originally described as a variety of *pseudocentris*, the type specimens of both insects having been obtained at Mañaos. It occupies, however, a somewhat intermediate position between *seminigra*, on the one hand, with which it agrees in respect to the immaculate condition of the face and the dark coloration of the legs, and *pseudocentris*, on the other, sharing with *pseudocentris* the tawny coloration of the hair on the vertex and the mesonotum. In two aberrant specimens of *merrillæ* from the Rio Branco—where *seminigra* is also represented—an invasion of black hairs among the tawny may be noted, and the longer hairs on the front are entirely black, thus tending to indicate that *seminigra* and *merrillæ* are perhaps as closely related as are *pseudocentris* and *merrillæ*. In all three subspecies the dorsal side of the abdomen, while fringed with bristle-like, black hairs on its apico-lateral borders, is otherwise rather glabrous.

DISTRIBUTION.—Described from Mañaos, Brazil. Represented in the present collections by specimens from that locality collected by the Cornell University Expedition, September 7-9, 1920, and by Dr. Joseph Bequaert, July 28, 1924. Other localities in the State of Amazonas represented are: Flores, August 2, 1924 (J. Bequaert); S. Alberta, Rio Branco, August 25, 1924 (J. Bequaert); Carmo, Rio Branco, August 31, 1924 (J. Bequaert).

Melipona fasciata subspecies **rufiventris** (Lepeletier)

Melipona rufiventris LEPELETIER, 1836, 'Hist. natur. des Insectes, Hyménop.,' I, p. 421.

Melipona fulva LEPELETIER, 1836, 'Hist. natur. des Insectes, Hyménop.,' I, pp. 421-422.

Melipona helwola KLUG, cited by Spinola, 1840, Annales des Sciences natur., (2) XIII, p. 123.

Melipona fulva BLANCHARD, [1849], in 'Règne anim. de G. Cuvier,' 3d Ed., Insect., Atlas II, Pl. cxxix, fig. 7. Paris: Fortin, Masson et Cie.

Melipona fulva SMITH, 1854, 'Catal. Hymen. British Mus.,' part 2, p. 405.

Melipona rufiventris, SMITH, 1854, 'Catal. Hymen. British Mus.,' part 2, p. 405.

Melipona mondury SMITH, 1863, Trans. Entom. Soc. London, (3) I, pp. 505-506, Pl. xx, fig. 3 (♀). (Variety.)

?*Melipona rufiventris* SMITH, 1863, Trans. Entom. Soc. London, (3) I, p. 506, Pl. xx, fig. 12 (tongue).

Melipona fulva DALLA TORRE, 1896, 'Catal. Hymenopterorum,' X, p. 578.

Melipona mondury DALLA TORRE, 1896, 'Catal. Hymenopterorum,' X, p. 581.

Melipona rufiventris DALLA TORRE, 1896, 'Catal. Hymenopterorum,' X, p. 583.

Melipona flavolineata FRIESE, 1900, Termész. Füzet., XXIII, p. 382. (Variety.)

Melipona flavolineata DUCKE, 1902, Zool. Jahrb. System. Geogr. und Biol., 1903, XVII, pp. 288, 297.

Melipona flavolineata SCHULZ, 1903, Sitzungsber. Math.-Phys. Klasse der K. B. Akad. der Wissens., München, 1904, XXXIII, p. 820.

Melipona flavolineata nigrifulva FRIESE, 1903, Zeitschr. für Hymenop. und Dipter., III, p. 360. (Variety.)

Melipona rufiventris VON IHERING, 1903, Zool. Jahrb. System. Geogr. und Biol., 1904, XIX, pp. 201-204.

Melipona nigrifulva DUCKE, 1907, Revue d'Entom., XXVI, p. 89.

Melipona flavolineata DUCKE, 1907, Revue d'Entom., XXVI, p. 89.

Melipona scutellaris subspecies *rufiventris* DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., pp. 154-156, Pl. vii, fig. 23 (hind tibia).

Melipona scutellaris subspecies *rufiventris* variety *flavolineata* DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., pp. 155-156.

Melipona fulva DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., p. 154.

Melipona scutellaris subspecies *rufiventris* aberration *nigrifulva* DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., p. 156.

Melipona fulva COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 201.

Melipona mondury COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 202.

Melipona flavolineata COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 202.

Melipona rufiventris COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, pp. 201, 202.

Melipona flavolineata COCKERELL, 1920A, Annals and Mag. Nat. Hist., (9) V, pp. 115-116.

Melipona fulva DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, p. 435.

Melipona scutellaris subspecies *rufiventris* DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, pp. 435-436, Pl. iv, fig. 23 (hind tibia).

Melipona scutellaris subspecies *rufiventris* variety *flavolineata* DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, pp. 435-436.

Melipona scutellaris subspecies *rufiventris* transition form *nigrifulva* DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, p. 436.

Melipona mondury BISCHOFF, 1927, 'Biologie der Hymenopteren,' p. 106.

♀.—The clypeus usually more or less reddish, often narrowly rimmed with black at the base, and with a cream-colored longitudinal stripe of variable breadth bisecting it. The apex of the clypeus with a somewhat vaguely defined, cream-colored border. In typical *rufiventris* there are cream-colored to ferruginous lateral face-marks rimming the inner orbit of the eyes that are clavate below, tapering above, but these maculations may be faint and indistinct, approaching the condition of the variety *mondury*, in which they are lacking. The mandibles ferruginous on the basal half, more distinctly reddish on the apical half; the apical rim and the basal prominences black. Appressed, pale, scalelike hairs on the cheeks in addition to longer, downslanting, whitish hairs. The long hairs fringing the under side of the mandibles also usually white, sometimes yellowish. The longer hairs on the front usually fulvous or corn-yellow like those on the vertex, but pale, plumose, appressed hairs are also present on the front and on the sides of the face. The clypeus relatively devoid of hair (sometimes a few plumose hairs at its sides and base). See plate IV, figure B.

The pronotum cream-colored to ferruginous. The mesonotum dark but in the great majority of cases rimmed on each side with cream-colored to ferruginous bands of varying distinctness (the specimens with more conspicuous mesothoracic banding have been assigned by Friese to *flavolineata* but the separation of this variety from typical *rufiventris* is tenuous). The mesopleura usually black (sometimes black only on their lower half, fulvous on their upper half) but the metapleura and propodeum in many cases fulvous though sometimes brownish to black (the lighter specimens are probably callows). The axillæ and scutellum pale to ferruginous, the scutellum with rather granular, dark punctation on its posterior rim. The hairs on the mesonotum and scutellum a strong fulvous or corn-yellow (Lepeletier calls them "red"). Of a slightly richer tint, almost orange-colored, are the hairs on the upper half of the mesopleura; on the lower half they grade into white. Whitish to yellowish, plumose hairs also cover the metapleura and rather more sparsely the propodeum.

The legs are largely fulvous to light red but usually there are sooty stains or black areas at the apices of the femora and of the tibiæ (particularly the hind ones) and the middle and hind tarsi may be black except for a rimming of ferruginous (sometimes indistinct). The hairs on the coxæ and trochanters and those fringing the femora below whitish; those on the femora above slightly more yellowish. The hairs on the front tibiæ yellowish; those of the middle tibiæ yellowish but sometimes with black hairs as well (specimens from Santa Helena, Bolivia, and Prata, Brazil). The dark basitarsi usually with black to reddish hairs externally, more copper-colored to golden bristles within; there are black to reddish hairs usually on the external face also of the intermediate tarsal joints, but the apical tarsal joint has yellowish hair. The variety *flavolineata*, it has been stated by Ducke, differentiates itself from typical *rufiventris* in having black hairs fringing the apex of the hind tibiæ, but exclusively ferruginous hairs on this joint are the exception rather than the rule, and the gradations from pure ferruginous to a prevalence of black are so gradual that a sharp division cannot be established. The hind tibiæ are depicted on plate VI, figure C.

The wings of the type usual in *fasciata*. The tegulæ ferruginous.

The abdomen red, sometimes with the yellow stripes on tergites 1-5 barely traceable to absent but usually with these maculations distinct. An erect tuft of light hair on each side of the basal concavity. Tergites 1-2 otherwise virtually glabrous. The remaining tergites with usually short, for the most part rather appressed or only semierect, yellowish hairs, best seen when the insect is viewed slantingly,

sometimes also short, more erect, black hairs, and on the apical segments usually longer, black hairs (see DISCUSSION). In the variety *mondury* these darker hairs are absent. The venter with pale hairs on all but the apical sternite, the hairs of which are black.

Length 8 mm. (Ivon Beni and Tumupasa, Bolivia) to 10 mm.; width of thorax $3\frac{1}{4}$ mm. to 4 mm.; length of forewing, including tegulæ, 7 to $8\frac{1}{2}$ mm.

♀ (Gravid).—The head (Pl. I, fig. B) small, only a trifle wider than the mesonotum and falling far short of attaining the breadth of the outer margin of the tegulæ. The eyes very much shorter and narrower than in the worker (compare plate I, figure B, with plate IV, figure B). The malar space very long, even longer than the width of the mandible at its base. The mandibles very broad and rather flat (almost blade-like) in contrast to those of other species, of fairly uniform width, WITHOUT a somewhat hourglass-like median narrowing as in the worker. The outer margin of the mandible gently rounded for most of its extent but abruptly subemarginate near apical end. The apex of the mandible with a very faint, nicklike division at the middle, the margin virtually unindented. The base of the antennæ midway between the apex of the clypeus and the ocelli (as in the male), not nearer to the apex of the clypeus (as in the worker). The clypeus large and rather prominent. The antennæ long and slender, all of the intermediate and apical joints of the flagellum being more than twice as long as they are broad. The facial maculations subdued, dull brownish, represented by a median longitudinal stripe on the clypeus and lateral face-marks that are obsolete below. The malar spaces similarly brownish and the mandibles reddish, narrowly edged with black on the apex. The head much more uniformly hairy than in the worker and the male. The color is in general light to tawny and the hair extends over the clypeus as well as the upper half of the face, the vertex, and the cheeks. The reddish, fringing hairs of the labrum and lower edge of the mandibles particularly long and conspicuous.

As in the worker and male, there are fulvous hairs on the mesonotum and on the mesopleura, whitish hairs on the thorax below. In the specimen on which this description is based the bands along the lateral borders of the mesonotum that are supposed to characterize the worker and male of *flavolineata* are wholly lacking. The scutellum, mostly yellow as in the worker and male, nevertheless has a large, black discoloration at its middle.

The legs largely black to nearly the apex of the tibiæ, where they become ferruginous, that color prevailing also on the basitarsi and tarsi. The middle basitarsi not nearly so broad or flat as in the worker, and slightly down-tapering. The next two tarsal joints of the middle leg much longer than the corresponding joints in the worker and of more uniform width, not so conspicuously cordate as in the worker. The hind tibiæ (plate VI, figure A) relatively narrow, like those of the male, and of rather uniform width, at the apex rather less than half the width of the hind tibiæ of the worker at the corresponding part and rounded posteriorly instead of angulate, their slightly convex outer surface a little flattened toward the apex but without a concavity and covered with hairs. The hind basitarsi not broadened as in the worker and in the male, very similar to the basitarsi of the middle and fore legs. The lower tarsal joints absent from the specimen here described. The hair of the legs much more uniform in color than is the case in the worker, being light to fulvous with scarcely any evidence of darker hairs. As in the worker, the lightest hairs on the leg are those fringing the under side of the femora.

The abdomen much distended with eggs, the usually concealed basal part of each segment completely revealed and contrasting in its yellowish coloration with the dark reddish-brown apical portion, thus presenting a succession of alternations of light and dark. These usually concealed, basal portions prove to be clothed densely with exceedingly short, erect hairs (seen only in profile). The much longer hairs on the dark apical portion of each tergite are in the main dark, but in some lights they appear light brown. There are evidences of pale bands rimming the apex of some of the tergites. At each side of the base of tergite 1 there is a broad, conspicuous, groove-like depression.

Length $13\frac{3}{4}$ mm. (that of abdomen $8\frac{3}{4}$); width of thorax $3\frac{3}{4}$ mm.; length of wing, including tegulae, $6\frac{1}{4}$ mm.

[The above description is based on a single female, unaccompanied by workers, from Passa Quatro, presumably the locality in Minas Geraes. On the label is the comment "Egg-laying." Friese labeled the specimen *rufiventris*. In the darker color of its legs and of the apical half of each of its tergites (the half which in the more compressed abdomen of the worker would be the only one visible) this queen resembles *paraensis* rather than *rufiventris*. Its facial maculations, too, are brownish, not cream-colored, contrary to the condition in the worker. Nevertheless it has seemed unsafe to dispute Friese's interpretation, as in all probability he had workers from the same nest, and Ducke (1925) speaks of the abdomen of the queen as reddish brown, adding that the queen of *flavofasciata*, undoubtedly a misprint of *flavolineata*, is not to be distinguished from the common form. If Friese's identification be correct, it illustrates once more the difficulty in drawing sharp lines of distinction between different subspecies.]

♂.—Facial quadrangle considerably longer than broad, not quite rectangular, the eyes, which are a little more bulging than in the worker, converging slightly below (plate II, figure B). The clypeus prominent, about as long as it is broad at its broadest point and rather convex when contrasted with the flat upper half of the face. The malar space relatively well developed, the shortest distance between the lower edge of the eye and the base of the mandible being about a third of the width of the mandible at its base. The apex of the mandible without teeth, in profile a little irregularly curvilinear. The scape short but the flagellum long, somewhat greater in length than the head is wide at its widest. The clypeus cream-colored with two parallel, brownish lines extending from the base a little more than halfway to the apex and a linear, black patch along the basal half of each of the sides of the clypeus (this is the condition in both of the males here considered, which, coming from the same locality, São Paulo, may present a degree of maculation not always minutely duplicated in specimens from other regions). The maculations on the sides of the face also cream-colored, broad below, tapering to a point at a level well above the base of the antennae. A triangular to crescentic cream-colored maculation in the supraclypeal area. The labrum, and the mandibles except for their reddened apical third, light brown; the malar spaces a slightly deeper brown (in the worker usually

black). Short, pale hairs rather abundant on the clypeus. The other hairs of the head as described for the worker.

The color of the hairs of the thorax as described for the worker. Neither of the specimens here considered has stripes bordering the sides of the mesonotum, although a worker with identical data from the same locality has these stripes well developed. In both specimens the axillæ are dark red and in one of them the scutellum also is of this color. The scutellum of the other specimen is yellowish. (The worker from the same locality has both the axillæ and scutellum yellow.)

The third tibiæ (plate VI, figure B) are much narrower than in the worker, their outer surface convex to flat almost throughout, with only a slight depression near the apex; the apical contour is rounded posteriorly. The hind basitarsi approximate the width of the hind tibiæ at their apex. The legs reddish brown on their basal joints to the inclusion of all or most of the femora and in one of the specimens also of the tibiæ. The apical joints of a somewhat lighter red. No black markings such as were noted in the description of the worker and which characterize the worker from the same region. The hairs on the coxæ, trochanters, and femora whitish; on the other joints yellowish; no black hairs such as were noted in the worker.

The abdomen bright red as in the worker. In the two specimens considered there are only faint vestiges of stripes. The first two tergites virtually glabrous except for the tuft of pale hairs on each side of the basal concavity. The short, rather appressed hairs on the other tergites yellowish; longer, black hairs, in addition, on the apical tergites. Pale hairs on the venter; those of the apical sternite yellowish to ferruginous.

The genitalia are figured in plate X, figure C.

Length 9 to 10 mm.; width of thorax 4 mm.; length of forewing, including tegulæ, $8\frac{1}{2}$ mm. to $8\frac{3}{4}$ mm. (These males are probably larger than the average, as the accompanying worker from the same locality is one of the larger specimens of this subspecies.)

TYPE.—Lepeletier's description records *rufiventris* merely as from Brazil, without designation of the state or political division within that country. Two of the specimens labeled type in the Paris Museum, however, are, respectively, from Rio Janeiro and Nord Capit^e de St. Paul. The third specimen, taken by A. Saint-Hilaire in 1815, is labeled Brazil. The type of *mondury* is in the British Museum. Some of the specimens on which Friese's description of *flavolineata* was based are noted as being in the Museum of Hungary.

DISCUSSION.—From Lepeletier's description it is hard to determine with certainty the precise character of *rufiventris*. Smith (1863) conceived of it as an insect with black scutellum. Friese and Ducke, on the other hand, have identified as *rufiventris* an insect with yellowish scutellum. As a matter of fact, Lepeletier says nothing about the scutellum. His phrase is "corselet noir," not "ecusson noir," so that either interpretation would, on the basis of the description, be equally justified. Nevertheless, the facts of nature seem to weigh in favor of the Friese-

Ducke viewpoint. I do not find among the several Brazilian subspecies of *jasciata* any workers that have the combination of red hair on head and thorax, bright red abdomen, and black scutellum. On the other hand, specimens with red hair, red abdomen, and yellow scutellum are very numerous. The three specimens labeled "type" in the Paris Museum all have the light-colored scutellum.

As both Friese and Ducke separate *flavolineata* from *rufiventris* partly by the presence in the former of thoracic stripes, it is in order to mention that all three so-called type specimens of *rufiventris* have such stripes, although these are barely traceable under the thick thatching of pile unless the insect be held at a certain angle, when they are unmistakably revealed. In fact, judging from the specimens in the collections here considered, the absence of such stripes is exceptional.

Ducke (1925) furthermore distinguishes *flavolineata* by the black hairs on the apical part of the hind tibiae. One at least of the so-called types of *rufiventris*—that from Nord Capit^e de St. Paul—is characterized, however, by such black hairs. The other two specimens have only light hairs fringing the hind tibiae, according with the more usual conception of *rufiventris*, although as a matter of fact Lepeletier's description of this character is especially vague: all he says is, "Legs brown testaceous, with some red hairs." Even specimens with black hairs usually have "some red hairs."

Indeed, sometimes within a single series there are forms that intergrade with respect to the color of the hairs, and this is true not only of the tibial hairs but of those toward the apex of the abdomen. Lepeletier states that the hairs of the anus are in *rufiventris* black. The hairs on the apical part of the abdomen of Smith's type of *mondury* are tawny (Smith describes them as cinereous). This distinction might seem to supplement that based on the presence in *rufiventris* of stripes along the inner orbits of the eye and their absence in *mondury*. Nevertheless, it is of somewhat doubtful validity. After comparing with Smith's type a specimen from the State of Santa Catharina and, because of its complete accord, labeling it a homotype, I noted on running through the series from the same locality the presence in some specimens not only of black tibial hairs but also of black hairs on the apico-lateral margins of the abdomen. Even the absence of the lateral face-marks in *mondury* does not seem a dependable character. In some of the Santa Catharina specimens there are blurred vestiges of such stripes and even the specimens of *rufiventris* designated types in Paris show variability in respect to this character: the stripes are feeble in one or two of these specimens and, if a degree more evanescent, they would approach the condition of *mondury*.

Friese in describing *flavolineata* says nothing regarding yellow stripes on the red abdomen. Some specimens he has labeled *flavolineata* lack such stripes, others have them. So far as the collections before me indicate, such stripes are among the more tangible distinctions of the highly maculated specimens that Ducke interprets as *flavolineata*, but the distinction is one of degree rather than absolute and, as Ducke himself intimates with respect to the representatives from southern Brazil, *rufiventris* and *flavolineata* are so intergraded as to be virtually inextricable.

Variability may be noted among the Bolivian specimens from locality to locality. All of these have the thoracic stripes, the abdominal stripes (but in varying degree), and the partly black fringe on the hind tibiae,—characters associated with *flavolineata*—but in those from Tumupasa the hairs of the tergites are almost exclusively fulvous with only a few black hairs on the apico-lateral borders, while in those from Ivon Beni and Santa Helena black hairs are more abundant on the apical tergites without being confined to the sides. On the other hand, the Tumupasa and Ivon Beni specimens are in accord in respect to their body size and the strength of their abdominal maculations; the Santa Helena specimens are rather larger and less distinctly striped, more nearly resembling in these respects specimens from Prata and from Chapada in Brazil.

Ducke (1916 and 1925) lists both *mixta* and *fulva* as synonyms of *rufiventris*, which Cockerell (1912) challenges. In the case of *mixta* Ducke's interpretation is probably based on the specimen of *mixta* in Paris, which accords with his conception of *rufiventris*. Notwithstanding the fact that this specimen was taken, like the specimen on which Lepeletier based his description of *mixta*, in Rio de Janeiro, it obviously does not coincide with the description and its claim to be the type is open to challenge. Lepeletier's description of *mixta* fits *rufiventris* very inadequately, and one need only cite such fragments of the description as "hair of the head black" (it is corn-yellow in *rufiventris*), "legs black; their hairs black" (the legs are in *rufiventris* mostly bright red) to conclude that the relegation of *mixta* to the synonymy of *rufiventris* does violence to Lepeletier's conception of the insect. There are elements in the description of *mixta* which prompt one to think that it may possibly have been *quadrifasciata*, but all that one can say with certainty is that *mixta* is not the same as *rufiventris*.

The case of *fulva* is less difficult to determine. Making allowance for the inadequacy of the older descriptions, it seems likely that *fulva*

represents *rufiventris* or one of its varieties. The description lists *fulva* merely as from South America, but the wide distribution of *rufiventris* in that continent makes such a generalization less difficult of application than in the case of forms of more restricted range. There are in the Paris Museum four specimens without type label that are designated *fulva*. All are labeled "Cayenne" with the further entry "Leprieur, 1839." Lepeletier described *fulva* in 1836. The specimens from Cayenne have abdomens of a deeper red than is usual in *rufiventris*, more nearly like the condition in Cockerell's *pseudocentris*. Blanchard's colored figure of *fulva*, published 1849, shows a banded condition of the abdomen suggestive of *flavolineata*.

Friese in 1903 described as *flavolineata* variety *nigritula* insects from Para, the legs of which were "more or less to entirely black." Duce (1916) speaks of the legs of *nigritula* as "almost entirely black" and in 1925 as "entirely black." I have not come upon specimens that could be assigned with confidence to *nigritula*, which seems to bear a relationship to *rufiventris* somewhat like that which the dark-legged *merrillæ* bears to *pseudocentris*. From Friese's brief description one gets the impression that the abdomen of *nigritula* is red. Except for this, one would be tempted to think *nigritula* the same as Duce's *paraensis* as here delimited. Duce (1925) speaks of *nigritula* as an intergrading form between *flavolineata* and *paraensis*.

In 1807 Klug described a *Melipona testacea*. It might seem from the name that this insect had possible affinities with *rufiventris* or one of the other red-bellied subspecies of *fasciata*. It should be remembered, however, that it was only in 1807 that *Trigona* was described, and Klug's conception of *Melipona*, like that of Illiger, was not exclusive. In my estimation *testacea* is not a *Melipona* but a *Trigona*, and without doubt it is the yellow form of *cupira*, corresponding to the insect that Friese and Duce have interpreted as Latreille's *pallida*, although in accord with Cockerell, I believe Latreille's *pallida* to be no other than Friese's *kohli*. The description of *testacea* is brief but pertinent, and fortunately it is supplemented by a figure in full color, showing, as the description indicates, an insect entirely testaceous—head, thorax, and abdomen—with wide hind tibiae and, equally diagnostic, almost triangular hind basitarsi. Accompanying the painting is a scale of the actual size of the insect, which confirms the interpretation here given. The wings are represented as basally yellow, apically more iridescent with pink prevailing, and in certain lights that is the condition of the wing revealed in the yellow subspecies of *cupira*. Only we have been putting the cart

before the horse. Henceforth we shall have to speak not of subspecies or varieties of *cupira* but of *cupira* as itself a subspecies of *testacea*.

DISTRIBUTION.—Ducke (1925) lists a large number of localities in the Brazilian states of Para, Amazonas, Matto Grosso, Goyaz, and Ceará in which states both *rufiventris* and its variety *flavolineata* were obtained. Furthermore, in the state of São Paulo and Santa Catharina specimens of *rufiventris* were taken, in São Paulo transition forms between *rufiventris* and *flavolineata*, and in Acre-Territorium and the State of Maranhão specimens of *flavolineata*. Cockerell, 1919, records a specimen of *rufiventris* from Palcazu, Peru, and, 1920A, a specimen of *flavolineata* from French Guiana. Friese, 1916, alludes to the presence of *rufiventris* even in Mexico. Among the Central American specimens here reported upon *rufiventris* does not occur.

From Brazil there are in the present collections specimens representing relatively few localities when compared to those listed by Ducke. However, the Brazilian record is supplemented by specimens from several places in Bolivia.

BRAZIL.—A. Subspecies *rufiventris* and its variety *flavolineata*: State of Amazonas: Carvoeiro, near the junction of the Rio Negro and the Rio Branco, August 26, 1924 (J. Bequaert). State of Matto Grosso: Chapada (probably Sant' Anna do Chapada, close to Cuyaba, January, April, June, November (H. H. Smith). State of Para: Prata, July 7-10 (Parish); Belem, September 19, 1924 (J. Bequaert); Igarapé-Assu, July 21, 1919 (Parish). State of Minas Geraes: Pedra Blanca, February and April (H. H. Smith) and Passa Quatro, ♀, 1897 (Dutra). State of Rio de Janeiro: Rio de Janeiro, 1897 (Peckolt). State of São Paulo: São Paulo, 1897, ♂♂ as well as ♀ (von Ihering). B. Variety *mondury*: State of Santa Catharina (Cornell University).

BOLIVIA.—Variety *flavolineata*: Tumupasa, December, 1921 (W. M. Mann); Ivon Beni, February, 1922 (W. M. Mann); Santa Helena, August, 1922 (W. M. Mann);

***Melipona fasciata* subspecies *paraensis* (Ducke)**

Melipona scutellaris FRIESE (nec Latreille, 1811). Specimens in the American Museum collection identified by Friese as *scutellaris*.

Melipona scutellaris DUCKE (nec Latreille, 1811), 1902, Zool. Jahrb. System. Geogr. und Biol., 1903, XVII, pp. 288, 296. (In part.)

Melipona scutellaris subspecies *rufiventris* variety *paraensis* DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., p. 156.

Melipona fasciata barticensis COCKERELL, 1918B, Bull. Amer. Mus. Nat. Hist., XXXVIII, pp. 687, 688.

Melipona fasciata subspecies *panamica* COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 198.

Melipona fasciata subspecies *barticensis* COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 200.

?*Melipona scutellaris* COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, pp. 200, 203.

Melipona fasciata barticensis COCKERELL, 1920B, Bull. Amer. Mus. Nat. Hist., XLII, pp. 459, 460.

Melipona fasciata panamica COCKERELL, 1920B, Bull. Amer. Mus. Nat. Hist., XLII, p. 459.

Melipona fasciata panamica LUTZ AND COCKERELL, 1920, Bull. Amer. Mus. Nat. Hist., XLII, p. 493.

Melipona scutellaris subspecies *rufiventris* subrace *flavolineata* color variety *paraensis* DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., LXIX, p. 435.

♂.—Head black, a pale, faint stripe bisecting the dark reddish-brown clypeus longitudinally; lateral face-marks of a brownish, indistinct character or wanting. The mandibles dark, of a deep reddish-brown to black (toward the apex the black mandibles are briefly red, to be succeeded by the black edge). The labrum deep red to brownish black. The scape reddish brown at the base, otherwise dark; the flagellum reddish brown below, black above, or dark both below and above. The sides of the face and the front with the usual short, appressed, plumose pubescence, but the longer and more conspicuous, up-slanting hairs of the front largely blackish or brownish as are the hairs growing at right angles in the space between the antennæ. The hairs on the vertex longish, erect, and varying between black (or brownish) and fulvous, the dark hairs being mostly anterior to the fulvous ones. The cheeks with pale, scalelike pubescence and in addition with pale, down-slanting hairs. The hairs fringing the lower edge of the mandibles as a rule reddish brown, rarely pale.

The pronotum usually a reddish brown of variable intensity. The mesonotum as a rule with a pale stripe along each of its sides. The axillæ and scutellum pale to cloudy yellow. The hair of the mesonotum, scutellum, and upper half of the mesopleura fulvous or "brown yellow" (Ducke), sometimes with a few intermixed dark hairs (paratypes but not type of *panamica*); the lower half of the mesopleura with whitish hairs. The propodeum usually with a dull orange-colored spot at its middle (where the sculpturing is at its finest); the hairs of the propodeum plumose, pale, moderately abundant.

The legs dark, usually deep brown to black; in some specimens the depth of hue is rather uniform, in others the femora are of a little lighter hue than the more apical joints. The apical tarsal joint sometimes light reddish-brown, in other cases not greatly different in hue from the joints preceding it. The hair on the coxæ, first and third pair of trochanters, and under side of femora whitish; those of under side of middle trochanters sometimes of a golden hue—a condition more common in subspecies of *interrupta* than within *fasciata*. The hair on the front and middle tibiæ blackish above to brownish beneath (Ducke, 1902, describes the hairs of the front pair of legs of "*scutellaris*" as "pale brown yellow" but the description does not seem to me to apply to the Ducke specimens from Itaituba and Oyapoe in the present collections). The hairs fringing the hind tibiæ mainly black as are the hairs of the outer surface of the basitarsi except in the case of the apical joint, the hairs of which are reddish. Within, the basitarsal brushes are deep golden-brown, in some lights almost black. The hairs on the under side of the hind tibiæ are, as usual, minute and silvery.

The wings hyaline stained with yellow, more deeply so in the median cell. The venation ferruginous; the costal and subcostal veins deep red. The tegulæ pale ferruginous.

Abdomen above deep reddish brown, verging on black, to black. Tergite 1 usually reddish brown, whether or not the succeeding tergites are black. The basal

concavity pale yellow to ferruginous. Yellow bands of varying distinctness present apically on tergites 1-5, in rare cases all but obliterated (brownish and indistinct in the specimen from Itaituba taken by Ducke). The under side of the abdomen pale yellow to ferruginous basally, reddish brown to black on the apical sternites. A tuft of erect, light hairs on each side of the basal concavity. Except for this, the two basal tergites are virtually glabrous. The other tergites with moderately abundant, short, erect, black hairs—longer toward the apex and particularly on the apico-lateral margins. The hairs on the venter mostly pale to yellowish. A few bright copper-red hairs usually on the apical portion of the penultimate sternite; the apical sternite with black hair.

Length 9 to 10 mm.; width of thorax $3\frac{1}{2}$ to $4\frac{1}{4}$ mm.; length of forewing, including tegulae, $7\frac{1}{2}$ to 8 mm.

♀.—Unknown.

♂.—For structural characters of the male see the description of that sex under *M. fasciata* subspecies *rufiventris*. Mandibles piceous; labrum yellowish brown. Clypeus almost wholly cream-colored with two faint, brownish, longitudinal stripes, a crescentic, cream-colored figure in supraclypeal area. Cream-colored, lateral face-marks broad, filling the space between the clypeus and the inner orbit of the eye and extending slantingly upward to terminate on the inner orbit of the eye about halfway between the base of the antennae and the ocelli. The hair on the front pre-vaillingly light, relatively few darker hairs in evidence among the pale, plumose growth. Dark, brownish-black hairs abundant on the vertex. The hairs fringing the lower edge of the mandibles, like those on the cheeks, whitish.

The hair on the mesonotum darker laterally than in the workers described, being brownish rather than fulvous. (The specimens of the worker that Ducke described in 1902 as "*scutellaris*" had yellowish-brown hair on the thorax above, possibly approximating the coloration of these males.) Brownish, too, are the hairs on the scutellum and those of the mesopleura above. Mesonotum bordered laterally with cream-colored stripe. The axillae and scutellum pale. Legs prevaillingly dark. The hair of the legs light on the joints above the tibiae (except that the hind femora have a few black hairs on their upper surface in addition to the more abundant light hairs) and dark on those below the femora except for the usual golden to copper-colored bristles on the inside of the tarsi, the more ferruginous hairs of the apical tarsal joint, and the fine, short, appressed, silvery hairs on the inner side of the hind tibiae.

The abdominal tergites banded near the apex with distinct, cream-colored fasciae, there being such a maculation even on segment 6. The basal tergites bare, the apical ones with black hairs.

The genitalia are depicted on Pl. X, figs. A, B.

Length $8\frac{3}{4}$ mm.; width of thorax $3\frac{1}{2}$ mm.; length of forewing, including tegulae, $7\frac{3}{4}$ mm.

(The above description, based on two specimens from Para, is doubtless too categorical, and it is highly improbable that specimens of this sex always show so melanistic a tendency, there being marked variability in respect to the abundance of the black hairs in workers of *paraensis*.)

TYPE.—In a statement on p. 357 of his paper of 1925 Ducke says that his locality designations, unless there is a statement to the contrary,

are in the case of Amazonia and northeast Brazil based on specimens in the Museu Paraense. As most of the localities he gives for *paraensis* fall within this area, it is to be assumed that the type material is in the Museum of Para.

Of *barticensis*, here considered a synonym, the type from Bartica, Cat. No. 21672, is in the U. S. National Museum. There are metatypes of *barticensis* from Kaieteur, British Guiana, July 21, 1911 and August 13, 1911 (F. E. Lutz), in the collection of the American Museum.

Of *Melipona fasciata panamica*, here also considered a synonym of *paraensis*, there are in the U. S. National Museum the type (No. 21666) and two paratypes.

DISCUSSION.—Ducke described *paraensis* very briefly in 1916 as follows: "Differs from the variety *flavolineata* through the invariable absence of the yellow borders of the mesonotum, and through the color of the abdomen and of the legs, which are black or dark brown. The hairs of the two posterior pairs of legs black with admixture of some light hairs." The description of 1925 is very largely a repetition of that of 1916, the most important difference being the reduction of *paraensis* to the status of a color variety of *flavolineata* instead of according it rank with *flavolineata* as a variety of the subspecies *rufiventris*. In the paper of 1916 Ducke listed as a synonym of *paraensis* his own conception of *scutellaris* in 1902, and in the paper of 1925 he not only retained this synonymy but added to it what he believed to be also a misinterpretation of *scutellaris* on Friese's part. Ducke's description of *scutellaris* in 1902 is, however, at variance with his description of its alleged equivalent, *paraensis*, in 1916, in that the very character he emphasized as absent in *paraensis* (the bands on the mesonotum) is present according to the description of 1902. In so far as the specimens in the present collections may be considered representative, the banded mesothorax is the more usual condition, all of the specimens, males as well as workers, Brazilian individuals as well as those from the Guianas, having such stripes more or less strongly developed. (In this connection see also the DISCUSSION under *rufiventris*.) That these specimens should be included in *paraensis*, notwithstanding the limitation of Ducke's description of 1916 and 1925, receives validation from the fact that two such specimens (from Itaituba and Oyapoe) were collected by Ducke himself in the very localities from which he listed *paraensis* in 1925. These specimens were furthermore identified by Friese as *scutellaris*, and Friese's *scutellaris* was made by Ducke, in 1925, a synonym of *paraensis*.

In his description of 1902 of what he then believed to be *scutellaris*, Ducke spoke of the mesonotum as having brownish-yellow hair,—the

phrase applied also to the hair of the vertex. In the workers here considered the hair on the mesonotum is fulvous in contrast to the partly black, partly fulvous hair on the vertex. Nevertheless, the variability in the proportion of the black hair to the fulvous on the head suggests that in more strongly melanistic specimens the thoracic hairs, too, are at least partly dark, and this is the condition indeed in two males of the present collections taken by Goeldi in Para. These were labeled *flavolineata* by Friese but the black ground color of their tergites would seem to align them rather with *paraensis*. Dark hairs occur also intermixed with the predominantly fulvous hairs in the two paratypes of *panamica* at the U. S. National Museum, which like the type are from Panama. I have checked the type of *panamica* with the description of *paraensis* and with specimens from Para and I can find no difference of sufficient importance to justify its separation.

There are other elements in Ducke's description of 1902 that are rather out of accord with the condition represented by the present specimens. Notable among these differences is the record of size, which by Ducke's specifications is 9½–12 mm., but which ranges from 8 to 10 mm. in the present specimens. Ducke gives the thoracic width as 4 to 5 mm.; in the workers before me it varies from 3½ to 4¼ mm. Ducke in commenting on the specimens of 1902 said they average larger than *flavolineata*,—a circumstance which would seem to make their relegation in 1925 to a color race of *flavolineata* somewhat inconsistent. It is possible, however, that Ducke included in his description of 1902 specimens that are here considered a distinct subspecies, *melanoverter*, differentiated from *paraensis* among other things by its greater size. This suspicion is strengthened by the fact that among the specimens identified by Friese as *scutellaris*—and Friese's specimens were placed at the disposal of Ducke—there are representatives of both *paraensis* and *melanoverter*. The presence of *melanoverter* in Ducke's material of 1902 would account for such elements in his description as “part of the mandibles often also yellow,” which applies to *melanoverter* but not, on the basis of the specimens under examination, to *paraensis*.

Superficially *paraensis*, as here delimited, is much like *scutellaris* as conceived by Ducke in 1916 and 1925, the points of difference being indicated in the key here supplied for *fasciata* and its subspecies.

Cockerell's *barticensis* is in my estimation the same as *paraensis*. Indeed the range of this subspecies with essential adherence to type is, so far as the present specimens indicate, much more extensive than that of *melanoverter*, which seems more typically the *Melipona* of Para.

DISTRIBUTION.—Recorded by Ducke from localities in the State of Para, and from the Xingú region and the forests of the Pirocúluina in Matto Grosso. Occurs in British Guiana, Dutch Guiana, and in Panama. Represented in the present collections as follows:

BRAZIL.—State of Para: Itaituba, 1902 (Ducke); Oyapoe, June, 1904 (Ducke); Para, 1890 (Schulze), ♂♂, 1898 (Goeldi).

BRITISH GUIANA.—Kaieteur (metatypes of *barticensis*), July 21, 1911 and August 13, 1911 (F. E. Lutz); Kamakusa, October 25, 1922 and January, 1923 (H. Lang); Kartabo, July–August, 1920 (W. M. Wheeler), November, 1920 (Cornell University Expedition); Tumatumari, Potaro River, June 29, 1927 (Cornell University Expedition).

DUTCH GUIANA.—Moengo, Cottica River, May 18, 1927 (Cornell University Expedition).

***Melipona fasciata* subspecies *melanoventer*, new subspecies**

Melipona scutellaris FRIESE (nec Latreille, 1811). Specimens in the American Museum collection identified by Friese as *scutellaris*. (In part.)

Melipona scutellaris DUCKE (nec Latreille, 1811), 1902, Zool. Jahrb. System. Geog. und Biol., 1903, XVII, Heft 2, pp. 288, 296. (In part.)

♀.—The clypeus more or less light reddish, with a horseshoe-shaped rim of black margining its base, a cream-colored, longitudinal stripe bisecting it medianly, and a cream-colored to pale ferruginous edging of somewhat indefinite outline along its apex and in the antero-lateral angles. Cream-colored stripes, clavate below, extending along the inner orbit of the eye nearly to the level of the ocelli. (In specimens from Santarém all of these maculations are fainter than in the specimens from the other localities listed.) The mandibles reddish yellow on their basal half or two-thirds and brownish red on their apical half or one-third with the apical margin narrowly rimmed with black. The scape fuscous with a vague, brownish, longitudinal stripe in front. Joint 1 and usually part of 2 of the flagellum dark both above and below, the other joints dark above, more reddish below, the apical joint often wholly reddish. A few erect, usually dark hairs between the antennæ. In addition to pale, semiappressed, plumose pubescence on the sides of the face and the front, there are on the front longer, up-slanting, yellowish hairs and usually intermixed with them dark brownish to black hairs. The hairs on the vertex are long, erect, and for the most part fulvous, a few black hairs usually occurring immediately in back of the ocelli. There are short, pale to ochraceous, appressed, scalelike hairs spread densely over the cheeks and, in addition, down-slanting, whitish hairs. Such hairs also fringe the lower edge of the mandibles.

The pronotum pale to ferruginous. The mesonotum black, not infrequently with pale stripes along its lateral margins. The axillæ and scutellum honey-colored, the former sometimes a trifle cloudy. The metapleura usually yellow. The propodeum dark brown or reddish brown, as a rule, more or less extensively ferruginous to orange-colored at its lower middle. The hair on the mesonotum, scutellum, and the upper part of the mesopleura a rich fulvous. On the lower part of the mesopleura the hair is white. Pale to ochraceous, plumose hairs on the propodeum.

The legs somewhat variable in color. The coxæ, trochanters, and femora as a rule reddish, although the femora frequently have the apex blackened. The tibiæ also

sometimes reddish (many of the Santarém specimens and some of the Prata specimens, possibly callows) or deep reddish-brown with darkened apex (Prata and Para specimens). In the third tibiae the blackish area occupies most of the joint. Usually the basitarsi are black, with a brown border on the third pair. This applies to most of the Prata and Para specimens and a few of the Santarém specimens. In the Santarém specimens and a few of the Prata specimens the basitarsi are, however, reddish brown (possibly these are callows, although they give no other evidence of being such). The other joints of the tarsi usually red, the intermediate ones sometimes splashed with black, or wholly darkened, the apical half of the claws black. The hair of the joints above the tibiae pale on all three pairs of legs. The outer surface of the front and middle tibiae with flat-lying, pale, silky hairs and, in addition, with semierect, black hairs, slightly bristle-like and best seen in profile. The under side of the front and middle tibiae with pale to brownish hairs. The anterior lateral fringe of the hind tibiae sometimes with intermixed light and dark hairs (especially in specimens from Santarém) but often mainly or wholly dark; the posterior lateral fringe more often with exclusively black hairs. The hair of the basitarsi and intermediate tarsal joints black on the outside, reddish golden to deep copper-colored on the inside; the hair of the apical tarsal joint reddish or yellowish.

Wings hyaline tinged with yellow, more strongly so in the median cell. The venation ferruginous, dark red in the case of the costal and subcostal veins. The tegulae light ferruginous.

The abdomen dull due to dense tessellation. Segment 1 usually deep reddish-black to brown on its dorsal side, its basal concavity pale yellowish to cream-colored, and its ventral side also cream-colored. The other tergites black, their apical rims sometimes brownish but without distinct evidences of banding. (In the series from Santarém the evidence of banding is a little less vague than in the series from Prata.) Except for its cream-colored base, the venter is as a rule reddish brown. A tuft of erect light hairs on each side of the basal concavity. All of the tergites, including the two basal ones (which in many subspecies of *fasciata* are virtually glabrous), with moderately abundant, erect, black hairs, but nowhere so abundant as to conceal the surface. The hairs on the apico-lateral margins of more conspicuous length and, like the other hairs, black. In addition to the erect hairs, there is a fine, inconspicuous growth of short flat-lying hairs over the tergites of the abdomen, rather more abundant toward the apex. The hairs of the venter for the most part pale; yellowish to reddish sometimes on the penultimate sternite; black, or black variegated with red, on the apical sternite.

Length 10 to 11¼ mm.; width of thorax 4 to 4½ mm.; length of forewing, including tegulae, 8¼ to 8¾ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—Holotype (from Para) and seven paratypes in the American Museum, seven paratypes in the Academy of Natural Sciences of Philadelphia, three paratypes in the collection of Dr. T. Frison, two paratypes (type number 908) in Cornell University, one paratype in the collection of Dr. G. Salt.

DISCUSSION.—This subspecies is represented in part by specimens that Friese labeled *scutellaris*, and Friese's interpretation of *scutellaris*

is made a new race, *paraensis*, by Ducke. However, this is not the only insect from Para that Friese has labeled *scutellaris*. There are about an equal number of specimens so designated that in spite of their common name seem to me to have characters quite distinct from the first group. Which of Friese's interpretations of *scutellaris* did Ducke include as a synonym of his *paraensis*? The question is complicated by the fact that Ducke lists his own interpretation of *scutellaris*, 1902, as a synonym of *paraensis*. It must be confessed that that description in several respects applies more closely to the present insect than it does to what is here delimited as *paraensis*, a possible explanation being, I think, that individuals of both subspecies may have been present among the named specimens furnished by Friese to aid Ducke's work (see Ducke's acknowledgments, 1902, p. 287), and which were thus embodied in a description that fits neither of them unmistakably. The description of 1916, brief as it is, makes clear that *paraensis* is in Ducke's conception close to *flavolineata*, an insect of much smaller stature than the maximum indicated for *scutellaris* in 1902 and in other respects, too, more closely related to *paraensis* as delimited in the present paper than to *melanoventer*.

The subspecies *melanoventer* here erected is not only larger than *paraensis* but differentiates itself by other characters. The most fundamental of these in my estimation is the presence of erect, black hairs evenly distributed all over the surface of tergites 1 and 2 in contrast to the virtually glabrous condition of these tergites not only in *paraensis* but in *flavolineata* and other forms closely related to it. The face of *melanoventer* is much lighter than that of *paraensis*, the maculations on the clypeus and the sides of the face cream-colored and extensive, the ground color of the clypeus being mostly light red. In *paraensis*, on the other hand, the ground color is of a deeper brown, the median stripe on the clypeus faint, and the lateral face-marks brownish and indistinct. Similarly the mandibles incline to light in *melanoventer*, to dark in *paraensis*. The intermixed black hairs on the vertex are more abundant in most specimens of *paraensis* than in *melanoventer*, which, on the basis of the present specimens, has only a few dark hairs behind the ocelli. The legs are usually darker in *paraensis* than in *melanoventer*, the coxæ, trochanters, and femora of the latter inclining more decidedly to reddish. Finally in *melanoventer* the tergites are black and unbanded or with merely a dim brownish border apically. While in a few specimens of *paraensis* this subdued condition is approached, usually the fasciæ are distinct. In the dark, virtually unmaculated condition of its tergites, *melanoventer* resembles most the subspecies *fuscata*.

Superficially, *melanoventer* is also somewhat like *cramptoni* and its variety *duidæ*. The bright red legs, virtually glabrous tergites 1-2, and the more distinct banding of the abdomen serve, however, among other characters to distinguish *cramptoni* and its variety from *melanoventer*.

DISTRIBUTION.—Confined, so far as the specimens here considered would indicate, to the State of Para in Brazil. There are specimens from the following localities: Para, May, 1901 (Ducke), July 15, 1924 (J. Bequaert), without date (Baker collection); Santarém (H. H. Smith); Prata, June 31, July 7, July 10 (Parish).

***Melipona fasciata* subspecies *scutellaris* (Latreille)**

Melipona scutellaris LATREILLE, 1811, 'Recueil d'Observ. de Zool. et d'Anat. comparée faites par Humboldt et Bonpland,' I, p. 290.

Melipona scutellaris SPINOLA, 1840, Annales des Sciences natur., (2) XIII, p. 124.

Melipona scutellaris SMITH, 1854, 'Catal. Hymen. British Mus.,' part 2, p. 404.

?*Melipona scutellaris* LUCAS, 1861, Ann. de la Soc. entom. de France, (4) I, Bull. pp. xxxvii-xxxviii. (From the environment of Rio de Janeiro.)

Melipona scutellaris DRORY 1872, 'Quelques Observations sur la Melipone scutellaire,' Bordeaux.

Melipona scutellaris DRORY, 1872A, Bienenzeit., XXVIII, Nr. 13-18.

Melipona scutellaris DRORY, 1873, Bienenzeit., XXIX, pp. 172-176.

Melipona scutellaris DRORY, 1873A, Compt. rend. des Séances de la Soc. Linn. de Bordeaux, XXIX, p. 31.

Melipona scutellaris DRORY, 1873B, Le Rucher du Sud-Ouest, pp. 44-47, 59-61, 64-71, 90-94, 104-111.

Melipona scutellaris DRORY, 1873C, Act. (C. r) Soc. Linn. de Bordeaux, XXIX, pp. xxxi-xxxii.

Melipona scutellaris DRORY, 1874, Bienenzeit., Dec. 15, XXX, No. 23.

Melipona scutellaris GIRARD, 1874, Ann. de la Soc. entom. de France, (5) IV, pp. 567-572, Bull., pp. cvi, cxl.

Melipona scutellaris GIRARD, 1876, Ann. de la Soc. entom. de France, (5) VI, Bull. pp. l-li.

Melipona scutellaris GIRARD, 1876A, Bull. de la Société d'Acclimat., (3) III, pp. 192-197.

Melipona scutellaris DRORY, 1876, Bull. de la Société d'Acclimat., (3) III, pp. 197-198.

Melipona scutellaris DRORY, 1877, Le Rucher du Sud-Ouest, pp. 113-117, 144-145.

Melipona scutellaris GIRARD, 1879, 'Traité élémentaire d'Entomol.,' II, pp. 708, 710, 711, 712, 714-720.

Melipona scutellaris BENTON, 1893, Proc. Ent. Soc. Wash., III, pp. 18-20.

Melipona scutellaris PÉREZ, 1895, Compt. rend. hebdomad. de l'Acad. des Sciences, CXX, pp. 273-275.

Melipona scutellaris PÉREZ, 1895A, Annals and Mag. Nat. Hist., (6) XVI, pp. 125-127.

Melipona scutellaris DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, pp. 583-584.

Melipona scutellaris BUTTEL-REEFEN, 1915, 'Leben und Wesen der Bienen,' p. 79 (footnote).

Melipona scutellaris subspecies *scutellaris* DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., pp. 149-150.

Melipona bonitensis COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 200.

Melipona scutellaris WHEELER, 1923, 'Social Life among the Insects,' p. 126.

Melipona scutellaris subspecies *scutellaris* DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., pp. 430-431.

Melipona scutellaris MARTIN, 1930, La Nature (1st half-year), p. 99.

♂.—The mandibles reddish brown on their apical half or third, more yellowish on their basal half, but without sharp demarcation; their apical edge is rimmed with black, and black, too, are the basal prominences. The labrum reddish yellow. The clypeus reddish brown with a horseshoe-shaped border of black rimming it basally and a pale, perpendicular stripe from base to apex bisecting it. The pale stripe is supplemented by pale markings along the apex of the clypeus. The inner margin of the eye with a pale stripe that extends about three-quarters of the distance to the summit of the eye, narrow throughout most of its length but widening abruptly below to fill the space between the clypeus and the eye. A crescentic supraclypeal mark. The face below the antennæ with few or no hairs except for a light fringe on the underside of the mandibles and the labrum. Short, light, plumose hairs on the portion of the face above the antennæ; these are replaced by longer and more yellowish hairs as the ocelli are approached. The cheeks with pale, appressed, scalelike pubescence and down-slanting, pale hairs. The hair on the vertex fulvous.

Bright fulvous, too, is the color of the hairs on the mesonotum and on the upper half of the mesopleura. On the lower half of the mesopleura and on the thorax beneath, the hair is whitish. Plumose, whitish hairs clothe the metapleura and, more sparsely so, the propodeum. The pronotum is cream-colored with reddish stains. The axillæ are yellow as is the scutellum, but in the specimen here considered the axillæ are of a lighter yellow than the scutellum.

The legs deep brown to black, the hind femora posteriorly and the apical joint of the tarsi a brighter reddish brown. Light hairs on all of the coxæ, trochanters, and femora; short, semierect, black hairs on the outer side of the front and middle tibæ; longer light, or dark and light hairs intermingled, on the under side of the front and middle tibæ; black hairs fringing the hind tibæ; black hairs externally on all of the tarsi except the apical joint; copper-colored hairs on the tarsi within.

The wings hyaline, lightly stained with yellow; their venation brownish red, the costal and subcostal veins a deep, dark red, almost black. The tegulæ light ferruginous.

The abdomen shiny, black above (except that tergite 1 is usually reddish), with a cream-colored band before the apical rim of the first five tergites. These bands—particularly those on tergites 2, 3, and 4—are relatively broad along the median third of their width but have a curvilinear emargination on each side that gives them a rather undulating and on the whole narrow appearance. The bands extend to the under side of the abdomen, the venter being cream-colored varied with light brown on the basal segment and banded with brown on two or three of the sternites near the base. There is a tuft of long, erect, light hairs on each side of the basal concavity, but with this exception the basal segments are virtually hairless. Black hairs appear, however, sparsely on the sides of tergites 3 and 4 and increase in abundance and in length as the apex of the abdomen is approached. The under side of the abdomen is

clothed with light hairs except at the base, which is bare, and at the apex, where black hairs replace the light.

Length given by Ducke as $9\frac{1}{2}$ –12 mm.; width of thorax 4–5 mm.; length of wing (in the specimen before me) $8\frac{3}{4}$ mm., including the tegulæ.

♀ (Virgin).—"The females are far from being as beautiful as [the workers]; they are even smaller. Their head and thorax are smaller than those of the workers; the thorax, as well as the scutellum, is dark, almost black and shiny, and surrounded with clear brown hairs. The dorsum of the abdomen is dark brown, and the hind margin of tergites 1–5 is not ornamented with a slender whitish stripe as in the workers; the ventral side of the abdomen is silky and of a clear brown. The legs are more dainty and of a clear, somewhat reddish brown; the hind legs are of the same type as those of the queen mother; they are more slender and are devoid of a corbicula; their color too is reddish brown; they are provided with short hairs of the same color, fine and silky. The two compound eyes are brown; the antennæ are longer than those of the workers; the clypeus has not the three whitish longitudinal lines that characterize that of the workers; it is of a uniform brown."—Cited from Drory, 1873B. Ducke's description (1916, 1925) of the queen of *scutellaris*—a little at variance with the above and probably indicative of variability—may also be quoted: "Scutellum pale merely on the margins. The light bands on the tergites subdued. Hairs of the abdomen and of the legs rust-colored."

♂.—See comments under DISCUSSION.

TYPE.—Apparently no longer in existence. The type of *bonitensis* (No. 21671) from Bonito, Province of Pernambuco, January, 1883, and a paratype are in the U. S. National Museum.

DISCUSSION.—The locality of the type is given by Latreille (1811) merely as Brazil, and Spinola (1840) contents himself by listing his own specimens also merely as from Brazil. Lucas (1861) obtained live specimens that he designated *scutellaris* from the environment of Rio de Janeiro, but it is possible that his identification was wrong and that the bee in question was not that subspecies. Ducke gives as collecting sites of *scutellaris* localities in the states of Pernambuco and Bahia, which adjoin one another, but only from the former state did he apparently see specimens that he personally interpreted as *scutellaris*, Bahia being included on the authority of Drory (1873–1877) and of Girard (1874–1879). The description of Girard (1879, II, p. 714), which I have checked with a worker from Pernambuco, leaves little doubt, however, that the range of this subspecies includes both Pernambuco and Bahia.

Originally (1902) Ducke, following Friese, had interpreted as typical *scutellaris* the insect that he subsequently (1916) designated variety *paraensis*, but while this insect also comes fairly close to Latreille's description, it does not accord with it quite so well as does the bee from the State of Pernambuco. Hence Ducke's interpretation of *scutellaris*, as published in 1916 and subsequently, is here adopted.

What Cockerell, 1919, described as *bonitensis* is a synonym of *scutellaris* as here conceived.

There is no male of *scutellaris* in the collections before me. Ducke devotes to the male and worker of *scutellaris* a joint description, which leaves one under the impression that the facial maculations of the two sexes are the same. Drory (1877) states, however, that the male is easily recognized by its whitish face and Girard (1879, II, p. 715) also alludes to the white face of the male.

DISTRIBUTION.—According to Ducke, 1925, "southern half of the middle section of north Brazil," presumably equivalent to the states of Pernambuco and Bahia, from which are listed various collecting sites. Drory (1873B) included also the State of Ceara in its range, although the hive he reported upon was obtained from Bahia, and recently (1930) Martin, writing from the State of Ceara, makes allusion to *scutellaris*.

***Melipona fasciata* subspecies *eburnea* (Fries)**

Melipona eburnea FRIESE, 1900, Természetrzaji Füzetek, XXIII, p. 382.

Melipona scutellaris subspecies *eburnea* DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., p. 153.

Melipona eburnea COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, pp. 197, 199.

Melipona scutellaris DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, pp. 433-434.

♀.—Head fairly broad and short, dark, immaculate except for a faint, median, longitudinal, yellowish-red stripe on the clypeus (sometimes virtually absent) and now and then deep reddish stains on the apical third of the mandibles, labrum, and on the apex of the clypeus. The scape dark, dull red basally; the flagellum black above, dull brown or black below. The hair between the antennæ erect and usually black (sometimes pale). In addition to the usual semiappressed, short, plumose, pale hairs on the front and the sides of the face, there are longer, ochraceous to gray, up-slanting hairs on the front, with sometimes darker hairs intermixed. Hair on the vertex also largely ochraceous to gray, with rarely a few darker hairs in back of the ocelli. (The reader is referred to the DISCUSSION.) The cheeks with short, appressed, almost scalelike, whitish hairs and longer, down-slanting, whitish hairs. Hairs on the labrum pale. Hairs fringing the lower border of the mandibles usually grading from silvery white near the base into golden as the apex is approached.

The thorax black except for the axillæ and scutellum, which are yellow, and very rarely a narrow band of yellow on each side of the mesonotum. The hair on the tessellated mesonotum ochraceous to gray and that of the scutellum similarly colored; more strongly golden on the upper half of the mesopleura, white on the lower half and on the tubercles; ochraceous on the metapleura above, whitish below, and whitish on the propodeum.

The legs variable from deep reddish-brown to black, the reddish brown being usually present on the basal half of the outer side of the hind tibiæ (and more extensively so on the under side); sometimes the femora and front and middle tibiæ are

also a deep reddish-brown except for their black apices. Apical angle of hind basitarsi often ferruginous as is also the apical joint of all the tarsi except for the black apical half of the claws. Light hairs on all the coxæ, trochanters, and femora. The front and middle tibiæ with dark, semierect hairs on their outer surface and with longer, ochraceous to brownish hairs on their under surface. The hind tibiæ fringed laterally with black hairs, their under surface with the usual minute, appressed, silvery hairs. All of the tarsal joints except the apical one with black or dark hair on their outer surface, and with golden to copper hair on their inner surface. The apical tarsal joint with light golden hairs on the outer as well as the inner surface.

The wings hyaline stained with yellow, the median cell and the upper half of the marginal cell more strongly so than the rest of the forewing. The venation light ferruginous, the costal and subcostal veins and the stigma darker. The tegulæ ferruginous.

Tergite 1 usually almost wholly pale yellow ("ivory colored"), often a dark spot on each side of the basal concavity, and frequently a rimming of black about the concavity posteriorly. Tergites 2-5 black, with a strongly developed, light yellow ("ivory colored") band just before the apical rim. The band is broadest at its middle, sloping off toward each side. A tuft of erect, long, white hairs on each side of the basal concavity, and a few yellowish hairs on each side of tergites 1 and 2 as well as a short fringe bordering apically the bands on these tergites, which are otherwise almost devoid of hair and rather shiny notwithstanding their delicate tessellation and, especially on tergite 2, scattered and sparse but fairly distinct punctation. Tergites 3-5 rather densely and conspicuously covered with yellow hairs. Especially heavy is the growth on tergites 4 and 5, where the yellow hairs are of a plumose character; these hairs are supplemented on tergite 5 by scattered black hairs that, although only feebly branched, are conspicuous because of their greater length and appear almost spinelike. Tergites 3, 4, and 5 with dense and progressively longer, plumose, flat fringes bordering the apical bands. Tergite 6 more thinly covered with unbranched, black hairs and rather shiny due to the near absence of sculpturing in contrast to the more strongly tessellated surface of tergites 3-5. The yellow of segment 1 extends to the venter. The sternites with pale hairs, except the penultimate one, which usually has a few bright ferruginous hairs apically, and the apical sternite itself, the hairs of which are black.

Length $9\frac{1}{2}$ to 11 mm.; width of thorax 4 to $4\frac{1}{4}$ mm.; length of forewing, including tegulæ, $8\frac{1}{4}$ to $8\frac{3}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—Friese's description was based on eight specimens from Bolivia (Yungas) and Peru (Vilcanota), but he does not indicate the depository of his type material.

DISCUSSION.—Friese's description (1900) of *eburnea* is very brief and in parts somewhat difficult to interpret. It reads in translation as follows:

"♀.—Black, with cinereous-fusca hair, as in *fasciata*, but with the face immaculate, clypeus often fuscous; abdomen smooth, segment 1 ivory-colored, on both sides white-tufted, 2-4 with ivory margins, 3-5 with coarse ferruginous hairs, 6 with black hairs; legs black; wings testaceous.—Length 11 mm., width 4 mm."

The comparison with *fasciata* tends to obscure rather than clarify the interpretation. Friese designated as *fasciata* the insect that Ducke later described as *flavofasciata*. It has intermixed black and white hairs on the vertex and on the mesonotum. If an insect of this type is the basis of Friese's description of 1900, all one can say is that he has greatly widened the original conception in his later interpretations of its limits, for before me are several specimens identified by Friese as *eburnea* that are devoid of black hairs on the mesonotum and that have at most a few inconspicuous, black hairs among the prevailing light hairs on the vertex. Yet these specimens come from Peru and Bolivia, from both of which countries *eburnea* was described, and in other respects they bear out Friese's description. I suspect that perhaps Friese intended to limit the comparison with "*fasciata*" to the hairs on the head, but even in this restricted sense the comparison does not seem particularly apt for the specimens in question. There are many additional specimens from localities in Peru before me, but none of them seem to justify comparison with "*fasciata*." Ducke, too, in his paper of 1925, apparently was inclined to eliminate from his redescription of *eburnea* the reference to fuscous hairs that figures in Friese's original description, for he retains merely the phrase "gray-haired" in alluding to the head and thorax. In the conviction that this is at least the much more usual and representative condition and in view of the doubts as to the precise application of Friese's description, I have followed Ducke's course in considering *eburnea* as an insect with prevailing gray (in the sense of pale) hairs. In fact, the term gray is less applicable than ochraceous, for in fresh specimens there is a distinctly yellow tinge to the hair, older specimens having a more faded, grayish-white appearance.

In specimens from Oriente, from La Chorrera to La Sombra, and from La Sombra, a pale stripe is usually traceable on each side of the mesonotum. As these localities are in the Putumayo District, it might seem that a geographic race is establishing itself in this area; but the character is hardly sufficiently defined as yet to receive recognition and the dependableness of this character is open to question (see DISCUSSION under *rufiventris* and *paraensis*).

DISTRIBUTION.—Ducke (1925) defines the range of *eburnea* as follows: "Western part of the Upper Amazon and contiguous eastern Andes; it is (like the two subspecies *flavofasciata* and *fuscata*) confined to the very moist rain forest." Later he adds with reference to specimens from the State of Amazonas, Brazil: "Specimens from the eastern limits of the distribution area (Tabatinga and Rio Javary) are the least

characteristic and approach to some extent the subspecies *flavofasciata*." In addition to localities in the northwestern part of Brazil, Ducke includes records from eastern Peru, from the southeastern part of Colombia, and, on the authority of Friese, from the eastern Andes of Peru and Bolivia. Some Friese specimens, merely labeled Peru, are included among the material here discussed. They bear date of 1900—the very year his description of *eburnea* appeared—but do not belong to the original type material. There is also a specimen from Mapiri, Bolivia, likewise bearing date of 1900, that was identified by Friese as *eburnea*.

All the other specimens in the collections here considered are from Peru, where they were collected by the Cornell University Expedition of 1919–1920, in which Professors J. C. Bradley and William T. M. Forbes and for part of the time also Messrs. Harris and Williamson participated. The following Peruvian localities are represented in this material loaned by Cornell University:

Colony of the Perené: Hda. San Juan, June, 1920; El Campamiento, June 7–30, 1920.

R. Chanchamayo: La Merced, June 17, 1920.

Cam. del Pichis: Tambo Eneñas, July 3–4, 1920; Dos de Mayo to El Porvenir, July 6, 1920.

Putumayo District: El Oriente, August 18–19, 1920; La Chorrera to La Sombra, August 21, 1920; La Sombra, August, 22, 1920.

***Melipona fasciata* subspecies *rufescens* (Friese)**

Melipona rufescens FRIESE, 1900, Természetrzaji Füzetek, XXIII, p. 381.

Melipona rufescens DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., pp. 160–161.

Melipona rufescens DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, p. 439.

♂.—Clypeus dull red, infuscated along the basal border; a median longitudinal stripe and antero-lateral angles of clypeus cream-colored to ferruginous. The stripes along the inner orbits of the eye similarly cream-colored; clavate, but of somewhat indistinct outline, below. Labrum and mandibles reddish, the latter edged apically with black and with black basal prominences. The scape black, vaguely dark reddish in front, more brightly so at its base; the flagellum black above, more or less dark reddish below, with little differentiation between the upper and lower surface. Short, pale, rather appressed, plumose hairs of an inconspicuous character sparsely represented on the sides of the face and the front; longer, much more conspicuous, up-slanting hairs of a plumose character on the front and on the sides of the face, darkish in color. The hair on the vertex fulvous, with a few dark hairs in the region immediately behind the ocelli and also near the compound eyes. Scalelike, pale, appressed hairs on the cheeks and also down-slanting, longer, white hairs. The hairs fringing the mandibles below grading from white into ferruginous.

The pronotum cream-colored to ferruginous, more or less cloudy. The mesonotum with very faint, obsolescent, pale stripes dimly traceable along the lateral margin. Pale yellow to ferruginous axillæ and scutellum, with the usual granular, black punctation along the posterior margin. The hair of the mesonotum fulvous, sometimes with darker hairs intermingled (see DISCUSSION). Those on the upper half of the mesopleura fulvous, with a warm orange-colored to fuscous patch below the tegulæ. The hairs of the lower half of the mesopleura whitish or grading into white. Hair on the propodeum, as usual, less abundant than on the pleura, pale and plumose.

Legs somewhat variable in color. Described by Friese as "black or fuscous" but in his two metatypes, on which this redescription is partly based, of a fairly uniform reddish-brown with deeper but not clearly demarked staining here and there. A third specimen (not a metatype) has much darker legs: for the most part deep brown, verging on black, but with a rather clearly defined, light brownish streak along all of the femora above, with black markings on the apices of the tibiæ (narrow on the front and middle pair, covering most of the joint on the hind pair) and with black middle and hind basitarsi except for narrow lateral borders of brown. The hairs on the coxæ and those fringing the trochanters and femora beneath white; those on the outside of the femora a little more yellowish. The hairs on the outside of the front and middle tibiæ brownish to black, longer and softer (less semibristle-like) than in other subspecies of *fasciata*, even *eburnea*. The hairs fringing the hind tibiæ, the hairs on the outside of the basitarsi and the other tarsal joints (except the apical one, the hairs of which are light reddish), and also the hairs on the under side of the front and middle tibiæ black. The hairs on the inside of the basitarsi and other tarsal joints deep golden to copper-colored; the minute hairs on the inner surface of the hind tibiæ, as usual, silvery.

Wings described by Friese as lutescent. The wings of specimens here considered are, like those of other subspecies of *fasciata*, lightly suffused with yellow (of somewhat deeper stain in the median cell). The venation is mostly ferruginous, the costal and subcostal veins and stigma of a deeper red.

Tergites 1-2 very densely tessellated, dull without a shimmer. Tergites 3-5 also densely tessellated and roughened with scattered punctures. The apical tergite densely but delicately tessellated, faintly shiny. The concavity at the base of the abdomen pale ferruginous. Friese refers to the bands along the apices of tergites 1-5 as "white." Strictly speaking, those on the specimens here considered are cream-colored, in one of the metatypes even ferruginous on tergites 3-5. A tuft of erect, whitish hairs on each side of the basal concavity. All of the tergites rather densely and uniformly covered with erect, fulvous hairs,—a condition that distinguishes this subspecies from the other subspecies of *fasciata*. Along the border of the apical tergite there may be a few black hairs. In addition to the abundant, longish, erect, fulvous hairs over the tergites, there is, fringing the apices of tergites 2-5, a dense array of small, fine, flat-lying, fulvous hairs that on tergites 3 and 4 at least (in the specimen from Dos de Mayo to El Porvenir, Peru, on tergites 2 and 5 as well) briefly overlays a fringe of much longer and coarser fulvous hairs, of the same character indeed as the erect hairs. The venter with cream-colored to ferruginous suffusion at the base, otherwise brownish. The hairs of the sternites pale except those of the apical sternite, which are black, and those of the penultimate sternite, which are reddish.

Length $10\frac{1}{2}$ to 11 mm.; breadth of thorax 4 to $4\frac{1}{4}$ mm.; length of forewing including tegulæ, $8\frac{3}{4}$ to $8\frac{3}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—Friese does not indicate where his type material, consisting of four specimens from Bolivia (Yungas), was deposited. Two metatypes are in The American Museum of Natural History.

DISCUSSION.—Friese's description of *rufescens* is very brief:

"♀.—Black, with ferruginous hairs, face dull; thorax with long, ferruginous hairs; abdomen dull, very finely and very densely wrinkled, segments 1-5 with a white band, 3-5 with ferruginous hairs; legs black or fuscous; wings lutescent (clay yellowish).—Length 10 mm., lat. 4 mm."

The limitation of the ferruginous hairs to tergites 3-5 in this description fails to emphasize what is perhaps the most characteristic feature of *rufescens*, namely, the rather dense growth of yellowish to ferruginous hairs not only on tergites 3-5 but also on 1-2. Of all the subspecies *rufescens* has the strongest sculpturing on the abdomen, the dense tessellation being reinforced on tergites 3-5 by rather coarse if scattered punctation, giving these tergites an almost granular appearance. Friese's description makes mention three times of ferruginous hairs. His insect was described from Bolivia and a metatype from that country approximates Friese's description in having only a few black hairs on the vertex and no black hairs on the mesonotum. But in a metatype from Peru and in yet another specimen from that country there are intermixed fuscous hairs in both of these regions as well as a fuscous patch on the mesopleura immediately below the tegulae. It is possible, therefore, that the Peruvian insects should receive varietal recognition, as there is between them and the Bolivian specimen about the degree of difference that obtains between *cramptoni* and its variety *duidæ*. However, a larger series is desirable to determine whether these distinctions in the coloration of the hair approach constancy. In all three specimens, the one from Bolivia as well as the two from Peru, the long hairs on the front are dark.

Friese in his description says nothing about the maculations of the face. In his two metatypes as well as in the third specimen the face bears distinct maculations, and, if these are constant, they furnish an additional character for separating *rufescens* from the prevailingly dark-faced *eburnea*, to which it is rather more closely related than to any of the other subspecies of *fasciata*. These face-marks are a little less brilliant and the clypeus is a duller red than in *pseudocentris*, *cramptoni*, and *melanoverter*; nevertheless the facial maculations are an approach at least to the condition found in these subspecies. Dense fringes of short, fulvous hairs along the apices of tergites 2-5 are present also in

fasciata as here interpreted and in *melanopleura*. In *melanopleura* these fringes are supplemented, as in the present insect, by fringes of longer hairs, but in *melanopleura* these longer hairs are black, not fulvous. The fringes on *belizæ*, while somewhat coarser, may also be cited. Comparison is especially apt with *eburnea*. The fringe of densely placed, short, fulvous hairs on tergite 3 of *eburnea* is like the fringe here referred to, while the much longer fringes of coarse, fulvous hairs on tergites 4 and 5 of *eburnea* resemble the supplementary fringes of long hairs described for some of the segments of *rufescens*. Apical fringes occur in several forms other than those just mentioned—such as *rufiventris*, *flavolineata*, *paraensis*, etc.—but they are inconspicuous, the hairs either very minute or sparse, not of a curtain-like density.

DISTRIBUTION.—Described from Bolivia. The present specimens are from the following localities:

BOLIVIA.—Mapiri, 1900.

PERU.—Pozuzo; Dos de Mayo to El Porvenir, Cam. del Pichis, July 6, 1920 (J. C. Bradley).

***Melipona fasciata* subspecies *fuscipes* (Fries)**

Melipona fuscipes FRIESE, 1900, Természetráji Füzetek, XXIII, p. 382.

?*Melipona fuscipes* ZABRISKIE, 1909, Journ. N. Y. Entom. Soc., XVII, p. 48. (From Orinoco River, Venezuela.)

?*Melipona scutellaris* subspecies *fuscipes* DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., pp. 152–153.

?*Melipona fuscipes* COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 203.

?*Melipona scutellaris* subspecies *fuscipes* DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, p. 433.

"♀.—Black or fuscous, with ashy fuliginous hair, rarely with fulvous hair, as in *rufiventris*, but with the face immaculate; the abdomen red, segments 3–6 black-haired; the legs fuscous; the wings lutescent.—Length 10 mm., width 4 mm.

"♂.—Similar to the worker, but with the disc and sides of the clypeus, and the orbits yellow; the antennæ fulvous."

(The above is a translation of the description in Latin by Fries.)

TYPE.—The type specimens were deposited in the Museum of Hungary.

DISCUSSION.—Appended to his description of 1900 Fries indicates an extraordinarily wide range for this subspecies, mentioning as the countries from which specimens were obtained: Venezuela, Colombia, Mexico, Brazil, and Peru. The specimens on which his description was based numbered only six workers and two males. Brief as the description is, it makes provision for variability, and this circumstance, coupled with the wide range, renders it probable, as surmised by Pro-

fessor Cockerell (1914), that more than one valid subspecies was represented in the original type material.

Subsequently Friese included yet another country in the range of *fuscipes*, namely, Ecuador, represented by specimens from Guayaquil. These Cockerell has separated as *mimetica*. There are several specimens from Guayaquil in the American Museum, designated by Friese as *fuscipes*. They differ sharply from another insect identified by Friese as *fuscipes*, which bears a label reading "Popayan, Colombia, 1900 (Lehmann)." This specimen has intermixed black and pale fulvous hair on the vertex. It is in all other respects, including its black-haired pleura, virtually a replica of Cockerell's *melanopleura*.

The brevity of the original description, the inclusive character of Friese's later determinations of *fuscipes*, and the inaccessibility of the type material, make it difficult to interpret *fuscipes*. Ducke accepts the geographic range as widened out by Friese with a possible doubt as to the inclusion of Peru. He furthermore adds a locality record: Teffé, in the State of Amazonas. Fortunately there is in the present collections a specimen from Teffé taken by H. Parish, January 12, 1920, that accords in general with the specifications given by Ducke in his interpretation of *fuscipes*. On only one or two points is there possible doubt. Ducke says that the gray hair on the vertex is usually intermixed with black, but says nothing of a similar condition on the mesonotum. In the Teffé specimen here commented upon there are intermixed dark hairs in both regions. Another point of doubt is the face. In Friese's description of *fuscipes* the face is referred to as being immaculate. It is virtually immaculate (except for the dull hair-fine streak down the middle of the clypeus) in *seminigra*, with which Ducke compares *fuscipes*, and that is the condition of the face, too, in the present specimen. I believe it was probably the condition of the face likewise in Ducke's specimen from Teffé, although, strangely enough, Ducke excludes from the *fuscipes* fold a specimen from northern Matto Grosso on the ground that its face and scutellum were black, without light markings. The immaculate condition of the face, instead of barring out the Matto Grosso specimen, really furnishes it, on the basis of Friese's definition, with one of the earmarks of admission to *fuscipes*, and one cannot avoid the conclusion that there is some confusion of language in Ducke's statement, so greatly at variance is it with what is implied in the remainder of his paragraph. I believe, therefore, that the specimen from Teffé noted by Ducke and that here recorded are one subspecies. If so, Ducke's conception of *fuscipes* is very close to the insect described by Cockerell

as *kangarumensis*, possibly identical with those specimens of which Cockerell said (1920B): "The two specimens from the lower savannah have the abdominal bands inconspicuous and look different." In the Teffé specimen the bands are inconspicuous to absent. Ducke (1916, 1925) says that the normally red tergites of what he interprets as *fuscipes* are frequently brown or nearly black,—paralleling what was observed in the series of *kangarumensis* from Kamakusa.

If the specimen from Teffé be *fuscipes*, then Friese's specimens from Guayaquil should be given distinct subspecific rank. Accordingly *mimetica*, the name conferred by Cockerell on these specimens, is retained in this paper. The true character of *fuscipes*, due to the probably composite character of the type material, remains in doubt. Cockerell (1919) interpreted *fuscipes* as a form close to his own *melanopleura* (see DISCUSSION of *melanopleura*).

DISTRIBUTION.—See the comments under the DISCUSSION of *fuscipes*.

***Melipona fasciata* subspecies *mimetica* (Cockerell)**

Melipona mimetica COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 203.

Melipona fuscipes FRIESE (determination).

♀.—Head black with the clypeus and the space between the clypeus and the inner orbits of the eye largely reddish brown, sometimes briefly continued upward along the inner orbits as a very narrow stripe. No light maculations on the face whatever. The mandibles of deep reddish-brown at the base, of brighter red toward the apex, with the usual narrow, black apical rim and dark basal prominences. The scape black, light red at the base; the first joint of the flagellum and the basal part of the second joint dark both above and below; the apical part of the second joint and all of the joints apical to it of a light reddish below and barely darker above. The pale, appressed pile on the front and sides of face wholly inconspicuous and indeed hard to differentiate from the longer, up-slanting hairs of the front, being of the same color, a pale ashy hue without any intermixed black hairs whatsoever. The hair on the vertex of the same faded appearance, with just a touch of faint ochraceous. The usual scalelike, pale pile on the cheeks (rather dense) in addition to the down-slanting, white hairs. The hairs fringing the mandibles below not exclusively white, usually predominantly reddish to slightly brownish. The tessellation on the front finer than usual, virtually no sculpturing as the ocelli are approached, with resulting shininess.

The mesonotum shiny, the tessellation usual in most subspecies being faint to absent. The hair of the mesonotum, axillæ, and scutellum, like that of the head, a pale gray. The upper half of the mesopleura with faded fulvous hairs, the lower half with white hairs. The hairs on the propodeum of much the same character and color as in the other subspecies,—pale, relatively sparse, and plumose. The pronotum reddish; also the axillæ and scutellum sometimes deep red but often black like the mesonotum. The propodeum reddish to reddish brown, especially at its middle and below the middle.

The legs for the most part mahogany-red, briefly black on the apex of the femora, more extensively so on the under side of the hind and frequently of the middle femora, briefly so on the front and middle tibiae, supplemented sometimes by black stripes along the apical half of the outer surface in the case of the middle tibiae, and broadly so on the outer surface of the hind tibiae (the inner surface is extensively red, rimmed usually on each side and apically with black). The middle and hind basitarsi black, narrowly rimmed with brown. The apical tarsal joint light red but the apical half of the claws, as usual, black; the intermediate tarsal joints, barely deeper in color, nevertheless appear so due to the dark bristles. The hair on the coxae, trochanters, and femora white, that on the under side of the middle trochanters and on the upper side of the femora slightly ochraceous. The hair on the front and middle tibiae somewhat variable, usually inclined to yellowish with a few short, black bristles on the external surface of the middle tibiae, but in some specimens prevailing brown. The hairs fringing the hind tibiae mostly black but with sometimes a few reddish-brown hairs intermixed in the anterior fringe. The tarsi externally with black bristles; within the brushes are copper-colored; the apical tarsal joint with reddish hairs.

The wings lightly stained with yellow, the median cell more strongly so than the others; the venation ferruginous. The tegulae ferruginous.

Abdomen dorsally and ventrally a clear, bright red devoid of maculations. The tergites daintily tessellated, not quite so shiny as the mesonotum, notwithstanding the fact that they are virtually glabrous, there being hair only in the following regions: a tuft of pale hairs on each side of the basal concavity, short, white hairs bordering the extreme sides of the basal and intermediate tergites, and longer, more bristle-like, black hairs along the lateral borders of the two or three apical tergites. The sternites with pale hairs except the apical sternite, which has black hairs.

Length 9 to $9\frac{1}{2}$ or 10 mm.; width of thorax $3\frac{1}{2}$ to 4 mm.; length of forewing, including tegulae, $7\frac{1}{2}$ to $7\frac{3}{4}$ mm.

♀ (Virgin).—Smaller than the worker. The proportions of the head and its parts as described for the queen under *rufiventris*. The sculpturing more delicate, however: the clypeus, in contrast to that of the *rufiventris* queen, absolutely devoid of hair and shiny, its tessellation of faint and superficial character. The upper half of the head, too, is uniformly shiny wherever visible under the covering of hair. The hair of the front and vertex a trifle more yellowish, not so ashen-hued as in the worker. On the labrum and the lower edge of the mandibles there are long, conspicuous, reddish hairs. The mandibles are light yellow in the specimen at hand, but this may be due to immaturity, for in the worker the mandibles are mahogany-colored. The antennae as described for the worker, except that the joints beyond the third are not even faintly darkened above, being wholly light reddish-yellow. The bright mandibles and flagellum are in contrast to the otherwise black appearance of the face.

The mesonotum wholly without tessellation, polished, its hairs like those of the scutellum rather uniform in hue, very slightly ochraceous, not quite so distinctly ashen as in the worker. The pronotum, scutellum, axillae, and propodeum dark red, verging on black.

The legs considerably darker than in the worker, black with narrow ferruginous markings on the apex of the three pairs of tibiae and with more or less red on the tarsal joints beyond the basitarsi. The hair on the under side of the coxae and trochanters and the dense but narrow fringe of hairs on the under side of the femora white but rather lusterless. The hair on the upper surface of the femora considerably darker,

brownish to black. The hairs of the tibiae and tarsi of a reddish to brownish hue. The structure of the legs corresponds with that described for the queen under *rufiventris*.

The tegulae darker than in the worker, of a deep, not light red.

The abdomen of about the same color dorsally and ventrally as that of the worker, polished, shiny with only bare traces of sculpturing. In contrast to the worker, however, it is relatively hairy not only on the lateral margins but pretty well over all of tergites 3-6, the hair being long, thin, and yellowish red. Similar hairs occur on the sides of tergites 1-2 and over the venter. There is a slight, groovelike depression on each side of the base of tergite 1.

Length 8 mm.; width of thorax $3\frac{1}{4}$ mm.; length of forewing, including tegulae, 7 mm.

♂.—Unknown.

TYPE.—The type material (from Guayaquil) consisted of specimens collected by Professor C. T. Brues. One of the cotypes is in the American Museum. A specimen taken by Buchwald at Guayaquil and identified by Friese as *fuscipes* was acquired by the U. S. National Museum and was recognized by Cockerell (1919) as his *mimetica*. Duplicate specimens (one queen, five workers) taken by Buchwald at Guayaquil and similarly identified by Friese as *fuscipes* were purchased by the American Museum and constitute topotypes of *mimetica*.

DISCUSSION.—Cockerell regarded *mimetica* as "extremely close to the Brazilian *M. pseudocentris*." It is true that in certain respects it shows affiliations with *pseudocentris* and its near relatives, perhaps in no respect more fundamentally so than in the relatively hairless condition of the tergites of its worker. Nevertheless its distinctly smaller size, more nearly comparable with what is usual for *rufiventris*, and its lighter sculpturing make one wonder whether after all the relationship to *pseudocentris* is quite so close as was believed to be the case.

DISTRIBUTION.—Described from Guayaquil, Ecuador, and thus far known only from that locality.

Melipona puncticollis Friese

INTRODUCTORY COMMENTS.—The two subspecies of this species have a little the appearance of unusually large *marginata*, being, as Ducke has pointed out, comparable in size to small specimens of *Melipona fasciata rufiventris flavolineata*. So far as the only known cast (the worker) gives evidence, the relationship to *marginata* is structurally very close. The degree of flatness and convexity of the clypeus and the sculpturing of the mesonotum vary among the subspecies constituting *marginata*, and some of these subspecies might almost be regarded as intergrades linking *marginata* to *puncticollis*. Particularly

is this true of *marginata* subspecies *tumupasæ*, which not only in its plastic characters but even in its markings and the coloration of its hairs could pass as a small relative of *puncticollis* subspecies *puncticollis*.

KEY TO THE WORKERS OF *puncticollis* AND ITS SUBSPECIES

The abdomen light red, with narrow, distinct bands apically on tergites 1-5. The legs prevailing light red..... *puncticollis* (p. 414).
The abdomen blackish, with narrow, somewhat indistinct bands. The legs deep reddish-brown..... *ogilviei*, new subspecies (p. 416).

***Melipona puncticollis* subspecies *puncticollis* (Fries)**

Melipona puncticollis FRIESE, 1902, Zeitschr. für Hymenop. und Dipter., II, p. 382.

Melipona puncticollis DUCKÉ, 1916, 'Enumeração dos Hymenopteros,' p. 157.

Melipona puncticollis DUCKÉ, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, pp. 436-437.

♀.—The facial quadrangle somewhat longer than broad (plate X, figure H). The distance from one eye to the other measured at the level of the middle ocellus only about five-sixths as great as the length of the eye. The lateral ocelli relatively close to the eye, the distance from the outer rim of each to the nearest point on the eye being rather less than half the distance from the outer rim of one lateral ocellus to the outer rim of the other. The malar space exceedingly short, with the rim of the eye virtually in contact with the mandible near its inner angle. The clypeus rather flat, covered like the sides of the face with dense, microscopic sculpturing of a punctate-tessellate character. The front with rather granular tessellation and superimposed, faint and relatively sparse punctures. The vertex faintly punctate-tessellate, somewhat shiny. The clypeus reddish brown, with a horseshoe-shaped infuscation at the base and a linear infuscation, thickened at each extremity, along the apex; a cream-colored, longitudinal stripe bisecting the clypeus medianly; spots of similar color in the antero-lateral angles of the clypeus; and a narrow stripe along the inner margin of each eye to well above the level of the base of the antennæ. The supra-clypeal area yellow below, more reddish above. The labrum and mandibles ferruginous, with the apical margin of the latter narrowly rimmed with black and the basal prominence black. The scape brownish with a narrow, ferruginous stripe in front; the flagellum for the most part black above, brownish to fulvous below, the apical joint fulvous above as well as below. The lower half of the face rather glabrous; the front with pale, grayish-white, plumose hairs, contrasting with hairs of distinctly more fulvous hue on the vertex. The down-slanting hairs on the genæ grayish white as is the appressed, scalelike pile; short, white hairs on the labrum; a few pale hairs fringing the lower border of the mandibles. The chitin of the lower portion of the cheeks suffused with a warm orange color, possibly due to immaturity.

The mesonotum covered with small, distinct punctures, dense but clearly separated, not confluent, with shiny spaces between. The upper half of the mesopleura with distinct but crowded punctures of a somewhat coarser character; the lower half of the mesopleura with sparser and finer punctation. The scutellum with a fairly dense, fine punctation, the posterior rim not so coarsely granular as in most subspecies of *fasciata*. The propodeum densely but finely tessellated. The pronotum pale yel-

low with ferruginous discoloration; a pale yellow stripe bordering each side of the mesonotum confluent with the similarly colored axillæ and scutellum. Rich orange suffusions on the pleura and propodeum such as sometimes occur in *fasciata rufiventris*. The hair on the mesonotum and pleura of about the same shade as that on the vertex, a somewhat faded fulvous (Friese alludes to the color of the hair as reddish yellow, and doubtless that is the condition in fresh specimens).

The legs fulvous from the coxæ downward, a little clouded at the apex of the tibiæ, on the basitarsi (especially the hind pair), and on the intermediate tarsal joints; the apical half of the tarsal claws black. The coxæ, trochanters, and femora with white hair below; the hair on the femora above more yellowish, particularly so on the hind pair. Short, black, semibristle-like hairs on the outer surface of the front and middle tibiæ in addition to longer and softer, recumbent, pale hairs; more conspicuous, pale hairs on the under side of these tibiæ. The hairs in the anterior fringe of the hind tibiæ seriatim ferruginous and black, those of the posterior fringe mostly black. The coarse hairs of the outer surface of the basitarsi and intermediate tarsal joints mostly black with some lighter hairs intermixed; the tarsal brushes golden to copper-colored. The hind tibiæ (plate VI, figure D) triangular in shape, the posterior angle distinct but not prolonged spinelike. The hind basitarsi rounded posteriorly, about three-quarters of the width of the tibiæ at their apex.

The wings hyaline, rather uniformly stained with yellow. The venation ferruginous, the costal and subcostal veins a slightly deeper red. The tegulæ ferruginous with a translucent pupil.

The abdomen bright reddish to fulvous both above and below; each of the first five tergites with a narrow, distinct, cream-colored band apically. The tergites finely, densely and rather uniformly tessellated, semidull; tergite 1, in addition, with shallow but fairly distinct, separated punctures bordering its apex. The hair on tergite 1 relatively long, erect, and pale. The erect hairs on the two succeeding tergites (best seen when the insect is viewed from the side) distinctly shorter and dark; dark, too, are the erect hairs on the three apical tergites but progressively longer and rather sparse with concentration at the sides in the case of tergite 6. Viewed from above, all of the tergites beyond tergite 1 reveal themselves as covered with short, pale, down-like, recumbent hairs; short but dense fringes of flat-lying hairs border the apex of tergites 2-5. The venter with white hairs except on the penultimate sternite, where some black hairs occur, and on the apical sternite, the hairs of which are wholly black.

Length about 9 mm.; width of thorax about $3\frac{3}{4}$ mm.; length of forewing, including tegulæ, $7\frac{1}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—Friese in describing *puncticollis* noted that he had received two specimens from Para through A. Ducke, taken on February 27 and in May. A specimen now in the American Museum bearing Friese's type label and the following data, "Para, 27-2, 1902, Ducke," is doubtless one of the two specimens that figured in Friese's description.

DISCUSSION.—Both Friese in his original description (1902) and Ducke (1916, 1925) differentiated *puncticollis* from *flavolineata*, one of the forms of *fasciata*, merely on the ground of its clearly punctated

mesonotum with polished interspaces between the punctures. While this in itself is a character probably justifying specific independence, considerable variability occurs in the sculpturing of the mesonotum within *fasciata*, witness as extreme departures from the usual condition *mimetica* and *boliviana*. Ducke raised the question, accordingly, whether *puncticollis* might not be one of the multiform subspecies of *scutellaris* (here superseded by the earlier name *fasciata*). What definitely removes *puncticollis* from *fasciata* and its subspecies is, however, not merely the distinctive punctuation of its mesonotum but its exceedingly reduced malar space, the lower rim of the eye virtually being in contact with the mandible at one point whereas in all of the subspecies of *fasciata* there is a clear separation of the two. In respect to its malar space *puncticollis* is indeed comparable to *schencki*, *concinnulla*, and *marginata*, all of which in the worker have rather similar facial proportions.

DISTRIBUTION.—Ducke mentions various places in the State of Para. So far as our knowledge extends at present, the typical subspecies is confined to that state.

***Melipona puncticollis* subspecies *ogilviei*, new subspecies**

♀.—The proportions and sculpturing of the head are those described for the typical subspecies. The coloration of the mandibles and labrum and the facial maculations virtually duplicate those of the typical subspecies, but the ground color of the clypeus is a little darker, brownish black rather than reddish brown. The scape dark, a little reddish at the base, but without a ferruginous stripe; the flagellum rather dark below, as well as above, with only the apical joint distinctly reddish. The lower half of the face rather glabrous but with traces of scalelike, appressed, pale pile on the sides of the face and borders of the clypeus. The hair of the front a little more yellowish with slightly dark admixture, the hair of the vertex a little more strongly fulvous than in the typical subspecies; but, on the whole, rather similar to the typical subspecies. The hairs on the genæ, labrum, and mandibles pale as in the typical subspecies.

The sculpturing of the mesonotum, scutellum, mesopleura, and propodeum as described for the typical subspecies. The pronotum black maculated with yellow. As in the typical subspecies, there is a pale yellow stripe bordering each side of the mesonotum confluent with the similarly colored axillæ and the scutellum of slightly deeper yellow. The pleura and propodeum dark. The hair of the pleura above and of the mesonotum much like that of the vertex, a rich fulvous, perhaps corresponding with the "reddish yellow" that Friese notes for the typical subspecies. The hair of the propodeum paler than that of the mesonotum, slightly ochraceous.

The legs much darker than in the typical subspecies, deep reddish-brown, even the apical joint of the tarsi being not much lighter in hue than the joints that precede it. The posterior apical angle of the hind basitarsi reddish and a diffuse reddish streak on the under side of the middle and hind femora. The coxæ, trochanters, and femora below with white hair; the hair on the femora above slightly more yellowish. Short, black, semibristle-like hairs on the outer surface of the middle tibia in addi-

tion to longer and softer, recumbent, pale hairs on this joint and also on the fore pair of tibiae; longer and more outstanding (not recumbent) pale hairs on the under side of the front and middle tibiae. The straight hairs of anterior fringe of the hind tibiae ferruginous, the succeeding, back-curved hairs of the anterior fringe black, and the hairs of the posterior fringe black (duplicating the condition in the typical subspecies). The hairs on the fore basitarsi pale and soft; on the middle and hind basitarsi and intermediate tarsal joints black, short, and more bristle-like.

The wings as described for the typical subspecies, but the tegulae more brownish.

The abdomen, in sharp contrast to that of the typical subspecies, prevailingly black (on the two basal tergites there is a diffuse reddish-brown staining and the basal concavity and the basal sternite are ferruginous). The first five tergites narrowly banded apically as in the typical subspecies, but these bands much less distinct,—feeble on tergite 4 and medianly interrupted on tergite 1. The sculpturing of the abdomen like that of the typical subspecies. The hair on tergite 1 long and pale, that of the subsequent tergites exclusively black (this applies to the recumbent hairs as well as to the erect ones); the black hairs fringing the apico-lateral margins of the abdomen are the longest. The venter with mostly pale hair, that of the apical sternite black.

Length about $8\frac{3}{4}$ mm.; width of thorax about $3\frac{3}{4}$ mm.; length of forewing, including tegulae, about $7\frac{1}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—This subspecies is based on a single specimen collected by Mr. J. Ogilvie and kindly loaned by Professor T. D. A. Cockerell to the American Museum.

DISCUSSION.—This insect is structurally identical with the relatively rare *puncticollis* from Para. Unfortunately there is only a single specimen from which to form an impression of its character and some elements in the above description may, therefore, be too limiting. In its facial and thoracic maculations, in the color of the hair of its head, thorax, and legs it very closely approximates the typical subspecies. The dark color of its legs and abdomen, however, and the exclusively dark color of the hair of the tergites beyond tergite 1 give it a very different superficial appearance from that of its relative from Para.

It is named in honor of Mr. J. Ogilvie, who caught the insect at Marshall Fall, Mazaruni River, British Guiana, on April 8, 1929.

This insect is superficially and in many respects fundamentally like Cockerell's *concinnulla*, a description of which follows.

DISTRIBUTION.—Known at present only from Marshall Fall, British Guiana.

Melipona concinnula Cockerell

INTRODUCTORY COMMENTS.—Known only from a single specimen, which may possibly be an aberrant form of *puncticollis*.

Melipona concinnula Cockerell

Melipona concinnula COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, pp. 203-204.

♂.—The proportions of the head resembling those of *puncticollis* and *schencki*. The eyes slightly convergent below. The malar space exceedingly reduced, eye and mandible being virtually in contact near the inner angle of the mandible. The spread of the ocelli relatively wide, the distance from the outer rim of one lateral ocellus to the outer rim of the other lateral ocellus being as in *puncticollis*, *schencki*, and *marginata* about twice the distance from the outer rim of the lateral ocellus to the eye. The arrangement of the ocelli linear as in these species but the middle ocellus, although fully formed, very minute when compared with the lateral ones, only about a third as large, whereas in *puncticollis*, *schencki*, and *marginata* it is only a little smaller than the others although oval rather than round. The clypeus and face rather flat, densely and minutely tessellate to punctate-tessellate and devoid of shininess. The mandibles yellowish red with narrow, black apex, which has a notch near the middle followed by a median denticle. The labrum yellowish red. The black clypeus bisected longitudinally by a fairly broad, cream-colored stripe that fails to reach the base. There is a cream-colored spot, too, in each of the antero-lateral angles of the clypeus, which connects with the pale, narrow stripe that borders the inner orbit of the eye to well above the level of the base of the antennæ. Scape black, with a longitudinal, reddish stripe of vague outline in front; the flagellum black above, dull brownish beneath, with a little brightening on the apical joints. The clypeus and sides of the face with an ultra fine but fairly dense covering of microscopic, appressed hairs, silvery white in hue. Silvery white hairs, too, fringe the lower edge of the clypeus and the lower edge of the mandibles, and are present also on the genæ. The hair on the front up-slanting and slightly tawny, and tawny also are the hairs on the vertex.

The mesonotum very finely but closely tessellated, here and there the tessellation giving way to a punctate condition such as characterizes *puncticollis*, the nearest relative of *concinnula*. Dense but rather distinct punctation on the mesopleura, but almost concealed by the thatch of hair. The propodeum very densely tessellated and dull. The mesonotum black but rimmed laterally by a rather strong band of yellow that is confluent with the bright yellow axillæ and scutellum. The hair on the mesonotum plastered down through moisture and therefore hard to interpret with certainty but probably of the tawny hue that characterizes the hair on its yellow-lined lateral margins, on the scutellum, and on the upper half of the pleura. The hair of the lower half of the pleura grading through ochraceous to white on the ventral surface. The propodeum rather densely covered with plumose, ochraceous hairs.

The hind tibiæ possibly a little broader relatively than those of *marginata* subspecies, though it is easy to miscalculate the dimensions when the insect itself is larger than those with which it is compared. The legs predominantly fulvous to ferruginous, but clouded with darker pigment. The coxæ, trochanters, and femora are wholly fulvous-ferruginous, and this is the condition mainly too of the hind tibiæ and tarsi. The front and middle tibiæ and their basitarsi are, however, brownish black and the ferruginous color does not again assert itself in their case until the apical tarsal joint is reached. Coxæ, trochanters, femora, front and middle tibiæ, and tarsi are clothed in this species with pale hairs; the anterior fringe of the hind tibiæ is tawny, the posterior fringe black.

The wings hyaline with yellowish staining. The tegulae ferruginous with a darker pupil.

The tergites dull due to a very dense if fine tessellation and the presence of hair. The tergites are black with the hind margin of the second and following tergites dark, obscure reddish. The hair rather abundant but not conspicuous because of its short and more or less appressed character. All of the tergites, including the basal ones, are covered with hair. Silvery hairs on the sternites except the apical sternite, which has black hair.

Length "about 9 mm."

♀.—Unknown.

♂.—Unknown.

TYPE.—From Rio Mato, Caura District, Venezuela, collected in October, 1909. Numbered 21677 in the type series of the U. S. National Museum.

DISCUSSION.—This species is very close to *puncticollis*. Even in such superficial respects as the maculation of the face and thorax and the coloration of the hair of the head and thorax, it is very close to the two subspecies of *puncticollis*. In more fundamental respects, too, such as the proportions of the head and the character of its sculpturing and in the presence of hair on all the abdominal tergites, and finally in the approximation to a punctate condition of the mesonotum, it emphatically indicates its affinity. In the coloration of its legs it leans in the direction of the typical subspecies of *puncticollis*; in that of its abdomen to the subspecies *ogilviei*. If, notwithstanding, I have retained it as a distinct species instead of making it a subspecies of *puncticollis*, it has been due to the extraordinary reduction of its median ocellus. A larger series—unfortunately as yet not available—would reveal whether this is in the nature of a freak development peculiar to an individual or an established character.

DISTRIBUTION.—Known only from a single specimen from Rio Mato, Venezuela.

***Melipona subnitida* Ducke**

INTRODUCTORY COMMENTS.—A species of apparently rather limited range and with as yet no recognized subspecies.

Melipona subnitida DUCKE, 1910, Rev. ent. Caen, XXVIII, pp. 107–108.

Melipona subnitida DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., pp. 157–158.

Melipona subnitida DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, p. 437.

Melipona subnitida MARTIN, 1930, La Nature (1st half-year), pp. 98–99.

"♀.—Body black, [sometimes] partly brownish; head without pale maculations; the hair is whitish on the face, which is dull, and brownish ferruginous [rust-red]

on the vertex, which is feebly shiny. Mandibles without teeth; malar spaces narrow; flagellum of the antennæ red, above rather brown. [The form of all parts of the head as in *M. scutellaris rufiventris*.]

"Thorax covered with hairs that are vividly ferruginous [rust-red]; mesonotum and especially the scutellum more or less shiny, but without distinct punctation; mesopleura densely punctated. The hind part of the propodeum finely punctated, smooth [and shiny] at the middle.

"Abdomen [strongly] convex, [finely roughened], fairly shiny; the three basal tergites have a small yellow spot in each apico-lateral corner. In dry specimens, however, these spots disappear more or less [for the most part]. Basal part of tergite 1 with long, grayish-yellow hairs; the dorsum of the abdomen up to tergite 5 with short and sparse pilosity, rather blackish [brownish]; tergite 6 and the venter with grayish-white hairs.

"Wings [rather strongly] yellow; tegulæ ferruginous.

"[Legs shaped as in *scutellaris rufiventris*], black or [in part] reddish brown; femora with grayish hair, tibiæ and tarsi with black hairs, ferruginous hairs on the interior surface of the latter.

"Length $7\frac{1}{2}$ to $8\frac{1}{2}$ mm.; width of thorax $3\frac{1}{4}$ mm."

[The above is a translation of DUCKE's original description of 1910 with elements from the description of 1916–1925 added in brackets.]

♀.—Unknown.

♂.—Unknown.

TYPE.—The original type material included specimens from Alcantara in the State of Maranhão and from Fortaleza, Maranguape, Baturité, Serra de Baturité, and Miguel-Calmon—all in the State of Ceara. The type localities listed in 1910 are duplicated without extension of range in DUCKE's accounts of 1916 and 1925. In a footnote to the paper of 1916 and in the text of the paper of 1925 DUCKE says that, unless there is an express statement to the contrary, locality records from north-eastern Brazil refer to specimens in the Museum of Para. Almost certainly, then, that is where the type was placed. Possibly some of the paratypes were distributed, for in a footnote to the edition of 1925 DUCKE indicates that of the material from northeastern Brazil and from Amazonia numerous duplicates were sent to different institutions.

DISCUSSION.—In his paper of 1925 DUCKE comments on the relations of *subnitida* as follows:

The present species resembles at first glance small specimens of *M. scutellaris rufiventris paraensis* but has a shiny thorax, an abdomen that is more strongly shiny and that, in the case of fresh specimens, bears on both sides of its anterior tergites a yellow spot or dot, and a uniformly black clypeus and scutellum; it is, however, if anything, somewhat more closely related to *nigra*.

These references leave one rather puzzled. Grounds for the belief that *subnitida* may be related to "*nigra*" (the insect here designated

schencki) are not mentioned by Ducke. It may be that the putative relationship is based on the fact that in both all the abdominal tergites have hair even though it is sparse in *subnitida*. Ducke's statement that the structural characters of the head duplicate those of *M. scutellaris rufiventris paraensis* would seem, however, to refer to a much more fundamental relationship. The fact that all of the tergites of *subnitida* are covered with hair and that the insect is relatively small conjures up the possibility of its being related to *puncticollis*. Against this must be weighed Ducke's statement that the plastic characters of the head accord with those of *M. scutellaris rufiventris paraensis* and the fact that this parallelism does not extend to *puncticollis*.

In the original description the "d" and "t" of *subnitida* are transposed but in Ducke's later references to the insect the spelling is *subnitida*, and that is the spelling here adopted in accordance with the Entomological Code, 1912.

DISTRIBUTION.—"Northern part of the dry northeastern Brazil," the localities being those listed for the type material in the states of Ceara and Maranhão.

Melipona schencki Gribodo

INTRODUCTORY COMMENTS.—The insect for which the name of *schencki* is here revived is the one that is recognized by other authors as Lepeletier's *nigra*. To sustain their viewpoint, there is the type material of *nigra* in the Paris Museum, consisting of four specimens, three of which bear the designation Rio de Janeiro and the fourth "Brésil, A. Saint-Hilaire, 1815." It is very doubtful, however, whether the so-called type material can be considered authentic. Certainly there is a wide divorce between it and some of the characters noted by Lepeletier in his brief description. The most notable disparity between the two is with respect to the hairs on the abdominal tergites, which in the description are referred to as sparse ("en petit nombre" or "subvillosum," a phrase applied by Lepeletier to other species with only an inconspicuous number of hairs). Lepeletier's description of *nigra* is too brief to be assigned with confidence, but certainly it would seem that it could under no circumstances be applied to *schencki*, the hair on the abdomen of which was so dense and concealing that Gribodo in his description hesitated to mention the color of the chitin beneath ("Because of the extreme density of the hair I could not see well what the coloring was of the dermis on the thorax and abdomen"). In view of the doubt as to the identity of *nigra*, similar doubt exists regarding the identity of *vestita* Klug, which Spinola (1840, p. 124) made the equivalent of *niger*.

KEY TO THE WORKERS OF *schencki* AND ITS SUBSPECIES

- The hairs of the scutellum and mesopleura subflavescent to fulvous; those of the mesonotum inclined to fulvous but usually with some dark admixture, in rare instances predominantly dark. The inner orbits of the eye with usually a pale stripe that tends to widen clavately below.....*schencki* (p. 422).
- The hairs on the scutellum and mesopleura blackish, as well as those of the mesonotum. No stripes along the inner orbits of the eye or at most a dull reddish discoloration in this region.....*picadensis* (p. 425).

***Melipona schencki* subspecies *schencki* (Gribodo)**

Melipona schencki GRIBODO, 1893, Bull. della Società entomol. Italiana, XXV, pp. 255-256.

Melipona schenckii DALLA TORRE, 1896, 'Catalogus Hymenop.,' X, p. 583.

Melipona nigra FRIESE (nec Lepeletier, 1836). Specimens in the American Museum determined by Friese as *nigra*.

Melipona nigra VON IHERING (nec Lepeletier, 1836), 1903, Zool. Jahrb. System. Geogr. und Biol., 1904, XIX, pp. 200-201, Pl. x, figure 3 (nest). (Assigned to the typical subspecies of *schencki* on the basis of the localities given by von Ihering, which are in Rio de Janeiro and in São Paulo.)

Melipona nigra DUCKE (nec Lepeletier, 1836), 1916, 'Enumeração dos Hymenopteros,' etc., pp. 158-161.

Melipona nigra COCKERELL (nec Lepeletier, 1836), 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 203.

Melipona vulpina COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, pp. 204-205. (Variety.)

Melipona nigra DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, pp. 437-439.

Melipona nigra BISCHOFF, 1927, 'Biologie der Hymenopteren,' pp. 106, 289, 292.

♂.—The head (plate IV, figure A) mostly opaque due to a fine, dense tessellation, but more or less shiny on the vertex and in the region about the ocelli. The facial quadrangle somewhat longer than broad. The tessellation on the clypeus sometimes with superimposed, scattered punctation similar to that of *favosa*. The eyes converging slightly below; the malar space reduced almost to the vanishing point. A denticle at the middle of the apex of the mandibles. The scape black except for a ferruginous discoloration at the base and sometimes at the apex; the flagellum black above but, except on the basal segment or the two basal segments, usually ferruginous below. The maculations on the face are variable in intensity and in extent. When strong and full, they usually are as follows: on the mandibles light ferruginous except for the black apical edge and the basal prominence, on the labrum light ferruginous, along the inner orbits of the eye to above the level of the antennæ narrowly cream-colored ("ivory-testaceous") though broadening as the lower part of the face is approached, on the clypeus stripelike down the middle and then more vaguely and often discontinuously cream-colored along the apical border to the inclusion of the antero-lateral angles of the clypeus; and there is usually a supraclypeal triangle. Sometimes there is also a yellow spot or a ferruginous discoloration at the lower extremity of the cheeks. In less clearly maculated specimens, the markings above noted are either quenched or diffuse, becoming of vague outline, and extremes are found in specimens even from the same locality. (In plate IV, figure A, the usually broad median stripe

on the clypeus has become thus diffuse and vague.) The hair on the lower half of the face is much less conspicuous than that on the upper half. The clypeus sometimes wholly bare but usually with relatively sparse, short, appressed, pale pile and at the base usually with a few, more erect hairs. The labrum and the under side of the mandibles bearded with a thin fringe of light hairs. The sides of the face and the region above the antennæ to the inclusion of the vertex covered rather densely with intermixed light and dark to mainly dark hairs that are especially long on the vertex, and long and up-slanting in the region between the antennæ and the ocelli (more erect and even down-slanting between the antennæ and on the lower sides of the face). The hair on the occiput silvery. The genæ with fine, for the most part light, hairs of intermediate length (such dark hairs as occur are usually confined to the upper half of the cheeks).

The hair of the mesonotum somewhat variable from gray or subflavescent to tawny, dulled usually by intermixed darker hairs, that in rare cases (*vulpina*) predominate. The hairs along the sides of the mesonotum, however, usually bright tawny as are those of the scutellum and mesopleura. The hairs of the metapleura and of the thorax below, pale. The propodeum is relatively bare, but such hair as occurs is light. The mesonotum is very finely tessellate. The sculpturing of the mesopleura is concealed beneath the thick matting of hair but, when stripped of this covering, reveals itself as finely and densely punctate. Densely and finely punctured, too, is the scutellum, but to appreciate this fact it is necessary to remove the all but concealing thatch of hair. The propodeum is densely and strongly tessellate, with resulting dullness. In a few specimens there are traces of yellow on the pronotum. The axillæ and scutellum are yellow, intensifying the vividness of the tawny hairs that clothe them. In some specimens this yellow continues upward from the axillæ, rimming as a narrow band the sides of the mesonotum to the level of the tegulæ.

The legs deep reddish-brown, sometimes verging on black, with black areas at the apex of the tibiæ, particularly the hind pair, and usually on the basitarsi. A dark red area at the base of the hind tibiæ as in many other species. The hind tibiæ (plate VII, figure C) triangular in outline, their surface convex basally, rather strongly excavated apically. The hind basitarsi rounded posteriorly, about three-fourths as wide as the hind tibiæ at their apex. The coxæ, trochanters, and femora with light hairs; the other joints with largely dark hair on their outer surfaces at least. The hind tibiæ with short, appressed, silvery pile on their inner surface, and all of the basitarsi with golden hairs on their inner surface.

The wings hyaline, faintly tinted with yellowish, of slightly darker stain in the basal part. The venation yellowish to brownish. The tegulæ ferruginous.

The abdomen dull with a fine tessellation on the two basal tergites; slightly more shiny on the other tergites, which are likewise tessellated and slightly granular in appearance. The hair on the tergites exceptionally dense, of rather uniform, intermediate length; that on tergites 1-2 usually wholly or mainly fulvous to ochraceous. In some instances tergite 3 may also be fulvous to ochraceous and there are even examples (probably callows) in which all of the tergites have exclusively or predominantly fulvous to ochraceous hairs. But the more usual condition is black or predominantly black hair on the tergites beyond tergite 2, although this is only fully apparent when the insect is viewed from the side, for, viewed from above, the hairs appear to be gray. There is an inconspicuous, thin fringe of pale hairs on the apex of tergite 2 and a similar fringe on the apex of the following tergites. The hair on the abdominal sternites silvery.

Length $8\frac{1}{2}$ to $9\frac{1}{2}$ mm.; width of thorax $3\frac{3}{4}$ to 4 mm.; length of forewing, including tegulae, $7\frac{1}{2}$ to 8 mm.

♀.—Head (plate I, figure A) smaller than that of the worker; narrower than its own narrowed mesonotum. The malar space not completely reduced as in the worker, about a quarter to a third as long as the mandible is wide at the base. The mandibles rather sickle-shaped, not straight. The sculpturing finer than in the worker, the clypeus especially being shiny instead of opaque and its maculations somewhat fuller than in the worker, but all parts of the body are more delicately sculptured and semishiny. The hair on the head, thorax, and abdomen rather uniformly straw-yellow, that on the legs also prevailing yellowish but with darker hairs intermixed. The hind tibiae (plate VII, figure A) not so broad as in the worker; at their apex about twice the width of the rather parallel-sided basitarsi. The outer surface of the hind tibiae more extensively convex than in the worker and overgrown with hair, not merely laterally fringed. The wings much shorter than in the worker. The abdomen (gravid specimen) very elongate and swollen, nearly half again as long as the head and thorax combined. An orange spot, shiny because relatively impunctate, on each side of tergite 1 near the base, has a significance possibly similar to that of the depressions in the corresponding region of *flavipennis*.

Length about 12 mm. (length of abdomen about 7 mm.); width of thorax $3\frac{1}{4}$ mm.; length of forewing, including tegulae, $6\frac{1}{4}$ mm.

♂.—Much the same general appearance as the worker but some specimens (possibly callows, for the chitin is light here and there instead of dark) have straw-colored hairs like the queen instead of the tawny hairs usual in the worker. The head (plate II, figure A) subtriangular, the face much narrower than in the worker, the sculpturing similar. The mandibles black with slightly reddish tips; the labrum black or black with a slight invasion of yellow. The clypeus wholly pale yellow or pale yellow with two more or less developed, irregular to subparallel, dark, longitudinal stripes. The lateral face-marks as described for the worker but, like the supraclypeal mark, sometimes feeble. No well-marked differentiation in the color of the flagellum above and below, the joints being rather uniformly black. The clypeus covered (but by no means concealed) by rather long, semierect to down-sloping or flat-lying light hairs instead of with the sparse, appressed, pale pile characteristic of the clypeus of the worker. Usually intermixed light and dark hairs on the upper half of the head as in the worker, but in some specimens there is no dark admixture.

The sculpturing of the thorax as noted for the worker. The coloration of the thoracic hairs usually as in the worker but sometimes as noted for the queen. The hind tibiae (plate VII, figure B) elongate suboval in shape, their somewhat rounded apex about as wide as the rather parallel-sided basitarsi, which are more than half the length of the tibiae. The color of the hair of the legs similar to that of the worker but in some specimens (possibly callows) wholly light.

The abdominal hairs present the same extremes of variability noted in those of the worker.

The genitalia are depicted on plate IX, figures E, F, G, H.

Length $8\frac{1}{2}$ to 9 mm.; width of thorax about 4 mm.; length of forewing, including tegulae, about 8 mm.

TYPE.—The description of *schencki* was based on a single worker in Gribodo's collection bearing simply the generalized designation Brazil.

According to Horn (1926) the Hymenoptera of Gribodo (and presumably among them this type specimen) were acquired by the Museum of Genoa. Cockerell's *vulpina* (at most, I think, a variety of the typical subspecies) was based on a single specimen that was collected at Rio de Janeiro, July, 1915, by P. G. Russell. It is in the U. S. National Museum and is numbered 21679.

DISCUSSION.—The coloration of the hairs on the abdominal tergites is, as Ducke (1916, 1925) pointed out in connection with "*nigra*," very unstable. There is also instability in the coloration of the thoracic hairs. An extreme case of darkening of the hairs of the mesonotum is to be seen in what Cockerell has described as *vulpina* from Rio de Janeiro. In the single specimen that formed the basis of Cockerell's description the hair is distinctly darker on the mesonotum than in other specimens from the same locality that I have had an opportunity to examine, but Cockerell's insect shares so many of the other characters of these specimens that I prefer to interpret it as a variety or aberration within the typical subspecies rather than as a distinct form. Notwithstanding its melanistic tendency, it seems to belong to the subspecies *schencki* instead of to the subspecies *picadensis*.

DISTRIBUTION.—The typical subspecies, as restricted in the above description, is represented by specimens in the collections under examination as follows:

BRAZIL.—Districto Federal: Rio de Janeiro, November (H. H. Smith). State of São Paulo: São Paulo, ♀ ♀, ♂ ♂, ♀, 1897 (Ihering), Cayeiras, 1900 (Wingerter). Ducke (1925) lists specimens of "*nigra*" also from Espírito Santo and Minas Geraes, but it is impossible for me to say whether they fall within the typical subspecies as here delimited or not.

***Melipona schencki* subspecies *picadensis* (Strand)**

?*Melipona gurupú* HERMANN MÜLLER, 1875, Zool. Garten, XVI, pp. 47, 50, (sans descrip.).

?*Melipona gurupina* HERMANN MÜLLER, 1875, Zool. Garten, XVI, p. 50 (sans descrip.).

?*Melipona gurupú* FRITZ MÜLLER, 1875, Zool. Garten, XVI, p. 295 (sans descrip.).

"*Melipona Guaráipo*" HOLMBERG, 1887, Boletín de la Acad. Nacion. de Ciencias en Córdoba (Rep. Argentina), X, pp. 258, 283.

Melipona picadensis STRAND, 1910, Zool. Jahrb. System. Geogr. und Biol., XXIX, pp. 554-555.

Melipona nigra BERTONI (nec Lepeletier, 1836), 1911, Anales del Museo Nacion. de Hist. Nat. de Buenos Aires, XXII [(3) XV], published 1912, p. 141.

♀.—The facial maculations subdued to absent; the line down the middle of the clypeus sometimes rather broad but of vague outline, reddish and diffuse, the inner

orbits of the eye immaculate or with only dimly traceable reddish discoloration. The labrum and mandibles brownish yellow to bright ferruginous, the mandibles in addition with the narrow black apical rim and the basal prominences black. The upper half of the face and the vertex sometimes with light and dark hairs intermixed but usually with mainly or wholly black hairs. Black, too, as a rule are the hairs on the cheeks; those fringing the mandibles below rather golden-hued.

Sharply in contrast to that of the typical subspecies is the coloration of the thoracic hairs, not only those of the mesonotum and of the mesopleura but even those of the scutellum and axillæ being blackish brown or black. The scutellum and axillæ "lighter than the mesonotum," which is black, but not corn-yellow as in the typical subspecies, rather more brownish.

The legs, according to Strand's description, with pure black hairs except for the hairs on the first and third coxæ, which "glint silver-gray in a characteristic manner" and except for the golden brushes on the inner side of the hind metatarsi. In the specimens here reported upon the color of the hair on the legs is somewhat variable but in most instances not merely the joints below the femora (with the exceptions noted in connection with the typical subspecies) but the femora as well have black hairs.

The tergites, according to Strand, with dark brown hairs (viewed from the side, the hairs have a brownish-yellow sheen). In the specimens here reported upon, tergites 1-4 have dense yellowish hairs (almost velvet-like viewed in mass) over most of their surface but a narrow fringe of black, rather bristle-like hairs at the apex of tergites 2-4 (best seen when the insect is viewed from the side). Tergite 5 has in these specimens largely yellowish hairs but usually there is also an invasion of black hairs, especially on the sides. Tergite 6 with usually large, erect, dark hairs and a few short, appressed, white hairs. Ventral hairs silvery gray as in the typical subspecies.

Length $8\frac{1}{2}$ to 10 mm.; width of thorax $3\frac{3}{4}$ to 4 mm.; length of forewing, including tegulæ, $7\frac{1}{2}$ to 8 mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—Described on the basis of a single specimen from Picada à Salto Yguazu, Paraguay, in the Zoological Museum of Berlin, identified by Friese as *Melipona nigra*.

DISCUSSION.—Although Strand compares his *picadensis* with *seminigra* and *fuscata*, the structural characters he gives seem to point to the probability that it is related to *schencki*, and this probability approaches a certainty when cognizance is taken of the fact that Friese had previously identified the insect as *nigra*. Friese like Ducke mistook, I think, for *nigra* the insect that Gribodo described as *schencki* and which I believe to be distinct from *nigra*. (See the INTRODUCTORY COMMENTS under *schencki*.)

It is likely, I think, that Strand's *picadensis* is very close to if not identical with the bee to which Hermann Müller and Fritz Müller allude independently as their *gurupú*. In Der Zoologische Garten, February, 1875, Hermann Müller mentions a number of species—among them

gurupú—as “nob.,” with the implication that they were described by him or possibly jointly by him and his brother. I have been unable, however, to trace the descriptions. They are listed neither in the Zoological Record nor in the Archiv für Naturgeschichte. The Royal Society Catalogue of Scientific Papers has yielded no title that might serve as a clue to the existence of a paper devoted to them. Dalla Torre, who takes the precaution in other instances of listing even species that appear without description in the literature, does not mention them in his ‘Catalogus.’ So that they may find place in the record, I list them herewith:

M. gurupú
M. coyrepu
M. lilliput

M. trombeta
M. variabilis

M. cuculina
M. gurupina

Of these names *gurupú* finds mention also in a footnote to a paper by Fritz Müller (1875) who in addition alludes to a *Melipona pulchella*, a *Trigona pigra*, and a *Trigona mirim* as species of which he and his brother are the authors—at least that is the inference placed upon the initials F.u. H.M. that follow each specific name. Of these species, too, diligent search has failed to reveal a description.

Hermann Müller (1875) recognized only one genus, *Melipona*, but of the species above listed only *gurupú*, *coyrepu*, *cuculina* (probably the virgin queen of *coyrepu*), and *gurupina* (probably the virgin queen of *gurupú*) can with reasonable certainty be assigned to *Melipona* as here delimited—this much Hermann Müller’s comments regarding the nest, etc., make fairly clear. Probably also *variabilis* is so to be considered. The other species are probably *Trigona*. The “smallest species,” *lilliput*, is alluded to in the paper of 1875 as not 3 mm. in size; in an earlier paper (1874) as “comparable in size to a housefly.” As to the identity of these species, with the possible exception of *gurupú*, doubt will probably remain.

The name *gurupú* bestowed by the Müllers is merely a corruption of the popular Brazilian name “guarupú” or “guarapú” (in Argentina and Paraguay “guaraiipo”) applied to the insect that, following the interpretation of Friese and Ducke, is usually known as *nigra* but that has here been termed *schencki*. Whether any distinction is drawn by the natives between the typical subspecies and the dark form is, however, doubtful. If I have associated the undescribed *gurupú* with the melanistic subspecies *picadensis* rather than with the typical subspecies of *schencki*, it is out of deference for the fact that Fritz Müller lived in Santa Catharina, where some of the specimens here assigned to

picadensis were taken. Blumenau, in Santa Catharina, was the place where he established himself and it was there doubtless that he observed "14 species of *Melipona* and *Trigona*," having in his own garden "4 of our species."¹

The predominance of yellowish hairs on the tergites characterizing the specimens merged with *picadensis* in the above description is shared by some specimens (probably callows) assigned to the typical subspecies of *schencki*, which nevertheless lack the black apical fringes on tergites 2-4 noted in the case of the specimens merged with *picadensis*.

DISTRIBUTION.—The small number of specimens of this subspecies in the collections under examination are all from the two southern states of Brazil,—Santa Catharina and Rio Grande do Sul. From the former state the locality represented is São Leopoldo, 1898 (Dutra); from the latter the specimens bear the label Campo Alegre. Possibly these differ slightly from Strand's *picadensis*, 1910, and Bertoni's *nigra*, 1911,—both from Paraguay—but not enough, I think, to justify further splitting. The brief and somewhat contradictory description that Holmberg (1887) gives under the popular name "Guaráipo" leaves one somewhat in doubt whether his insects were of the typical subspecies or closer to *picadensis*, but the fact that they were collected in Misiones, the narrow strip of Argentina that separates Paraguay from the Brazilian states of Santa Catharina and Rio Grande do Sul (in all of which *picadensis*, or what is very close to *picadensis*, occurs), leads me to believe that Holmberg's insects, too, may be closer to *picadensis* than to typical *schencki*.

***Melipona marginata* Lepeletier**

INTRODUCTORY COMMENTS.—Ducke, 1916 and 1925, who had available specimens of this species from a large number of localities, nevertheless merged them all regardless of their differences, with this comment: "It has not yet proved possible to establish geographic races in this species (although in the related and likewise very variable *M. scutellaris*² the varieties are well defined); light and dark, dull and shiny individuals in addition to all degrees of intergrade are found from north to south Brazil." Other investigators have, however, attempted to subdivide even the Brazilian forms, while outside of Brazil there are additional subspecies that have received recognition. The material from Brazil here reported upon is much less embracing, so far as *marginata* is concerned, than that upon which Ducke's paper was based. There is some

¹Quoted from a letter to Darwin, 1874.

²The group of insects here designated *fasciata*.

diffidence, therefore, in overriding his conclusions. Nevertheless consistency seems to demand that, as in the case of other species, an attempt at subdivision be made also for *marginata*, and hence recognition is given to several subspecies in the following key.

KEY TO THE WORKERS OF *marginata* AND ITS SUBSPECIES

- 1.—Rather robust, black bees, 8-9 mm. in length, with limited yellow maculations. Mesonotum shiny, with sparse, shallow punctures, not tessellated. Pronotum with a yellow, transverse band, mesonotum immaculate, axillæ maculated (but not the scutellum).....*marginata* subspecies *ghilianii* (p. 443).
Smaller and more slender bees, rarely more than 7 mm. in length, not infrequently less, including reddish as well as black species of various degrees of maculation.....2.
- 2.—Ground color of abdomen black or predominantly black.....3.
Ground color of abdomen red or predominantly red.....7.
- 3.—The mandibles black except for red on the apex. The axillæ as well as the scutellum immaculate. The hair of the vertex, mesonotum, scutellum, and upper half of the pleura exclusively black. The mesopleura dull due to dense tessellation.....*marginata* subspecies *torrida* (p. 436).
The mandibles ferruginous to red. At least the axillæ and sometimes also the scutellum maculated.....4.
- 4.—The mesopleura dull due to dense tessellation. The scutellum with largely fulvous to ferruginous hairs. The abdomen not infrequently with some of the tergites (especially the basal ones) red instead of black. Tergite 6 immaculate.....*marginata* subspecies *marginata* (p. 430).
The mesopleura more shiny, their tessellation evanescent to absent, being replaced by an ultra fine, sparse punctation. The scutellum with black or mostly black hairs. Tergite 6 maculated at the apex (sometimes feebly) . . 5.
- 5.—The clypeus immaculate, dull red at its middle. The femora bright red, the hind pair striped with black beneath; the front and middle tibiæ a little duller red, the hind tibiæ bright red at the base.
marginata subspecies *carrikeri* (p. 438).
The clypeus distinctly maculated. The legs with the color contrasts less sharply drawn, the reds inclined to brownish and dull.....6.
- 6.—The clypeus slightly arched. The mesonotum with strong lateral stripes. The scutellum as well as the axillæ maculated
marginata subspecies *bradleyi*, new subspecies (p. 439).
The clypeus distinctly flat. The mesonotum without lateral stripes. The scutellum black.....*marginata* subspecies *amazonica* (p. 435).
- 7.—The mesopleura dull due to dense tessellation. The hair of the vertex sometimes gray but usually with a strong blackish to brownish admixture, and dark hair as a rule present also on the mesonotum, but the hairs of the scutellum usually fulvous. Some of the tergites not infrequently black, especially those toward the apex. Tergite 6 immaculate.
marginata subspecies *marginata* (p. 430).
The mesopleura shiny with fine, sparse punctures. The hair of the vertex and mesonotum like that of the scutellum usually unmingled fulvous. Tergite 6 maculated at the apex.....8.

8.—The clypeus flat. The scape immaculate. The mesonotum shiny with clearly separated punctures instead of dense tessellation. The middle and hind legs bright red with sharply outlined black stripes on the under side of the femora as well as black on the knees, the apex of the tibiae, and the basitarsi. The front legs with similar dark areas but with the ground color less brilliantly red. *marginata* subspecies *tumupasæ*, new subspecies (p. 442).

The clypeus slightly arched. The scape with a strong stripe in front. The mesonotum dull due to dense, fine tessellation. The pronotum strongly maculated. The sides of the mesonotum heavily banded. The legs pale red with a black area on the apex of the hind tibiae and the hind basitarsi black, and usually a faint yellow, longitudinal stripe on the outside of the front and middle tibiae. *marginata* subspecies *illustris*, new subspecies (p. 440).

***Melipona marginata* subspecies *marginata* (Lepeletier)**

Melipona marginata LEPELETIER, 1836, 'Hist. natur. des Insectes, Hyménop.,' I, pp. 424–425.

Melipona marginata SMITH, 1854, 'Catal. Hymen. British Mus.,' part 2, p. 405.

Melipona marginata DALLA TORRE, 1896, 'Catalogus Hymenop.,' X, p. 580.

Melipona marginata SILVESTRI, 1902, Riv. Patol. veg., X, pp. 124–125, Pl. 1, fig. 6 (hind tibia).

Melipona marginata VON IHERING, 1903, Zool. Jahrb. Sytem. Geogr. und Biol., 1904, XIX, pp. 195–199.

Melipona marginata marginata SCHULZ, 1905, Zeitschr. wissensch. Insektenbiol., I, pp. 199–204, 250, 252.

Melipona favosa FRIESE (nec Fabricius, 1798). Specimens determined by Friese as *favosa*.

Melipona marginata DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., pp. 144–147. (In part.)

Melipona marginata COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, pp. 195, 199.

Melipona marginata atratula FRIESE, cited by Cockerell, 1919, U. S. Nat. Museum, 1920, LV, p. 205.

Melipona marginata DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, pp. 427–428. (In part.)

Melipona marginata BISCHOFF, 1927, 'Biologie der Hymenopteren,' p. 289.

♀.—The distance between the compound eyes at the level of the anterior ocellus less than the length of the eye. The spread of the ocelli rather wide, the distance from the outer part of the rim of one lateral ocellus to the outer part of the rim of the other lateral ocellus being about twice as great as the distance separating each ocellus from the inner margin of the corresponding eye. The malar space exceedingly reduced. The mandibles with a small denticle at the middle of their apical edge (sometimes worn down) and with an angulation at the inner corner of this edge. The mandibles usually prevailing red except for their black apical edge. The clypeus flat and minutely tessellate to tessellate-punctate; the front densely sculptured, finely granular; the vertex with more delicate tessellation, slightly shiny. The antennæ described as black, but more often brownish red on the under side of the flagellum; the scape dark, not with a stripe in front. The clypeus bisected longitudinally by a pale stripe of irregular thickness. The antero-lateral angles of the clypeus similarly

maculated, the maculations sometimes extending along the apical edge of the clypeus. The inner orbits of the eye bordered briefly by a pale stripe that usually broadens more or less abruptly below. A hemispherical or crescentic maculation in the supra-clypeal area. The hair of the head sometimes wholly gray but more often with a rather strong admixture of brownish or black on the front and vertex. The hairs of these parts prevailing plumose, especially so on the front, and up-slanting. Pale, scalelike pile on genæ in addition to down-slanting, gray hairs (plate III, figure F.).

The pronotum almost invariably black, very rarely with a little yellow. The mesonotum, pleura, and propodeum densely tessellated. The mesonotum black with usually faint or developed lateral stripes bordering its posterior half. The axillæ and scutellum yellow. The propodeum black, sometimes invaded by dark red. The hair of the thorax variable, rarely wholly cinereous or fulvous on the mesonotum, usually with predominantly brownish or blackish hair that is succeeded largely or wholly by fulvous hair on the scutellum. The hair on the mesopleura grayish, often with a fulvous tinge near the tegulæ.

The legs, particularly the middle and hind pair, often more or less testaceous to ferruginous (in the specimen on which Lepeletier's description was based, all the tibiæ and the two hind femora at the middle were testaceous), but specimens in which the legs are wholly or largely dark with lighter spots, if present, confined to the knees and the apex of the tibiæ, also occur. The hairs on the legs predominantly grayish; sometimes there are a few black hairs fringing the hind tibiæ (plate VI, figure F) or on the outer surface of the hind basitarsi, but even on these joints more often the hairs are silvery; within the tarsal joints have golden brushes.

The wings rather uniformly hyaline, with a faint yellowish tinge that is barely or not at all stronger in the median cell. The venation ferruginous.

The abdomen very variable in its basic color. The abdomen of the type is described as testaceous but more frequently only the basal segment or in some specimens the first two or three tergites are red, the others being more deeply brown to black. In other specimens the entire dorsum is dark, even the narrow apical stripes in rare instances being scarcely distinguishable (*M. marginata atratula*). As a rule these stripes are, however, rather distinct, being present on tergites 2-5 and usually present also on tergite 1 but not on tergite 6. Those on tergites 2-4 are emarginate laterally above with a resulting undulation. The tessellation on the tergites exceedingly fine to absent, with resulting shininess. The hair on tergite 1 is relatively long and pale with concentration into a tuft on each side of the basal concavity. Viewed from above the abdomen appears rather glabrous due to the short, inconspicuous, mostly dark, and recumbent hairs that sparsely cover it. Toward the apex of the abdomen, especially apico-laterally, these hairs are longer and more erect. The venter has silvery hairs except on the apical sternite, the hairs of which incline to golden.

Length 6 to 7 mm.; width of thorax $2\frac{1}{2}$ to 3 mm.; length of forewing including tegulæ $5\frac{1}{4}$ mm. to 6 mm.

♀ (Gravid specimen).—"The length of the body, measured from the apical margin of the clypeus to the anus, 8.5 mm., of the abdomen 5 mm., of the forewing 4.5 mm. Width of the thorax at the tegulæ 2.5 mm. The color of the wings and the venation as in the worker.

"Basic color pitch black. Tips of the tibiæ, the tarsi, and the hind margin of the abdominal segments light brownish. The tegulæ brownish yellow. The base and

apex of the scape, the segments of the flagellum beneath and the apical joint also above, reddish brown. Mandibles and labrum brown. The clypeus with the exception of two brown, longitudinal stripes and the similarly colored apical margin, a triangular maculation above the clypeus, malar spaces, sides of the face, and the scutellum as well as the axillæ, whitish yellow.

"Sculpturing of the head similar to that of the worker, but the forehead part a trifle shiny. Malar space longer than that of the worker, equal to the length of the second plus half of the length of the third joint of the flagellum. Antennæ likewise longer and more slender than in the worker, especially the joints of the flagellum; the terminal joint nearly as long as the two preceding joints. The genæ narrower than in the worker. Head covered throughout with fine, sparse, rust-yellow hair that is longest on the vertex.

"Thorax shiny, very finely and fairly densely punctated, covered throughout, as well as the legs, with long, coarse, rust-yellow hair, densest and longest on the tubercles and on the posterior rim of the scutellum. Hind legs naturally without corbicula, the tibiæ convex on their outer surface and hairy throughout.

"The propodeum dull, with very fine and dense, rugose punctation; only at the base in the middle there is a small, triangular, shiny, smooth space; hair fine, rust-yellow. Abdomen, as always¹ in the case of meliponid queens, considerably swollen and expanded, on its dorsal surface strongly shiny, finely and sparsely punctated. Segments 3 and 4 dull at the base, each with a plushlike transverse band consisting of short, dense, yellow hairs of minute size. The three end segments with long, rust-yellow, bristle-like hairs; the two end segments and to some extent also the one preceding them sloping downward almost perpendicularly. The spiracles of segment 1 are placed on each side at the beginning of the down-sloping part, appearing as small brown tubercles. Ventral segments shiny, finely and sparsely punctated; from the punctures spring yellow, bristle-like hairs. Yellow maculations are not traceable on the abdomen; nevertheless it is possible that in the case of living queens or of queens recently killed yellow may appear in broad extension on the hind margin of the three end segments, for in the specimen before me this seems almost to be the case, as though originally yellow had been present there and only as a result of internal rot, due to starvation, had been converted into brown."

The above description is a translation of that supplied by Schulz (1905) based on a specimen taken near the city of São Paulo. As *marginata* from this general region is here recognized as constituting the typical subspecies, the description is given precedence over that of Silvestri (1902) based on a specimen from Misiones, Argentina. It seems likely, however, from Silvestri's description of the worker that in Misiones also the typical subspecies occurs, and Silvestri's description of the queen may, therefore, be quoted for the additional aid it gives in interpreting the character of that sex:

♀.—"Black with the entire clypeus and the sides of the face stramineous; abdominal segments 3-6 and the tibiæ and tarsi of the legs rufescent. Abdomen with the anterior part of tergites 3-6 wholly covered with very short, dense hairs and the posterior part [of these tergites] with rather long hairs, those on tergites 5-6 long, in

¹True of the gravid but not of the virgin queen.

many rows, and increasingly rufescent; the posterior part of the sternites provided with short, rather sparse hairs as well as with rather long hairs posteriorly; sternite 6 rather narrow, subtrapezoidal, at the middle with no hairs, the remaining part covered with long hairs. The front and middle legs with their tibiae provided externally with rather long, rufescent hairs; the hind legs with the tibiae barely dilated toward the apex, their external face somewhat convex, provided with many short and long, rufescent hairs, the pecten and comb lacking; the metatarsus somewhat shorter than the tarsi, rounded, toward the apex slightly attenuated, its external face with shorter hairs and with these short hairs rather sparse, the internal face covered densely with rather stout hairs.

"Length of body 11; width of head 2.5, abdomen 4.

"Length of antennae 3.2, length of third tibiae 2.1; greatest breadth of tibiae 0.66.

"Length of third metatarsus 0.96, width of this 0.31."

♂.—The head (plate III, figure B) considerably broader than long. The eyes large. The ocelli rather widely spread, occupying from end to end a space more than three times as great as that separating the lateral ocellus from the eye. The face very narrow, particularly below; the clypeus filling the space between the eyes, with its lateral extremities in contact with their inner rims. Malar space barely detectable on the outer side; on the inner side the base of the mandible touches the rim of the eye. The front and clypeus densely and finely tessellated, dull, especially the front. The vertex also tessellated but more lightly so with resulting shininess. The clypeus, supraclypeal area, side of face to a little above the base of the antennae, and the antennal sockets yellow. The labrum and mandibles dark brown with reddish staining toward the apex of the mandibles. The hair of the clypeus sometimes ferruginous, sometimes dark, that of the front plumose and gray with dark admixture, that of the vertex largely dark brown, that of the genae gray. The scape and the first two joints of the flagellum shiny black; the remaining joints of the flagellum dull black.

The sculpturing of the thorax as described for the worker. The scutellum wholly yellow as in that cast, but the axillae sometimes mostly black and the lateral lines bordering the posterior half of the mesonotum not always present. In the three specimens on which this description is based the hair of the thorax is more unicolored than in the worker, being grayish brown on mesonotum and mesopleura and without transition to ferruginous on the scutellum. The whitish hairs on the tubercles are in contrast to the darker hairs surrounding them.

The legs largely blackish brown with ferruginous spots at the knees and at the apex of the tibiae; the tarsal joints (including the basitarsus) of the middle and hind pair of legs largely to wholly ferruginous. [Doubtless a larger series would reveal the range of variability noted in the case of the worker.] The hair of the legs rather uniformly pale, a trifle lighter on the femora than on the joints apical to them, and with pale, golden hairs on the inner surface of the basitarsi and of the other tarsal joints. The hind tibiae (plate VI, figure E) of an elongate, suboval shape, convex on their outer surface, rounded apically, only a trifle broader than their basitarsi and about twice as long.

The tergites dull with a fine, dense, uniform tessellation, much stronger than in associated workers even from the same locality, but possibly a larger series would tend to bridge the gap. In the three male specimens on which this description is based the tergites are black, with a fine line of yellow bordering apically tergites 1-5.

that on tergite 1 sometimes poorly developed, those on the other tergites usually distinct and of undulating shape on 2-4. The hair on the abdomen as described for the worker.

The genitalia are depicted on plate IX, figures I, J, K, L.

Length about $6\frac{1}{2}$ to 7 mm.; width of thorax $2\frac{3}{4}$ to 3 mm.; length of forewing, including the tegulæ, about 6 mm.

TYPE.—Lepeletier recorded *marginata* merely as "from Brazil." In the Natural History Museum in Paris there is a single specimen labeled "type" that was obtained in the western part of Minas Geraes. It may be of doubtful authenticity, but it is pretty close to Lepeletier's description and is here accepted as probably representative of his conception.

DISCUSSION.—Even the typical subspecies has, as the descriptions indicate, a rather wide range of variability. So far as the material before me may be relied upon, however, the sculpturing of the head and thorax is fairly constant, agreeing with the specimen labeled type in being microscopically roughened. What Friese separated as *atrátula* is scarcely separable from typical *marginata*, for specimens presenting an obliteration of the abdominal bands occur intermingled with specimens from the same locality having the bands distinct. Irrespective of whether or not the condition mentioned deserves varietal recognition the name *atrátula* has been used by Illiger [s. descr.], in 1806, and by Spinola (1840), who makes it a synonym of *hyalinata* Lepeletier.

DISTRIBUTION.—The range here indicated for the typical subspecies is based on specimens I have had an opportunity to examine or which from detailed descriptions by others can be safely included. In all probability, were more extensive material available, the territory occupied by the typical subspecies would prove to be greater. It is likely that specimens reported from the State of Rio de Janeiro, Brazil, as well as those from Paraguay, should be placed here. Even those from the State of Matto Grosso may be representative of the typical subspecies, which on the basis of the specimens here considered seems primarily a south Brazilian form.

SOUTH BRAZIL.—State of Minas Geraes: Bello Horizonte, November 1-6, 1919 (Cornell University Expedition). State of São Paulo: Itatilia¹ (Cornell University), ♂♂ as well as ♀♀, São Paulo, May, 1897 (Ihering), Jundiáhy, 1898 (Schrottky). State of Santa Catharina: Blumenau.

ARGENTINA.—Misiones (on the authority of Silvestri).

¹I have been unable to find this locality on the maps and I have wondered whether it could be a misprint for Itatiba, São Paulo.

Melipona marginata subspecies **amazonica** Schulz

Melipona marginata DUCKE, 1902, Zool. Jahrb. System. Geogr. und Biol., 1903, XVII, Heft 2, p. 288, pp. 298-299.

Melipona marginata amazonica SCHULZ, 1905, Zeitschr. wissensch. Insektenbiol., I, p. 204.

Melipona marginata DUCKE, 1916, 'Enumeração dos Hymenopteros,' etc., pp. 144-147. (Para specimens and possibly some others.)

Melipona marginata DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, pp. 427-428. (Para specimens and possibly some others.)

♂.—The proportions of the head and its parts and their sculpturing as described for typical *marginata*. The maculations of the face and the color of the mandibles also as described for the typical subspecies. In addition the scape has usually a more or less developed stripe in front, frequently confined to its base. The flagellum dark above, reddish below, tending to become bright red on the apical joint. The hair on the front gray with dark admixture and that of the vertex with dark usually predominant.

The sculpturing of the mesonotum and of the propodeum as in the typical subspecies, but the mesopleura with excessively delicate sculpturing and as a result more shiny than in *marginata* proper. In contrast to the typical subspecies the pronotum is pale yellow (not black) and merely the axillæ (and not also the scutellum) are similarly maculated. The mesonotum with a low, appressed growth of pale hairs and longer and more conspicuous, blackish hairs. Black hairs are present also on the scutellum in contrast to the usually fulvous growth on the scutellum of the typical subspecies. The other parts of the thorax with gray hair.

The legs a deep reddish-brown with sometimes a black stripe on the under side of the femora and tibiæ and blackish apices on the hind and occasionally the middle tibiæ, which, in addition, usually have a faint and abbreviated blackish stripe externally; there is a broad, black area, narrowly framed by reddish brown, also on the middle and hind basitarsi. The hair of the legs somewhat variable,—in the main light, but dark at least on the external surface of the hind basitarsi and usually also on the posterior lateral fringe of the hind tibiæ. The basitarsi and other tarsal joints with golden to copper-colored hairs within.

The wings as described for the typical subspecies.

The basic color of the tergites black although the basal concavity is sometimes reddish. The band on tergite 1 much interrupted or semiobliterated, usually reduced to two linear spots. The bands on tergites 2-4 undulating but continuous or with at most a narrow, median interruption, that on tergite 5 somewhat broader and not undulating. There is a strong maculation also on tergite 6, in contrast to the immaculate condition of that tergite in the typical subspecies. The hairs on tergites 2-6 are definitely black, and this is usually the condition, too, of the hairs on the apical sternite.

Length 7 mm.; width of thorax, 3 mm.; length of forewing, including tegulæ, $5\frac{3}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—In separating *amazonia* from typical *marginata*, Schulz relied on characters that Ducke (1902) had mentioned in his description

of *marginata* from Para. It is not quite clear whether Schulz had, in addition, actual specimens from that region. At any rate, he did not indicate where the type material, if such existed, was placed.

DISCUSSION.—It is with some diffidence that *amazonica* is here retained as a valid subspecies in view of Ducke's mature conclusion that geographic races within *marginata* have not yet been clearly separated. Ducke's earlier viewpoint, however, tended to recognize geographic races. In 1902, commenting on specimens of *marginata* from the State of Para, he drew many distinctions between the north Brazilian form on the one hand and the south Brazilian form on the other. If there was any hesitation on his part at that time to affirm the independence of each, it was in deference to Friese, who thought that "both forms belong together." If such was Friese's impression in 1902, it changed radically in the course of the years. There are in the American Museum collection three specimens from localities in the State of Para that were purchased from Friese and that are indubitably *amazonica*. Two of these Friese labeled *torrida*, a subspecies of *marginata* that he himself had described in 1916 from Costa Rica. Whether *amazonica* and *torrida* should be considered one, need not concern us for the moment. The important point is that Friese by assigning the name *torrida* to these specimens recognized them as distinct from the *marginata* of southern Brazil. The third specimen of *amazonica* Friese labeled *ghilianii*. It differs from other specimens that he assigned to *ghilianii*, but this again is of subordinate importance for the moment to the fact that he differentiated between the two forms from northern and southern Brazil. The three specimens in question have the shiny mesopleura and the distinctions of coloration that Ducke (1902) emphasized and Schulz (1905) reaffirmed for the northern form. On the basis of these specimens, admittedly limited in number, the distinctions established are convincing.

DISTRIBUTION.—The form *amazonica* seems to be the prevalent one in the State of Para, although, according to Ducke, it is at best rare. He collected specimens in the shady forests about Belem and Jambú-assú. The specimens from the State of Para in the American Museum collection were obtained at the following localities: Para, 1898 (Göldi) and July, 1903 (Ducke); Faro, July, 1903 (Ducke).

***Melipona marginata* subspecies *torrida* Friese**

Melipona marginata var. *torrida* FRIESE, 1916, Entomol. Zeit. Stettin, LXXVII, pp. 299-348.

Melipona marginata torrida LUTZ AND COCKERELL, 1920, Bull. Amer. Mus. Nat. Hist., XLII, p. 494.

♀.—Differs from the subspecies *amazonica* as follows: The labrum and mandibles prevalingly black, not ferruginous to red. The hair of the front prevalingly or exclusively dark; the vertex with exclusively black hair; even the genæ sometimes with brownish instead of whitish hairs. The scape not maculated.

Not merely the hairs of the mesonotum and scutellum exclusively black, but even the hairs of the mesopleura brownish black grading into gray below. The mesopleura densely tessellated like the mesonotum, not shiny. The pronotum black, not pale yellow. Not merely the scutellum but the axillæ immaculate.

The legs a very deep brown verging on black, with the black areas indicated for *amazonica* scarcely differentiated from the contiguous brown; the intermediate tarsal joints of at least the hind legs and the apical tarsal joint of all the legs reddish brown. The hair of the legs darker than in *amazonica*, those of the tibiæ and tarsal joints externally being sometimes wholly or mainly black.

The wings as described for the typical subspecies.

The bands on the abdomen more fragmentary, usually lacking on tergite 1, reduced to two widely interrupted, transversely linear spots on tergite 2, sometimes interrupted also on tergites 3-5; the maculation on tergite 6 lacking.

Length 7 mm.; width of thorax, 3 mm.; length of forewing, including tegulæ, $5\frac{3}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—The subspecies *torrida* was described from San José, Costa Rica. There are two specimens from this locality in the American Museum collection, both bearing date of 1913 and both secured through Friese. One of these bears a type label; the other, differing in trifling details from its fellow, was given yet another varietal name, *nigritula*,¹ by Friese,—a name he had previously employed to designate a variety of *flavolineata*.

DISCUSSION.—The differences between *torrida* and *amazonica*, its closest relative, have been indicated in the description. In the main these differences consist of more pronounced melanism in *torrida*, which has fewer maculations and predominantly black hair. Some of its characters agree with those of the typical subspecies; especially is this true of the closely tessellated and dull mesopleura, and the absence of distinct maculations on the pronotum.

As indicated in the DISCUSSION of *amazonica*, Friese has interpreted various specimens from the State of Para as *torrida*, thus considerably widening the original definition. If the conception of *torrida* be made thus inclusive, *torrida* itself must give way to the prior name of *amazonica*. I see, however, no need for merging *amazonica* from Para with *torrida* from Costa Rica, which on the basis of the specimens before me, supplemented by the descriptions, seem to be well separated by structural and other characters.

DISTRIBUTION.—Known at present only from Costa Rica.

¹This is probably a manuscript name.

Melipona marginata subspecies **carrikeri** Cockerell

Melipona marginata subspecies *carrikeri* COCKERELL, 1919, Proc. U. S. Nat. Museum, 1920, LV, pp. 198-199.

Melipona marginata carrikeri LUTZ AND COCKERELL, 1920, Bull. Amer. Mus. Nat. Hist., XLII, p. 494.

♀.—Clypeus dull red at the middle but otherwise immaculate. A narrow, pale stripe rimming the inner orbits of the eye to above the level of the antennæ, obliterated at its lower extremity. The mandibles yellowish red. The genæ below reddish brown, grading into black above. The scape with a dull red, indistinct stripe in front; the flagellum black above, dull reddish brown below, the apical tergite a little more brightly red. The hairs on the front and vertex exclusively black.

The sculpturing on the mesopleura much finer than on the mesonotum with resulting shininess in contrast to the dull, lustreless effect of the tessellation on the latter. The pronotum cream-colored. A cream-colored stripe on each side of the mesonotum, confluent with the maculation on the axillæ; the scutellum dark above but maculated on its rim. The hair of the mesonotum and scutellum wholly black. The hair of the pleura above briefly black grading into sooty gray, white below.

The legs marked similarly to those of *amazonica* but the color contrasts sharper and more conspicuous. The hairs in the main light on the joints above the tibiæ (a few black hairs at the apex of the hind femora) but black on the tibiæ and tarsi, even the anterior fringe of the hind tibiæ and the metatarsal brushes being black. The hairs of the terminal tarsal joint, like the joint itself, are, however, ferruginous.

The wings as described for the typical subspecies.

The ground color of the tergites black with the basal concavity deep reddish. All the tergites banded continuously though narrowly and toward the apex less distinctly with rather dull stripes, that on tergite 6 being barely traceable. The first three tergites bare, the hair on the three apical tergites prevailing dark. The sternites with pale hairs.

♀.—Unknown.

♂.—Unknown.

TYPE.—A single specimen (No 21668) from Costa Rica, collected by Carriker, June 15, 1902; in the U. S. National Museum.

DISCUSSION.—The presence not only of *torrida* but also of *carrikeri* in Costa Rica is an instance of the difficulty, pointed out by Ducke, of attempting to establish geographic races in *marginata*. The fact that *carrikeri* is erected on a single specimen makes it difficult to determine, too, whether that specimen represents merely an extreme individual development or is sustained in its distinctiveness by other specimens. Its relations to *amazonica* would seem to be a little closer than those it bears to its compatriot *torrida*.

DISTRIBUTION.—Costa Rica.

Melipona marginata subspecies **bradleyi**, new subspecies

♀.—Basic color black as in the subspecies preceding.

The proportions and the sculpturing of the head as described for the typical subspecies except that the clypeus is somewhat arched, not so distinctly flat. The mandibles ferruginous, narrowly edged apically with black. The facial maculations are those characteristic of the subspecies (exclusive of *carrikeri*) already described (the reader is referred to the description of the typical subspecies), but the scape in front has a strong, uninterrupted cream-colored stripe that is more emphatic than the corresponding maculation in *amazonica*. The second joint and the apical joint of the flagellum bright red, the other joints in the main dark even on the under side. The hair dusky gray on the front, gray with dark admixture on the vertex.

The sculpturing of the thorax much as in *amazonica*, the mesonotum dull anteriorly due to fine, dense tessellation, a little more shiny posteriorly; the scutellum strongly shiny (more so than in *amazonica*); the mesopleura sparsely dotted with faint, widely separated punctures, shiny; the propodeum of the usual, strongly tessellated type. The thorax highly maculated; the following parts strongly and brightly yellowish: pronotum; tubercles; continuous, heavy, lateral bands on the mesonotum extending from just beyond the tegulae to the completely maculated axillae; the scutellum except for a median, longitudinal, dark streak (probably a variable character). The hair on the mesonotum and scutellum black except that the scutellum has a fringe of white hairs posteriorly. The hairs of the mesopleura mainly gray, slightly tinged with fuscous on the upper half of the mesopleura.

The legs as described for *amazonica*.

The wings as described for the typical subspecies.

The abdomen very finely tessellated but nevertheless shiny. Tergites 1-6 continuously banded along their apex without median interruptions, the bands on tergites 2-4 slightly undulating laterally, the band on tergite 6 thicker than those preceding. The hairs on the apical tergites short and black, the basal tergites almost devoid of hair (except for the usual tuft of light hairs on each side of the basal concavity). The basal sternite cream-colored. The hairs of the venter silvery except on the apical sternite, the hairs of which intergrade between flame-red and black.

Length 7 mm.; width of thorax, 3 mm.; length of forewing, including tegulae, $5\frac{3}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—The description is based on a single specimen (type number 904.1), which was loaned by Cornell University and will be deposited there. The fact that the insect is so distinctive and comes from a section of Peru hitherto not reported upon justifies the belief that the specimen represents a valid subspecies and is not a case of extreme individual maculation.

DISCUSSION.—This subspecies differs from other prevailingly black forms of *marginata*, especially by the very full and ornamental character of its maculations and, in addition, structurally by the convexity of its clypeus in contrast to the flattened clypeus of most other subspecies.

The present subspecies is named in honor of Professor J. Chester Bradley, who through ardent field collecting in South America brought together, in collaboration with Dr. William T. M. Forbes and others, a collection of Meliponidæ that has been of unusual aid in the study of that family.

DISTRIBUTION.—The type specimen (type number 904.1) was collected between La Chorrera and La Sombra in the Putumayo District of Peru, August 21, by the Cornell University Expedition.

Melipona marginata subspecies **illustris**, new subspecies

♀.—Readily differentiated from the subspecies that precede (with the possible exception of extreme cases of the typical subspecies) by the prevailing red color of its abdomen.

The clypeus slightly arched as in *bradleyi*, the other parts of the head structurally as in the typical subspecies. The color of the mandibles and the maculations of the face as described for the typical subspecies, except that the scape is not immaculate but ornamented with a strong stripe in front running from base to apex, and the flagellum is usually of a brighter red beneath. The clypeus covered fairly densely with short, thick, pale hairs. The hair of the front and vertex prevailing yellowish to fulvous, usually without any dark admixture.

Yellowish to fulvous, too, is the prevailing color of the hair of the mesonotum, which rarely has dark admixture, and the hair of the upper part of the mesopleura also has the tendency to assume this hue. The mesonotum tessellated and dull as in the typical subspecies, but the mesopleura, like those of *amazonica* and of certain other subspecies, very delicately sculptured with resulting shininess. The pronotum strongly maculated; the tubercles maculated; the mesonotum with a well-developed, relatively broad stripe on each side that extends from before the tegulæ to the maculated axillæ and scutellum (the last-mentioned usually has a cloudy median area more or less bisecting it).

The legs pale ferruginous to fulvous, with the hind tibæ (at the apex), the hind basitarsi and the intermediate tarsal joints of the hind leg, and, of course, all of the claws on their apical half, black. In the three specimens on which this description is based there are no black stripes on the under side of the femora and tibæ as noted for some of the subspecies, but in two of the specimens at least there is a pale yellow, not very distinct, longitudinal stripe on the outer surface of the front and middle tibæ. The hair of the legs pale except on the dark areas mentioned, where the hair inclines to black, and except also for the usual golden to bronze basitarsal brushes.

The wings as described for the typical subspecies.

The basic color of the tergites bright red to chestnut-red (sometimes even a little sooty). All of the tergites, including tergite 6, maculated along their apex, the bands being narrow and continuous (uninterrupted medianly) and on tergites 1-4 at least undulating above. The basal tergites more or less glabrous except for the usual pale tuft on each side of the basal concavity; on the apical tergites the hairs are fairly dense but rather inconspicuous (except on the apico-lateral borders) due to the fact that they are short and semirecumbent. In color they are variable, tending to black in specimens with chestnut-red abdomens. The venter with pale hairs except on the apical sternite, the hairs of which are darker.

Length 7 mm.; width of thorax 3 mm.; length of forewing, including tegulæ, $5\frac{3}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—The holotype and the two paratypes are in The American Museum of Natural History.

DISCUSSION.—This subspecies by its wide distribution tends to justify Ducke's contention that geographic races of *marginata* have not yet been satisfactorily separated. On the other hand, its distribution is no greater than that of *rufiventris*, which has been recognized as a valid subspecies of the insect here designated *fasciata*. The subspecies *illustris* is rather close in some respects to typical *marginata*. Lepeletier's description of the abdomen of typical *marginata* fits this subspecies even rather better than it does the usual condition of typical *marginata*. Nevertheless *illustris* differentiates itself from specimens of typical *marginata* from southern Brazil that have come to my attention especially by its maculated scape, its maculated pronotum, the more developed character of the lateral bands on its mesonotum, the almost exclusively yellow or fulvous hairs of its head and mesonotum, the more delicate sculpturing of its mesopleura, the greater prevalence of red instead of black on its abdomen, and the apical maculation of its tergite 6.

In all of these respects except the coloration of the abdomen it alligns itself with *bradleyi*, in addition to having a clypeus of similar structure. From *bradleyi* it may be differentiated, however, not only by the red color of its abdomen (the basic color of the tergites of *bradleyi* being pitch black) but also by the absence or virtual absence of dark hairs on head and thorax (black hairs are abundant, particularly on the mesonotum, of *bradleyi*). In fact, only one of the three specimens of *illustris* (that from the Mount Duida region) has any dark hairs whatever either on the head or the thorax.

Two of the three specimens here considered were given by Friese the name *marginata* variety *rubra*. I have hunted in vain through the literature for a description under the designation *rubra* and have concluded that it is merely a manuscript name. Perhaps Friese reached the conclusion that the insect was not clearly separable from the typical subspecies and so abandoned the plan of describing it. A closer relative of *illustris* than the typical subspecies as here interpreted seems, however, to be *bradleyi*, and the two forms, impressively different as they are at first glance, may nevertheless be merely extremes of an intergrading series.

The subspecies *illustris* is superficially much like the subspecies *tumupasæ*. For distinctions between the two the reader is referred to the DISCUSSION of *tumupasæ*.

DISTRIBUTION.—There are three specimens in the present collection taken in rather widely sundered regions as follows:

BRAZIL.—State of Matto Grosso: Corumba. State of Para¹: Faro, December, 1905.

VENEZUELA.—Mt. Duida region, November 4, 1928 (G. H. H. Tate).

***Melipona marginata* subspecies *tumupasæ*, new subspecies**

♀.—Proportions of the head and its sculpturing as indicated for the typical subspecies. The mandibles ferruginous to red except for the basal prominences and a narrow rim of black apically. The labrum red. The facial maculations somewhat restricted: the median longitudinal stripe on the clypeus abbreviated, extending from the apex about halfway up the clypeus; the maculation in each of the antero-lateral angles of the clypeus brief; the band along the inner margin of each eye of considerable extent but narrow, without an abrupt, clavate expansion below; the supraclypeal area with two in-slanting and up-slanting, linear maculations that suggest an uncompleted angle. The scape fuscous, sometimes reddish in front; the flagellum black above but strongly brownish red beneath, the second joint and the apical joint bright red. The hair of the front ochraceous, that of the vertex bright golden yellow without admixture of dark.

The pronotum with yellowish to reddish staining. The mesonotum with a narrow, yellow stripe on each side from the level of the tegulæ to the watery yellow axillæ and scutellum. The tubercles and tegulæ ferruginous. The mesonotum subpolished, shiny, without tessellation but with rather fine, separated punctures. The mesopleura also shiny, with larger and more distinct punctures than those on the mesonotum rather sparsely distributed over its surface. The propodeum dull with the usual heavy tessellation. The hair of the mesonotum, scutellum, and even of the upper half of the mesopleura bright golden yellow; the lower half of the mesopleura and the thorax below with silvery hairs.

The legs with sharply contrasting areas of red and black (especially is this true of the middle and hind pair). The prevailing color is bright red but there are coal black stripes on the under side of all the femora and on the under side of all the tibiæ; there are black spots on the apices of all the tibiæ (in the case of the hind tibiæ the apical half of the joint is black); the middle and hind basitarsi are black except for a narrow border of red; there are splashes of black on the other tarsal joints of the hind pair of legs, and the apical half of the claws is black. The legs are covered for the most part with silvery hairs, especially so on the femora beneath, slightly more ochraceous on the hind femora above, on the middle tibiæ above, and on the lateral fringes of the hind tibiæ; the last-mentioned, as well as the hind basitarsi above, with some dark hairs. The basitarsi beneath with the usual golden to copper-colored brushes.

The wings as described for the typical subspecies.

The abdomen above and to a large extent beneath a vivid red; the basal concavity, however, dark brown, posteriorly edged with black. Rather broad, uniform,

¹Presumably State of Para, although Friese on his label has Amazonas.

medianly uninterrupted, yellowish stripes along the apex of all of the tergites, including tergite 6. No emargination above on the lateral halves of the bands on tergites 2-4, as is the case in several other subspecies; instead, two faint brownish lines are imbedded in the yellow of each of these bands, paralleling a condition that occurs in *favosa* and some of its subspecies. Tergites 1-2 sparsely covered with erect, mostly rather long, pale hairs which, in the case of tergite 1, are supplemented by a tuft of such hairs on each side of the basal concavity. The other tergites with shorter, denser, more flat-lying, fulvous hairs that tend to increase in length and conspicuousness on the apico-lateral edges. The venter with pale hairs on all but the apical sternite, the hairs of which vary from red to black.

Length 7 mm.; width of thorax 3 mm.; length of forewing, including tegulæ, $5\frac{3}{4}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—The type material consists of two workers from Tumupasa, Bolivia. The holotype is being placed in the National Museum, the paratype has been retained for the American Museum.

DISCUSSION.—Superficially the subspecies *tumupasæ* is very similar to the subspecies *illustris*, from which it differs as follows: clypeus rather flatter and nearly glabrous instead of with abundant short hairs; the scape immaculate or merely vaguely reddish in front, not with a strong, distinct, yellow stripe; the facial maculations more delicate, the maculations on the sides of the face not being abruptly clavate below nor the median stripe so thick or so long as in *illustris*; the pronotum not so fully maculated; the mesonotum shiny with delicate punctures on its surface, not dull due to dense tessellation; the legs a more vivid red with strong, black stripes on the underside of their femora and tibiæ whereas *illustris* lacks such stripes although it has usually very faint yellow stripes on the outer side of its front and middle tibiæ that are lacking in *tumupasæ*; bands of tergites 2-4 with imbedded dark line, not sinuous above on each side. This insect is very similar, too, to *M. puncticollis* subspecies *puncticollis*, but smaller in size, more delicate in the punctation of its mesonotum, and with broader abdominal bands.

DISTRIBUTION.—Known from Tumupasa, Bolivia, where it was taken by W. M. Mann in December, while on the Mulford Biological Expedition of 1921-22.

***Melipona marginata* subspecies *ghilianii* (Spinola)**

Trigona ghilianii SPINOLA, 1853, Mem. Accad. Sc. Torino (2) XIII, pp. 92-93. (Read December, 1850.)

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

Melipona marginata ghilianii FRIESE, cited by Cockerell, 1919, Proc. U. S. Nat. Museum, 1920, LV, p. 198.

♀.—Larger and more robust than any of the other subspecies. In its maculation but not in its sculpturing similar to *amazonica*. Rather fewer dark hairs on the vertex than in that subspecies, the hair in this region and likewise that on the front being prevailingly pale (in the type, according to Spinola, fulvous). Head maculated and sculptured as in typical *marginata* and as in *amazonica* and *torrida*, except that in neither of the specimens on which this description is based is there a pronounced clavate expansion of the lateral face-marks below, as is usually the case in the subspecies mentioned.

The pronotum with a cream-colored maculation as in *amazonica* and with merely the axillæ (and not also the scutellum) similarly maculated, again in agreement with *amazonica*. The mesonotum shiny, faintly dotted with minute, shallow punctures in contrast to the densely tessellated, dull mesonotum of typical *marginata*, *amazonica*, *torrida*, *illustris*, and *bradleyi*. The mesopleura with barely stronger punctation than the mesonotum, but the sculpturing here also very delicate with resulting shininess. The erect hairs of the thorax described by Spinola as sparse and fulvous. In the specimens here considered they are relatively sparse but blackish on the mesonotum and scutellum, gray on the mesopleura, agreeing in these respects with *amazonica*.

The legs described by Spinola as black, with the corbicula of the hind pair rufopiceous at the base. In the specimens here considered the legs are a deep reddish-brown, deepening into black here and there as already described for *amazonica*. The hair of the legs, described by Spinola as rufous, accords in the two specimens here considered with that described for *amazonica*.

The wings a little more cloudy than in the typical subspecies. The tegulæ brownish.

"The abdomen smooth and nearly glabrous to the naked eye." Even under the microscope the sculpturing appears very delicate, almost negligible, there being a few widely scattered, indistinct punctures on the subpolished basal tergites. The hair is relatively short and dark, sparse on the basal tergites, more dense on the apical ones, a little dulling their shininess. In the two specimens on which this description is based the maculations are similar to those of *amazonica*: they are reduced to widely separated, transversely linear, lateral spots on tergite 1, they are barely discontinued medianly and subemarginate laterally above on tergites 2-4, and are continuous on tergites 5-6; all of the bands are narrow and fine, merely edging the apex of each tergite. The bands on tergites 2-4 accord with the original description, which, however, fails to mention maculations on tergites 1, 5, and 6. The hairs of the venter pale, except on the apical sternite, where they are in one of the specimens brownish black.

Length 8 mm., width 3 mm., according to Spinola. The length of the present specimens is 8 mm., but the width is in excess of 3 mm., being more nearly $3\frac{1}{2}$ mm.

♀.—Unknown.

♂.—Unknown.

TYPE.—Spinola's description was based on a single specimen that Ghiliani had secured in the course of an expedition made in the year 1846 to the State of Para. Ghiliani was detained by illness in Belem, being unable to carry out his original project of collecting throughout the state. The type locality for *ghiliani* is, therefore, in all probability Belem.

The Hymenoptera of Spinola were placed, according to Horn, in the Museum of Turin and it is there probably that *ghilianii* is to be found.

DISCUSSION.—I have followed Friese in interpreting two specimens from Faro as probably representing *ghilianii* although in some respects, especially the coloration of the hair, the color of the legs, etc., the specimens do not accord with the description of Spinola. Allowance must be made, however, for the fact that Spinola based his description on a single specimen, which may have been slightly aberrant, and for the further fact that apparently his optical instrument was not of the strongest. Such a phrase as “to the naked eye,” which he employs in his description, raises doubt at least whether he had a dependable instrument.

An objection to the present interpretation that might be raised is that Spinola designated *ghilianii* as a *Trigona*, although one of unusually large size. Spinola's distinctions between *Melipona* and *Trigona* cannot, however, be accepted with confidence. He described, for instance, a *Melipona bocandei* from Africa, which is almost certainly a generic misinterpretation. Certain of the characters he gives for *ghilianii* point to the probability of its being a *Melipona*, and as such it is here designated.

The type of *ghilianii* was collected probably at Belem, but at any rate in the State of Para. The insects that Friese assigned to *ghilianii* are also from the State of Para, having been collected at Faro, just across the border from the State of Amazonas.¹

In several respects Spinola's description applies nearly as well to *amazonica*, also from the State of Para, but the dimensions indicated for *ghilianii* and the specification “shiny” as applied to its body in the inclusive sense accord better with the two specimens from Faro than they do with the specimens that were assigned to *amazonica*.

On the basis of their maculations and the color of their hairs it would be difficult to separate *ghilianii* as here interpreted from *amazonica*. Nevertheless the greater size of *ghilianii* and the much lighter sculpturing of its mesonotum readily differentiate it from its smaller relative.

DISTRIBUTION.—State of Para, Brazil. The type presumably from Belem. Represented in the present collection by two specimens from Faro, taken in December, 1905.

***Melipona rufipes* Friese**

INTRODUCTORY COMMENT.—A species of apparently very restricted distribution, known as yet from only one locality.

¹Friese's label indicates Faro, Amazonas, but available maps list Faro in Para and do not mention any Faro in Amazonas. Presumably the locality is that close to the borderland of the neighboring state.

Melipona rufipes FRIESE, 1900, Természettajzi Füzetek, XXIII, p. 382.

Melipona rufipes DUCKE, 1916, 'Enumeração dos Hymenopteros,' p. 147.

Melipona rufipes DUCKE, 1925, Zool. Jahrb. System. Geogr. und Biol., XLIX, p. 429.

“♂.—Especially in its build very similar to *M. marginata*, but without any yellow maculations whatever, face broader, abdomen with a much more strongly developed covering of hair (which, nevertheless, is much less pronounced than in *M. nigra*). The chitin uniformly black to dark brown; the mouth, antennæ, and the great part of the legs reddish brown. The hair of the body (even that of the ventral segments) rust-colored, on the thorax abundant and long, on the dorsum of the abdomen grading rather more into brown and short, but especially from segment 3 on very uniform and fairly dense. Face broader than in *marginata*, finely roughened, dull; the malar space short. Thorax (in the case of the only specimen that I saw) feebly shiny but in the case of the scutellum rather strongly shiny; the pleura with regular punctation; the mesonotum with obsolescent sculpturing. The abdomen with little shininess, at the end portion almost dull with fine sculpturing. [Friese in his brief original description speaks of the abdomen as fuscous and the venter as ferruginous.] Legs as in *marginata*, in the case of the specimen before me merely somewhat more slender; the knees and the end of the tibiæ black. Wings stained a fairly dark yellow. Length of body $7\frac{1}{2}$ to 8 mm., width of thorax 3 mm.”

[The above is a translation of Ducke's redescription of *rufipes*.]

♀.—Unknown.

♂.—Unknown.

TYPE.—Ducke reported (1925) that several specimens were in the collection of Friese.

DISCUSSION.—There is no specimen of this species among the material here reported upon. The reader is referred to the DISCUSSION under *variegatipes* for certain surmises regarding the affiliations of *rufipes*.

DISTRIBUTION.—Known only from Uberaba in the State of Minas Geraes, Brazil.

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bibliography of arthropods associated with meliponid bees the reader is referred to the paper by George Salt: 'Contribution to the ethology of the Meliponidæ' (Trans. Ent. Soc. London, 1929, LXXVII, pp. 468-470).

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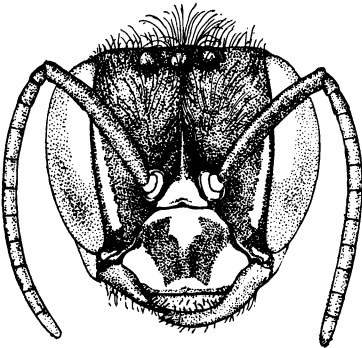
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PLATES I to X

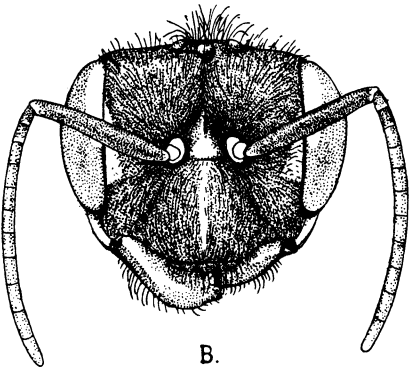
PLATE I

Melipona Queens.—A, *schencki* subspecies *schencki*; B, *fasciata* subspecies *rufiventris*; C, *beecheii* subspecies *beecheii*; D, *interrupta* subspecies *salti*; E, *flavipennis*; F, *quadrifasciata* subspecies *anthidioides*.

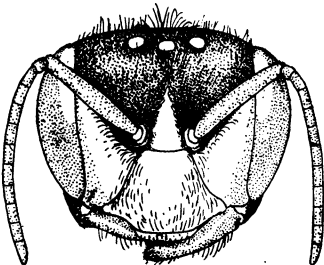
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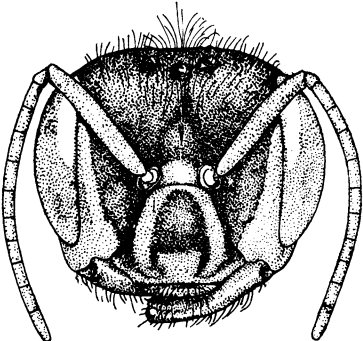
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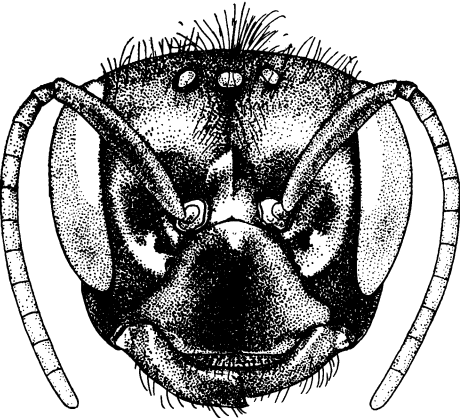
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C.

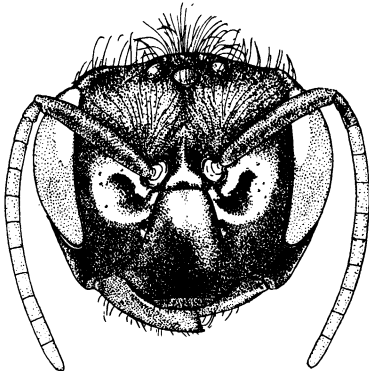


D.



E.

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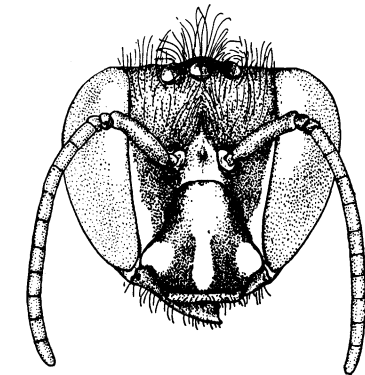


F.

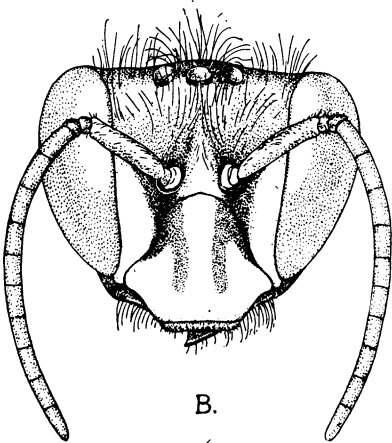
PLATE II

Melipona Males.—A, *schencki* subspecies *schencki*; B, *fasciata* subspecies *rufiventris*; C, *beecheii* subspecies *beecheii*; D, *interrupta* subspecies *salti*; E, *flavipennis*; F, *quadrifasciata* subspecies *anthidioides*.

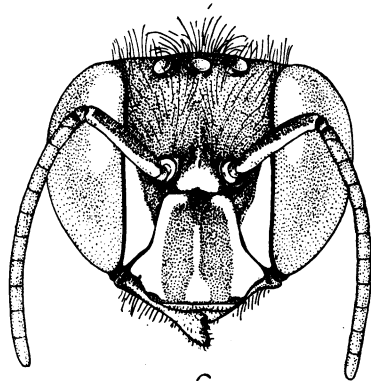
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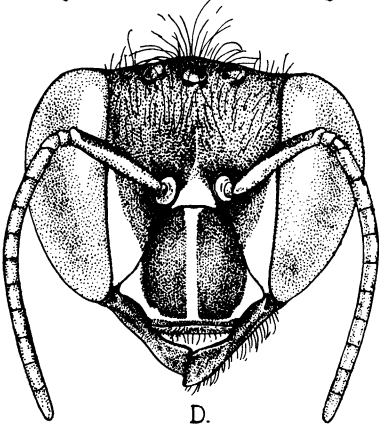
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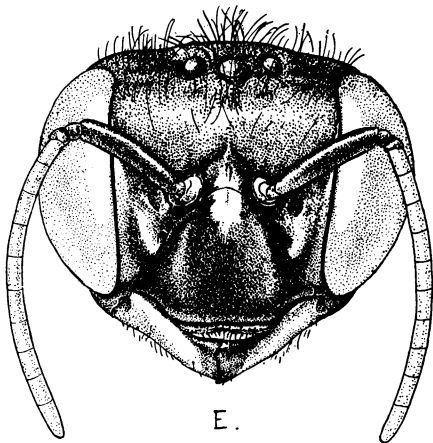
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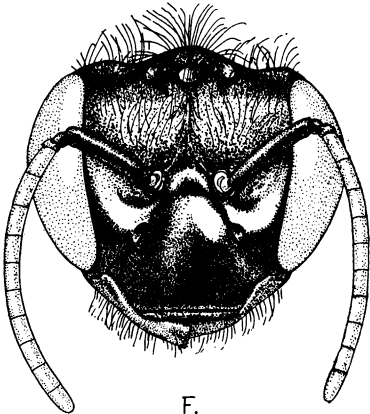
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D.



E.



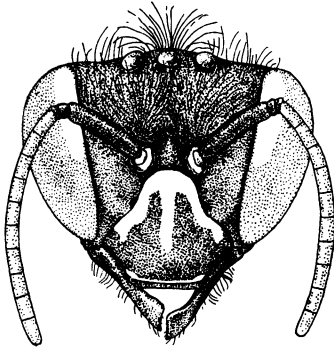
F.

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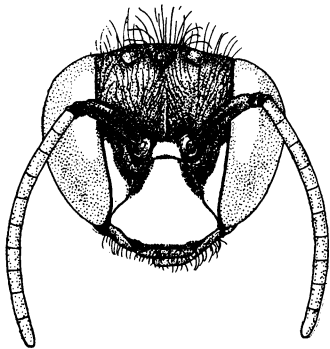
PLATE III

Melipona Males and Workers.—A, *favosa* subspecies *orbignyi* ♂; B, *marginata* subspecies *marginata* ♂; C, *quinquefasciata* ♂; D, *quinquefasciata* ♀; E, *favosa* subspecies *favosa* ♀; F, *marginata* subspecies *marginata* ♀.

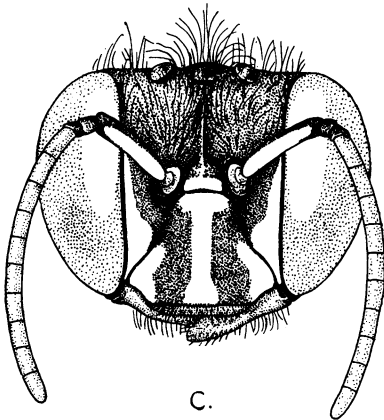
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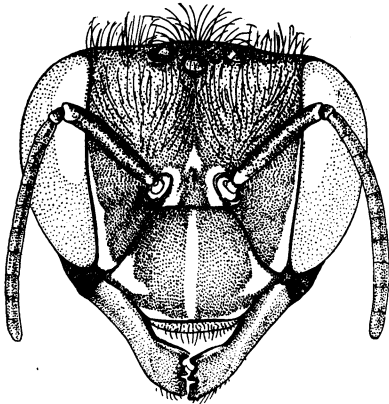
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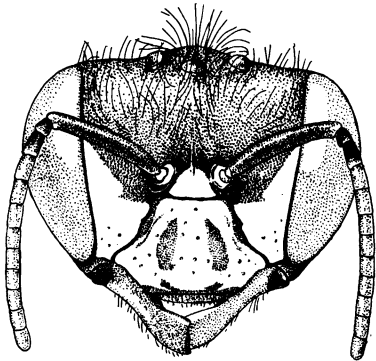
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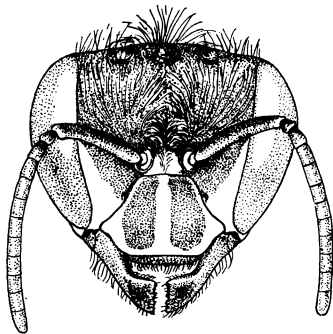


D.



E.

E.L.Beutenmuller.

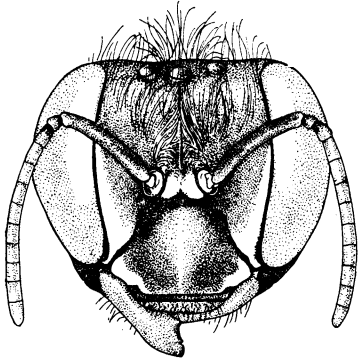


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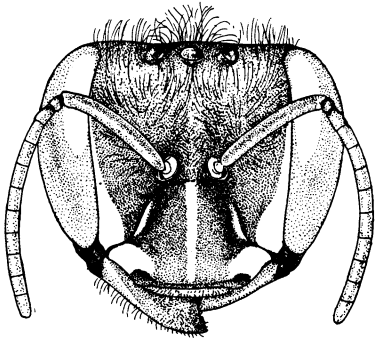
PLATE IV

Melipona Workers.—A, *schencki* subspecies *schencki*; B, *fasciata* subspecies *rufiventris*; C, *beecheii* subspecies *beecheii*; D, *interrupta* subspecies *salti*; E, *flavipennis*; F, *quadrifasciata*.

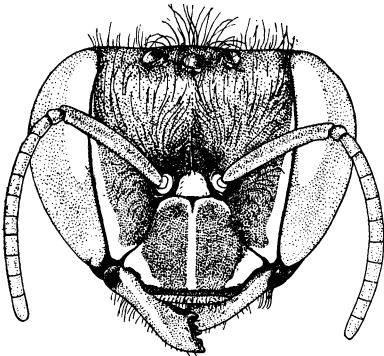
(From freehand drawings ; magnification about $\times 10$.)



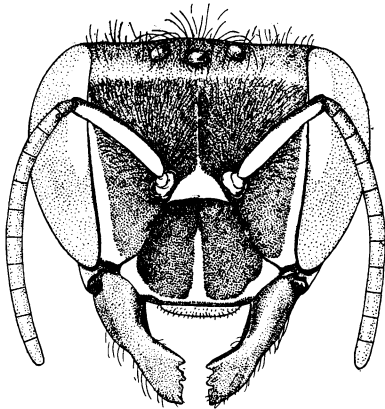
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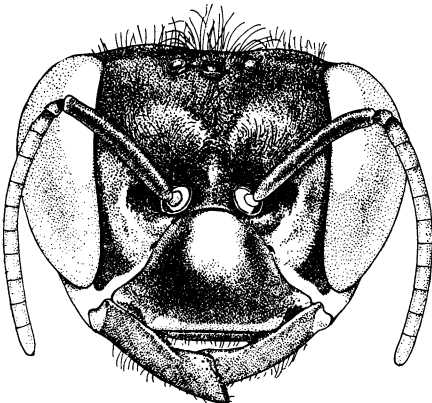
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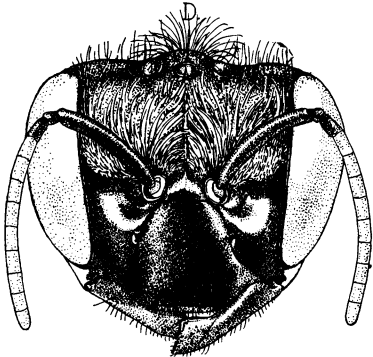
C.



D.



E.



F.

EL Beutenmuller.

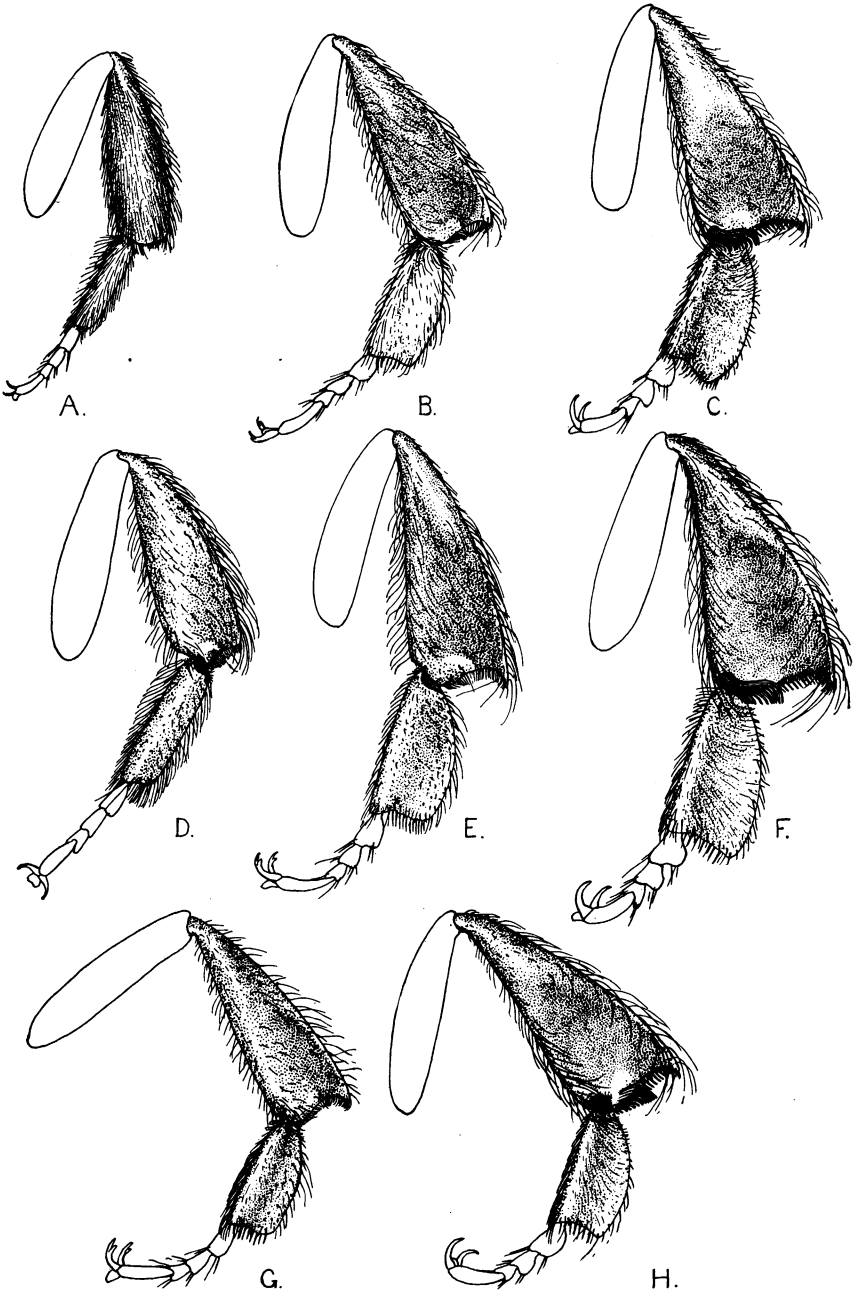
PLATE V
HIND TIBIÆ AND TARSI.

TOP ROW.—*Melipona beecheii* subspecies *beecheii* (A, ♀; B, ♂; C, ♀).

MIDDLE ROW.—*Melipona interrupta* subspecies *salti* (D, ♀; E, ♂; F, ♀).

BOTTOM ROW.—*Melipona quinquefasciata* (G, ♂; H, ♀).

(From freehand drawings; magnification about $\times 10$.)



H.
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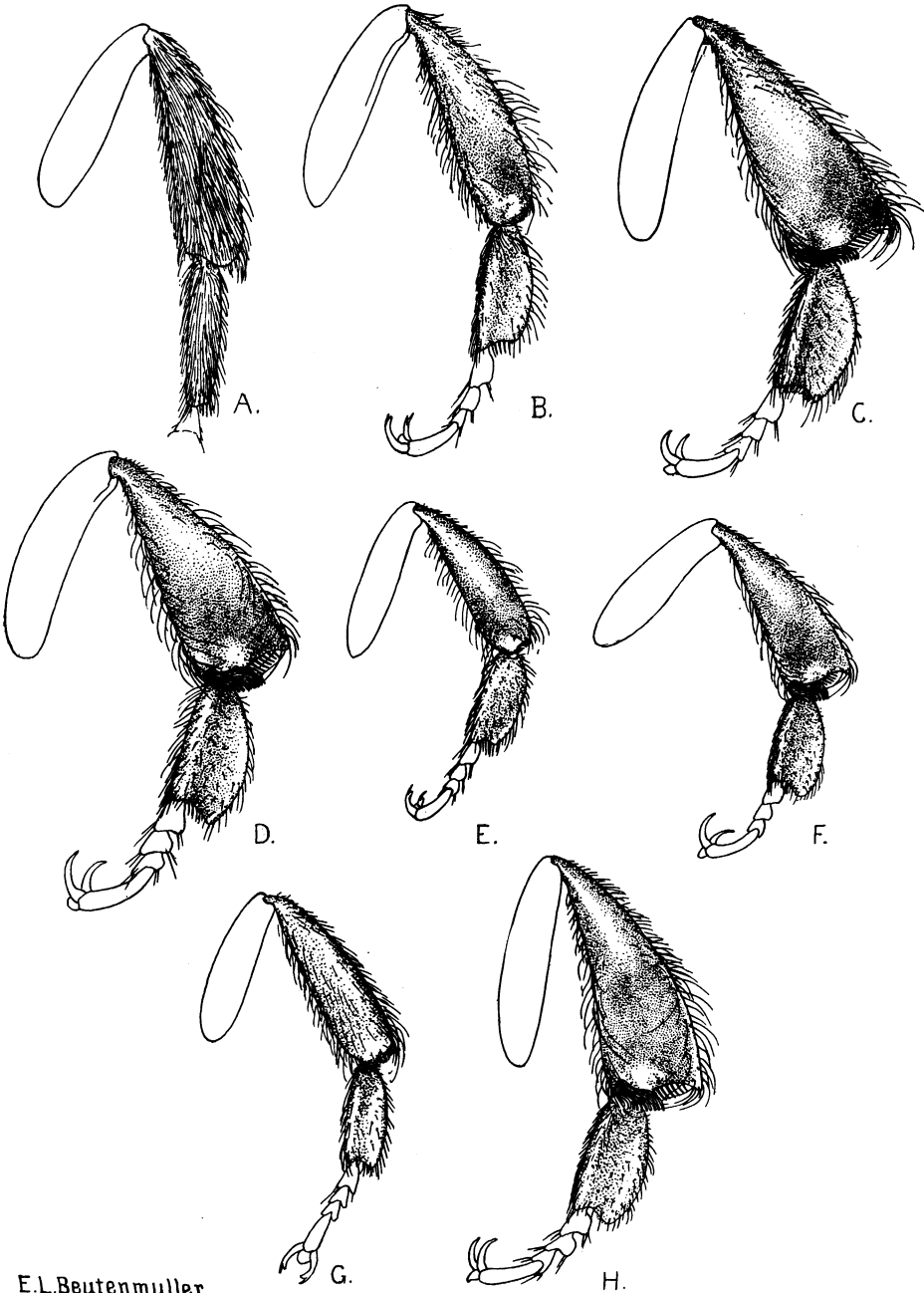
PLATE VI
HIND TIBIÆ AND TARSI.

TOP ROW.—*Melipona fasciata* subspecies *rufiventris* (A, ♀; B, ♂; C, ♀).

MIDDLE ROW.—*Melipona puncticollis* (D, ♀); *Melipona marginata* subspecies *marginata* (E, ♂; F, ♀).

BOTTOM ROW.—*Melipona favosa* subspecies *phenax* (G, ♂); subspecies *favosa* (H, ♀).

(From freehand drawings, magnification about $\times 10$.)



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PLATE VII

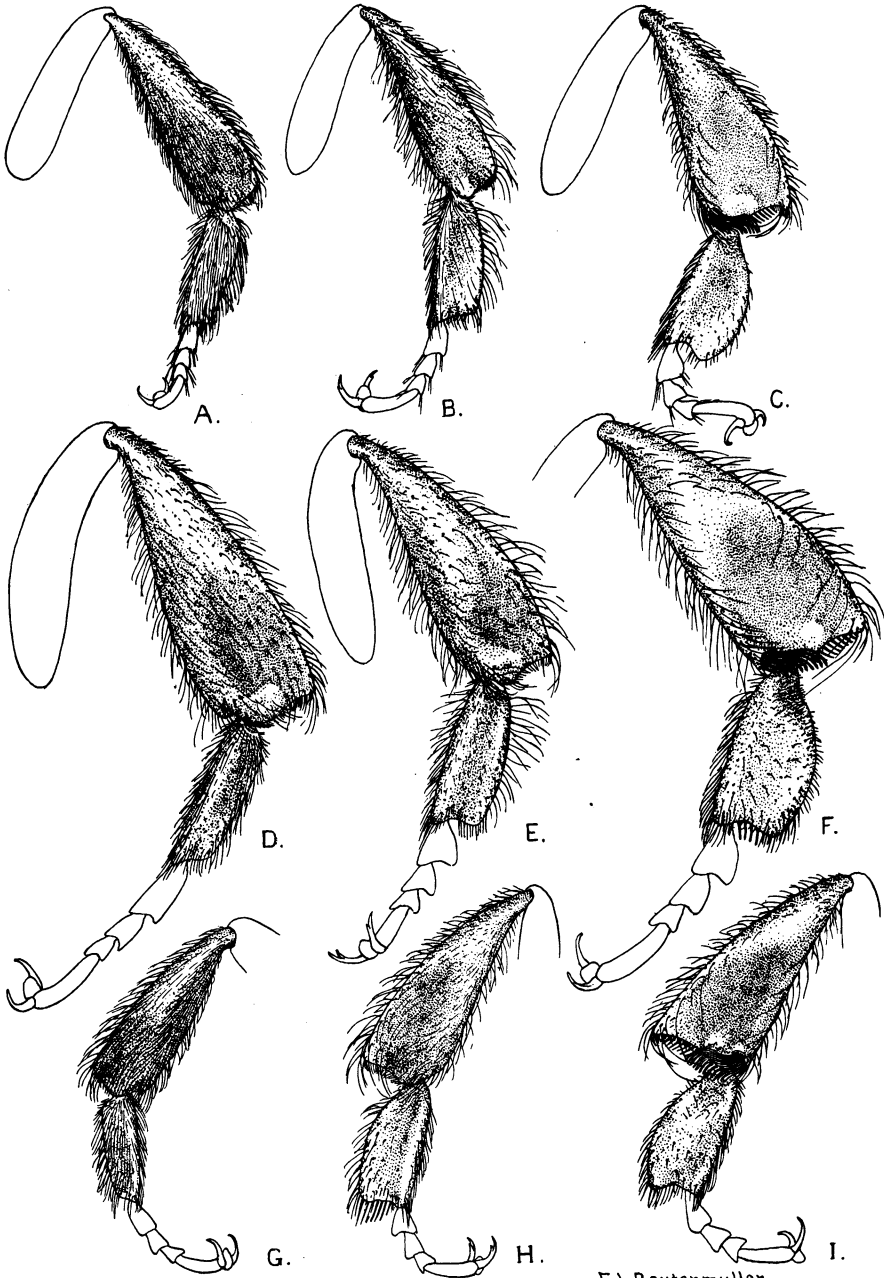
HIND TIBIÆ AND TARSI.

TOP ROW.—*Melipona schencki* (A, ♀; B, ♂; C, ♀).

MIDDLE ROW.—*Melipona flavipennis* (D, ♀; E, ♂; F, ♀).

BOTTOM ROW.—*Melipona quadrifasciata anthidioides* (G, ♀; H, ♂; I, ♀).

(From freehand drawings; magnification about $\times 10$.)



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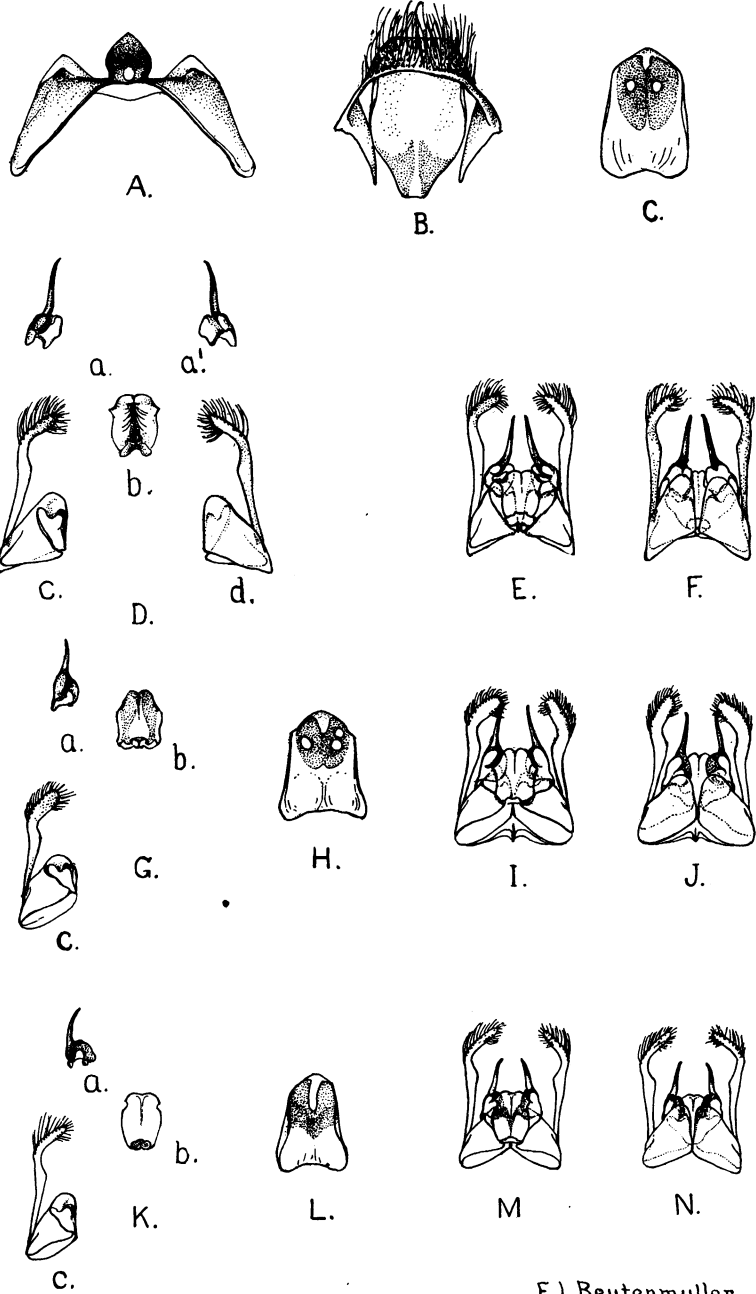
PLATE VIII

Melipona interrupta subspecies *salti*.—A, concealed sixth sternite, with the ordinarily exposed, spadelike process; B, seventh tergite (or eighth tergite if the propodeum be counted as the first segment), ordinarily concealed by the preceding tergite, within it is the largely membranous eighth (or ninth) tergite; C, spatha, with its fenestræ; D, *a* and *á*, dorsal and ventral view respectively of a sagitta, *b*, uncus, *c*, stipes and stalklike volsella, dorsal view, *d*, stipes and volsella, ventral view; E, the genitalia, exclusive of the spatha, dorsal view; F, the genitalia, exclusive of the spatha, ventral view.

Melipona beecheii subspecies *beecheii*.—G, *a*, sagitta, dorsal view, *b*, uncus, *c*, stipes and stalklike volsella, dorsal view; H, spatha, showing fenestræ; I, genitalia, exclusive of the spatha, dorsal view; J, genitalia, exclusive of the spatha, ventral view.

Melipona quinquefasciata.—K, *a*, sagitta, dorsal view, *b*, uncus, *c*, stipes and stalklike volsella, dorsal view; L, spatha; M, genitalia, exclusive of the spatha, dorsal view; N, genitalia, exclusive of the spatha, ventral view.

(From freehand drawings; magnification about $\times 10$.)



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PLATE IX

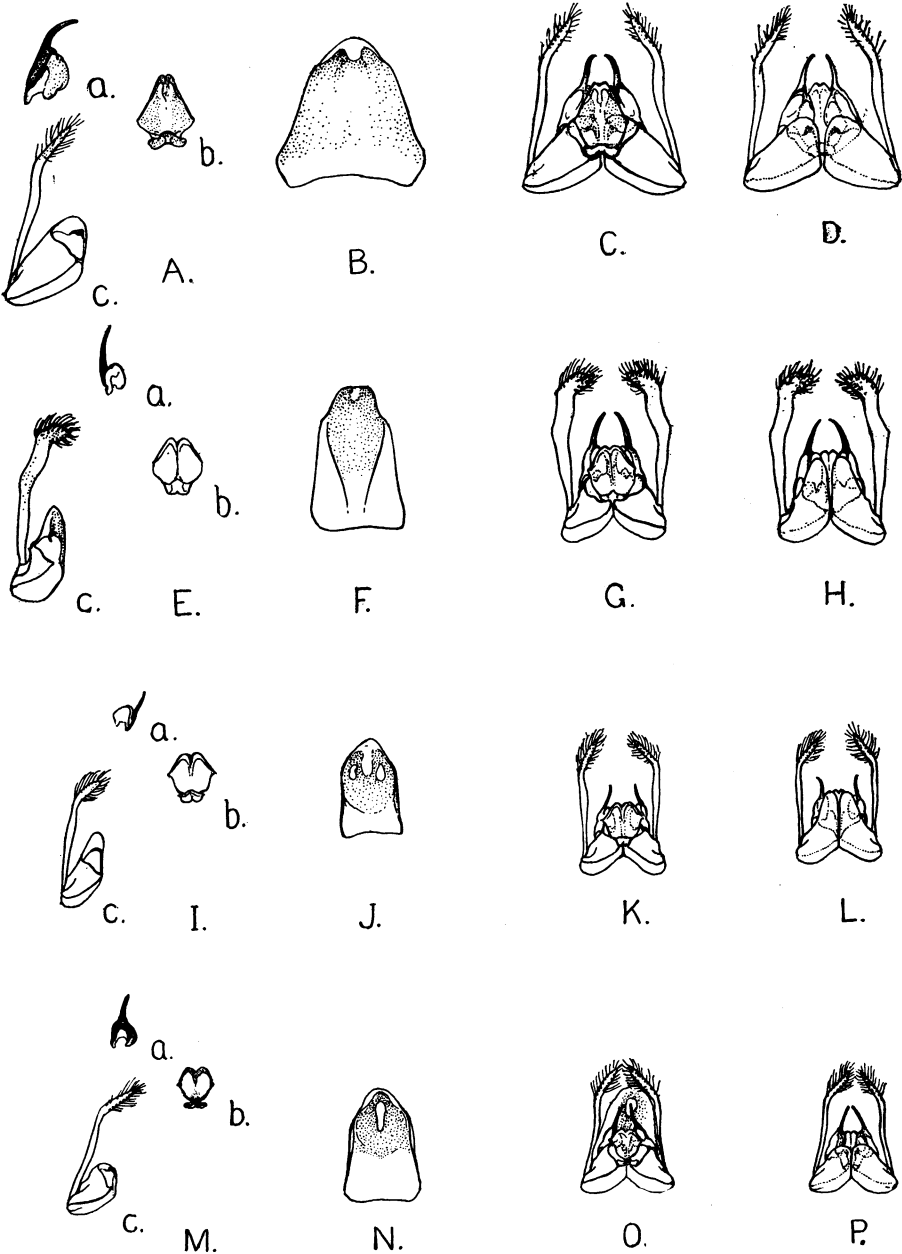
Melipona flavipennis.—A, *a*, sagitta, lateral view, *b*, uncus, *c*, stipes and stalklike volsella, dorsal view; B, spatha; C, genitalia, exclusive of spatha, dorsal view; D, genitalia, exclusive of spatha, ventral view.

Melipona schencki subspecies *schencki*.—E, *a*, sagitta, lateral view, *b*, uncus, *c*, stipes and stalklike volsella, dorsal view; F, spatha; G, genitalia, exclusive of spatha, dorsal view; H, genitalia, exclusive of spatha, ventral view.

Melipona marginata subspecies *marginata*.—I, *a*, sagitta, *b*, uncus, *c*, stipes and stalklike volsella, dorsal view; J, spatha, with fenestræ; K, genitalia, exclusive of spatha, dorsal view; L, genitalia, exclusive of spatha, ventral view.

Melipona favosa subspecies *phenax*.—M, *a*, sagitta, dorsal view, *b*, uncus, *c*, stipes and stalklike volsella, dorsal view; N, spatha, with fenestra; O, genitalia, including spatha, dorsal view; P, genitalia, exclusive of spatha, ventral view.

(Freehand drawings, magnification about $\times 10$.)



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PLATE X

Melipona fasciata subspecies *paraensis*.—A, *a*, sagitta, lateral view; *b*, uncus; *c*, stipes and stalklike volsella, dorsal view; B, spatha.

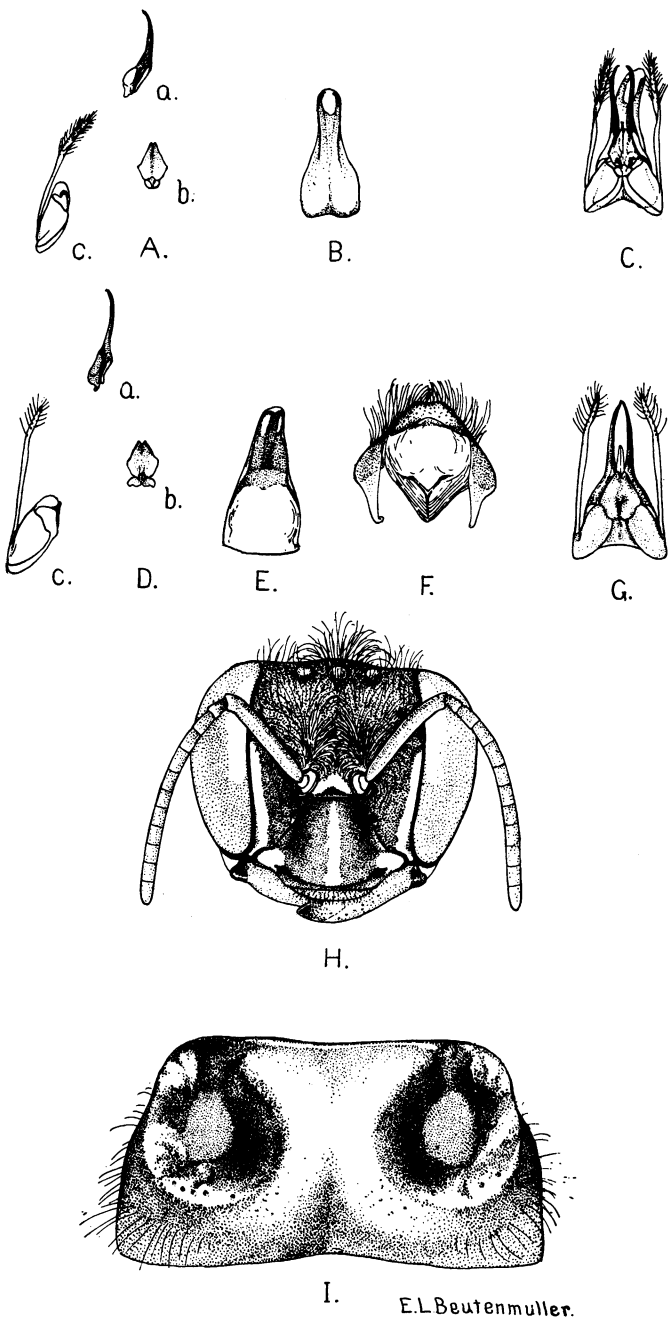
Melipona fasciata subspecies *rufiventris*.—C, genitalia, including the spatha, dorsal view.

Melipona quadrifasciata subspecies *anthidioides*.—D, *a*, sagitta, lateral view, *b*, uncus, *c*, stipes and stalklike volsella, dorsal view; E, spatha, with fenestræ; F, seventh tergite (or eighth tergite if the propodeum be counted as the first segment), ordinarily concealed by the preceding tergite; within is the largely membranous eighth (or ninth) tergite; G, genitalia before the removal of the tissue and exclusive of the spatha, dorsal view.

Melipona puncticollis.—H, head of worker.

Melipona flavipennis.—I, basal abdominal tergite of a virgin queen.

(From freehand drawings; magnification about $\times 10$.)



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