The Aculeate Hymenoptera of Micronesia
II. Colletidae, Halictidae, Megachilidae, and Apidae

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Part I, treating the Micronesian wasps of the families Scoliidae, Mutillidae, Pompilidae, and Sphecidae, has been published (Proc. Hawaii. Ent. Soc. 13:367-410, 1949). Part II deals with all the bees now known to occur in Micronesia, and includes additional notes and records of the wasp fauna, an appendix to Part I. A bibliography of papers dealing with bees is also included in Part II. Illustrations for Parts I and II are both in this part, since the services of an artist were not available when the text for Part I was prepared.

The material on which Part II is based is comprised mainly of the collections noted in the introduction of Part I. Additional specimens have been made available by the California Academy of Sciences (CAS) through Dr. E. S. Ross, by the Chicago Natural History Museum (CNHM) through Dr. H. S. Dybas and by the Kyushu University (KU) through Dr. K. Yasumatsu. The material collected by Dr. Dybas in Micronesia in 1947-48 under the auspices of the Pacific Science Board has also formed an important additional source of specimens; the first set of this material has been deposited in the U. S. National Museum, the second in the Chicago Natural History Museum and the third in the Bishop Museum. Miss L. E. Cheesman has kindly furnished some notes on the type of *Megachile hedleyi* Rainbow.

DISTRIBUTION OF MICRONESIAN BEES

(An asterisk denotes an endemic or supposedly endemic species.)

COLLETIDAE

***Hylaeus (Hylaeus) guamensis** (Cockerell). Marianas (Guam)
***Hylaeus rotensis** (Yasumatsu). Marianas (Rota)
***Hylaeus (Hylaeus) yapensis** (Yasumatsu). Carolines (Yap)
***Hylaeus hirticaudus** Cockerell. Carolines (Palaus)

HALICTIDAE

***Halictus (Indohalictus) yapensis** Cockerell. Carolines (Ponape, Truk, Ulithi, Yap, Palaus)
***Halictus (Homalictus) palaonicus** Cockerell. Carolines (Yap—?, Palaus)
***Halictus (Homalictus) nummatus** sp. n. Carolines (Yap)

*Halictus (Homalictus) auriger sp. n. Carolines (Kusaie, Ponape)
*Halictus (Homalictus) saffordi Cockerell. Marianas (Guam)
*Halictus (Homalictus) swezeyi Cockerell. Marianas (Guam, Rota, Saipan)
*Halictus (Homalictus) rotaënsis Cockerell. Marianas (Rota, Tinian)
*Halictus (Homalictus) vexator sp. n. Marianas (Agrihan)

MEGACHILIDAE

Lithurgus (Lithurgus) scabrosus (Smith). Marianas (Guam, Saipan, Tinian, Agrihan), Carolines (Kusaie, Ponape, Truk, Yap, Palaus)
*Heriades (Michenerella) paganensis Yasumatsu. Marianas (Guam, Tinian, Saipan, Pagan)
*Heriades (Michenerella) plumosa sp. n. Carolines (Palaus)
Megachile (Eumegachile) umbripennis Smith. Marianas (Saipan)
Megachile (Eutricharaea) fullawayi Cockerell. Marshalls (Majuro, Eniwetok, Kwajalein and Jaluit Atolls), Marianas (Guam, Pagan, Agrihan), Carolines (Kusaie, Kapingamarangi, Nukuoro, Truk)
Megachile laticeps Smith. Marianas (Guam, Rota, Tinian, Saipan, Pagan, Agrihan), Carolines (Kusaie, Ponape, Truk, Yap, Palaus)
Megachile diligens hedleyi Rainbow. Marshalls (Kwajalein, Eniwetok, Ailinglapalap, and Bikini Atolls), Carolines (Murilo Atoll—?)
*Megachile palaonica Cockerell. Carolines (Palaus)

APIDAE

*Ceratina mariannensis Yasumatsu. Marianas (Rota, Saipan)
*Ceratina palauensis Yasumatsu. Carolines (Palaus, Yap, Ulithi, Truk)
Xylocopa brasilianorum varipuncta Patton. Marianas (Guam, Saipan)
Trigona (Tetragona) fusco-balteata Cameron. Carolines (Palaus)
Trigona (Tetragona) iridipennis var. valdezi Cockerell. Carolines (Truk)
Apis mellifera Linnaeus. Marianas (Guam, Saipan), Carolines (Ponape, Palaus)

GENERALIZATIONS ON THE ENDEMIC ACULEATE FAUNA

No endemic species are known from the Marshalls, nor is it likely that any occur there, for all the islands are low atolls. For purposes of tabulation and discussion the remaining islands may be divided into several groups: The northern Marianas, comprising the islands from Medinilla north (aculeates have been collected on Pagan and Agrihan only in this group); the southern Marianas, comprising the islands from Guam to Saipan; the most eastern Carolines (Kusaie, Ponape); the central Carolines (Truk and surrounding atolls); Yap Island and Ulithi Atoll in the western Carolines; and the Palaus in the far western Carolines.

The accompanying table lists the known endemic species in Micronesia, the Caroline Islands from west to east in descending order, and the Mariana Islands from south to north in descending order. While the Palaus comprise a number of islands, they are separated from each other by short distances only, and since many of the species apparently occur on all islands of the Palaus on which collections have been made, the entire group has been treated as one island.

Table 1.—Endemic Aculeate Hymenoptera in Micronesia (species marked with an asterisk are perhaps endemic on more than one island).

CAROLINE ISLANDS

PALAUS

Campsomeris palauensis
Timulla sp.
Episyron maehleri
Pseudonortonia esakii
Pseudonortonia palauensis
Lestica constricta
Dasyproctus immaculatus
Motes townesi
Liris williamsi
Pison korrorense
Hylaeus hirticaudus
*Halictus yapensis
*Halictus palaonicus
Heriades plumosa
Megachile palaonica
*Ceratina palauensis

YAP

Pseudonortonia yapensis
Liris esakii
Hylaeus yapensis
*Halictus yapensis
*Halictus palaonicus
Halictus nummatus
*Ceratina palauensis

TRUK

Liris carolinensis
*Halictus yapensis
*Ceratina palauensis

PONAPE

Pison nigellum
Pison ponape
*Halictus yapensis
*Halictus auriger

KUSAIE

*Halictus auriger

MARIANA ISLANDS

GUAM

*Polistes semiflavus
*Pison esakii
*Pison oakleyi
Hylaeus guamensis
Halictus saffordi
*Halictus swezeyi

ROTA

*Polistes semiflavus
*Odynerus mariannensis
*Pison esakii
*Pison oakleyi
Hylaeus rotensis
*Halictus swezeyi
*Halictus rotaënsis
*Ceratina mariannensis

TINIAN

*Pison esakii
*Halictus rotaënsis

SAIPAN

Odynerus saipanensis
*Halictus swezeyi
*Ceratina mariannensis

PAGAN

Odynerus paganensis
Heriades paganensis

AGRIHAN

Halictus vexator

Dispersion has unquestionably been from the Palaus eastward. The most western group, the Palaus, has by far the largest endemic fauna, and families (Scoliidae, Mutillidae, Pompilidae) and genera (*Lestica, Dasyproctus, Motes, Megachile*) occur there which are not represented elsewhere in Micronesia by endemic species. So far as I can determine, the affinities of such endemics as the Palau species of *Campsomeris, Lestica, Dasyproctus,* perhaps the *Timulla,* and the wide-ranging (in the Carolines) *Halictus* (*Indohalictus*) *yapensis* appear to be with species of the Moluccas-New Guinea-Solomons area, rather than with elements in the Philippines. However, the fauna of the Philippines and Austro-Malayan region is so poorly known on the whole that it is not possible to state that all or most of the dispersion in Micronesia has been from the Moluccas-New Guinea-Solomons area.

The next large island to the east is Yap. The endemic fauna is much smaller, and several species are shared with the Palaus on the west and Truk and Ponape to the east. One peculiarity of the Yap fauna is that in species belonging to genera customarily having yellow maculations, the most extensively maculated of all the Micronesian species are those occurring on Yap. This phenomenon may be noted in *Pseudonortonia yapensis* in the Vespidae and *Hylaeus yapensis* in the Colletidae. Both of these genera also have endemic species in the Palaus, and *Hylaeus* also in the Marianas, but none of them is so brightly colored as the Yap representatives.

Truk likewise has a very small endemic fauna and as recorded to date only one of the species is confined to Truk alone, though Dr. Yasumatsu informs me that he has a new *Pison* from Truk.

Ponape has two endemic *Pison* which do not occur elsewhere, and one endemic *Halictus* which occurs also on Kusaie. More thorough collecting on these two islands might turn up a few additional endemics in such genera as *Ceratina, Hylaeus,* or *Pseudonortonia.*

The Marianas as a whole have a larger endemic fauna than any other island group in Micronesia with the exception of the Palaus. The individual islands, however, have very few endemics. There are several peculiarities to be noted about the aculeates of the Marianas, such as the development of three endemic *Odynerus sens. lat.* which are apparently more closely related to species occurring in Hawaii than elsewhere in Oceania (personal communication from Dr. Jos. Bequaert), the presence of a supposedly endemic *Polistes* no other species of which are endemic in Oceania, and the fact that none of the species endemic to the Marianas occurs also in the Carolines and vice versa. Yasumatsu has recorded the Marianas *Ceratina mariannensis* from Yap and Truk, but this is a misdetermination, and the specimens are referable to *palauensis.*

The southern Marianas have a dozen endemic species, most of which occur on more than one of the included islands. The fauna of the northern Marianas is comparatively much more poorly known, but undoubtedly is much smaller. To date there is one *Halictus* known from Agrihan, and one *Odynerus sens. lat.* and one *Heriades* from Pagan, the last species occurring also in the southern Marianas, though probably introduced on those islands during the war, as it was not taken on any of the earlier Guam surveys.

Certain other tendencies may be noted in a comparison of the endemic aculeate fauna. In the genus *Odynerus sens. lat.* endemic forms with highly polished and relatively impunctate integument and darkened wings occur in the Marianas. *Pison esakii* in the southern Marianas is a similar case. There are no close relatives of these two groups elsewhere in Micronesia. In the endemic species of *Liris* occurring respectively in the Palaus and more eastern Carolines (Yap and Truk), the Palau *williamsi* is the more densely punctate, has a duller integument and pale wings, while the Truk *carolinensis* is more polished, less densely punctate and has strongly infumated wings, and the Yap *esakii* is intermediate in wing color. A similar condition in relative density of the

punctation is also to be noted in the two endemic *Ceratina* from the Carolines and Marianas respectively. Micronesian *Heriades* (*Michenerella*) differ by the rather dense discal plumose pubescence on the terminal abdominal tergites, whereas other species belonging to this subgenus from the Philippines and Asiatic mainland have only very sparse simple hairs discally on these tergites.

The percentage of endemism in the bees is much higher than in the wasps. Of the 26 known species of bees, 17 are endemic, while of the 52 wasps (49 recorded in Part I of this series, one additional in the appendix to Part I, and Dr. Yasumatsu writes that he has two additional undescribed endemic *Pison*), only 23 are endemic. I believe that this higher percentage of endemism in the bees is undoubtedly an expression of their more complicated and direct relationship with plants, since many bees which might otherwise be well adapted to survive in Micronesia are unable to do so because the plants they visit for pollen for provisioning their cells, or for resins and gums for nest construction, do not occur in Micronesia. The much higher survival of the introduced species of wasps may be attributed to their not being too selective in prey preference, or if they are, such preferred hosts are already to be found in Micronesia.

It is interesting to note that there has been no "explosive" development of a number of endemic species on any one island in Micronesia, such as in the Samoan halictine bees, or the Hawaiian eumenine, crabronine and psenine wasps and hylaeine bees.

KEY TO THE FAMILIES OF MICRONESIAN BEES[1]

[1] Only the genera now occurring in Micronesia will key out properly.

1. Forewing with two closed submarginal cells 2
   Forewing with three closed submarginals, or these cells entirely absent (*Trigona*) 3
2. Females with a ventral scopa on abdomen composed of simple hairs; males usually with four or fewer visible abdominal sternites, if with six (*Lithurgus*), the abdominal sternum with dense plumose hairs and integument of head entirely black ..... **Megachilidae,** p. 118
   Females without a scopa on venter of abdomen or hind legs; males with six visible abdominal sternites bearing only sparse, simple hairs, the head always with some yellow integumental markings ..... **Colletidae,** p. 105
3. First submarginal cell longer on cubital vein than second and third cells combined, three submarginals always distinct though the third transverse cubital vein is weaker than the others; females with a scopa of long curled plumose hairs on venter of abdomen in addition to a scopa on hind legs.... **Halictidae,** p. 109
   First submarginal cell never as long on cubital vein as the second and third cells combined, or no closed submarginals present; females never with an abdominal scopa, the scopa if present always on hind legs, or the hind tibia flattened and lined with long hairs to form a corbiculum or pollen basket..... **Apidae,** p. 131

FAMILY COLLETIDAE

It is quite likely that the key given below may be rather unsatisfactory. I have had both sexes of *yapensis* (Yasumatsu) and *guamensis* (Cockerell), and females of *hirticaudus* Cockerell only, so many of the separation characters had to be taken from the original descriptions,

which are based mainly on color. All species are endemic, and it is not improbable that additional forms may be found on such high islands as Ponape and the northern Marianas.

Hylaeus guamensis and *H. yapensis* are referable to the typical subgenus. I suppose the other Micronesian species also belong there, but the male genitalia and retracted sternites must be examined before subgeneric assignments can be made.

Specimens of *guamensis* were reared from nests in a rotten branch of mangrove by O. H. Swezey, and H. S. Dybas found *hirticaudus* nesting in a log. Nothing is known as to the ethology of the other species, but presumably it is quite similar.

KEY TO THE MICRONESIAN COLLETIDAE

1. Abdomen usually ferruginous in part or entirely; yellow markings more extensive than in other species, pronotal band complete, space between lateral margin of clypeus and inner eye margin entirely yellow, females with yellow spots on clypeus, mesoscutum anterolaterally and axillae; punctation of thorax much denser, almost all the punctures on mesoscutum uniformly subcontiguous; male genitalia and retracted sternites as figured (figs. 1, 4, 5, 8); Carolines (Yap) ..... **Hylaeus (Hylaeus) yapensis** (Yasumatsu), p. 107

   Abdomen never ferruginous, occasionally dark brown on basal segments, but usually black with obscure metallic green reflections; yellow markings much less extensive, pronotal band always interrupted in middle, space between lateral margin of clypeus and inner eye margin not entirely yellow (needs confirmation in *rotensis*), females without yellow markings on clypeus, mesoscutum or axillae; punctation of thorax much sparser, that on mesoscutum not uniformly subcontiguous, but the punctures separated by a little less than or as much as the width of a puncture (needs confirmation in *rotensis*) 2

2. Scutellum and postscutellum entirely black; female unknown; Marianas (Rota) ..... **Hylaeus rotensis** (Yasumatsu), p. 107

   Scutellum and postscutellum with large yellow marks 3

3. Male: upper margin of yellow mark on clypeus irregular, supraclypeal mark present; yellow mark on scutellum larger than on postscutellum, the anterior margin of the mark on the former straight; genitalia and retracted sternites as figured (figs. 2, 3, 6, 7). Female: pronotal collar not produced above level of anterior part of mesoscutum, scarcely notched in middle; yellow mark on scutellum covering the entire disk except narrow anterior margin. Marianas (Guam) ..... **Hylaeus (Hylaeus) guamensis** (Cockerell), p. 106

   Male: upper margin of yellow mark on clypeus rounded, the supraclypeal mark absent (?); yellow mark on postscutellum as large as that on scutellum, the anterior margin of the mark on the latter with a median notch. Female: pronotal collar strongly produced above level of anterior part of mesoscutum and with a broad, deep notch in middle; yellow mark on scutellum less extensive, covering only the posterior half or two-thirds of disk. Carolines (Palaus) ..... **Hylaeus hirticaudus** Cockerell, p. 107

Hylaeus (Hylaeus) guamensis (Cockerell) (Figs. 2, 3, 6, 7)

Prosopis sp. Fullaway, 1913. Proc. Hawaii. Ent. Soc. 2:282 [♀, ♂; Guam].

Prosopis guamensis Cockerell, 1914. Ann. Mag. Nat. Hist. (8) 14:4 [♀, ♂; Guam; type and allotype in U. S. National Museum].

Hylaeus guamensis (Cockerell), Cockerell, 1942. B. P. Bishop Mus. Bul. 172:189 [♀, ♂; Guam; reared from nests in rotten branch of mangrove].

Hylaeus sp. Townes, 1947. Rpt. 14, U. S. Comm. Co. Surv. Micronesia, p. 51 [Guam].

Some comparative notes are given in the discussions of the other species below. I have examined the following material:

Mariana Islands: 1 ♀, 1 ♂; Guam (D. T. Fullaway; type and allotype). 1 ♂; Guam. 2 ♀ ♀, 1 ♂; Sumay Road, Guam; June 23, 1936 (O. H. Swezey; from nest in dead *Lumnitzera*).

Hylaeus rotensis (Yasumatsu), new combination

Prosopis rotensis Yasumatsu, 1939. Tenthredo 2:329, figs. 2, 3 [♂; Rota; type in Kyushu University].

Hylaeus sp. Townes, 1947. Rpt. 14, U. S. Comm. Co. Surv. Micronesia, p. 51 [Rota].

I have had no material of this species, apparently still known only from the unique male type. The description does not differ in any essential particular from males of *guamensis* except that *rotensis* has the scutellum and postscutellum black. Perhaps it will be ranked as a subspecies of *guamensis* when specimens of the two can be compared.

Hylaeus (Hylaeus) yapensis (Yasumatsu), new combination (Figs. 1, 4, 5, 8)

Prosopis yapensis Yasumatsu, 1942. Tenthredo 3:346, figs. 1-4 [♀, ♂; Yap; type in Kyushu University].

This species is quite distinct from the other Micronesian *Hylaeus* in having the abdomen red in part or entirely. In the other species the abdomen is black usually with metallic greenish or bluish reflections at least in the male. In *guamensis* the basal abdominal segments are usually dark brown. *Yapensis* also is more extensively maculated with yellow than in the other species, the female having yellow spots on the clypeus, mesonotum and axillae which are lacking in *guamensis* and *hirticaudus,* the only other species in which the female is known. The mesonotal punctation in the series of *yapensis* before me is contiguous for the most part, whereas in *guamensis* it is much sparser, most of the punctures except anteriorly and along the margins separated by almost the width of a puncture.

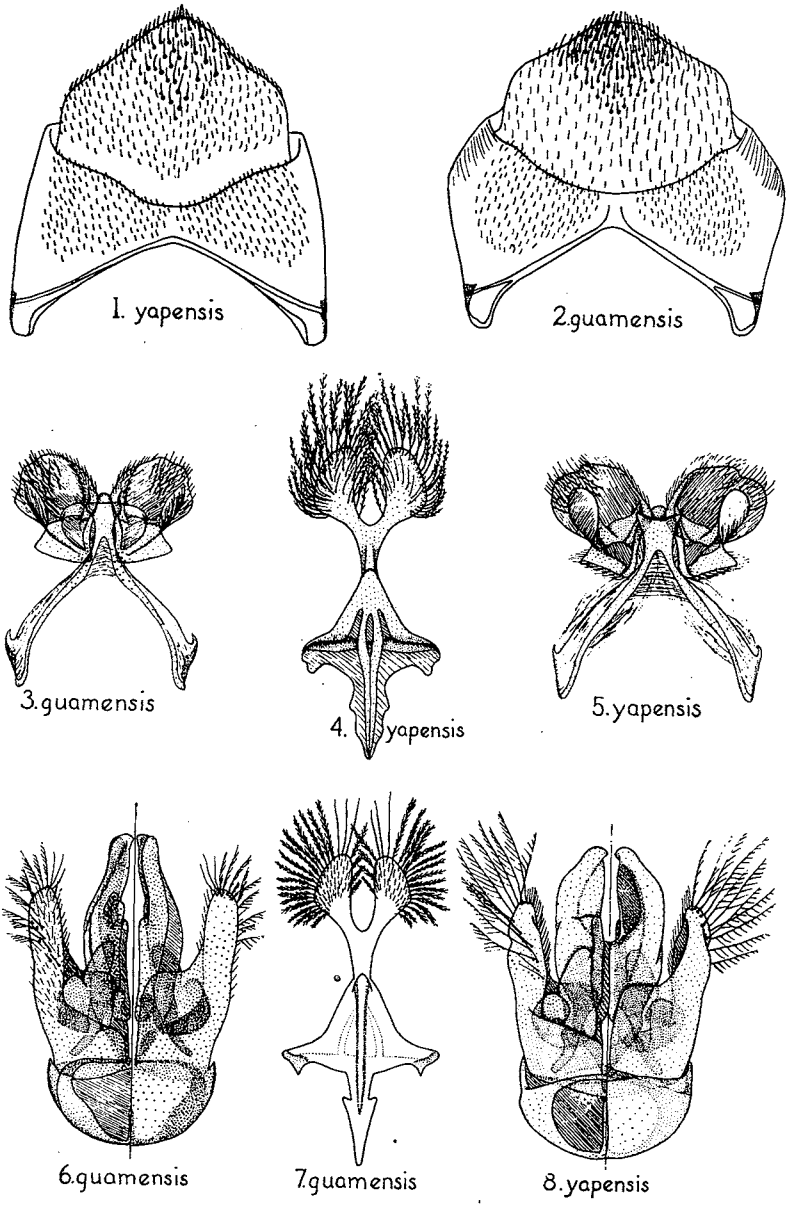
Caroline Islands: 1 ♀; Rul-Nif, Yap Island; September 8, 1939 (T. Esaki; paratype). 1 ♀; Rumu, Yap Island; March 1-8, 1949 (K. L. Maehler; visiting flowers). 1 ♂; Yaptown (labeled Colonia), Yap; March 1-8, 1949 (K. L. Maehler).

Hylaeus hirticaudus Cockerell

Hylaeus hirticaudus Cockerell, 1939. Occas. Papers B. P. Bishop Mus. 15:66 [♂; Palaus; type in Bishop Museum].

Hylaeus sp. Townes, 1947. Rpt. 14, U. S. Comm. Co. Surv. Micronesia, p. 51 [Palaus].

This species too is known in the male sex only from the unique type which I have been unable to study. Comparison of specimens of *guamen-*



HYLAEUS MALES. Fig. 1, H. yapensis, 6th sternite; **fig. 2, H. guamensis,** 6th sternite; **fig. 3, H. guamensis,** 8th sternite; **fig. 4, H. yapensis,** 7th sternite; **fig. 5, H. yapensis,** 8th sternite; **fig. 6, H. guamensis,** genitalia; **fig. 7, H. guamensis,** 7th sternite; **fig. 8, H. yapensis,** genitalia. (All figures drawn by Miss Addie M. Egbert, Bureau of Entomology and Plant Quarantine.)

sis with the original description of *hirticaudus* indicates only the slight differences used in the foregoing key. Undoubtedly there are other differences though none is apparent from the description.

The following brief notes will serve to distinguish the hitherto unknown female: Length 7-9 mm.; black, scape of antenna and legs in varying degrees ferruginous, anterior abdominal segments sometimes brownish, and with the following yellow markings—band along inner eye margin narrowing above to slightly above level of antennal insertions, pronotal collar except narrowly in middle, pronotal tubercle, band on posterior half or two-thirds of disk of scutellum, and band on postscutellum almost equal in extent to that on scutellum. Structurally it is apparently closer to *yapensis* than to the other Micronesian species as evidenced by the produced pronotal collar, but differs in the deeper notch in middle of pronotal collar and the coarser but relatively sparser punctation on mesoscutum.

Caroline Islands: 9 ♀ ♀; east coast of Peleliu Island, Palaus; January 26, 1948 (H. S. Dybas; one female and a pupa found in log).

FAMILY HALICTIDAE

These small bees occur in rather large numbers of individuals in Micronesia and apparently visit flowers of a great variety of plants to collect pollen. Townes, 1947, notes that with the exception of one species on Ulithi Atoll [*yapensis*], all halictids are restricted to the high islands where they occur in the native forests. He says further that they are usually difficult to find, but are often abundant in localized areas, and may occur in large numbers at coconut flowers. The larger species belonging to the subgenus *Homalictus* Cockerell have a rather restricted range, but the smallest one, *yapensis* Cockerell of the subgenus *Indohalictus* Blüthgen, has a very wide range throughout the Carolines and shows an incipient tendency toward the development of island races.

All species have strong metallic reflections on head and thorax and strong to indistinct metallic reflections on the abdomen. All females have a well-developed functional scopa on the venter of the abdomen as well as the normal (for the family) one on the hind legs, the former composed of very dense, shorter hairs plumose almost to the base on the lateral incurved sides of the first to fourth tergites, a brush of similar hairs at base of first sternite, and transverse rows of sparser, longer hairs plumose only on the apical half across the middle of the second to fourth sternites.

Species of this genus and *Trigona* in the Apidae frequently show considerable variation in color of the abdomen, this varying from reddish to dark brown, or black. In *Trigona* this paler coloration has been associated with a callow state, and it seems reasonable to suppose that the variation in certain *Halictus* is also due to the presence in normal populations of a certain number of immature individuals.

KEY TO THE MICRONESIAN HALICTIDAE

1. Front between antennal fossae without longitudinal carina; pronotum with a sharp crest laterally, but not dentate; scutum and scutellum dull, granulate-appearing due to excessively fine lineolation, punctation obsolescent; front, vertex and temples not with close parallel rugulae or striae (fig. 17); male gonocoxite (fig. 9) with a large, thin, fan-shaped accessory process on inner edge at apex; Carolines (Ponape, Truk, Ulithi, Yap, Palaus)..... **Halictus (Indohalictus) yapensis** Cockerell, p. 111

   Front between antennal fossae with a longitudinal carina of varying lengths (occasionally evanescent in males of *saffordi* and *rotaënsis*); pronotum with an acute or obtuse tooth laterally (best seen when viewed from anteriorly); scutum and scutellum more or less shining, or at least not so strongly lineolate as in *yapensis*, and with discernible punctures; front, vertex and temples, one or all, with close parallel rugulae or striae (fig. 16); gonocoxite with accessory process absent, or if present (*rotaënsis* and *saffordi*) very small..... 2

2. Dorsum of propodeum shining, the sculpture consisting of close, moderate to strong rugulae radiating from base, or oblique and meeting along midline to form broad arches, in either case usually extending to apex of dorsal surface..... 3

   Dorsum of propodeum shining or dull and granulate, if shining the sculpture consisting of fine rugulae anastomosing to form irregular reticulations, if dull and granulate the sculpture consisting of sparse, short, radiating rugulae not extending to apex..... 4

3. Dorsum of abdomen in both sexes semi-mat, dark blue, the entire surface including depressed apical areas with dense short, dark brown hair except for narrow white bands of hair at base; front with close longitudinal rugulae, vertex with transverse rugulae; genitalia (fig. 12) with volsellae normal, tapering gradually to tip and without a patch of tubercles along outer margin; Carolines (Palaus, Yap—?)..... **Halictus (Homalictus) palaonicus** Cockerell, p. 113

   Abdomen red to dark brown in male (female unknown), the dorsum with dark green reflections and with much sparser, longer, dark hairs, the depressed apical areas nude; front granulate, vertex with transverse striae; genitalia (fig. 14) with volsellae greatly expanded at apex and with a patch of short stout tubercles on outer margin; Carolines (Yap)..... **Halictus (Homalictus) nummatus,** new species, p. 114

4. Vertex with only fine transverse striae, the rugulae obsolescent or absent; pronotum with an acute lateral tooth; dorsum of propodeum dull and appearing granulate from the coarse lineolation, the rugulae rather sparse, short, radiating, almost never anastomosing to any extent; abdomen of female with only feeble metallic reflections; seventh sternite of male (figs. 10, 11) with a large median lobe on apical margin, gonocoxite with a small accessory process, gonostylus rounded at tip..... 5

   Vertex with coarse transverse rugulae; pronotum with lateral tooth right-angled or obtuse; dorsum of propodeum shining, not granulate, the rugulae more numerous and forming a network of irregular reticulations; abdomen of female with strong metallic reflections; seventh sternite of male (fig. 13) narrow throughout, gonocoxite without an accessory process, gonostylus pointed at tip 7

5. Apical impunctate area of first to fourth tergites testaceous, forming a marked contrast to the castaneous, sparsely punctate anterior area; scutellum of female dull, the interspaces between punctures lineolate; male unknown; Marianas (Agrihan)..... **Halictus (Homalictus) vexator,** new species, p. 117

   Apical impunctate area of first to fourth tergites concolorous with anterior punctate areas, dark brown or bluish; females with the interspaces between punctures on disk of scutellum glossy, lineolation absent except along edges..... 6

6. Mesoscutum with the interspaces between punctures rather dull from excessive delicate lineolation, the punctures themselves, especially in the male, difficult to discern because of the roughened surface; upper half of front irregularly roughened; apical margin of clypeus with the angles not at all prominent; second to fifth sternites of male with sparse scattered hairs on apical half; man-

dible of male normal in shape, more or less falciform; male seventh sternite with the apical lobe triangular, genitalia as figured (fig. 11); Marianas (Rota, Tinian)..... **Halictus (Homalictus) rotaensis** Cockerell, p. 116

Mesoscutum with the interspaces shining, lineolation obsolescent or lacking, the punctures well-defined; upper half of front with longitudinal rugulae; apical margin of clypeus with angles very prominent; second to fifth sternites of male with dense bands of hair on apical half; mandible of male very broad on basal three-fourths (fig. 15); male seventh sternite with apical lobe broadly rounded, genitalia as figured (fig. 10); Marianas (Guam)..... **Halictus (Homalictus) saffordi** Cockerell, p. 117

7. Upper half of front with close longitudinal rugulae (fig. 16); basal tubercle on labrum of female deeply sulcate; lateral angles of apical margin of clypeus of female protruding, very prominent; male with tibiae usually red, occasionally the tarsi also, the rest of legs and antennal scape black; male genitalia as figured (fig. 13); Marianas (Guam, Rota, Saipan)..... **Halictus (Homalictus) swezeyi** Cockerell, p. 116

Upper half of front granulate; basal tubercle on labrum of female not sulcate; lateral angles of apical margin of clypeus of female not protruding; male with antennal scape and legs entirely red; Carolines (Kusaie, Ponape)..... **Halictus (Homalictus) auriger,** new species, p. 115

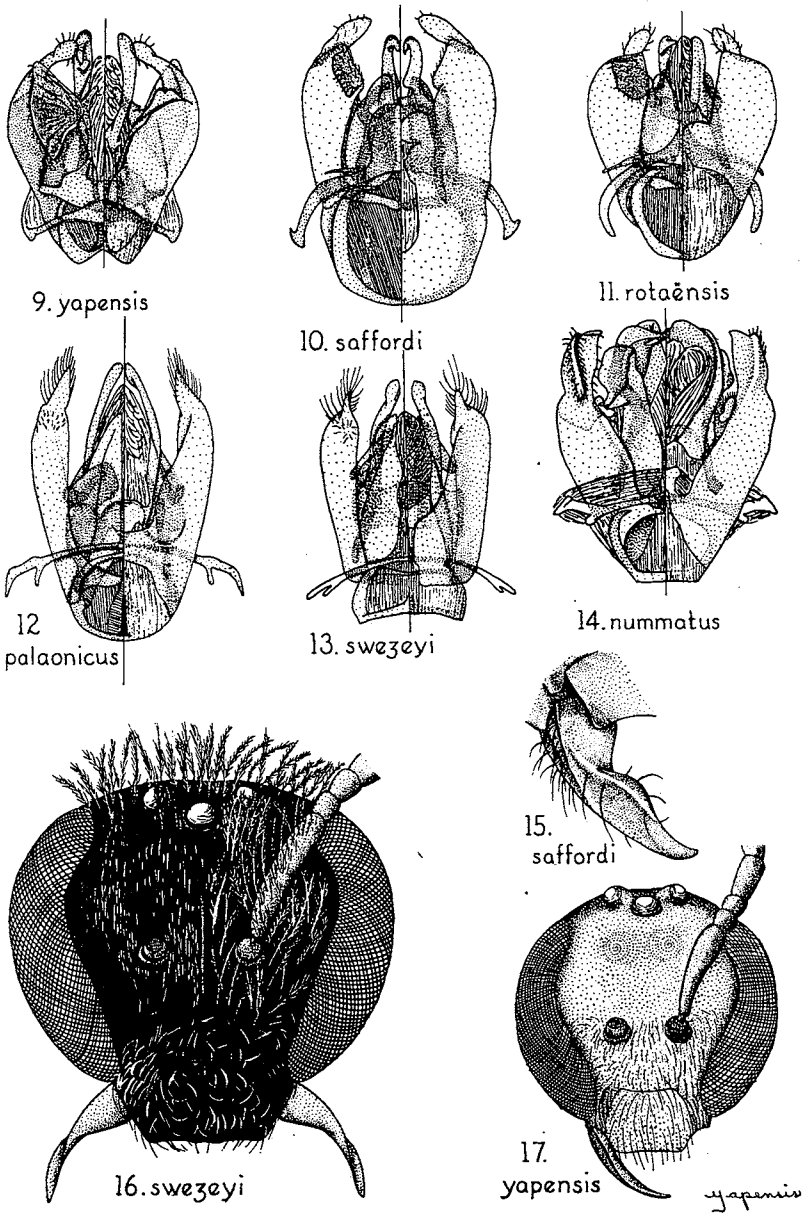
Halictus (Indohalictus) yapensis Cockerell (Figs. 9, 17)

Halictus yapensis Cockerell, 1939 (May 29). Occas. Papers B. P. Bishop Mus. 15:65 [♀, ♂; Yap, Palaus; type in Bishop Museum].

Halictus carolinensis Yasumatsu, 1939 (May 31). Tenthredo 2:332, pl. 9, fig. 1, pl. 10, figs. 4, 5, pl. 11, fig. 10 [♀, ♂; Truk, Ponape; type in Kyushu University]. **New synonymy.**

This species, readily distinguished from other Micronesian *Halicti* by the small size, densely granulate scutum and scutellum, the lack of rugulae on head, and the lack of an interantennal carina, is apparently most closely allied to the New Hebridean *zingowli* Cheesman and Perkins, 1939 (Feb. 28). The male genitalia are identical with those of a male from the Santa Cruz Islands just east of the southern Solomons which I have identified tentatively as *zingowli*. The latter form is known definitely only from the female, and the description of that sex fits specimens of *yapensis* very well, differing only in some minor details of the propodeal sculpture and color. When adequate series of both sexes of *zingowli* are available for comparison with a series of *yapensis*, it may be established that the latter should be treated as a subspecies of *zingowli*.

My specimens of *yapensis* come from Yap, Ulithi, Truk and Ponape. Cockerell described the species from Yap and the Palaus and Yasumatsu from Truk and Ponape. I thought at first that the Ulithi series might be treated as a discrete subspecies for the sculpture of the dorsum of the propodeum is made up principally of regular to somewhat irregular radiating or oblique rugulae with very little tendency toward anastomoses. The specimens from Yap and Truk usually have anastomosing rugulae forming irregular reticulations, though occasionally the sculpture is made up of only irregular oblique rugulae. The specimens from Yap and Ponape usually have these rugulae forming irregular reticulations at the base with oblique rugulae extending from this basal area, but several females exhibit the Ulithi type of sculpture. The specimens



HALICTUS MALES. **Figs. 9-14,** genitalia and seventh sternite; **fig. 9, H. yapensis; fig. 10, saffordi; fig. 11, H. rotaënsis; fig. 12, H. palaonicus; fig. 13, H. swezeyi; fig. 14, H. nummatus; fig. 15, H. saffordi,** mandible; **fig. 16, H. swezeyi,** head; **fig. 17, H. yapensis,** head.

from Truk have more of this area irregularly reticulate and somewhat more strongly so than in the Yap specimens, but again there are some specimens exhibiting the Ulithi type of sculpture. The Yap females, except two specimens, have the exposed parts of the fourth and fifth tergites reddish, whereas the other two females from Yap and all those from Truk and Ulithi have the basal two-thirds of the fourth dark brown, the apical third of the fourth and most of the fifth reddish. The Ponape females have most of the abdomen reddish, but in several specimens it is dark olive brown. No differences were found in the male genitalia of specimens from the three groups of islands from which I have seen males.

There is, perhaps, an incipient tendency toward development of separate subspecies on these island groups, but this has not yet progressed far enough to permit one to distinguish all specimens with any certainty. Continued isolation of the separate stocks may eventually result in the establishment of separate races showing no such intergradation of characters as noted above.

Dr. Yasumatsu has confirmed the synonymy given under the specific heading by comparison of specimens sent him with the type in the collection of Kyushu University.

Caroline Islands: 1 ♀; Jokaj Island, Ponape; February 26, 1948 (H. S. Dybas). 2 ♀ ♀; Nanpil, Nett Distr., Ponape; March 14, 1948 (H. S. Dybas). 26 ♀ ♀; Colonia, Ponape; March 6, 1948 (H. S. Dybas; on palm blossom, *Chyophorba amaricum,* at Expt. Sta.). 14 ♀ ♀; Udet Island, Truk Atoll; May 25, 1946 (R. G. Oakley; at seashore visiting coconut flowers). 1 ♀; same data, but collected by H. K. Townes. 2 ♀ ♀; Pis Island, Truk Atoll; June 3, 1946 (H. K. Townes). 1 ♀; Moen Island, Truk Atoll; May 23, 1946 (H. K. Townes; 0-400 ft. elev.). 2 ♀ ♀; same data, but June 1, 1946. 2 ♀ ♀; same data, but January 6-15, 1949 (M. M. Ross). 2 ♂ ♂; Dublon Island, Truk Atoll; May 28, 1946 (H. K. Townes; 1000-1200 ft. elev.). 4 ♀ ♀; same data, but February 12, 1948 (K. L. Maehler; on *Crotalaria*). 1 ♀; Mt. Uiniböt, Tol Island, Truk Atoll; May 24, 1946 (H. K. Townes). 1 ♂; Yap Island; May 21, 1936 (Z. Ono; cotype of *yapensis*). 1 ♀, 2 ♂ ♂; Yap Island (Z. Ono; cotypes of *yapensis*). 3 ♀ ♀; Yaptown, Yap Island; July 13, 1946 (H. K. Townes). 21 ♂ ♂; Fassarai Island, Ulithi Atoll; July 10, 1946 (H. K. Townes; at dusk resting on fern leaves at base of coconut trees). 20 ♀ ♀; same data, but July 11, 1946. 2 ♀ ♀; Potangeras Islet, Ulithi Atoll; November 10, 1947 (H. S. Dybas). Recorded also from the Palaus by Cockerell.

Halictus (Homalictus) palaonicus Cockerell (Fig. 12)

Halictus palaonicus Cockerell, 1939 (May 29). Occas. Papers B. P. Bishop Mus. 15:64 [♀, ♂; Palaus, Yap; type in Bishop Museum].

Halictus palauensis Yasumatsu, 1939 (May 31). Tenthredo 2:333, pl. 10, figs. 6, 7 [♀; Palaus; type in Kyushu University]. **New synonymy.**

This species is readily distinguished by the characters mentioned in the foregoing key. In addition the transverse rugulae on the vertex are stronger than in any of the other Micronesian *Halicti*. It is known only

from the western Carolines. The specimens recorded here from Yap are unquestionably *palaonicus,* though my opinion is that they may have been mislabeled as the species has not been taken since on Yap by other collectors, and species of this subgenus have a very restricted range.

Dr. Yasumatsu has confirmed the synonymy given above by comparison of specimens sent him with the type in the collection of Kyushu University.

Caroline Islands: 2 ♀ ♀; Yap Island (Z. Ono; cotypes of *palaonicus*). 3 ♀ ♀, 2 ♂ ♂; Palaus; April 5, 1936 (Z. Ono; cotypes of *palaonicus*). 6 ♀ ♀, 27 ♂ ♂; Arakabesan Island, Palaus; July 18, 1946 (H. K. Townes). 4 ♀ ♀; Koror Island, Palaus; March 15-25, 1948 (K. L. Maehler; on *Ipomoea* flowers and burrowing in bark). 1 ♀; same data, but November 21, 1947 (H. S. Dybas). 1 ♀; Peleliu Island, Palaus; July 30, 1945 (H. S. Dybas) [CNHM]. 10 ♀ ♀, 4 ♂ ♂; Ulimang, Babelthuap Island, Palaus; December 11, 1947 (H. S. Dybas; around flowering shrub). 2 ♂ ♂; same data, but December 22, 1947.

Halictus (Homalictus) nummatus, new species (Fig. 14)

While this species appears to be most closely related to *palaonicus* among the Micronesian *Halicti,* it is quite distinct as may be seen by reference to the key, the following description and the illustrations of the male genitalia. The female is unknown, but should differ from *palaonicus* females in being relatively much more weakly sculptured and in having a shining rather than a semi-mat abdominal dorsum.

Type: ♂; Gorror, Yap; March 1-8, 1949 (K. L. Maehler; visiting flowers of unidentified plant). [U. S. National Museum, Type No. 59395.]

Male.—Length 6.7 mm., forewing 4.9 mm. Head and thorax bright golden green, the abdomen above dark brown with dark green reflections, beneath reddish; base of antennal scape and flagellum beneath ferruginous, antennae elsewhere dark brown; fore femora and all tibiae and tarsi ferruginous except hind tibia above, legs elsewhere dark brown with green reflections. Vestiture of head and thorax whitish to creamy, rather dense on front, head beneath and sides of thorax, very sparse on dorsum of thorax; on abdomen the hair dark, short, sparse and appressed on dorsum, longer on sides and at apex, the broad depressed apical margins of tergites nude. Wings hyaline, veins dark brown.

Head rather dull from surface sculpture, rounded in frontal aspect, the height (from posterior ocelli to apex of clypeus) less than greatest width (10:12); clypeus nearly flat (strongly protuberant in *palaonicus*) with apical margin truncate, lateral angles not protuberant, twice as broad as high, surface of clypeus and supraclypeal area densely lineolate, the former with scattered large punctures, the latter practically impunctate (both areas with lineolation practically absent in *palaonicus*); frontal carina as in *palaonicus,* strong and extending from base of supraclypeal area half-way to anterior ocellus; front granulate, punctures not discernible; vertex and temples with close striae, transverse on vertex, longitudinal on temples.

Thorax shining; pronotal tooth obtuse, not at all prominent; scutum with very delicate lineolation and a few scattered, small punctures; scutellum not at all lineolate, the punctures more numerous; postscutellum more strongly lineolate than scutum, the vestiture denser, but punctures not discernible; dorsum of propodeum with close radiating rugulae, those in the center extending only two-thirds the length of disk, the surface delicately lineolate, carina separating lateral and posterior surfaces present on lower third only (complete in *palaonicus*); mesopleural sculpture much like that of scutum, but punctures denser, and transverse rugulae entirely lacking (present anteriorly in *palaonicus*).

Abdomen shining, though less so than thorax, the tergites with very delicate transverse striae, and with scattered small punctures on areas basad of depressed apices; genitalia and seventh sternite as figured (fig. 14), the volsellae unique among Micronesian *Halicti* in being greatly expanded at the apex and with a patch of short, stout tubercles along outer margin.

Paratypes: 3 ♂ ♂; same data as type. 3 ♂ ♂; same data as type, but March 1, 1949 (K. L. Maehler; on unidentified plant). One male paratype will be deposited in the collection of the B. P. Bishop Museum, Honolulu, and one in Kyushu University, Fukuoka, Japan.

Male paratypes vary in length from 6.2 to 7.2 mm. The color is much the same as in the type, except that in some specimens the abdomen may be almost entirely red, and the legs may vary to entirely ferruginous. The sculpture is fairly uniform, the dorsum of the propodeum showing some variation in that some of the rugulae may be more oblique in position and may meet along the midline to form broad arches as in some specimens of *palaonicus*.

Halictus (Homalictus) auriger, new species

Halictus saffordi Cockerell, Yasumatsu, 1939. Tenthredo 2:331, figs. 8, 9, 11 [♀, ♂; Kusaie; misdetermination of Cockerell species].

This species is quite distinct from *saffordi* Cockerell, and is similar in coloration to the Samoan *perpessicus* Kohl, being the only Micronesian species, except for the distantly related *yapensis,* with brilliant golden-green reflections on the head and thorax. The female differs from *perpessicus* in the non-sulcate tubercle at the base of the labrum and the non-protruding lateral angles of the apical margin of the clypeus. I have not seen the male and it is included in the key on the basis of characters mentioned in Yasumatsu's brief descriptive notes. It is the only known Micronesian male with the scape of antenna and legs entirely ferruginous.

Type: ♀; Lele Island, Kusaie; August 19, 1946 (R. G. Oakley). [U. S. National Museum, Type No. 59396.]

Female.—Length 6.7 mm., forewing 4.6 mm. Head and thorax brilliant golden-green, the clypeus darker and metallic bluish green, the abdomen light brown with brassy reflections; antennal scape entirely, flagellum beneath, and legs, ferruginous. Vestiture of thorax moderately long on the sides, white, on scutum and dorsum of abdomen short, rather dense, creamy. Wings hyaline.

Head rounded in frontal aspect, the height (from posterior ocelli to apex of clypeus) slightly less than greatest width (10:11); process at base of labrum low and rounded, not sulcate; clypeus with apical margin truncate, the angles not prominent, surface sculpture of clypeus and supraclypeal area lineolate with scattered large punctures; frontal carina extending almost half the distance from base of supraclypeal area toward anterior ocellus; front closely rugulosopunctate; vertex and temples with close transverse rugulae, stronger than in *swezeyi,* the rugulae laterad of posterior ocelli oblique.

Thorax shining, the dorsum with scarcely any lineolation except anteriorly and laterally on scutum; pronotal tooth right-angled; scutum moderately densely punctate on anterior half and laterally, the scutellum more sparsely so; postscutellum rugulosoreticulate; dorsum of propodeum rugosoreticulate, much more coarsely so than in *swezeyi,* the center somewhat depressed, the rim rounded and not sculptured, carina separating lateral and posterior surfaces of propodeum only one-third the height; mesopleuron with close, fine transverse rugulae, stronger than in *swezeyi.*

Inner hind tibial spur with four teeth decreasing in length toward tip.

Basal four abdominal tergites with delicate transverse striae, apices broadly impunctate, the anterior parts with minute, moderately numerous punctures.

Paratype: ♀; Mt. Dolennankap, Ponape; August 13, 1946 (H. K. Townes; 1700-1900 ft. elev., in native rain forest). [U. S. National Museum.]

The paratype shows some variation, and a series including males from both islands might indicate that two separate forms are involved. However, a similar range of variation is seen in the Samoan *perpessicus,* so until additional material is available I prefer including the specimens available under one name. The paratype is larger (7.2 mm. long, forewing 5.0 mm.), ratio of head height to width somewhat different (10:10.5), the abdomen is darker brown but with brassy reflections, and only the femora and tibiae are ferruginous to some extent, the rest of the legs brown with brassy reflections.

Halictus (Homalictus) swezeyi Cockerell (Figs. 13, 16)

Halictus swezeyi Cockerell, 1939. Occas. Papers B. P. Bishop Mus. 15:66 [♀; Guam; type in Bishop Museum; brief descr. in key only].—Cockerell, 1942. B. P. Bishop Mus. Bul. 172:189 [♀, ♂; Guam; full descr.].—Cockerell, 1942. B. P. Bishop Mus. Bul. 172:191-3 [♀, ♂; Rota; in key to Pacific Island *Halicti*].

In structural details this seems rather closer to *auriger* than to any of the other Micronesian species, though it is readily distinguished by the key characters. The normal coloration appears to be dark brown or black with metallic green reflections in the female, while in the male the abdomen almost always is dark blue, and occasionally the thorax also. There is also variation in the color of the male legs which vary from entirely dark with green reflections to forms having the tibiae and tarsi, or tibiae only, ferruginous.

Mariana Islands: 1 ♀, 1 ♂; Santa Rosa Peak, Guam; May 19, 1936 (R. L. Usinger; cotypes of *swezeyi*). 1 ♂; same data, but labeled *swezeyi* var. by Cockerell. 7 ♀ ♀, 1 ♂; Ritidian Point, Guam; June 1945 (J. L. Gressitt). 2 ♂ ♂; Agricultural Farm, Guam; May 15, 1948 (K. L. Maehler). 1 ♂; Ylig, Guam; December 14, 1947 (K. L. Maehler; on *Scaevola*). 12 ♂ ♂; Asan, Guam; January 31, 1948 (K. L. Maehler; visiting citrus). 17 ♀ ♀, 9 ♂ ♂; Talofofo, Guam; July 1, 1946 (R. G. Oakley; on coconut flowers). 2 ♀ ♀; same locality, but December 20, 1947 (K. L. Maehler). 1 ♂; Haputo Point, Guam; April 29, 1948 (K. L. Maehler; on Chinese inkberry). 3 ♀ ♀, 1 ♂; Point Oca, Guam; June 1945 (J. L. Gressitt and G. E. Bohart). 1 ♂; same data, but June 2, 1945 (H. S. Dybas) [CNHM]. 4 ♀ ♀, 5 ♂ ♂; Merizo, Guam; June 11, 1936 (R. L. Usinger). 1 ♀; same locality, but December 18, 1947 (K. L. Maehler). 4 ♀ ♀; Rota; July 23, 1925 (Hornbostel). 1 ♀; Rota; June 26, 1946 (R. G. Oakley). 3 ♀ ♀; Saipan; January 1, 1948 (K. L. Maehler).

Halictus (Homalictus) rotaënsis Cockerell (Fig. 11)

Halictus rotaënsis Cockerell, 1942. B. P. Bishop Mus. Bul. 172:191 [♀; Rota; type in Bishop Museum].

? Halictus rotaënsis var. *hornbosteli* Cockerell, 1942. B. P. Bishop Mus. Bul. 172:191 [♀; Rota; type in Bishop Museum].

The clypeus of the females of the Tinian series recorded below is less strongly lineolate than in Rota females, but due to the absence of males from Rota, I prefer placing them all under typical *rotaënsis* for the time being. Differences in the males, if there are any, would suggest the desirability of recognizing two subspecies. Typically the head and thorax are dark with greenish reflections, the abdomen brown of varying shades and with obscure metallic reflections. The variety *hornbosteli* Cockerell is separated by having the clypeus and supraclypeal area with rosy tints, and the mesonotum and scutellum rosy pink. I have seen no specimens with this coloration, and do not know whether it should be recognized as a distinctive form or placed in the synonymy as just a chance variation.

Mariana Islands: 1 ♀; Rota; July 26, 1925 (Hornbostel; cotype). 1 ♀; same data, but June 27, 1946 (R. G. Oakley; on *Oscillita*). 1 ♀; Shinaparu, Rota; June 24, 1946 (H. K. Townes). 8 ♀ ♀, 12 ♂ ♂; Mt. Lasso, Tinian; June 12, 1946 (H. K. Townes).

Halictus (Homalictus) saffordi Cockerell (Figs. 10, 15)

Halictus sp. Fullaway, 1913. Proc. Hawaii. Ent. Soc. 2:282 [Guam].
Halictus saffordi Cockerell, 1914. Ann. Mag. Nat. Hist. (8) 14:2 [♀; Guam; type in U. S. National Museum].—Cockerell, 1942. B. P. Bishop Mus. Bul. 172:189 [♀, ♂; Guam localities].—Cockerell, 1942. B. P. Bishop Mus. Bul. 172:192-3 [in key to Pacific Island *Halicti*].

This is rather similar to *rotaënsis* in general coloration, though larger and with rather infumated wings in addition to the separation characters mentioned in the key. The mandible of the male is very unusual, and not at all like any other Micronesian species, but the genitalia show the species to be rather close to *rotaënsis*.

Mariana Islands: 3 ♀ ♀; Guam (D. T. Fullaway; type and cotypes). 3 ♀ ♀, 1 ♂; Guam; 1937 (R. G. Oakley). 37 ♀ ♀, 2 ♂ ♂; Talofofo, Guam; July 1, 1945 (R. G. Oakley; on coconut flowers). 5 ♀ ♀; same data, but February 26, 1948 (K. L. Maehler). 2 ♀ ♀; Talofofo Bay, Guam; January 25, 1948 (K. L. Maehler; on *Scaevola*). 3 ♀ ♀; Merizo, Guam; December 18, 1947 (K. L. Maehler; on *Scaevola*). 1 ♀; Mt. Santa Rosa, Guam; June 1945 (J. L. Gressitt and G. E. Bohart). 1 ♀; Tumon Bay, Guam; April 27, 1948 (K. L. Maehler; on coconut flower). 1 ♂; Piti, Guam; October 29, 1936 (O. H. Swezey). 1 ♀; Barrigada, Guam; June 24, 1936 (O. H. Swezey; on corn).

Halictus (Homalictus) vexator, new species

This is obviously rather closely related to two other species occurring in the Marianas, *saffordi* and *rotaënsis*. It is readily distinguished from them by the very strong lineolations of the scutum and scutellum. The pallid posterior margins of the first four tergites are also distinctive, but my specimens appear to be callows, and it may be that fully mature individuals would not show the marked contrast in coloration of the tergites exhibited by them.

Type: ♀; Agrihan, Marianas; July 29, 1945 (Borror and Holder). [U. S. National Museum, Type No. 59397.]

Female.—6.1 mm. long, forewing 4.6 mm. Head and thorax dark, with metallic blue and green reflections, dull; antennae and abdomen castaneous, the broad apical margins of the first to fourth tergites pallid; tegulae, femora, tibiae and tarsi ferruginous; pubescence of head and thorax short, grayish, not obscuring the sculpture.

Head rounded in frontal aspect, the height from posterior ocelli to apex of clypeus equal to greatest width; clypeus with apical margin truncate, the angles moderately prominent, the surface lineolate and with scattered punctures; process at base of labrum narrow, sulcate in middle; supraclypeal area more minutely lineolate and duller than clypeus, and with scattered punctures; front closely rugulosoreticulate, frontal carina very short; almost evanescent; vertex with fine close transverse striae; temples with some fine longitudinal rugulae.

Thorax dull from strong lineolation; pronotal tooth acute; scutum densely lineolate, the punctures also rather dense and for the most part separated by about the width of a puncture; scutellum with the punctures denser; postscutellum with punctation obscure, the punctures much smaller than on scutellum; dorsum of propodeum densely granulate and with irregular, sparse rugae radiating from base about three-fourths the distance to summit; carina separating lateral and posterior surfaces of propodeum extending three-fourths the height of propodeum; mesopleuron on lower half with very fine, close transverse rugulae.

Inner hind tibial spur with four teeth decreasing in length toward tip.

First four abdominal tergites with dense, transverse striae, the anterior two-thirds of each with scattered small punctures, the broad, pallid posterior margins impunctate.

Paratype: ♀; Agrihan (D. J. Borror). [U. S. National Museum.]

FAMILY MEGACHILIDAE

This family is well represented in Micronesia though more than half the species are introduced. Many species of the genus *Megachile* are popularly called leaf-cutter bees because the females cut more or less circular pieces from leaves to construct cells for the young. Townes, 1947, notes that the various "species of *Megachile* are common on the atolls and on the coastal parts of high islands. Their leaf-cutting activity affects many species of plants whose leaves are not too thick and leathery, and often reaches serious proportions. Dead twigs of *Scaevola frutescens* are favorite nesting sites. Favorite flowers are those of *Triumfetta procumbens, Scaevola frutescens,* and *Wedelia biflora.* On high islands many other flowers are available and used."

KEY TO THE MICRONESIAN MEGACHILIDAE

1. Tarsi with an arolium between the claws; anterior declivous surface of first tergite separated from posterior horizontal surface by a strong transverse carina; small bees, not over 7 mm. in length.....**Heriades (Michenerella)** 2
   Tarsi without an arolium between the claws; first tergite without such a carina; larger forms, at least 8 mm. in length, and usually much more..... 3
2. Plumose pubescence of vertex, dorsum of thorax and last three tergites ochraceous; legs and abdomen brown. Female: upper edge of thickened apical margin of clypeus slightly crenulate; dorsal carina of mandible almost straight, present only on apical half. Male: mesonotum with some short, scattered, moss-like plumose hairs on disk as well as the dense ones along margins; apical margin of first sternite convex in middle; transverse sinuate flange across middle of fourth sternite (fig. 22) interrupted at midline, a strut-like thickening along midline between flange and base of sternite. Carolines (Palaus).....
   .....**Heriades (Michenerella)) plumosa,** new species, p. 125

Plumose pubescence of these areas white to creamy; legs and abdomen black. Female: upper edge of thickened apical margin of clypeus not crenulate; dorsal carina of mandible present on apical two-thirds, curved strongly upwards about halfway to base. Male: disk of mesonotum with simple hairs, only the margins with short, plumose moss-like hairs; apical margin of first sternite slightly emarginate in middle; transverse sinuate flange across middle of fourth sternite not interrupted at midline, no strut-like thickening between flange and base of sternite. Marianas (Guam, Tinian, Saipan, Pagan)..... **Heriades (Michenerella) paganensis** Yasumatsu, p. 123

3. Tongue long, in repose reaching apex of first sternite; last visible tergite in both sexes with a very narrow pygidial plate; dorsum of mesonotum of female transversely and irregularly rugose anteriorly, punctate only along margins; male with six visible sternites clothed with dense, plumose, suberect hairs; Marianas, Carolines, general..... **Lithurgus (Lithurgus) scabrosus** (Smith), p. 120

Tongue in Micronesian species short, in repose not extending beyond apex of fore coxae; differentiated pygidial area absent; dorsum of mesonotum of female entirely punctate, except rugosopunctate laterally in *umbripennis;* male with only four visible sternites clothed with short decumbent hairs, sparse except for bands at apices..... **Megachile** 4

4. Females 5
Males 9

5. Second to fifth sternites with narrow apical bands of pale tomentum beneath the scopa; scopa white on second, fulvous on remaining sternites except at apex of sixth where it is black; face, sides of head and thorax with pure white hair; Marshalls, Marianas, Carolines, general..... **Megachile (Eutricharaea) fullawayi** Cockerell, p. 126

Sternites without such bands at apices; scopa colored differently; pubescence of head and thorax never pure white..... 6

6. Mandibles without a straight cutting edge between any teeth, the margins between the second, third and fourth (innermost) teeth concave; dorsum of thorax and first tergite with dense, short, appressed, bright fulvous hair; sides of mesonotum and much of mesopleuron closely and coarsely rugosopunctate; apical two-thirds of wings strongly infuscate; scopa whitish except at apex of fifth sternite and all of sixth where it is black, the pale hairs slightly capitate at tips; Marianas (Saipan).... **Megachile (Eumegachile) umbripennis** Smith, p. 125

Mandibles with a straight cutting edge (thin septum) between the second and third and third and fourth teeth; dorsum of thorax and first tergite with most of hair longer, finer, sparser and not appressed, never bright fulvous; sides of mesonotum and mesopleuron closely punctate, not at all rugose; wings never more than slightly infumated; scopa differently colored and pale hairs not capitate at tips 7

7. Tergites with extremely fine dense punctures, no large impunctate areas present; scopa bright fulvous except on last sternite where it is black; Marshalls (general), Carolines (Murilo Atoll)..... **Megachile diligens hedleyi** Rainbow, p. 130

Tergites with larger, more scattered punctures and with large impunctate areas on third to fifth tergites; scopa not colored as above..... 8

8. Median half of apical margin of clypeus shallowly concave; narrow apical bands of second to fifth tergites white; scopa pale whitish except black laterally on fifth and entirely on sixth sternites, the fifth occasionally tending toward pale fulvous; erect hair on dorsum of thorax pale fulvous; Marianas, Carolines, general..... **Megachile laticeps** Smith, p. 127

Only the median third of apical margin of clypeus shallowly concave; narrow apical bands of second to fifth tergites fulvous; scopa fulvous except sides of third and fourth, and fifth and sixth sternites entirely where it is black; erect hair on dorsum of thorax dark except on margins; Carolines (Palaus)..... **Megachile palaonica** Cockerell, p. 129

9. Fore coxa with a small tooth (*umbripennis*) or process beneath near apex; mandible at tip tridentate, with a basal or subbasal tooth on inferior margin

except in *umbripennis* which has dense, bright fulvous hair on dorsum of thorax and first tergite..... 10

Fore coxa unarmed; mandible at tip quadridentate, and without a tooth on inferior margin at or near base..... 12

10. Fore basitarsus concave beneath, spirally twisted, the anterior margin abruptly narrowed about two-thirds the distance to apex; mandible on inferior margin with a moderate-size subbasal tooth; carina (not morphological apical margin) of sixth tergite irregularly crenulate, not deeply and broadly emarginate in middle; Marianas, Carolines, general.....
.....**Megachile (Eutricharaea) fullawayi** Cockerell, p. 126

Fore basitarsus not concave beneath or spirally twisted; mandible on inferior margin unarmed (*umbripennis*) or with a large basal tooth (*diligens hedleyi*); carina of sixth tergite not irregularly crenulate..... 11

11. Apical two-thirds of wings deeply infuscate; dorsum of thorax and first tergite with short, dense, bright fulvous pubescence; carina of sixth tergite broadly rounded, very shallowly emarginate in middle and not dentate on either side of emargination; fore tarsus black, not widened; Marianas (Saipan).....
.....**Megachile (Eumegachile) umbripennis** Smith, p. 125

Wings only slightly infumate on apical fourth; dorsum of thorax and first tergite with longer whitish hairs, those on mesonotum with some dark ones intermixed on disk; carina of sixth tergite semicircularly emarginate in middle and with a strong tooth on each side of emargination; fore tarsus reddish to fulvous, flattened and wide, the basitarsus about three times the width of the apical segment; Marshalls (general), Carolines (Murilo Atoll).....
.....**Megachile diligens hedleyi** Rainbow, p. 130

12. Clypeus with pubescence so dense that basic punctation is not visible; apical bands on second to fifth tergites white; sixth tergite black, with sparser fulvous tomentum, the carina emarginate in middle, but not so deeply and without a large tooth on each side of emargination; tarsi with fringes of long, slightly curled hairs, those of fore and mid tarsi on posterior margins, and those of hind tarsi on anterior margin; Marianas, Carolines, general.....
.....**Megachile laticeps** Smith, p. 127

Clypeus with pubescence sparser on basal half, not obscuring the basic punctation; apical bands on second to fifth tergites light fulvous to almost golden; sixth tergite red, with dense golden tomentum, the carina semicircularly and more deeply emarginate in middle and with a large tooth on each side of emargination; tarsi with the fringes of hair normal in length, much shorter and straight; Carolines (Palaus).....**Megachile palaonica** Cockerell, p. 129

Lithurgus (Lithurgus) scabrosus (Smith)

Megachile scabrosus Smith, 1859. Jour. Proc. Linn. Soc. 3:134 [♀; Aru Island; type in Hope Museum, Oxford University].

Lithurgus albo-fimbriatus Sichel, 1867. Reise Novara, Zool. 2:151 [♀; Tahiti; type in Vienna Hofmuseum].

Lithurgus sp. Fullaway, 1913. Proc. Hawaii. Ent. Soc. 2:282 [Guam].

Lithurgus guamensis Cockerell, 1914. Ann. Mag. Nat. Hist. (8) 14:1 [♀; Guam; type in U. S. National Museum].—Yasumatsu, 1939. Tenthredo 2:333, figs. 19, 20 [♀, ♂; Saipan, Kusaie, Ponape, Truk, Palaus].—Cockerell, 1942. B. P. Bishop Mus. Bul. 172:189. **New synonymy.**

Lithurgus albofimbriatus froggatti Cockerell, 1914. Ann. Mag. Nat. Hist. (8) 14:469 [♀; New Hebrides; type in U. S. National Museum].

Lithurgus scabrosus froggatti Cockerell, 1929. Rec. Austral. Mus. 17:233 [*froggatti* transferred as subspecies of *albofimbriatus* to *scabrosus*].

Lithurgus scabrosus (Smith), Cockerell, 1939. Occas. Papers B. P. Bishop Mus. 15:64 [♀; Yap, Palaus, Ponape].

Perkins and Cheesman, 1928 (Ins. Samoa, Hym., Pt. 5, Fasc. 1:10), after studying Smith's type concluded that it was identical with specimens from Samoa, Fiji, Rarotonga, Society Islands, Marquesas and Hawaii. Kohl, 1908 (Denkschr. K. Akad. Wiss. Wien, Math.-Naturw. Kl. 81:308), had previously found that specimens from Samoa were identical with Sichel's type, so Perkins and Cheesman placed *albo-fimbriatus* in synonymy. Cheesman, 1936 (Trans. Roy. Ent. Soc. 85:172), synonymized *albofimbriatus froggatti* under *scabrosus.*

After a study of some hundred-odd specimens from various of the Pacific islands, I am convinced that only one rather variable species is involved, except for the Solomon Islands *fortis* Cockerell which appears to be constantly distinct. I cannot well suppose that the male Samoan *bractipes* Perkins and Cheesman is anything but the male of *scabrosus* (they record only females of *scabrosus* from Samoa). I am able to confirm the synonymy of *albofimbriatus froggatti* by examination of the type. The dense hair at apex of sixth tergite in females ranges from black through brown to bright red, and series from one island may show all stages of variation.

Females may or may not have a median groove on the scutellum which is subject to some variation in development, though apparently always absent in Micronesian specimens; only one of the males before me has a feeble indication of such a groove. Micronesian females have the space between clypeus and frontal ridge punctate, whereas other females tend to have this space impunctate; however, Micronesian males are variable in this character, some having the ridge continuous to base of clypeus and others with an intervening punctate area. The variability is very marked in the male eighth sternite which in no two specimens is quite identical in shape or arrangement and number of apical setae. In fact, there is even variation in the setal arrangement on the two sides of one specimen. In the two males from the Carolines the narrow basal part of the eighth sternite is more slender and longer than in others. Unfortunately, I do not have adequate series of males from any one locality so I am unable to state whether specimens from one island might show more constancy in the shape of this sternite.

When I wrote Dr. Yasumatsu of my conclusions as to the variability of this species, he replied that he agreed with my treatment of all Micronesian material as *scabrosus,* and stated further that he was unable to separate the Japanese *collaris* Smith, 1873, from Micronesian material of *scabrosus.*

Cheesman, 1932 ("Hunting Insects in the South Seas," pp. 125-130), records *scabrosus* in the New Hebrides as nesting in deserted beetle burrows in dry posts and in canes. This habit would undoubtedly facilitate dispersion of the species from island to island.

Mariana Islands: 2 ♀ ♀; Guam (D. T. Fullaway; type and cotype of *guamensis*). 1 ♀; Machanao, Guam; June 30, 1936 (R. L. Usinger). 1 ♀; Santa Rita, Guam; January 29, 1949 (K. L. Maehler; on *Ipomoea*). 1 ♀; Guam; 1937 (R. G. Oakley). 1 ♂; Tinian; June 8, 1946 (H. K. Townes). 1 ♀; Charan Kanoa, Saipan; May 11, 1940 (Yasumatsu and Yoshimura)

[KU]. 1 ♀; Garapan, Saipan; December 20, 1944 (H. S. Dybas) [CNHM]. 1 ♂; Susupe Lake, Saipan; January 13, 1949 (K. L. Maehler). 1 ♂; Fanagam, Saipan; May 12, 1940 (Yasumatsu and Yoshimura) [KU]. 2 ♂ ♂; 1-2 mi. E. of Tanapag, Saipan; November 21, 1944 (S. Edgar) [CNHM]. 1 ♀; same locality, but November 24, 1944 (H. S. Dybas) [CNHM]. 1 ♂; Agrihan; July 29, 1945 (Borror and Holder).

Caroline Islands: 4 ♀ ♀; Mwot-utwe, Kusaie; December 12, 1937 (T. Esaki) [KU]. 1 ♀; Pouneran-Neipip, Ponape; February 24, 1936 (Z. Ono; det. as *scabrosus* by Cockerell). 2 ♀ ♀; Colonia-Sankakuyama; July 14, 1939 (T. Esaki) [KU]. 2 ♂ ♂; Moen Island, Truk Atoll; February 6, 1948 (K. L. Maehler; on *Ipomoea*). 3 ♀ ♀; same locality, but March 1949 (D. Langford). 1 ♀; same locality, but February 19, 1948 (H. S. Dybas). 2 ♀ ♀; Sabote-Epin, Pata Island, Truk Atoll; April 10, 1940 (Yasumatsu and Yoshimura) [KU]. 1 ♀; Rul, Yap Island; November 13, 1939 (T. Esaki) [KU]. 1 ♂; Yaptown (labeled Colonia), Yap Island; March 1-8, 1949 (K. L. Maehler; on flowers of unidentified plant). 1 ♀; Palau Islands; April 8, 1936 (Z. Ono; det. as *scabrosus* by Cockerell). 1 ♂; Koror Island, Palaus; March 8, 1949 (K. L. Maehler). 1 ♂; same data, but March 15-25, 1948, on *Ipomoea*. 2 ♀ ♀; Ngarard-Ngarasumao, Babelthuap Island, Palaus; February 7, 1938 (T. Esaki) [KU]. 2 ♀ ♀; Ulimang, Babelthuap Island, Palaus; December 14, 1947 (H. S. Dybas). 1 ♀; same data, but December 24, 1947.

Heriades subgenus **Michenerella,**[2] new subgenus

Type of the subgenus: *Heriades paganensis* Yasumatsu.

The species assigned herein to this new subgenus have occupied a taxonomic no-man's land until this time. Michener, 1938 (Ann. Ent. Soc. Amer. 31:514-531, 26 figs.), in his classification of the American *Heriades,* was unable to assign them to a subgenus because he had the female of only one of the species. Yasumatsu, 1942 (Tenthredo 3:342-6, 2 figs.), in describing *paganensis,* suggested that it might belong to the New World subgenus *Neotrypetes* Robertson, but comparison of the retracted male sternites of *paganensis* and other species assignable to *Michenerella* with those of *Neotrypetes* shows that this suggested assignment is untenable.

This new subgenus is established for the Old World members of the genus which have rounded axillae as in the New World subgenera *Neotrypetes* and *Physostetha* Michener, rather than having the axillae produced into points as in the Old World subgenus *Heriades* Spinola. The species which I have seen that may be assigned definitely to *Michenerella,* are the Marianas *paganensis* Yasumatsu, the Palau *plumosa,* new species, the Philippine *sauteri philippinensis* (Friese) (as determined by Cockerell), the Bornean *fulvescens* Cockerell and *bakeri* Cockerell, and the Siamese *laosella* Cockerell. The subgenus is predominantly Oriental in distribution with fringe elements in Oceania and Egypt (*H. moricei*

[2] For C. D. Michener, whose research on the generic classification of the Osmiinae has established the basis for the subgeneric groupings in *Heriades.*

Friese, *fide* Michener). It is possible that it is the only subgenus occurring in the Oriental region, though I cannot say positively since I lack a number of the species described from that region. Unfortunately the original descriptions do not mention characters considered to be of subgeneric importance, and frequently are practically worthless for specific identification.

The combination of characters which serve to separate *Michenerella* from the other described subgenera are as follows (based on the forms mentioned above as definitely assignable to *Michenerella*): Axillae rounded; ♀ ♀—clypeal margin thickened but not denticulate or tuberculate or very weakly so, mandibular carinae separated except apically, crest of postscutellum developed on median third only and not interrupted at mid-line, hypostomal carinae high posteriorly and rather abruptly reduced; ♂ ♂—first sternite large, broadly rounded apically and almost totally concealing the second, the apex in middle slightly convex to slightly concave, fifth sternite with a narrow median emargination on apical margin as in *Neotrypetes,* sixth sternite with apical margin broadly rounded and with a median emargination, not subtriangular as in *Neotrypetes* and *Physostetha* or with a short, narrow projection as in *Heriades sens. str.,* the hairs along apical margin long, and with an oval or rounded area basad of emargination with very stout curved setae, genitalia with paramere gently curved inward toward apex and narrowing slightly toward apex, not abruptly incurved near apex nor slightly expanded into a bulb at tip.

Heriades (Michenerella) paganensis Yasumatsu

Eriades sp. Yasumatsu, 1940. Akitu 2:185 [Pagan Island, Marianas].
Heriades paganensis Yasumatsu, 1942. Tenthredo 3:342, figs. 4, 5 [♀, ♂; Pagan; type in Kyushu University].

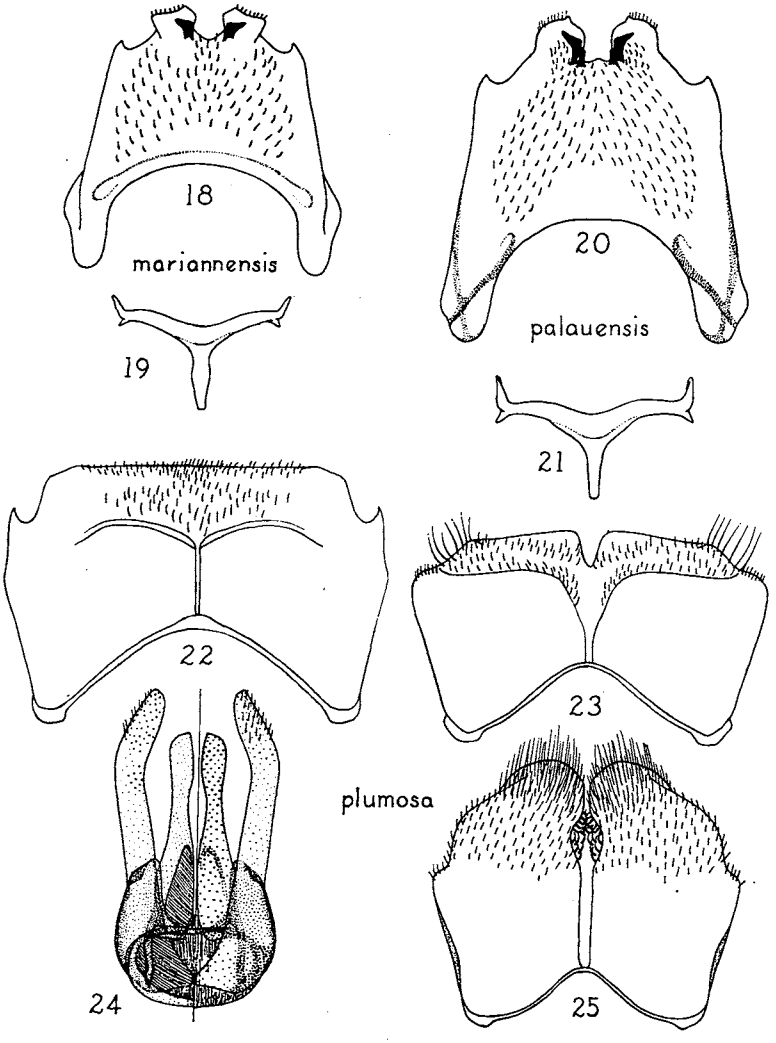
The present species and *plumosa,* new species, are unique among all *Michenerella* known to me in having rather dense discal plumose pubescence on the apical tergites in addition to the apical bands, the fourth to sixth tergites in the males practically entirely covered, and those in the female to a somewhat lesser extent. In all other *Michenerella* the plumose pubescence on the abdominal tergites is restricted to a single row of apical hairs except laterally, the remainder of the surface covered with short, inconspicuous simple hairs. Only the Central American *Heriades (Neotrypetes) bruneri* Titus has similar plumose pubescence on most of the apical tergites.

Originally this species probably was restricted to the northern Marianas for all records from the southern Marianas are 1945 or later.

Nothing is known concerning the nesting habits of this or the following species, but other members of the genus nest in twigs or posts, most likely in deserted beetle borings.

Mariana Islands: 1 ♀; Soñgsoñg, Pagan Island; April 26, 1940 (Yasumatsu and Yoshimura; paratype). 1 ♂; Civil Administration, Saipan; January 10, 1949 (K. L. Maehler; swept in field). 1 ♂; Tanapag, Saipan;

January 15, 1949 (K. L. Maehler). 1 ♀; Charan Kanoa, Saipan; January 2, 1948 (K. L. Maehler). 7 ♂ ♂; Tinian; June 9, 1946 (H. K. Townes). 1 ♀; Talofofo, Guam; February 2, 1948 (K. L. Maehler). 1 ♀; Amantes Point, Guam; May 27, 1945 (H. S. Dybas) [CNHM].



CERATINA AND HERIADES MALES. Fig. 18, C. mariannensis, 6th sternite; **fig. 19, C. mariannensis,** 7th sternite; **fig. 20, C. palauensis,** 6th sternite; **fig. 21, C. palauensis,** 7th sternite; **fig. 22, H. plumosa,** 4th sternite; **fig. 23, H. plumosa,** 5th sternite; **fig. 24, H. plumosa,** genitalia; **fig. 25, H. plumosa,** 6th sternite.

Heriades (Michenerella) plumosa, new species (Figs. 22-25)

The present species, though similar to *paganensis,* may be distinguished readily by the characters listed in the foregoing key, as well as by additional minute characters in the hidden sternites and genitalia. In *plumosa* the oval setose area of the sixth sternite bears larger and denser setae, while the hairs at the apex are somewhat finer. The genitalia are practically identical though *plumosa* has shorter setae along inner margin of gonoforceps about two-thirds the distance from base. Also, in *plumosa* the apical edge of the clypeus of the male is not quite so thickened as in *paganensis.*

Type: ♂; Peleliu Island, Palaus; July 23, 1946 (H. K. Townes). [U. S. National Museum, Type No. 59398.]

Male.—5.6 mm. long, forewing 3.6 mm. Black; tegulae, legs and abdomen brownish; pubescence on dorsum of head, thorax and fourth to sixth tergites of abdomen ochraceous, on sides, venter, legs and first three tergites creamy; pubescence of mesonotum rather uniform in character, plumose, moss-like, denser along margins than discally, fourth to sixth tergites with moderately dense, appressed, short plumose hairs anterior to the apical bands, the apical bands on the first five tergites composed of several rows of short, dense, appressed plumose hairs.

Labrum with a transverse ridge near base interrupted in middle by a punctate area; margin of clypeus not as thickened as in *paganensis,* not tuberculate, the disk evenly and closely punctate (in *paganensis* the punctures more separated at base); first segment of flagellum slightly wider than long, the remaining segments about one and one-half times as long as broad except for the last which is twice as long as broad.

Apical margin of first sternite convex in middle; fourth to sixth sternites and genitalia as figured (figs. 22-25).

Allotype: ♀; Peleliu Island, Palaus; July 29, 1945 (H. S. Dybas). [Chicago Natural History Museum.]

Female.—Length 6.1 mm., forewing 4.1 mm. Similar to male in color of pubescence and integument; mesonotum without scattered, moss-like, plumose hairs except along margins.

Mandible with inner margin very deeply, almost semicircularly, incurved basad of inner apical tooth (only slightly and shallowly incurved in *paganensis*), the dorsal carina almost straight, present only on apical half (present on apical two-thirds in *paganensis,* and strongly curved upwards about halfway to base); upper edge of thickened apical margin of clypeus slightly crenulate.

Paratype: ♀; same data as allotype, but July 30, 1945 [U. S. National Museum]. The paratype is slightly smaller (5.6 mm. long) than the allotype, but agrees in details of structure and pubescence.

Megachile (Eumegachile) umbripennis Smith

Megachile umbripennis Smith, 1853. Cat. Hym. Brit. Mus. 1:175 [♀; Nepal; type in British Museum].

Megachile schauinslandi Alfken, 1898. Ent. Nachr. 24:340 [♀; Honolulu; location of type unknown].

Megachile lerma Cameron, 1908. Jour. Bombay Nat. Hist. Soc. 18:654 [♀; Matheram, Bombay Presidency; type in British Museum].

Meade-Waldo, 1914 (Ann. Mag. Nat. Hist. (8) 14:403), synonymized *lerma* with *umbripennis* after an examination of the types, and Cockerell, 1918 (Ann. Mag. Nat. Hist. (9) 2:388), synonymized *schauinslandi* after examining Hawaiian specimens determined as *umbripennis* by Friese.

Timberlake, 1921 (Proc. Hawaii. Ent. Soc. 4:551), suggested that *schauinslandi* might be distinct from *umbripennis* stating that Hawaiian specimens have a short fulvous apical fringe laterally on second tergite, similar white lateral fringes on the third and fourth, and an entire white fringe on the fifth, whereas *umbripennis* is supposed to have only lateral fringes, those of the second and third fulvous, and of the fourth and fifth white. I am not inclined to place much emphasis on these supposed differences. The complete band on the fifth tergite is very readily denuded and is interrupted medianly in some Hawaiian material before me, which specimens also show some variation in the color of the fringe on the third tergite from fulvous to creamy.

The species has been recorded previously from India, China, Siam and Hawaii. Seemingly it is a relatively recent introduction to Micronesia for it was not taken before or during the war.

The closest relative is the Chinese *strupigera* Cockerell, 1922 (Proc. U. S. Nat. Mus. 60, Art. 18:11), which I have seen also from India (identified as *faceta* Bingham by Sladen) and Siam. Cockerell stated that *strupigera* was closely allied to the Javan *thoracica* Smith, but the resemblance is superficial only as a specimen of the latter determined by Cockerell belongs to a different subgenus.

Umbripennis and *strupigera* are referable to the subgenus *Eumegachile* established by Friese for females having a broad short clypeus. So far as I know the species referable to this subgenus are resin-workers rather than leaf-cutters. While these two species do not have such a clypeus in the female, this character probably is not of too much importance as evidenced by the varying proportions of the clypeus in resin-workers of the subgenus *Chelostomoides* Robertson. The males of these two species agree with the known males assigned to *Eumegachile* by Friese in having the clypeal beard developed only along the apical margin and in having a deep depression before the carina of the sixth tergite. Males of *Chelostomoides* have only three exposed sternites (four in *Eumegachile*) and the clypeal beard is not restricted to the apical margin.

Timberlake (*op. cit.*, p. 554) recorded *umbripennis* in Hawaii as constructing its nests of resinous material, frequently in keyholes.

Mariana Islands: 1 ♀; native settlement, Saipan; June 18, 1946 (R. G. Oakley). 1 ♀; Susupe, Saipan; December 31, 1947 (K. L. Maehler; on *Ipomoea* sp.). 2 ♂ ♂; Civil Administration, Saipan; January 11, 1949 (K. L. Maehler). 1 ♀; Saipan; March 4, 1948 (W. H. Lange).

Megachile (Eutricharaea) fullawayi Cockerell

Megachile sp. Fullaway, 1913. Proc. Hawaii. Ent. Soc. 2:282 [Guam].
Megachile fullawayi Cockerell, 1914. Ann. Mag. Nat. Hist. (8) 14:2 [♀, ♂; Guam; type in U. S. National Museum].—Yasumatsu, 1939. Tenthredo 2:336, figs. 13, 17, 22 [♀, ♂; Kusaie, Jaluit Atoll].—Yasumatsu, 1942. Tenthredo 3:335, figs. 1 a-f [♀, ♂; Pagan].—Cockerell, 1942. B. P. Bishop Mus. Bul. 172:189.

This species is now widespread in Micronesia. Apparently it became established in Hawaii about 1919 (Timberlake, 1921. Proc. Hawaii. Ent. Soc. 4:556).

Timberlake (*op. cit.*, p. 552) suggested that *fullawayi* was introduced into Hawaii from the Oriental region rather than from Guam because at that time there were not extensive communications with Guam. It seems hard to believe that it is endemic in Micronesia because of the large number of islands on which it has become established. It is close to the Philippine *navicularis* Cockerell, which, however, does not have the anterior margin of the fore basitarsus of the male abruptly narrowed two-thirds the distance to apex, but the segment is equally broad throughout. However, in the series determined as *navicularis* in the U. S. National Museum I found one male *fullawayi* from Occidental Negros (determined as *navicularis* by Sandhouse) which is identical with Micronesian specimens in structural characters and genitalia. The pubescence in the Philippine male is pale fulvous, similar to that in two males from Hawaii and Nukuoro Atoll, rather than the normal (?) white. Perhaps the pubescence is fulvous in newly emerged individuals and fades rapidly to white after exposure to light.

Marshall Islands: 15 ♀ ♀; airfield, Majuro Atoll; August 26, 1946 (H. K. Townes). 1 ♂; Engebi Island, Eniwetok Atoll; May 18, 1946 (R. G. Oakley). 2 ♀ ♀, 1 ♂; Kwajalein Island, Kwajalein Atoll; August 16, 1946 (H. K. Townes). 4 ♂ ♂; same data, but on airfield; August 17, 1946 (H. K. Townes). Yasumatsu records it from Jabor Island, Jaluit Atoll.

Mariana Islands: 2 ♀ ♀, 1 ♂; Guam (D. T. Fullaway; type and cotypes). 1 ♀; Mt. Alutom, Guam; June 18, 1946 (H. K. Townes). 1 ♀; Agrihan; August 1, 1945 (Borror and Holder). Yasumatsu records it also from Pagan.

Caroline Islands: 2 ♂ ♂; Nukuoro Island, Nukuoro Atoll; August 6, 1946 (R. G. Oakley). 1 ♀; Hare Island, Kapingamarangi Atoll; August 3, 1946 (H. K. Townes). 1 ♀; Yaptown, Yap; July 12, 1946 (H. K. Townes). Yasumatsu records it from Kusaie.

Megachile laticeps Smith

Megachile laticeps Smith, 1853. Cat. Hym. Brit. Mus. 1:183 [♂; Philippines; type in British Museum].—Cockerell, 1939. Occas. Papers B. P. Bishop Mus. 15:63 [♀, ♂; Carolines].—Yasumatsu, 1942. Tenthredo 3:337, fig. 2 [♀, ♂; new syn. and distrib.].—Cockerell, 1942. B. P. Bishop Mus. Bul. 172:188 [♀, ♂; Guam].

Megachile caecina Cameron, 1903. Jour. Str. Br. Roy. Asia. Soc., no. 39, p. 173 [♀; Trusan; type in British Museum].

Megachile borneana Cameron, 1903. Jour. Str. Br. Roy. Asia. Soc., no. 39, p. 174 [♀; Kuching; type in British Museum].

Megachile gadara Cameron, 1903. Jour. Str. Br. Roy. Asia. Soc., no. 39, p. 176 [♂; Kuching; type in British Museum].

Megachile robbii Ashmead, 1904. Proc. U. S. Nat. Mus. 28:128 [♀; Manila; type in U. S. National Museum].

Megachile semperi Friese, 1905. Ztschr. Hym. Dipt. 5:17 [♀; Palaus; location of type unknown].—Yasumatsu, 1935. Mushi 8:95, fig. [♀; Tinian; descr. of nest].—Cockerell, 1939. Occas. Papers B. P. Bishop

Mus. 15:63.—Yasumatsu, 1939. Tenthredo 2:335, figs. 14, 16, 23 [♂; Marianas, Carolines, Palaus].

Megachile varidens Cameron, 1905. Jour. Str. Br. Roy. Asia. Soc., no. 44, p. 166 [♂; Kuching; type in British Museum].

Megachile metallescens Cockerell, 1918. Phil. Jour. Sci. 13:135 [♀; Mt. Maquiling, Luzon; type in U. S. National Museum].

Megachile mcgregori Cockerell, 1918. Phil. Jour. Sci. 13:140 [♂; Mt. Maquiling, Luzon; type in U. S. National Museum].

The Cameron names were synonymized by Meade-Waldo, 1914 (Ann. Mag. Nat. Hist. (8) 14:403), after comparison of the Smith and Cameron types. In 1939 Yasumatsu synonymized *metallescens* under *semperi.* In 1942 he placed *semperi* as a synonym of *laticeps* after Cockerell, 1939, had suggested that *metallescens* was a synonym of *laticeps.* Cockerell, 1931 (Amer. Mus. Novit. 480:3), reported Sandhouse's conclusion that *robbii* and *metallescens* were identical. I am able to confirm this synonymy by examination of the types. Both have the metallic bluish abdominal reflections. The type of *metallescens* differs in that the scopa of the fifth sternite is pale only on the extreme base whereas in the type of *robbii* it is black only laterally on the fifth sternite. As pointed out below, this appears to be within the range of normal variation. Cockerell's synonymy (1942) of *mcgregori* under *laticeps* has been confirmed by comparison of the type and its genitalia with Micronesian material of *laticeps.* The type of *mcgregori* has the peculiar arrangement of hair on the tarsi mentioned in the foregoing key, though in Cockerell's (1918) key it is stated not to have such hair.

There is some variation in the amount of black hairs in the scopa of the fifth sternite. Normally the scopa on this segment is black only laterally; occasionally specimens have the black hairs extending across the apex, or the fifth sternite may be entirely black except for a row or two of pale hairs at the base as in the type of *metallescens.* This variation does not appear to be of any significance for I have found a certain amount of it to exist in series from the Philippines, Palaus and Yap.

This and the following two forms, *palaonica* Cockerell and *diligens hedleyi* Rainbow, are not referable to any of the described subgenera as defined at present. However, it seems premature to erect new subgenera for their reception until the large Oriental and Australian fauna has been studied thoroughly and some knowledge gained as to the relative emphasis to be placed on certain characters. Yasumatsu (1942) suggested that *laticeps* and *palaonica* might belong to the subgenus *Anthemois* Robertson, but as limited at present, the males of that group have a basal tooth on the inferior margin of the mandible and tridentate mandibles, and the females usually have quinquedentate mandibles.

Yasumatsu (1935) describes and figures a nest from Saipan constructed in a dead reed from pieces cut from leaves of *Pithecellobium dulce.*

Mariana Islands: 1 ♀; Mt. Santa Rosa, Guam; May 16, 1945 (G. E. Bohart and J. L. Gressitt) [CAS]. 1 ♀; Tumon Bay, Guam; December 28, 1947 (K. L. Maehler; on *Ipomoea pes-caprae*). 1 ♀; Agaña airport,

Guam; January 30, 1948 (K. L. Maehler). 1 ♀; Agaña springs, Guam; May 23, 1945 (G. E. Bohart and J. L. Gressitt). 1 ♂; Mt. Alutom, Guam; June 18, 1946 (H. K. Townes). 1 ♂; Piti, Guam; August 2, 1936 (O. H. Swezey). 2 ♂ ♂; same data, but September 14, 1936. 1 ♀; same locality, but November 18, 1937 (R. G. Oakley). 3 ♂ ♂; Santa Rita, Guam; January 29, 1949 (K. L. Maehler; on *Ipomoea*). 1 ♀; Barrigada, Guam; June 14, 1936 (O. H. Swezey; on *Crotalaria*). 2 ♂ ♂; Rota, Rota; June 23, 1946 (H. K. Townes). 1 ♂; same data, but June 26, 1946. 1 ♀, 1 ♂; Hagoya Lake, Tinian; June 10, 1946 (H. K. Townes). 1 ♀; hills E. of Garapan, Saipan; January 1, 1945 (H. S. Dybas) [CNHM]. 3 ♀ ♀; native settlement, Saipan; June 18, 1946 (R. G. Oakley). 2 ♂ ♂; Saipan; June 28, 1946 (H. K. Townes). 1 ♀; Saipan; March 4, 1948 (W. H. Lange). 1 ♂; Magicienne Bay, Saipan; February 25, 1949 (K. L. Maehler; on *Ipomoea*). 1 ♀; 1-2 mi. E. of Tanapag, Saipan; November 17, 1944 (H. S. Dybas) [CNHM]. 1 ♂; same data, but April 16, 1945 [CNHM]. 1 ♀; same locality, but December 3, 1944 (S. Edgar) [CNHM]. 1 ♀, 1 ♂; Agrihan; July 29, 1945 (Borror and Holder). 3 ♀ ♀; same data, but August 2-6, 1945 (D. J. Borror). Yasumatsu records it also from Pagan.

Caroline Islands: 1 ♂; Mt. Uiniböt, Tol Island, Truk Atoll; May 24, 1946 (H. K. Townes). 1 ♀; Pis Island, Truk Atoll; June 3, 1946 (H. K. Townes). 1 ♀; Moen Island, Truk Atoll; March 1949 (D. Langford). 2 ♀ ♀; Dublon Island, Truk Atoll; February 10, 1948 (K. L. Maehler; on *Ipomoea*). 5 ♀ ♀; Tomil, Yap; March 5, 1949 (K. L. Maehler; on flowers of *Euphorbia pulcherrima*). 1 ♀; Yaptown, Yap; July 13, 1946 (H. K. Townes). 9 ♀ ♀, 1 ♂; same data, but July 14, 1946. 4 ♀ ♀; Yaptown (labeled Colonia), Yap; March 1-8, 1949 (K. L. Maehler; on *Ipomoea* flowers). 1 ♂; Dugor, Yap; March 1-8, 1949 (K. L. Maehler). 4 ♀ ♀, 1 ♂; same data, but collected on *Ipomoea pes-caprae* flowers. 1 ♀; Gorror, Yap; March 1, 1949 (K. L. Maehler; on *Ipomoea*). 2 ♀ ♀, 2 ♂ ♂; Arakabesan Island, Palaus; July 18, 1946 (H. K. Townes). 1 ♀; Babelthuap Island, Palaus; July 19, 1946 (H. K. Townes). 1 ♀; Aurungi, W. of Ulimang, Babelthuap Island, Palaus; December 17, 1947 (H. S. Dybas; on nipa palm blossom). 1 ♀; Koror Island, Palaus; March 15-25, 1948 (K. L. Maehler; on *Ipomoea*). Yasumatsu records it also from Kusaie and Ponape.

Megachile palaonica Cockerell

Megachile palaonica Cockerell, 1939. Occas. Papers B. P. Bishop Mus. 15:62 [♀, ♂; Palaus; type in Bishop Museum].

Megachile subrixator Cockerell, Yasumatsu, 1939. Tenthredo 2:334, figs. 12, 15, 21 [♀, ♂; Palaus; misdetermination of Cockerell species].—Yasumatsu, 1942. Tenthredo 3:340, figs. 3 a-i [♂; Palaus; *palaonica* incorrectly synonymized under *subrixator*].

Probably this is the only true endemic *Megachile* in Micronesia. At least I have found no specimens of it among a large number of *Megachile* from the Oriental and Australian regions. Yasumatsu's identification of this species as the Philippine *subrixator* Cockerell, 1915 (Ann. Mag. Nat. Hist. (8) 15:535), and subsequent synonymizing of *palaonica*

under *subrixator* are incorrect, for an examination of the female type in the U. S. National Museum shows *subrixator* to be a *Megachile* (*Eutricharaea*) close to *fullawayi*. Males associated with female *subrixator* by Cockerell have simple fore tarsi.

Caroline Islands: 1 ♂; Babelthuap Island, Palaus; July 19, 1946 (H. K. Townes). 1 ♀; same data, but July 22, 1946 (R. G. Oakley). 1 ♀, 10 ♂ ♂; Ulimang, Babelthuap Island, Palaus; December 9-21, 1947 (H. S. Dybas). 1 ♀; wooded peak S.W. of Ulimang, Babelthuap Island, Palaus; December 12, 1947 (H. S. Dybas). 1 ♀; Koror Island, Palaus; July 22, 1946 (H. K. Townes). 3 ♀ ♀, 3 ♂ ♂; Peleliu Island, Palaus; July 23, 1946 (H. K. Townes). 1 ♀; same locality, but August 14, 1945 (H. S. Dybas) [CNHM].

Megachile diligens hedleyi Rainbow

Megachile hedleyi Rainbow, 1897. Mem. Austral. Mus. 3:93, pl. 1, fig. 5 [♀; Funafuti; type in Sydney].

Megachile calens Cockerell, 1914. Ann. Mag. Nat. Hist. (8) 14:464 [♀, ♂; Epi, New Hebrides; type in U. S. National Museum].

Megachile vavauensis Cockerell, 1924. Ann. Ent. Soc. Amer. 17:393 [♂; Vavau, Tonga Islands; type in British Museum].

Megachile diligens calens Cockerell, Perkins and Cheesman, 1928. Ins. Samoa, Hym., Pt. 5, Fasc. 1:8 [♀, ♂; Tutuila].

Megachile diligens hedleyi Rainbow, Cheesman, 1936. Trans. Roy. Ent. Soc. London 85:174 [♀, ♂; New Hebrides].

Megachile loiensis Cockerell, 1947. Pan-Pac. Ent. 23:68 [♀; Kwajalein Atoll; type in U. S. National Museum]. **New synonymy.**

Perkins and Cheesman placed *calens* as a subspecies of *diligens*, a treatment in which I concur, and synonymized *vavauensis*. The male type of *calens* does not differ from Micronesian males, and the female cotype of *calens* is identical with the female type and cotype of *loiensis*. Cheesman, 1936 (Trans. Roy. Ent. Soc. London 85:174) synonymized *calens* under the Ellice Islands *hedleyi* Rainbow, an action with which Cockerell did not agree. There are certain differences between Rainbow's description and specimens I identify as *diligens hedleyi*, but Miss Cheesman saw Rainbow's type and informs me that it does not agree with all the characters Rainbow ascribes to it, and that she considers it to be *diligens*.

Diligens hedleyi is uncomfortably close to typical *diligens* Smith from Hawaii, but apparently the female is constantly separated from that of the typical subspecies by having the scopa on the sixth sternite black instead of fulvous, and by the intermixed black hairs on the vertex and scutum which are lacking in typical *diligens*. The separation characters for *diligens* and *loiensis* mentioned by Cockerell do not hold as the color of the tarsal claws, bands on tergites and the mandibles (worn in the type series of *loiensis*) are the same in both subspecies.

Cheesman, 1936, records *diligens hedleyi* as nesting in dry logs on coral beaches in the New Hebrides, and the closely related *diligens buxtoni* Perkins and Cheesman as nesting in ready-made tunnels in

madreporic boulders on coral reefs, both forms constructing the nests from pieces of leaves.

Marshall Islands: 2 ♀ ♀; Loi Island, Kwajalein Atoll; January 14, 1945 and February 8, 1945 (H. S. Wallace; type and cotype of *loiensis*). 1 ♀; Engebi Island, Eniwetok Atoll; May 18, 1946 (R. G. Oakley; on flowers of *Scaevola*). 1 ♂; same data, but (H. K. Townes and R. G. Oakley). 1 ♀, 1 ♂; Japtan Island, Eniwetok Atoll; May 15, 1946 (H. K. Townes). 1 ♀; airfield, Majuro Atoll; August 27, 1946 (H. K. Townes). 1 ♀; Roguron Island, Majuro Atoll; April 18, 1949 (R. P. Owen). 2 ♀ ♀; Bigatyelang Island, Ailinglapalap Atoll; August 25, 1946 (H. K. Townes). 3 ♀ ♀; Bikini Atoll; April 30, 1946 (J. P. E. Morrison). 4 ♀ ♀, 2 ♂ ♂; same data, but July-August 1947 (A. C. Cole).

Caroline Islands: 1 ♀; Murle (*recte* Murilo?) Atoll; April 22, 1948 (K. L. Maehler).

FAMILY APIDAE

This large family of bees is very poorly represented in Micronesia by six species, only two of which are endemic.

KEY TO THE MICRONESIAN APIDAE

1. Length of second submarginal cell along cubital vein equal to or less than length of first cell; hind legs of female with a scopa of dense hairs; males with pale integumental marks on head 2
   Second submarginal cell as long as combined lengths of first and third cells along cubital vein, or closed submarginal absent; hind tibiae of females, except queens of *Trigona*, with a corbiculum, the flattened, expanded outer surface of hind tibia with marginal hairs 4
2. Large bulky forms, bumblebee-like in appearance, the female entirely black and with black hairs, the male largely ferruginous and with fulvous hair; Marianas Guam, Saipan) ..... **Xylocopa brasilianorum varipuncta** Patton, p. 133
   Small slender forms, both sexes with head and thorax dark with metallic greenish or bluish reflections, the males also with pale clypeal markings, the abdomen similarly colored or ferruginous in part, or entirely 3
3. Hypostomal carina high; temples with a moderately broad band of punctures along eye margin, many of which are subcontiguous; scutum with punctures between parapsidal furrows and sides; upper posterior part of mesopleuron rather closely punctate, with only a very small impunctate area; males with second and third tarsal segments with a pale macula; male sixth and seventh sternites as figured (figs. 20, 21), the denticle of sixth bifid; Carolines (Palaus, Yap, Truk) ..... **Ceratina palauensis** Yasumatsu, p. 132
   Hypostomal carina very low; temples with a much narrower band of punctures along eye margin, most of the punctures well-separated; scutum nearly impunctate between sides and parapsidal furrows; upper posterior part of mesopleuron impunctate except along margins; males with tarsal segments immaculate; male sixth and seventh sternites as figured (figs. 18, 19), the denticle of sixth simple; Marianas (Saipan, Rota) ..... **Ceratina mariannensis** Yasumatsu, p. 132
4. Eyes densely hairy; larger forms, 11 mm. or more in length; Marianas (Guam, Saipan), Carolines (Ponape, Palaus) ..... **Apis mellifera** Linnaeus, p. 135
   Eyes bare; smaller forms never over 7 mm. in length (gravid females) and usually much less 5

5. Smaller forms, worker with forewing including tegula not over 3.5 mm. long; scape of male black, the seventh tergite compressed laterally, beaklike and downcurved, the gonoforceps slightly and evenly curved inward toward the tip; Carolines (Palaus).....**Trigona (Tetragona) fusco-balteata** Cameron, p. 133
Larger forms, worker with forewing including tegula 4.5-4.75 mm. in length; scape of male ferruginous, the seventh tergite rather evenly convex, gonoforceps bisinuate; Carolines (Truk).....
.....**Trigona (Tetragona) iridipennis** var. **valdezi** Cockerell, p. 135

Ceratina mariannensis Yasumatsu (Figs. 18, 19)

Ceratina mariannensis Yasumatsu, 1939. Tenthredo 2:346, fig. 2 [♀; Rota Island; type in Kyushu University].—Yasumatsu, 1942. Tenthredo 3:346 [♀; Rota, Saipan; the specimens recorded from Yap and Truk are referable to *palauensis*].

Ceratina sp. Townes, 1947. Rpt. 14, U. S. Comm. Co. Surv. Micronesia, p. 51 [Rota].

The males of the two endemic *Ceratina* in Micronesia may be readily separated by the characters in the foregoing key. The characters of punctation should also be useful in separating the females.

Dr. Yasumatsu has confirmed my supposition that the specimens recorded by him (1942) as *mariannensis* from Yap and Truk are actually *palauensis* by comparison of his material with a manuscript copy of the foregoing key. The specimens I have seen from Yap are referable to *palauensis,* though the abdomen may or may not be ferruginous in part (entire abdomen ferruginous in Palau material).

Mariana Islands: 6 ♀ ♀; Shinaparu, Rota; June 24, 1946 (H. K. Townes). 1 ♂; Rota, Rota; June 23, 1946 (H. K. Townes).

Ceratina palauensis Yasumatsu (Figs. 20, 21)

Ceratina palauensis Yasumatsu, 1939. Tenthredo 2:344, fig. 1 [♂; Babelthuap and Angaur Islands, Palaus; type in Kyushu University.]

Ceratina mariannensis Yasumatsu, Yasumatsu, 1942. Tenthredo 3:346 [♀, ♂; specimens from Yap and Truk recorded as *mariannensis* referable to *palauensis*].

Ceratina sp. Townes, 1947. Rpt. 14, U. S. Comm. Co. Surv. Micronesia, p. 51 [Palaus].

As pointed out in the discussion of the preceding species, the specimens from Yap studied by me differ from the Palau specimen in having only the three basal abdominal segments ferruginous, or sometimes all the abdomen dark. I can find no differences in the genitalia, retracted sternites or punctation between Palau and Yap material.

Caroline Islands: 1 ♂; Potangeras Islet, Ulithi Atoll; November 10, 1947 (H. S. Dybas). 1 ♀, 1 ♂; Dugor, Yap; March 1-8, 1949 (K. L. Maehler; on *Terminalia catappa*). 1 ♂; Mt. Matada, Yap; July 12, 1946; (H. K. Townes). 1 ♀, 2 ♂ ♂; Gorror, Yap; March 1, 1949 (K. L. Maehler). 1 ♀; Rumu, Yap; March 1-8, 1949 (K. L. Maehler). 1 ♂; Peleliu Island, Palaus; July 23, 1946 (H. K. Townes). 1 ♂; Ngerehelong, Babelthuap Island, Palaus; December 18, 1947 (H. S. Dybas).

Xylocopa brasilianorum varipuncta Patton

Xylocopa varipuncta Patton, 1879. Canad. Ent. 11:60 [♀ ; Arizona; location of type unknown].

Xylocopa brasilianorum varipuncta Patton, Ackerman, 1916. Jour. N. Y. Ent. Soc. 24:226.

This large carpenter bee is a very recent introduction to the Marianas, undoubtedly from Hawaii. Nininger, 1916 (Pomona Jour. Ent. Zool. 8:164), records the species in California as preferring to make its tunnels in partially decayed wood.

Mariana Islands: 1 ♀ ; Kobler Field, Saipan; January 13, 1949 (K. L. Maehler; on *Ipomoea*). 1 ♀ ; Agricultural Farm, Guam; February 25, 1949 (K. L. Maehler; on *Ipomoea*).

Trigona (Tetragona) fusco-balteata Cameron

? Trigona ruficornis Smith, Horne, 1870. Trans. Zool. Soc. London 7:185.—Smith, 1870. *Op. cit.*, p. 194 [☿ ; Mainpuri; type in British Museum].

? Melipona smithii Bingham, 1897. Fauna Brit. India, Hym. 1:563 [substitute name for *ruficornis* Smith, preoccupied in *Melipona* by Lamarck].

Trigona fusco-balteata Cameron, 1908. Entomologist 41:194 [☿ ; Sarawak; type in British Museum].—Schwarz, 1939 b. Mushi 12:151 [Palaus].

Trigona atomella Cockerell, 1919. Ann. Mag. Nat. Hist. (9) 3:243 [☿ ; Penang; type in U. S. National Museum].—Cockerell, 1939. Occas. Papers B. P. Bishop Mus. 15:64 [Palaus].

Trigona pygmaea Friese, 1933. Naturh. Maandblad 22:147 [☿ ; Sumatra; location of type unknown].

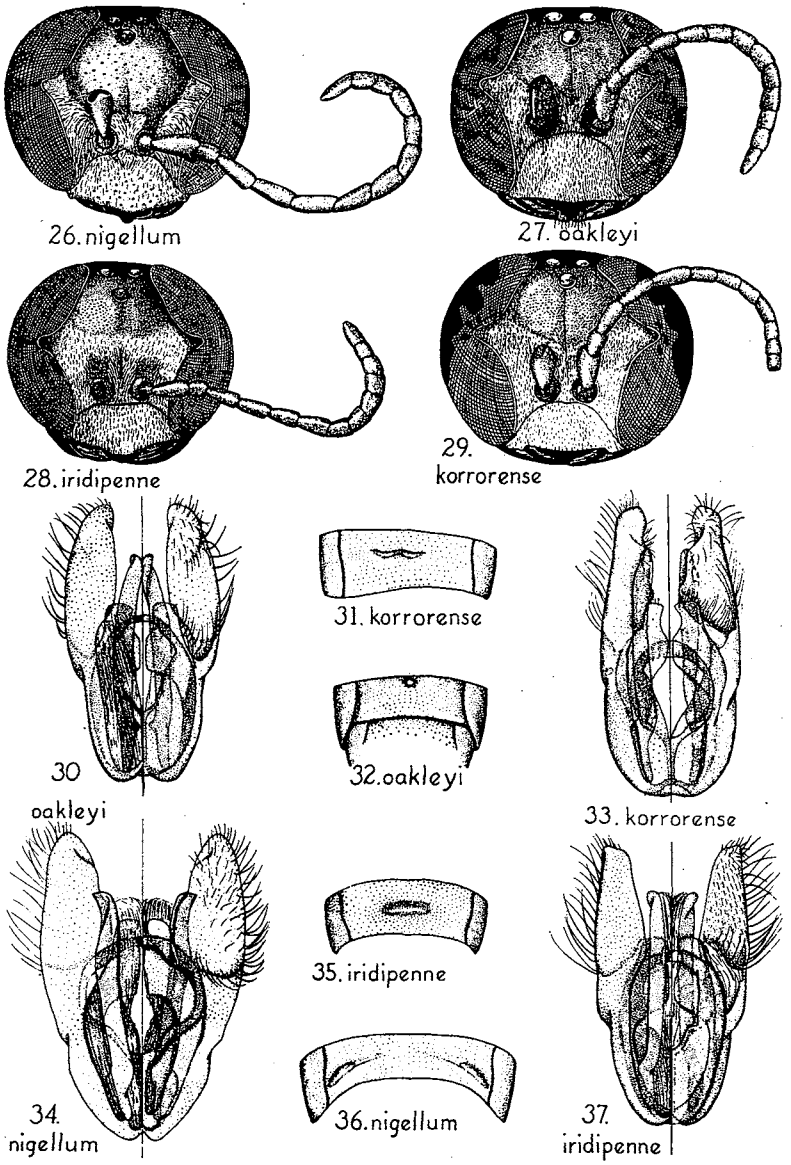
Melipona (Trigona) atomella (Cockerell), Yasumatsu, 1935. Mushi 8:94 [Palaus].—Esaki, 1936. Mushi 9:44-5.

Trigona (Tetragona) fusco-balteata var. *fusco-balteata* Cameron, Schwarz, 1939 a. Bul. Amer. Mus. Nat. Hist. 76:107-110, figs. 5 A, 6 A, 7 A, 8 A [synonymy, description, habits; recorded from French Indo-China south to Celebes, Philippines].

Trigona spp. Townes, 1947. Rpt. 14, U. S. Comm. Co. Surv. Micronesia, p. 51 [Palaus; visiting resinous secretions of *Wedelia biflora*].

This small stingless honeybee is perhaps an intentional introduction to the Palaus. It is readily separated from the introduced *iridipennis* var. *valdezi* of Truk by the smaller size and other characters mentioned in the key. Pagden, quoted by Schwarz, reported this species as nesting in crevices of timber and jalousies in houses in Kuala Lumpur. The synonymy as suggested above is that given by Schwarz, 1939 a. He suggests that *fusco-balteata* represents a callow form of *atomella,* and notes that Palau specimens are somewhat larger than typical *fusco-balteata,* and approach small specimens of typical *iridipennis* in wing length.

Townes' mention of two species of *Trigona* occurring in the Palaus is undoubtedly due to this species having been recorded from there as *atomella* by Cockerell and Yasumatsu and as *fusco-balteata* by Schwarz.



PISON MALES. Fig. 26, P. nigellum, head; **fig. 27, P. oakleyi,** head; **fig. 28, P. iridipenne,** head; **fig. 29, P. korrorense,** head; **fig. 30, P. oakleyi,** genitalia; **fig. 31, P. korrorense,** 3rd sternite; **fig. 32, P. oakleyi,** 3rd sternite; **fig. 33, P. korrorense,** genitalia; **fig. 34, P. nigellum,** genitalia; **fig. 35, P. iridipenne,** 3rd sternite; **fig. 36, P. nigellum,** 3rd sternite; **fig. 37, P. iridipenne,** genitalia.

Caroline Islands: 8 ☿ ☿; Peleliu Island, Palaus; July 23, 1946 (H. K. Townes). 33 ☿ ☿; same data, but July 31-August 1, 1945 (E. Hagen) [CAS]. 4 ☿ ☿, same data, but (H. S. Dybas) [CNHM]. 14 ☿ ☿; Arakabesan Island, Palaus; July 18, 1946 (H. K. Townes). 1 ☿; Koror Island, Palaus; July 20, 1946 (R. G. Oakley). 4 ☿ ☿; same data, but July 23, 1946. 1 ☿; same data, but northeast corner of island, July 22, 1946 (H. K. Townes). 259 ☿ ☿, 1 ♂; same data, but March 8, 1949 (K. L. Maehler; entrance of nest in crack in wall). 1 ☿; same data, but February 8-15, 1949 (M. M. Ross). 4 ☿ ☿, 46 ♂ ♂; same locality, but November 20, 1947 (H. S. Dybas; bees in swarm about building with nests in cracks in walls). Numerous ☿ ☿ and ♂ ♂; same locality, but December 2, 1947 (H. S. Dybas; bees dancing in swarm about building—tubular openings in cracks in wood walls). 1 ♀; same locality, but February 15, 1948 (H. S. Dybas). 1 ☿; Gapik, Babelthuap Island, Palaus; July 19, 1946 (H. K. Townes). 24 ☿ ☿; Ngerehelong, Babelthuap Island, Palaus; December 18, 1947 (H. S. Dybas). 3 ☿ ☿; Airai, Babelthuap Island, Palaus; January 20, 1948 (H. S. Dybas).

Trigona (Tetragona) iridipennis var. **valdezi** Cockerell

Trigona valdezi Cockerell, 1918. Ann. Mag. Nat. Hist. (9) 2:387 [☿; Singapore; type in U. S. National Museum].—Cockerell, 1939. Occas. Papers B. P. Bishop Mus. 15:64 [♀; Truk].

Trigona (*Tetragona*) *iridipennis* var. *valdezi* Cockerell, Schwarz, 1939 a. Bul. Amer. Mus. Nat. Hist. 76:116 [synonymy, descriptive notes; recorded from French Indo-China south to Borneo, Philippines].—Schwarz, 1939 b. Mushi 12:152 [Truk].

Trigona sp. Townes, 1947. Rpt. 14, U. S. Comm. Co. Surv. Micronesia, p. 51 [Truk].

This also is probably an introduced species on Truk. Schwarz, 1939 a, separates the variety *valdezi* from typical *iridipennis* by the slightly greater wing length of the worker, 4¾ mm. in the former and 4¼ mm. in the latter. No data have been presented on the nesting habits of the variety *valdezi*, though Schwarz, 1939 a, summarizes the information on typical *iridipennis*.

Caroline Islands: 1 ☿; Tol Island, Truk Atoll; May 25, 1946 (H. K. Townes). 1 ☿; same data, but January 7-27, 1949 (D. Langford). 6 ☿ ☿; Moen Island, Truk Atoll; February 8, 1948 (K. L. Maehler; on wild legume). 1 ☿; Dublon Island, Truk Atoll; February 9, 1948 (K. L. Maehler).

Apis mellifera Linnaeus

Apis mellifera Linnaeus, 1758. Syst. Nat., 10th Edit., p. 576.—Fullaway, 1913. Proc. Hawaii. Ent. Soc. 2:282 [notes that it was introduced on Guam from Hawaii in 1907].—Esaki, 1936. Mushi 9:44 [notes that it was introduced on Koror Island, Palaus in 1912].—Cockerell, 1942. B. P. Bishop Mus. Bul. 172: 188 [Guam].—Townes, 1947. Rpt. 14, U. S. Comm. Co. Surv. Micronesia, p. 51 [Ponape, Palaus, southern Marianas, common only on the latter group].

Cockerell, quoting Swezey, states that the honeybee on Guam is not used for commercial production. Any convenient box is used for a hive, and wild colonies occur in trees and in limestone cliffs.

Mariana Islands: 1 ♀ ; Asumiatok, Saipan; August 27, 1944 (D. G. Hall). 1 ♀ ; 1-2 mile E. of Tanapag, Saipan; November 25, 1944 (H. S. Dybas) [CNHM]. 1 ♀ ; Point Ritidian, Guam; June 1945 (J. L. Gressitt). 4 ♀ ♀ ; Point Oca, Guam; May 1945 (J. L. Gressitt and G. E. Bohart). 3 ♀ ♀ ; Pago Bay, Guam; June 2, 1945 (H. S. Dybas) [CNHM]. 1 ♀ ; Mt. Santa Rosa, Guam; May 16, 1945 (G. E. Bohart and J. L. Gressitt) [CAS]. 1 ♀ ; Agaña, Guam; May 7, 1945 (G. E. Bohart and J. L. Gressitt) [CAS].

Caroline Islands: 4 ♀ ♀ ; Colonia, Ponape; August 9, 1946 (H. K. Townes). 1 ♀ ; same locality, but March 14, 1948 (H. S. Dybas). 1 ♀ ; Auak, Ponape; August 12, 1946 (H. K. Townes). 5 ♀ ♀ ; Koror Island, Palaus; July 23, 1946 (H. K. Townes). 1 ♀ ; same locality, but November 24, 1947 (H. S. Dybas).

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APPENDIX I

Some additional wasps have been examined since the publication of Part I, but I include here only the records from new islands and certain other notes. Several plates of illustrations for some of the species treated in Part I are also included here.

FAMILY SCOLIIDAE

Campsomeris (Campsomeriella) manokwariensis (Cameron)

? Scolia agilis Smith, 1858. Jour. Proc. Linn. Soc. Zool. 3:10 [♂; Celebes; type in Oxford Univ.].

Scolia annulata (Fabricius), Smith, 1861. Jour. Proc. Linn. Soc. Zool. 6:53 [♀; Celebes; misdetermined].

Dielis manokwariensis Cameron, 1906. Res. Exped. Neerl. Nov. Guin. 5:52 [♀; Manokwari, New Guinea; type in Zool. Mus., Amsterdam].

Dielis humboldti Cameron, 1906. Res. Exped. Neerl. Nov. Guin. 5:53 [♀; Humboldt Bay, New Guinea; type in Zool. Mus., Amsterdam].

Campsomeris (Campsomeris) manokwariensis (Cameron), Betrem, 1928. Treubia, Suppl. vol. 9:123, fig. 57 (labeled *humboldtii*) [♀, ♂; Celebes, New Guinea, Bismarck Arch.; redescription, synonymy as given above].

Campsomeris annulata (Fabricius), Townes, 1946 [1947]. Rpt. 14, U. S. Comm. Co. Econ. Surv. Micronesia, p. 51 [misdetermined, in part].

Campsomeris (Campsomeris) annulata (Fabricius), Krombein, 1949. Proc. Hawaii. Ent. Soc. 13:374 [misdetermined, in part].

The present species is very similar in general appearance to *annulata* and has been confused with it more than once. The females of *manokwariensis* are distinguished by having the wings entirely dark fuscous rather than only the apical third as in *annulata,* and the vertex, postscutellum and median area of the dorsum of the propodeum impunctate or practically so, as opposed to the moderately densely punctate condition of these areas in *annulata.* The males of the two species are much more difficult to separate with certainty on external characters, but in doubtful cases the genitalic characters may be relied on, the genitalia of *manokwariensis* having the paramere equal in width throughout (greatly widened at the middle in *annulata*), and the squama with very dense, long hair (with sparse, short hair in *annulata*). Typically, *annulata* males have apical yellow bands on the first five abdominal tergites, paired lateral spots on the scutellum, a median band on the postscutellum, and lateral spots on the clypeus, while *manokwariensis* males have apical bands on only the first four tergites and lateral spots on the clypeus, but lack the yellow markings on the scutellum and postscutellum. However, *annulata* males occasionally show some reduction in markings, the band on the fifth tergite may be lacking and the spots on scutellum and postscutellum may be reduced or lacking; in these cases the clypeal spots are also reduced or lacking, and this will aid in separating those *annulata* with only four abdominal bands from the similarly marked *manokwariensis.*

There is some doubt as to the correctness of the synonymy given above, as Betrem notes that the type of *manokwariensis* has yellowish abdominal fringes (Cameron says bright fulvous). Betrem suggests that this coloration may have been caused by immersion in alcohol, and states that if it is found to be natural coloration that the white-fringed form should be known as var. *humboldti.* In a long series of *manokwariensis* from New

Guinea before me, the abdominal fringes of the females vary from white to creamy.

I have seen no published records relative to the introduction of *manokwariensis* and *annulata* into the Marianas. I feel certain that neither is an endemic species there, for they are absent from the rest of Micronesia and were not taken on any of the prewar surveys, though they were abundant as early as 1945. It is most likely that they were introduced, accidentally or intentionally during the early part of the war, during the Japanese occupation.

Mariana Islands: 1 ♀; 3 ♂ ♂; Mt. Alutom, Guam; June 6, 1946 (H. K. Townes). 4 ♂ ♂; Oscilita, Rota; June 27, 1946 (R. G. Oakley). 1 ♀; central section, Tinian; October 10-15, 1945 (H. S. Dybas) [CNHM].

Scolia (Triscolia) procer Illiger

Scolia procer Illiger, 1802. Mag. f. Insektenk. 1:196 [♀, ♂; Sumatra; type in Zool. Mus., Berlin].

Scolia (Triscolia) procer Illiger, Saussure and Sichel, 1864. Cat. Spec. Scolia, p. 43.—Betrem, 1928. Treubia, Suppl. vol. 9:240 [♀, ♂; redescription; Borneo to Tenasserim].

C. P. Clausen informs me that according to a report by K. L. Maehler this species was introduced into the Palaus with *Scolia (Triscolia) patricialis plebeja* (Gribodo) for control of *Oryctes rhinoceros* (Linnaeus).

It is a large species, rather similar to *patricialis plebeja* in general appearance, but lacks the dense black hair on the pronotum before the tegula, and the female has a tubercle in that area which is lacking in *patricialis plebeja*.

FAMILY POMPILIDAE

Episyron maehleri Krombein

1 ♀; limestone ridge S. of inlet, Koror Island, Palaus; January 18, 1948 (H. S. Dybas). The second known female; agrees in all essentials with the type.

FAMILY SPHECIDAE

Chalybion bengalense (Dahlbom)

1 ♀; Com. Mar. Hill, Guam; March 28, 1949 (K. L. Maehler).

Sceliphron laetum (Smith).

1 ♀, 2 ♂ ♂; Yaptown (labeled Colonia), Yap; March 1-8, 1949 (K. L. Maehler). 1 ♂; Dugor, Yap; March 1-8, 1949 (K. L. Maehler).

Dasyproctus immaculatus Krombein

2 ♀ ♀; Peleliu Island, Palaus; August 10, 1945 (E. Hagen) [CAS]. 1 ♀; same locality, but January 24, 1948 (H. S. Dybas). 1 ♀; Angaur Island, Palaus; February 4, 1948 (H. S. Dybas). Recorded previously only from Koror Island, Palaus.

Pison punctifrons Shuckard

1 ♀ ; Colonia, Ponape; February 26, 1948 (H. S. Dybas). 1 ♂ ; same locality, but January 7-31, 1949 (M. M. Ross).

Pison nigellum Krombein (figs. 26, 34, 36)

13 ♀ ♀ ; Mt. Tamatamansakir, Ponape, 500-1000 ft. alt.; February 29, 1948 (H. S. Dybas; about holes in clay bank along trail in secondary forest—gallery system about six inches deep with burrows leading further in).

So far as I know this is the first record of a species of this genus nesting in this type of situation, other species having been recorded as constructing clay cells above ground in sheltered situations. In reply to my inquiry as to whether the wasps were actually nesting in the soil or whether they might have been preying on ground-burrowing spiders, Dr. Dybas wrote, "I have a clear recollection as to the circumstances under which these wasps were captured. I noted the wasps flying in small numbers about a series of openings in a cut along the side of the trail. The openings were in a group about a foot in diameter and led into a loose honey-combed pocket which extended about six inches into the side of the trail. I scraped some of this loose earth away and noted several burrows extending further into the earth. Unfortunately, I did not investigate further and found no provisioned cells. However, I do not think these were spider burrows, being totally unlike any spider burrows that I know." Since this species, like other *Pison,* lacks a tarsal comb, it is possible that it does no excavating, but utilizes abandoned burrows of other insects.

Pison argentatum Shuckard

1 ♀ ; Yaptown (labeled Colonia), Yap; March 1-8, 1949 (K. L. Maehler).

Pison hospes Smith

4 ♂ ♂ ; Bikini Atoll; July-August 1947 (A. C. Cole).

Pison iridipenne Smith (figs. 28, 35, 37)

1 ♂ ; Civil Administration, Saipan; January 10, 1949 (K. L. Maehler). 1 ♀ ; Tanapag, Saipan; January 14, 1949 (K. L. Maehler).

Pison korrorense Yasumatsu (figs. 29, 31, 33)

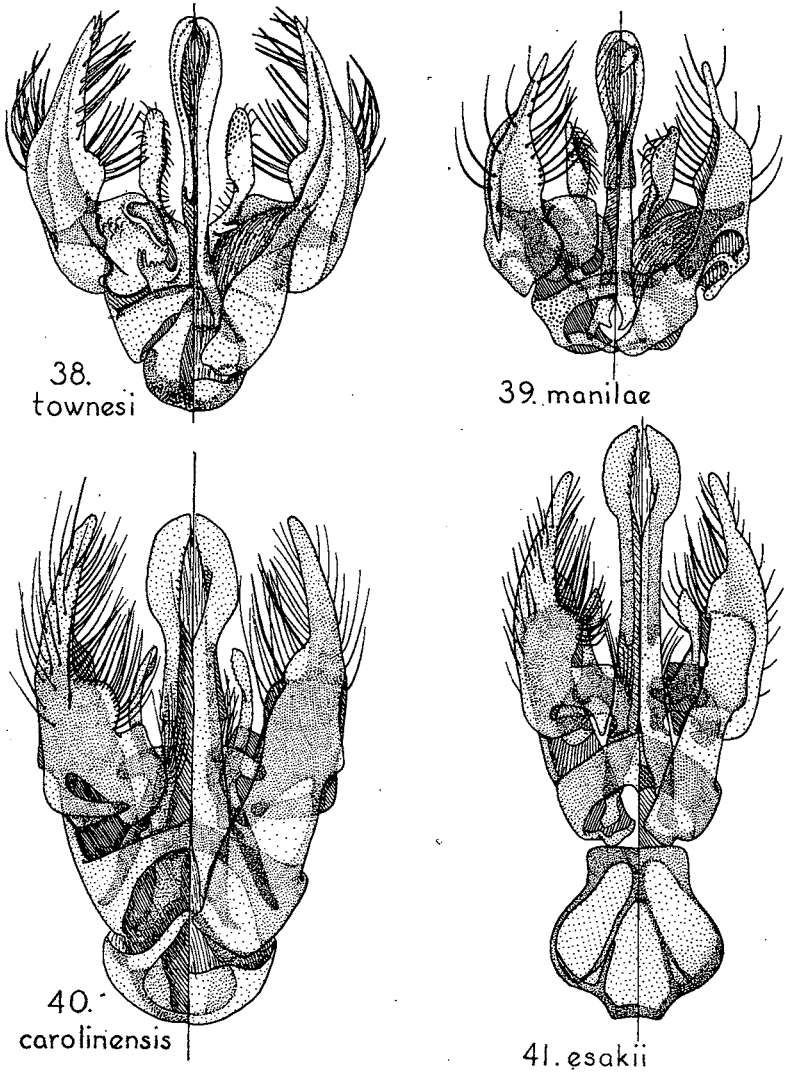
Pison oakleyi Krombein (figs. 27, 30, 32)

Motes manilae (Ashmead) (fig. 39)

Motes townesi Krombein (fig. 38)

1 ♀ ; Peleliu Island, Palaus; July 30, 1945 (H. S. Dybas) [CNHM]. 3 ♂ ♂ ; same locality, but January 26, 1948. 1 ♂ ; Koror Island, Palaus; November 21, 1947 (H. S. Dybas). 1 ♀ ; same data, but December 2, 1947. 4 ♂ ♂ ; Angaur Island, Palaus; February 3, 1948 (H. S. Dybas).

The females are very similar to the type, and the males vary in length from 6.1 to 8.2 mm.



MOTES AND LIRIS MALE GENITALIA. Fig. 38, M. townesi; fig. 39, M. manilae; fig. 40, L. carolinensis; fig. 41, L. esakii (cardo displaced).

Dicranorhina luzonensis Rohwer

Dicranorhina luzonensis Rohwer, 1919. Bul. 14, Ent. Ser., Hawaii. Sugar Planters' Assoc., pp. 6-7 [♀, ♂; Los Baños, Luzon; type in U. S. National Museum].

Dicranorhina sp. Krombein, 1949. Proc. Hawaii. Ent. Soc. 13:370, 382, 394.

In Part I I mentioned the probability that the specimens seen in the Palaus by Dr. Williams were *luzonensis*. Two males taken on Koror Island, Palaus, March 1, 1949 (K. L. Maehler) suggest this supposition was probably correct. Other specimens examined: 4 ♂ ♂; Peleliu Island, Palaus; January 30, 1948 (H. S. Dybas). 1 ♂; Angaur Island, Palaus; February 4, 1948 (H. S. Dybas).

Liris esakii Yasumatsu (Fig. 41)

Liris esakii Yasumatsu, 1941. Mushi 14:46, pl. 1, figs. 1-3 [♀, ♂; Yap specimens only; Truk ♀ paratype is referable to *carolinensis* Yasumatsu; type in Kyushu University].—Krombein, 1949. Proc. Hawaii. Ent. Soc. 13:397 [Yap ♀ only; Truk specimens referable to *carolinensis* Yasumatsu].

Liris carolinensis Yasumatsu, new status (Fig. 40)

Liris mindanaoensis carolinensis Yasumatsu, 1941. Mushi 14:46, pl. 1, fig. 5 [♂; Truk; type in Kyushu University].—Krombein, 1949. Proc. Hawaii. Ent. Soc. 13:399.

Liris esakii Yasumatsu, 1941. Mushi 14:47 [♀ paratype from Truk only].—Krombein, 1949. Proc. Hawaii. Ent. Soc. 13:383 (in key), 397-8 [Truk specimens only].

The confusion as to the identification of *esakii* and *carolinensis* has been caused by lack of material, and the fact that females of the two forms are quite similar. When making the original description of *esakii* Yasumatsu had a series of both sexes from Yap, but only one female from Truk, and assumed that the latter was conspecific with the Yap specimens. When I prepared Part I of this series, I had a short series of both sexes from Truk which I assumed were *esakii,* though I did note certain differences in the apical margin of the clypeus of the males as compared with Yasumatsu's figure, but ascribed these differences to variability in the one species. A single female paratype of *esakii* from Yap was received from Dr. Yasumatsu in late December of 1948 after Part I had gone to the printer, but at that time did not seem different enough from my Truk females to arouse any suspicions that two species were involved. It was not until K. L. Maehler sent in a series of one female and two males collected at Yaptown (labeled Colonia), Yap, March 1-8, 1949, that I realized that the Yap form was specifically distinct from the one occurring on Truk.

The male type of *carolinensis* apparently is an abnormal specimen as the measurements given by Yasumatsu indicate a much smaller specimen than the two before me which average 8.5 mm. in length.

Dr. Yasumatsu has confirmed the synonymy of the two species of *Liris* as given above by comparison of specimens sent him and the following

key with the type series of the two species in the collection of Kyushu University.

Couplets 16 and 17 of my key (Proc. Hawaii. Ent. Soc. 13:383, Part I) to the Micronesian Sphecidae may be amended as follows to provide for the additional species.

16. Dorsum of propodeum with a strong median carina almost to apex, median groove not well marked, the carinae elsewhere on disk stronger and curving outwardly; mesoscutal punctation sparser posteriorly, most of punctures there separated by more than the width of a puncture; wings strongly infumated with brown and with violaceous reflections; Carolines (Truk)..... **Liris carolinensis** Yasumatsu

Dorsum of propodeum with median carina lacking, or present at most on basal half, the median groove well developed, carinae elsewhere on disk weaker, oblique or transverse, frequently present only toward sides; mesoscutal punctation denser, the punctures separated by not more than the width of a puncture posteriorly, and frequently much less; wings less strongly infumated or hyaline except for tips..... **17**

17. Pygidial pile of female golden; posterior surface of propodeum shining, smooth; Carolines (Ponape)..... **Liris samoensis** Williams

Pygidial pile of female dark brown; posterior surface of propodeum dull, scabrous..... **17a**

17a. Wings uniformly infumated, though not so dark as in *carolinensis*, and with violaceous reflections; head and thorax shaggier in appearance than in *williamsi* owing to the somewhat longer erect hair; Carolines (Yap).... **Liris esakii** Yasumatsu

Wings hyaline with iridescent reflections, slightly infumated at apex; male unknown; Carolines (Palaus)..... **Liris williamsi** Krombein