

# CONTRIBUTION TO THE KNOWLEDGE OF THE INDO-AUSTRALIAN PSENINAE (HYMENOPTERA, SPHECIDAE)

by

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Part II. *Psenulus* Kohl, 1896

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## INTRODUCTION

As compared with the study of the genus *Psen* that of the Indo-Australian species of the genus *Psenulus* is more difficult because of the considerable sexual dimorphism existing in some groups. The material on the whole being scarce it is therefore sometimes impossible to associate the sexes with satisfactory certainty. In those species which are more or less marked with yellow the conformity of the colour pattern may be a useful indication, but there are also species, in the group of *Ps. scutatus* for instance, in which the males are much darker than the females.

For this study I could examine about 400 specimens, originating from Malaya, from nineteen Indonesian and Philippine islands and from New Guinea. Taking into account this vast area of distribution and the fact that the material includes a series of 107 specimens belonging to one subspecies, *Ps. carinifrons xanthognathus* (Rohwer), this number is very small. A few islands, such as Java and Luzon, have been rather thoroughly explored by collectors of Hymenoptera and therefore we may suppose that the material which is available from these islands can be considered as being representative for their fauna. The Psenine fauna of New Guinea seems to be poor; the

few specimens I have seen are all closely allied. In this paper they have been treated cursorily only, as Dr. K. V. Krombein, Washington, will deal with the New Guinea and Solomon Islands fauna in his intended comprehensive work on the Sphecoidea of that area.

When we draw up the balance of the species of *Psenulus* which have been described at the present moment, including the new species in this paper, we arrive at the following numbers:

	earlier described species	earlier described subspecies	new species	new subspecies
Malay Peninsula	3	—	7	—
Indonesian Islands (8)	8	3	8	5
Philippine Islands (11)	9	6	6	10
New Guinea	1	—	—	—
	<hr/> 21	<hr/> 9	<hr/> 21	<hr/> 15

making a total of 66 species and subspecies. Under the heading of Indonesian Islands three forms (*Ps. antennatus*, *Ps. nigrolineatus* and *Ps. carinifrons rohweri*) are included which also occur in Malaya and in addition one subspecies (*Ps. erraticus basilanensis*) of which the area of distribution extends from Singapore to Basilan.

In the first part of this paper (1959) I have already mentioned the institutes and entomologists who sent me their material or who have helped in other ways. Many thanks are also due to the Museo Civico di Storia Naturale, Genoa (MCG), to the Bureau of Plant Industry, Entomology Research Section, Manila (BPIM) and to the Naturhistorisches Museum, Vienna (NMW) for the loan of material and to Prof. Dr. K. Tsuneki, Fukui, and Dr. Eric Kjellander, Stockholm, for their valued assistance in procuring for me some descriptions which were not easily accessible.

I wish to emphasize once more that this study would not have been possible without the help of Dr. J. van der Vecht, Leiden, who also took the trouble to examine for me a number of types in the collections of the British Museum (Natural History), London.

The figures in this paper have been made with the aid of a Leitz drawing apparatus (mirror). They are mostly magnified about 22 times; only the figures 14, 27, 32, 38, 42, 45 and 61 (pygidial areas) are about 40 times the natural size. In the semi-diagrammatic figures the punctures and the

hairs, but for a few exceptions, have been omitted. In those cases where the thorax, or the scutum only, shows a black and yellow pattern, the black parts have been dotted.

## SYSTEMATICS

### **Morphology** (general)

In his paper of 1957 Leclercq discusses the structure of the mesospectus. He is of opinion that what Richards (1956a) calls the anterior oblique suture is the epicnemial suture and his prepectal carina then substitutes the epicnemial carina of de Beaumont (1937) and Richards. I have maintained the nomenclature of Richards, who regards the area between the epicnemial carina and the anterior oblique suture as the anterior plate of the mesepisternum (fig. 1).

In this second part I have used the term gastral segments (abdominal segments number two etc.) instead of abdominal segments as in the first part. The advantage is that the numbering of these segments now agrees with the old conception of the abdomen.

During the examination of the Pseninae I was struck by the remarkable shape of the second gastral sternite which was found in the genus *Psen* s.l. as well as in *Psenulus*. Until recently most authors have drawn attention only to the slight semi-elliptic or triangular depression which in some Palaearctic *Psenulus* covers a large part of the second gastral sternite. Yarrow (1954) briefly mentions a transverse carina of the second sternite of *Ps. schencki* (Tournier) and *Ps. atratus* (Fabr.), to which the surface of this sternite either abruptly descends or gently slopes down.

Yoshimoto (1959) was the first entomologist who recognized the value of the structure of the base of the second gastral sternite and he has even used it for identification of the species and for the association of the sexes, in the Hawaiian genera *Nesomimesa* and *Deinomimesa*. He was in error, however, when he regarded the membranous part between the first and second gastral sternite and the anterior ridge of the second sternite as parts of the ventral apex of the petiole. It may therefore be useful to discuss these structures here in detail.

All Pseninae which I have examined have a deep, transverse depression on the base of the second gastral sternite (cf. fig. 5, *Psen politiventris*; fig. 3, *Psenulus concolor*). In most specimens, for instance in the type of *Psenulus erraticus* (Smith) (fig. 2), a large tooth or better tongue is distinctly protruding from under the plate of the petiole. Dissection of a female of the Palaearctic *Psen* (*Mimumesa*) *atratinus* (Morawitz) revealed that this tongue forms part of the anterior ridge of the second sternite, which bends

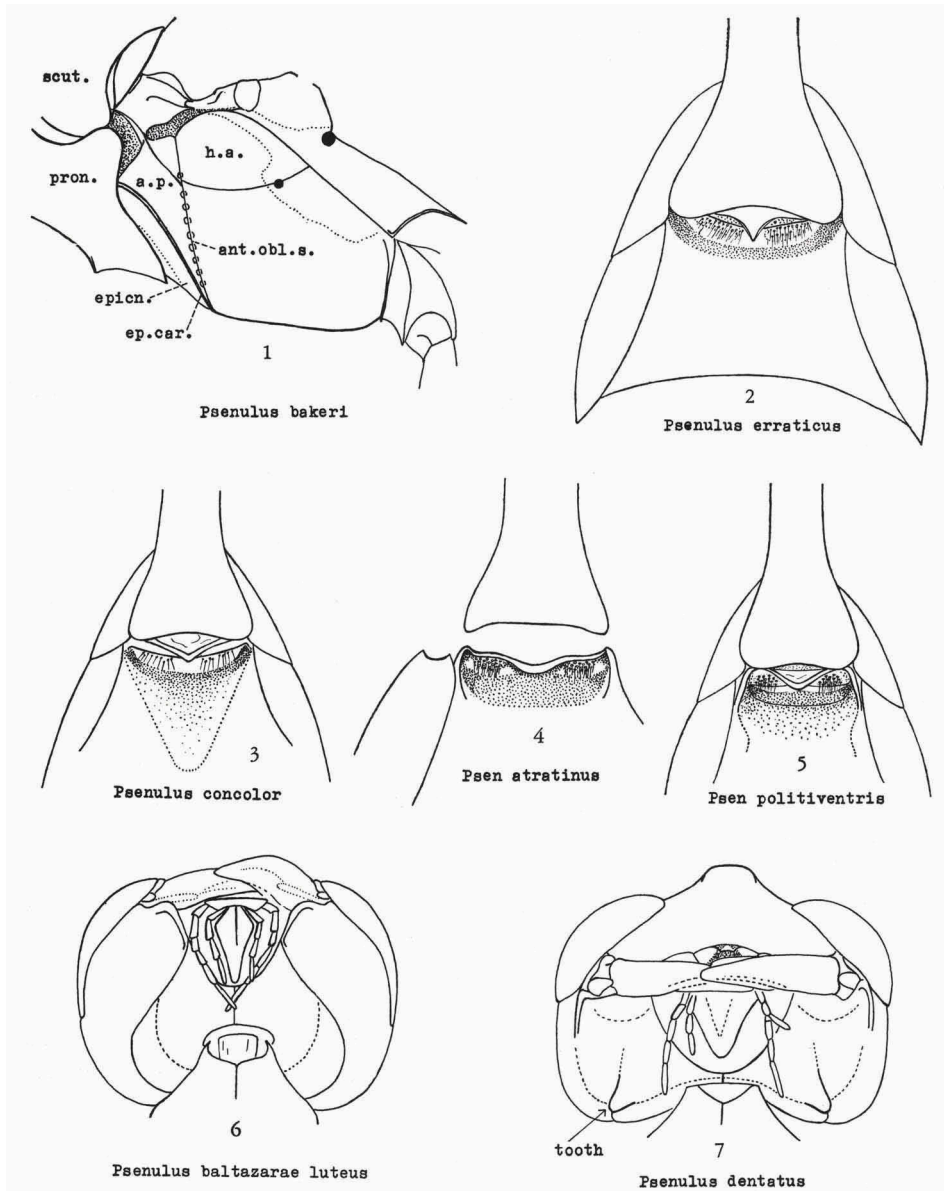


Fig. 1. Thorax of *Psenulus bakeri* (Rohwer); scut. = scutum, pron. = pronotum, epicn. = epicnemial area, ep. car. = epicnemial carina, a.p. = anterior plate of mes-episternum, h.a. = hypo-epimeral area, ant. obl. s. = anterior oblique suture.

Figs. 2-5. First and second gastral sternites of some Oriental and Palearctic species of *Psenulus* and *Psen*.

Figs. 6-7. Head of *Psenulus baltazarae luteus* n. subsp. and *Psenulus dentatus* n. sp. (in ventral view).



backwards over the depression (fig. 4). The lateral hooks and the margin of the sternal plate of the petiole just fit in the excavation of the second sternite, when the gaster is bent forwards under the thorax. Probably the tongue which is formed by the anterior ridge has the function to keep the second sternite and, consequently, the whole gaster in its place. The two lateral patches of short hairs in this depression may be sensory areas. The flexibility of the gaster has already been recorded in my notes on the bionomics of Palaearctic *Psenulus* (1951). I have described there how during the copulation of *Ps. concolor* (Dahlb.) and *Ps. schencki* (Tourn.) the male bends its gaster, except the petiole, forwards under its thorax until it touches the mesosternum. I have also observed the females bending their gaster under the thorax and then along the sides of the thorax until they could even touch the scutum with their sting. I do not know if there are any other Sphecidae which dispose of a similar flexibility of the gaster.

#### Genus **Psenulus** Kohl

A frontal carina runs from the median ocellus downwards; between the bases of the antennae it is more or less prominent; in many species this protruding part is broadened dorsally, and it has then mostly an oval excavation (fig. 11). Below the antennae this carina ends in a raised area which in all the males and in the females of many groups of species is defined below by a sharp transverse carina (frontal view). This carina does not reach the eyes, but the outer ends are bent upwards. Sometimes the transverse carina is so much protruding that it forms a horizontal plate.

The clypeal margin shows much more diversity in the females than in the males; in the former sex it may be unidentate, bidentate or tridentate, or even quadridentate, whilst in the males the margin usually is more or less distinctly bidentate.

With the exception of one species, *Ps. dentatus* (fig. 7), the occipital carina ends in the hypostomal carina (fig. 6).

The tips of the mandibles are mostly bidentate; there is also a tooth on the inner side of the mandibles, but in the males we find a tendency to reduction, especially of the inner tooth. In some species the females have mandibles with tridentate apex.

The prescutal sutures of the mesoscutum are usually about as long as the anterior half or the anterior third of the scutum, sometimes also vaguely defined on the posterior half of the scutum. In the group of *Ps. scutatus* Rohwer they are extremely long and distinct and extend to the hind margin of the scutum. Rohwer called these grooves the parapsidal sutures (1921)

or notauli (1923) but the true parapsidal sutures are situated much closer to the tegulae and are mostly of about the same length as the tegulae (fig. 8). The scutellar suture is nearly always foveolate, i.e., rather broad and with a number of short longitudinal carinae; rarely it is simple.

The anterior oblique suture (fig. 1) is mostly foveolate, in some species more or less simple. The epicnemial areas (fig. 1) are well defined, having a round patch of short appressed hairs on the lower part in the females of many species. The enclosed area of the propodeum is usually triangular, but in a few species it is very much reduced and linear. The sculpture of the declivity (posterior surface) of the propodeum often differs in the two sexes; in that case it is more coarsely reticulate in the males.

In the females of some groups of Indo-Australian species the base of the hind tibiae is provided with a special structure, consisting of a depressed and smooth area and a number of short strong spines at the base of this depression (fig. 83). There may also be one or more very long spines (figs. 15 and 71). In other groups we find at most a number of very short spines, placed closely together, but no depressed or smooth area. This structure corresponds with the patella which we find in some bees; it probably plays a rôle during the construction of the nesting tunnels or in the movements of the wasp in the nest, although the other species which also nest in branches apparently can do without it. The apex of the mid and hind tibiae sometimes has a number of spines, which may be characteristic for the species or groups of species.

In some species the recurrent veins of the fore wings end in the first and third submarginal cells, in other forms the first recurrent vein is interstitial or received by the second submarginal cell. This character should be used with care for the identification of species, as I have noticed some variation in the venation in one and the same species. In the hind wings the anal cell always ends before the origin of the cubital vein.

In many Indo-Australian *Psenulus* the gaster is more slender than in the Palaearctic species. The petiole is also longer and in most species it is not distinctly separated from the postpetiole (first gastral tergite) in dorsal view. As a rule the petiole is cylindrical and only exceptionally it is more or less quadrate as in the European species; in one species from Sumatra the dorsal side of the petiole has a flat median carina.

Most of the females have a small but distinct, elongate-triangular or narrow pygidial area with smooth or inconspicuously sculptured surface; in some groups the pygidial area is indistinct, rarely completely absent. The males have a long hypopygial spine, as in the genus *Psen* s.l.

### Division into groups of species

Except *Ps. (Eopsenulus) iwatai* Gussakovskij the Palaearctic species are all entirely or almost entirely black; they have a broadened, dorsally excavate interantennal carina and a short petiole, which is distinctly separated from the postpetiole. The Indo-Australian *Psenulus*, on the contrary, vary much in shape as well as in colour. Some groups of species are easily recognized and I am convinced that a few subgenera can be created. However, in view of the scarcity of material it would be premature to proceed now to a subgeneric division and I have restricted myself here to combining the known species in some, mostly well-defined, groups.

The principal characters used for distinguishing the various groups have been arranged in an analytical table (p. 10), which also demonstrates the relationships between the groups. It is evident that the combinations of characters are not in all cases important enough to consider these groups as good subgenera. Certainly a character such as the presence or absence of a transverse carina below the antennae (this carina is always present in the males) does not have any subgeneric value. Nevertheless certain groups are very characteristic as it appears from some of the special characters mentioned in the last column of the table.

### Provisional key to the groups (mainly based on the females)

1. Carina between antennae dorsally broadened and excavate (fig. 11). If this is distinct only in the female sex, prescutal sutures as long as scutum (fig. 8) . . . . . 2.
- This carina not broadened and excavate; if somewhat broadened it is not distinctly excavate . . . . . 5.
2. Prescutal sutures well-defined until hind margin of scutum. Base of hind tibiae with long spine in the females (fig. 15). Scutum yellow or partly yellow. First recurrent vein of fore wings received by first submarginal cell or interstitial. In the females the anterior margin of the clypeus is more or less tridentate, they have a short transverse carina below the antennae or this carina is absent. Pygidial area distinct. In the males the antennae are short, moniliform. Eight species and subspecies. (Java, Borneo and Philippine Islands) . . . . . Group of *Ps. scutatus*
- Prescutal sutures nearly reaching hind margin (*Ps. rugosus*), in the other species at most distinct on anterior half, absent or indistinct on posterior part. Base of hind tibiae without long spine in the females. Clypeal margin not tridentate . . . . . 3.
3. Prescutal sutures long, but not extending as far as hind margin of scutum (fig. 34). First recurrent vein of fore wings received by second submarginal cell. Clypeal margin bluntly protruding, not emarginate. A short transverse carina below antennae. No distinct pygidial area. Small, completely black species, with coarse sculpture. Only one female known. (Mindanao) . . . . . Group of *Ps. rugosus*
- Prescutal sutures vague on posterior half of scutum. Clypeal margin bi- or quadridentate. First recurrent vein of fore wings interstitial or ending in second submarginal cell. Thorax black except pronotal tubercles, gaster red. Antennae of male moniliform . . . . . 4.

Table of principal taxonomic characters of Indo-Australian *Psenulus* (for explanation of abbreviations see opposite page)

group	spe	car ♀	sut ♀ ♂	cly ♀	rec ♀ ♂	pyg ♀	spi ♀	tra ♀	col ♀ ♂	ant ♂	special characters
<i>scutatus</i>	4 (8)	+	+	3	1/i	+	+	±	ye/bl	mon	prescutal sutures complete
<i>rugosus</i>	1 ♀	+	±	1	2	—	—	+	bl	?	sculpture rugose
<i>quadridentatus</i>	5	+	±	2/4	i/2	+	—	±	bl	mon	enclosed area short
<i>antennatus</i>	2	+	±	2	i/2	—	—	—	bl	mon	similar, but no pygidial area
<i>singularis</i>	1 ♀	±	—	1	i	—	—	—	ye	?	interantennal carina broad, but not excavate
<i>erraticus</i>	1 (3)	—	—	2	± i	±	—	+	bl	nor	postpetiole swollen
<i>crabroniformis</i>	2 (4)	—	—	2	1	—	—	+	bl	nor	thorax and petiole long
<i>tuberculifrons</i>	4 (6)	—	—	2	1	+	+	+	bl	nor	long spines base hind tibiae
<i>nigrolineatus</i>	3 (7)	—	—	2	1	+	±	+	ye	nor	projection metanotum
<i>luteopictus</i>	1 (2) ♀	—	—	2	1	—	—	—	ye	?	no pygidial area
<i>sandakanensis</i>	7	—	—	2	1	+	—	±	ye	nor	heterogenous group
<i>interstitialis</i>	9 (15)	—	—	2	i	+	—	—	ye/bl	nor	first recurrent ± interstitial
<i>pulcherrimus</i>	3 (5)	—	—	± 1	i	+	—	—	bl	nor	margin clypeus projecting, blunt or unidentate

4. Pygidial area (females) distinct. Enclosed area of propodeum short or linear (both sexes) and sometimes interrupted. In some species a short transverse carina below antennae (females). Five species. (Malaya, Sumatra, Java and Borneo) . . . . . Group of *Ps. quadridentatus*
- Pygidial area (females) indistinct. Enclosed area of propodeum short. No distinct transverse carina below antennae in the females. Two species. (Malaya, Java, Bali). . . . . Group of *Ps. antennatus*
5. Interantennal carina dorsally broad, but not distinctly excavate. No transverse carina below antennae. Clypeal margin bluntly protruding. First recurrent vein of fore wings interstitial. Pygidial area narrow, lateral carinae indistinct. Thorax completely yellow, gaster pale red. Only one female known. (Luzon) . . . . . Group of *Ps. singularis*
- Interantennal carina at most slightly broadened, often sharp . . . . . 6.
6. Postpetiole (first gastral tergite) much swollen, sharply separated from petiole (first gastral sternite). Both sexes with transverse carina below antennae, females with indistinct pygidial area. Except a small bare area laterally behind the enclosed area the posterior surface of the propodeum is coarsely reticulate and densely pubescent. Propodeal declivity below with a wide and sometimes deep, shining longitudinal excavation (fig. 60). First recurrent vein of fore wings interstitial or nearly interstitial. Antennae of male long, with tyloidea. Thorax and petiole black, gaster red. One species with two subspecies. (Singapore, Borneo, Celebes, southern Philippine Islands) . . . . . Group of *Ps. erraticus*
- Postpetiole not or little swollen. Pubescence of propodeum normal, leaving structure distinctly visible, apex without a wide groove. . . . . 7.
7. Thorax very long; behind the enclosed area a shining, horizontal part. Petiole long. The first recurrent vein of the fore wings ends in the first submarginal cell. Philippine species with tubercles on frons. A transverse carina below antennae. No distinct pygidial area. Thorax black, gaster red. Four species and subspecies. (Sumatra, Java, Borneo, Philippine Islands). . . . . Group of *Ps. crabroniformis*

spe — number of species (between parentheses the total number of species and subspecies) of each group.

car — interantennal carina broadened and excavate (+) or broadened and not excavate (±) or simple (—) (♀).

sut — prescutal sutures complete (+) or not (—) (♀ ♂).

cly — clypeal margin uni-, bi-, tri- or quadridentate (♀).

rec — first recurrent vein of fore wings interstitial or ending in first or second submarginal cell (♀ ♂).

pyg — pygidial area distinct (+) or not (—) (♀).

spi — base of hind tibiae with long spines (+) or not (—) (♀).

tra — transverse carina below antennae (+) or not (—) (♀).

col — thorax mainly coloured black (bl) or yellow (ye) (♀ ♂).

ant — antennae of male moniliform (mon) or of the usual shape (nor).

- Thorax of normal proportions. The first recurrent vein of the fore wings ends either in the first submarginal cell or very near the radial sector, or it is interstitial. Scutum mostly with yellow markings . . . . . 8.
- 8. First recurrent vein of fore wings ending in first submarginal cell. In some groups both sexes with transverse carina below antennae . . . . . 9.
- First recurrent vein of fore wings interstitial or ending close to radial sector in second submarginal cell. Females without transverse carina below antennae . . . 12.
- 9. Ground colour of scutum black, often with yellow markings. Femora thick. Females with a transverse carina below antennae and with elongate-triangular pygidial area; posterior surface of propodeum almost smooth. Females with three long spines at base of hind tibiae (fig. 71). In the single male which is known the posterior surface of the propodeum is coarsely reticulate. Philippine species with tubercles on frons. Six species and subspecies. (Malaya, Java and Philippine Islands). . . . .
- . . . . . Group of *Ps. tuberculifrons*
- Scutum largely yellow with three black marks or with three longitudinal lines . . 10.
- 10. Females without pygidial area; sixth gastral tergite somewhat keeled. No transverse carina below antennae. Base of hind tibiae without special structure. One species and one subspecies. (Philippine Islands) . . . . . Group of *Ps. luteopictus*
- Females (as far as known; of many species only males have been studied) with pygidial area . . . . . 11.
- 11. Large species. Females with distinct and protruding transverse carina below antennae and elongate-triangular pygidial area. Metanotum laterally with a conspicuous long, narrow and partly membranous projection which is directed obliquely backwards towards the median line and which is longer than the lateral depression of the metanotum (fig. 82). Females with many short spines at base of hind tibiae (*Ps. nigrolineatus*) or with three long spines (*Ps. diversus*). Seven species and subspecies. (Malaya, Sumatra, Borneo and Philippine Islands) . . . Group of *Ps. nigrolineatus*
- Smaller species. Females without distinct transverse carina below antennae, this carina very fine (*Ps. corporali*) or indistinct (*Ps. sandakanensis*). A fairly heterogeneous group, at the moment mainly consisting of species of which the female is unknown. Seven species. (Malaya, Sumatra, Borneo, southern Philippine Islands). . . . . Group of *Ps. sandakanensis*
- 12. Clypeal margin never very prominent, bidentate in both sexes, but teeth not always distinct (fig. 111). Posterior surface of propodeum of males not very coarsely reticulate. Females with narrow pygidial area. Scutum completely yellow or with one or three black spots, in some species with three black lines. In the two Javanese species (only males available) the yellow colour on the scutum much reduced, in *Ps. ornatus* reduced to not more than two narrow lines which are widened on the posterior part of the scutum. Fifteen species and subspecies. (Malaya, Java, Borneo, Philippine Islands, New Guinea) . . . . . Group of *Ps. interstitialis*
- Clypeal margin of females very prominent medianly (fig. 131). If clypeus less prominent anterior margin almost straight (fig. 133) and scutum completely black. Females with narrow pygidial area. Thorax largely black. Five species and subspecies. (Tenasserim, Malaya, Sumatra, Krakatau, Java, Borneo, Philippine Islands, Buru) . . . . . Group of *Ps. pulcherrimus*

### Key to the species of *Psenulus* Kohl

I would have preferred to make one key, both for females and males. Owing to the sexual dimorphism, which sometimes is considerable and to the fact that of many species only one of the sexes was available, this proved to be impossible, however, and separate keys had to be drawn up.

The males are more uniform than the females and difficult to arrange into groups. As the males of many species are unknown the key for this sex is very incomplete.

### Key to the females of the genus *Psenulus* Kohl

1. Protruding part of carina between antennae much broadened and moreover excavate dorsally (fig. 10) . . . . . 2.
- Carina between antennae at most slightly broadened, without distinct oval excavation . . . . . 16.
2. Anterior margin of clypeus protruding, rounded (fig. 33). Short transverse carina below antennae. Head and thorax with coarse sculpture. Prescutal sutures nearly as long as scutum. No distinct pygidial area. Thorax and gaster black. Small species. Male unknown. (Mindanao) . . . . . *rugosus* n. sp. (p. 35).
- Clypeal margin emarginate. Scutum with fine sculpture . . . . . 3.
3. Prescutal sutures extending to hind margin of scutum, completely well-defined. Base of hind tibiae dorsolaterally with longitudinal depression, margined on inner side by a sharp carina, base of depression with a very long spine (fig. 15); apical half of tibiae often with a number of spines on outer side. Thorax partly yellow . . . . . 4.
- Prescutal sutures sharp only on anterior half or third of scutum, sometimes vaguely defined posteriorly. No extremely long spine on base of hind tibiae. Head and thorax black, gaster for the greater part red . . . . . 10.
4. Occipital carina not ending in hypostomal carina, but in a large tooth on the cheeks below (fig. 7). Anterior margin of clypeus bluntly tridentate (fig. 28). Short transverse carina below antennae. Pygidial area broad, almost rectangular, lateral carinae only distinct at apex. Thorax black with pale yellow markings, gaster ferruginous, petiole dark-brown. Male unknown. (W. Java) . . . . . *dentatus* n. sp. (p. 33).
- Cheeks without tooth; the occipital carina ends normally in the hypostomal carina . . . . . 5.
5. No distinct transverse carina below antennae. Protruding part of clypeal margin broad, bisinuate, median tooth blunt and not sunken below the level of the margin (fig. 25). Pygidial area distinct, apex almost rectangular . . . . . 6.
- Transverse carina below antennae, in dorsal view, protruding as a plate (fig. 11). Clypeal margin emarginate, with median tooth which is sunken and protruding from under the anterior edge of the clypeus (fig. 10). Pygidial area narrow, distinct . . . . . 7.
6. Scutum with large black mark (fig. 24). Petiole red. Male unknown. (Luzon) . . . . . *baltazarae baltazarae* n. sp. (p. 31).
- Scutum yellow, except black sutures. Petiole completely black, postpetiole partly black. Male unknown. (Sibuyan) . . . . . *baltazarae luteus* n. subsp. (p. 32).
7. Anterior part of scutum yellow . . . . . 8.
- Anterior part of scutum black . . . . . 9.
8. Thorax largely yellow, mesopleura and mesosternum entirely yellow except mesosternal median groove, which is black and covered with long golden hairs. Scutum with large black mark, gaster pale ferruginous, petiole black or dark-brown. (Luzon, Samar, Negros) . . . . . *scutatus scutatus* (Rohwer) (p. 23).
- Lower part of thorax largely black, mesopleura with a yellow line below, gaster rufous, petiole black. Male unknown. (Mindanao) . . . . . *scutatus mindanaoensis* (Rohwer) (p. 27).
9. Anterior margin of clypeus with slight emargination, tridentate, median tooth on somewhat lower level. Mesepisternum entirely black, gaster piccous. Male unknown. (Borneo) . . . . . *scutatus borneensis* (Rohwer) (p. 28).
- Anterior margin of clypeus with semi-circular emargination, tridentate, median tooth

- on much lower level (fig. 19). Mesepisternum black, except anterior plate, gaster ferruginous, petiole black, postpetiole partly darkened. Smaller than *Ps. scutatus scutatus*. (Palawan) . . . . . *hemicyclius* n. sp. (p. 28).
10. Pygidial area distinct . . . . . 11.  
— Pygidial area indistinct . . . . . 15.
11. Clypeal margin with bidentate median projection, deeply emarginate on either side of it and with small tooth on outer side of these emarginations, thus quadridentate (fig. 35). Petiole red . . . . . 12.  
— Clypeal margin with two distinct teeth. Petiole red or black . . . . . 13.
12. Enclosed area of propodeum linear, complete, the depressed lateral parts extending to the median longitudinal groove (fig. 37). Pygidial area triangular. (Malaya) . . . . . *quadridentatus* n. sp. (p. 37).  
— Enclosed area still narrower, incomplete, lateral parts not extending to median longitudinal groove (fig. 41). Pygidial area narrower. Transverse carina below antennae shorter (in frontal view). Male unknown. (W. Java) . . . . . *separatus* n. sp. (p. 38).
13. Enclosed area of propodeum much reduced; distance between lateral parts and median longitudinal groove still greater than in *Ps. separatus* (fig. 44). No distinct transverse carina below antennae. Anterior margin of clypeus with two large teeth (fig. 43). Pygidial area triangular, apical part narrowed. Male unknown. (Borneo). . . . . *pendleburyi* n. sp. (p. 38).  
— Enclosed area complete. A short transverse carina below antennae . . . . . 14.
14. Interantennal carina ending normally in the short transverse carina below antennae. Anterior margin of clypeus with two long teeth (fig. 46). Lateral carinae of pygidial area almost parallel. Petiole red. Male unknown. (Sumatra) . . . . . *macrodentatus* n. sp. (p. 41).  
— Broadened and excavate part of interantennal carina crossing the short, transverse carina below antennae (fig. 50). Anterior margin of clypeus with two teeth of normal size. Pygidial area triangular. Petiole with flat dorsal carina, short and black. Male unknown. (Sumatra) . . . . . *compactus* n. sp. (p. 42).
15. Petiole red. Propodeal declivity coarsely reticulate (description Rohwer). Anterior margin of clypeus bidentate medianly. Male unknown. (Malaya). . . . . *penangensis* (Rohwer) (p. 46).  
— Petiole black, short. Propodeal declivity smooth and shining, enclosed area short. Vertex sparsely punctate. Anterior margin of clypeus bidentate (fig. 53). Mandibles quadridentate. (Singapore, Java, Bali) . . . . . *antennatus* (Rohwer) (p. 44).
16. Clypeal margin with blunt projection (fig. 57). Interantennal carina broadened but not excavate, no transverse carina. Interocellar area raised. Antennae short, clavate. Pygidial area with indistinct lateral carinae. Thorax, fore and mid legs and hind coxae yellow. Hind legs beyond coxae and gaster including petiole pale red. Male unknown. (Luzon) . . . . . *singularis* n. sp. (p. 47).  
— Clypeal margin normal; if unidentate, thorax largely black. Interantennal carina rarely somewhat broadened . . . . . 17.
17. Thorax except tubercles and tegulae black. Transverse carina below antennae always present. No well-defined pygidial area . . . . . 18.  
— At least one or more parts of thorax other than tubercles and tegulae yellow. Transverse carina below antennae sometimes lacking . . . . . 22.
18. Behind the short enclosed area of the propodeum only a small lateral bare and shining area; rest of propodeum normally declivous and uncommonly densely pubescent, below with wide and sometimes deep shining groove (fig. 60). Petiole short, sharply separated from postpetiole . . . . . 19.  
— Thorax elongate, propodeum partly horizontal and shining behind enclosed area. Petiole longer, in dorsal view not distinctly separated from postpetiole . . . . . 20.
19. Lower part of clypeal disk strongly convex, margin depressed, weakly emarginate



- (figs. 58 and 59). Interantennal carina more protruding than in *Ps. erraticus basilanensis*. Scutum finely punctate. Pygidial area indistinct, without sharp lateral carinae, apex blunt. Large species, length about 10 mm. Gaster except petiole and legs red. Male unknown. (Celebes) . . . . . *erraticus erraticus* (Smith) (p. 48).
- Very similar. Lower part of clypeal disk more projecting, underside of this projection in lateral view forming a right angle with the depressed margin (fig. 63). Excavation of lower part of propodeum less deep. Smaller, length about 8 mm. Red of gaster and legs darker. (Singapore, Borneo, Basilan) . . . . . *erraticus basilanensis* (Rohwer) (p. 49).
- (In a male from Mindanao the scutum is transversely striate. The female most likely has the same structure: . . . . . *erraticus butuanensis* n. subsp. (p. 50)).
20. Frons normal. Scutum shining, with widespread minute punctures. Base of petiole yellowish, rest dark-brown. All femora and hind tibiae for the greater part brown. Pubescence of head and thorax whitish. Male unknown. (Java, Sumatra) . . . . . *crabroniformis sumatranus* (Ritsema) (p. 53).
- (The female of the nominate subspecies is not known. In the male the petiole is pale red, fore and mid legs are yellowish and hind legs red. Pubescence of head and thorax very pale golden. (Borneo) . *crabroniformis crabroniformis* (Smith) (p. 51)).
- Frons raised (a large tubercle) between ocelli and oculi . . . . . 21.
21. Frons with oblique raised part between ocelli and oculi. Scutum anteriorly with tendency to transverse striation. Petiole pale red. Male unknown. (Luzon) . . . . . *philippinensis philippinensis* (Rohwer) (p. 54).
- Raised parts of frons somewhat less distinct. Scutum densely but mostly finely punctate. Apical two thirds of petiole dark-brown. Male unknown. (Mindanao) . . . . . *philippinensis dapitanensis* (Rohwer) (p. 56).
22. Distinct transverse carina below antennae. Clypeal margin distinctly bidentate. Base of hind tibiae dorsolaterally with longitudinal depression and a curved row of conspicuous thick spines or a few very long spines. Recurrent veins of fore wings received by first and third submarginal cells. Pygidial area distinct . . . . . 23.
- No distinct transverse carina below antennae or, if any, not protruding (vide *Ps. corporaali*) or very indistinct (*Ps. luteopictus*). Base of hind tibiae rarely with curved row of conspicuous spines (vide *Ps. bakeri*) and transverse carina then lacking. First recurrent vein of forewings interstitial or ending in second submarginal cell, rarely ending well before end of first submarginal cell (*Ps. luteopictus*) or close to end of first submarginal cell . . . . . 33.
23. Frons with prominent, shining tubercle near each eye. Interocellar area raised. Pygidial area elongate-triangular . . . . . 24.
- No prominent tubercles on frons . . . . . 26.
24. Frons between large, smooth and shining tubercle and median line slightly concave. Clypeal margin bidentate. Upper part of propodeal declivity sparsely punctate, lower part transversely rugose. Pygidial area elongate-triangular (fig. 79). Upper part of pronotum, pronotal tubercles, two triangular marks on posterior part of scutum, a small spot against tegulae and metanotum yellow. Posterior surface of propodeum black. Pubescence of face silvery. Male unknown. (Samar) . . . . . *cavifrons* n. sp. (p. 60).
- Frons between tubercle and median line also somewhat raised, more coarsely punctate. Upper side of projecting part of interantennal carina slightly broadened, flat and shining. Oblique striation of posterior surface of propodeum extending somewhat higher. Lateral carinae of pygidial area more parallel (figs. 75 and 77) . . . . . 25.
25. Gaster black. Yellow: upper part of pronotum, pronotal tubercles, two irregular pentagonal marks on posterior part of scutum, hind margin of scutellum laterally and metanotum completely. Propodeum black. Pubescence of face pale golden. Male unknown. (Luzon) . . . . . *tuberculifrons tuberculifrons* (Rohwer) (p. 57).

- First two gastral tergites partly red. Yellow parts of thorax: upper part of pronotum, pronotal tubercles, spot against tegulae, a large transverse, triangularly emarginate yellow mark on scutum in front of scutellum, a triangular median spot on scutellum, a small spot on the axillae and two spots on hind margin of scutellum, metanotum and greater part of propodeal declivity. Pubescence of face golden. Male unknown. (Sibuyan) . . . . . *tuberculifrons decoratus* n. subsp. (p. 59).
- 26. Scutum largely black. Petiole brown or black. Anterior margin of clypeus distinctly bidentate. Femora thick, mid tibiae with short groove at apex. Base of hind tibiae with three long spines (fig. 71). Pygidial area more elongate-triangular (fig. 72) . . . . . 27.
- Scutum largely yellow, with three black marks or broad lines. Base of petiole nearly always yellow and apex darkened, petiole rarely completely rufous. Anterior margin of clypeus with two distinct teeth. Femora less thick. Lateral carinae of pygidial area almost parallel (fig. 84). Metanotum laterally with long projection (fig. 82) . . . . . 28.
- 27. Scutum black, with yellow mark along tegulae and two almost triangular spots in front of scutellum. Scutellum with large yellow spot. Propodeum with four elongate yellow marks. Scape of antennae yellow, except apex above. Base of pygidial area with irregular row of punctures along margin. Male unknown. (Malaya) . . . . .  
. . . . . *maculatus maculatus* n. sp. (p. 61).
- Scutum with smaller yellow spot along tegulae, rest of scutum black or with two small spots in front of scutellum. Scutellum with small circular yellow spot. Propodeum with four small elongate spots. Upper side of scape of antennae more darkened. Only a few punctures on base of pygidial area. (Java) . . . . .  
. . . . . *maculatus javanensis* n. subsp. (p. 62).
- 28. Petiole completely rufous. Lateral black lines of scutum complete, median line as long as anterior two thirds of scutum. Punctuation of scutum distinct. Apex of mid tibiae with two red spines (always?). Base of hind tibiae with three very long and thin spines (cf. *maculatus* fig. 71). Male unknown. (Singapore) . . . . .  
. . . . . *diversus* n. sp. (p. 70).
- Petiole yellow, with darkened apex. Mid tibiae with long shallow groove at apex, anteriorly defined by a long slightly raised area of darker colour and a tooth at the apex and posteriorly by four long red spines. Base of hind tibiae with a curved row of stout spines (fig. 83) . . . . . 29.
- 29. Scutum with large median and small lateral spots. Femur of all legs and tibiae of hind legs black on dorsal side. Pedicel of antennae yellow. Male unknown. (Luzon). (Extract of original description by Rohwer. Type not examined) . . . . .  
. . . . . *nigrolineatus ajax* (Rohwer) (p. 65).
- Black markings of scutum more extensive . . . . . 30.
- 30. Scutum with at most two complete black lines, the median line not reaching hind margin of scutum . . . . . 31.
- Scutum with three complete black lines, extending from anterior to hind margin, median line narrowed near scutellum . . . . . 32.
- 31. Black lateral lines of scutum at least as long as posterior three fourths of scutum, but not complete; median line as long as anterior half of scutum (in a female from Kudat the three black lines are longer (fig. 80). Male unknown. (Malaya, Borneo). . . . .  
. . . . . *nigrolineatus nigrolineatus* (Cameron) (p. 63).
- Black lateral lines complete, median line as long as anterior two thirds of scutum. Ground colour of scutum sulphureous-yellow. Besides apex of petiole also disk of first gastral tergite blackish. Punctuation of scutum extremely fine. Male unknown. (W. Sumatra) . . . . .  
. . . . . *nigrolineatus sulphureus* n. subsp. (p. 67).
- 32. First three segments and base of following two segments of antennae completely yellow (in some cases also fourth segment completely yellow). Base of petiole yellowish, apex darkened. Male unknown. (Sibuyan) . . . . .  
. . . . . *nigrolineatus flavicornis* n. subsp. (p. 65).

- Pedicel and following segment (segments four etc. lacking in the type) of antennae darkened above. Base of petiole yellowish, apex darkened. Black band on base of propodeum broader than in preceding subspecies. Scutellum with brown hind margin. Male unknown. (Mindanao) . . . . . *nigrolineatus dubius* n. subsp. (p. 67).
- 33. No distinct pygidial area, sixth gastral tergite somewhat keeled. Clypeal margin slightly produced, two distinct blunt teeth. No transverse carina below antennae. First recurrent vein of fore wings received by first submarginal cell well before apex (fig. 92) . . . . . 34.
- Pygidial area distinct. Central part of clypeal margin either straight, with smaller tooth laterally, or more distinctly produced medianly. First recurrent vein of fore wings interstitial or nearly interstitial . . . . . 35.
- 34. Scutum with irregular, large punctures. Apex only of petiole darkened. Scutum yellow with three, black, irregularly triangular marks, narrowing towards hind margin (in some cases the lateral marks do not reach the hind margin of the scutum). Antennae strongly clavate. Pubescence of face and frons golden. Male unknown. (Luzon, Negros) . . . . . *luteopictus luteopictus* (Rohwer) (p. 71).
- Very similar, but scutum less coarsely punctate. Petiole nearly completely black. Male unknown. (Mindoro) . . . . . *luteopictus calapanensis* n. subsp. (p. 73).
- 35. Transverse carina below antennae fine but distinct, not protruding. First recurrent vein of fore wings received by first submarginal cell, near apex. Anterior margin of clypeus reddish, median part almost straight, with a small tooth laterally (fig. 96). Frons without tubercles. Scutum yellow with three black lines; lateral lines complete, median line as long as anterior two thirds of scutum. Sides of mesothorax for the greater part yellow. Mesosternum black, marking roundly extending on to mesopleura. Male unknown. (Sumatra) . . . . . *corporeali* n. sp. (p. 76).
- No distinct transverse carina below antennae. Frons in some cases with tubercles . . . . . 36.
- 36. First recurrent vein of fore wings ending in first submarginal cell. Thorax largely yellow, but anterior plate of mesepisternum completely or nearly completely black or brown . . . . . 37.
- First recurrent vein of fore wings interstitial or ending in second submarginal cell. If anterior plate of mesepisternum black also scutum largely black . . . . . 38.
- 37. Scutum with large median and two small, indistinct, dark-brown lateral spots. Mesosternum dark-brown, marking roundly extending on to mesopleura. Greater part of metapleura dark-brown. Axillae and lateral depressions of scutellum and metanotum black-brown. Gaster including petiole pale red. Clypeal margin with two distinct teeth. Posterior surface of propodeum smooth. Pygidial area narrow (fig. 98). (Borneo, Sumatra) . . . . . *sandakanensis* (Rohwer) (p. 73).
- Scutum yellow with trilobate black mark (fig. 106) and black hind margin. Epicnemial areas, mesosternum and greater part of mesopleura and metapleura black. Axillae and lateral depressions of scutellum and metanotum black. Gaster including petiole pale red; apex of petiole sometimes somewhat infuscate. Clypeus smooth, median part of anterior margin emarginate (fig. 107). Posterior surface of propodeum very smooth. Pygidial area narrow (fig. 108). Male unknown. (Malaya) . . . . . *pagdeni* n. sp. (fig. 81).
- 38. Clypeal margin projecting medianly as a large tooth, rounded at apex (fig. 131). Third antennal segment depressed. Mid tibiae apically with longitudinal depression, defined posteriorly by a row of four to five reddish spines and anteriorly by an oblique elongate raised area which is slightly darker than the rest of the tibiae. First recurrent vein of fore wings interstitial or nearly interstitial. Thorax largely black . . . . . 51.
- Median part of clypeal margin almost straight, with two well-separated teeth (fig. 111), if more projecting (fig. 133) scutum black, otherwise scutum largely yellow . . . . . 39.
- 39. Thorax largely yellow. Gaster reddish . . . . . 40.

- Thorax and gaster largely black, pronotum, scutellum and metanotum more or less yellow. . . . . 49.
- 40. No prominent tubercles on frons. Scutum finely punctate . . . . . 41.
- A large tubercle on frons between ocelli and oculi. Scutum coarsely punctate. Large species . . . . . 47.
- 41. Scutum entirely yellow. Mesosternum yellow, but interepicnemial area with black central spot. Metapleura yellow. Scutellar suture black or brown. Enclosed area of propodeum partly black or brown. Horizontal part of propodeum behind enclosed area smooth, posterior surface distinctly obliquely rugose. Pygidial area distinct, narrow. Pubescence of face and frons very pale golden. (New Guinea) . . . . .  
*interstitialis interstitialis* (Cameron) (p. 84).
- Scutum with one or three black marks. Mesosternum black or at least with broad black median line. Metapleura brown or black . . . . . 42.
- 42. Petiole pale red with yellowish base . . . . . 43.
- Petiole darkened at apex . . . . . 45.
- 43. Mesosternum with broad black median line. Scutum with large central spot and two smaller lateral spots; the latter two sometimes absent. Hind margin of scutum black. Mesopleura with black spot in front of hind margin. Anterior part of clypeus and raised part of face below interantennal carina reddish. Propodeum smooth behind enclosed area, lower part obliquely rugose. Pubescence of face pale golden. (Luzon, Negros, Biliran) . . . . .  
*interstitialis luzonensis* (Rohwer) (p. 86).  
(in the females from Negros the median spot on the scutum is sometimes connected with the dark hind margin of the scutum).
- Mesosternum black, marking roundly dilated on to the mesopleura . . . . . 44.
- 44. Median mark of scutum connected with fore margin of scutum, lateral marks almost as long as scutum. Male unknown. (Bali) . . . . .  
*interstitialis baliensis* n. subsp. (p. 88).
- Scutum with black spot near centre and a small irregular spot on the sides at the base. Male unknown. (Borneo) . . . . .  
*nigromaculatus* (Cameron) (p. 89).
- 45. Resembling *Ps. interstitialis luzonensis*, but black parts on the whole more extended. Scutum with three black marks, the median, larger spot connected with the hind margin of the scutum by a narrow line. (Mindanao, Mindoro) . . . . .  
*interstitialis davanus* (Rohwer) (p. 87).
- Scutum with three black lines, the median line not extending to hind margin . . . . . 46.
- 46. Frons subcontiguously punctate. Mid tibiae with a row of six stout setae. Mesosternum entirely black (according to information from K. V. Krombein). Male unknown. (Luzon) . . . . .  
*multipictus* (Rohwer) (p. 90).
- Frons smooth with usual minute punctures. Mid tibiae with a row of four red spines. First recurrent vein of fore wings interstitial. Mesosternum entirely black, marking roundly extending on to mesopleura. Median black line of scutum about as long as anterior three quarters of scutum. Male unknown. (Malaya) *continentis* n. sp. (p. 97).
- 47. Mesopleura yellow, at most a small black spot below. Scutum with large median spot (often connected with hind margin) and with two small lateral spots. Upper side of antennae dark-brown. Clypeus almost straight, margin with two relatively small teeth (fig. 125). Posterior surface of propodeum completely and finely reticulate. Base of hind tibiae with curved row of short spines. Pygidial area narrow. (Luzon, Mindanao, Samar) . . . . .  
*bakeri bakeri* (Rohwer) (p. 98).
- Mesopleura mainly black, with two yellow spots . . . . . 48.
- 48. Antennae dark-brown above. Median spot of scutum not connected with anterior margin of scutum (fig. 128). Male unknown. (Bohol) . . . . .  
*bakeri boholensis* n. subsp. (p. 99).
- Antennae completely orange. Median spot on scutum connected with anterior margin. Male unknown. (Negros) . . . . .  
*bakeri canlaonensis* n. subsp. (p. 100).
- 49. Mandibles quadridentate (apex tridentate and also upper margin with tooth). An-

- terior margin of clypeus hardly projecting (fig. 136). Pronotum laterally and scutellum more or less black, sometimes only hind margin of scutellum yellow. Metanotum yellow. Fore and mid legs including trochanters yellow, tarsi of mid legs brownish. Gaster black. Pygidial area narrow, lateral carinae not sharp. (Malaya) . . . . . *sogatophagus* Pagden (p. 109).
- Mandibles tridentate (apex bidentate and one inner tooth). Pronotum and scutellum more yellow. Anterior margin of clypeus more projecting (fig. 133). Pygidial area as in preceding species . . . . . 50.
50. Scutellum and metanotum yellow. Trochanter and base of femur of fore and mid legs partly brown. Gaster black, but at least part of second gastral tergite red or reddish. (Luzon, Sibuyan, Samar, Negros, Mindanao, Palawan) . . . . . *carinifrons xanthognathus* (Rohwer) (p. 104).
- Very similar, but gaster completely black or dark-brown. Trochanter and femur of fore and mid legs sometimes completely yellow. (Malaya, Sumatra, Java, Kangean Islands, Borneo, Buru) . . . . . *carinifrons rohweri* n. subsp. (p. 108).
51. Scutum laterally with elongate yellow mark above the tegulae and with median yellow spot in front of scutellum. Marks on propodeum large, in dorsal view reaching lateral margin. Petiole yellowish, somewhat darkened beneath and at apex. Male unknown. (Tenasserim) . . . . . *pulcherrimus pulcherrimus* (Bingham) (p. 101).
- Scutum only with median yellow mark in front of scutellum. Spots on propodeum elongate and small, sometimes absent. Petiole black or dark brown. (Java) . . . . . *pulcherrimus projectus* n. subsp. (p. 102).
- (A female from Krakatau is somewhat paler, the petiole is light brown. The first recurrent vein is not quite interstitial but ends just in the first submarginal cell).

#### Provisional key to the males of the genus *Psenulus* Kohl

1. Prescutal sutures completely well-defined, extending from anterior margin of scutum to hind margin. Interantennal carina not so much broadened and excavate as in the females. Antennae probably always moniliform. (Group of *Ps. scutatus*) . . . . . 2.  
(The males of *Ps. dentatus*, *Ps. sandakanensis*, *Ps. scutatus mindanaensis* and *Ps. scutatus borneensis*, which belong to this group, are not yet known).
- Prescutal sutures not well-defined to hind margin of scutum . . . . . 5.  
(The unknown male of *Ps. rugosus* will probably be completely black, with coarse sculpture of head and thorax and with long prescutal sutures, which nearly extend to the hind margin of the scutum).
2. Anterior margin of scutum yellow . . . . . 3.
- Anterior margin of scutum black . . . . . 4.
3. Mesepisternum black, except anterior plate. Anterior margin of clypeus with minute emargination, indistinctly bidentate (fig. 17). (Luzon, Samar) . . . . . *scutatus scutatus* (Rohwer) (p. 23).
- Mesepisternum with small yellow triangular spot behind anterior oblique suture. (Negros) . . . . . *scutatus* subsp.? (p. 27).
4. Anterior margin of clypeus with minute emargination, as in *Ps. scutatus scutatus*. Propodeal declivity almost completely yellow, gaster pale red. Female unknown. (Sibuyan) . . . . . *scutatus sibuyanensis* n. subsp. (p. 27).
- Anterior margin of clypeus with small and indistinct triangular depression (fig. 22). Darker, propodeal declivity with two median yellow spots. (Palawan) . . . . . *hemicyclius* n. sp. (p. 28).
5. Thorax black except yellow tubercles; gaster red but petiole sometimes black . . . . . 6.
- Thorax marked more or less yellow, if yellow marking not distinct, the gaster is black. (In the male of *Ps. singularis*, of which species only a single female is known, the thorax is probably completely yellow) . . . . . 11.

6. Thorax of normal proportions, about one and a half times as long as its broadest part. Hind femora when stretched backwards extending to postpetiole or still longer. . . . . 7.
- Thorax about twice as long as its broadest part. Petiole longer than hind femora . . . . . 10.
7. Upper part of propodeal declivity shining and bare. Petiole somewhat quadrate. Antennae moniliform. Interantennal carina excavate dorsally. (Groups of *Ps. quadridentatus* and *Ps. antennatus*) . . . . . 8.
- Propodeal declivity densely pubescent, concealing structure; pubescence leaving a small lateral shining area behind enclosed area of propodeum. Antennal segments less convex below, partly with tyloidea. Interantennal carina not excavate . . . . . 9.
8. Petiole red. (Malaya) . . . . . *quadridentatus* n. sp. (p. 37).
- Petiole black. (Malaya, Java, Bali) . . . . . *antennatus* (Rohwer) (p. 44).  
(The males of *Ps. separatus*, *Ps. macrodentatus*, *Ps. compactus* and *Ps. penangensis* are not yet known).
9. Lower part of clypeal disk more projecting, underside of this projection rectangular with the depressed margin (fig. 63). Antennal segments 4-9 with tyloidea. Scutum with indistinct transverse rugae. (Singapore, Borneo, Basilan) . . . . .  
. . . . . *erraticus basilanensis* (Rohwer) (p. 49).  
(The male of the nominate subspecies will probably be very similar).
- Disk of clypeus only slightly convex. Antennal segments 4-10 with tyloidea. Scutum distinctly transversely rugose. Female unknown. (Mindanao) . . . . .  
. . . . . *erraticus butuanensis* n. subsp. (p. 50).
10. No raised ridge between ocelli and oculi. Petiole entirely reddish. Female unknown. (Borneo) . . . . . *crabroniformis crabroniformis* (Smith) (p. 51).  
(In the male of *Ps. crabroniformis sumatranus* the petiole is probably darkened at the apex).
- A raised ridge between ocelli and oculi. No males known. (Luzon, Mindanao) . . . . .  
. . . . . *philippinensis* (Rohwer) (p. 54).  
(In the nominate subspecies from Luzon the whole petiole is probably pale red; in the subspecies *dapitanensis* (Rohwer) from Mindanao the petiole will be darkened at the apex).
11. First recurrent vein of fore wings received by first submarginal cell. (Of the group of *Ps. luteopictus* no males are known, but it is likely that they can be distinguished by triangular black markings on the scutum, as in the females) . . . . . 12.
- First recurrent vein of fore wings received by second submarginal cell or interstitial. (This character is not always reliable and the possibilities under couplet 12 should also be tried) . . . . . 21.
12. Scutum completely black, or largely black with yellow markings. Posterior surface of propodeum coarsely reticulate . . . . . 13.
- Scutum yellow, with three (rarely one) black marks or with three longitudinal lines. . . . . 14.
13. Frons with large tubercles. Scutum and hind legs black. Female unknown. (Luzon). . . . .  
. . . . . *maurus* (Rohwer) (p. 60).  
(Of the closely allied *Ps. tuberculifrons tuberculifrons*, *Ps. tuberculifrons decoratus* and *Ps. cavifrons* no males are known).
- Frons without tubercles. Scutum black or with two yellow marks near hind margin. (Java) . . . . . *maculatus javanensis* n. subsp. (p. 62).  
(The male of the nominate subspecies from Malaya is most likely somewhat more brightly coloured).
14. Larger species (about 10 mm). The first recurrent vein of the fore wings ends distinctly in the first submarginal cell . . . . . 15.
- Smaller species. The first recurrent vein ends in the first submarginal cell, but is often almost interstitial . . . . . 17.

15. Metanotum with long transverse projections (fig. 82). Antennae with tyloidea. Lateral black lines at least as long as the posterior five sixths of scutum. Median black line as long as anterior two thirds of scutum. Petiole darkened at apex. Lower part of posterior surface of propodeum fairly coarsely reticulate. (Malaya, Borneo). . . . . *nigrolineatus nigrolineatus* (Cam.) (p. 63).  
— No long transverse projections on metanotum. Antennae without tyloidea. Otherwise resembling group of *Ps. nigrolineatus* . . . . . 16.
16. Scutum with three complete black lines; median line, which is broad on anterior two thirds of scutum, abruptly narrowed towards hind margin and then again broadened into a low triangle. Petiole darkened at apex. Propodeal declivity with large smooth area laterally behind enclosed area, lower part irregularly reticulate, not very coarsely. Antennae long. Female unknown. (Malaya). Caught in month of September. . . . . *varius* n. sp. (p. 69).  
— Very similar, but petiole completely red, not darkened at apex. Female unknown. (Malaya). Caught in month of March. (In view of the very small difference in colour and of the fact that this male and the preceding one have been taken at almost the same locality, I hesitate to consider the former as a different subspecies) . . . . . *varius* n. sp. (p. 69).
17. Prescutal sutures lacking. Antennae long, segments cylindrical. Scutum with lateral black lines; median mark as long as anterior two thirds of scutum. Female unknown. (Basilan) . . . . . *filicornis* (Rohwer) (p. 77).  
— Prescutal sutures present. Antennae shorter, segments somewhat rounded . . . . . 18.
18. Scutum with three broad black lines. Petiole completely light red. Mesepisternum with three yellow spots. Propodeum coarsely reticulate. (These characters according to original description of Rohwer). Female unknown. (Mindanao) . . . . . *ajaxellus* (Rohwer) (p. 79).  
— Scutum with three (rarely one) black spots or incomplete lines, at least the median line not extending to hind margin, or scutum with only one central spot . . . . . 19.
19. Scutum with three elongate marks, lateral marks nearly as long as scutum, median mark as long as anterior two thirds of scutum (fig. 102). Anterior plate of mesepisternum yellow. Underside of femora partly brown. Apex of petiole darkened. Female unknown. (Borneo) . . . . . *esuchus* (Rohwer) (p. 79).  
— Scutum with one or three black spots. Anterior plate of mesepisternum black or brown. . . . . 20.
20. Scutum with three black spots, median spot tending to connect with anterior margin, lateral spots with vague projection towards hind margin. Anterior plate of mesepisternum black. Axillae yellow. Legs not darkened. Gaster including petiole light red. Female unknown. (Malaya) . . . . . *trimaculatus* n. sp. (p. 80).  
— Scutum with one distinct black spot and black hind margin; there may also be two vague lateral spots. Anterior plate of mesepisternum brown, except a small yellow spot. Axillae black. Apex of petiole brown. Female unknown. (Sumatra and Borneo). . . . . *sandakanensis* (Rohwer) (p. 73).
21. Scutum yellow with black markings or black with two narrow longitudinal lines which are broadened near hind margin . . . . . 22.  
— Scutum completely black or black with median yellow spot . . . . . 31.
22. No tubercles on frons . . . . . 23.  
— Frons with tubercles . . . . . 30.
23. Scutum completely yellow or with three black spots. Median spot sometimes connected with hind margin . . . . . 24.  
— Scutum with three black lines, which are as long as scutum, or scutum black with two yellow lines . . . . . 27.
24. Scutum without black spots. Enclosed area of propodeum not completely black

- (extension of black colour variable), median sulcus not dark. (New Guinea) . . . . .  
 . . . . . *interstitialis interstitialis* (Cameron) (p. 84).
- Scutum with three black spots . . . . . 25.
25. Median spot of scutum rarely connected with hind margin. A large black spot on mesopleura adjacent to metapleura. Petiole completely reddish. (Luzon, Biliran, Negros) . . . . . *interstitialis luzonensis* (Rohwer) (p. 86).
- Markings on scutum more elongate, median spot often connected with hind margin of scutum. Black colour on mesopleura below hypo-epimeral area extending from anterior oblique suture to hind margin . . . . . 26.
26. Lateral marks on scutum not linear. Median spot sometimes free from hind margin. Apex of petiole somewhat darkened. (Mindanao, Mindoro) . . . . .  
 . . . . . *interstitialis davanus* (Rohwer) (p. 87).
- Lateral marks on scutum somewhat linear and nearly extending to anterior margin of scutum, median spot distinctly connected with black hind margin of scutum (fig. 118). Petiole almost completely light red. Female unknown. (Palawan) . . . . .  
 . . . . . *interstitialis pseudolineatus* n. subsp. (p. 88).
27. Scutum black, with two narrow yellow lines which are broadened near hind margin (fig. 122). Propodeum with four yellow marks. Scutellum black with two large yellow marks. Pronotum, posterior part of scutellum and the whole metanotum (Java) . . . . . *ornatus* (Ritsema) (p. 92).
- Scutum with two long yellow lines and also a yellow mark along lateral margin (fig. 119) . . . . . 28.
28. Scutellum yellow, axillae black. Scutum with two median yellow lines and a yellow line along lateral margin of scutum. Propodeal declivity with four yellow marks. Mesepisternum black except upper part of anterior plate. Apex of petiole and hind femora darkened. Female unknown. (Palawan) . . . . . *tristis* n. sp. (p. 91).
- Scutellum largely black, axillae yellow . . . . . 29.
29. No prescutal sutures visible. Metanotum with long and pointed lateral projections. Scutum with two median yellow lines and a yellow spot against the tegulae. Scutellum black except narrow hind margin. Axillae yellow. Propodeal declivity with four yellow marks. Mesepisternum black, except small spot on upper part of anterior plate. Petiole black. Female unknown. (Java) . . . . . *pseudajax* n. sp. (p. 93).
- Prescutal sutures normal. Metanotum without lateral projections. More yellow. Scutum with two median lines and a line along lateral margin. Scutellum black except interrupted line along hind margin, axillae yellow. Propodeal declivity with four yellow spots. Mesepisternum black, except small spot on upper part of anterior plate and a vague spot on lower side of mesopleura. Female unknown. (Java). . . . .  
 . . . . . *elegans* n. sp. (p. 96).
30. Scutum coarsely punctate, with large median black spot (connected with hind margin) and two smaller lateral spots. (Luzon, Mindanao, Samar) . . . . .  
 . . . . . *bakeri bakeri* (Rohwer) (p. 98).
- (The unknown male of *Ps. bakeri canlaonensis* n. subsp. will probably have the median spot on the scutum connected with fore as well as with hind margin. The mesopleura will be darker. (Negros)).
31. Scutum with large yellow spot near hind margin. Propodeal declivity with two large yellow marks. Pronotum, posterior part of scutellum and the whole metanotum yellow. Gaster, except petiole and postpetiole, red. First two segments of flagellum distinctly flattened. (Java, Krakatau) . . . . . *pulcherrimus projectus* n. subsp. (p. 102).
- Scutum and propodeum black. Gaster black or dark-brown. Proximal segments of flagellum not distinctly flattened . . . . . 32.
32. Pronotum black or dark-brown, scutellum and metanotum with small yellow marks or completely dark-brown. Pronotal tubercles with small yellow spot. Gaster black. (Malaya) . . . . . *sogatophagus* Pagden (p. 109).



- Pronotum, scutellum and metanotum yellow, pronotal tubercles with small yellow spot. . . . . 33.
33. Frons and scutum distinctly and densely punctate. Frons on both sides of median carina slightly raised; also interocellar area. Gaster black (in Mindanao specimens brownish (discoloured?)). (Luzon, Samar, Negros, Mindanao, Sibuyan, Palawan). . . . . *carinifrons xanthognathus* (Rohwer) (p. 104).
- Punctuation of frons and scutum much less distinct. Frons almost flat. Gaster black, in some males from Borneo brownish (discoloured?). (Malaya, Singapore, Sumatra, Java, Kangean Islands, Borneo, Buru) . . . . . *carinifrons rohweri* n. subsp. (p. 108).

#### Group of *Psenulus scutatus*

A relatively small part of the Indo-Australian *Psenulus* possesses a dorsally excavate interantennal carina. The largest group which shows this structure, although in the females only, is the group of *Ps. scutatus*. The species belonging to this group are characterized by the extraordinarily long prescutal sutures, which extend to the hind margin of the scutum. The females have a more or less tridentate clypeal margin and a long spine on the base of the hind tibiae. Three species and four subspecies have been distinguished, all restricted to the Philippine Islands (Luzon, Sibuyan, Samar, Negros, Mindanao and Palawan) and Borneo.

In Java a single female of *Ps. dentatus* has been found. This seems also to belong to the group of *Ps. scutatus*, but it differs from any other *Psenulus* I know in a very important detail, namely in the presence of the large teeth in which the occipital carina ends below instead of ending in the hypostomal carina. This is a very peculiar deviation from the usual structure of the head in the Pseninae and it reminds of the long projections on the cheeks of the females belonging to the Hawaiian genus *Nesomimesa* Perkins. Since only one female has been captured in a district which has been thoroughly searched for Hymenoptera, I suppose that it represents an isolated and rare species of the group of *Ps. scutatus*.

#### *Psenulus scutatus scutatus* (Rohwer)

1921, Rohwer, S. A., Phil. Jl. Sc., vol. 18, no. 3, pp. 310-312, ♀ and ♂, (*Diodontus scutatus*; Luzon).

1923, Rohwer, S. A., Phil. Jl. Sc., vol. 22, no. 6, p. 596.

Female. — Head black; palpi and mandibles except dark tips yellow. Scape of antennae yellow, rest of antennae brown, underside yellowish-brown. Thorax yellow; black are: lower part of pronotum, an irregular transverse mark on the scutum (fig. 8), prescutal sutures, scutellar suture, enclosed area of propodeum, a small spot on both sides of it, median sulcus, a spot

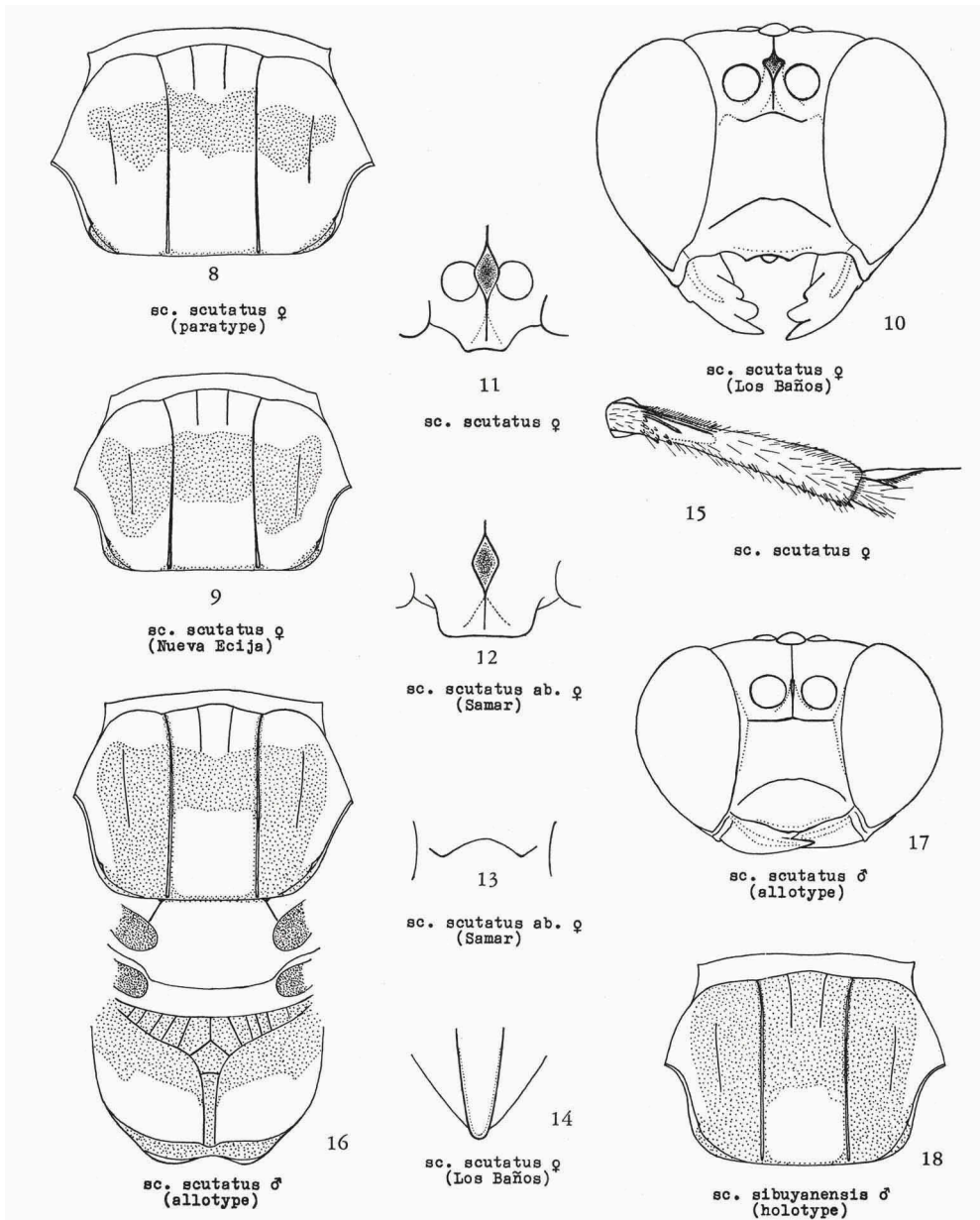
above base of petiole or hind margin of propodeum, interepicnemial area, median groove of mesoscutum, subalar pits, metapleura and a small adjacent part of the mesepisternum. Fore and mid legs and hind coxae yellow, rest of hind legs pale red. Veins of wings pale brown. Gaster pale red, petiole black or dark-brown.

Head thick. Clypeus smooth and shining, with some fine punctures; protruding central part of anterior margin with weak emargination. A small median tooth, which is on lower level than the margin, makes the clypeus appear to be tridentate in frontal view (fig. 10). Frontal line (carina) very prominent between antennae, here dorsally broadened and with longitudinal almost oval depression. Below it ends in a protruding plate which in frontal view forms a short transverse carina; this is arched and about as long as one third of the distance between the eyes (fig. 11). Frons somewhat depressed below anterior ocellus, the area between oculi and ocelli thus seeming to be somewhat raised. Frons and vertex smooth and shining, finely and scarcely punctate, a hooked groove against the outer side of the posterior ocelli. Mandibles with broad base, lamellate above, tridentate. Antennae clavate, the shortest articles about as long as they are broad.

Scutum very finely punctate with a few larger punctures and fine, sometimes indistinct, longitudinal striation. Prescutal sutures extending to scutellum. Scutellum and metanotum almost smooth, very finely punctate. Scutellar suture not foveolate. Enclosed area of propodeum normal, with longitudinal carinae. Propodeal declivity almost imperceptibly reticulate, laterally with irregular and shallow longitudinal furrow, median groove narrow. Anterior oblique suture not foveolate. Scrobal suture complete, but weakly defined.

Apex of mid tibiae with a short longitudinal row of about four red spines on the outer side. In obliquely dorsal view base and middle part of hind femora dilated so that the basal half seems to be excavate. Base of hind tibiae depressed and bare, a longitudinal lamina on the inner side of this depression, a blunt long spine at the base of it and a number of short red spines on the outer side (fig. 15). Posterior half of hind tibiae with five spines, also outer side of apex with a number of spines. Inner spur of hind legs angled, both spurs shorter than basitarsus. First recurrent vein of fore wings received by first, second recurrent vein received by third submarginal cell. Petiole cylindrical, flattened dorsally, not sharply separated from post-petiole. Gaster except petiole finely punctate. Pygidial area distinct, narrow, base dull, apical part somewhat shining, apical carina rounded (fig. 14).

Face with silvery pubescence, which is appressed below transverse carina; clypeus almost bare. Base of mandibles with a tuft of long whitish hairs. Vertex, thorax and gaster with sparse yellowish pubescence, pygidial area



Figs. 8-15. *Psenulus scutatus scutatus* (Rohwer), ♀; 8 and 9: scutum, 10: head in frontal view, 11 and 12: interantennal and transverse carina (in dorsal view) of normal and of aberrant specimen, 13: transverse carina of aberrant specimen in frontal view, 14: pygidial area, 15: left hind leg.

Figs. 16-17. *Psenulus scutatus scutatus*, ♂; thorax and head.

Fig. 18. *Psenulus scutatus sibuyanensis* n. subsp., ♂, holotype, scutum.

bare. Petiole laterally with long erect hairs, dorsally near the margin with a row of minute hairs. Hind margin of fourth and fifth gastral sternites with a fringe of short whitish hairs, base of sixth sternite with a patch of short appressed hairs, apex with a few long apically directed hairs. Groove of mesosternum with long and dense golden pilosity. Lower part of epicnemial areas with ill-defined patch of dense silvery pubescence.

Length about 7-8 mm.

Male. — Much darker than female. Black spot on scutum larger and laterally extending backwards to scutellum, leaving a square yellow spot on posterior part of scutum, between prescutal sutures (fig. 16). Mesosternum, interepicnemial area and part of epicnemial areas, mesopleura behind anterior oblique suture completely, also hypo-epimeral area, black. Upper part of propodeum and a transverse band above base of petiole black.

Anterior margin of clypeus rounded, with minute emargination, so that two very indistinct teeth are formed. Interantennal carina hardly broadened and not distinctly sulcate, below the antennae it ends in a transverse carina which almost reaches the eyes (fig. 17). Mandibles bidentate. Antennae moniliform. Scutum shining, finely and sparsely punctate, prescutal sutures foveolate. Scutellar suture slightly foveolate. Propodeum different from that of female, enclosed area somewhat longer, median sulcus broader and more or less foveolate, upper part of propodeal declivity, behind enclosed area, obliquely rugose, lower part transversely rugose, with stronger carina at apex of longitudinal sulcus. Anterior oblique suture foveolate. Hind femora normal, hind tibiae without spines on base or apical half.

Length about 7.5-10 mm.

Luzon: Rohwer (1921, 1923) mentions the following specimens: 1 ♀ (holotype, cat. no. 22838) and 1 ♂ (allotype), Los Baños, Laguna; 1 ♀ (paratype), Mount Makiling, Laguna (all USNM), of which I could examine the latter two. The allotype is labelled Mt. Makiling, not Los Baños. New records are: Mount Makiling, Laguna, 1 ♀, C. F. Baker (USNM); 2 ♀, 19 Jan. 1954, C. R. Baltazar and A. A. Marmeto (BPIM), 1 ♀, 20 March 1954, C. R. Baltazar (ML); near Kias, Mountain Province, 1 ♀, 30 Nov. 1953, C. R. Baltazar (BPIM); Cuenca, Batangas, 1 ♀, 11 Febr. 1954, Macabasco (BPIM); Sierra Madre Mts., Nueva Ecija, 1 ♀, 29 Jan. 1953, A. Concepcion (MR); Los Baños, Laguna, 1 ♀, 23 Febr. 1953, Townes family (HT).

Samar: 2 ♀ and 1 ♂, C. F. Baker (USNM).

Negros: 1 ♂, Cuernos Mts., C. F. Baker (USNM).

There is some variation in this material. In the female from Nueva Ecija, which is slightly smaller than the paratype, the black spot on the scutum is

larger than in the female from Los Baños (fig. 9). The specimens from Samar are larger, measuring about 8 mm.; in one of these two females the transverse carina is longer than half the distance between the eyes (figs. 12 and 13). Hind margin of scutum black. The male from Negros has a vague yellow spot on the lower part of the mesopleura. The first recurrent vein of this specimen is distinctly interstitial. This male may represent a separate subspecies.

Both sexes of *Ps. scutatus scutatus* are easily distinguished by the colour-pattern of the thorax and in the female moreover by the structure of the clypeal margin.

***Psenulus scutatus sibuyanensis* n. subsp.**

A male from Sibuyan, coll. C. F. Baker (USNM), has the black marking of the scutum extended to the anterior margin (fig. 18). The hind legs are darkened, especially the tarsi. There are no yellow spots under the wings. The oblique and transverse sculpture of the declivity of the propodeum is obsolete.

The colour-pattern of the scutum resembles that of the male from Palawan which I have associated with the female of *Ps. hemicycli*, but the extension of the yellow colour on the propodeum is almost the same as in the typical form and the clypeal margin shows no trace of a depression, as in *Ps. hemicycli*, but it has two minute teeth.

The only female of the group of *Ps. scutatus* which I have seen from Sibuyan is *Ps. baltazarae luteus*. This is certainly a quite different species, even when the sometimes considerable sexual dimorphism in the genus *Psenulus* is taken into account.

***Psenulus scutatus mindanaoensis* (Rohwer)**

1923, Rohwer, S. A., Phil. Jl. Sc. vol. 22, no. 6, p. 596, ♀ (*Diodontus scutatus* var. *mindanaoensis*, Mindanao).

Original description: "Female. — Length, 8.5 millimeters. Differs from the type in the following color characters: Black spot on the scutum larger, covering most of the surface; base and apex of propodeum black; mesepisternum, except prepectus and a narrow longitudinal ventral line, and mesosternum black; metapleuron black.

Type locality. — Iligan, Mindanao.

Described from a single female received from C. F. Baker.

Type. — Catalogue No. 25041, United States National Museum. This may possibly be the female of variety A."

I have not seen this type but Dr. K. V. Krombein kindly informed me (in his letter of the 13th November 1958) as follows: "This appears to be properly placed as a subspecies of *scutatus*; in addition to the color differen-

ces noted by Rohwer, the transverse frontal carina projects forward more strongly and the dorsal lamella at base of mandible is stronger than in typical *scutatus*; the pygidium and apical margin of clypeus are as in typical *scutatus*; thorns on outer side of hind tibia more numerous and stronger in *mindanaoensis*".

This subspecies is darker than the typical form; according to the key given by Rohwer (1923) the anterior part of the scutum is yellow and the gaster is rufous. I do not think it is the female of Rohwer's "variety A.", as this author suggested; the male which was labelled as such is considered here as the male of *Ps. hemicyclius* n. sp. It is not quite impossible that *Ps. scutatus mindanaoensis* is identical with the preceding male from Sibuyan, *Ps. scutatus sibuyanensis*, but more material from both islands is needed to solve this problem.

#### ***Psenulus scutatus borneensis* (Rohwer)**

1923, Rohwer, S. A., Phil. Jl. Sc., vol. 22, no. 6, p. 596, ♀ (*Diodontus scutatus* var. *borneensis*, Borneo).

Original description: "Female. — Length, 7.5 millimeters. Because of the dark gaster this superficially resembles *Diodontus xanthognathus* Rohwer, but it differs markedly from that species. The scutum, except a quadrate spot before the scutellum and the narrow lateral margins, is black. Mesepisternum (except spot below tegula) and sternum black; metapleura black; gaster piceous; otherwise colored like the typical form.

Type locality. — Sandakan, Borneo.

Described from one female received from C. F. Baker.

Type. — Catalogue No. 25040, United States National Museum."

Regarding this type I received the following note from Dr. K. V. Krombein (13th Nov. 1958): "This also seems properly placed as a subspecies of *scutatus*; the median depressed tooth of apical margin of clypeus is weaker than in typical *scutatus* and the dorsal lamella at base of mandible is stronger; hind tibial thorns about as in *scutatus*."

This subspecies resembles *Ps. hemicyclius*, but it differs in the shape of the clypeal margin. In view of the dark gaster it is not likely that it belongs to the same subspecies as the preceding male from Sibuyan. I wonder, however, whether the gaster really has been piceous or has discoloured after the wasp was killed.

#### ***Psenulus hemicyclius* n. sp.**

1921, Rohwer, S. A., Phil. Jl. Sc., vol. 18, no. 3, p. 312, ♂ (*Diodontus scutatus* var. A., Palawan).

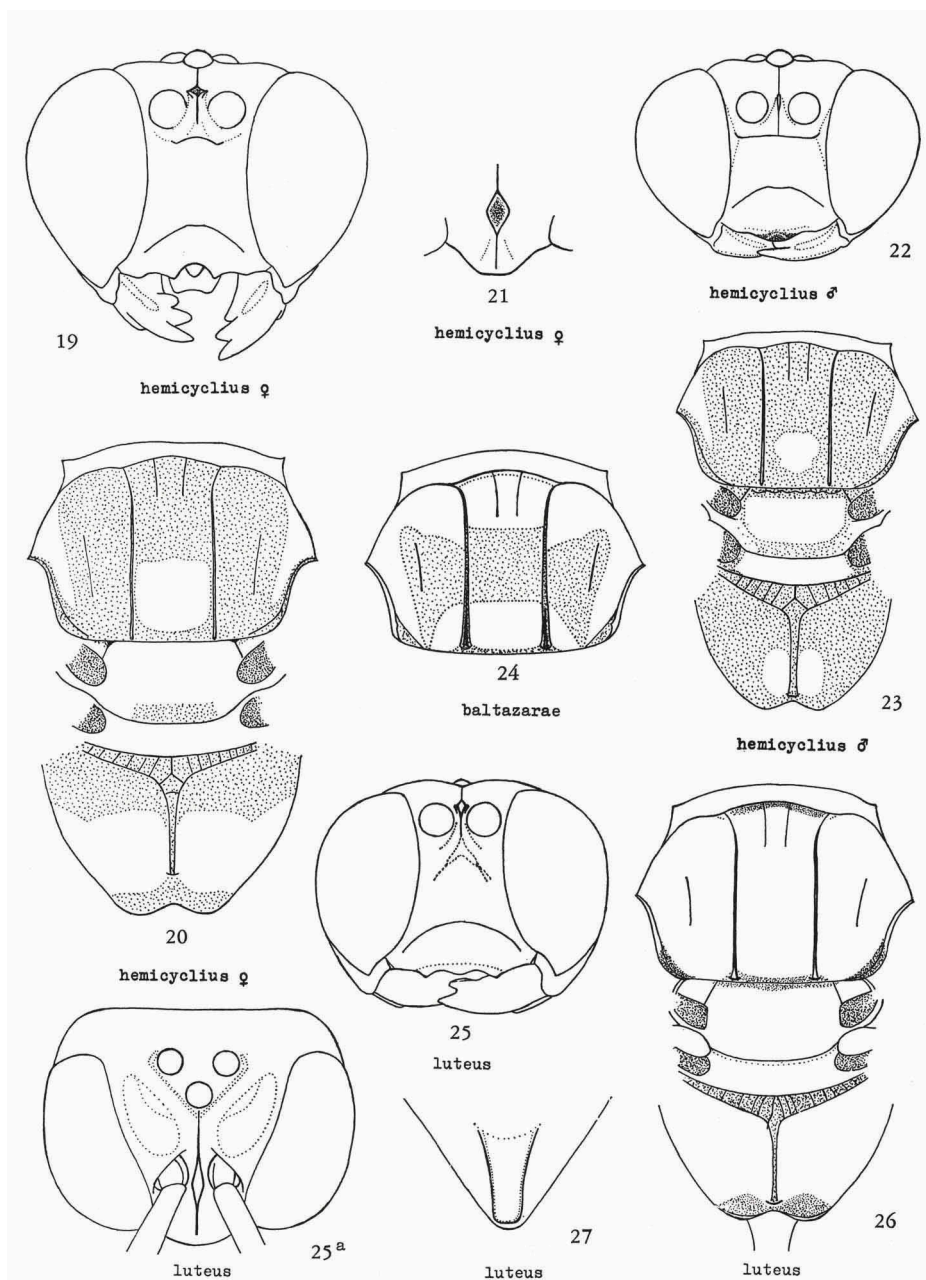
Female. — Head black; mandibles yellow except dark tips, scape of antennae yellow, rest of antennae brown, underside paler. Thorax black

except upper part of pronotum, tubercles, a triangular mark along and in front of the tegulae, a square spot on posterior part of scutum between prescutal sutures (fig. 20), scutellum, metanotum, propodeum except margins and median longitudinal groove, and anterior plate of mesepisternum, which are all yellow. Tegulae pale reddish. Fore and mid legs yellow, hind femora, tibiae and tarsi much darkened. Wing-veins brown. Petiole black, postpetiole partly darkened, rest of gaster red.

Clypeus smooth and shining, with some fine punctures, mainly on its base; protruding median part of anterior margin with deep, semi-circular emargination. A median tooth, which as in *Ps. scutatus* is lower placed than the margin, extends about as far as the teeth on the sides of the emargination, making the clypeal margin tridentate (fig. 19). Frontal carina very prominent between antennae, dorsally broadened and concave (fig. 21). It ends below antennae in a protuberance which is somewhat less prominent than in *Ps. scutatus* and which in frontal view is defined below by a short transverse carina which is arched and about as long as one third of the distance between the eyes. Frons somewhat depressed below anterior ocellus, slightly raised between ocelli and oculi. Surface of frons and vertex smooth and shining, scarcely and finely punctate, with a fine groove from outer side of posterior ocelli to the frontal carina just below anterior ocellus. Base of mandibles broad, lamellate above. Antennae clavate, shortest segments about as long as they are broad.

Pronotum laterally with distinct tooth. Scutum with tendency to very fine longitudinal striation, finely punctate. Prescutal sutures extending to hind margin, the anterior half is narrow, but distinctly foveolate. Scutellum and metanotum finely punctate. Enclosed area of propodeum normal, with longitudinal carinae. Declivity of propodeum almost imperceptibly rugose and finely punctate, laterally with longitudinal shallow and irregular depression, median groove narrow. Anterior oblique suture foveolate. Scrobal suture complete but weakly defined. Apex of mid tibiae with two or three red spines on outer side. Mid and hind femora and hind tibiae as in *Ps. scutatus*. Inner spur of hind legs angled, shorter than basitarsus. First recurrent vein of fore wings received by first, second recurrent vein received by third submarginal cell. Petiole cylindrical, not sharply separated from postpetiole. Gaster very finely punctate. Pygidial area distinct, narrow, surface dull, apical margin rounded.

Pubescence of face below antennae silvery, partly appressed, clypeus almost bare. Mandibles with a tuft of long whitish hairs on base below. Circular depression on lower part of epicnemial areas with dense silvery pubescence, centrally somewhat golden. Groove of mesosternum with long and dense



Figs. 19-21. *Psenulus hemicyclius* n. sp., ♀, holotype; head, thorax, inter-antennal and transverse carina (dorsal view).

Figs. 22-23. *Psenulus hemicyclius* n. sp., ♂, allotype; head and thorax.

Fig. 24. *Psenulus baltazarae baltazarae* n. sp. and subsp., ♀, holotype; scutum.

Figs. 25-27. *Psenulus baltazarae luteus* n. subsp., ♀, holotype; head in frontal and in dorsal view, thorax and pygidial area.



golden pubescence. Petiole with long erect hairs on the sides and two rows of short hairs above. Hind margin of fourth and fifth gastral sternites with fringe of short whitish hairs, base of sixth sternite with a patch of short appressed pubescence, apex with a few long apically directed hairs. Rest of body with yellowish pubescence, pygidial area bare.

Length about 8 mm.

Male. — Black mark of scutum extending to pronotum, as in female, but yellow spot between prescutal sutures, near scutellum, smaller (fig. 23). Lower part of thorax black; yellow are: a spot in front of anterior oblique suture and an almost rectangular spot on either side of median longitudinal groove of propodeum. Colour of legs and gaster as in female.

Projecting part of interantennal carina narrow, transverse carina below antennae almost straight and nearly reaching the eyes. Anterior margin of clypeus with minute and sometimes difficultly visible triangular depression (fig. 22). Antennae moniliform.

Prescutal sutures completely but finely foveolate; scutellar groove indistinctly foveolate. As in *Ps. scutatus scutatus* enclosed area of propodeum longer than in female. Sides of propodeum transversely rugose, a transverse carina just below apex of median groove of propodeum.

Length about 6 mm.

Palawan: 1 ♀ (holotype), Tagburos (near Puerto Princesa), 11 Dec. 1952, H. Townes (HT); 1 ♂ (allotype), Puerto Princesa, C. F. Baker (USNM).

This couple is smaller than *Ps. scutatus scutatus*. The female differs from all other forms of the group of *Ps. scutatus* in the deep emargination of the clypeal margin. In the male the margin is only indistinctly depressed.

***Psenulus baltazarae baltazarae* n. sp. and subsp.**

Female. — Head black; mandibles except black tips and scape of antennae yellow, rest of antennae brown, underside yellowish-brown. Palpi pale yellow. Thorax yellow; black are the following parts: prescutal sutures and hind margin of scutum between these sutures, a large black mark on the scutum consisting of a square between the prescutal sutures and an adjacent triangle on the lateral areas of the scutum (fig. 24), enclosed area of propodeum, median sulcus of propodeum and two spots in front of apical margin of propodeum, interepicnemial area, metapleura and a small adjacent part of the mesopleura. Fore and mid legs and coxa of hind legs yellow; rest of hind legs yellowish-red. Veins of wings brown. Gaster, including petiole, red.

Head thick; anterior margin of clypeus protruding, broad and smooth,

with two weak emarginations, hence tridentate (fig. 25), disk of clypeus flat, opaque. Broadened part of interantennal carina dorsally with oval depression. Raised area below antennae ill-defined, without distinct transverse carina. Vertex and frons shining, area between ocelli and oculi slightly raised (fig. 25a). Base of mandibles below with lamina, apex bidentate whilst there is also a small inner tooth. Antennae clavate, segment eleven shorter than it is broad at the base.

Scutum, scutellum and metanotum smooth and shining, with minute punctures, scutum moreover with traces of extremely fine, longitudinal striation. Prescutal sutures deep, extending to hind margin of scutum. Scutellar suture very narrow, not foveolate. Enclosed area of propodeum with median carina as in *Ps. scutatus* (fig. 16). Posterior surface of propodeum smooth and shining, median groove narrow. Anterior oblique suture simple. Scrobal suture only partly distinct. Basal half of mid femora behind and hind femora below distinctly depressed. Base of hind tibiae depressed dorsally, with a long spine and a short tooth pointing backwards and a longitudinal carina on the inner side. First recurrent vein of fore wings received by first, second recurrent vein by third submarginal cell. Petiole not sharply separated from post-petiole, almost cylindrical. Pygidial area broad, with very fine coriaceous sculpture, lateral carinae of apical part parallel, apex blunt, almost rectangular (fig. 27).

Face below antennae with dense silvery pubescence, for the greater part appressed. Protruding margin of clypeus bare. Broad base of mandibles with tuft of long hairs below. Mesosternum with dense silvery pubescence, much longer in the median groove. No distinct patches on lower part of epicnemial areas. Legs and gaster with pale pubescence, last segment with long hairs, pygidial area bare. Fourth and fifth gastral sternites with fringe of short hairs, base of sixth sternite densely pubescent.

Length about 8 mm.

Male unknown.

Luzon: 1 ♀ (holotype), near Kias, Mountain Prov., 30 Nov. 1953, C. R. Baltazar (BPIM).

I have dedicated this species to Miss Clare R. Baltazar, Manila, who has collected various interesting *Psenulus* and who assisted me very much in the study of the Philippine *Pseninae*. *Ps. baltazarae* is easily distinguished by the shape of the clypeal margin. In the typical form the marking of the scutum resembles that of *Ps. scutatus scutatus*.

***Psenulus baltazarae luteus* n. subsp.**

Female. — Differs from the typical form in the absence of black spots

on the yellow scutum. Furthermore the petiole is completely black and the postpetiole is partly black, rest of gaster red.

The longitudinal carinae of the enclosed area of the propodeum are somewhat irregular (fig. 26), apparently deformed.

Length about 8 mm.

Male unknown.

Sibuyan: 1 ♀ (holotype), C. F. Baker (USNM).

This subspecies is easily recognized by the yellow scutum.

***Psenulus dentatus* n. sp.**

Female. — Head black; mandibles red with dark tips; scape of antennae yellow, rest of antennae brown with yellowish-brown underside. Palpi pale yellow. Thorax black; pale yellow are: upper side of pronotum, pronotal tubercles, a broad line along tegulae, one or two spots on posterior half of scutum (in the type this part of the scutum has been damaged by the pin), scutellum except a black mark on posterior half, metanotum, anterior plate of mesepisternum and a spot below hind wings. Propodeum with four elongate yellow spots, on the lower part between these markings somewhat reddish-brown. Legs pale yellow, fore and mid femora darkened behind, hind femora almost completely brown, hind tibiae and hind tarsi partly brown. Veins of wings brown. Gaster red, petiole black, anterior two thirds of postpetiole darkened.

Head thick, clypeus flat, anterior margin almost straight, a depression on either side of median line, leaving a raised median tooth (fig. 28). Frontal carina very prominent between antennae, dorsally broadened and somewhat excavate; below antennae it ends in a large projecting tubercle (fig. 29). This projection is defined below by a short but distinct, transverse carina, W-shaped in frontal view. Frons smooth and shining, slightly raised between ocelli and oculi. A fine groove defines the lateral legs of the ocellar triangle. Underside of head very much concave; the occipital carina does not reach the hypostomal carina but ends below in a downwards directed blunt triangular tooth (figs. 7 and 30). A short carina which runs backwards from base of mandibles defines anterior half of concavity of underside of head. Mandibles not with lamina above or broadened below. Antennae clavate.

Scutum with extremely fine alutaceous sculpture and fine punctures; distinct prescutal sutures extending to hind margin; on anterior part of scutum two irregular depressions across prescutal sutures (fig. 31). Scutellar suture simple. Propodeal enclosure triangular, shining and with longitudinal carinae. Posterior surface of propodeum smooth and shining, median groove narrow. Anterior oblique suture indistinctly crenulate. Scrobal suture in-

complete, fore part indistinct. Mid and hind femora and hind tibiae as in *Ps. scutatus*, but the long spine on the base of the hind tibiae is pointed and the small spines are less distinct. Inner calcaria of hind tibiae sharply bent. First recurrent vein of fore wings interstitial, second recurrent vein received by third submarginal cell. Petiole not sharply separated from gaster, cylindrical, dorsally somewhat flattened. Pygidial area broad, apex blunt, surface finely coriaceous, carinae only distinct at apex, where they are very high (fig. 32).

Face with silvery pubescence which is appressed below transverse carina, lower part of clypeus almost bare. Base of mandibles below with tuft of long silvery hairs. Petiole laterally with long erect hairs. Thorax and gaster with normal whitish pubescence. Last segment with brownish bristles, pygidial area bare. On lower part of epicnemial areas a small indistinct circular spot of dense silvery pubescence. Margin of fourth and fifth gastral sternites with indistinct fringe of pale short hairs and base of sixth sternite with patch of short pubescence.

Length about 7,5 mm.

Male unknown.

W. Java: 1 ♀ (holotype), Mt. Tjisuru, Djampang Tengah, Sept. 1939, collection K. V. Krombein, who intends to donate this specimen to the USNM (on the label the name of the locality was written as: "Mt. Disaerae, Mts. Djampang Tengah").

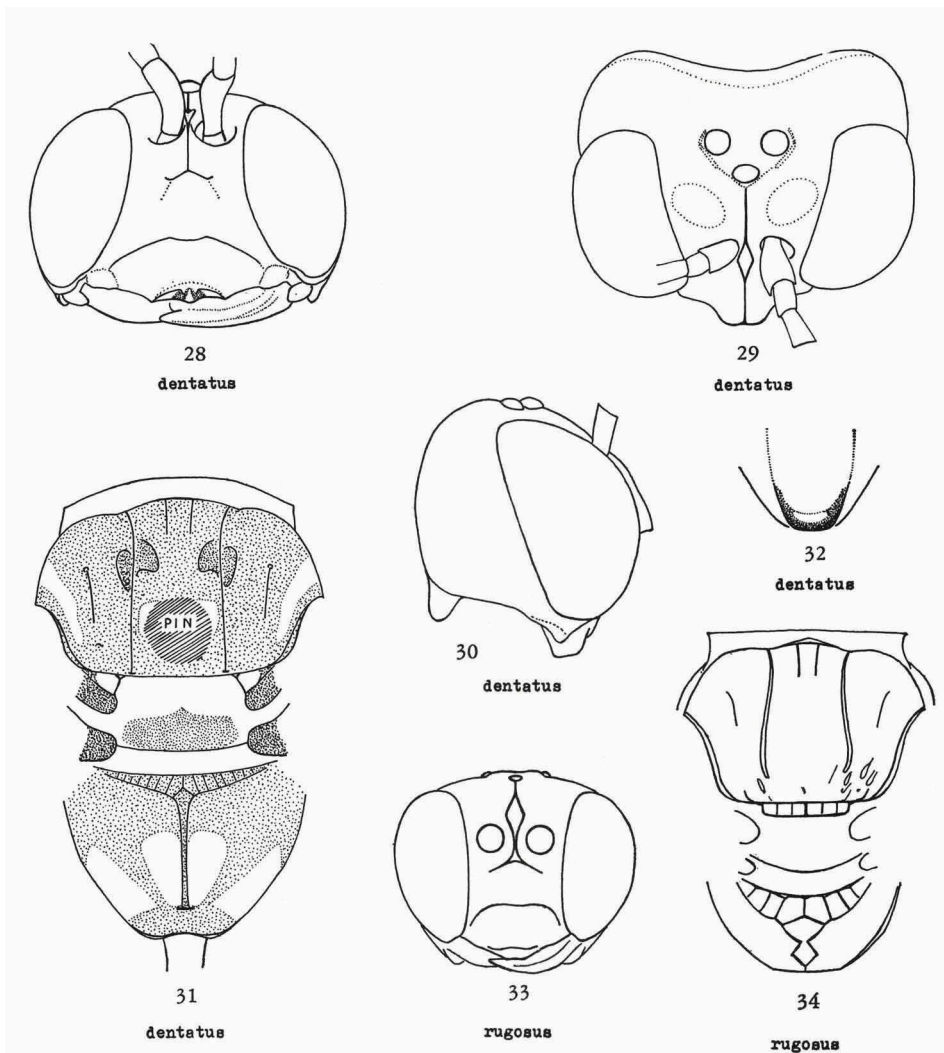
This wasp takes a very isolated position owing to the structure of the underside of the head and the course of the occipital carina. Notwithstanding this unusual structure it is evident that it is closely related to *Ps. scutatus*, in view of the long prescutal sutures, the shape of the hind femora and the long spine on the base of the hind tibiae. This female, which Dr. Krombein received from Mrs. M. E. Walsh, is the only specimen I have seen, in spite of the intensive collecting by the entomologists of the Bogor Museum.

#### Group of ***Psenulus rugosus***

A small female specimen, completely black and with very coarse sculpture of head and thorax, differs considerably from the other Indo-Australian groups. It seems to be closely related to the Western Palaearctic forms. The anterior margin of the clypeus is not emarginate. The prescutal sutures are very long but shorter and less regular than in the preceding group; they do not reach the hind margin of the scutum. The petiole of the gaster is short. The species lacks a distinct pygidial area. The single female has been found in Mindanao.

***Psenulus rugosus* n. sp.**

Female. — Black. Reddish-brown are: a spot before tip of mandibles, base of second gastral sternite and an adjacent spot on the sides of the second tergite. Testaceous are: palpi, underside of antennae, fore tibiae and tarsi, back of mid tibiae, mid tarsi and base of hind tibiae. Tegulae and veins of wings dark-brown.



Figs. 28-32. *Psenulus dentatus* n. sp., ♀, holotype; head in frontal, dorsal and lateral view, thorax and pygidial area.

Figs. 33-34. *Psenulus rugosus* n. sp., ♀, holotype; head and thorax.

Median part of clypeal margin roundly protruding (fig. 33), smooth, disk of clypeus densely punctate. Face between clypeus and antennae coarsely coriaceous with large shallow punctures. Frontal carina broadened between antennae and excavate, ending below antennae in a short, transverse carina, which is arched in frontal view. Frons and vertex shining, but with very irregular sculpture, partly rugose. Interocellar area raised. Cheeks coarsely sculptured, an irregular carina runs parallel with outer orbit. Antennae clavate.

Pronotum with sharp transverse carina dorsally. Scutum shining, densely punctate, fine and coarse punctures intermixed, scutum laterally with tendency to oblique striation. Prescutal sutures not extending to scutellum, but lost in an irregular sculpture near hind margin (fig. 34). Scutellar suture only with distinct median carina, further indistinctly foveolate. Scutellum smooth and shining, sparsely punctate. Enclosed area of propodeum with strong median and oblique lateral carinae. Posterior surface of propodeum coarsely sculptured, partly transversely rugose, a narrow area along upper part of median suture is smooth. Median groove broad and irregular. Mesepisternum densely and coarsely punctate, hypo-epimeral area well-defined, much finer punctate. Legs normal. First recurrent vein of fore wings received by second, second recurrent vein received by third submarginal cell. Petiole short, cylindrical. Gaster smooth and shining, base of second gastral tergite bare, rest of tergites with extremely fine punctures from which the pubescence arises. No distinct pygidial area. Sternites with fine punctures.

Face with silvery, partly somewhat appressed pubescence. Rest of head, thorax and gaster with short, greyish pubescence. Margin of fourth and fifth gastral sternites with fringe of dense pubescence.

Length about 5 mm.

Male unknown.

Mindanao: 1 ♀ (holotype), Dapitan, C. F. Baker (USNM).

#### Group of ***Psenulus quadridentatus***

This group and the following one are characterized by the short, sometimes linear enclosed area of the propodeum. The females of *Ps. quadridentatus* and its allied forms have a distinct pygidial area and a more or less distinct transverse carina below the antennae, structures which are lacking in the very similar group of *Ps. antennatus*. The prescutal sutures are indistinct on the posterior half of the scutum.

The males have about the same broadened and excavate interantennal carina as the females; it is likely that they all have moniliform antennae.

The five species described below inhabit Malaya, Sumatra, Java and Bor-

neo. Probably they are also near relatives of the Palaearctic forms, especially the sturdy *Ps. compactus* from Sumatra, the only Indo-Australian species I have seen that has a carinate petiole.

***Psenulus quadridentatus* n. sp.**

Female. — Head black; mandibles yellow with dark tips, labrum red, palpi pale yellow, scape of antennae red, dorsally with brown tip, rest of antennae dark-brown with reddish underside. Thorax black, pronotal tubercles reddish or yellowish, tegulae red. Legs and gaster including petiole red. Fore and mid femora darkened on lower part of hind surface. Veins of wings brown.

Clypeus slightly convex, anterior margin quadridentate (fig. 35), upper part of disk densely and finely punctate, lower part almost smooth, but there are a few coarse punctures near the fore margin. Frontal carina very prominent between antennae, dorsally broadened and excavate, here with distinct lateral row of fine hairs (fig. 36). Frontal carina ending below antennae in a short transverse carina, arched in frontal view. Frons almost flat, smooth and shining, with minute punctures, also on vertex. A small depression on outer side of posterior ocelli. Anterior margin of labrum crenulate. Mandibles with three distinct teeth. Antennae clavate.

Scutum, scutellum and metanotum smooth and shining, sparsely and finely punctate, a few coarse punctures intermixed. Prescutal sutures distinct on anterior part of scutum, vague on posterior half. Enclosed area of propodeum linear, concave between the short longitudinal carinae, ill-defined posteriorly (fig. 37). Behind this enclosed area the propodeum is polished, bare. Posterior and lateral surface of propodeum also smooth and shining, but pubescent, a broad lateral line is transversely rugose. Mesepisternum smooth and shining. Anterior oblique suture foveolate. Scrobal suture distinct. Legs slender, apex of mid tibiae with a few red spines, inner spur of hind tibiae bent and about as long as metatarsus. First recurrent vein of fore wings interstitial or ending in second submarginal cell, second recurrent vein ending in third submarginal cell. Petiole cylindrical, rest of gaster smooth and shining, minutely and sparsely punctate. Pygidial area elongate-triangular, finely coriaceous, lateral carinae distinct (fig. 38). Base of second gastral sternite with triangular depression.

Face below transverse carina with silvery, mostly appressed pubescence, long hairs on clypeus leaving sculpture easily visible. Rest of body greyish pubescent. Lower part of epicnemial areas with circular patch of appressed hairs. Mesosternum with dense silvery pubescence.

Length about 8 mm.

Male. — Resembles female but anterior margin of clypeus almost straight with two small triangular teeth near the median line. (fig. 39). Carina between antennae not as broad as in female (fig. 40). Transverse carina more distinct, sides bent upward, reaching outer side of antennal sclerites. Mandibles bidentate, inner third tooth being rudimentary. Antennae long, moniliform, segments four, five and six with indistinct tyloidea. Posterior surface of propodeum as smooth as in female. First recurrent vein interstitial.

Length about 7.5 mm.

Malaya: 2 ♀ (holotype no. 01009, paratype no. 01008), Pahang, Cameron Highlands Ringlet, 3700 feet, 14 August 1947, H. T. Pagden (HTP); 1 ♂ (allotype, no. 2140), Cameron Highlands, 4600 feet, 29 May 1931, H. T. Pagden (HTP); 1 ♀ (paratype), Perak, Larut Hills, 4500 feet, 20 Febr. 1932, H. M. Pendlebury (BM, 1955 — 354, ex FMS Museum).

The female is easily recognized by the emargination of the clypeal margin; apart from the usual dimorphism in the structure of the face the male is very similar, also as regards the structure of the propodeum.

#### ***Psenulus separatus* n. sp.**

Female. — Similar to *Ps. quadridentatus*, but scape of antennae, legs and gaster somewhat paler. Tegulae pale yellow. In frontal view only the middle part of the transverse carina is distinct. Enclosed area of propodeum still more linear, incomplete, lateral parts not reaching the median longitudinal suture (fig. 41); this suture is narrower than in the preceding form. Spines on base of hind tibiae very short and inconspicuous. First recurrent vein of fore wings interstitial, second recurrent vein ending in the third sub-marginal cell. Pygidial area narrower than in preceding form (fig. 42).

Length about 9 mm.

Male unknown.

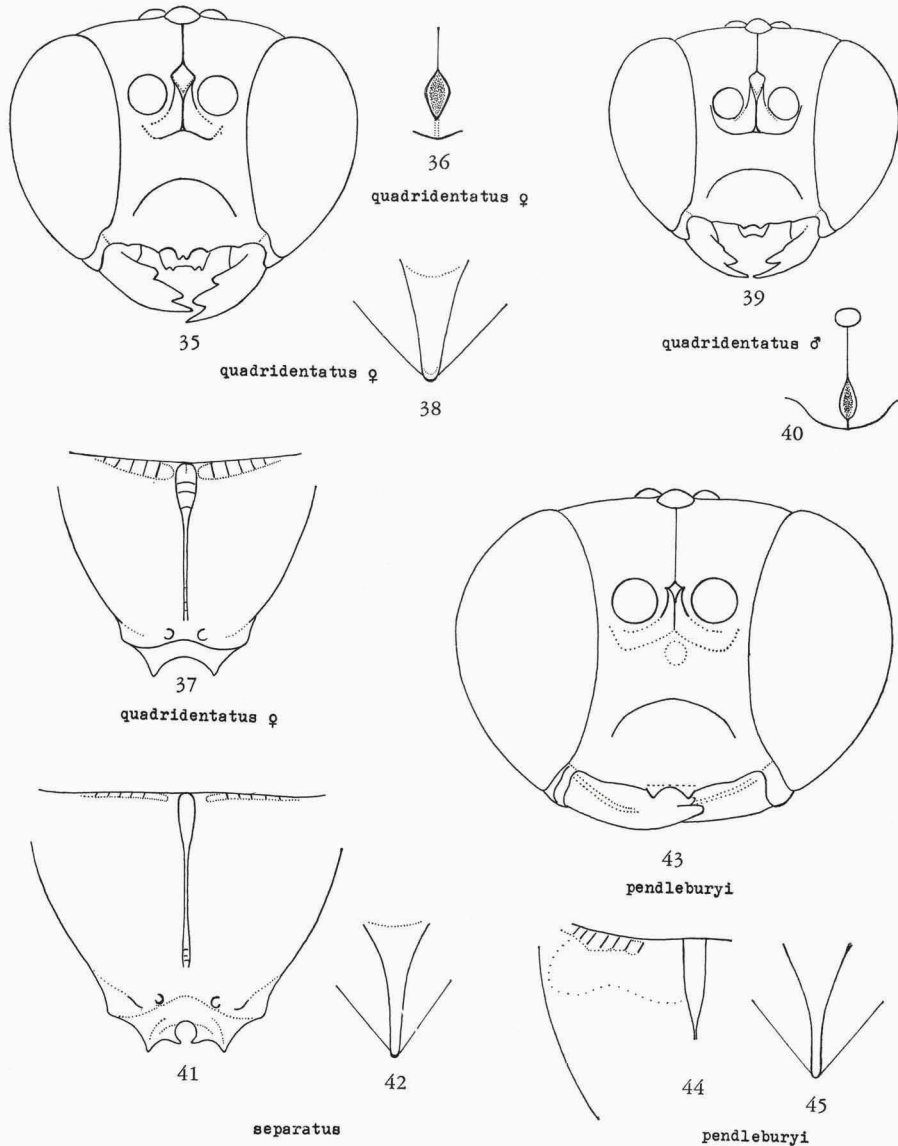
W. Java: 1 ♀ (holotype), Sukanegara, 500-700 m, Febr. 1940, native coll. (ML).

The structure of the clypeus and the colour being almost the same as in the preceding form I have hesitated to consider this wasp as a separate species. However, the shape of the propodeal enclosure and of the pygidial area are distinctly different. I hope that more material will become available to prove the constancy of these characters.

#### ***Psenulus pendleburyi* n. sp.**

Female. — Head black; mandibles except dark tips yellowish-red, palpi and underside of antennae yellowish-red. Thorax black, pronotal tubercles





Figs. 35-38. *Psenulus quadridentatus* n. sp., ♀, holotype; 35-36: head in frontal view, interantennal and transverse carina in dorsal view, 37: propodeum, 38: pygidial area. Figs. 39-40. *Psenulus quadridentatus* n. sp., ♂, allotype; head in frontal view, interantennal and transverse carina in dorsal view.

Figs. 41-42. *Psenulus separatus* n. sp., ♀, holotype; propodeum and pygidial area.

Figs. 43-45. *Psenulus pendleburyi* n. sp., ♀, holotype; head, left half of propodeum and pygidial area.

and tegulae reddish. Legs including coxae and gaster including petiole reddish. Veins of wings brown.

Clypeus slightly convex, mostly densely punctate, just before anterior margin a narrow transverse depression; margin with deep emargination and two large teeth (fig. 43). Frontal carina very prominent between antennae, this projection dorsally broadened and excavate. No distinct transverse carina below antennae. Face below frontal carina with shallow circular depression. Frons and vertex minutely punctate. A small depression on outer side of posterior ocelli. Antennae long.

Pronotum with sharp antero-dorsal carina. Scutum, scutellum and metanotum smooth and shining, sparsely and finely punctate; prescutal sutures only distinct on anterior half of scutum. Scutellar suture with some short longitudinal carinae. Declivity of propodeum smooth and shining, upper fourth part bare. Enclosed area of propodeum reduced to a narrow lateral depression with a few longitudinal carinae; the distance between these depressions and the median longitudinal groove is about as long as the length of the metanotum (fig. 44). Between posterior part and sides of propodeum a finely reticulate area. Mesopleura shining, finely punctate. Anterior oblique suture foveolate. Hypo-epimeral area distinct. Apex of mid tibiae with longitudinal depression, margined anteriorly by an oblique ridge and posteriorly by a row of four or five red spines. Inner spur of hind tibiae about as long as basitarsus. First recurrent vein of fore wings interstitial, second recurrent vein received by third submarginal cell. Petiole cylindrical, gaster smooth and shining, with minute punctures. Pygidial area elongate-triangular, on the apical part the lateral carinae almost parallel (fig. 45).

Face with silvery pubescence, rest of body with yellowish-grey hairs. Lower part of epicnemial areas with the usual circular patch of appressed hairs. Mesosternum densely pubescent.

Length about 11 mm.

Male unknown.

Borneo: 1 ♀ (holotype), British North Borneo, Mt. Kinabalu, Lumu Lumu, 5500 feet, 8 April 1929, H. M. Pendlebury (BM, 1955-354, ex FMS Museum).

Because of the reduced enclosed area of the propodeum this wasp resembles *Ps. separatus* from Java; the emargination of the clypeal margin tends to that of *Ps. macrodentatus* from Sumatra. The three species are certainly closely related with *Ps. quadridentatus* from Malaya. If the structure of the propodeum is constant, which I believe will prove to be so, this form from Borneo is easily recognized by the great distance between the lateral rudiments of the enclosed area and the median longitudinal groove.

***Psenulus macrodentatus* n. sp.**

Female. — Head black; mandibles dark red with black tips, labrum red, palpi yellow, antennae dark-brown with reddish underside. Thorax black; tegulae and pronotal tubercles yellowish-red. Legs red, fore femora brown below, fore tibiae yellowish, hind tarsi partly brown. Wing-veins dark-brown. Gaster including petiole reddish.

Clypeus convex, dull, anterior margin with two stout triangular teeth (fig. 46). Frontal carina very prominent between antennae, dorsally broadened and excavate (fig. 47), this excavation with a few lateral hairs. Frontal carina ending below antennae in a short but distinct transverse carina, arched in frontal view (fig. 46). Frons and vertex shining, densely but minutely punctate. Mandibles tridentate, lower tooth blunt, upper margin with a row of coarse punctures. Antennae clavate.

Scutum shining, densely and finely punctate with only a few larger punctures. Prescutal sutures sharp on anterior half of scutum, then passing into a shallow, less distinct suture which extends to the hind margin. Scutellum and metanotum finely punctate. Enclosed area of propodeum triangular, with traces of a median carina (fig. 48). Median sulcus of propodeum rather broad with a few transverse carinae. Posterior surface of propodeum smooth and shining, upper part bare. Anterior oblique suture foveolate. Hypo-epimeral area well-defined. Mid tibiae with a row of four red spines on apical outer fourth. Hind femora slender. Spines on base of hind tibiae very short and inconspicuous. First recurrent vein of fore wings received by second, second recurrent vein by third submarginal cell. Petiole cylindrical, in dorsal view not sharply separated from postpetiole. Rest of gaster very finely punctate. Pygidial area dull, with a few irregular punctures, elongate-triangular, lateral carinae distinct (fig. 49).

Face below transverse carina with silvery, mostly appressed pubescence, also on base of mandibles. Head and thorax with whitish, gaster with somewhat yellowish pubescence, pygidial area bare. Margin of fourth and fifth gastral sternites with fringe of short whitish hairs. Central part of sixth gastral sternite with patch of dense pubescence.

Length almost 8 mm.

Male unknown.

Sumatra: 1 ♀ (holotype), Fort de Kock, 920 m, 1925, E. Jacobson (MA).

This wasp agrees with *Ps. quadridentatus* in having a short transverse carina below the antennae and complete though posteriorly vague prescutal sutures. It differs considerably, however, in the emargination of the clypeal margin and in the shape of the enclosed area of the propodeum.

***Psenulus compactus* n. sp.**

Female. — Head black; mandibles partly reddish, palpi testaceous, under-side of antennae more or less reddish. Thorax black; scutum, scutellum and metanotum with oily shine, hind margin of pronotal tubercles somewhat reddish; tegulae, knees, tibiae and tarsi of all legs and posterior half of hind femora ferruginous red. Petiole black, rest of gaster red. Veins of wings brown.

Clypeus almost flat, shining, with a few punctures near the margin; margin with two distinct, blunt teeth (fig. 50). Carina between antennae broadened and excavate, this excavation shining, the lateral fine hairs longer than in *Ps. antennatus*. Below antennae a short transverse carina which is arched in frontal view and crosses the lower end of the prolonged broadened part of the interantennal carina. Frons and vertex densely punctate. Apex of mandibles bidentate, inner (third) tooth indistinct. Antennae clavate.

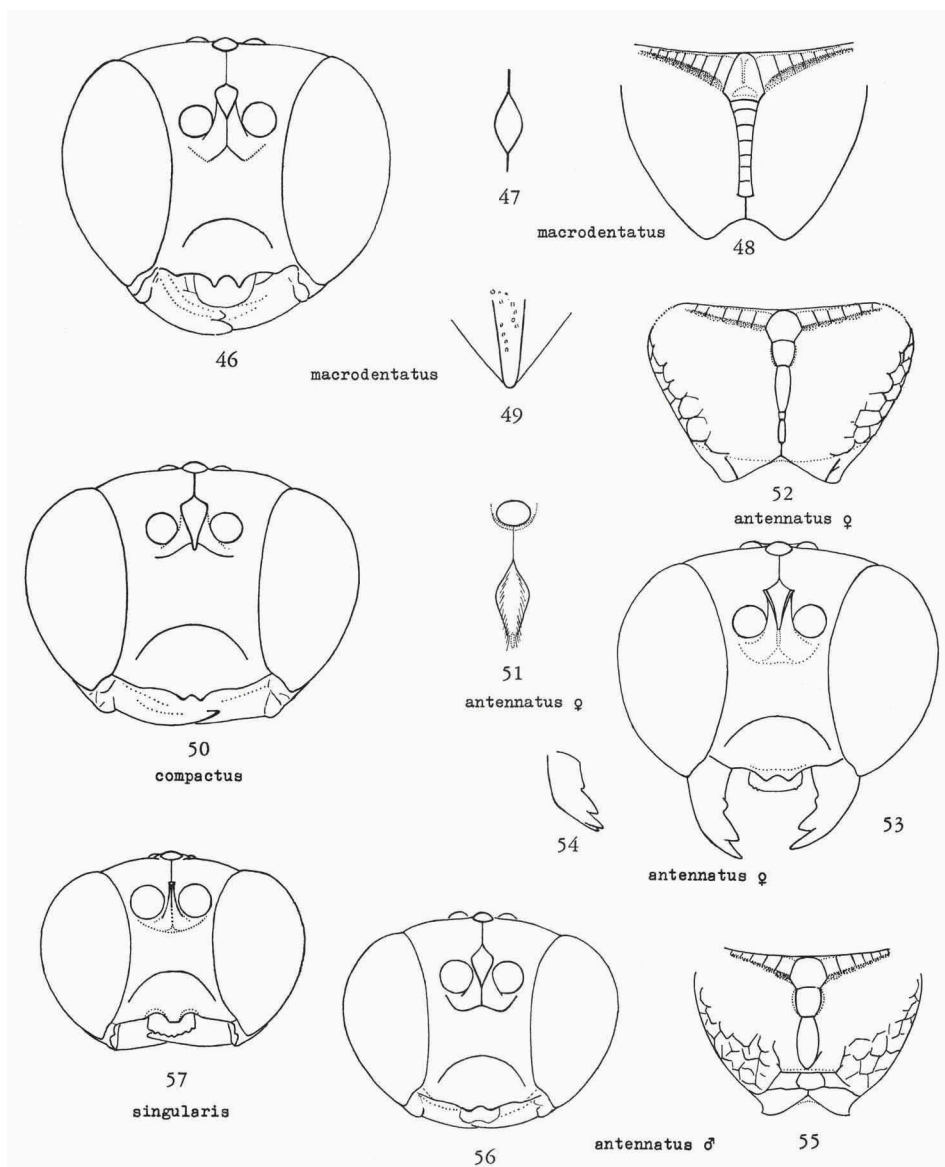
Scutum, scutellum and metanotum shining, densely punctate, punctures of irregular size. Enclosed area of propodeum almost linear. Median sulcus of propodeum broad, irregular. Upper part of posterior surface of propodeum smooth and shining, middle third with somewhat irregular puncturation, lower third reticulate. Anterior oblique suture strongly foveolate. Mesepisternum finely punctate, hypo-epimeral area convex, smooth and almost impunctate. Legs normal. The first recurrent vein of fore wings ends in second, second recurrent vein in third submarginal cell. Petiole sharply separated from rest of gaster. Upper side of petiole with lateral carinae and a broad median carina, which tapers towards apex. Gaster extremely finely punctate. Pygidial area distinct, elongate-triangular with pointed apex, apical part of surface shining.

Pubescence of face silvery, below transverse carina for the greater part appressed. Base of mandibles whitish pubescent. Rest of head and thorax with greyish pubescence. Gaster more yellowish pubescent. Hind margin of fourth and fifth gastral sternites with fringe of yellowish short hairs.

Length about 8,5 mm.

Male unknown.

Sumatra: 8 ♀, Sungai Kumbang, Aug./Sept. 1915, Edw. Jacobson (holotype and one paratype nrs. 84-90, originally on one piece of mark, ML; 3 paratypes nrs. 84-87 on one piece of mark, ML; 3 paratypes nrs. 84-88 originally on one piece of mark, 1 ML, 2 MR). On the labels pinned under the five specimens numbered 84-88 and 84-90 the printed date (9.1915) has been altered with ink into 8.1915, but not in the three specimens numbered 84-87. Judging from the numbering it seems probable that all specimens have been collected in the month of August.



Figs. 46-49. *Psenulus macrodentatus* n. sp., ♀, holotype; head, interantennal carina in dorsal view, propodeum and pygidial area.

Fig. 50. *Psenulus compactus* n. sp., ♀, holotype; head in frontal view.

Figs. 51-54. *Psenulus antennatus* (Rohwer), ♀, Malang (Java); interantennal carina in frontal view, propodeum, head and right mandible.

Figs. 55-56. *Psenulus antennatus* (Rohwer), ♂, Malang (Java); propodeum and head.

Fig. 57. Head of *Psenulus singularis* n. sp., ♀, holotype.

The prolonged excavation of the broadened interantennal carina, which crosses the transverse carina as a suture, easily distinguishes this wasp from allied species. If the gaster were black instead of red it would, with its compact habitus, closely resemble the Western Palaearctic species, to which fact also the carinate petiole contributes.

#### Group of ***Psenulus antennatus***

I have provisionally separated the next two species from the preceding group as both the transverse carina below the antennae and the pygidial area are lacking in the females. The clypeal margin is bidentate, not quadridentate as in some females of the preceding group.

The male of *Ps. antennatus* has moniliform antennae; the male of *Ps. penangensis* is not yet known, but it is undoubtedly very similar.

The two species described below have been taken in Malaya, Java and Bali.

#### ***Psenulus antennatus*** (Rohwer)

1923, Rohwer, S. A., Phil. Jl. Sc., vol. 22, no. 6, pp. 595-596, ♂ (*Diodontus antennatus*; Singapore).

Female. — Head and thorax black; mandibles partly reddish-brown, also underside of antennae, tegulae and apex of hind coxae. Palpi, pronotal tubercles, fore and mid tibiae and tarsi and base of hind tibiae testaceous. Rest of legs dark-brown. Veins of wings dark-brown. Petiole and greater part of postpetiole black, rest of gaster red.

Protruding margin of clypeus with two blunt triangular teeth (fig. 53), lower part of clypeus convex. Mandibles with three apical teeth and one inner tooth (fig. 54). Margin of labrum rounded, crenulate. Frontal carina between antennae very prominent, dorsally broadened and excavate; shining margin of excavation separated from dull central part by a distinct row of short white hairs (fig. 51). No distinct transverse carina below antennae. Frons and vertex shining, punctate. Antennae clavate.

Scutum shining, sparsely and finely punctate, a few larger punctures. Prescutal sutures complete, but posteriorly they are vaguely defined. Scutellar suture foveolate. Scutellum and metanotum finely punctate. Enclosed area of propodeum almost linear (fig. 52). Median sulcus of propodeum irregular, upper part broad. Posterior surface of propodeum smooth and shining, with very fine puncturation on lower part. A coarsely sculptured area separates back of propodeum from the sides, which are somewhat dull. Mesosternum finely punctate. Anterior oblique suture foveolate. Hypo-epimeral area well-defined. Mid tibiae with a row of four pale spines on outer

side of apical third. Hind legs normal. First recurrent vein of fore wings received by second submarginal cell, second recurrent vein by third submarginal cell. Petiole almost cylindrical, in dorsal view distinctly separated from postpetiole. Rest of gaster finely punctate. Pygidial area indistinct, a short rounded carina at apex. Second gastral sternite densely, but finely punctate, base depressed, following sternites somewhat dull owing to extremely fine reticulation, some fine punctures on apical third.

Pubescence of head and thorax silvery, longest on lower part of propodeal declivity, on gaster more yellowish. Pubescence of face below interantennal carina mostly appressed; excavation of carina bare. Metanotum with long, dense and silvery pubescence, directed outwards. Epicnemial areas with circular pubescent spot near inner line. Hind margin of fourth and fifth gastral sternites with dense pubescence, a large pubescent patch on sixth sternite.

Length about 7 mm.

Male. — Resembles female. Underside of first two antennal segments red, of following segments yellowish-brown. Upper side of fore and mid femora partly testaceous.

The interantennal carina ends below antennae in a transverse carina; in frontal view this transverse carina is arched medianly and the outer ends are bent upwards to the outer sides of the antennal sclerites (fig. 56). Clypeal teeth smaller than in female. Antennae moniliform.

Posterior part of scutum with some irregular oblique rugae, more distinct than in the female. Lower half of posterior surface of propodeum coarsely reticulate (fig. 55). Median sulcus of propodeum ending below in a strong but somewhat irregular transverse carina. Petiole almost square, basal third of dorsal surface and posterior two thirds of ventral surface being flattened and forming a well-defined right angle with the sides. Dr. Krombein kindly examined the type and confirmed that the petiole tends to be more square than cylindrical in cross section.

Length about 6,5-7 mm.

The female of *Ps. antennatus* is easily distinguished from the other species belonging to this group by the absence of a distinct pygidial area and the lacking transverse carina below the antennae. It has these characters in common with *Ps. penangensis* (Rohwer), which I have not seen, but which has a red petiole. The mandibles of the female of *Ps. antennatus* are quadridentate.

Singapore: 1 ♂ (holotype), C. F. Baker (USNM, catalogue no. 25039).

Malaya: 1 ♂, Negri Sembilan, Port Dickson, 18 Dec. 1935, H. M. Pendlebury (BM, 1955-354, ex FMS Museum).

Java: 1 ♀ and 1 ♂ (the former died or killed just before hatching), Bogor,

250 m, Forestry Exp. Garden, in tunnel in branch of Leea, 28 Dec. 1952, J. van der Vecht (ML); 12 ♀ and 13 ♂, Malang, March-June 1933, J. G. Betrem (9 ♀ and 11 ♂ ML, 1 ♀ BPIM, 2 ♀ and 2 ♂ MR); 1 ♀, Malang, Karangploso, April 1933, J. G. Betrem (ML).

Bali: 2 ♀ and 8 ♂, Den Pasar, 50 m, 1 June 1935, Awibowo (1 ♀ and 6 ♂ ML, 1 ♀ and 2 ♂ MR).

The male from Bogor has dark bands, partly more or less interrupted, on the gastral tergites. The males from Malang have darker mid femora.

### ***Psenulus penangensis* (Rohwer)**

1923, Rohwer, S. A., Phil. Jl. Sc., vol. 22, no. 6, pp. 593-594, ♀ (*Diodontus penangensis*; Penang Island).

Original description: "Female. — Length, 6.5 millimeters. Clypeus convex, the anterior margin bidentate medianly; face closely punctured, convex at end of frontal carina but without a transverse carina; eyes closest together just below antennae; frons with close distinct punctures; vertex with widely scattered punctures; ocelli in an obtuse triangle; postocellar line subequal with ocellocular; antennae short, stout, distinctly thickening apically, third joint somewhat longer than fourth; pronotum strongly carinate anteriorly, the lateral angles rounded; scutum shining, very sparsely punctured; notauli indicated on anterior half of scutum; suture in front of scutellum feebly foveolate; scutellum shining with a few punctures; dorsal area of propodeum shining, with a wide depressed area medianly which connects posteriorly with the deep channel and anteriorly with the nearly linear, foveolate basal area; posterior face of propodeum coarsely reticulate, the sides nearly smooth; mesepisternum polished, the suture strongly foveolate; petiole strongly curved, cylindrical, subequal in length with hind femora, distinctly separated from rest of tergite; gaster polished; first recurrent received near base of second cubital cell; second recurrent sinuate, joining third cubital cell a distance equal to about half the length of second intercubitus from base of cell; second cubital cell about three times as long on cubitus as on radius. Black; scape, basal joints of antennae, and flagellum beneath rufopiceous; tubercles and tegulae testaceous; abdomen dark rufous; tibiae and tarsi testaceous; head and thorax with dense silvery hair; wings hyaline, venation dark brown.

Type locality. — Penang Island.

Described from one female received from C. F. Baker.

Type. — Catalogue No. 25037, United States National Museum."

The bidentate clypeus, the linear enclosed area of the propodeum and the distinctly separated petiole point to a close relationship with *Ps. antennatus*. Judging from the original description it differs, however, from *Ps. antennatus* in the coarsely reticulate posterior surface of the propodeum and in the red colour of the petiole.

### **Group of *Psenulus singularis***

*Psenulus singularis*, of which only a single female — from Luzon — is known, has a dorsally broadened interantennal carina; in frontal view the dorsal side of the latter is only slightly depressed. This female lacks a



transverse carina below the antennae. The anterior margin of the clypeus is very protruding but not distinctly emarginate. The thorax is completely yellow, whilst the prescutal sutures are of the normal length. Notwithstanding the shape of the interantennal carina, which resembles that of the preceding groups, I am unable to decide where this wasp should be properly placed in the system.

***Psenulus singularis* n. sp.**

Female. — Head black; mandibles yellow, except dark tips; palpi testaceous; labrum reddish. Scape of antennae yellow, flagellum black above, pedicel and following two segments yellow below, rest of flagellum orange below. Thorax probably entirely yellow (in the holotype the posterior half of the scutum has been damaged by the pin), but lateral depressions on either side of scutellum and scutellar groove black. Fore and mid legs yellow, tarsi of mid legs reddish. Hind legs reddish except coxae, which are yellow. Wing-veins brown. Gaster including petiole yellowish-red.

Middle part of clypeal margin sharply protruding, apex almost straight (fig. 57). Disk of clypeus with close but shallow puncturation. Interantennal carina broadened, oval in dorsal view, not excavate; no distinct transverse carina below antennae. Frons with minute puncturation, interocellar area raised and shining with only a few but distinct punctures. Temples broad, vertex immediately behind lateral ocelli strongly sloping to occipital carina. Antennae short, clavate, segments 8-11 shorter than they are broad at the base.

Scutum scarcely but distinctly punctate. Enclosed area of propodeum triangular, with very few longitudinal carinae. Median longitudinal groove of propodeum narrow. Declivity of propodeum smooth and shining, laterally and at apex obliquely striate. Anterior oblique suture simple. Hypo-epimeral area convex. Mid tibiae with longitudinal row of about ten red spines and a few smaller spines parallel with this row. Base of hind tibiae with inconspicuous spines, apical half with a row of distinct but small red spines. Inner spur of hind tibiae strongly bent, about as long as basitarsus. First recurrent vein of fore wings interstitial, second recurrent received well in third submarginal cell. Petiole cylindrical. Pygidial area narrow, lateral carinae not distinct.

Pubescence yellowish-grey, silvery on frons and face, on face partly appressed. A round patch of dense and appressed pubescence on lower part of epicnemial areas, also central part of hind margin of fourth and fifth gastral sternites and disk of sixth sternite densely pubescent.

Length about 6,5 mm.

Male unknown.

Luzon: 1 ♀ (holotype), Sierra Madre Mounts, Nueva Ecija, 29 Jan. 1953, A. Concepcion (HT).

At first glance this wasp resembles *Ps. interstitialis* Cam. but it differs considerably in its structural characters, having a broadened interantennal carina and a protruding clypeal margin.

#### Group of ***Psenulus erraticus***

In this group and in the following groups the interantennal carina is not distinctly excavate dorsally although it is sometimes slightly broadened.

The group of *Ps. erraticus* takes a very isolated position, with its very much swollen and sharply separated postpetiole and the dense pubescence on the thorax, especially on the posterior surface of the propodeum. Above the base of the petiole the propodeum has a deep and bare groove, in which the base of the petiole fits. I have distinguished three subspecies which have been collected in Celebes, Borneo, the southern Philippine islands and in Singapore.

#### ***Psenulus erraticus erraticus*** (Smith)

1861, Smith, F., Jl. Proc. Linn. Soc. Zool., vol. 5, p. 85, ♀ (*Psen erraticus*; Celebes).

As the original description is very incomplete and mainly based on the colour, the following redescription is given:

Female. — Head, thorax and petiole black, rest of gaster pale red. Testaceous are: mandibles except dark tips, palpi, antennae except yellowish underside of first segments and dark-brown upper side of flagellum, apical part of hind coxae and all legs beyond coxae, pronotal tubercles and tegulae. Veins of wings also testaceous.

Face and clypeus dull, densely but not deeply punctate. Lower part of clypeus convex (fig. 59); margin depressed, weakly emarginate, two widely separated indistinct teeth. Carina between antennae sharply protruding, narrow, below antennae ending in a transverse carina which is angulate in frontal view (fig. 58); frons just above antennal sclerites depressed, median carina normal. Frons and vertex smooth and shining, interocellar area somewhat raised. So far as they are visible the mandibles seem to be bidentate at the apex, without inner tooth. Antennae long, tenth and eleventh segments about one and a half times as long as they are broad at the base.

Scutum smooth with sparse and fine puncturation, central part raised, prescutal sutures crossed by short transverse rugae. Scutellar suture foveolate. Scutellum convex, shining; metanotum dull. Enclosed part of propodeum

shining, with one median and a few oblique carinae. Upper part of propodeal declivity with quadrate lateral shining areas which have a few oblique striae. Almost the whole posterior surface of the propodeum coriaceous and with coarse reticulation, median groove narrowing towards centre, a transverse carina separates it from a very deep and wide groove in which the base of the petiole, if bent upwards, fits (fig. 60). Apical part of this groove smooth and shining. Mesosternum smooth and shining. Legs slender; base of hind tibiae normal, inner thorn of hind tibiae as long as basitarsus. First recurrent vein of fore wings interstitial, second recurrent received by third submarginal cell at a distance which is about half the length of the base of the second submarginal cell. Petiole cylindrical, strongly curved, in dorsal view hardly longer than first gastral tergite, surface smooth and shining, punctate on the sides. Gaster smooth and shining. Pygidial area flat but ill-defined with indistinct and short lateral carinae, apex bluntly rounded with distinct posterior carina (fig. 61), surface shining, with a few fine punctures. The depressed base of the second gastral sternite forms a right angle with the ventral side of the sternite.

Head with dense short pubescence, silvery and more appressed below transverse carina, lower part of clypeus sparsely pubescent, a few long hairs on face below carina and on vertex. Thorax with dense short greyish pubescence and a few longer hairs, also on declivity of propodeum (enclosed area, median longitudinal groove and lateral areas behind enclosed area bare). Pubescence very dense on metanotum; upper side of pronotum with appressed silvery hairs. Mesosternum with long greyish hairs. Epicnemial areas with circular pubescent spot on lower part. Petiole with long lateral hairs, pubescence of gaster yellowish, last tergite with long bristles laterally, last sternite with large patch of appressed golden hairs.

Length about 9,5 mm.

Male unknown.

Celebes: 1 ♀ (holotype), "Mak." (= Makassar) (OUM).

This is a well preserved specimen.

The following two forms are very near relatives. As there is a number of small differences I have considered them as subspecies of *Ps. erraticus*.

***Psenulus erraticus basilanensis* (Rohwer)**

1921, Rohwer, S. A., Phil. Jl. Sc., vol. 18, no. 3, pp. 318-319, ♀ (*Diodontus basilanensis*; Basilan).

1923, Rohwer, S. A., Phil. Jl. Sc., vol. 22, no. 6, p. 595 (♀, Borneo, Sandakan; ♂, Singapore).

I have not seen the holotype, but a female from Borneo, labelled "meta-

type" and also a female from Singapore. They differ from the preceding form in the following points:

Antennae and legs somewhat darker, upper side of flagellum dark-brown.

Lower part of clypeus above the abruptly depressed margin more projecting (fig. 63), lower part of disk with irregular transverse striation, upper part dull, with fine sculpture, teeth on margin somewhat more distinct. Inter-antennal carina hardly protruding, on the lower part of the frons slightly broadened. Transverse carina less arched in frontal view (fig. 62).

Apical excavation of propodeum much shallower than in preceding form. Oblique rugae of areas behind enclosed area of propodeum less distinct. The female from Borneo has no fore wings; in the holotype and in the female from Singapore the first recurrent vein ends quite near the end of the first submarginal cell. Apex of pygidial area slightly more blunt, lateral carinae almost absent.

Much smaller, length about 8 mm.

Male. — Dr. K. V. Krombein kindly also sent me for examination the male from Singapore, recorded by Rohwer (1923). It hardly differs from the female from Borneo. Antennae long and slender, segments 4-9 with oblong tyloidea of reddish colour, tyloides of ninth segment smaller. Apex of mandibles bidentate. First recurrent vein of fore wings interstitial.

Length about 8 mm.

Basilan: 1 ♀ (holotype), C. F. Baker (USNM, catalogue no. 22845).

Borneo: 1 ♀ (metatype), Sandakan, C. F. Baker (USNM).

Singapore: 1 ♂ (allotype), C. F. Baker (USNM); 1 ♀, H. N. Ridley, 1902-205 (BM).

#### ***Psenulus erraticus butuanensis* n. subsp.**

A single male from Mindanao differs from the male of *Ps. erraticus basilanensis* in the following details:

Clypeus slightly convex. Antennal segments 4-10 with tyloides, that on tenth segment much smaller. Scutum laterally, mainly across the prescutal sutures, with transverse rugae which are much longer than in the female of the nominate form. First recurrent vein of fore wings distinctly received in first submarginal cell, second submarginal cell almost triangular, second recurrent vein received by third submarginal cell.

Length about 8,5 mm.

Mindanao: 1 ♂ (holotype), Butuan, C. F. Baker, no. 18897 (USNM).

The transverse rugae on the scutum are much longer and more distinct than in the other subspecies of *Ps. erraticus*. It further differs from the

male from Singapore in the presence of a small tyloides on the tenth antennal segment.

Group of ***Psenulus crabroniformis***

The group of *Ps. crabroniformis* is characterized by the slender body and the uncommonly long and completely black thorax. The females have a transverse carina below the antennae. The two forms which have been found in the Philippine islands Luzon and Mindanao have large tubercles on the frons. The two forms from Borneo, Java and Sumatra, do not show this special structure. Apparently these frontal tubercles are confined to some Philippine species belonging to a few different groups.

***Psenulus crabroniformis crabroniformis*** (Smith)

1858, Smith, F., Jl. Proc. Linn. Soc. Zool., vol. 2, p. 107, "♀" (♂!) (*Mellinus crabroniformis*; Borneo).

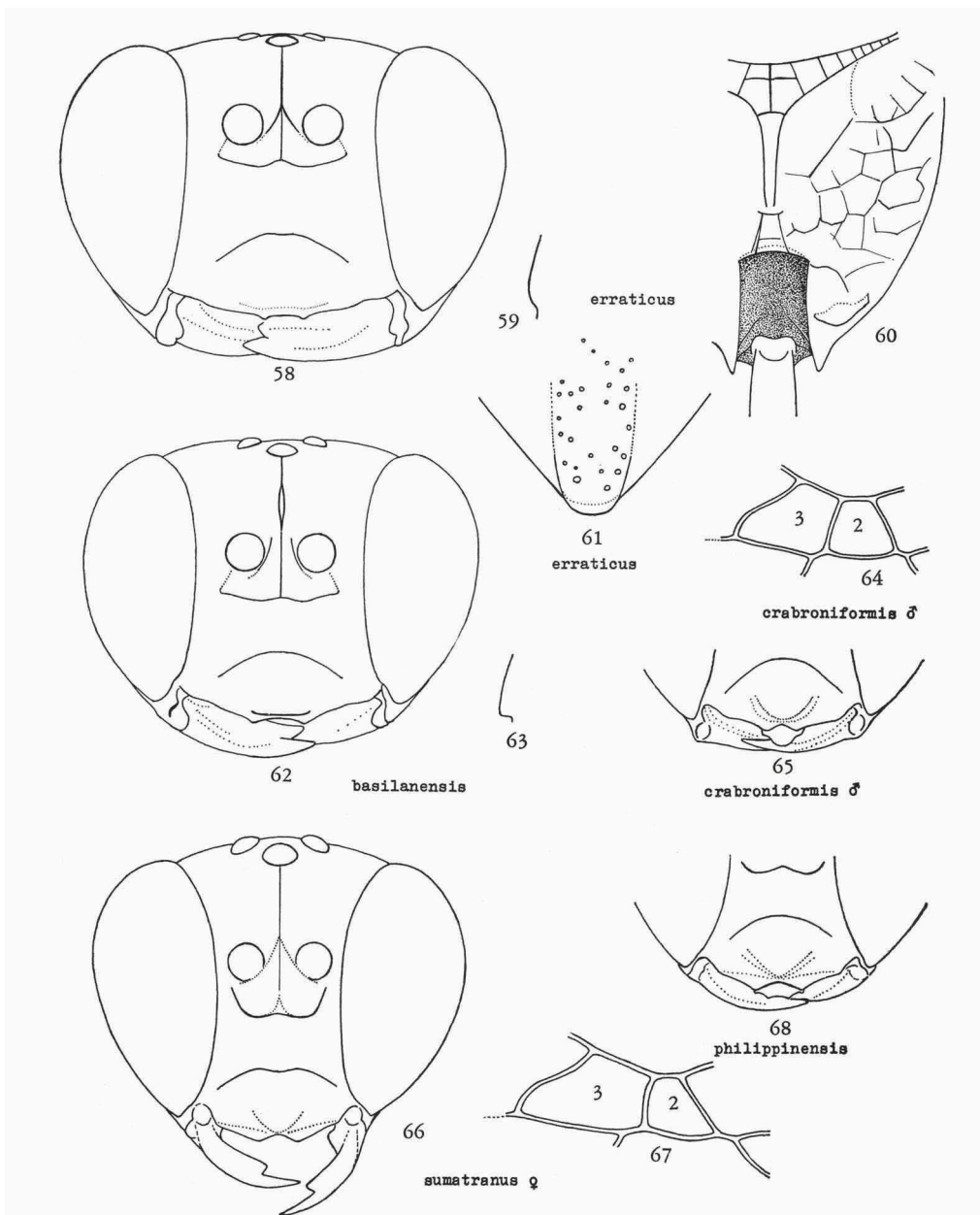
1887, Handlirsch, A., Sitzb. kais. Akad. Wissensch., vol. 96, p. 294 (*Mellinus crabroniformis*).

1907, Cameron, P., Jl. Straits Br. R. Ass., vol. 48, pp. 23-25 (*Mellinus crabroniformis*).

Male. — Head and thorax black; mandibles (except reddish tips), scape of antennae, palpi, pronotal tubercles, fore and mid tarsi, tibiae and knees yellow. Tegulae, fore and mid femora, hind legs and gaster, including petiole, pale red. Underside of flagellum reddish, upper side except pedicel brown. Labrum reddish. Wing-veins testaceous.

Depressed margin of clypeus with broad triangular emargination (fig. 65). Lower part of clypeal disk triangularly raised, surface with shallow punctures, upper half of clypeal disk almost smooth. Carina prominent between antennae, dorsal side of projecting part sharp. Below antennae it ends in a transverse carina, which is arched in frontal view, and its ends are bent upwards to the outer side of the antennal sclerites. Frons and vertex smooth and shining, flat, a small depression on outer side of lateral ocelli. Inter-ocular area slightly raised. Antennae rather slender, no tyloidea.

Pronotum with sharp anterior ridge, declining foreside partly finely transversely striate. Scutum shining, with only a few punctures, scutellum long and flat, with broad anterior foveolate groove. Prescutal sutures indistinct. Enclosed area of propodeum long, triangular, well-defined posteriorly and with distinct longitudinal carinae. Upper half of median suture of propodeum broader than in the females (males unknown) of the following species of this group, lower half widened towards apex, shining. Upper part of propodeum behind enclosed area smooth and shining. Posterior and lateral



Figs. 58-61. *Psenulus erraticus erraticus* (Smith), ♀, holotype; head, convexity of clypeus, right half of propodeum, pygidial area.

Figs. 62-63. *Psenulus erraticus basilanensis* (Rohwer), ♀, Borneo; head and convexity of clypeus.

Figs. 64-65. *Psenulus crabroniformis crabroniformis* (Smith), ♂, holotype; 64: second and third submarginal cells of left fore wing, 65: lower part of head.

Figs. 66-67. *Psenulus crabroniformis sumatranus* (Ritsema), ♀, Tjiguha (Java); 66: head, 67: second and third submarginal cells of right fore wing (from below).

Fig. 68. *Psenulus philippinensis philippinensis* (Rohwer), ♀, paratype; lower part of head.

surface of propodeum very coarsely reticulate, median upper part of propodeal declivity depressed. Hypo-epimeral area convex, mesepisternum smooth and shining, almost impunctate. Tarsi of hind legs long, inner spur about two thirds of length of basitarsus. First recurrent vein of fore wings received by first, second recurrent vein by third submarginal cell (fig. 64). Petiole long and slender, cylindrical; as it is somewhat turned it is not clear whether it reaches beyond hind femora. Gaster almost impunctate. Apical spine black.

Pubescence pale golden, partly appressed on face.

Length: about 8 mm (the way in which this specimen has been mounted does not allow exact measuring of its length).

Female unknown. It will hardly differ, except in the usual sexual characters, from the type, which has been redescribed here. Smith took this male for a female, probably being misled by the apical spine.

Borneo: 1 ♂ (holotype), Sarawak (OUM).

***Psenulus crabroniformis sumatranus* (Ritsema)**

1880, Ritsema Cz., C., Notes Leyden Mus., vol. 2, pp. 225-226, ♀ (*Psen sumatranus*; Sumatra).

Female. — Head and thorax black; yellowish are: palpi, mandibles except dark tips, scape of antennae (underside of flagellum testaceous, upper side dark-brown) and pronotal tubercles. Labrum dark-brown. Tegulae reddish. Legs brown, but knees yellowish, also tibiae and tarsi of fore and mid legs and base of hind tibiae. Base of petiole yellowish, posterior two thirds black or dark-brown; rest of gaster red, except apex of last sternite which is black. Wing-veins brown.

Depressed margin of clypeus with broad triangular emargination (fig. 66). Lower part of clypeal disk triangularly raised, indistinctly but densely punctate, upper half almost smooth. Frontal carina prominent between antennae, upper side slightly broadened but not excavate. It ends in a transverse carina below antennae which does not reach the sides and is bent upwards to the antennal sclerites. Frons and vertex smooth and shining, flat, a small half-moon-like depression on outer side of lateral ocelli. Antennae rather slender.

Pronotum dorsally with sharp anterior carina, declining foreside finely transversely striate. Scutum shining with a few scattered punctures, scutellum long and flat with broad and foveolate scutellar groove. Prescutal sutures indistinct. Enclosed area of propodeum long, triangular, well-defined posteriorly and with distinct longitudinal carinae. Horizontal part of propodeum behind enclosed area smooth and shining. Posterior surface and sides of propodeum coarsely reticulate, median upper part of propodeal declivity

depressed. Upper half of median suture of propodeum narrow, lower half widened towards apex, shining. Mesepisternum almost impunctate; hypopimeral area convex. Tarsi of hind legs long, inner spur of hind tibiae about two thirds of length of basitarsus. First recurrent vein of fore wings received by first, second recurrent by third submarginal cell (fig. 67). Petiole long and slender, cylindrical, in dorsal view reaching well beyond apex of hind femora. Gaster with minute punctures, last tergite very finely coriaceous with sparse shallow punctures. No distinct pygidial area.

Pubescence of head and thorax whitish, partly appressed on face; pubescence of gaster yellowish. Hind femora below with long whitish hairs, upper half of back bare. Lower part of epicnemial areas with round patch of dense pubescence. Pubescence of mesosternum almost appressed, densest along posterior part of median line.

Length about 10 mm.

Male unknown.

West Sumatra: 1 ♀ (holotype), van Lansberge (ML).

West Java: 1 ♀, W. Priangan, S. Sukabumi, April 1933, J. van der Vecht (MR); 1 ♀, Djampang Tengah, Mt. Tjisuru, Jan. 1933, Mrs. Walsh (ML); 1 ♀, Tjiguha, May 1938, J. van der Vecht (ML).

East Java: 1 ♀, Western slope of Idjen Mts., 500 m., 29 June 1939, J. van der Vecht (ML).

In the female from Tjiguha (W. Java) the abdomen, especially the post-petiole, is very much darkened.

The above re-description is based on the four females from Java. Later I have had an opportunity to compare these with the type in the Leiden Museum but I could not find any important differences. The only difference with the male of *Ps. crabroniformis crabroniformis* is in the colour of the petiole.

### ***Psenulus philippinensis philippinensis* (Rohwer)**

1921, Rohwer, S. A., Phil. Jl. Sc., vol. 18, no. 3, pp. 317-318, ♀ (*Diodontus philippinensis*; Luzon).

Female. — Head and thorax black; palpi and mandibles except reddish tips yellowish, labrum reddish. Scape of antennae and underside of flagellum yellow, upper side of flagellum brown. Pronotal tubercles, tegulae, fore and mid legs yellowish-red, hind legs pale red. Gaster including petiole pale red. Wing-veins pale brown.

Clypeus striato-punctate, lower part triangularly raised, depressed margin with broad triangular emargination (fig. 68). Interantennal carina prominent, dorsally slightly broadened, not excavate but with fine longitudinal



groove. It ends in a transverse carina below antennae which carina does not reach the sides; the ends are bent upwards to the outer side of the antennal sclerites. Frons with broad oblique ridges between ocelli and oculi, these tubercles shining and almost impunctate. Vertex not densely, but distinctly punctate, interocellar area raised. A small depression on outer side of lateral ocelli. Antennae slender.

Pronotum dorsally with sharp anterior carina, declining foreside finely transversely striate. Scutum with large shallow punctures which tend to transverse striation on basal half. Prescutal sutures indistinct. Scutellar suture foveolate. Scutellum long, flat and in same plane as scutum, shining and sparsely punctate. Enclosed area of propodeum relatively long, triangular, well-defined posteriorly and with sharp longitudinal carinae. Horizontal part of propodeum just behind enclosed area shining, almost smooth; posterior surface and sides of propodeum coarsely reticulate, median upper part of declivity depressed. Upper half of median longitudinal suture narrow, lower half widening towards apex, shining. Mesopleura and mesosternum shining, with sparse irregular puncturation. Hypo-epimeral area convex. Tarsi of hind legs long, inner spur of hind tibiae about two thirds of length of basitarsus. First recurrent vein of fore wings received by first, second recurrent vein by third submarginal cell. Petiole long and slender, cylindrical, extending well beyond apex of hind femora. Gaster with minute punctures. Last tergite finely coriaceous with sparse shallow punctures, no distinct pygidial area (in the female from Sierra Madre Mts. the last tergite seems to be keeled, but this may have been caused by pressure during capture or preparation).

Face below antennae with dense, short pubescence, pale golden. Rest of head with sparse, longer pubescence, the oblique tubercles are bare. Dorsal side of thorax and declivity of propodeum with yellowish-brown or somewhat golden, rather long and dense pubescence. Pubescence of mesosternum appressed and paler, densest along posterior two thirds of median line, the inner hairs are golden there. Legs and gaster with usual pubescence, petiole with long erect hairs on the sides. Fifth gastral sternite with fringe of short yellowish hairs.

Length 9-10 mm.

Male unknown.

Luzon: Rohwer recorded two females (one of these is the type, catalogue no. 22844) from Los Baños, Laguna, leg. C. F. Baker and a paratype from Lamao, Bataan (USNM). Besides the paratype from Los Baños (catalogue no. 22844) I have also examined: 1 ♀, Sierra Madre Mts., Nueva Ecija, 29 Jan. 1953, A. Concepcion (MR); 1 ♀, Antipolo, Rizal, 1 March 1953, Townes family (HT); Mount Makiling, Laguna, 1 ♀, 12 Nov. 1954, C. R.

Baltazar, 1 ♀, 5 Jan. 1954, A. A. Marmeto (BPIM and ML); 1 ♀, Cuenca, Batangas, 2 Febr. 1954, P. Feliciano (BPIM).

My description differs from Rohwer's original description in some small details. According to the latter author the clypeal margin should be truncate, but in the paratype which I could examine through the kind intermediary of Dr. K. V. Krombein, it is distinctly emarginate.

*Ps. philippinensis* is very closely related to *Ps. crabroniformis*, from which it can easily be distinguished by the raised parts of the frons. From *Ps. crabroniformis sumatranus* it further differs in the paler colour of flagellum, labrum, legs, wing-veins and in the reddish petiole. The sculpture of vertex, clypeus and scutum is somewhat coarser.

#### ***Psenulus philippinensis dapitanensis* (Rohwer)**

1923, Rohwer, S. A., Phil. Jl. Sc., vol. 22, no. 6, pp. 594-595, ♀ (*Diodontus dapitanensis*; Mindanao).

Female. — Differs from *Ps. philippinensis* in the following details. Apical two thirds of petiole dark-brown or almost black; base yellowish. Raised parts of frons less prominent and depressions on outer side of posterior ocelli smaller. Scutum densely but finely punctate, intermixed with some larger punctures.

Length about 10 mm.

Male unknown.

Mindanao: 1 ♀ (holotype), Dapitan, C. F. Baker (USNM, cat. no. 25038); 1 ♀, Butuan, C. F. Baker, no. 18897 (USNM).

Bohol: 1 ♀, Sierra Bullones, 2400 feet, 21 April 1955, C. R. Baltazar (BPIM).

Rohwer did not mention the raised parts of the frons in his description. I have not seen the type, but Dr. Krombein, who kindly compared it with a provisional key I had sent him, informed me that it ran to the same couplet of the key as *Ps. philippinensis*, from which I conclude that also the type of *Ps. dapitanensis* has these tubercles. So there is good reason to believe that both specimens from Mindanao are identical. As the structural differences between *Ps. philippinensis* (from Luzon) and *dapitanensis* (from Mindanao and Bohol) are only small, I consider the latter to be a subspecies of *Ps. philippinensis*. In the specimen from Bohol the lateral parts of the scutum are somewhat less densely punctate.

#### **Group of *Psenulus tuberculifrons***

The four species and two subspecies which have been combined in this group have a rather slender body, but the proportions of their thorax are

normal. Moreover the thorax is more or less marked with yellow. The females have three peculiar long spines on the base of the hind tibiae, which spines are also found in one of the members of the next group, *Ps. diversus*. Further the females have a very distinct transverse carina below the antennae. The femora are thick. Again the Philippine species (from Luzon, Sibuyan and Samar) have large tubercles on the frons in both sexes, whereas such structures are lacking in the species from Malaya and its subspecies from Java.

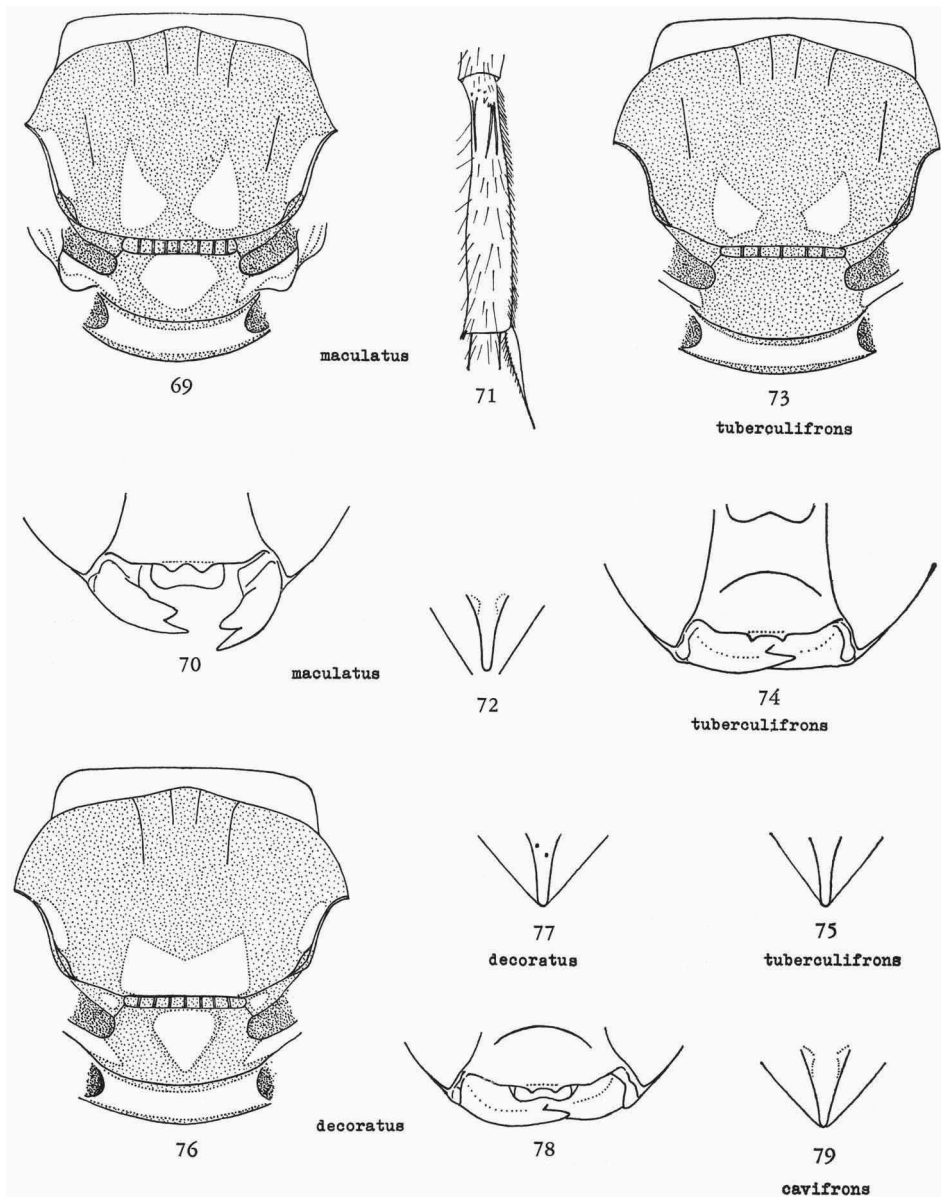
***Psenulus tuberculifrons tuberculifrons* (Rohwer)**

1921, Rohwer, S. A., Phil. Jl. Sc., vol. 18, no. 3, pp. 315-316, ♀ (*Diodontus tuberculifrons*; Luzon).

Female. Head black, except the following parts which are yellow: scape of antennae, pedicel and following four or five segments of flagellum (last segments of flagellum reddish-brown below), mandibles except dark tips and palpi. Thorax black, except following yellow parts: upper part of pronotum, pronotal tubercles, two irregular pentagonal marks on posterior part of scutum (fig. 73), hind margin of scutellum laterally, the whole metanotum and tegulae. Femora black except apices, fore and mid tibiae completely yellow, base and end of hind tibiae also yellow. Veins of wings brown. Gaster except petiole somewhat brownish-black, apex of last tergite reddish.

Clypeus slightly convex, anterior margin with two distinct teeth (fig. 74). Frontal carina prominent between antennae, dorsal side of projecting part slightly broadened and almost flat, smooth and shining. It ends in a transverse carina below antennae; this carina is arched in frontal view and the ends are bent upwards to the outer side of the antennal sclerites. Frons with two large elongate tubercles near the eyes, central part of frons on either side of median line not concave but slightly raised, and coarsely punctate. Interocellar area raised, with a few strong punctures. Vertex finely punctate. Mandibles bidentate. Antennae clavate.

Scutum with irregular, partly unsharp, puncturation. Punctures of scutellum more distinct. Scutellar groove foveolate. Enclosed area of propodeum triangular. Median longitudinal groove of propodeum not extending to apex; apical third of propodeal declivity slightly concave medianly. Upper third of declivity of propodeum with a few rugae and some fine punctures; lower two thirds of posterior surface and sides finely transversely striate, on the edges finely reticulate. Hypo-epimeral area convex. Mesopleura finely and sparsely punctate. Legs stoutly built; femora thick. Hind tibiae depressed near base and with three long but fine spines. The first recurrent vein of the fore wings ends in the first, the second recurrent vein in the third



Figs. 69-72. *Psenulus maculatus maculatus* n. sp., ♀, holotype; thorax, lower part of face, left hind tibia and pygidial area.

Figs. 73-75. *Psenulus tuberculifrons tuberculifrons* (Rohwer), ♀, paratype; thorax, lower part of face, pygidial area.

Figs. 76-78. *Psenulus tuberculifrons decoratus* n. subsp., ♀, holotype; thorax, pygidial area and lower part of face.

Fig. 79. *Psenulus cavifrons* n. sp., ♀, holotype; pygidial area.

submarginal cell. Petiole cylindrical. Pygidial area narrow, on the apical half the carinae are almost parallel (fig. 75).

Pubescence greyish. Face pale golden, hairs partly appressed. Antennae with conspicuous whitish, short and appressed pubescence on basal half of underside. Epicnemial areas below with circular patch of greyish and golden hairs. Mesosternum with long whitish hairs, pubescence medianly more dense and golden. Fourth and fifth gastral sternites with apical fringe of short hairs, sixth sternite with a patch of brownish appressed hairs. Hind femora bare on upper half of their back surface.

Length about 8.5 mm.

Male unknown.

Luzon: 2 ♀ (one holotype, cat. no. 22842), Los Baños, Laguna, C. F. Baker (USNM), 1 ♀, Mt. Banahao, C. F. Baker (USNM).

Through the courtesy of the authorities of the United States National Museum of Washington I have been able to examine the paratype from Los Baños. The yellow band on its metanotum is broad with only a very slight emargination on the hind margin. The interruption to which Rohwer refers seems to occur only in the specimen from Mount Banahao.

The species is characterized by the two elongate and shining tubercles on the frons, together with the transverse carina below the antennae and the yellow markings on the scutum. It differs from *Ps. cavifrons* in the slightly convex part of the frons between the median line and the large lateral tubercles. *Ps. tuberculifrons decoratus* is closely allied, but the colour-pattern of the latter contains much more yellow.

***Psenulus tuberculifrons decoratus* n. subsp.**

Female. — Head and thorax black, except the following parts which are yellow: scape and underside of antennae, mandibles except dark tips, pronotum, pronotal tubercles, tegulae, a short broad line along the tegulae, a great mark on scutum (fig. 76) in front of scutellum, this mark triangularly emarginate on its fore margin, a small spot on axillae, a large triangle on scutellum and two lateral spots on its hind margin, metanotum and greater part of propodeum. Labrum red. Legs yellow except black base of fore and mid femora, upper side of hind femora and underside of hind tibiae. The ends of the fore and mid tarsi and the whole hind tarsi are brownish. Wing-veins dark brown. Gaster black, the first gastral tergite is red on its posterior part, second gastral tergite with a broad reddish transverse band.

The structural differences as compared with the nominate form from Luzon are unimportant only. The distance between the clypeal teeth is slightly smaller (fig. 78). The frontal carina between the antennae is somewhat

broadened dorsally, smooth and shining there. The lateral tubercles of the frons are more prominent. Scutum and scutellum more coarsely punctate. The longitudinal carinae of the enclosed area of the propodeum are irregular, probably deformed. Pygidial area: fig. 77.

Pubescence of frons and face golden, rest of body with yellowish-grey pubescence.

Length about 8 mm.

Male unknown.

Sibuyan: 1 ♀ (holotype), C. F. Baker (USNM).

***Psenulus cavifrons* n. sp.**

Female. — Similar to *Ps. tuberculifrons* but differing in the following characters: Scutum laterally also with a small yellow mark along the tegulae. Central part of frons between the large lateral tubercles not somewhat raised, as in *Ps. tuberculifrons*, but slightly concave. The interocellar area is somewhat less raised than in the preceding species and has a few distinct punctures. Vertex finely punctate. Scutum finely punctate, with a few larger punctures, on the whole finer than in *Ps. tuberculifrons*. Oblique striation of propodeal declivity less distinct on upper median part. Pygidial area elongate-triangular, carinae not parallel (fig. 79).

Pubescence of face silvery.

Length about 8 mm.

Male unknown.

Samar: 1 ♀ (holotype), C. F. Baker (USNM).

At first glance there is a confusing similarity with the preceding species, but in view of the two important structural differences (concavity of frons and shape of pygidial area) I prefer to regard them as separate species.

***Psenulus maurus* (Rohwer)**

1921, Rohwer, S. A., Phil. Jl. Sc., vol. 18, no. 3, pp. 316-317, ♂ (*Diodontus maurus*; Luzon).

Original description: "Male. — Length, 7 millimeters. Clypeus convex medially, the apical margin with two obtuse teeth, which are separated by a U-shaped emargination; clypeus and face with distinct, separate punctures; frontal carina weak dorsally, very prominent between bases of antennae to the transverse facial carina; transverse facial carina nearly complete to eye margins where it joins a raised line which follows the eye margins; frons and vertex shining and sparsely punctured; on the frons near the top of the eye is an elongate, shining tubercle; intraocellar area and behind a narrow curved depressed line; postocellar line slightly longer than the ocellocular line; antennae submoniliform, the third joint slightly longer than the fourth; anterior dorsal margin of the pronotum carinate and feebly dentate laterally; scutum shining, with well-separated, distinct punctures; parapsidal furrows present anteriorly;

scutellum and metanotum punctured like the scutum; propodeum coarsely reticulate, the median impressed line of uniform width; mesopleura shining, almost impunctate, the sutures feebly foveolate; longer calcarium of the posterior tibia shorter than the hind basitarsus; petiole cylindrical, fully as long as hind trochanter and femur; abdomen shining; first recurrent joining first cubital well before the apex. Black; mandibles except apices, spot on tubercles, scape beneath, and four anterior tibiae and tarsi yellow; rather sparsely clothed with silvery hair; wings hyaline, iridescent; venation black.

Type locality. — Mount Maquiling, Laguna, Luzon. Described from one male received from C. F. Baker.

Type. — Catalogue No. 22843, United States National Museum."

It is very likely indeed, that this male is allied to *Ps. tuberculifrons*, as Rohwer suggested, but it is much darker. The coarsely reticulate posterior surface of the propodeum corresponds with that of the male of *Ps. maculatus javanensis*, which has been placed in the same group, but which has no frontal tubercles. Unfortunately there are no other males of this group available.

***Psenulus maculatus maculatus* n. sp. and subsp.**

Female. — Head black, with the following yellow parts: scape of antennae (except dark upper side of apex), underside of pedicel and of following five or six segments (the apical four segments are completely black) and mandibles except tips which are dark. Labrum reddish. Thorax black except following yellow parts (fig. 69): pronotum, pronotal tubercles, tegulae partly, two elongate spots on scutum against tegulae and two triangular marks in front of scutellum, an irregular large spot on scutellum, a small indistinct spot on axillae, lateral hind margin of scutellum, metanotum, four large elongate marks on propodeum, and underside of coxae. Fore and mid legs yellow, except base of femora; hind legs brown or reddish-brown but underside of hind femora yellow. Petiole black, rest of gaster red. Veins of wings brown.

Clypeal margin almost straight, with two triangular teeth (fig. 70), central part of clypeus convex. Interantennal carina sharp, a transverse carina below antennae. Frons and vertex sparsely, minutely punctate. Mandibles bidentate at apex. Antennae clavate.

Scutum and scutellum finely but distinctly punctate. Enclosed area of propodeum triangular, space between the two inner longitudinal carinae with irregular carination; propodeum just behind enclosed are smooth and shining, posterior surface of propodeum almost smooth, with a few indistinct oblique rugae and fine punctures; median groove narrow; sides of propodeum with irregular reticulation. Femora short and thick; upper half of back of hind femora smooth and shining. Apex of mid tibiae with short triangular and flat groove, two short spines on posterior margin of this groove. Base

of hind tibiae depressed and with three long spines (fig. 71), a row of short spines at apex. First recurrent vein of fore wings received by first submarginal cell, second recurrent vein by third submarginal cell. Petiole cylindrical, dorsally somewhat flattened. Pygidial area elongate-triangular, basally with row of punctures along margin (fig. 72).

Pubescence of face and temples silvery, rest of head brown-golden. Pubescence of thorax yellowish-grey, white below, pale golden along median carina of mesosternum. Gaster with yellowish-brown pubescence which is dense on margin of fourth and fifth gastral sternites and on disk of sixth sternite. Epicnemial areas below with round patch of appressed pubescence.

Length about 8.5-9 mm.

Male unknown.

Malaya: 1 ♀ (holotype), 31 May 1955, 1 ♀ (paratype), 30 June 1955, at *Grewia paniculata*, both from Penang, 25¼ mile Sungai Pinang Hills, H. T. Pagden (HTP).

In the paratype the yellow mark on the scutellum is more extended and connected with the yellow lateral parts of the hind margin.

#### ***Psenulus maculatus javanensis* n. subsp.**

Female. — Much darker than preceding form. Scape of antennae with brown streak above. Yellow upper side of pronotum sometimes indistinctly interrupted in the middle, laterally somewhat shortened. Triangular marks in front of scutellum reduced to two small spots or completely lacking. Yellow mark on scutellum smaller, though variable in size, spots on propodeum small. Coxae black; apices of fore and mid femora and underside of hind femora yellow, fore tibiae yellow with a black mark below. First gastral tergite and base of second tergite black-brown. Posterior surface of propodeum below with more distinct fine oblique rugae.

Pubescence of frons and vertex whitish.

Length about 8-9 mm.

Male. — Similar to female, but propodeum without yellow marks and posterior surface very coarsely reticulate, except a narrow smooth area behind the enclosed area. Antennae normal, not very long, twelfth segment about as long as it is broad at the base. Upper half of back of hind femora bare and shining, as in female.

Length about 9 mm.

West Java: 1 ♀ (holotype) and 1 ♂ (allotype), Mt. Tjisuru, Djampang Tengah, Jan. 1933, Mrs. M. E. Walsh (ML); 1 ♀, Radjamandala, Djampang Wetan, Oct. 1936, Mrs. M. E. Walsh (MR); 1 ♀, W. Preanger, S.



Sukabumi, March 1933, J. van der Vecht (ML); the latter two are paratypes.

East Java: 1 ♀ (paratype), Malang, March 1933, J. G. Betrem (ML).

#### Group of ***Psenulus nigrolineatus***

The group of *Ps. nigrolineatus* seems to be closely allied to the preceding one. One of its representatives, *Ps. diversus* ♀, has the same long spines on the base of the hind tibiae. In the other females the depressed area on the base of the hind tibiae is margined by a larger number of very short, but strong spines. All the females and the only male which could be recognized with certainty have a very conspicuous transverse projection on either side of the metanotum; these projections are pointing inwards across the lateral depressions of the metanotum. This peculiar structure is lacking in the two males of *Ps. varius* which have been placed here provisionally.

All the forms of this group are relatively large. They occur in the Philippine islands Luzon, Sibuyan and Mindanao, and also in Borneo, Sumatra and Malaya. In spite of this vast area of distribution most of them are so closely related that I regard them as subspecies of *Ps. nigrolinca'us*.

#### ***Psenulus nigrolineatus nigrolineatus*** (Cameron)

1907, Cameron, P., Jl. Straits Br. R. Asiat. Soc., vol. 48, pp. 22-23, ♀ (*Mellinus nigrolineatus*; Borneo).

1920, Turner, R. E. Ann. Mag. Nat. Hist. Lond., ser. 9, vol. 5, p. 267 (*Psenulus nigrolineatus*).

Original description: "Thorax pale testaceous, the metanotum pale yellow, the abdomen rufo-testaceous; the head, a broad line in the middle of the basal half of mesonotum, a slightly narrower one on the apical three-fourths down the sides, the furrow at the base of the scutellum, the metanotal area, the central furrow, its apex, the centre of propleurae broadly, the mesosternum, the apex of mesopleurae and the base of meta-pleurae, black; the apex of the petiole and the base of the dilated part broadly, infuscated; antennae black, the scape yellowish, the basal joints of flagellum testaceous below. Wings hyaline, iridescent, the costa, stigma and nervures fuscous. ♀.

Length 10 mm.

Kuching, January 14th.

Face and clypeus densely covered with silvery pubescence as are also, but less densely, the sides of the front; the vertex is smooth, shining and sparsely haired. Below the antennae is a transverse keel; between it and the base of the antennae is a longitudinal plate, rounded and narrowed in the middle. Eyes large slightly diverging below, coarsely faceted. Thorax smooth, shining, sparsely haired; the furrow at the base of scutellum, stoutly crenulated. On either side of the metanotal area are six stout, clearly separated keels. The base of propleurae stoutly, irregularly striated. The dilated apex of petiole large, longer than wide, pyriform. The mandibles are testaceous, tinged with yellow-collar transverse, margined at the base. Tibiae fringed with white hair; the tarsi covered with darker, shorter, stiffer hair. The apical half of the metanotum has the sides transversely striated. The petiole is distinctly, roundly curved and is much more dilated than in *pygmaeus* or *arvensis*; it is longer than the following 2 segments united."

In view of the transverse carina below the antennae and the relatively large size of this wasp I had already placed it in the same group as *Ps. nigrolineatus ajax* (Rohwer). Dr. J. van der Vecht, who examined the type in the British Museum (Natural History) in London (♀, 14 Jan. 1898, no. 21.837) confirmed that it has similar projections of the metanotum, whilst the structure of mid and hind legs and the venation of the fore wings also agree with that of *Ps. ajax*. The pygidial area is narrow. The differences from all the other forms except one belonging to this group are so small that I have considered them to be of subspecific value only.

A female from North Borneo almost completely agrees with the original description, but the median line on the scutum is as long as the anterior two thirds and the lateral lines are at least as long as the posterior five sixths part of the scutum (fig. 80). The lower part of the epicnemial areas is yellow. Anterior margin of clypeus with two distinct teeth (fig. 81). Metanotum laterally with a transverse projection across the depressed area of the metanotum. Hind margin of scutellum laterally with tooth (fig. 82). Base of hind tibiae with smooth depressed area, this area at basal margin with a number of stout but short spines (fig. 83). Pygidial area: fig. 84.

I was fortunate enough to find a male of the group of *Ps. nigrolineatus* amongst the Malayan material, which the British Museum (Natural History) kindly allowed me to study. I had already seen a good many females belonging to this group but this was the first male which could be reckoned to this group with certainty, as it shows the same peculiar — partly transparent — transverse projections of the metanotum. This male, collected in Pahang, closely resembles the female from Borneo mentioned above. The markings of the scutum are about the same, but the median spot is more distinctly pointed at the apex. The epicnemial areas are completely black, also the mesopleura, except the anterior plate, an adjacent spot and the hypopleural area, which are yellow. The black band on the base of the propodeum is broader.

Antennal segments 5-12 with distinct tyloidea, that on the twelfth segment is small. Transverse projections of metanotum broad, the posterior part of the apices is transparent. Lower three fourths of posterior surface of propodeum coarsely reticulate. Hind legs as in *Ps. nigrolineatus ajax*.

Borneo: 1 ♀ (holotype), Kuching, 14 Jan. 1898 (BM, no. 21837); 1 ♀, Kudat (North Borneo), 7 Sept. 1927, C. Boden Kloss and H. M. Pendlebury (BM, 1955-354, ex FMS Museum).

Malaya: 1 ♂, Pahang, Fraser's Hill, 4000 feet, 30 May 1932, H. M. Pendlebury (BM, 1955-354, ex FMS Museum).

Turner (1920) records a variety of *Ps. nigrolineatus* which occurs in

Ceylon. I have seen a male and a female, both taken at Kandy by O. S. Wickwar in June 1918 (BM). They probably belong to two different species, but certainly not to the group of *Ps. nigrolineatus*.

***Psenulus nigrolineatus ajax* (Rohwer)**

1921, Rohwer, S. A., Phil. Jl. Sc., vol. 18, no. 3, pp. 320-321, ♀ (*Diodontus ajax*; Luzon).

Original description: "Female. — Length, 12 millimeters. Labrum broadly arcuately emarginate apically and with a fringe of hair; clypeus convex, with separate, distinct punctures, the apical margin with two small teeth; frontal carina prominent and sharp, terminating ventrally in a transverse ridge which does not quite reach the eye margin; frons and vertex shining, with small sparse punctures, no tubercles on frons, ocelli in a low triangle; the postcellar line subequal with the ocellocular line; flagellum only slightly thickened apically, the first joint somewhat longer than the second; pronotum sharply carinate anteriorly but not toothed; scutum shining, with small, well-separated punctures, parapsidal furrows present anteriorly; scutum in front of scutellum strongly foveolate; scutellum and metanotum smooth, impunctate; mesopleura smooth, polished, the posterior aspect finely aciculate, dorsal aspect with a transverse area which has twelve longitudinal carinae; median sulcus of posterior surface strong and of uniform width; legs rather hairy; longer spur of hind tibia as long as the basitarsus, strongly angled basad of middle; petiole cylindrical, without carinae, nearly as long as hind trochanter and femur; abdomen polished; first recurrent before the first intercubitus by a distance as great as the second abscissa of radius, the second recurrent the same distance beyond the second intercubitus; third intercubitus forming a right angle with the cubitus for a short distance only, then strong-curving inward to the radius so that the third cubital is one-fourth longer on the cubitus. Head black; a yellow spot on mandibles; antennae black, scape, pedicellum, and most of flagellum beneath yellowish; thorax black with the following yellow marks: Top of pronotum, tegulae, scutum except a large median and a small lateral spot, scutellum, metanotum, two large spots on posterior and lateral surfaces of propodeum, top of mesepisternum; legs yellow, posterior femora and tibiae above black; hind tarsi brownish; abdomen reddish, base of petiole yellow, its apex blackish; wings hyaline, iridescent; venation dark brown.

Type locality. — Mount Maquiling, Laguna, Luzon. Described from one female received from C. F. Baker.

Type. — Catalogue No. 22847, United States National Museum."

Dr. Krombein kindly informed me in a letter of 13 Nov. 1958 that the structure of the mid tibiae and of the pygidium of the type agrees with that of *Ps. nigrolineatus flavicornis*. Judging from the original description the type mainly differs from the forms which have been described under this group in the less extensive black colour on the scutum.

The female from Singapore mentioned by Rohwer (1923) is to be regarded as a different species (*Ps. diversus* n. sp., see p. 70).

***Psenulus nigrolineatus flavicornis* n. subsp.**

Female. — Head black; the following parts are yellow: mandibles except dark tips, and palpi. Scape of antennae and following two segments com-

pletely yellow, fourth and fifth antennal segments partly yellow above, rest of flagellum black above, pale reddish below. Pronotum dorsally and also pronotal tubercles yellow. Scutum yellow with broad black lateral lines and a median line which is still broader but which is very much narrowed near the scutellum (fig. 85). Scutellum yellow except black scutellar suture and lateral depressions. Metanotum yellow. Propodeum yellow with broad black band at base and a narrower band at apex, median groove also black. Mesosternum, mesopleura and metapleura black but with the following yellow parts: Anterior plate, hypo-epimeral area and a large irregular mark below the hypo-epimeral area. Fore and mid legs including coxae and also hind coxae yellow; hind femora reddish-brown on back, hind tibiae brown except yellow underside; hind tarsi completely brown. Veins of wings brown. Base of petiole yellowish, apex dark-brown, rest of gaster reddish.

Clypeus convex, anterior margin with two strong triangular teeth. Inter-antennal carina prominent between antennae, sharp dorsally, it ends below the antennae in a distinct transverse carina. Frons and vertex shining, with fine puncturation. Antennae long, last segment more than twice as long as it is broad at the base.

Pronotum with sharp antero-dorsal carina. Scutum with fine but distinct punctures. Base of metanotum laterally with a very long projection which is partly sclerotized. Enclosed area of propodeum triangular, with usual longitudinal carinae. Posterior surface of propodeum smooth and shining behind the enclosed area, lower part with weak transverse rugae, median longitudinal groove narrow. Hypo-epimeral area well-defined. Mid tibiae at apex with longitudinal depression, which is defined anteriorly by a long oblique raised area, hind margin of depression with four relatively long reddish spines. Upper half of back surface of hind femora smooth, and shining, defined below by a longitudinal row of fine hair-bearing punctures. Hind tibiae longitudinally depressed at base, this depression is smooth and in front of it there are a number of short but strong spines. The first recurrent vein of the fore wings ends in the first, the second recurrent vein in the third submarginal cell. Petiole cylindrical, in dorsal view not sharply separated from postpetiole. Pygidial area elongate (fig. 86), smooth, with sharp lateral carinae.

Pubescence yellowish, face silvery or pale golden. Mesosternum on both sides of median carina with long apically directed golden hairs. Lower part of epicnemial areas with round patch of golden-yellowish pubescence. Margin of fourth and fifth gastral sternites with dense brown-golden pubescence.

Length about 11 mm.

Male unknown.

Sibuyan: 1 ♀ (holotype), C. F. Baker (USNM, no. 21322); 1 ♀ (paratype), C. F. Baker (USNM, no. 21322); 1 ♀ (paratype), C. F. Baker (USNM).

***Psenulus nigrolineatus dubius* n. subsp.**

Very similar to preceding subspecies, but somewhat darker. Second and following segments of antennae dark-brown above. Hind margin of scutellum brown. Black band on base of propodeum broader than in *Ps. nigrolineatus flavicornis*. First gastral tergite darkened above.

Pubescence of face pale golden.

Length about 11 mm.

Male unknown.

Mindanao: 1 ♀ (holotype), Butuan, C. F. Baker (USNM).

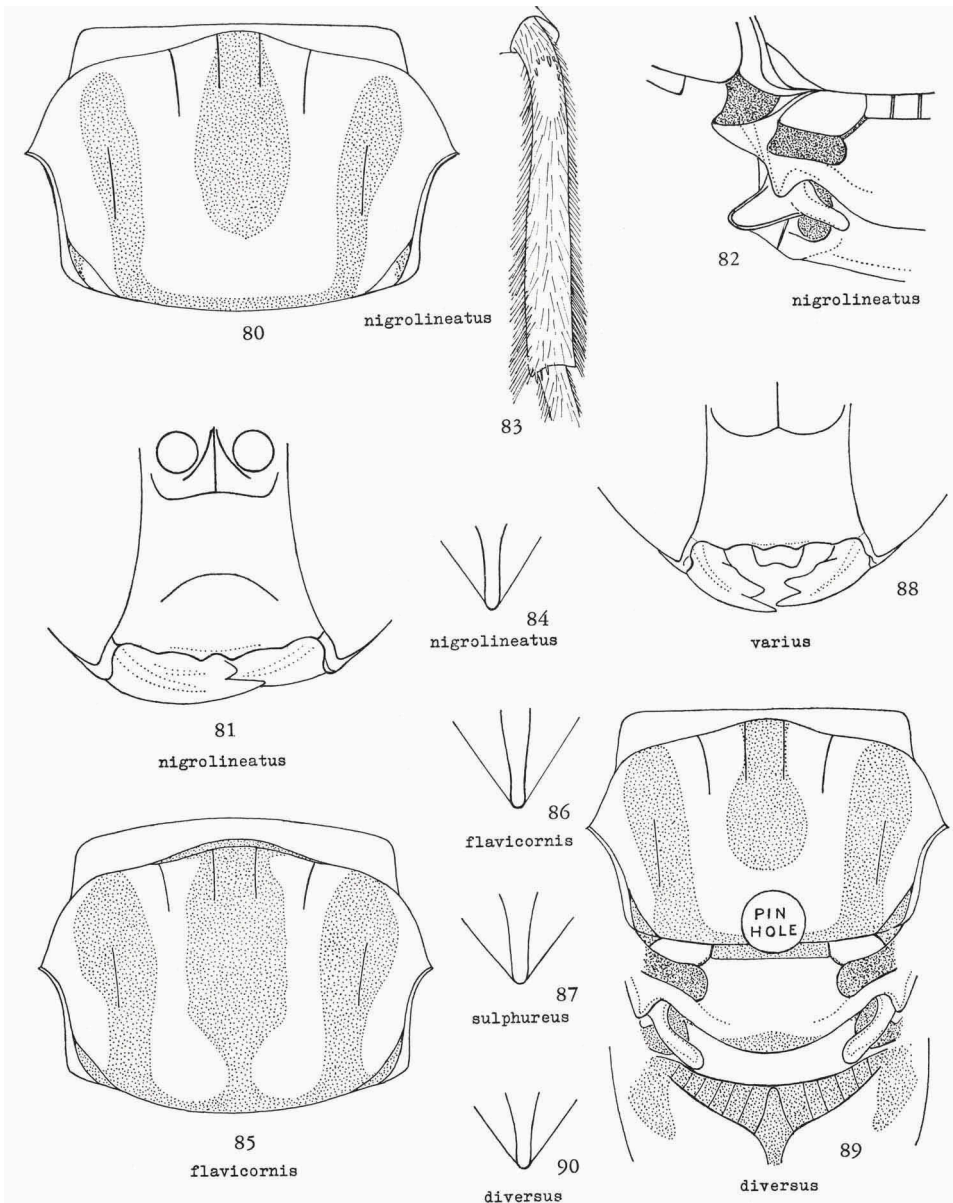
The differences between this form and the preceding subspecies are not very important. As it is the only specimen of this group which has been found on Mindanao, further material is needed to prove the constancy of the distinguishing characters which have been used here.

***Psenulus nigrolineatus sulphureus* n. subsp.**

Female. — Head black; mandibles except dark tips and palpi yellow. Scape of antennae and underside of base of flagellum yellow, rest of flagellum reddish-brown below, flagellum black above. Labrum reddish. Thorax sulphureous-yellow, the following parts are black: a broad line on anterior two thirds of scutum and complete lateral lines which are gradually tapering towards the scutellum, a narrow black margin round the propodeum, enclosed area and median longitudinal groove, epicnemial areas, mesosternum, posterior and lower part of mesopleura, and metapleura. Legs yellow, upper side of hind legs reddish-brown, tarsi and a spot on mid tibiae reddish. Veins of wings brown. Base of petiole yellowish, apex black-brown. Rest of gaster reddish but first tergite black-brown above.

Central part of clypeus convex, margin with two distinct, well-separated teeth. Projecting part of interantennal carina not broadened dorsally, this carina ends below antennae in a distinct transverse carina. Vertex almost impunctate. Antennae long, last segment more than twice as long as it is broad at the base.

Scutum dull, with minute punctures. Metanotum laterally with long projection, as in *Ps. nigrolineatus nigrolineatus*. Enclosed area of propodeum ill-defined posteriorly, with about ten longitudinal carinae. Posterior surface



Figs. 80-84. *Psenulus nigrolineatus nigrolineatus* (Cameron), ♀, Borneo; scutum, lower part of face, left part of scutellum and metanotum, showing tooth of scutellum and transverse projection of metanotum, left hind tibia and pygidial area.

Figs. 85-86. *Psenulus nigrolineatus flavicornis* n. subsp., ♀, holotype; scutum and pygidial area.

Fig. 87. *Psenulus nigrolineatus sulphureus* n. subsp., ♀, holotype; pygidial area.

Fig. 88. *Psenulus varius* n. sp., ♂, holotype; lower part of face.

Figs. 89-90. *Psenulus diversus* n. sp., ♀, holotype; thorax and pygidial area.

of propodeum smooth and shining behind enclosed area, lower part with weak transverse rugae, median longitudinal groove narrow. Hypo-epimeral area well-defined. Legs as in *Ps. nigrolineatus nigrolineatus*. First recurrent vein of fore wings received by first, second recurrent vein by third sub-marginal cell. Petiole cylindrical, gaster with minute puncturation. Pygidial area elongate-triangular, with rounded apex, smooth, lateral carinae sharp (fig. 87).

Pubescence greyish, on hind legs and gaster yellowish. Face silvery, hairs partly appressed. Margin of fourth and fifth gastral sternites with dense and short yellowish-golden pubescence, sixth sternite with somewhat longer, appressed hairs of the same colour.

Length about 12 mm.

Male unknown.

West Sumatra: 1 ♀ (holotype), Anai cleft, 500 m, 1926, leg. E. Jacobson (ML).

A large species, if well-preserved easily distinguished from the other subspecies by the sulphureous-yellow colour of the thorax. Apart from the lateral black lines of the scutum being complete there is very little difference with the typical subspecies in the black markings (fig. 80). The pygidial area seems to be somewhat broader than in the typical subspecies.

#### ***Psenulus varius* n. sp.**

Male. — Head black; margin of clypeus reddish, mandibles except dark tips yellow, palpi pale yellow, labrum testaceous. Scape of antennae and pedicel yellow, upper side of flagellum brown, underside pale brown. Thorax black; the following parts are yellow: dorsal part of pronotum, pronotal tubercles, scutum except three broad black lines (the median one abruptly narrowed in front of scutellum almost as in *Ps. nigrolineatus flavicornis*, tegulae, scutellum except a dark spot on the hind margin, axillae, metanotum, and four large elongate spots on the propodeum; these spots are connected at the apex. Upper two thirds of anterior plate of mesepisternum yellow, a small spot below fore and hind wings, a larger spot on the mesopleura below. Fore and mid legs entirely reddish-yellow, coxae yellow; hind legs reddish except coxae which are yellow and trochanters which are brown. Veins of wings brown. Gaster including petiole reddish.

Anterior margin of clypeus nearly straight (fig. 88) with two small blunt teeth, surface of clypeus finely and densely punctate. Interantennal carina sharp, it ends below the antennae in a transverse carina which is bilobed in frontal view. Frons and vertex shining, almost impunctate. Mandibles bidentate at apex, a small indistinct tooth halfway the upper margin. Antennae

long, segments cylindrical, slightly flattened below and somewhat rounded on foreside.

Scutum finely punctate, prescutal sutures about one fourth of length of scutum. Scutellar suture foveolate. Enclosed part of propodeum triangular, relatively long. Upper part of propodeal declivity shining, lower part of posterior surface of propodeum and the sides irregularly reticulate. Median longitudinal groove narrowing towards apex. Legs slender, hind femora extending beyond petiole. Apex of mid tibiae with in total three red spines, two of which are placed on the apical margin; a small circular depression just before margin. Inner spur of hind tibiae about as long as four fifths of basitarsus. First and third submarginal cells each receiving a recurrent vein. Petiole cylindrical.

Pubescence whitish, on face silvery, for the greater part appressed, frons and temples with dense silvery pubescence.

Length about 9 mm.

Female unknown.

Malaya: Selangor, Kuala Lumpur, 1 ♂ (holotype), 15 March 1950, 1 ♂ (paratype), Tanglin Road, 18 Sept. 1935, both H. T. Pagden (HTP).

In the male captured in September the apex of the petiole is darkened, but in all other respects it agrees with the male taken in March.

Neither of the two males has conspicuous projections on the metanotum like the other forms of the group of *Ps. nigrolineatus*. On the other hand the apical spines of the mid tibiae agree with those of the female of *Ps. diversus* from Singapore, and also in regard to the colour-pattern of the thorax there exists a great resemblance, so that I have provisionally placed these males in the group of *Ps. nigrolineatus*.

### ***Psenulus diversus* n. sp.**

1923, Rohwer, S. A., Phil. Jl. Sc., vol. 22, no. 6, p. 597, ♀ (*Diodontus ajax*; Singapore).

Differs from *Ps. nigrolineatus sulphureus* in the following details: Yellow colour of thorax darker. Scutellum with low black triangle on hind margin (fig. 89). On the sides of the thorax the following parts are yellow: anterior plate of mesepisternum, a vague small spot behind the anterior oblique suture and the whole hypo-epimeral area. Hind femora yellow below, upper side and complete hind tibiae reddish. Gaster including petiole reddish, petiole slightly darkened posteriorly.

Scutum with fine but distinct puncturation. Mid tibiae with only two red spines on hind margin of the indistinct groove at the apex, raised longitudinal area in front of this groove also indistinct. Hind tibiae depressed



near base, three long spines at the base of this depression and also a number of short indistinct spines. Pygidial area: fig. 90.

Dense whitish pubescence on margin of fourth and fifth gastral sternites. Length about 9.5 mm.

Male unknown.

Singapore: 1 ♀ (holotype), C. F. Baker (USNM).

This wasp very closely resembles the species of the group of *Ps. nigrolineatus*, having the same long lateral projections of the metanotum, but it is smaller and darker, whilst the petiole is almost completely reddish. The structure of the apex of the mid tibiae and of the base of the hind tibiae is quite different. In this respect it approaches the group of *Ps. maculatus* and therefore it is certainly not identical with *Ps. nigrolineatus ajax* as Rohwer thought it to be, nor a subspecies of it.

#### Group of ***Psenulus luteopictus***

The small group of *Ps. luteopictus* consists of one species with one subspecies, occurring in Luzon, Negros and Mindoro. They are also large and as in the preceding three groups the first recurrent vein of the fore wings ends in the first submarginal cell, but the transverse carina below the antennae and also the pygidial area are lacking in the females. The dorsal side of the pygidium is even somewhat keeled.

#### ***Psenulus luteopictus luteopictus*** (Rohwer)

1921, Rohwer, S. A., Phil. Jl. Sc., vol. 18, no. 3, pp. 319-320, ♀ (*Diodontus luteopictus*; Luzon).

Female. — Head black; mandibles yellow except dark tips, labrum and palpi yellowish. Scape of antennae, pedicel and underside of flagellum yellow; upper side of antennae dark-brown. Thorax black; the following parts are yellow: pronotum dorsally, pronotal tubercles, scutum except broad black median line, which is narrowed in front of the scutellum and two long lateral triangles, which extend from the pronotum to the scutellum or nearly to the scutellum (fig. 93 and 91), tegulae, scutellum and metanotum. Also propodeum yellow except base, enclosed area with lateral adjacent spots, median groove and apex, which are all black. Upper two thirds of anterior plate of mesepisternum, and anterior two thirds of hypo-epimeral area yellow. Fore and mid legs yellow, tarsi red, base of mid coxae brown. Hind legs brown except yellow coxae, yellow underside of femora and paler base of tibiae. Veins of wings brown. Petiole brown, paler at base, apex almost black; rest of gaster red.

Lower part of clypeus shining, almost impunctate, resembling that of *Ps. nigrolineatus*, margin with two distinct teeth. Interantennal carina sharp, a very indistinct transverse carina below antennae. Vertex with a few distinct punctures. Interocellar area raised, shining, with a few punctures. Antennae short, clavate.

Pronotum with sharp antero-dorsal carina, angles sharp or at least not rounded. Scutum shining, with sparse, but large irregular punctures. Parapsidal sutures almost extending to scutellum. Enclosed area of propodeum triangular, long, posterior surface of propodeum with irregular reticulation and a few transverse rugae. Anterior oblique suture simple, not foveolate. Legs normal. The first recurrent vein of the fore wings ends in the first submarginal cell, the second recurrent vein in the third submarginal cell (fig. 92). Petiole cylindrical, it reaches beyond the hind femora when they are stretched. Last tergite without pygidial area, distinctly keeled.

Pubescence of head golden, dense, appressed on face. Interocellar area bare. Pubescence of thorax and petiole long, yellowish-grey, white on mesosternum. Pubescence of gaster short, dense on margin of fourth and fifth gastral sternites and on base of sixth sternite. Epicnemial areas below with a large, golden pubescent spot.

Length about 10 mm.

Male unknown.

Luzon: 1 ♀ (holotype), Mount Makiling, C. F. Baker (USNM, cat. no. 22849) (I have not seen this specimen); 1 ♀, Mount Limay, C. F. Baker (USNM, paratype no. 22846); 1 ♀, Antipolo, Rizal, 1 March 1953, Townes family (HT).

Negros: I have seen two females from Cuernos Mounts, collected by C. F. Baker (USNM, no. 21321), which are decidedly darker than the specimens from Luzon. The yellow markings on the sides of the thorax are more reduced, but the degree of the reduction varies in the two specimens. The black colour on the base of the propodeum is somewhat more extended. The axillae are black instead of yellow as in the females from Luzon. They may belong to a geographical subspecies but I should like to see more material before taking a decision.

*Ps. luteopictus* is characterized by the venation of the fore wings, the anterior oblique suture which is not foveolate as in most other species, the absence of a distinct transverse carina below the antennae and of the pygidial area, the very clavate antennae and the strong puncturation of the scutum.

I conclude from the original description that in the holotype from Mt. Makiling the lateral black lines are extending to the hind margin of the scutum.

***Psenulus luteopictus calapanensis* n. subsp.**

Like the females of *Ps. luteopictus* from Negros a female from Mindoro is also somewhat darker than the form from Luzon. As there are also a few distinct structural differences I have considered it as a good subspecies.

The lateral black markings on the scutum extend to the hind margin, as in *Ps. luteopictus luteopictus* from Negros (fig. 93). The axillae are black, the petiole is almost completely dark-brown.

Scutum nearly impunctate. Interocellar area less raised than in the nominate subspecies.

Length about 9.5 mm.

Mindoro: 1 ♀ (holotype), St. Louis, Calapan, 150 feet, 15 April 1954, H. M. and D. Townes (HT).

**Group of *Psenulus sandakanensis***

In the group of *Ps. sandakanensis* I have provisionally placed a number of species, mostly males, in which the first recurrent vein of the fore wings ends in the first submarginal cell close to the radial sector, and in which the colour pattern of the thorax is more or less similar. Of *Ps. filicornis*, *Ps. ajaxellus*, *Ps. esuchus* and *Ps. trimaculatus* only males have been collected, whilst of *Ps. pagdeni* and *Ps. corporaali* only a few females could be studied. The female of *Ps. corporaali* has a transverse carina below the antennae, but this is fine and not protruding. The group may be closely related to that of *Ps. nigrolineatus*, but more material is needed to determine its affinities. The material studied was collected in Malaya, Sumatra, Borneo and the southern Philippine islands Basilan and Mindanao.

***Psenulus sandakanensis* (Rohwer)**

1923, Rohwer, S. A., Phil. Jl. Sc., vol. 22, no. 6, pp. 597-598, ♂ (*Diodontus sandakanensis*; Borneo).

I have not seen the type specimen, but a topotype (♂) which is described below.

Male. — Head black; anterior margin of clypeus, also labrum red; mandibles yellow, except dark tips. Face between and below antennae somewhat reddish. Scape and pedicel of antennae yellow, flagellum black, underside pale testaceous. Dorsal side of thorax yellow, except the following parts, which are brown: a large spot in the centre of the scutum (fig. 100), hind margin of scutum, scutellar suture, depressions on either side of scutellum, axillae, enclosed area of propodeum and upper half of median sulcus. The following parts are also brown: epicnemial and interepicnemial area, lower

three quarters of anterior plate of mesepisternum, mesosternum (roundly dilated on to mesepisternum) and most of the lower part of the metapleura. Fore and mid legs yellow, hind legs reddish-brown except the yellow coxae. Veins of wings brown. Base of petiole pale yellow, apex brown. Gaster reddish.

Anterior margin of clypeus with two small teeth, distance between these teeth about one seventh of the distance there between the eyes (fig. 99). A distinct transverse carina below antennae. Vertex almost impunctate, shining. Antennae long, segments nearly cylindrical, slightly convex below. Scutum with minute punctures. Scutellum smooth. Posterior surface of propodeum smooth, sides slightly reticulate on the upper half. Anterior oblique suture nearly simple. First recurrent vein of fore wings not interstitial but ending near the apex of the first submarginal cell (fig. 101); the second recurrent vein ends well in the third submarginal cell. Petiole cylindrical, short, in dorsal view reaching about halfway the stretched hind femora.

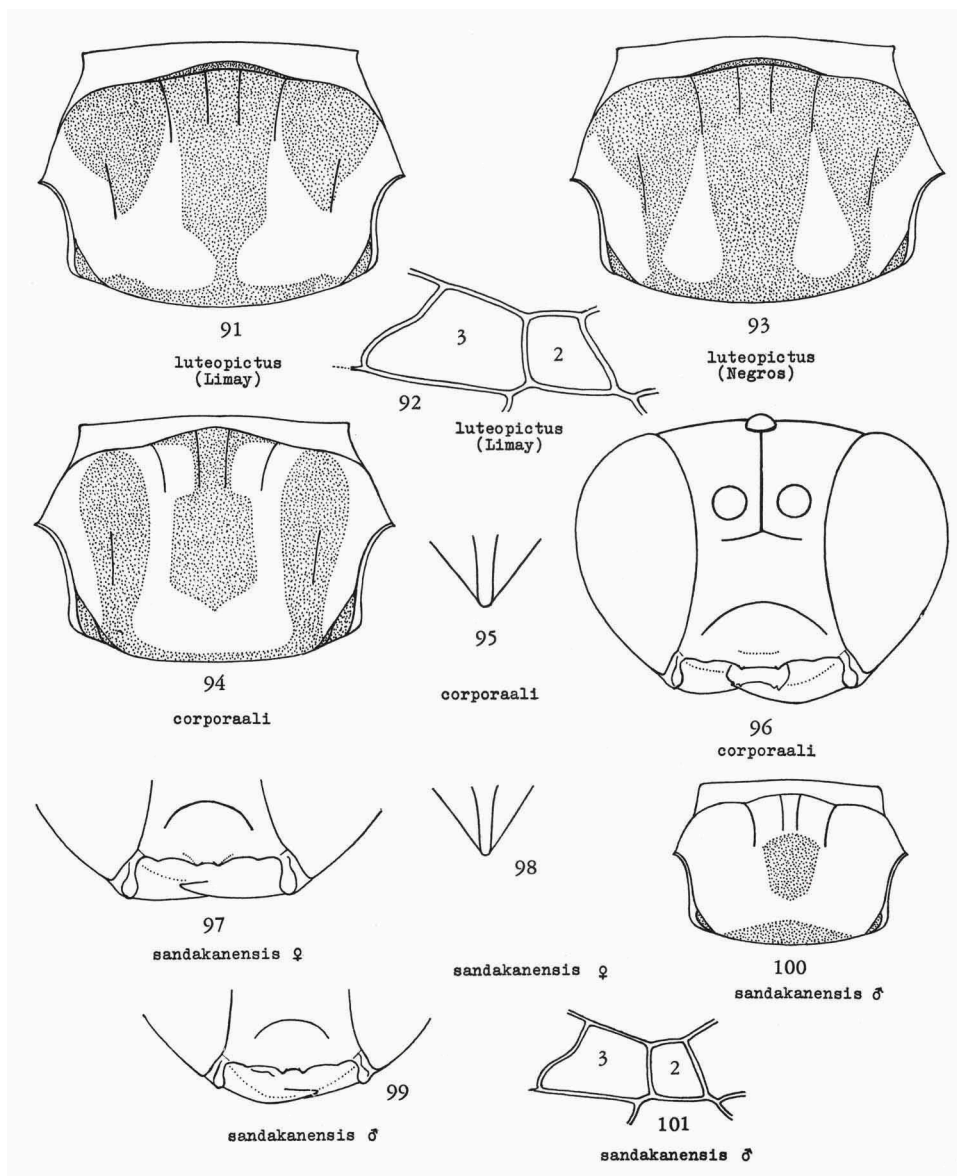
Pubescence of face and frons dense and silvery, partly appressed on face. Rest of body with greyish pubescence.

Length about 5.5 mm.

The dark markings of the mesosternum seem to agree with those of *Ps. nigromaculatus* (female), although they are not black but brown. I do not know, however, what Cameron exactly meant with "base of mesopleurae (of *nigromaculatus*) black". In *Ps. sandakanensis* the epicnemial area and the anterior plate of the mesepisternum are brown and I wonder whether Cameron considers this part of the thorax as the base of the mesopleuron. It is not clear from the original description of *Ps. nigromaculatus* whether its axillae are brown or black as in *Ps. sandakanensis*. *Ps. nigromaculatus* has the first recurrent vein of the fore wings distinctly ending in the second submarginal cell.

In view of the venation of *Ps. sandakanensis* I have not included it in the group of *Ps. interstitialis*, although it very much resembles various Philippine species of this group.

In the collection of the British Museum (1955-354, ex FMS Museum) is a second male from North Borneo, which is slightly larger and darker. There are two vague lateral spots on the scutum, there is a large black area on either side of the upper part of the propodeum, adjacent to the enclosed area and the black colour on the mesosternum extends along the foreside of the metapleura. On the contrary the yellow spot on the anterior plate of the mesepisternum is slightly larger. The sides of the propodeum are fairly coarsely reticulate. The first recurrent vein of the fore wings is somewhat more close to the first cubital vein.



Figs. 91-93. *Psenulus luteopictus* (Rohwer), ♀; scutum and second and third submarginal cells of left fore wing of paratype (Limay, Luzon) and scutum of Negros specimen.

Figs. 94-96. *Psenulus corporaali* n. sp., ♀; scutum, pygidial area and head.

Figs. 97-101. *Psenulus sandakanensis* (Rohwer); 97-98, ♀, Liangtelan (Borneo?), lower part of face and pygidial area; 99-101, ♂, topotype, lower part of face, second and third submarginal cells of left fore wing and scutum.

Through the kind intermediary of Dr. J. van der Vecht I received from the Naturhistorisches Museum, Vienna, two *Psenulus* which have the same venation and about the same marking of the thorax as the holotype, but the apex of the petiole is not, or only slightly darkened.

One is a male, closely resembling the male from Sandakan and is certainly conspecific. The other specimen has the same marking of the thorax as the male from Bettotan (N. Borneo); I consider it as the female of *Ps. sandakanensis*.

The hind legs of this female are completely reddish-yellow.

The median part of the clypeal margin is very protruding, but narrow and slightly emarginate so that two blunt teeth are formed (fig. 97). The posterior surface of the propodeum is smooth, the sides are finely reticulate. Pygidial area narrow (fig. 98).

Length about 8 mm.

Borneo: 1 ♂ (holotype) and 1 ♂ (paratype?), Sandakan, C. F. Baker, no. 16829 (USNM, holotype catalogue no. 25042), 1 ♂, Bettotan near Sandakan, 22 July 1927, C. Boden Kloss and H. M. Pendlebury (BM); 1 ♀, Liangtelan, Gribodo (NMW). (I have not succeeded in tracing this latter locality on the maps, but it is supposed to be situated in Borneo).

Sumatra?: 1 ♂, Marang, Gribodo (NMW). There are various localities of this name, a.o. in Celebes, Borneo and on the southwest coast of Sumatra. It may be that this male originates from Sumatra, in view of the fact that the Vespid *Icaria marangensis*, named by Gribodo, does not occur in the former two islands. In view of the other captures of *Ps. sandakanensis* it seems also possible, however, that this male from Marang has been taken in Borneo.

### ***Psenulus corporaali* n. sp.**

Female. — Head black; mandibles yellow with dark tips, palpi yellow, labrum reddish, anterior margin of clypeus reddish-brown. Scape of antennae yellow, pedicel yellow below, reddish above, flagellum black above, reddish-brown below. Pronotum yellow above, pronotal tubercles yellow, scutum yellow with three broad black lines, the lateral lines complete, the median line as long as the anterior three fourths of the scutum (fig. 94), tegulae yellow. Scutellum yellow with a small, oblong brown spot, also axillae yellow. Base of propodeum with a broad black band, median longitudinal groove black, apex of propodeum with two black spots. Epinemial areas, interepinemial area and mesosternum black. Anterior plate of mesepisternum yellow, anterior two thirds of hypo-epimeral area yellow, anterior part of meso-

pleura with large yellow mark which is connected with the hind margin. Metapleura black. Fore and mid legs including coxae yellow, tarsi darker. Hind coxae yellow, femora with a yellow line below, rest of hind legs brown. Veins of wings brown. Petiole pale yellow, apex darkened, rest of gaster pale red.

Median part of anterior margin of clypeus straight, with two small teeth (fig. 96), broadly depressed and with a transverse row of large punctures. Disk of clypeus strongly convex. Raised part of interantennal carina sharp, ending below antennae in a transverse carina which is not distinct and almost concealed by the pubescence. Frons and vertex smooth, almost impunctate. Antennae clavate.

Pronotum with sharp antero-dorsal carina. Scutum smooth, almost impunctate, prescutal sutures distinct, as long as anterior quarter of scutum. Metanotum without lateral projections. Enclosed area of propodeum triangular, median longitudinal groove narrowing towards apex. Propodeum smooth behind enclosed area and behind the metapleura; posterior surface with irregular rugae, rather weak, more distinct on the sides. Anterior oblique suture indistinctly foveolate, hypo-epimeral area well-defined. Mid tibiae with a longitudinal depression on apical fifth part, defined behind by a row of four red spines, anteriorly by an oblique raised area and an apical spine. Hind tibiae without distinct depression at the base, outer side of base with a number of minute red tubercles. First recurrent vein of fore wings received by first submarginal cell near the end, the second recurrent vein ends well in the third submarginal cell. Petiole cylindrical. Pygidial area narrow, carinae parallel on apical half (fig. 95).

Pubescence of head silvery, mostly appressed on face, yellowish on thorax and gaster, dense on margin of fourth and fifth and on disk of sixth gastral sternites.

Length about 10 mm.

Male unknown.

Sumatra: 1 ♀ (holotype), East Coast, Medan, 20 m, 11 Aug. 1921, J. B. Corporaal (MR).

### ***Psenulus filicornis* (Rohwer)**

1923, Rohwer, S. A., Phil. Jl. Sc., vol. 22, No. 6, pp. 598-599, ♂ (*Diodontus filicornis*; Basilan).

Male. — Head black; anterior margin of clypeus reddish, mandibles except dark tips yellow, palpi testaceous. Scape of antennae yellow, flagellum orange below, brownish above. Thorax largely yellow, the following parts black: lower part of pronotum, a mark on the median anterior two thirds

of the scutum (fig. 104), a lateral longitudinal line over the parapsidal suture, hind margin of scutum very narrowly, scutellar suture, base of propodeum, and median sulcus and apex of propodeum. Epicnemial areas, mesosternum, lower third of anterior plate of mesepisternum, anterior two thirds of mesepisternum and complete metapleura also black. Fore and mid legs including coxae and coxae of hind legs yellow. Hind legs beyond coxae yellowish-red. Veins of wings light-brown. Gaster reddish but apex of petiole blackish.

Anterior margin of clypeus with two distinct small teeth (fig. 105). Inter-antennal carina sharp, ending in a transverse carina below antennae. Frons and vertex distinctly punctate. Interocellar area somewhat raised. Antennae very long, at least as long as head and thorax together, slender, segments cylindrical.

Anterior dorsal margin of pronotum sharp. Scutum with sparse but distinct punctures, no prescutal sutures. Enclosed area of propodeum triangular, an adjacent smooth and shining area laterally; posterior surface of propodeum irregularly reticulate. Anterior oblique suture almost simple. Legs slender. The first recurrent vein of the fore wings ends in the first submarginal cell at a distance of about one fourth of the base of the second submarginal cell. The second recurrent vein ends in the third submarginal cell. Gaster slender, first tergite somewhat swollen.

Pubescence yellowish-grey, face silvery.

Length about 7,5 mm.

Female unknown.

Basilan: 1 ♂ (holotype) and 1 ♂ (paratype?), C. F. Baker, both no. 16826 (USNM, holotype catalogue no. 25042).

The above description is based on the latter male, which presumably is a topotype. According to information received from Dr. K. V. Krombein in his letter of November 13, 1958, it has been determined by Baker and has never been seen by Rohwer. This species is so characteristic, however, that there is no doubt that it is identical with the holotype.

*Ps. filicornis* differs from the other *Psenulus* in the very long and cylindrical antennal segments. As in *Ps. multipictus* Roh. and *Ps. pseudajax* n. sp. the prescutal sutures are lacking or at least invisible. In view of these characters and also taking into account the course of the first recurrent vein of the fore wings I have not placed *Ps. filicornis* in the group of *Ps. interstitialis* but provisionally in the heterogeneous group of *Ps. sandakanensis*. We shall have to await further material, especially females, to learn more about its relationships.



***Psenulus ajaxellus* (Rohwer)**

1923, Rohwer, S. A., Phil. Jl. Sc., vol. 22, no. 6, p. 600, ♂ (*Diodontus ajaxellus*; Mindanao).

Original description: "Male. — Length, 7 millimeters. Slender. Anterior margin of clypeus with two small, triangularly shaped teeth medianly; transverse ridge below antennae strong, and joining the equally strong frontal ridge medianly; frons and vertex shining; ocelli in nearly an equilateral triangle; postocellar line slightly less than ocellular line; antennae as long as head and thorax, joint 6 to 12 rounded out beneath, third joint subequal with fourth; pronotum carinate anteriorly, lateral anterior angles sharp but not dentate; scutum polished and with a few punctures; notauli indicated anteriorly; dorsal surface of propodeum polished, basal area triangular in outline and crossed by strong rugae which are more widely separated medianly; posterior face of propodeum coarsely reticulate, the median channel deep; mesepisternum polished, the suture foveolate; petiole gently curved, cylindrical, fully as long as hind femur, not very sharply separated from rest of tergite; gaster polished; first recurrent received by first cubital cell close to first intercubitus; second recurrent bisinuate, received by third cubital a distance equal to half the length of second intercubitus from base of cell; second intercubitus perpendicular; second cubital cell one third longer below. Head and thorax black; mandibles and scape yellow; flagellum, from the basal joints, testaceous beneath; dorsal part of pronotum, three spots on mesepisternum (the lower one smallest), spot below hind wings, scutum except three broad lines, scutellum, metanotum, and posterior face of propodeum (except median channel) yellow; four anterior legs and hind coxae yellow; hind legs below coxae testaceous; abdomen rufous, base of petiole yellowish; head with the usual pale pubescence; wings hyaline, venation pale brown.

Type locality. — Kolambugan, Mindanao.

Described from one male received from C. F. Baker.

Type. — Catalogue No. 25045, United States National Museum."

Apparently this wasp resembles some of the darker coloured forms of the group of *Ps. luzonensis*, but the venation is different and I have therefore provisionally placed it in the group of *Ps. sandakanensis*.

***Psenulus esuchus* (Rohwer)**

1923, Rohwer, S. A., Phil. Jl. Sc., vol. 22, No. 6, pp. 600-601, ♂ (*Diodontus esuchus*; Borneo).

Male. — Head black, but anterior margin of clypeus dark red. Mandibles yellow, with dark tips. Palpi pale yellow. Scape of antennae yellow; flagellum dark-brown above, pale reddish below. Pronotum yellow except lower base, pronotal tubercles yellow. Scutum yellow with three longitudinal black marks. The lateral marks extend from just behind the pronotum to the hind margin of the scutum, the median mark is as long as the anterior two thirds of the scutum (fig. 102). Upper third of propodeum, median longitudinal carina and two spots at apex black. Epicnemial areas black with yellow outer margin; mesosternum, mesopleura and metapleura black, except anterior plate of mesepisternum, hypo-epimeral area and a large spot behind the anterior oblique suture. Fore and mid legs, including coxae, yellow but femora partly

brownish darkened; hind legs reddish-brown with partly yellow coxae and darker tarsi. Veins of wings brown. Gaster red, petiole darkened at sides of apex.

Anterior margin of clypeus almost straight with two teeth at a distance of about two ninths of the distance there between the eyes (fig. 103). Inter-antennal carina sharp, a distinct transverse carina below antennae. Frons with indistinct puncturation, vertex sparsely punctate. Antennae long, segments slightly rounded below.

Enclosed area of propodeum triangular; propodeum behind enclosed area smooth and shining, posterior surface with irregular carination. The first recurrent vein of the fore wings ends in the first submarginal cell at about one quarter of the length of the first intercubitus (not one third as Rohwer stated), the second recurrent vein ends in the third submarginal cell.

Pubescence yellowish-grey, silvery and somewhat appressed below transverse carina.

Length about 8 mm.

Female unknown.

Borneo: 1 ♂ (holotype) and 1 ♂, Sandakan, C. F. Baker, both no. 16828 (USNM, holotype catalogue no. 25046).

According to Dr. K. V. Krombein (in his letter of November 13, 1958), the second male has been determined by Baker and has never been seen by Rohwer. I have not examined the holotype, but judging from Rohwer's description and the fact that both specimens have the same collecting number, we may presume that they are conspecific.

I am not sure yet whether this wasp has been properly placed. The anterior margin of the clypeus resembles that of *Ps. interstitialis*, but the first recurrent vein of the fore wings ends well in the first submarginal cell. The median mark of the scutum is connected with the anterior margin and not with the hind margin, as is the tendency in the subspecies of *Ps. interstitialis* in the southern Philippine islands. According to Rohwer (1923) *Ps. esuchus* resembles *Ps. ajaxellus* from Mindanao, but it differs from the latter species in the somewhat longer third antennal segment and in the darker colour of legs and petiole. The female of *Ps. continentis* n. sp. from Malaya has about the same colour-pattern of the scutum, but in the type of this species the first recurrent vein of the fore wings ends distinctly in the second submarginal cell.

### ***Psenulus trimaculatus* n. sp.**

Male. — Head black; anterior margin of clypeus reddish, mandibles yellow with dark tips, labrum pale red, palpi yellow. Scape of antennae

yellow, upper side of flagellum dark-brown, underside testaceous. Thorax yellow; the following parts are black: large median spot on scutum, this spot somewhat extended towards the anterior margin of the scutum (fig. 109), two lateral spots, vaguely extended in backward direction, hind margin of scutum, scutellar suture, base of propodeum and median longitudinal groove, epicnemial, mesosternum, which is roundly dilated on to the mesopleura, and the anterior plate of the mesepisternum. Fore and mid legs yellow, hind legs and gaster, including petiole, pale red. Veins of wings brown.

Anterior margin of clypeus with two distinct teeth (fig. 110), the sharp interantennal carina ends in a distinct transverse carina. Frons and vertex almost impunctate. Segments of antennae slightly rounded below. Ends of mandibles bidentate, a small and indistinct tooth in the middle of the inner margin.

Scutum shining, with a few minute punctures. Prescutal sutures about one third of the length of the scutum. Enclosed area of propodeum triangular, upper part of posterior surface of propodeum smooth and shining, lower part finely reticulate. The first recurrent vein of the fore wings ends near the end of the first submarginal cell, the second recurrent vein in the third submarginal cell.

Pubescence of head whitish, for the greater part appressed below the transverse carina. Thorax and gaster yellowish pubescent.

Length about 7.5 mm.

Female unknown.

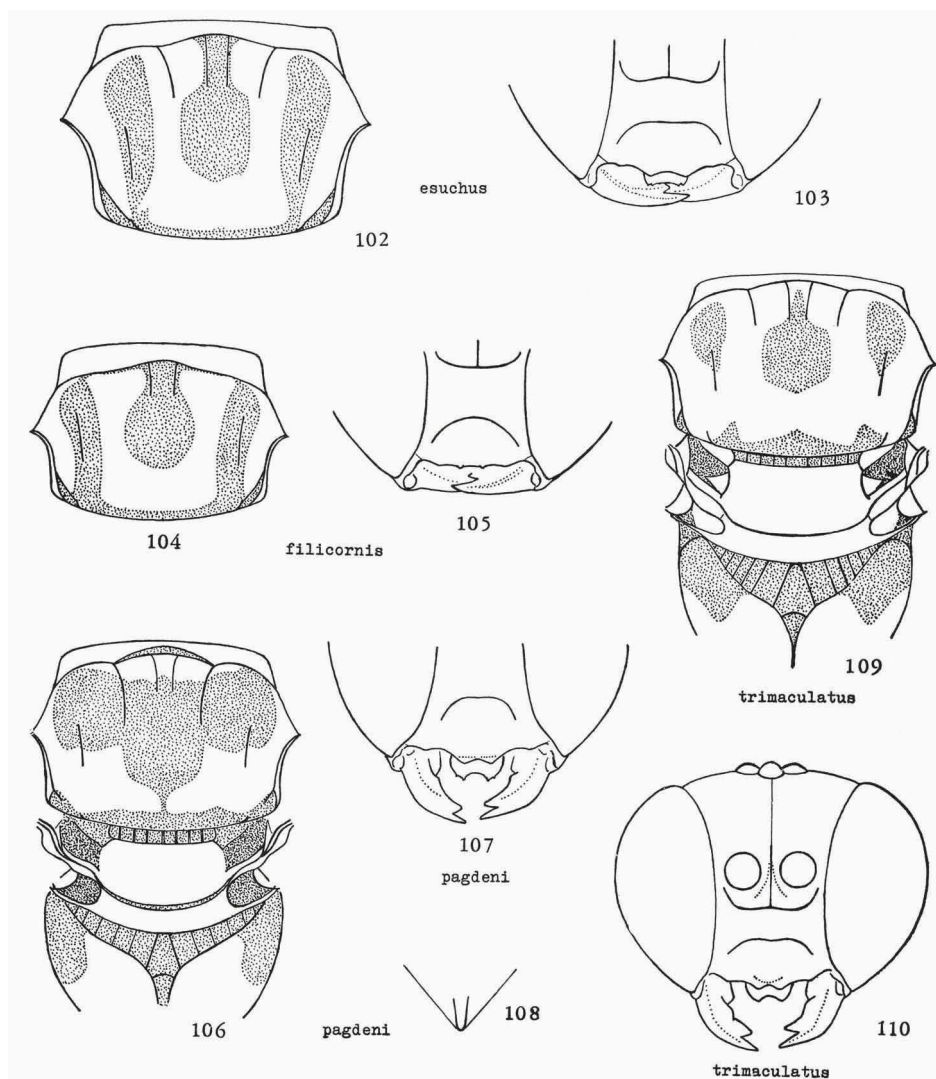
Malaya: 1 ♂ (holotype), Penang, S. Batu Feringgi, 15 Aug. 1955, H. T. Pagden (HTP).

This wasp seems to be closely allied to the preceding males which have all the first recurrent vein of the fore wings ending in the first submarginal cell, near the end. As in *Ps. sandakanensis* the anterior plate of the mesepisternum is dark, but it can easily be distinguished from the latter species by the markings of the scutum.

#### ***Psenulus pagdeni* n. sp.**

Female. — Head black; mandibles except dark tips yellow; labrum red, palpi yellow. Scape of antennae, except brown spot at apex, and underside of pedicel yellow, rest of flagellum reddish below, black above. Thorax black, except the following yellow parts: upper side of pronotum, pronotal tubercles, scutum except a trilobate transverse black mark and black hind margin (fig. 106) (sometimes mark and hind margin connected by a fine median line), scutellum except scutellar suture and except axillae (lateral depressions black), metanotum except lateral depressions, two extensive areas on the

propodeum covering almost completely the declivity and the sides, a small spot below the hind wings, hypo-epimeral area and upper part of mesopleura, and tegulae. Trochanters of all legs yellow, also fore and mid legs except tarsi, which are reddish. Rest of hind legs red. Gaster including petiole red, but petiole sometimes slightly darkened near apex.



Figs. 102-103. *Psenulus esuchus* (Rohwer), ♂, topotype; scutum and lower part of face.  
 Figs. 104-105. *Psenulus filicornis* (Rohwer), ♂, topotype; scutum and lower part of face.  
 Figs. 106-108. *Psenulus pagdeni* n. sp., ♀, holotype; thorax, lower part of face and pygidial area.

Figs. 109-110. *Psenulus trimaculatus* n. sp., ♂, holotype; thorax and face.

Central part of clypeus shining, almost impunctate, the projecting anterior margin with triangular emargination (fig. 107). Interantennal carina sharp, no transverse carina below antennae. Frons and vertex shining, almost impunctate. Mandibles bidentate at apex, there is also a small tooth on the inner margin. Antennae clavate.

Hind margin of pronotum broadly emarginate and pronotum very narrow there. Scutum with minute punctures, prescutal sutures about as long as basal half of scutum. Posterior surface of propodeum smooth and shining, sides with fine reticulation, enclosed area triangular. The narrow median groove does not reach the apex of the propodeum. Femora thick. Apex of mid tibiae without a distinct flattened area but with a longitudinal row of three red spines. Inner spur of hind tibiae as long as basitarsus. First recurrent vein of fore wings received by first, second recurrent vein by third submarginal cell. Petiole cylindrical, base with short dorso-lateral carinae. Pygidial area narrow, lateral carinae almost parallel (fig. 108).

Pubescence yellowish-grey, face silvery. Mesosternum with long white hairs, on both sides of the median carina the hairs are golden-brown. Epicnemial areas with large spot of short golden-brown pubescence on inner side. Margin of fourth and fifth gastral sternites with fringe of short white hairs.

Length about 7 mm.

Male unknown.

Malaya: 1 ♀ (holotype), 16 July 1957, 3 ♀ (paratypes), 5, 9 and 16 July 1957, all from Penang, Batu Feringgi catchment area, 300 feet, H. T. Pagden (HTP). — Mr. Pagden kindly informed me by letter that this locality is not easy to reach as it means wading up a stream and climbing a waterfall. He took all the specimens in a few square yards, flying around two small trees, presumably collecting prey.

*Ps. pagdeni* is a small but stoutly built species and easily distinguished by the brightly coloured yellow and black thorax with the trilobate black mark on the scutum and by the red gaster.

#### Group of ***Psenulus interstitialis***

In the remaining two groups of the section with non-excavate interantennal carina the first recurrent vein is interstitial or nearly interstitial; the females have a narrow pygidial area, but no transverse carina below the antennae.

Of the group of *Ps. interstitialis* I have seen a few closely related forms from New Guinea; it extends to the Solomon Islands, according to information received from Dr. K. V. Krombein. Westwards the representatives of this group occur in many of the Philippine Islands and in Borneo; some

species from Java, Bali and Malaya have also been placed in this group. In a large species from the Philippine Islands, the frons bears large tubercles and the scutum is coarsely punctate; the female also differs in the structure of the base of the hind tibiae, which as in *Ps. nigrolineatus* is depressed and which bears a number of short but strong spines. The other species have no striking features. Their scutum is completely yellow or it has one or three black spots which in some species have developed into three black lines. In the Javanese species these lines may be so broad that the scutum is largely black. The clypeal margin is bidentate, but the teeth are small and between these teeth the margin is almost straight. Perhaps *Ps. pseudajax*, known from a single male only and placed here provisionally, does not belong to this group.

***Psenulus interstitialis interstitialis* Cameron**

1906, Cameron, P., Tijdschr. v. Ent., vol. 49, part 1, pp. 222-223, ♀ (*Psenulus?* *interstitialis*; New Guinea).

Female. — Head black; mandibles yellow except dark tips, palpi pale testaceous, lower part of clypeus reddish. Antennae testaceous, flagellum brownish above. Thorax pale yellow; base of pronotum, lateral depressions of scutellum, the greater part of the enclosed area of the propodeum and the interepicnemial area are black. Fore and mid legs pale yellow, hind legs reddish, but coxae also pale yellow. Gaster including petiole pale red.

Clypeal margin with two distinct small teeth (fig. 111), the distance between these teeth is about one fifth of the distance between the eyes there. Clypeus and face with fine puncturation. Protruding part of inter-antennal carina sharp, no distinct transverse carina below the antennae. Puncturation of frons extremely fine. Vertex shining, a small depression against the outer side of the lateral ocelli. Antennae short, clavate.

Scutum shining, with widespread but distinct punctures. Scutellum with less distinct puncturation. Enclosed area of propodeum triangular, with only a few longitudinal carinae. Posterior surface of propodeum obliquely rugose, the horizontal upper part behind the enclosed area is smooth, sides of propodeum also smooth. Anterior oblique suture not distinctly foveolate. Hypoepimeral area convex. Mid tibiae with a longitudinal row of four red spines, a separate spine in front of this row on the apical margin. First recurrent vein of fore wings interstitial (fig. 113) or nearly interstitial — in the type the first recurrent vein of the right wing ends in the first submarginal cell, close to the end (fig. 114) — the second recurrent vein ends well in the third submarginal cell. Petiole cylindrical. Pygidial area narrow, lateral carinae sharp, parallel (fig. 112).

Pubescence of frons pale golden, silvery on face, mostly appressed. Mandibles, especially below, with short and dense, white pubescence. Large, pale golden, pubescent spots on lower part of epicnemial areas. Fourth and fifth gastral sternites with dense whitish pubescence, disk of sixth sternite with dense golden pubescence.

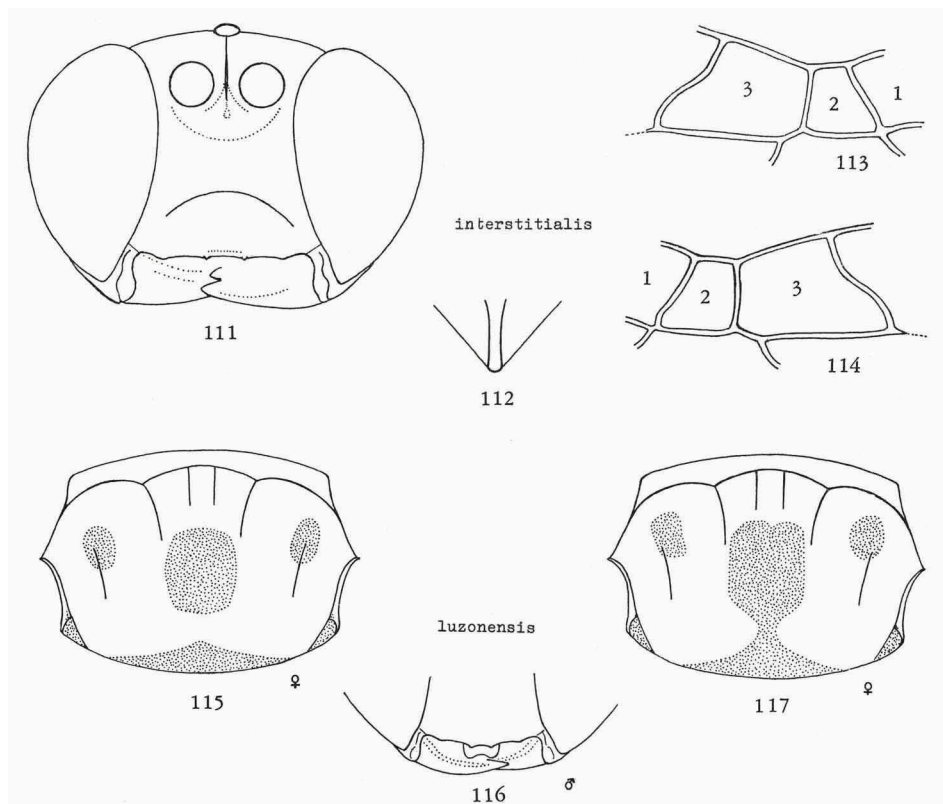
Length about 9 mm.

Male unknown.

New Guinea: 1 ♀ (holotype), Etna Bay, Dutch New Guinea Expedition 1904/1905 (MA).

In his description Cameron did not mention the small, but distinct teeth on the clypeal margin and the protruding interantennal carina.

I have seen a single female from Hollandia, Aug. 1957, collected by G.



Figs. 111-114. *Psenulus interstitialis interstitialis* Cameron, ♀, holotype; face, pygidial area, second and third submarginal cells of left and right fore wing.

Figs. 115-117. *Psenulus interstitialis luzonensis* (Rohwer); 115, ♀, Los Baños, scutum; 116, ♂, Mt. Makiling, lower part of face; 117, ♀, Mt. Makiling, scutum.

den Hoed (ML), in which the enclosed area of the propodeum is completely yellow. This may be a subspecies, but as the extension of the black colour on the propodeum appears to be variable, some good series from different localities are needed to confirm this.

***Psenulus interstitialis luzonensis* (Rohwer)**

1921, Rohwer, S. A., Phil. Jl. Sc., vol. 18, no. 3, pp. 313-314, ♀ (*Diodontus luzonensis*; Luzon).

Female. — Head black; mandibles yellow except dark tips; palpi yellow; labrum yellowish-red; anterior margin of clypeus red, greater part of disk of clypeus orange, a reddish spot on face just below the interantennal carina. Antennae yellow, upper side of flagellum dark-brown. Thorax yellow, with the following black parts: sides of pronotum, a large median spot and (not always) two lateral spots on the scutum (fig. 115), hind margin of scutum, scutellar suture, lateral depressions on either side of scutellum, enclosed area of propodeum and a spot on either side of it, median longitudinal groove and apex of propodeum, subalar pits, a spot on the hind margin of the mesopleura, metapleura almost completely and a broad median stripe on the mesosternum. Fore and mid legs yellow, hind legs pale red except the coxae which are yellow. Veins of wings brown. Gaster including petiole pale red.

Anterior margin of clypeus with two small teeth, distance between these teeth about one fifth of the distance between the eyes. Clypeus and face finely punctate. Protruding part of interantennal carina sharp, no transverse carina below antennae. Frons densely and finely punctate. Vertex with minute punctures and a few larger ones. Antennae short, clavate.

Scutum shining, with sparse and fine punctures. Scutellum and metanotum smooth. Enclosed area of propodeum triangular, median suture narrow. Propodeum smooth behind enclosed area, obliquely rugose on the declivity and irregularly reticulate on the sides. Anterior oblique suture not distinctly foveolate. The first recurrent vein of the fore wings is interstitial or nearly interstitial, the second recurrent vein is received by the third submarginal cell. Petiole cylindrical. Pygidial area narrow, somewhat concave, lateral carinae distinct.

Pubescence of face dense and silvery, for the greater part appressed, on frons slightly golden. Pubescence of rest of body greyish, dense on margin of fourth and fifth gastral sternites and on disk of sixth sternite (here golden). A large pubescent spot on the lower part of the epicnemial areas.

Length about 8 mm.

Male. — Black markings more extensive than in the female. Anterior



part of pronotum black, spots on scutum, especially the lateral ones, larger, also spot on mesopleura, apical margin of propodeum black. Face largely reddish. Labrum yellow.

Distance between clypeal teeth smaller than in the female (fig. 116), about one sixth of the distance there between the eyes. Normal transverse carina below antennae, bilobate in frontal view. Antennae almost cylindrical, long, the last five segments about twice as long as they are broad, underside slightly rounded.

Posterior surface of propodeum reticulate, not distinctly obliquely rugose. Length about 7-7.5 mm.

Luzon: 3 ♀ (one paratype no. 22840) and 3 ♂, Los Baños, Laguna, C. F. Baker (USNM); 1 ♀, Los Baños, Laguna, 7 Sept. 1953, Townes family (HT); 3 ♀ and 2 ♂, Mt. Makiling, C. F. Baker; 1 ♀, Mt. Banahao, C. F. Baker, collection 1927 (all USNM); 2 ♀, Antipolo, Riz., 27 July 1952 and 1 March 1953, Townes family (HT and ML); 1 ♀, Rosario, La Union, 30 Nov. 1953, A. Marmeto (BPIM).

Biliran: 3 ♂, C. F. Baker (USNM).

Negros: 2 ♀ (no. 21318) and 1 ♂, Cuernos Mts., C. F. Baker (USNM); 2 ♀, Mt. Canlaon, Negros Or., 3600 feet, 5-7 May 1953, H. M. and D. Townes (HT and MR).

The paratype is somewhat discoloured, the thorax being reddish.

In two females, one from Mt. Makiling and one from Negros, the central scutal spot is connected with the hind margin (fig. 117).

*Ps. interstitialis luzonensis* is undoubtedly closely related to the form from New Guinea, but can easily be distinguished by the greater extension of the black colour.

### ***Psenulus interstitialis davanus* (Rohwer)**

1923, Rohwer, S. A., Phil. Jl. Sc., vol. 22, no. 6, p. 599, ♂ (*Diodontus davanus*; Mindanao).

Female. — Differs from *Ps. interstitialis luzonensis* in the following points: Only outer margin of clypeus dark red. Antennal segments 6-12 reddish below. Anterior part of pronotum black. The three spots on the scutum larger, the median one is always connected with the black hind margin (rarely in *Ps. interstitialis luzonensis*, cf. fig. 117). Apical margin of propodeum black. Spot in front of hind margin of mesopleura large. Hind trochanters brown. Hind femora somewhat brownish darkened. Apex of petiole black laterally.

Pubescence of face pale golden.

Length about 8-9 mm.

Male. — Also resembling *Ps. interstitialis luzonensis*, but the black part of the mesopleura is larger and extends along the hypo-epimeral area to the anterior oblique suture. Flagellum testaceous below.

Length about 7.5 mm.

Mindanao: material examined: 1 ♀, Davao (type locality), C. F. Baker (USNM); 1 ♀, Cotabato, 11 Oct. 1953, H. Townes (HT); 1 ♂, Surigao, C. F. Baker (USNM); 1 ♂, Zamboanga, C. F. Baker (USNM).

Mindoro: S. Luis Calapan, 150 feet, 1 ♀, 17 April 1954, 1 ♂, 13 April 1954; Alcate Vict., 2 ♀, 10 April 1954, all collected by H. M. and D. Townes (HT, ML and MR).

The specimens from Mindoro are slightly darker than those from Mindanao. Especially the hind femora and trochanters are darker brown.

Rohwer already recognized the close relationship between *Ps. davanus* and *Ps. luzonensis*, although he had only seen a male of the former and a female of the latter form and he was not aware of the sexual dimorphism in regard to the presence or absence of a transverse carina below the antennae.

***Psenulus interstitialis pseudolineatus* n. subsp.**

Male. — Closely related to *Ps. interstitialis luzonensis*, but darker. Narrow anterior margin of clypeus red, teeth brown. Lateral black marks on scutum extending from near the anterior margin to the broad black hind margin; median spot connected with hind margin of scutum. As in *Ps. interstitialis davanus* the black mark on the mesopleura runs to the anterior oblique suture, the hind trochanters are dark-brown and the base of the hind femora is darkened. The median black line on the mesosternum is broad. Gaster, including petiole, yellowish-red, apex of petiole not darkened.

Length about 9 mm.

Female unknown.

Palawan: 1 ♂ (holotype), Puerto Princesa, 6 Dec. 1952, Henry Townes (HT).

***Psenulus interstitialis baliensis* n. subsp.**

Female. — Head black; anterior margin of clypeus somewhat reddish, mandibles yellow except dark tips, palpi testaceous, scape of antennae yellow, flagellum orange-brown. Thorax yellow dorsally, but scutum with three black marks, almost as in *Ps. corporaali* (fig. 94), and black hind margin, a broad black band on upper part of propodeum and a narrower band above base of petiole, longitudinal groove also black. Epicnemial areas black. Mesosternum black, marking extending on to mesopleura. Anterior plate of mesepisternum yellow, a large yellow spot on hypo-epimeral area and a large

horizontal yellow mark on the mesopleura below. Metapleura black. Fore and mid legs completely and coxae of hind legs yellow; rest of hind legs reddish-brown. Veins of wings brown. Gaster, including petiole, reddish-brown.

Anterior margin of clypeus almost straight, with two small teeth. Protruding part of interantennal carina sharp, no transverse carina below antennae. Vertex almost smooth. Antennae clavate.

Scutum minutely punctate. Enclosed area of propodeum ill-defined posteriorly, upper half of posterior surface of propodeum smooth, lower part irregularly transversely striate. Anterior oblique suture foveolate (short transverse carinae). The first recurrent vein of the fore wings ends just in the second submarginal cell, the third recurrent vein is received by the third submarginal cell. Pygidial area narrow.

Pubescence of face silvery and appressed below antennae, yellowish on rest of body. Epicnemial areas below with round patch of dense yellowish pubescence.

Length about 9 mm.

Male unknown.

Bali: 1 ♀ (holotype), coll. Gribodo (NMW).

There is a confusing resemblance in the marking of the scutum to that of *Ps. corporaali*, but the absence of a transverse carina below the antennae and the different venation of the fore wings indicate that this wasp is closely related to the forms of this group from New Guinea and the Philippine Islands.

### ***Psenulus nigromaculatus* (Cameron)**

1907, Cameron, P., Jl. Straits Br. R. Asiat. Soc., vol. 48, pp. 23-25, ♀ (*Mellinus nigromaculatus*; Borneo).

1920, Turner, R. E., Ann. Mag. Nat. Hist. Lond., ser. 9, vol. 5, p. 267 (*Psenulus nigromaculatus*).

Original description. "Rufo-testaceous, the head, the 3rd and following segments of the antennae, a small irregular spot on the sides of the mesonotum at the base, a larger one near the centre, the furrows at the base and sides of the scutellum, the metanotal area, upper part of furrow, the base of mesopleurae broadly, of the metapleurae narrowly on lower half and the mesosternum, the mark roundly dilated on to the mesopleurae, black. Legs coloured like the body, but paler, the hinder darker tinted than the anterior. Head densely covered with silvery pubescence; the front with a distinct keel down the middle; except at the ocelli the front and vertex are dark rufo-testaceous. Mandibles yellowish to beyond the middle; the apex black, the part behind it rufo-testaceous. Antennal plate stout, roundly narrowed in the middle; there is no transverse keel below it. Scutellar furrow irregularly crenulated. Metanotal area large; in its middle are two widely separated keels; on either side are a few irregular striae. Abdominal petiole curved, thickly nodose at the apex; it is as long as the following 2 segments united. Thorax sparsely covered with pale and fuscous hair. The keel bordering the base of the

apex of pronotum is narrow, and is thinner in the middle than at the sides. Basal two segments of antennae pale yellow, the others black, brownish below. Wings hyaline, highly iridescent, the stigma and nervures dark fuscous. ♀.

Length 8 mm.

Kuching, November 13th.

There may be a black mark in the middle of the mesonotum, forming a triangle with the basal pair. Ocelli in a triangle, the hinder bordered by a furrow on the outer side and separated from the eyes by a distinctly greater distance than they are from each other. Sides of pronotum at base roundly narrowed."

Dr. J. van der Vecht kindly compared the type, which is in the collection of the British Museum (Natural History) (Kuching, 13 Nov. 1900, no. 21836) with a female of *Ps. interstitialis luzonensis* and confirmed that they are closely related. The black marking of the mesosternum seems to be more extended. The frons and vertex are not dark rufo-testaceous, as Cameron stated, but black; probably Cameron has been misled by some dirt sticking to the head. The petiole is yellowish, slightly infuscated apically. The first recurrent vein of the fore wings ends in the second submarginal cell but it is almost interstitial. As Dr. van der Vecht informed me that the course of the two median longitudinal carinae in the enclosed area of the propodeum is different from that of *Ps. interstitialis luzonensis* I am hesitating to regard it as a subspecies of *Ps. interstitialis*. In the type of *Ps. nigromaculatus* these carinae are not diverging but forming a long elliptic area.

### ***Psenulus multipictus* (Rohwer)**

1921, Rohwer, S. A., Phil. Jl. Sc., vol. 18, no. 3, pp. 314-315, ♀ (*Diodontus multipictus*; Luzon).

Original description: "Allied to *Diodontus luteopictus*, but can be distinguished by the characters used in the preceding key (Frons subopaque, coriaceous; first recurrent in the second cubital; flagellum not much thickened apically).

Female. — Length, 8.5 millimeters. Clypeus flat, the apical margin narrowly depressed and truncate; face without a transverse carina; frontal carina strong, especially prominent below; frons and vertex coriaceous with a tendency to rugulosity just above the antennae; occiput smooth; lateral ocelli in distinct pits; postocellar line distinctly shorter than the ocellular line; antennae rather short, scarcely thickening apically, the third joint distinctly longer than the fourth; anterior dorsal margin of pronotum carinate, not dentate laterally; scutum polished, with well-separated punctures, parapsidal furrows not indicated; scutellum and metanotum with only setigerous punctures; base of propodeum with a triangularly shaped, depressed area which is crossed by about twelve rugae; the median sulcus distinct, deep; posterior surface of the propodeum coriaceous; mesepisternum polished, with only setigerous punctures, sutures not foveolate; petiole cylindrical, curved, almost as long as hind trochanter and femur; longer calcarium of hind tibia shorter than hind basitarsus; first recurrent received by the second cubital near the base; second recurrent received well within the third cubital cell. Black, with abundant yellow marks; flagellum testaceous; mandibles, scape, pronotum dorsally, tubercles, tegulae, large spot on mesepisternum, spot below hind wings, scutum except three broad lines, scutellum, metanotum, propodeum except basal depressed area and median line yellow;

legs yellow, hind femora, tibiae, and tarsi testaceous; petiole yellow at base, black apically; gaster reddish; body sparsely clothed with silvery hair; wings clear hyaline; venation testaceous.

Type locality. — Mount Banahao, Luzon. Described from one female received from C. F. Baker.

Type. — Catalogue No. 22841, United States National Museum."

Dr. K. V. Krombein, who kindly examined the type for me, wrote in his letter of the 13th of November 1958 that it ran to the *luzonensis* couplets in the provisional key which I had sent him. *Ps. multipictus* had not yet been included in this provisional key. Dr. Krombein further provided me with the following useful details: "mesosternum entirely black and median black stripe on scutum not extending to posterior margin; clypeal lobe as in *luzonensis*; face between antennae and ocelli subcontiguously punctate; mid tibia with a row of six stout setae on lower fourth, margining the elongate ovate sensory (?) area."

Various important characters, such as the shape of the clypeal margin, the lacking transverse carina below the antennae, the venation of the fore wings and the colour-pattern speak in favour of its relationship with the group of *Ps. interstitialis*. It is remarkable, however, that apparently the prescutal sutures are lacking, as has also been observed in two males with somewhat uncertain systematic place, namely *Ps. filicornis* Rohwer from Luzon and *Ps. pseudajax* n. sp. from Java.

### ***Psenulus tristis* n. sp.**

Male. — Head black; mandibles yellow except dark tips, palpi testaceous. Scape of antennae yellow, pedicel and flagellum black above, testaceous below. Pronotum yellow except lower part, pronotal tubercles yellow. Greater part of thorax black, but scutum yellow with three complete broad black longitudinal lines and black fore and hind margin. Tegulae yellow. Scutellum yellow; axillae and depression on either side of scutellum black, also scutellar suture. Metanotum yellow, lateral depressions black. Propodeum black, with four large oval yellow marks, one on either side of the longitudinal groove and one on the sides of the propodeum, lateral and median spots connected basally. Upper half of anterior plate of mesepisternum yellow. Greater part of coxae black. Fore and mid legs yellow, basal half of femora dark-brown on the underside, apical tarsi reddish. Hind legs dark red, outer side of femora partly black. Veins of wings brown. Petiole with black apex, base yellowish-red. Gaster red, last sternite dark-brown.

Clypeal margin with two distinct small teeth. Face including clypeus finely punctate. Interantennal carina sharp, transverse carina below antennae distinct, bilobate in frontal view. Frons with minute punctures, vertex sparsely

punctate. Mandibles bidentate at apex, inner tooth, if any, not visible in the type. Antennae long, slightly convex below.

Scutum with sparse and fine puncturation. Enclosed area of propodeum triangular, long, with usual longitudinal carinae. Immediately behind the enclosed area the propodeum is smooth; posterior surface and sides with relatively coarse and irregular reticulation. First recurrent vein of fore wings ending just in the second submarginal cell, the second recurrent vein ends well in the third submarginal cell. Petiole almost cylindrical.

Pubescence yellowish-grey, silvery on face and temples and on the clypeus for the greater part appressed.

Length about 7 mm.

Female unknown.

Palawan: 1 ♂ (holotype), Puerto Princesa, 6 Dec. 1952, Henry Townes (HT).

*Ps. tristis* undoubtedly belongs to the group of *Ps. interstitialis*. It is much darker, however, than *Ps. interstitialis pseudolineatus*, of which one male was taken at the same locality and on the same date and which probably represents the geographical race of *Ps. interstitialis* on the island of Palawan. In view of the considerable deviation from the more usual colour-pattern in *Ps. interstitialis* in this part of the area of distribution I have treated *Ps. tristis* provisionally as a separate species. Since only a single male of each Palawan form is available we hope that additional material from this island and from the neighbouring islands will throw light on the status of *Ps. tristis*.

### ***Psenulus ornatus* (Ritsema)**

1876, Ritsema Cz., C., Entom. Monthly Mag., vol. 12, pp. 185-186, ♂ (*Psen ornatus* "♀" (!); East Java).

Male. — Head black; mandibles yellow with dark tips, palpi testaceous. Scape of antennae yellow, the following segments are brown above, testaceous below; on the apical half the segments are also on the underside partly darkened.

Thorax black, with the following exceptions. Upper part of pronotum and pronotal tubercles yellow, but pronotum laterally and in the middle somewhat darkened. Scutum with two longitudinal yellow lines, which are broadened near the scutellum but do not reach this (fig. 122). Tegulae testaceous. Scutellum black with two large quadrate yellow spots. Axillae black. Metanotum yellow. Propodeum with four large elongate oval yellow spots. Mesepisternum completely black. Fore and mid legs testaceous, coxae, femora, tibiae and tarsi partly brown. Hind legs brown, coxae partly yellow, under-

side of hind femora yellow on apical two thirds, also base of tibiae yellow. Veins of wings brown. Gaster red; apex of petiole and underside of sixth gastral sternite black.

Anterior margin of clypeus almost straight, with two small teeth (fig. 123). Interantennal carina sharp, ending in a transverse carina below the antennae. Frons and vertex smooth and shining, almost impunctate. Antennal segments long, almost cylindrical.

Scutum smooth and shining, puncturation fine but somewhat irregular. Prescutal sutures present, but not very distinct. Enclosed area of propodeum triangular, long, on both sides of it a large, smooth and shining area. Posterior surface of propodeum reticulate, not very coarse. Inner spur of hind tibiae about three quarters of the length of the basitarsus. First recurrent vein of fore wings received by second submarginal cell, almost interstitial (fig. 124). Petiole cylindrical, in dorsal view not sharply separated from postpetiole.

Pubescence whitish on head and thorax, more appressed on face, dense along median carina of mesosternum. No pubescent round patches on epicnemial areas. Pubescence on gaster somewhat yellow, dense on base of sixth gastral sternite.

Length about 10 mm.

Female unknown.

East Java: 1 ♂ (holotype), Mt. Ardjuno, coll. Mr. Hekmeyer (ML).

The description of *Ritsema* was good, but the above redescription contains a few structural characters which were not mentioned by *Ritsema*. He mistook his specimen for a female and was apparently misled by the apical spine.

The following two species seem to be closely related and although they are relatively dark coloured on the scutum I have placed them provisionally in the group of *Ps. interstitialis*. These three Javanese specimens are all males. It would therefore be very interesting to study their females, which should have no transverse carina below the antennae.

### ***Psenulus pseudajax* n. sp.**

Male. — Head black; mandibles yellow, except dark tips. Palpi testaceous. Scape of antennae yellow, a black spot on apex above; flagellum dark-brown, basal half orange-brown below.

Thorax black, the following parts are yellow: pronotum dorsally, pronotal tubercles, two irregular longitudinal lines on scutum (fig. 121) which are much broadened on the inner side near the scutellum (it seems that these broadened parts are not connected but this is not distinctly visible in the type owing to the pin), a spot along the tegulae, axillae, posterior margin of scutellum, metanotum, four elongate spots on the propodeum and a small

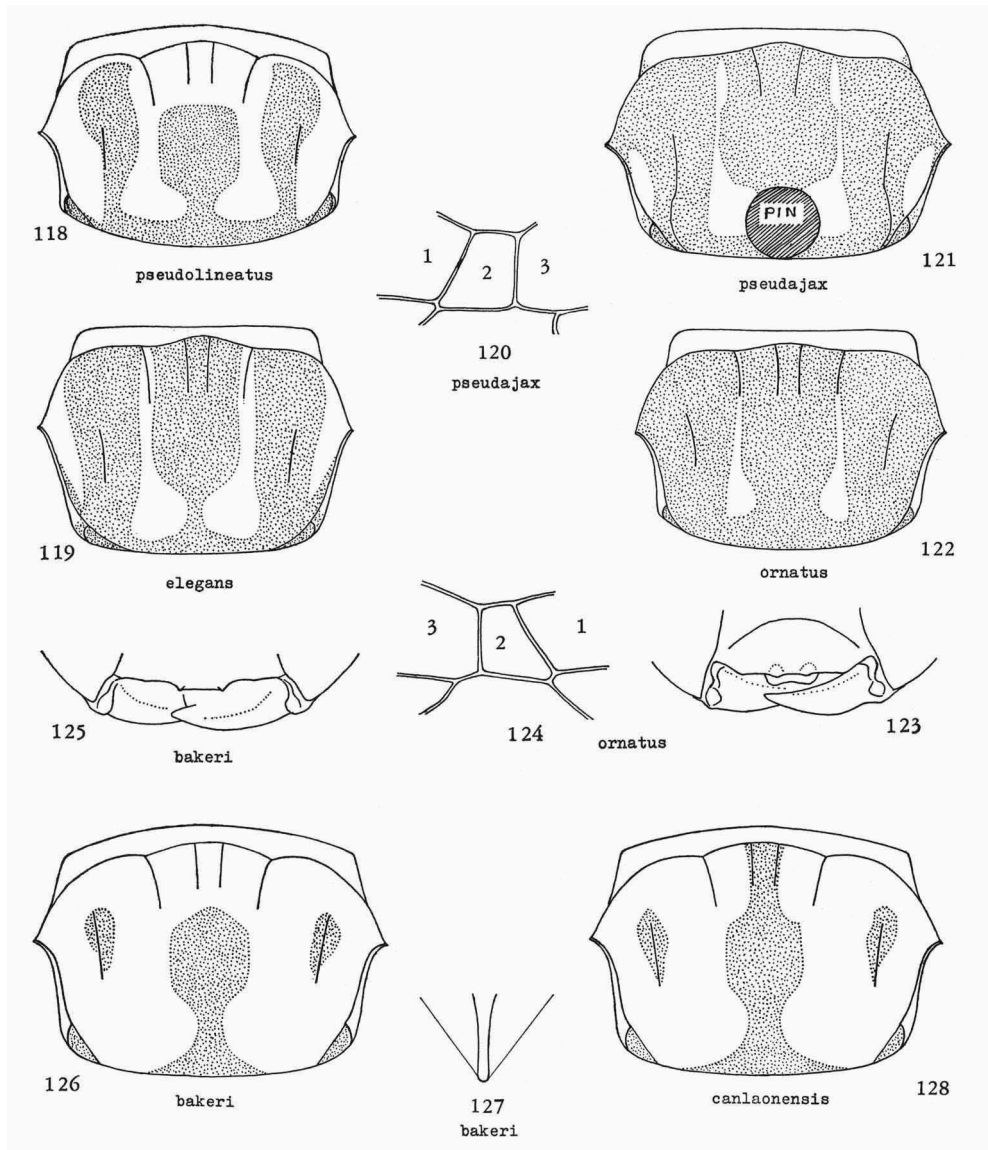


Fig. 118. *Psenulus interstitialis pseudolineatus* n. subsp., ♂, holotype, scutum.

Fig. 119. *Psenulus elegans* n. sp., ♂, holotype, scutum.

Figs. 120-121. *Psenulus pseudajax* n. sp., ♂, holotype; second submarginal cell of right fore wing and scutum.

Figs. 122-124. *Psenulus ornatus* (Ritsema), ♂, holotype; scutum, lower part of face and second submarginal cell of left fore wing.

Figs. 126-127. *Psenulus bakeri* (Rohwer), ♀; scutum and pygidial area.

Fig. 128. *Psenulus bakeri canlaonensis* n. subsp., ♀, holotype, scutum.



spot on the upper part of the anterior plate of the mesepisternum. Fore and mid legs yellow, femora with a large brown patch behind, tibiae with a small spot and last segments of tarsi brownish. Hind legs dark-brown and yellow, the two colours sharply separated; coxae yellow with a brown triangle on the inner and one on the outer surface; trochanters brown, femora brown above, yellow below, tibiae brown with a narrow yellow streak on the outer side, tarsi brown. Veins of wings dark-brown. Gaster red, petiole black, base of postpetiole darkened. Second and third gastral sternites and sixth sternite largely black.

Anterior margin of clypeus with two small teeth. Interantennal carina sharp, ending in transverse carina below the antennae. Frons with dense but minute punctures, punctures of vertex also minute, but much sparser. Interocellar area slightly raised. The suture on the outer side of the lateral ocelli continues until the lower half of the median ocellus where it joins a fine suture round the median ocellus. Antennae long, segments cylindrical.

Scutum with fine but distinct puncturation, also a few larger punctures, no prescutal sutures visible. An indistinct groove which is curved outwards connects the parapsidal sutures with the hind margin of the scutum. Metanotum laterally with a long projection resembling that of *Ps. nigrolineatus* but more pointed. Enclosed area of propodeum triangular, long, on both sides a large smooth area. Posterior surface of propodeum with irregular reticulation. The first recurrent vein of the fore wings ends in the second submarginal cell (almost interstitial), the second recurrent vein in the third submarginal cell (fig. 120). Petiole cylindrical, but base somewhat flattened above.

Pubescence of frons pale golden, of rest of head and of the thorax whitish, on the gaster the hairs are slightly yellow, dense and golden on the base of the sixth gastral sternite.

Central Java: 1 ♂ (holotype), Siluwok Sawangan, Sept. 1940, in kapok branch, collected by Mr. Duyvendijk (ML).

Although I have provisionally placed this male in the group of *Ps. interstitialis*, female material is needed to prove that it really belongs to this group. The wing venation corresponds with that of *Ps. interstitialis*, but the metanotum has two long and narrow lateral projections as in the group of *Ps. nigrolineatus*.

The other two males from Java seem to be related when the colour-pattern of the scutum is considered. *Ps. pseudajax* differs from these two males in having long projections on the metanotum but no distinct prescutal sutures, whilst the petiole is relatively long and black.

***Psenulus elegans* n. sp.**

Male. — Head black; middle part of anterior margin of clypeus reddish-brown, mandibles yellow with dark tips, palpi yellowish-brown. Scape of antennae yellow, following segments brown above, underside yellowish-brown. Ground colour of thorax black; the following parts are yellow: dorsal surface of pronotum, pronotal tubercles, scutum except three broad black lines (the median line is very much narrowed near the scutellum) (fig. 119), a yellow spot on the upper part of the anterior plate of the mesepisternum, a vague small spot on the mesopleura below, axillae, an interrupted line along the hind margin of the scutellum, metanotum, a small spot under the hind wings, and four large elongate oval spots on the propodeum. Tegulae testaceous. Fore and mid legs yellow, including lower half of coxae; outer side of femora and the greater part of the tarsi brown. Hind legs brown, coxae on the dorsal surface with a yellow spot, underside of femora paler, tarsi dark-brown. Veins of wings brown. Gaster red; petiole darkened at apex, also the apical sternite is darkened.

Anterior margin of clypeus with two small teeth. Interantennal carina sharp, a long transverse carina below the antennae. Frons and vertex smooth and shining. Interocellar area slightly raised. Temples narrow. Occipital carina not rounded below but angular. Antennal segments convex on the underside.

Scutum and scutellum shining, with minute punctures. Prescutal sutures distinct, about one third of the length of the scutum. Enclosed area of propodeum triangular, long, on both sides of it a large smooth and shining area. Posterior surface of propodeum reticulate, but not as coarse as in the group of *Ps. pulcherrimus*. The whole posterior surface of the hind femora with the usual minute hairbearing punctures. Inner spur of hind tibiae about three quarters of the length of the basitarsus. The first recurrent vein of the fore wings ends in the second submarginal cell, the second recurrent vein in the third submarginal cell. Petiole cylindrical, in dorsal view not sharply separated from the postpetiole.

Pubescence whitish on head and thorax, more appressed on face, dense along the median carina of the mesosternum. Pubescence of hind legs and gaster somewhat yellowish, dense on base of sixth gastral sternite.

Length about 9 mm (apical spine not included).

Female unknown.

West Java: 1 ♂ (holotype), Bolang Tjilangkap, 500 m, 25 Febr. 1940, M. A. Lieftinck (ML).

This male is not as dark on the scutum as *Ps. ornatus*. The colour-pattern

of the thorax resembles that of *Ps. maculatus* from Java. In the latter species, however, the first recurrent vein of the fore wings ends in the first submarginal cell.

***Psenulus continentis* n. sp.**

Female. — Head black; anterior margin of clypeus somewhat red, mandibles yellow except dark tips, labrum reddish, palpi yellow. Scape of antennae yellow, flagellum above dark-brown, nearly black, and reddish below. Upper part of pronotum and pronotal tubercles yellow. Scutum yellow with three black marks and black hind margin; the lateral marks are long but free from anterior and hind margin, the median mark is as long as the basal two thirds of the scutum. Tegulae yellow. Scutellum yellow, scutellar suture and lateral depressions black. Metanotum yellow, the inner third part of the lateral depressions is black. Propodeum yellow, except the enclosed area, a short line along the spiracles, the longitudinal sulcus and an interrupted line along the apex, which are black. Epicnemial black, mesosternum black (the black marking is roundly dilated on to the mesepisternum). Anterior plate of mesepisternum yellow, but anterior oblique suture black. Metapleura black. Fore and mid legs and hind coxae yellow; tarsi red. Hind legs beyond coxae red; a yellow line on the underside of the hind femora. Veins of wings brown. Petiole pale red, apical third black, rest of gaster red.

Anterior margin of clypeus with two distinct teeth at a distance of about one fourth of the distance there between the eyes. Surface of clypeus finely punctate. Interantennal carina sharp. No transverse carina below the antennae. Vertex almost impunctate. Mandibles bidentate at apex and with distinct inner tooth. Antennae slightly clavate.

Scutum smooth, with only a few larger punctures. Enclosed area of propodeum triangular, with distinct longitudinal carinae. Lower two thirds of posterior surface and also sides of propodeum with fine reticulation. Anterior oblique suture foveolate. Apex of mid tibiae with a row of three or four red spines and one opposite and also a longitudinal raised area. The first recurrent vein of the fore wings ends in the second, the second recurrent vein in the third submarginal cell. Petiole cylindrical, in dorsal view the stretched hind femora extending just beyond the apex of the petiole. Pygidial area narrow, carinae distinct.

Pubescence of head and thorax whitish, silvery and appressed on face, yellowish on gaster and legs. Lower part of epicnemial areas with a round patch of pale golden appressed pubescence.

Length about 9,5 mm.

Male unknown.

Malaya: 1 ♀ (holotype), Penang, Batu Feringgi, in car, 10 April 1956, H. T. Pagden (HTP).

***Psenulus bakeri bakeri* (Rohwer)**

1921, Rohwer, S. A., Phil. Jl. Sc., vol. 18, no. 3, pp. 312-313, ♀ (*Diodontus bakeri*; Luzon).

1923, Rohwer, S. A., Phil. Jl. Sc., vol. 22, no. 6, p. 597, ♀ (Mindanao).

Female. — Head black; mandibles yellow except dark tips, labrum reddish, palpi testaceous. Scape of antennae and pedicel yellow, upper side of flagellum dark-brown, underside testaceous. Thorax yellow with the following black parts: lower half of foreside of pronotum, a large spot in the middle of the scutum, mostly connected with hind margin by a narrow line, a small oblong spot on the sides of the scutum (fig. 126), scutellar suture, lateral depressions of scutellum and metanotum, enclosed area of propodeum and adjacent lateral spots, median suture and apex of propodeum, median part of mesosternum, interepicnemial area, an irregular area on the hind margin of the mesopleura, a spot on the lower side of the mesopleura (this spot is variable in size and may also be absent), and the metapleura. Fore and mid legs yellow, all tarsi reddish. Hind legs reddish except the coxae which are yellow; femora and tarsi more or less darkened. Veins of wings brown. Gaster including petiole red, but apex of petiole somewhat brown or black.

Clypeus closely punctate, margin with two small teeth, at great distance from each other (fig. 125). Interantennal carina not sharp, but flattened above, although it is still narrow. No transverse carina below antennae. Frons somewhat concave on either side of the median carina, a large and shining tubercle between the median ocellus and the oculi; interocellar area also much raised and smooth and shining. Puncturation of frons and vertex rather dense. Antennae long.

Scutum with large and irregular punctures. Mesopleura much more finely and more sparsely punctate. Scutellum and metanotum almost impunctate. Enclosed area of propodeum triangular. Posterior surface of propodeum irregularly, mostly transversely striato-reticulate with narrow median suture. Anterior oblique suture not foveolate, against the front side of this narrow suture a row of indistinct depressions. Apex of mid tibiae on outer side with a longitudinal depression which is margined behind by a row of three or four red spines, on the front side by one apical spine and a longitudinal ridge. The first recurrent vein of the fore wings is interstitial, the second recurrent vein ends in the third submarginal cell. Petiole long, cylindrical. Gaster with minute punctures. Pygidial area narrow, basally and towards apex somewhat widened (fig. 127).

Pubescence of face, frons and vertex pale golden, temples silvery, rest of body greyish-yellow, denser on margin of fourth and fifth gastral sternites. Epicnemial areas with a large round patch of appressed pale pubescence. Back surface of hind femora not bare.

Length about 10-11 mm.

Male. — Resembling female, median black mark on scutum connected with hind margin. The lateral marks are longer than in the female. The dark spot on the lower side of the mesopleura is larger and connected with the black mesosternum.

Antennae very long and slender, most segments at least 2.5 times as long as they are broad at the base.

Pubescence of face silvery.

Length about 9-10 mm.

I have seen the following specimens:

Luzon: Los Baños, Laguna, 1 ♀ (paratype), C. F. Baker, no. 527 (USNM, no. 22839), 2 ♀, 5 June and 19 Sept. 1953, Townes family (ML and HT); Mt. Makiling, Laguna, 2 ♂, C. F. Baker (USNM, one allotype no. 22839), 1 ♀, 5 March 1954, A. A. Marmeto (BPIM), 2 ♀, 9 Sept. 1953 and 8 Nov. 1954, C. R. Baltazar (BPIM and MR); Mt. Banahao, 1 ♀, C. F. Baker, coll. 1927 (USNM); Lipa City, Batangas, 1 ♀, 21 May 1954, C. Magabasco (BPIM).

Mindanao: 1 ♀, Iligan, C. F. Baker (USNM), labelled "*Diodontus bakeri* Roh. metatype".

Samar: 1 ♀, C. F. Baker (USNM).

*Ps. bakeri* is easily distinguished from related species by the coarse puncturation of the scutum and the large tubercles on the frons. According to Rohwer (1921) the pygidial area is not defined, but this must have been an error, as also the paratype, which I was allowed to examine, has a distinct pygidial area, defined by lateral carinae.

The extension of the black marking on the mesopleura is variable, especially in the males. In one of the males from Mt. Makiling (not the allotype) the mesopleura are black except two large yellow spots against the anterior oblique suture. Also the inner margin of the epicnemial areas is black in this specimen.

#### ***Psenulus bakeri boholensis* n. subsp.**

Female. — Resembles typical form, but is darker. Flagellum of antennae dark-brown. Lateral spots on scutum longer, about as long as in the male of *Ps. bakeri bakeri*. Median spot on scutum not connected with anterior margin. Epicnemial areas, mesosternum and mesopleura black except anterior plate

of mesepisternum, which is yellow, a large yellow spot on hypo-epimeral area and an almost triangular yellow spot against the anterior oblique suture. Hind legs brown. Apical part of petiole darker than in typical form. Gastral tergites 3-6 and all sternites partly brown.

Length about 11 mm.

Male unknown.

Bohol: 1 ♀ (holotype), Sierra Bullones, 2400 feet, 21 April 1955, C. R. Baltazar (BPIM).

***Psenulus bakeri canlaonensis* n. subsp.**

Female. — Very similar to preceding form. Mesosternum and mesopleura black, except the anterior plate of the mesepisternum, which is yellow, a large yellow spot on the hypo-epimeral area and a yellow mark below the scrobal suture, about as in the female from Bohol. The black median mark on the scutum is connected with fore and hind margin by a broad line (fig. 128).

Antennae orange, scape and pedicel and first segments of flagellum yellow. Mid tibiae and hind legs light-brown. Veins of wings dark-brown.

Length about 10 mm.

Male unknown.

Negros Or.: 1 ♀ (holotype), Mt. Canlaon, 3600 feet, 8 May 1953, H. M. and D. Townes (HT).

This subspecies is easily distinguished from *Ps. bakeri* s. str. by the dark underside and sides of the thorax and from the subspecies from Bohol by the orange antennae. The black marking on the scutum is more extended.

**Group of *Psenulus pulcherrimus***

This group corresponds remarkably well with the subgenus *Eopsenulus* of Gussakovskij who created it in 1934 for the Japanese species *Ps. iwatai* Guss. (cf. also Tsuneki 1959). *Ps. iwatai* differs considerably from all other Japanese forms and is undoubtedly a near relative of *Ps. carinifrons* (Cameron), a widespread member of this group, which occurs also in Malaya. It seems that *Ps. iwatai* is the only *Psenulus* with a narrow interantennal carina which has been found as far north as Japan. In view of these facts it is not surprising that the group of *Ps. pulcherrimus* is distributed over an extensive area. It is now known from many of the Philippine Islands, Buru, Kangean Islands, Java, Krakatau, Sumatra and Malaya (up to Tenasserim where *Ps. pulcherrimus pulcherrimus* Bingham occurs). The females of the five Indo-Australian forms of the group are distinguished by the black or largely black scutum and by the projecting median part of the clypeal margin; in the males the posterior surface of the propodeum is very coarsely reticulate, whilst in the females this part is almost smooth.

***Psenulus pulcherrimus pulcherrimus* (Bingham)**

1896, Bingham, C. T., Jl. Linn. Soc. Zool., vol. 25, p. 443, ♀ (*Psen pulcherrimus*; Tenasserim).

1897, Bingham, C. T., The Fauna of British India, including Ceylon and Burma, Hymenoptera, vol. 1, p. 263.

Original description: "♀. Head above, thorax, and abdomen smooth and shining, the clypeus densely pilose; clypeus small, convex, the front between the eyes broad; the flagellum of the antennae testaceous, the 2nd joint as long as or longer than the 3rd and 4th together; ocelli in a triangle wide apart from each other, each ocellus in a pit; the apex of the mesonotum and the sides and apex of the postscutellum with coarse outwardly oblique striae; median segment long, rounded posteriorly, with a well-marked longitudinal furrow in the middle from base to apex; legs stout, the posterior tibiae with very minute spines; abdomen with the apices of segments 2-4 slightly constricted. Head and thorax black, abdomen ferruginous red; the scape and the basal five joints of the flagellum of the antennae below, a line on the pronotum, a spot before the tegulae, the tegulae, a large square spot at the apex of the mesonotum, the scutellum and postscutellum, two large oblong spots at the apex of the median segment, the apex of the coxae, the trochanters, femora, tibiae, and tarsi of the legs, and the petiole of the abdomen, yellow; the femora, tibiae, and tarsi of the posterior legs have a fuscous stain, and the apex of the petiole below is black; wings hyaline and beautifully iridescent, the nervures testaceous.

♀. Length 7 millim., exp. 12 millim.

Hab. Amherst (Tenasserim)."

Dr. J. van der Vecht, who during a recent stay in London kindly compared the type with a female of *Ps. pulcherrimus projectus*, made the following additional notes: "Slightly smaller than *projectus*, and a little more brightly coloured. Mesoscutum on each side with elongate yellow mark above the tegula, the median spot at posterior margin subrectangular, nearly twice as wide as long and only slightly narrower than mark on scutellum. Spots on propodeum large, as seen from behind reaching the lateral margins. Gastral petiole yellowish, somewhat infuscated beneath and at apex. Legs as in *projectus*, but hind femora and tibiae paler, trochanter of hind legs yellowish.

Interantennal carina, third antennal segment, carinate scutellar suture, sculpture of propodeum, shape of pygidial area etc. as in *projectus*.

May be regarded as subspecifically different only."

There is indeed little doubt that Bingham's specimen, taken at Amherst in Tenasserim, in Dec. 1893 (BM, no. 21.835), is closely related to the following subspecies, which represents *Ps. pulcherrimus* in Java. The depressed third antennal segment is characteristic in both forms and although Dr. van der Vecht did not state so expressly I suppose that the clypeal margin is protruding in the same way as in the Javanese subspecies.

My statement in the first part of this study (1959) that *Psen pulcherrimus* Bingham should be placed in *Diodontus* (sensu Kohl) was erroneous.

***Psenulus pulcherrimus projectus* n. subsp.**

Female. — Head black; mandibles except dark tips yellow, also palpi yellow. Scape of antennae yellow, underside of flagellum orange-yellow, upper side dark-brown. Thorax black; the following parts are yellow: upper part of pronotum, pronotal tubercles, a spot on scutum in front of scutellum (fig. 129), scutellum except hind margin, metanotum, two elongate spots on propodeum (sometimes these spots are very small, rarely completely absent). Tegulae reddish. Fore and mid legs including coxae yellow, tarsi reddish; hind legs dark-brown except the base of the tibiae, which is yellow. Veins of wings dark-brown. Petiole black or dark-brown, also greater part of first gastral tergite and sometimes also the base of the second tergite; rest of gaster red.

Clypeus almost flat; central part of anterior margin projecting as a large tooth which is coarsely punctate, more or less rounded at the apex; this apex seems to consist of two teeth which have melted together (fig. 131). On both sides of this median tooth the clypeus is emarginate. Projecting part of interantennal carina not broadened; no distinct transverse carina below the antennae. Frons and vertex smooth and shining. Antennae clavate, third segment with longitudinal depression on upper side.

Scutum shining, with minute punctures. Enclosed area of propodeum triangular; posterior surface of propodeum smooth and shining, some irregular reticulation at apex, sides reticulate. The narrow median groove of the propodeum ends below in some circular depressions, separated from each other by transverse carinae. Femora thick. Apex of mid tibiae with a flat, partly bare area, anteriorly defined by an oblique raised ridge, posteriorly by a row of 4-5 red spines. Inner spur of hind tibiae as long as basitarsus. First recurrent vein of fore wings interstitial or just ending in second submarginal cell, second recurrent vein received by third submarginal cell. Petiole cylindrical. Gaster with minute punctures. Pygidial area narrow, lateral carinae parallel (fig. 130).

Pubescence whitish, dense and more yellowish-brown on margin of fourth and fifth gastral sternites and on disk of sixth sternite. Face with silvery, partly appressed pubescence. On both sides of the median mesosternal carina the pubescence is long and dense. Epicnemial areas below with a round patch of yellowish pubescence. Behind the enclosed area of the propodeum on each side a bare area. Posterior surface of hind femora with fine pubescence.

Length about 7,5-8 mm.

Male. — Differs from the female in the following characters. Underside of flagellum not completely yellowish-orange, but most segments with a yel-



lowish spot on base only. Fore and mid femora darkened below. Yellow markings on propodeum usually larger.

Clypeal margin normally bidentate (fig. 132). Distinct transverse carina below antennae, arched in frontal view. Antennae long, first two segments of flagellum flattened, front side of segments 6-12 rounded in dorsal view. Posterior surface of propodeum very coarsely reticulate. Apex of mid tibiae without a flat and bare area, only two red spines, closely together.

Length about 7-8 mm.

East Java: 1 ♀ (holotype), Malang, May 1933, J. G. Betrem (ML); 1 ♂ (allotype), Malang, March 1933, J. G. Betrem (ML). The following specimens from Java are all paratypes: 10 ♀ and 3 ♂, Malang, March-June 1933, J. G. Betrem (8 ♀ and 2 ♂ ML, 2 ♀ and 1 ♂ MR); 1 ♀, Idjen Plateau, Blawan, 900 m, 26 June 1939, J. van der Vecht (ML).

West Java: Bandung, 700 m, 26 ♀, 7 March 1940, 12-13 Oct. 1940, May-June 1941, Aug.-Sept. 1941, 5 ♂, 13-16 Febr. 1941, 6-9 March 1941, 15-25 May 1941, 2 July 1941 (♀ ♂ ML, MZB, 1 ♀ BPIM, 3 ♀ and 2 ♂ MR); Mt. Gede, Tapos, 800 m, 1 ♀, Febr. 1933, 1 ♀, 1-16 Aug. 1936, J. van der Vecht (ML); Bogor, 1 ♀, 1955, Bot. Gard., 250 m., leg. Hamann (ML), 1 ♀, 31 May 1954, M. A. Lieftinck (ML), 1 ♂, 1 March 1937, R. Awibowo (ML), 1 ♀, 3 July 1953, M. A. Lieftinck (ML); Sukabumi, 1 ♀ (IRSNB, I.G. 18.388); 1 ♀, Bibidjilan, Mts. Djampang Tengah, Febr. 1939, ex coll. K. V. Krombein (USNM).

Krakatau: 1 ♀, Dec. 1919 (ML).

In this latter specimen the first recurrent vein of the fore wings ends in the first submarginal cell. The petiole is much paler brown. It has been identified by Maidl as *Ps. pulcherrimus* Bingham.

According to notes on the labels a female from Bogor has been taken "with prey (Cicadellids)", and a male from the same locality was reared from a twig of *Ceiba pentandra*, in which a larva of the Curculionid *Alcides leeuweni* had made its tunnel.

### ***Psenulus carinifrons* (Cameron)**

1902, Cameron, P., Jl. Bombay Nat. Hist. Soc., vol. 14, pp. 288-289, ♂, (*Psen carinifrons*; Deesa).

This Indian species has the largest area of distribution, extending to Luzon and N. Queensland, and evidently it is very common, as I have seen large series from various islands. Deesa is situated at the extreme north of the province of Gujarat, being about 40 miles distant from Mount Abu (Nurse, 1903).

Original description: "Niger, mandibulis, scapo antennarum, linea pronoti, scutello, postscutello, pedibus anterioribus tibiisque posticis flavis; abdominis medio rufo late maculato; alis hyalinis; nervis stigmatumque nigris. ♂.

Long: fere 7 mm.

Habitat: Deesa.

Antennae black, stout, the scape and second joint straw-yellow; the flagellum brownish beneath towards the apex and base. Head black; the vertex smooth, shining; the front minutely and closely punctured; the lower part of the face and the clypeus thickly covered with depressed silvery pubescence; between the antennae is a stout, projecting keel, which becomes triangularly widened below the antennae. Mandibles and palpi straw-yellow; the mandibular teeth black, the palpi yellow. Thorax shining; the edge of the pronotum, the tubercles, scutellum and postscutellum straw-yellow. Median segment reticulated, broadly furrowed down the middle, the furrow not margined; the base of the segment is smooth; the narrow depression at the base is striated; pro- and meso-pleurae smooth and shining; the furrows crenulated; the metapleurae reticulated; the reticulations are closer and more regular than they are on the metanotum. The four front legs are straw-yellow, as are also the hinder tibiae, the hinder coxae, except at the apex, the femora, the apex of the tibiae and of the tarsi, black. Wings clear hyaline; the first and second transverse cubital nervures are parallel and oblique; the first recurrent nervure is interstitial; the second is received shortly beyond the second transverse cubital, almost touching it. Abdomen black; the second segment is rufous to shortly beyond its middle; the petiole is longer than usual, being as long as all the rest of the abdomen united in the ♂; it is largely nodose at the apex."

I have seen a male from Deesa, June 1897, Col. C. G. Nurse collection (BM, 1920-72), labelled "type". It is probably a paratype, the holotype in the BM having catalogue number 21834, according to Dr. van der Vecht. There is very little difference between this specimen and the next form which occurs in the Philippines and which has been described by Rohwer as *Diodontus xanthognathus* (1910). The posterior surface of the propodeum is slightly less coarsely reticulate and the second gastral tergite has two red lateral spots, as in the female of *Ps. xanthognathus*, which has been considered here as a subspecies of *Ps. carinifrons*. The male of the Philippine form has no distinct spots on the second tergite.

However, this latter form and the subspecies from the other islands within the extensive area of distribution are very much resembling each other and as from some localities only one sex is known there are still some uncertainties in regard to the subspecific division.

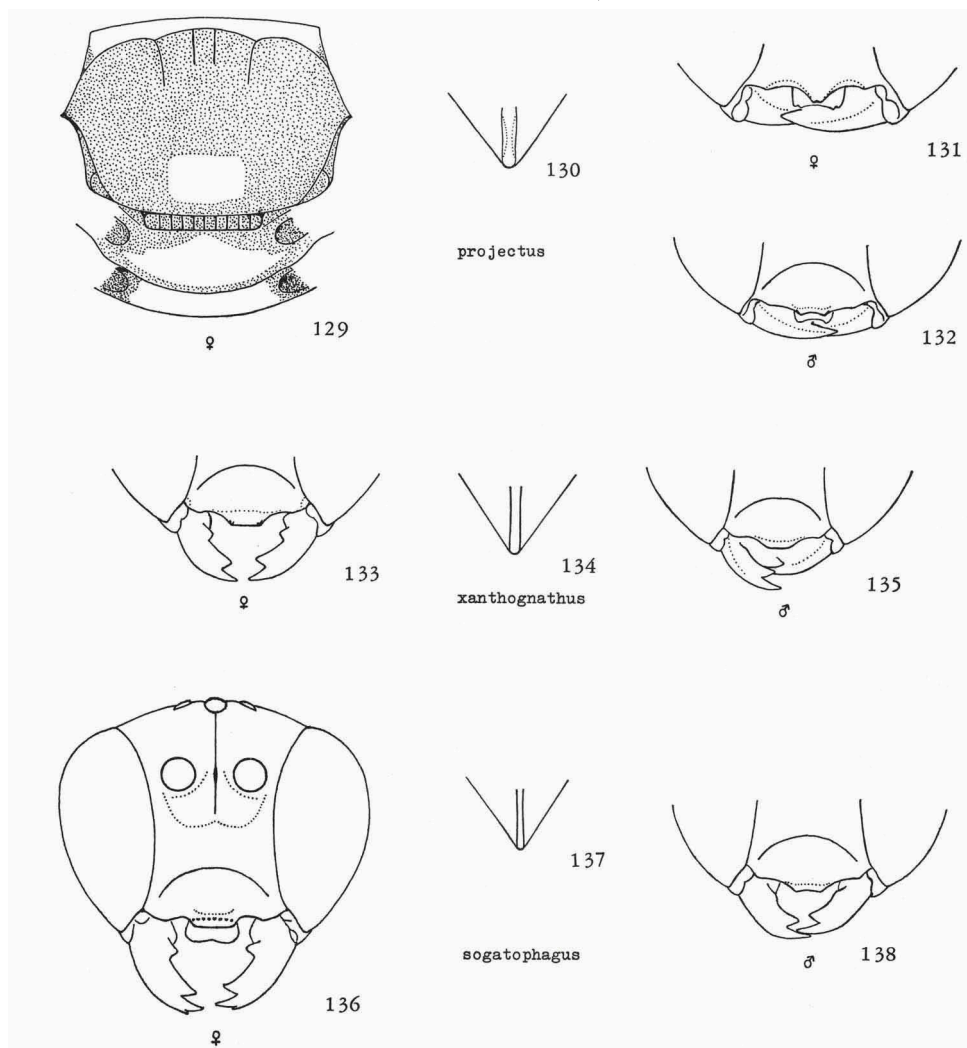
### ***Psenulus carinifrons xanthognathus* (Rohwer)**

1910, Rohwer, S. A., Proc. U. S. Nat. Mus., vol. 37, p. 660, ♂ (*Psenulus* (*Neofoxia*) *xanthognathus*; Luzon).

1921, Rohwer, S. A., Phil. Jl. Sc., vol. 18, no. 3, p. 312 (*Diodontus xanthognathus*; ♀ Luzon and Palawan, ♂ Luzon, Palawan and Mindanao).

1923, Rohwer, S. A., Phil. Jl. Sc., vol. 22, no. 6, p. 601 (*Diodontus xanthognathus*; ♀ Penang Island, ♂ Borneo and Mindanao).

Female. — Head black; mandibles yellow except dark tips, palpi testaceous. Scape of antennae yellow, flagellum black above, reddish-brown below. Thorax black, but the following parts are yellow: dorsal part of pronotum, pronotal tubercles, scutellum and metanotum. Tegulae testaceous. Fore and mid



Figs. 129-131. *Psenulus pulcherrimus projectus* n. subsp., ♀, holotype; thorax, pygidial area and lower part of face.

Fig. 132. *Psenulus pulcherrimus projectus* n. subsp., ♂, allotype; lower part of face.

Figs. 133-135. *Psenulus carinifrons xanthognathus* (Rohwer); lower part of face and pygidial area of female and lower part of face of male.

Figs. 136-138. *Psenulus sogatophagus* Pagden, paratypes; face and pygidial area of female and lower part of face of male.

legs yellow except the coxae which are black and the trochanters which are brown, at least dorsally; a brown mark on the basal upper surface of the femora. Hind legs brown except the yellow basal three quarters of the tibiae. Veins of wings brown. Gaster dark-brown or black; petiole black, the sides of the first gastral tergite and the basal two thirds of the second gastral tergite red, or the second tergite with two red lateral spots only.

Median part of anterior margin of clypeus broad and protruding, almost straight, lateral teeth very small (fig. 133). Disk of clypeus convex, dull. Interantennal carina sharp, also the dorsal side of the protruding part; no distinct transverse carina below the antennae. Frons on each side of the median carina slightly convex, puncturation fine, but mostly dense and distinct. Vertex with finer punctures. Interocellar area raised. Mandibles bidentate at apex and with a distinct tooth on the inner margin. Antennae clavate.

Scutum with minute punctures, parapsidal sutures well defined, straight, prescutal sutures distinct on basal half of scutum. Enclosed area of propodeum triangular, with usual oblique carinae and more or less pentagonal median area. Posterior surface of propodeum smooth, median groove not extending to apex, but ending in a few almost circular depressions separated from each other by transverse carinae; sides of propodeum with close reticulation. Femora thick, base of fore femora flattened below. Inner spur of hind tibiae about as long as three quarters of the length of the basitarsus. The first recurrent vein of the fore wings ends in the second submarginal cell or it is interstitial, the second recurrent vein is received by the third submarginal cell. Petiole cylindrical. Pygidial area narrow, slightly widened towards the apex, lateral carinae not sharp (fig. 134).

Face silvery pubescent, mostly appressed. Pubescence of rest of body yellowish-grey, very dense and more white on margin of fourth and fifth gastral sternites. Basal two thirds of the upper part of the hind surface of the hind femora almost bare.

Length about 6.5-7 mm.

Male. — Resembling female, but no red on second gastral tergite. Protruding part of clypeal margin not as broad as in the female (fig. 135). A transverse carina below the antennae. Propodeum almost smooth just behind the enclosed area, declivity very coarsely reticulate. Antennae long, segments rounded below.

Length about 6-7 mm.

Luzon: 1 ♂ (paratype, no. 12819), Manila, Robt. Brown (USNM); 2 ♀, Manila, 28 Febr. 1953, Townes family (HT and MR); 1 ♀, Antipolo, Riz., 1 March 1953, Townes family (HT); Rosario, La Union, 1 ♀ and 2 ♂, 30 Nov. 1953, H. Townes (HT, 1 ♀ MR), 1 ♂, 30 Nov. 1953, C. R. Baltazar

(BPIM); 1 ♀ and 1 ♂, Benaue, Mt. Prov., 31 Dec. 1953, H. M. and D. Townes (HT, ♂ MR); 1 ♂, Tagaytay, Batangas, 9 Nov. 1952, Townes family (HT); Mt. Makiling, Los Baños, Laguna, C. F. Baker, 3 ♀ and 7 ♂ (USNM), 1 ♀ (BM, 1913-335); Los Baños, C. F. Baker, 5 ♀ and 5 ♂ (USNM), 3 ♂ (BM, 1913-335); 2 ♀, Malinao, Tayabas, C. F. Baker (USNM).

Samar: 10 ♀, C. F. Baker (USNM).

Mindanao: 2 ♂, Dapitan, C. F. Baker, no. 3219; 1 ♂, Tangcolan, Bukidnon, C. F. Baker; 1 ♂, Davao, C. F. Baker (all USNM).

Palawan: 1 ♀ and 3 ♂, Puerto Princesa, C. F. Baker, no. 3813 and 4979 (USNM).

Sibuyan: 3 ♀ (2 numbered 18895) and 11 ♂ (2 numbered 18896), C. F. Baker (USNM).

Negros: 21 ♀ and 14 ♂, Cuernos Mts., C. F. Baker (2 ♀ numbered 21319, 2 ♂ numbered 21320) (USNM); 1 ♀, Negros Or., Mt. Canlaon, 3600 feet, 8 May 1953, H. M. and D. Townes (HT).

Cebu: 2 ♂, Minglanilla, Camp 7, 3 Febr. and 23 May 1960, C. R. Baltazar (BPIM and MR).

Although there is some variation in the extension of the red markings on the gaster and the yellow colour on fore and mid legs I have considered all these specimens to belong to the form which was originally described from Luzon (Rohwer, 1910). The males, which have no distinct red colour on the gaster, might be confused with the following subspecies and only in those cases where both sexes are found together their identity can be ascertained with certainty.

The males which I have seen from Mindanao have a tendency to be more brownish coloured; the yellow band on the dorsal surface of the pronotum does not extend to the sides; the anterior margin of the scutellum is somewhat brown and even the scutum is not quite black. The fore and mid femora are almost completely brown.

In the females from Sibuyan and Negros the fore and mid trochanters and femora are completely yellow; in the males these parts may be partly darkened.

*Ps. carinifrons xanthognathus* is closely related to *Ps. (Eopsenulus) iwatai* Guss. of Japan. I would not be surprised if the small structural differences and the lesser extension of the yellow colour would later prove to be of no more than subspecific value. It is also allied to *Ps. sogatophagus* Pagden, from which it differs in the tridentate mandibles (quadridentate in the latter species). It is easily distinguished from other *Psenulus* by the protruding median part of the clypeal margin, which is almost straight in the female.

***Psenulus carinifrons rohweri* n. subsp.**

1923, Rohwer, S. A., Phil. Jl. Sc., vol. 22, no. 6, p. 601, ♀ (*Diodontus xanthognathus*, partim; Singapore).

This form represents *Ps. carinifrons* in Malaya and in the southern part of the Indo-Australian archipelago. It closely resembles the preceding form, but the females have a completely black gaster, sometimes reddish-brown tinged, but never with distinct red spots or transverse band. The puncturation of the frons and the scutum is indistinct in both sexes and the frons seems to be less convex than in the preceding form.

In the males from Semarang and in the females from Semarang, the Kangean Islands and Buru the fore and mid trochanters and femora are yellow; from the latter two localities I have seen no males.

Malaya: Selangor, 1 ♂, Puchong, Castlefield Estate, 7 Oct. 1928, no. 917, H. T. Pagden (HTP), 1 ♂, Serdang, 24 Nov. 1936, "on padi", no. 0343, H. T. Pagden (HTP); Perak, 1 ♂, Parit Buntar, 9 June 1929, no. 1077, H. T. Pagden (HTP).

Singapore: 2 ♀, C. F. Baker, no. 16830 (USNM).

Sumatra: 1 ♀, Anei cleft, Sumatra west coast, 500 m, 1925, E. Jacobson (MA); 1 ♂, Res. Bankulen, Muaro Tenam, South Sumatra, 250 m, 4-14 July 1935, Mrs. M. E. Walsh (ML); 1 ♂, Sinabang, Simalur, Febr. 1913, E. Jacobson (ML); 1 ♂, Labuan Badjan Sim., June 1913, E. Jacobson (ML); 1 ♀ and 2 ♂, July 1922, Brastagi, L. Fulmck (NMW).

Borneo: 1 ♀, E. Borneo, Pelawanbesar, sea level, May 1937, Mrs. M. E. Walsh (ML); 2 ♂, N. Borneo, Sandakan, C. F. Baker, no. 16827 (USNM); 3 ♂, N. Borneo, Kudat, 1-12 Sept. 1927 (BM, 1955-354, ex FMS Museum).

Java: 1 ♀ (holotype) and 2 ♂ (allotype and paratype), Res. Semarang, Tjandi, Aug. 1939, J. G. Betrem (holotype and allotype ML, paratype MR).

Kangean Islands: 2 ♀, Batuputih, 26 Aug. 1954, A. Hoogerwerf (ML, MR).

Buru: 1 ♀, Station 21, 12 Jan. 1922, L. J. Toxopeus, "caught on Zea Mays on excretion of aphids" (MA).

The three males from Kudat, N. Borneo, show a similar discoloration as the specimens of *Ps. carinifrons xanthognathus* from Mindanao.

A male from N. Queensland, June-July 1918, R. Veitch (BM, 1918-123) was placed in the collection of the BM under *Ps. scutellatus*, described by Turner in 1912 (♀). It is slightly more slender than the other males of *Ps. carinifrons*. If this wasp really represents the other sex of Turner's *Ps. scutellatus*, it is probable that *scutellatus* and *rohweri* are identical. In that case the former name should be used.

***Psenulus sogatophagus* Pagden**

1933, Pagden, H. T., Trans. Royal Ent. Soc. London, vol. 81, pp. 97-101, ♀ and ♂, (*Psenulus sogatophagus*; Malaya).

Pagden has given a very detailed description of this remarkable species. The extension of the yellow colour on scutellum and metanotum seems to vary somewhat. Below a redescription is given, based on the two paratypes which the author kindly sent me for examination and six specimens which are now in the BM. This description is not as extensive as the original description, but it has been adapted to those of the other species treated in this paper and furthermore it contains a few characters which have not been mentioned by the author.

Female. — Black; mandibles yellow except dark tips, palpi testaceous, labrum pale red. Scape of antennae yellow, underside of flagellum reddish-brown, upper side dark. Pronotum dorsally with yellow band, which is interrupted in the middle and reduced on the sides. Pronotal tubercles for the greater part yellow. Tegulae brown. Hind margin of scutellum with T-shaped yellow mark. Metanotum yellow. Fore and mid legs including trochanters yellow, tarsi except basitarsi reddish. Hind tibiae yellow except dark apical third part. Veins of wings brown.

Protruding median part of clypeus broad and nearly straight, almost imperceptibly bisinuate; depressed margin defined by a row of strong punctures (fig. 136). Behind this row a narrow shining area, disk of clypeus minutely punctate. Interantennal carina sharp, no transverse carina below the antennae. Frons slightly convex on each side of the median carina and distinctly but finely punctate. Vertex shining, almost impunctate. Mandibles tridentate at apex, also a strong tooth halfway the inner margin (fig. 136). Antennae clavate.

Scutum with minute punctures. Enclosed area of propodeum triangular; median suture on declivity of propodeum narrow, it does not reach the apex but ends in a few circular depressions separated from each other by transverse carinae. Hind surface of propodeum shining, with minute punctures, sides with close reticulation. Femora thick, base of fore femora flattened. Inner spur of hind tibiae about three quarters of the length of the basitarsus. First recurrent vein of fore wings usually received by second submarginal cell, second recurrent vein by third submarginal cell. Petiole cylindrical. Pygidial area narrow, slightly widened towards apex, lateral carinae not sharp (fig. 137).

Length about 8 mm.

Male. — Similar to female, but differing in the following points. Upper side of scape of antennae somewhat reddish-brown. Thorax darker, the marks

of scutellum and metanotum partly reddish-brown darkened. Pronotum without yellow marking, completely black- and reddish-brown. Legs coloured as in female.

Protruding median part of clypeal margin less broad, slightly emarginate, so that two indistinct teeth are formed (fig. 138). Distinct transverse carina below antennae, strongly arched. Apex of mandibles bidentate. Antennae long.

Behind the enclosed area of the propodeum a narrow, almost smooth area; posterior surface of propodeum with coarse reticulation which leaves free a semicircular depression at the apex. First recurrent vein of fore wings nearly interstitial.

Length about 7.5 mm.

The pubescence is in both sexes mostly grey or yellowish-grey, on the face it is silvery and mostly appressed.

Malaya: Perak, Bagan Sérai; 1 ♀ and 1 ♂ (paratypes), 30 Nov. and 1 Dec. 1931, numbers 2544 and 2547, H. T. Pagden (HTP); 2 ♂ and 4 ♀, 29 Nov. — 6 Dec. 1931, H. T. Pagden (BM, 1955-354, ex FMS Museum).

All these specimens have been bred, also the type (♂) and the allotype, which are in the BM and hatched on 1st Dec. 1931. I have not examined the type and allotype.

The venation of the fore wings is somewhat irregular. In one of the males (6 Dec. 1931) the first recurrent vein of both the left and the right fore wing ends in the first submarginal cell, in another male (1 Dec. 1931) the first recurrent vein of the right wing is interstitial and in one female (29 Nov. 1931) the first recurrent vein of the left wing is interstitial.

*Ps. sogatophagus* is closely related to *Ps. carinifrons xanthognathus* Rohwer but because of the quadridentate mandibles and the slight difference in the shape of the clypeal margin I have considered it as a separate species.

It is the only Indo-Australian *Psenulus* of which more detailed particulars regarding its bionomics have been published (Pagden, 1933, see also notes on bionomics, p. 111).

#### Notes on some *Psenulus* species from India

Of the few species of *Psenulus* described from India I have only seen *Psenulus bicinctus* Turner (1912), represented by a female received for study from the British Museum (Natural History), London. It is probably one of the four specimens which have been captured in Assam, Shillong, at a height of 6000 feet. This species is easily distinguished by the red colour of the second, fifth and sixth gastral segments. The female studied has a broad excavate interantennal carina and a transverse carina below the antennae, the first recurrent vein of the fore wings is interstitial and the pygidial area



is elongate-triangular. The petiole has a longitudinal dorsal groove. It differs distinctly from the Indo-Australian species described in this paper.

Unfortunately I have not been able to examine the following species recorded from India:

*Psen clavatus* Cameron (1890), Poona

*Psen rufobalteata* Cameron (1904), Khasia Hills, Assam

*Psen montanus* Cameron (1907a), Simla

*Psen puncticeps* Cameron (1907a), Simla

Judging from the descriptions these wasps seem to belong to the genus *Psenulus*, but it is not likely that they are identical with any of the forms from the Malay Peninsula or from the Malay Archipelago.

### BIONOMICS

*Ps. sogatophagus* Pagden, found in Malaya, is the only Indo-Australian species of which the bionomics have been reported in detail (Pagden, 1933). On the labels of a few other species I found some information with regard to their nests and their food.

The Indo-Australian *Psenulus* seem to have about the same nesting habits as their European relatives, making their nests in hollow twigs or stems. A pupa of *Ps. antennatus* was found in a stem of *Leea*, and *Ps. pulcherrimus projectus* was reared out of a twig of *Ceiba pentandra*. Mr. H. T. Pagden (1933) discovered *Ps. sogatophagus* nesting in the grass *Sacciolepis myosuroides* Ridley. The stems of this grass are hollow and floating on the water, the shoot being erect. The nests were made in the floating part of the stems, the entrance usually being just below a node and the first cell just above the previous node.

The partitions between the cells consisted of a thin membrane of whitish silk and the larvae had spun cocoons of brownish silk after having strengthened with silk the partitions above their heads. Some of the European species also make cocoons, others again content themselves with strengthening the partition or constructing a separate strong membrane above their head.

Like many other Pseninae *Ps. sogatophagus* was very local and was only found in one place, along a distance of not more than ten yards along one bank, although both its prey and the grass are widely distributed.

With regard to the prey of the Indo-Australian *Psenulus* the records are also very scarce. A female of *Ps. pulcherrimus projectus* was caught with prey: "cicadellids". The food of *Ps. sogatophagus* consisted, according to Pagden, of the Delphacid *Sogata furcifera* Horv. and, though in much smaller numbers, of the Jassid *Nephotettix bipunctata* F., both Homoptera being pests of rice. Most of this prey was in the nymphal stage, but also a few adults

were found in the cells. In this connection it is interesting to note that the European *Psenulus* collect Psyllidae, either exclusively nymphs or only adults, or Aphidae.

*Ps. pagdeni* was found by Mr. Pagden flying around two small trees (*Eugenia* sp.) presumably collecting Homoptera nymphs. The only homopteron which Mr. Pagden could find on the trees frequented by *Ps. pagdeni* and which almost certainly is the adult of the prey, has been identified by Dr. H. C. Blöte as *Idiocerus* sp. (Jassidae).

#### LIST OF THE PSENINAE FROM THE INDO-AUSTRALIAN ARCHIPELAGO AND THE MALAY PENINSULA

In the following list I have omitted the names of the few groups in which I have placed some species of the subgenus *Psen* (see Part I). The reason is that these groups do not have the same taxonomic value as the groups into which I have divided the genus *Psenulus*, where they have to be considered as an attempt to arrive at a subgeneric classification later on.

genus **Psen** Latr.

subgenus **Psen** Latr.

<i>curvipilosus</i> van Lith, ♀ ♂	— Java.
<i>lieftincki lieftincki</i> van Lith, ♀ ♂	— Sumatra, Malaya.
<i>lieftincki</i> subsp. ♂	— Malaya.
<i>triangulatus</i> van Lith, ♂	— Java.
<i>carbonarius</i> (Smith), ♂	— Morotai.
<i>nitidus</i> van Lith, ♀ ♂	— Java, Krakatau, Bangka, ?India.
<i>terrigenus</i> van Lith, ♀	— Java.
<i>elisabethae</i> van Lith, ♀ ♂	— Java, Sumatra (also India).
<i>coriaceus</i> van Lith, ♀ ♂	— Luzon, Mindoro, Negros, Mindanao.
<i>politiventris</i> Rohwer, ♀ ♂	— Luzon.
<i>rubicundus rubicundus</i> van Lith, ♀	— W. Java.
<i>rubicundus lawuensis</i> van Lith, ♀	— E. Java.
<i>bakeri</i> Rohwer, ♀ ♂	— Luzon.
<i>vechti</i> van Lith, ♀	— Java.
<i>melanosoma</i> Rohwer, ♂	— Negros, Luzon.
<i>emarginatus</i> van Lith, ♀ ♂	— Java.

<i>betremi</i> van Lith, ♀ ♂	— Java.
<i>opacus</i> van Lith, ♀	— Luzon.
<i>toxopeusi</i> van Lith, ♀	— Celebes.
<i>aureohirtus aureohirtus</i> Rohwer, ♀ ♂	— Luzon, Sibuyan.
<i>aureohirtus rufopetiolatus</i> van Lith, ♂	— Negros.
<i>petiolatus</i> Smith (well-placed?), ♀	— Misool.

subgenus **Pseno** Malloch

<i>townesi</i> van Lith, ♀	— Luzon.
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subgenus **Mimumesa** Malloch

<i>auratus auratus</i> van Lith, ♀	— Sumatra, Java, Bali.
<i>auratus mindoroensis</i> van Lith, ♀	— Mindoro.
<i>auratus multipunctatus</i> van Lith, ♀	— Negros.
<i>tridentatus</i> van Lith, ♀	— Sumatra.

genus **Psenulus** Kohlgroup of **scutatus**

<i>scutatus scutatus</i> (Rohwer), ♀ ♂	— Luzon, Samar, Negros.
<i>scutatus sibuyanensis</i> n. subsp., ♂	— Sibuyan.
<i>scutatus mindanaoensis</i> (Rohwer), ♀	— Mindanao.
<i>scutatus borneensis</i> (Rohwer), ♀	— Borneo.
<i>hemicyclius</i> n. sp., ♀ ♂	— Palawan.
<i>baltazarae baltazarae</i> n. sp. and subsp., ♀	— Luzon.
<i>baltazarae luteus</i> n. subsp., ♀	— Sibuyan.
<i>dentatus</i> n. sp., ♀	— Java.

group of **rugosus**

<i>rugosus</i> n. sp., ♀	— Mindanao.
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group of **quadridentatus**

<i>quadridentatus</i> n. sp., ♀ ♂	— Malaya.
<i>separatus</i> n. sp., ♀	— Java.
<i>pendleburyi</i> n. sp., ♀	— Borneo.
<i>macrodentatus</i> n. sp., ♀	— Sumatra.
<i>compactus</i> n. sp., ♀	— Sumatra.

group of **antennatus**

<i>antennatus</i> (Rohwer), ♀ ♂	— Malaya, Singapore, Java, Bali.
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*penangensis* (Rohwer), ♀ — Malaya.

group of **singularis**

*singularis* n. sp., ♀ — Luzon.

group of **erraticus**

*erraticus erraticus* (Smith), ♀ — Celebes.

*erraticus basilanensis* (Rohwer), ♀ ♂ — Singapore, Borneo, Basilan.

*erraticus butuanensis* n. subsp., ♂ — Mindanao.

group of **crabroniformis**

*crabroniformis crabroniformis* (Smith), ♂ — Borneo.

*crabroniformis sumatranus* (Ritsema), ♀ — Sumatra, Java.

*philippinensis philippinensis* (Rohwer), ♀ — Luzon.

*philippinensis dapitanensis* (Rohwer), ♀ — Mindanao, Bohol.

group of **tuberculifrons**

*tuberculifrons tuberculifrons* (Rohwer), ♀ — Luzon.

*tuberculifrons decoratus* n. subsp., ♀ — Sibuyan.

*cavifrons* n. sp., ♀ — Samar.

*maurus* (Rohwer), ♂ — Luzon.

*maculatus maculatus* n. sp. and subsp., ♀ — Malaya.

*maculatus javanensis* n. subsp., ♀ ♂ — Java.

group of **nigrolineatus**

*nigrolineatus nigrolineatus* (Cameron), ♀ ♂ — Malaya, Borneo.

*nigrolineatus ajax* (Rohwer), ♀ — Luzon.

*nigrolineatus flavicornis* n. subsp., ♀ — Sibuyan.

*nigrolineatus dubius* n. subsp., ♀ — Mindanao.

*nigrolineatus sulphureus* n. subsp., ♀ — Sumatra.

*varius* n. sp., ♂ — Malaya.

*diversus* n. sp., ♀ — Singapore.

group of **luteopictus**

*luteopictus luteopictus* (Rohwer), ♀ — Luzon, Negros.

*luteopictus calapanensis* n. subsp., ♀ — Mindoro.

group of **sandakanensis**

*sandakanensis* (Rohwer), ♀ ♂ — Borneo, Sumatra.

*corporaali* n. sp., ♀ — Sumatra.

<i>filicornis</i> (Rohwer), ♂	— Basilan.
<i>ajaxellus</i> (Rohwer), ♂	— Mindanao.
<i>esuchus</i> (Rohwer), ♂	— Borneo.
<i>trimaculatus</i> n. sp., ♂	— Malaya.
<i>pagdeni</i> n. sp., ♀	— Malaya.

group of **interstitialis**

<i>interstitialis interstitialis</i> Cameron, ♀ ♂	— New Guinea.
<i>interstitialis luzonensis</i> (Rohwer), ♀ ♂	— Luzon, Negros, Biliran.
<i>interstitialis davanus</i> (Rohwer), ♀ ♂	— Mindoro, Mindanao.
<i>interstitialis pseudolineatus</i> n. subsp., ♂	— Palawan.
<i>interstitialis baliensis</i> n. subsp., ♀	— Bali.
<i>nigromaculatus</i> (Cameron), ♀	— Borneo.
<i>multipictus</i> (Rohwer), ♀	— Luzon.
<i>tristis</i> n. sp., ♂	— Palawan.
<i>ornatus</i> (Ritsema), ♂	— East Java.
<i>pseudajax</i> n. sp., ♂	— Central Java.
<i>elegans</i> n. sp., ♂	— West Java.
<i>continentis</i> n. sp., ♀	— Malaya.
<i>bakeri bakeri</i> (Rohwer), ♀ ♂	— Luzon, Mindanao, Samar.
<i>bakeri boholensis</i> n. subsp., ♀	— Bohol.
<i>bakeri canlaonensis</i> n. subsp., ♀	— Negros.

group of **pulcherrimus**

<i>pulcherrimus pulcherrimus</i> (Bingham), ♀	— Tenasserim.
<i>pulcherrimus projectus</i> n. subsp., ♀ ♂	— Java, Krakatau.
<i>carinifrons xanthognathus</i> (Rohwer), ♀ ♂	— Luzon, Sibuyan, Samar, Negros, Cebu, Mindanao, Palawan.
<i>carinifrons rohweri</i> n. subsp., ♀ ♂	— Malaya, Singapore, Sumatra, Borneo, Java, Kangean Islands, Buru.
<i>sogatophagus</i> Pagden, ♀ ♂	— Malaya.

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