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CONTRIBUTION TO THE KNOWLEDGE OF THE PEMPHREDONINAE FAUNA OF FORMOSA AND THE RYUKYUS (HYMENOPTERA, SPHECIDAE)

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CONTRIBUTION TO THE KNOWLEDGE OF THE PEMPHREDONINAE FAUNA OF FORMOSA AND THE RYUKYUS (HYMENOPTERA, SPHECIDAE)*

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The material** used in the present study was sent from the Entomological Laboratory, Kyushu University, Fukuoka, and Bernice P. Bishop Museum, Honolulu. The author wishes to express his thanks to the curator of the respective collection to give him a chance of investigation of these interesting specimens.

Only 8 species of Pemphredoninae have been on record up to the present from the two regions concerned here, namely, 5 species from Formosa: *Psen* (*Psen*) *koreanus formosensis* Tsuneki, *Psenulus taihorinis* Strand, *Psenulus ornatus* Ritsema, *Psenulus formosicola* Strand, *Stigmus* (*Carinostigmus*) *formosanus* Tsuneki, and 3 species from the Ryukyus: *Psen* (*Psen*) *santaro* Yasumatsu, *Psen* (*Psen*) *exaratus* Eversmann and *Stigmus* (*Stigmus*) *shirozui* Tsuneki.

Among the specimens dealt with in this study I found 5 species of *Psen*, 2 species of *Psenulus*, 1 species of *Pemphredon*, 2 species of *Stigmus* and 1 species of *Passaloecus* which are as follows:

Psen (*Psen*) *exaratus santaro* Yasumatsu, 1942 (Conj. nov.) ..... Is. of Amami-Ohshima
Psen (*Psen*) *exaratus intermedius* subsp. nov. ..... Is. of Okinawa
Psen (*Psen*) *exaratus taiwanus* subsp. nov. ..... Formosa
Psen (*Psen*) *opacus gressitti* subsp. nov. ..... Is. of Amami-Ohshima
Psen (*Psen*) *hirashimai* sp. nov. ..... Is. of Amami-Ohshima
Psen (*Psen*) *hakusanus seminitidus* Van Lith, 1965 (Conj. nov)... Formosa
Psen (*Psen*) *shirozui* sp. nov. ..... Formosa
Psenulus quadridentatus formosanus subsp. nov. ..... Formosa
Psenulus formosicola Strand, 1915 ..... Formosa
Pemphredon (*Pemphredon*) *shirozui* sp. nov. ..... Formosa
Stigmus (*Carinostigmus*) *taiwanensis* sp. nov. ..... Formosa
Stigmus (*Carinostigmus*) *saigusai* sp. nov. ..... Formosa
Passaloecus annulicornis sp. nov. ..... Is. of Tokunoshima

1. *Psen* (*Psen*) *exaratus santaro* Yasumatsu, 1942 (conj. nov.)

Psen (*Psen*) *santaro* Yasumatsu, Mushi, 14 (2) : 94, 1924 (♂).
Psen (*Psen*) *santaro*: Tsuneki, Mem. Fac. Lib. Arts. Fukui Univ., II. 9 : 74, 1959.
Psen (*Psen*) *exaratus*: Tsuneki, (nec Eversmann), Life Study, 6 (1) : 6, 1962 (♀).
Psen (*Psen*) *santaro*: Tsuneki, Life Study (Fukui), 6 (3) : 40, 1962 (♂).
Psen (*Psen*) *santaro*: Van Lith, Zool. Verh., 73 : 18, 1965.

Among the specimens of *Psen* I found one that appeared very close to *P. exaratus* Eversmann, but its extraordinarily coarse and sparse punctuation led me to the thought that it might be the hitherto unknown female of *P. santaro* Yasumatsu, a believed close relative of *P. exaratus*, since the specimen was collected on the Island of Amami-Ohshima from where *P. santaro* had been known. I examined the specimen carefully and could confirm that it shared the same characters with *P. santaro* regarding the structural development in certain parts of the head. The

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discovery further induced me to reexamine my own specimen, also captured on the same Island and once reported to be a female of *P. exaratus*. To my surprise, despite the marked difference in the size and density of the punctures on the head and thorax, the specimen also possessed the same characters as found on the other specimen above mentioned. Thus, it was ascertained that both the specimens represented the female of *P. santaro* and the marked difference in punctuation between the specimens was only a matter of variation within the species.

P. santaro (♂) has been known to differ from the closely related *P. exaratus* (♂) mainly in two points, namely, the head seen in profile with the eye markedly wider than the temple, and the mandible without the tooth on the outer margin towards the middle. As the second point is considered a secondary sexual character the first point has been supposed to become a key character to distinguish the species in the female. In the two specimens above mentioned such a character was surely confirmed under the microscope. On that occasion I attempted to measure some parts of the head using all the specimens before me that had the abdominal petiole rugosely punctured, together with some specimens of *P. exaratus* from my own collection that were particularly selected from the view point of distribution and/or development. Of the results obtained two characters that are considered taxonomically of significance are given in Table 1.

Table 1. Measurements (relative value) of temple and eye (in profile) and IAD and OAD.

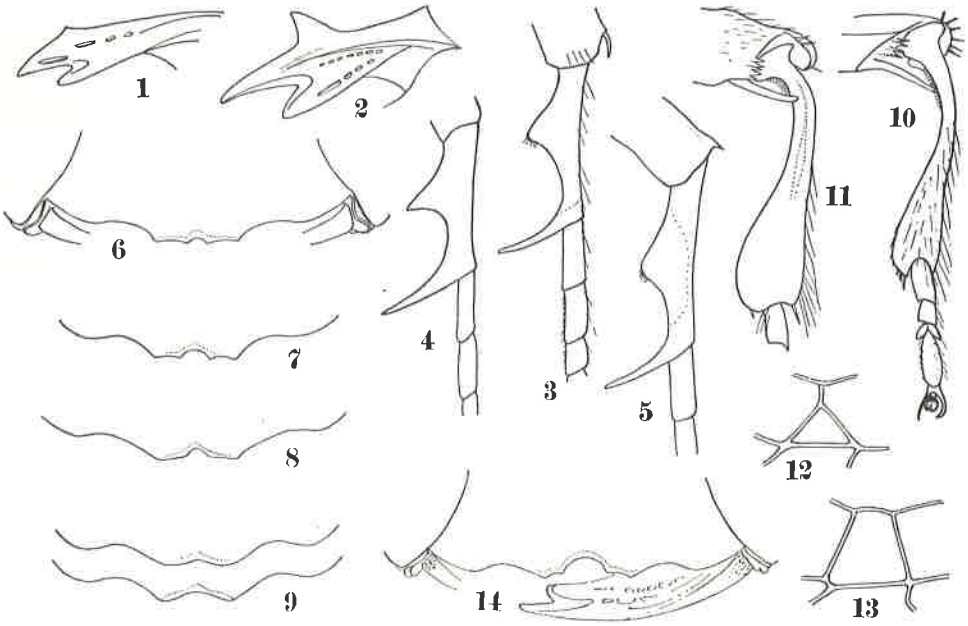
Loc. Sex	Ama. ♀	Ama. ♀	For. ♀	Oki. ♂	Joz. ♀	Aom. ♀	Aom. ♀	Toc. ♀	Fuk. ♀	Ish. ♀	Kor. ♀	Yam. ♂	Ish. ♂	Fuk. ♂
Eye	27	28	22	20	21	22	22	22	23	21	21	18	18	16
Temple	17	18	17	15	19	20	22	20	20	20	21	16	16	15
Ratio	1.6	1.6	1.3	1.3	1.1	1.1	1.0	1.1	1.2	1.1	1.0	1.1	1.1	1.1
IAD	8.0	8.0	8.0	7.0	7.0	8.0	9.0	8.5	9.0	8.0	9.0	8.0	8.0	7.5
AOD	2.0	2.5	2.7	3.0	4.0	4.0	4.7	4.5	4.5	4.0	4.5	4.2	4.5	4.0
Ratio	4.0	3.2	3.0	2.3	1.8	2.0	1.9	1.9	2.0	2.0	2.0	1.9	1.8	1.8

Abbreviations: Loc., Locality. IAD, Interantennal distance. AOD, Antenno-ocular distance. Ama., Amami-Ohshima Is. (Yuwandake and Yuwan). For., Formosa. Oki., Okinawa (Yona). Joz. (Jozankei, Hokkaido). Aom., Aomori Pref. (Towada and Ikarigaseki). Toc., Tochigi Pref. (Nasu). Fuk., Fukui Pref. (Koike). Ish., Ishikawa Pref. (Mt. Haku). Kor., Korea (Shoyozan). Yam., Yamagata Pref.

Close comparison of the female specimens of *P. santaro* and *P. exaratus* revealed that some further differences useful in separating them existed between the two species. Thus, the chief differences can be summarized as follows:

1. Head seen in profile with eye distinctly broader than temple in *santaro*, ratio approximately 1.6 (in *exaratus* it is 1.0～1.2, most usually 1.1).
2. Head seen in front with oculo-antennal distance less than 1/3 as great as interantennal distance in *santaro* (in *exaratus* it is about half as great as the distance).
3. Antennal joints 11–12 nearly as long as wide in *santaro* (in *exaratus* slightly longer than wide).
4. Punctures on head and thorax generally more or less sparser in *santaro*, though the pattern of punctuation is similar.
5. Antennae completely black in *santaro* (in *exaratus* apex of joint 1 and joints 2–4 (or 5) beneath ferruginous).

In my previous paper (1959) I referred to my opinion that *P. santaro* may be a subspecies of *P. exaratus*. However, when I captured the female that I thought at that time to be *P. exaratus* on the same Island as *P. santaro* was collected I changed my thought and accepted *santaro* as a good species, because they were sympatric. But the confirmation of the fact that the speci-



Figs. 1-14. *Psen* (*Psen*) *exaratus* Eversmann, subspp.
1-2, mandible. 3-5, mid metatarsus. 6-9, 14, anterior margin of clypeus. 10-11, front metatarsus. 12-13, right and left 2nd cubital cell of forewing.
Figs. 1, 3, 8, 10 12, 13, *P. exaratus intermedius* subsp. nov., ♂.
Figs. 2, 5, 9, 11, *P. exaratus exaratus* Eversmann, ♂.
Fig. 4, *P. exaratus santaro* Yasumatsu, ♂. Figs. 6 and 7, idem, ♀.
Fig. 14, *P. exaratus taiwanus* subsp. nov.

men in question is truly a female of *P. santaro* turned my thought to the starting point. The reasons for this are (a) they are allopatric, (b) the differences between them are all very slight or in degrees, and (c) the occurrence of another races having characters intermediate between the two have been known from Okinawa and Formosa. As regards (c) mention will briefly be made in the following:

In the male specimen from Okinawa the mandible has a vestigial tooth (Fig. 1, cf. Fig. 2, the tooth in *santaro*), the median dentiform protuberance of its mid metatarsus is less developed than in *santaro* (Fig. 3, cf. Fig. 4, that in *santaro*), but more developed than in *exaratus* s. str. (Fig. 5), and the development of the eye as compared with the temple in the lateral view is intermediate between the two races (Table 1). Further, the same is also the case with regard to the oculo-antennal distance as against the interantennal distance (Table 1).

In the female specimen from Formosa the same is also true with respect to the development of the eye and to the relative width of the oculo-antennal space (Table 1).

Probably the isolation on the respective island has brought about such local races as above mentioned. I can cite a similar instance found upon the Crabronid, *Crossocerus* (*Blepharipus*) *vagabundus* Panzer, a widely distributed Palaearctic species. In the European representative of this species the front femur is armed with a well-developed spine at the base beneath, so that it was once given "*Acanthocrabro*" as the generic (or subgeneric) name. On the other hand, in the specimen of the same species from Japan such a spine is usually completely lacking (at most the place is somewhat angulated). No hesitation was needed when the population was given a new subspecific name, *yamatonicus*. It seems interesting that a short spine was discovered upon the Korean specimens at the corresponding place of the front femur. This fact indicates

that the various degrees of development of the spine in question have been given rise to through the geographical isolation of the species. The facts of similar sort have numerously been known between the populations of species of Sphecidae at least of Europe and East Asia. Early investigators used to deal with these geographical variations as distinct species. But now-a-days it seems a general trend to place them within the category of the sama species, dealing with them as a subspecies respectively.

The developmental degrees of the eyes and of the dentiform protuberances on some parts of the appendages in *Psen exaratus* must fall within the same category as those mentioned above. The barrier of the sea has completed the isolation and might have brought up the local forms as above mentioned within the comparatively amall range of distribution. Needless to cite further instances of the islands fauna enbodying the similar phenomenon, especially of animals that have less developed moving ability.

Specimens examined: 1 ♀, Amami-Ohshima Is. (Yuwan), 30. VI. 1961, K. Tsuneki leg.; 1 ♀, the same Is. (Yuwandake), 29. VII. 1963, J. L. Gressitt leg.

Remarks. (1) Variation in punctuation. As above described in one of the specimens the punctures are markedly large, in general about twice as large in diameter as those in the other. This is especially marked on the head and mesonotum. On mesonotum the presence of the impunctate stripes on both sides of the median area is common to both specimens and similar in pattern to that of *exaratus* s. str.

(2) Variation in colour. In the gross-punctured specimen tibial spurs of mid and hind legs ivory white, while in the other they are yellowish pale brown as in the nominate species. In the former mandibles dark brown with apex black, while in the latter wholly black as in *exaratus* s. str.

(3) Sculpture of posterior limb of area dorsalis. Anteriorly not margined by carina, but the outline of area dorsalis is sharp and distinct; the area next to the anterior border weakly, irregularly rugose, not shining, this area is fairly broad and broader laterally (on antero-lateral portions a few notches along the anterior border defined), the next area coarsely rugoso-striate, mixing weaker ones, the striae posteriorly distincly radiately divergent and mixed with fine reticulation and finally connecting to the coarse reticulation on posterior slope. Though the pattern is similar, the degree of shine, coarseness of striae, size of meshes of reticulation more or less varied between the two specimens. Such a variation is also observed on *P. exaratus* s. str.

(4) Clypeus and pronotum. Clypeus (Fig. 6, in gross-punctured specimen; Fig. 7, in the other) similar in structure to that of *exaratus* s. str. Both of the shown forms fall within the vange of variation of this species. Pronotum also similar, having a marked tooth on each side of anterior margin.

(5) Pygidial area. As in *exaratus* s. str. In form elongate triangular, with apex rounded, in the lateral view slightly curved downwards, the surface polished and with a single row of sparse large punctures along the lateral margins.

2. *Psen* (*Psen*) *exaratus intermedius* subsp. nov.

The type is the male specimen from Okinawa as referred to above. Generally speaking, it is closer to subsp. *santaro* of Amami-Ohshima than to *exaratus* s. str. in the location of the antennal sockets, but in the colour of antennae it is rather similar to *exaratus* s. str. Further, in the relative width of the eye and the temple, and in the form of the medial protuberance of mid metatarsus it is intermediate between the two races (Figs. 3, 4 and 5, Table 1). Still further quite interesting to say, the example shows a vestigial tooth on the external margin of the mandible

(Fig. 1), which is well developed in *exaratus* s. str. (Fig. 2) and completely lacking in *exaratus santaro*.

♂. Length about 9.3 mm. Difference from the nominate species and subsp. *santaro* in relation to the developmental degrees of (1) eyes, (2) mandibular tooth, (3) medial protuberance of mid metatarsus and (4) oculo-antennal distance as already been stated in the foregoing pages (Table 1 and Figs. 1–5). Other differences and comments:

(5) Antenna. Black, slightly brownish; joint 1 (scape) glossy, externally broadly ferruginous, the following several joints beneath slightly darkened ferruginous, apically much darker. Relative length of the joints of apical portion comparatively shorter than in the nominate species, joint 4 about twice, joint 10 about 1.3 times as long as wide in middle (in *exaratus* s. str. about twice and 1.5 times as long as wide respectively[1]), from joint 6 apically more or less moniliform, tyloidea represented on posterior surface by roundly swollen glabrous area in full length of the joint, on the basal portion of the flagellum less swollen and on its apical portion swelling gradually indistinct, so that it is difficult to determine its starting point exactly.

However, judging from the general appearance it seems to start from joint 4 or 5 and reaching the ultimate joint; on joints 9–12 a small elongate tubercle, not so high, can be observed further on the smoothed area. The structure is similar to that of *exaratus* s. str. wherein the indistinct tubercle can be seen on the smoothed tyloidea of joints 8–12. But. as the structure is both very indistinct[2]), it is rather difficult to use this character in distinguishing the subspecies. Rather the following may be of some use:

In *intermedius* moniliform of the flagellar joints on the apical portion is more marked, the joints located from towards middle apically barrel-shaped (though there is a tendency to be flattened on the dorsal side), while in *exaratus* s. str. swelling is marked on two sides only, that is, on the posterior side (the side of tyloidea) and on the under side.

(6) Front legs. Ferruginous colour less broadly extended than in *exaratus* s. str. The portions: Femur at base narrowly and on upper apical half (darkened below), tibia except inside, metatarsus except base and apex (pale brown). Rest of tarsal joints brown, each apically paler. (In *exaratus* femur except basal third and beneath, tibia except inside narrowly (brown), tarsi except basal portions of joints 2–5. ferruginous). Metatarsus bent, and dilated and enlarged towards apex as given in Fig. 10, less in degrees than in *exaratus* s. str. (Fig. 11) (in *santaro* the state is uncertain, since the figure given in the original description was seen in profile).

(7) Colonr of mid legs. Nearly wholly black. Dark ferruginous portions: Femur on apical portion inside, tibia on basal portion inside and tarsal joints beneath and at apex. (In *exaratus* s. str. femur above and apical portion largely, tibta on basal portion inside and at apex, metatarsi largely and other tarsal joints at each apex ferruginous).

(8) Area dorsalis coarsely radiately striate, intervals shining as in *exaratus* s. str. Posterior limb distinctly marginated anteriorly by fine carina. Shift of surface condition of the limb: Smooth and glittering (laterally broader) — dull and opaque (weak minute rugae) — finely and coarsely striate — then turning to strong coarse and irregular reticulation of the posterior inclination. (Uncertain whether this is the representative case or not.) (In *exaratus* s. str., ♂, anterior carina of limb present also, limb first finely closely, or fairly strongly and coarsely (mixing fine rugae) rugoso-striate, then turning into the coarse net-work of posterior inclination.)

1) In *santaro*, "à peu près deux fois plus longs que larges". However, probably this is incorrect, at least on the apical portion, since the joints progressively shorter towards the penultimate joint.

2) In the original description of *santaro* only the following was given: "funicule ne presentant pas d'articles déformés".

(9) Abdominal petiole. Each side with 2 longitudinal carinae (the upper one forming the lateral edge of dorsal surface), the 3rd carina shifts to ventral side soon after starting from base, forming with that of the other side edges of the narrow groove on the ventral side. (In *exaratus* s. str. pattern of 3 carinae on each side is similar, but the shit of the lowermost carina towards the median line of ventral side is much less, forming the edges of the broader furrow beneath in middle.)

(10) wing venation in this example is probably abnormal. The 2nd cubital cells of the right and left fore wings are different in form from each other (Figs. 12, right, and 13, left). As the form of both cells is different from that of *exaratus* s. str. (and also of *santaro*) probably both are abnormal.

11. Clypeus. Difference is very slight (Fig. 8, cf. Fig. 9, those of *exaratus* s. str., ♂).

Holotype: ♂, Okinawa Is. (Yona), 27. IV. 1965, Y. Hirashima leg. (Coll. Kyushu Univ.)

3. *Psen* (*Psen*) *exaratus taiwanus* subsp. nov.

Some doubt still remains as to whether the present subspecies is really a valid one or merely representing the other rex of the preceding subspecies, since both are represented by different sexes and there is no specimen known of the other sex from the same location to compare with the other subspecies. Furthermore, the specimen (♀) shares some characters in common with the preceding subspecies. It must be noted, therefore, that the present treatice of the specimen is rather provisional.

♀. Length about 10 mm. Coloration generally similar to that of the nominate race, but mandibles brown, and the ferruginous part of the antennae somewhat more brownish, tarsi of mid legs slightly darker and tibial spurs of mid and hind legs ivory white as in one of the female specimens of race *santaro*. Developmental degree of eyes intermediate between those of *exaratus* s. str. and *santaro*, similar to that of *intermedius* (Table 1); ratio of IAD and AOD rather similar to that of *santaro* (Table 1); clypeus (Fig. 14) in form and structure falls within the range of variation of the nominate species (covering the forms shown in Figs. 6–8 and 14 in ♀), pronotum also as in the latter, with antero-lateral corners strongly toothed; *petiole of abdomen somewhat characteristic, having two carinae only on each side*, containing a narrow groove between, 3rd carina (lowermost one in other races) lacking and the surface roundly inclined towards median line very bluntly carinated. Pygidial area similar in structure and punctuation to other races, lateral carinae slightly roundly curved outwards, but the same form sometimes occurs in the nominate species also, six ventral plate strongly and closely punctured as in *exaratus* s. str., with a blunt median carina. Wing venation similar. Sculpture on posterior limb of area dorsalis anteriorly distinctly bordered by sharp carina which is undulating according to the rounded ends of the impressions between the strong striae of the area dorsalis, disc of limb broadly without sculpture, smooth and polished, this area much broader laterally, only on antero-lateral portion, along the anterior carina a few crenulae observable, next to the polished area the surface finely, fairly closely striate (on both sides of the median furrow the same striae appear from near the anterior margin), the striae run radiately and progressively stronger and coarser posteriorly, occupying the upper half of the posterior slope and turning into coarse reticulation posteriorly, the reticulation coarser and rougher towards median region, including a large oblong area having deep median furrow inside. Punctuation on head and mesonotum closer than in *santaro*, rather close to that of the nominate species (and also *intermedius*).

Holotype: ♀, Nantou Hsien (Penpuchi), Formosa, 26. V. 1965, T. Shirozu leg. (Coll. Kyushu Univ.)

4. *Psen* (*Psen*) *opacus gressitti* subsp. nov.

(*Psen* (*Psen*) *opacus* Van Lith, Zool. Verh., 39 : 46, 1959; Ibid., 73 : 58, 1965)

♀. Well agrees in character with the original description of *Psen* (*Psen*) *opacus* Van Lith, 1959, known from Luzon. Differing only in the colour of the mandibles and legs. Sculpture on propodeum somewhat different, but seems not very important.

Abdominal petiole dorsally transversely roundly raised, but with distinct lateral edges, and ventrally again roundly inclined to meet smoothly with the inclination of the other side, without the median carina. If such a state was called 'cylindrical' there is no difference from the original description.

Coloration: Black, with aeneous lustre on vertex, mesonotum and mesopleuron. Mandibles glossy, slightly darkend reddish brown, except base, and apically and externally slightly darker. Legs glossy, apex of front and mid coxae, all trochanters, basal half of front and mid femora above and inside broadly, base of hind femora above ferruginous, rest of femora and front and mid tibiae dark brown, the tibiae at base and apex somewhat paler and hind femora slightly darker, front and mid tarsi brown, hind tarsi dark brown, all tarsal joints apically pale brown, tibial spurs yellowish white; the 2nd abdominal segment laterally beneath (lateral extremities of tergite) slightly reddish yellow.

Sculpture of propodeum: Area dorsalis coarsely longitudinally striate, posterior limb anteriorly bordered by finely waved carinae forming the ends of impressions between the carinae of area dorsalis, limb obliquely coarsely rugoso-striate, intervals with irregular weak short lugulae, posterior slope coarsely irregularly reticulate.

In fore wing the point of junction of recurrent vein with cubital cells slightly different from *opacus opacus*, namely, cubital vein within 2nd cubital cell with the first abscissa about a half as long as the first transverse cubital vein, and within 3rd cubital cell first abscissa very short, about 1/6 the length of the second transverse cubital vein; in other word, 1st recurrent vein received by the 2nd cubital cell at about a third from base, and 2nd recurrent vein received by the 3rd cubital cell close to the base of the cell.

Hind femora beneath densely pilose, but without particular puncture line; on its posterior side hairs progressively denser from dorsal side downward; apparent sharp separation of the glabrous area and the haired area by a puncture line seems to be due to the state of reflection. At least in this specimen a similar state is observable under a certain light condition.

Holotype: ♀, Amami-Ohshima Is. (Yuwandake), 31. VII. 1953, J. L. Gressitt leg. (Coll. Bishop Mus.)

Remarks. *P. opacus* Van Lith was described with a single female specimen from Luzon, and this is the second record of the species in a new geographical race.

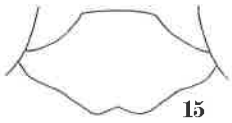
5. *Psen* (*Psen*) *hirashimai* sp. nov.

Closely resembles *Psen* (*Psen*) *hakusanus* m. in the general structure of the antennae, in the form of the propodeum in the lateral view, in the structure of the abdominal petiole, in the wing venation and in the character of apical fringe of hairs on abdominal sternites, but in the sculpture of posterior limb of area dorsalis on the propodeum it differs markedly from that species. Hence it can not be received in the "group of *Psen orientalis*", sensu Van Lith. In my opinion, however, in the taxonomic significance the sculpture of the propodeum is not so important as to be considered the first rank category. I therefore placed this species within the group of *P. orientalis*. This species further differs from *P. hakusanus* in the much sparser punctuation, in the details of the tyloidea of antennal joints, in the form of clypeus and in the structure of meso-

sternum.

♂. Length about 8.0 mm. Black and shining, with aeneous shimmer on vertex and mesonotum. Mandibles except base somewhat darkened reddish brown, apically much darker, pulpi ferruginous. Antennal flagella lustreless dark brown; front trochanters, base and apex of all femora and tarsi apically glossy brown, tibiae also apically somewhat brownish; tibial spurs all pale yellow. Hairs on lower front and clypeus silvery, dense and appressed, on vertex and mesonotum pale brownish; abdominal segments with comparatively abundant (but not dense) long hairs, pale brownish, in some light golden; sternites 3 and 4 provided with a fringe of longs hairs on apical margin in middle. Wings almost hyaline, strongly iridenscent.

Head from above transverse, with ratio of width to length approximately 2 : 1, ocellar region slightly elevated, each ocellus distinctly inclined externally, OOD : POD approximately 1 : 1, width of postocellus slightly more than half as great as OOD. Head in front with interocular distances at vertex, base of antennae and sides of clypeus relatively 34 : 24 : 30, clypeus slightly longer than supra-clypeal area, its apical margin: Fig. 15, mandibles normal, not particularly broadened. Antennal joint 2 almost wholly included in the apical cavity of joint 1 in the normal state, as in *P. hakusanus*, joint-3 2.5-times as long as wide at apex, subsequent joints progressively very slightly shorter towards penultimate joint, joint 10 about 1.5 times as long as wide, its relative length to joint-3 11/15, each joint slightly roundly swollen on the anterior side (under the sideward stretched state), especially so on joints 7–12, but the joint not in a regular barrel-shape, but the centre of the curve situated slightly beyond middle, joints 7–12 further carrying tyloidea, a gentle swelling, subelliptic in outline, occupying median part of the under side of each joint, the area outside the tyloidea with comparatively longer hairs which are marked by producing from apex of the joint. Head in profile with eye about 1.5 times as wide as temple. On mesonotum anterior scutal sutures each in an impressed line, reaching posteriorly about half of the scutum and anteriorly crenulate; the space between median scutal lines very slightly raised. Scutellum markedly convex, in the lateral view with the top of convexity located beyond middle (in *hakusanus* roundly regularly convex), postscutellum also markedly raised, the furrow between them deep and somewhat broader than in *hakusanus*, on mesopleuron hypoepimeral area swollen but less strongly so than in *hakusanus* and scrobal suture in an impressed line, also weaker than in the compared species. Propodeum in the lateral view with posterior inclination perpendicular to its dorasl side; area dorsalis markedly impressed with the posterior border margined by waved carinae, posterior inclination medianly above with a large subrhombic enclosed area having a few branch carinae within and the deep medial furrow which is extended from apex of area dorsalis. On mesopleuron precoxal longitudinal carina very feeble, having a faint, completely vestigial tooth toward middle, the carina only on anterior portion high and distinct as a continuation of epicnemial carina; on mesosternum median sternal line carinate, anteriorly with comparatively long costae on both sides (3 costae on one side), acetabular carina fairly long and distinct, resching near the posteriorly turning point of epicnemial carina, but not connected with it (in *hakusanus* acetabular carina completely lacking and the costae of medial carina much more abundant). Petiole of abdomen slightly shorter than two subsequent segments united (ratio 5: 6), reaching approximately apex of hind femora stretched posteriorly, with sides gently divergent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Figs. 15–17. Clypeus. (♂).
15, *Psen hirashimai* sp. nov.
16, *Psen hakusanus seminitidus* Van Lith.
17. Psen hakusanus Tsuneki.

posteriorly and the dorsal surface transversely rounded (not further medianly raised as in *hakusanus*), without the semicirdular or triangular impression at the posterior extremity (the place only slightly inclined towards apex), lateral surface with 2 longitudinal carinae, interval shallowly furrowed, ventral surface rounded, with median line indistinctly raised, not carinated; 6th sternite without the median carina. In fore wing 1st recurrent vein received by 2nd cubital cell at about 1/3 from base, 2nd interstitial.

Vertex finely very sparsely, frons finely closely (intervals as large as points), mesonotum slightly more grossly and sparsely (intervals generally 2-3 times as wide as punctures, punctures outside parapsidal sutures finer), scutellum and postscutellum more sparsely punctured; on mesopleuron scrobal suture not crenate, the surface very finely and very sparsely scattered with hair-bearing points. On propodeum area dorsalis coarsely longitudinally (slightly divergently) striate, median impression as broad as other ones between carinae, but with a few transverse carinae inside, posterior limb sculptured with moderate-sized rather weak network (only on lateral portions the surface longitudinally striate), but soon turned into the strong coarse reticulation on posterior slope, inside the meshes uneven but shining; sides of the segment smooth and polished, on dorso-posterior region obliquely, on ventro-posterior region transversely striate. Abdominal tergites very minutely sparsely punctured, punctures posteriorly slightly larger, punctures on sternites also fine and sparse, sternite 6 somewhat grossly and very closely punctured.

Holotype: ♂, Amami-Ohshima Is. (Yuwan), 29. VII. 1963, Y. Hirashima leg. (Coll Kyushu Univ.)

6. *Psen* (*Psen*) *hakusanus seminitidus* Van Lith, 1965 (conj. nov.)

Mimesa (in sp.) *kohli* Gussakovakij (nec Fox, 1898), Ark. Zool., 27 A (21) : 7, 1934 (♀).
Psen (s. str.) *kohli*: Gussakovskij, Trav. Inst. Zool. Acad. Sci. URSS, 4 : 653, 1936 (♀).
Psen (*Psen*) *seminitidus* Van Lith, Zool. Verh., 73 : 40, 1965 (♀).

A male specimen captured in Formosa agrees well in many characters with the description of the paratype female by Van Lith (1965), namely, in the structure and sculpture of frons and vertex, in the form of propodeum in the lateral view, in the sculpture of the segment, in the structure of abdominal petiole and in the wing venation. But the punctuation generally closer and without the longitudinal strise in front of anterior ocellus, the tibial spurs much paler in colour.

The original description of *kohli* (nec Fox) made upon the holotype female well agrees with that of Van Lith, except that the posterior limb of area dorsalis finely rugulose. In this respect the present specimen differs from the description. But the sculpture on this segment is not always important, since fairly variable.

According to the described suggestion of Van Lith I compared the specimen with males of *Psen hakusanus* m. Certainly they are very similar to each other, but slight differences could be observed in the form of apical margin of clypeus, the distribution of tyloidea on antennal joints and somewhat in the colour of legs.

Psen seminitidus Van Lith (= *kohli* Gussak.) was known from Tibet, Kansu and Nan-Chan, all China. Van Lith further recorded a female of (probable) this species captured in Szechuan (with head lost). Jndging from the occurrence of this species from the eastern coastal region of China—Kiangsi (Nanchang) and Szechuan—the occurrence of this species in Formosa is not strange. I therefore referred the specimen in question to the male of *P. seminitidus*. At the same time, I transferred the taxonomic position of *P. seminitidus* to a subspecies of *P. hakusanus*.

The differences of the Formosan specimen from the male of *P. hakusanus* as follows:

(1) Anterior margin of median lobe of clypeus broadly roundly emarginate and further with

a small sharrow triangular incision in middle (Fig. 16), in *hakusanus* most commonly only simply broadly roundly emarginate (Fig. 17). But such a slight difference is unimportant in this character.

(2) Tyloidea on antennal joints 3–12, each (except joint 3) occupying full length of the joint, on apical three joints more or less narrowed, inner margin of each tyloidea somewhat carinate (all such characters well agree with those of *hakusanus*, but in this species tyloidea defined on joints 3–10, rarely even on 11), the form of joints and their relative length as in *hakusanus*.

(3) Tarsal joints slightly more darkened, but the tibial spurs more whitish.

Punctuation as close as in *hakusanus*, and in this respect differs from the descriptions of the known females of *seminitidus*. Therefore, the Formosan representative may be another geographical race. To settle the problem, however, further specimens are needed.

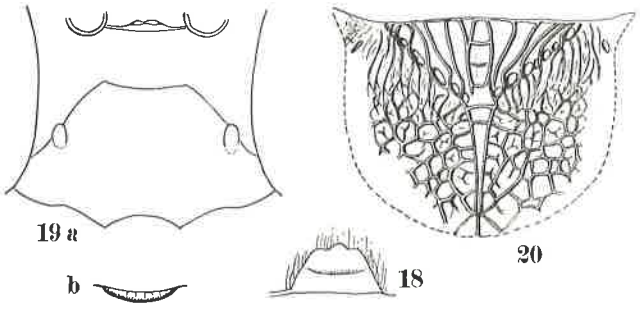
Abdominal petiole not reach the apex of hind femur stretched posteriorly as in *hakusanus*, sides slightly divergent posteriorly (however, this character considerably variable within a species in general), dorsal surface transversely rounded and anteriorly somewht raised in middle, lateral surface bicarinate, interval furrowed, ventral surface rounded in cross-section, not medially carinated.

Specimen: 1 ♂, Nantou Hsien (Sungkang), Formosa, 1. VI. 1965, T. Shirozu leg.

7. *Psen* (*Psen*) *shirozui* sp. nov.

This species belongs to the group of *Psen tsunekii* of Van Lith, having well-developed, very broad mandibles, but, at the same time, without the rings of long curved hairs on the abdomen. It resembles *P. vechiti* Van Lith in having the roughly Mt.-Fuji-shaped (Fig. 18) transverse carina between bases of antennae, but is different from it in the general trend of sculpture on propodeum. The species seems also closely allied to *P. assamensis* Van Lith (1965) known from northern India, but differs somewhat in some characters on the head and distinctly so in the relative length of the abdominal petiole.

♂. Length about 9.5 mm. Black and shining, with iridescent shine on head (including antennal scape), thorax-complex and legs up to femora, especially markedly so on mesonotum anteriorly. Further, vertex and mesonotum with aeneous shimmer in certain light. Mandibles nearly wholly black, only near apex faintly yellowish, palpi brown to pale brown. Legs largely glittering reddish ferruginous. Front and mid femora on inside broadly and at apex, hind trochanters and femora wholly and all tibiae and tarsi ferruginous. Antennal flagella slightly brownish, wing tegulae glossy, dark brown, externally paler, wings hyaline, feebly clouded, markedly iridescent, stigma and veins black to dark brown. Dense appressed hairs on lower front and clypeus silvery, long hairs on the sides of head and thorax and on propodeum white, those on vertex, mesonotum brownish. Scutellum and post scutellum with conspicuously long hairs. Abdominal sternites 3 and 4 each with an apical fringe of long, dense hairs. Hairs on hind femura long but sparse.



Figs. 18–20. *Psen* (*Psen*) *shirozui* sp. nov., ♂.
18, elevation of transverse carina below antennal socket. 19a, clypeus. 19b, idem, seen from beneath. 20 Propodeum.

Head above with ocellar region slightly raised and margined on the

sides and behind by a fine but deep furrow, the furrow on post-ocellar region bent anteriorly, drawing a broad isosceles triangular line, from the median angle of the furrow branched off a shallower and broader furrow towards the anterior ocellus, occipital carina with crenulate furrow in front, reaching below the hypostomial carina. OOD : POD=10 : 8.5, relative width of postocellus 5. Head in front with relative value of minimum interocular distance at vertex and clypeus 35 and 27, those of oculo-antennal and interantennal distance 4 and 8, frontal median impression broad, with a carina in middle, transverse carina between sockets of antennae raised perpendicularly, high, plate like and in form seen from beneath somewhat resembling Mt. Fuji (Fig. 18); relative length of clypeus and supra-clypeal area 13 : 6, median lobe of clypeus roundly raised, with apical margin broadly roundly emarginate, the lateral angles of the emargination acutely angulated (Fig. 19a), the emarginated area seen from beneath with a lunate impression (idem, b). Mandibles well developed and broad. Antennal joints from joint 5 apically slightly moniliform, each joint barrel-shaped, but the swelling rather slight in degree, joint 3 spproximately 2.5 times as long as wide at apex, succeeding joints progressively shorter apically, but in a very slight degree, joint 10 about 1.5 times as long as wide at apex, ultimate joint about twice as long as wide. Each joint simple, without tyloidea. Collar of pronotum with anterior margin carinate, but not pointed at lateral corners. On mesonotum pre-scutal sutures in impressed lines, anteriorly crenulate and posteriorly resching more than 2/3 of scutum, with the ends indistinct, median scutal lines shorter and finer than the lateral prescutal lines, interval impressed and with strong iridescence, parapsidal sutures approximately 1/5 of the scutum in length; scutellum raised high above the level of scutum, about twice as broad as long, without median furrow, scuto-scutellar furrow distinctly crenate. Area dorsalis on propodeum (Fig. 20) broad triangular, with posterior oblique furrows straight which are crossed and passed by the strong carinae of the area, the margins not bordered by carinae, median furrow on posterior slope bordered on both sides by carinae and attenuate apically; propodeum seen in profile with posterior slope roundly inclined, Petiole of abdomen long, reaching the apex of hind femur stretched posteriorly, the sides from middle posteriorly slightly divergent, dorsal surface transversely roundly raised, with lateral edges acute and distinct, without other carinae on ventral side. In fore wing 1st recurrent vein received by 2nd cubital cell at about 1/3 from base, 2nd recurrent vein interstitial. Legs normal, without deformity.

Vertex finely very sparsely punctured, mesonotum also finely and sparsely punctured, but punctures posteriorly slightly larger, medio-anterior impressed area much more minutely and closely punctured, lateral furrows along the edge carinae crenate, punctures on scutellum slightly larger but sparse, only on posterior region somewhat close, postscutellum with finer punctures sparsely scattered. Mesopleuron finely, much more sparsely punctured. On propodeum (Fig. 20) area dorsalis with strong coarse longitudinal carinae which are convergent toward apex and passed over the lateral furrow, turning into the longitudinal striae on the posterior limb; the carinae bordering the median furrow of the area roundly curved outwards, accompanying a few bars between, posterior slope covered with medium-sized irregular reticulation (the meshes generally about as large as ocellar size). Petiole polished, tergites 1 and 2 practically impunctate, only with sparse fine short-hair-bearing points, from tergite 3 apically hair-bearing punctures slightly larger and distinct, but always sparse; sternite 6 minutely granulate.

Holotype: ♂, Chiayi Hsien (Fenchihu), Formosa, 12. IV. 1965, T. Shirozu leg. (Coll. Kyushu Univ.)

8. *Psenulus* (*Psenulus*) *quadridentatus formosanus* subsp. nov.

(*Psenulus quadridentatus* Van Lith, Zool. Verh., 52 : 37, 1962, ♀ and ♂).

The new subspecies (based upon two male specimens) differs from the nominate species in the following points:

1. Antennal joints 3-6 with tyloidea.
2. First recurrent vein received by first cubital cell, very close to first transverse cubital vein (nearly interstitial).
3. Interantennal transverse carina seen in front distinctly medianly triangularly raised (even seen obliquely from above) not rounded as in *qusdridentatus* s. str., the longitudinal carina connecting its top with the lobiform extention above it much shorter.
4. Colour generally somewhat darker and less reddish:

Black. Mandibles medianly broadly dark yellow, mouth parts and palpi ferruginous. Antennae dark brown, joint 1 beneath at apex, subsequent joints beneath, except a few median joints, reddish ferruginous. Tegulae of wings, abdominal petiole and legs ferruginous, excepting the following portions which are black or dark brown: All coxae except apex, front and mid femora on under and outer sides and hind tarsi wholly. Abdominal tergites 1-7 yellowish red, but tergite 1 at apex and tergite 2 largely blackish (tergites 4-7 in the paratype slightly darkened), sternites wholly yellowish red. Length about 6.7 mm.

Holotype: ♂, Nantou Hsien (Sangkang), Formosa, 29. VI. 1965, T. Shirozu leg. (Coll. Kyushu Univ.)

Paratype: 1 ♂, the same place and time as the holotype.

9. *Psenulus* (*Psenulus*) *formosicola* Strand, 1915.

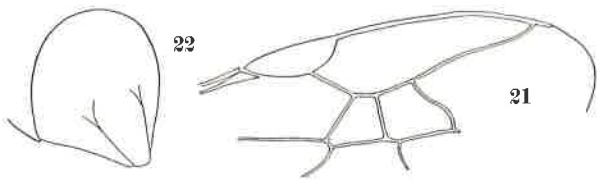
Psenulus formosicola Strand, Arch. f. Naturg., A, 7 : 21, 1915 (♀ ♂).

Specimens examined: 2 ♂♂, Nantou Hsien (Penpuchi), Formosa, 2. V. 1965, T. Shirozu leg.; 1 ♀, the same place, 26. V. 1965, T. Shirozu leg.; 1 ♀, Tainan Hsien (Kuantzuling), Formosa, 7. IV. 1965, Y. Hirashima leg.

Some supplementary description:

♂. Length 5.5~6.2 mm. Black. Mandibles with a dark reddish browh fleck near apex, antennal flagella beneath slightly-reddish ferruginous (sometimes medial region sligtly darker), above dark brown. Palpi, front tibia in front, all tibial spurs and all tarsi ferruginous, hind metatarsi basally darker.

Clypeus convex, the rounded inclination toward apical margin is conspicuous, apical margin very slightly produced anteriorly and bidentate in middle, with intervalic sinus rounded, supraclypeal area (up to the facial transverse carina) as long as clypeus in middle, facial transverse carina with median angle very obtuse (about 120°), space enclosed between the carina and antennal socket comparatively broad, approximately as broad as the width of antennal socket, median longitudinal carina with the lobiform extention on top very small and narrow, with the length about 2/3 the diameter of postocellus and 1/3~1/4 as wide as long. Antennal joints moniliform, without carrying tyloidea, joint 3 abouut 1.5 times as long as wide (in the widest view), the subsequeut joints progressively reducing in length, joint 10 about as long as wide in middle, ultimate joint 1.7 times



Figs. 21 and 22. *Psenulus formosicola* Strand. 21, fore wing. 22, pygidial area (♀).

as long as its basal width. On mesonotum prescutal suture reaching half of scutum, propodeum in the lateral view the dorsal portion very slight, at once turning to oblique portion and then to perpendicular portion, the angles fairly distinct, not simply roundly curved; area dorsalis posteriorly margined by fine carina, medianly broadly furrowed and coarsely crenate. Petiole of abdomen comparatively long, as long as hind femora or slightly shorter, not particularly narrowed and bent at base in the lateral view, dorsal surface medianly broadly furrowed, on both sides of the furrow run double carinae with interval finely grooved, the carinae on the basal and middle portions forming the lateral edge, but on posterior portion running at the lateral portion of the dorsal surface; sides of the petiole on posterior portion with oblique furrow, marginated by the blunt carinae; 2nd sternite with basal depression semicircular, not deeply excavated, but distinctly outlined on both sides, only on apical margin indistinct, reaching before middle of the segment.

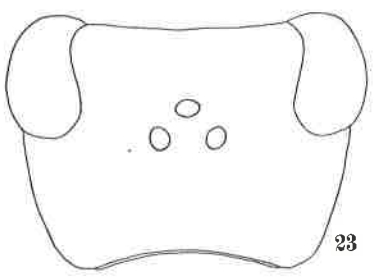
Punctures on frons fine and fairly close, in one specimen a tendency of longitudinal confluency observed on the sides, in the other distinctly longitudinally, somewhat arcuately rugoso-punctate on the sides, rugae arising from postocelli, occiput transversely strongly rugoso-striate in both specimens; punctures on mesonotum anteriorly fine and close, posteriorly slightly larger and sparser, with intervals larger than punctures, posterior margin of scutum with strong longitudinal carinae, 7–8 in number and divergent anteriorly (somewhat longer to be called crenae), lateral margins bordered by coarsely crenate furrow running along the carina on extreme margin; scuto-scutellar furrow with 5–6 strong crenae, the medial crena raised high and most distinct; area dorsalis lunate, sectioned with oblique carinae into 6–7 foveae on one side, each fovea with a fine bordering carina on posterior margin, medial furrow of the area broad and deep, reaching middle of the posterior inclination and coarsely sectioned with transverse carinae, posterior limb anteriorly smooth, posteriorly finely closely obliquely and somewhat rugosely striate, posterior slope with the median carina from end of medial furrow to apex of the segment, on both sides of the carina a large symmetrical fovea present (forming the perpendicular part in the lateral view), strongly margined by carinae, with the surface flattened and with a few transverse or irregular carinae within, other portions of posterior slope strongly coarsely reticulate; sides of the segment transversely (somewhat obliquely) fairly strongly closely rugoso-striate. Venation of fore wing: Fig. 21.

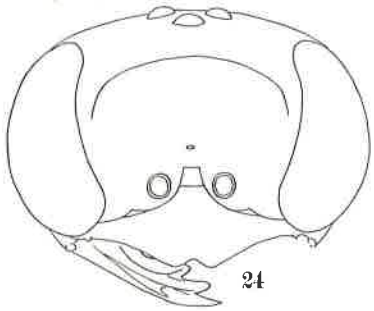
♀. Slightly larger than ♂. In general structure, sculpture and punctuation similar to ♂, but with the following secondary sexual differences:

Antennae clavate, apical 4–5 joints beneath only brownish, joint 3 about 1.3 times as long as broad at apex, subsequent joints progressively slightly shorter and thicker, joint 6 nearly as long as wide, thence subequal in length but thicker up to penultimate joint. Anal tergite with pygidial area (Fig. 22). Punctuation generally weaker than in ♂, especially so on occiput and propodeum. Other differences: Petiole somewhat shorter than hind femora, basal depression of 2nd sternite completely well-outlined, larger, reaching 2/3 of the segment from base, surface longitudinally cylindrically impressed and mat; punctures on vertex less rugose, but somewhat closer, on mesonotum also closer; striae on posterior limb of area dorsalis also fine, but closer and longer, slightly weaker anteriorly, on posterior slope the meshes ef reticulation transversely elongate and the carinae (less high than in ♂) mainly somewhat arcuate, the large foveae on both sides of median carina less marked. Colour of legs somewht darker, ferruginous portion in ♂ turning into brown to bark brown. Wing venation as in ♂.

10. *Pemphredon* (*Pemphredon*) *shirozui* sp. nov.

The present species seems somewhat resembling the Indian species, *Pemphredon fuscipennis* Bingham (Faun. Brit. Ind., Hym., I, p. 265, under the author name of Cameron, 1897, but





Figs. 23 and 24. *Pemphredon* (*Pemphredon*) *shirozui* sp. nov., ♂. Head.

Cameron did not describe the species after all) as far as the description goes. But the characters described were confined mainly to the colour and punctuation of the body, and strictly we can not obtain even the subgeneric concept from the description. The specimen at hand differs from this species at least in the punctuation on the posterior part of the propodeum. Judging from such a state of things it was dealt with as distinct from the above cited species.

This species is characteristic in having the propodeum broadly sculptureless and glittering, the antennal joints 6–12 provided with tyloidea, the radial cell of fore wing infuscted along the anterior margin and abdominal sternites 3–6 adorned with particular tufts of long hairs.

♂. Length about 9 mm. Black and shining, palpi slightly brownish black. Wings hyaline, slightly clouded toward apex, with radial cell markedly infuscated along costa, stigma black and veins dark brown. Clypeus and antenno-ocular areas covered with appressed silvery hairs, the hairs not dense so that when the apical margin is directed towards the light the surface well visible, other parts of body with sparse long greyish white hairs, only on abdominal tergites and tarsi of legs the hairs brownish and short. Sternites 3–6 provided with a line of long dark-brown hairs within a certain median extent across middle, on sternite 3 showing tendency to be separated into the right and left halves by the intermediate narrow space, the tendency posteriorly more and more marked and at the same time the breadth of the hair line becoming shorter, finally on sternite 6 it becomes 2 tufts of hairs distinctly separated from each other.

Head seen from above: Fig. 23, vertex gently roundly elevated, ocellar area slightly more raised, ocelli in an isosceles triangle, each ocellus inclined externally, so that the areas outside the ocelli narrowly impressed along their outer margin, OOD : POD : OCD=12 : 6 : 17 (approximately 2 : 1 : 3), ocelli uniform, with relative width 4; frontal median furrow lacking. Head seen in front: Fig. 24, lower frons broadly roundly excavated, supra-antennal spine vestigial, almost invisible from above, relative length between oculo-antennal distance, width of antennal socket and interantennal distance 6 : 4 : 6 (the same scale as above), clypeus in middle approximately as long as antennal joint 1, apical margin broad-triangularly produced and incised triangularly in middle, lateral angles of the incision rounded; mandibles tridentate at apex; antennal joint comparatively long, progressively reducing in length up to penultimate joint and increasing in thickness up to joint 8, thence gradually attenuate towards apex, joint 3 about 2.7 times as long as wide at apex, joint 10 about 1.8 times as long as wide, joints 6–10 each with a tyloidea, a polished swelling on the under side, occupying whole the length of the joint, except on 10. Pronotum

depressed much below the level of mesonotum, with the anterior margin weakly carinate, the carina consists of a series of short lines and at the lateral corners slightly reflected; mesonotum markedly convex, with lateral margins strongly carinate, with prescutal sutures indistinct, median scutal lines at first converging posteriorly, then running parallel and reaching about 2/5 of the scutum from base, interval feebly furrowed, parapsidal sutures in fine impressed lines, in length about a quarter of the scutum; scutellum about thrice as long as postscutellum; mesopleuron with epicnemial area not marginated by carina, but bordered upward by the coarsely crenated epicnemial furrow, and below by the anterior oblique furrow, also crenated, scrobal surure in a broad furrow not crenate. Area dorsalis in an impressed broad triangle, posteriorly not bordered by carinae, at the median angle about half as long as scutellum, posterior limb not margined posteriorly, but gradually inclining to posterior slope, from apex of median angle of area dorsalis a fine groove passing over the posterior limb broadened and deepened on posterior slope, with a few crenae on posterior portion; from the end of the furrow a short carina runs to apex of the segment. Petiole of abdomen as long as hind femur and 1.4 times as long as tergite 1, with the sides parallel and acutely edged, in the lateral view suddenly narrowed and bent downward near base, dorsal surface transversely roundly raised, with the median furrow on apical half which is posteriorly broadened, ventral surface with a median carina. Legs normal, no deformity on any pair. In fore wing 2nd cubital cell slightly wider above than below, 1st recurrent vein received by the 1st cubital cell toward middle, 2nd by the 2nd at about 1/4 from base, medial vein fairly strongly curved upwards (stronger than in *japonicus* or in *lugubris*).

Punctures on clypeus comparatively larger and close, with intervals smaller than width of punctures, frons except supra-antennal area fairly closely punctured with medium-sized irregular-shaped punctures, partly subreticulate, from upper frons to vertex punctures smaller and much sparser and on posterior portion of vertex turning again somewhat close, with intervals 1–2 times as wide as punctures. Mesonotum and scutellum with punctures fine and sparse, epicnemium on mesopleuron anteriorly closely punctured and mat, posteriorly shining with sparse fine punctures, hypoepimeral area longitudinally, somewhat arcuately finely and closely striate, episternum on anterior and lower portions fairly closely and somewhat coarsely punctured, area along metapleuron coarsely obliquely striate; metapleuron shining, but not even. Area dorsalis on propodeum coarsely foveolate, with medial region subreticulate, posterior limb smooth and polished, posterior slope finely sparsely punctured, sides of the segment slightly coarsely, closely punctured, on posterior portion rugoso-punctate, partly rugoso-striate; petiole of abdomen coarsely punctured, punctures partly longitudinally confluent, its sides with weak punctures and its ventral side impunctate, tergites 1 and 2 practically impunctate, from tergite 3 apically with microscopic fine rugulae and mat, with minute hair points somewhat closely imposed, sternites basally with transverse close and fine rugulae, apically shining, with sparse fine hair points scattered.

Holotype: ♂, Nantou Hsien (Sungkang), Formosa, 31. V. 1965, T. Shirozu leg. (Coll. Kyushu Univ.)

11. *Stigmus* (*Carinostigmus*) *taiwanensis* sp. nov.

This species closely resembles *S. formosanus* m., 1954, but the differences can be observed in the following points:

(1) Upper frons in front of anterior ocellus not furrowed, the surface nearly smooth, only very faintly obliquely striate.

(2) Frontal median carina not reaching anterior ocellus.

(3) OOD : POD=3 : 1 (instead of 2 : 1).

(4) Petiole of abdomen longitudinally finely closely rugoso-striate, only on apical portion smooth and polished.

(5) On the area behind area dorsalis the meshes of reticulation markedly, obliquely and arcuately elongate, that the area arcuately striate, lateral portions of dorsal and posterior aspects of the segment normally reticulated; on each side of the medial furrow of the posterior aspect a large smooth space (more or less weakly sculptured) is observed.

♀. Length about 6.5 mm. Black and shining. Mandibles medianly broadly reddish brown, humeral angles ivory white. Ferruginous to pale brown: Antennal joints 1 and 2 except dark brownish dorsal side (subsequent 2 joints dark brownish), labrum, apex of all trochanters, apex of front and mid femora, tibiae and tarsi of front and mid legs except apical tarsal joints, hind tibiae at base broadly and tegulae of wings. Wings clear hyaline, stigma and veins black, partly ferruginous. Clypeus and mandibles with sparse long pale brownish hairs.

Head seen from above as in *S. formosanus* (cf. Tsuneki, 1954, Fig. 18), but the emargination in front less deep, ocelli in an isosceles taiangle, OOD : POD=3 : 1, POD nearly equal in width to postocellus, opaque area on ocellocular area represented by a minute impression on top of a small tubercle close to the eye as in *formosanus*. Head in front with inner orbits gently convergent toward clypeus, lower frons on each side of medial carina deeply excavated, the carina produced into a short frontal spine slightly below middle of its length and upward not reaching anterior ocellus, ending at the bordering area of upper and lower frons, the end somewhat incrassate, the frontal spine also incrassate toward apex; minimum interocular distance : length of antennal scape=21 : 13, oculo-antennal distance : width of antennal socket : interantennal distance =7 : 6 : 15, of the inner-orbital double carinae that of eye-side not reaching below clypeus, clypeus markedly produced anteriorly, with apex broadly bidentate, just as in *S. formosanus*; labrum linguiform, with apical margin incrasste, mandibles tridentate at apex, antennal joints 2 and 3 subequal in length, 4 slightly longer than 3, about 3.5 times as long as wide at apex, the following joints progressively slightly shorter up to penultimate joint, ultimate joint as long as joint 4. Structure of pro- and mesonotum very similar to those of *formosauns*, pronotum with anterior margin carinate and pointed at the sides, about 4 times as wide as long in middle, humeral angles conical, on mesonotum median scutal line area slightly impressed, the impression less marked than in *S. iwatai*, prescutal sutures in impressed crenulated lines, also the area not deeply impressed; scutellum on anterior margin medianly shortly produced into a tooth, postscutellum marginate don anterior and posterior margins by a fine carina; on mesopleuron scrobal furrow fine and weak, not crenate, anterior and posterior oblique furrows broad and deep, coarsely crenate; structure of propodeum as in *formosanus*, only different in sculpture as above mentioned. Abdominal petiole slightly longer than hind femur (31 : 26), but slightly shorter than hind tibia (36 : 31), without carina on dorsal and lateral surface, in the lateral view suddenly bent downward from near the base; pygidial area elliptic, relatively wider than in *formosanus*. Venation of fore wing as in *formosanus* or *iwatai* (cf. Tsuneki, 1954, Fig. 10).

Vertex smooth and polished, with a few fine aciculate punctures scattered, temples below arcuately coarsely striate, outer orbits closely crenulate, *inner-orbital furrows without crenulae*, lower frons transversely very finely and closely ruguloso-striate, on the lateral portions rugulae turn oblique and slightly coarser; clypeus with a few somewhat large punctures scattered on the median raised area. Mesonotum finely sparsely punctured, on lateral marginal furrows crenulae distinct, on posterior margin coarsely crenate or foveolate, foveae longer medially, scuto-scutellar furrow crenate; scutellum impunctate except latero-posterior portions, postscutellum medianly broadly impunctate and smooth, laterally coarsely crenate. Sides of propodeum obliquely closely

striate, the striae posteriorly and dorsally diminishing in number and gradually turning into reticulation extended from the dorsal and posterior aspects of the segment, intervals of striae half mat, owing to minute wrinkles. Abdominal petiole except apical portion longitudinally finely, striate, subsequent tergites smooth and polished, only laterally with a few fine points, tergite 6 fairly closely punctured, pygidial area with more or less weak wrinkles, but shining. Sternite 2 on basal 2/3 very minutely coriaceous (under 30×), 3 similarly coriaceous except base and apex, with superimposed fine points scattered, sternites 4, 5 and 6 similar, but the points finer and closer.

Holotype: ♀, Nantou Hsien (Sungkang), Formosa, 1. VI. 1965, T. Shirozu leg.

Remarks. This species may be a form of *S. formosanus*. If the locality were other than Formosa it could be given no higher rank than the subspecies.

12. *Stigmus* (*Carinostigmus*) *saigusai* sp. nov.

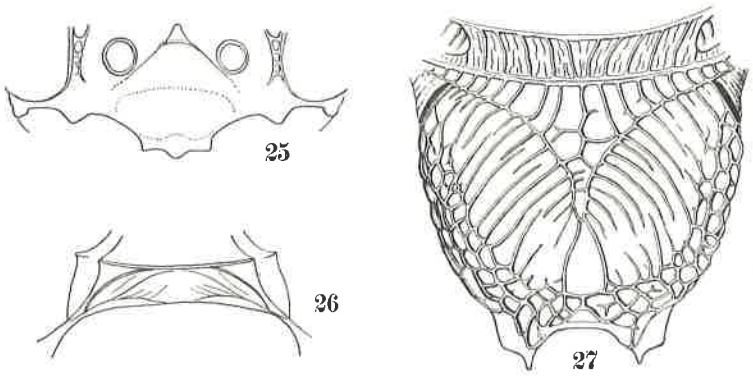
♂. Somewhat resembles *S. formosanus* ♂, but the clypeus tridentate at apex of the medial lobe, head behind eyes more strongly narrowed posteriorly, postscutellum wholly longitudinally closely striate and the colour of antennae and legs much brighter. This species is also close to *S. filippovi* Guss. occurring in Japan. But it has the clypeus more bluntly tridentate at apex. the head behind eyes more strongly convergent posteriorly and the pronotum much longer.

Length about 5 mm. Basal half of mandibles, antennal joint 1 in front and humeral angles ivory white; all trochanters and base of hind tibiae yellowish white, semitransparent. Apex of coxae, base and apex of all femora, front tibiae except inside, mid tibiae except broad median area, tarsi of all legs, antennal joints 2–5 and wing tegulae glossy ferruginous, semitransparent. Antennae dark brown, apically darker and comparatively glossy, joints 6–7 beneath and apex ferruginous. Wings hyaline, strongly iridescent, veins and stigma dark brown.

Head from above with temples roundly (more strongly than in *formosanus*) convergent posteriorly, occipital carina very distinct, OOD : POD : OCD=6 : 15 : 17 (ocellus 5), ocellar region slightly raised, each ocellus inclined externally and the area adjacent to the outer margin of each ocellus impressed, frontal median furrow broad and fairly deep, with a weak frontal longitudinal carina in middle which starts from the anterior ocellus; opaque area represented by a pit, also situated close to the eye on ocellocular line, but much larger than in *S. iwatai* or *formosanus* and the area hardly raised. Head in front similar in general feature to *formosanus*, lower front deeply, transversely roundly excavated, inner orbits convergent toward clypeus, relative interocular distance at upper front and at clypeus 34 : 27, inner orbits distinctly double-carinate, with interval furrowed and crenulate, median frontal carina fairly strong and distinct up to the upper end of lower frons, thence weakly continued to auterior ocellus (on upper frons well-defined in lateral oblique light only); supra-antennal spine comparatively short and truncate at apex: relative distance between oculo-antennal space, width of antennal socket and interantennal space 5 : 4 : 9; clypeus: Fig. 25, with median lobe roundly convex, medio-apical area produced and tridentate at apex, anterior margin of lateral lobe with a stout tooth towards middle. Head in profile with eye slightly wider than temple, outer orbit double-carinate, the carinae weaker than those of inner orbit, the furrow between them very weakly crenulate. Antennal joint 2 thick, slightly longer than 3; 3, 4 and 5 subequal, 3 approximately thrice as long as wide at apex, from joint 5 apically progressively slightly reducing in length and slightly increasing in thickness till penultimate joint which is about 1.5 times as long as wide, ultimate joint slightly more than as long as joint 2 and normally (slightly flattened dorso-ventrally) attenuate apically.

Pronotum: Fig. 26, approximately 4 times as broad at anterior margin as long in middle,

the anterior margin strongly carinate and pointed at the sides, in the frontal view the carina forming the outline somewhat like Mt. Fuji (decapitated triangle), mesonotum on anterior portion not so markedly uneven as in *S. iwatai*, with prescutal sutures weakly grooved and crenulate, reaching posteriorly somewhat before middle of scutum, median scutal lines indistinct, owing to the fine striae covering the interspace, the striae transverse on extreme anterior margin and oblique on the region next to it, extending laterally toward prescutal sutures, the median impressed line extending posteriorly as fine (rather indistinct) groove to about 4/5 of the scutum, parapsidal sutures distinct, scutellum less than twice as broad as long, medio-anteriorly slightly produced. Mesopleuron with anterior and posterior oblique surures broad and distinct, crenate, scrobal suture lacking. On propodeum area dorsalis not deeply impressed, on posterior oblique margins bordered by a carina on each side of the median furrow which extended to about middle of posterior slope (Fig. 27). Petiole of abdomen slightly longer than hind femur (24 : 21), but slightly shorter than hind tibia (24 : 26), dorsal surface transversely roundly raised but gradually flattened posteriorly and slightly triangularly impressed at the extreme apex. Legs and wing venation normal.



Figs. 25–27. *Stigmus* (*Carinostigmus*) *saigusai* sp. nov., ♂.
25, clypeus. 26, pronotum. 27, propodeum.

Vertex and upper frons impunctate and polished, with a few fine points along upper inner orbits, upper frons medio-anteriorly with faint fine striae, lower frons transversely very finely closely lugulose, on lateral portions longitudinally, somewhat arcuately very finely closely striate, clypeus shining, on median lobe with a few aciculate, somewhat large punctures scattered; sculpture on pronotum as given in Fig. 26, mesonotum sparsely punctured, punctures slightly large and tend to locate in longitudinal lines, the furrows at lateral margins indistinctly crenulate, posterior margin crenate, the crenae comparatively long, fine and close, not foveolate, scutellum half mat, with 4-5 fine punctures, postscutellum with anterior and posterior margins carinate and longitudinally closely striate (Fig. 27). On mesopleuron hypoepimeral area longitudinally finely closely striate, other portions smooth and polished, only on posterior margin longitudinally somewhat coarsely striate, mesosternal median carina distinct, with close fine oblique (anteriorly divergent) striae on both sides of its posterior 2/3, precoxal suture in a short weak carina, also accompanying close fine oblique (posteriorly divergent) striae, the striae much closer and finer than those of the median carina; metapleuron anteriorly transversely weakly rugoso-striate, posteriorly smooth and polished. Abdominal petiole smooth and polished, tergites 4, 5 and 6 laterally finely sparsely punctured, remaining portions impunctate and shining, sternite 2 on basal half and supsequent tergites wholly except base and apex very finely closely coriaceons, with a

row of sparse punctures before each posterior margin.

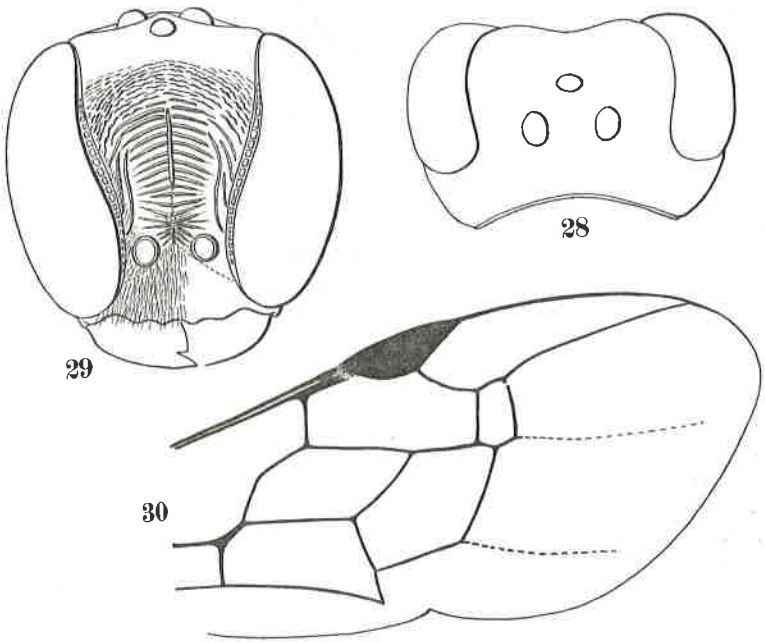
Holotype: ♂, Chiayi Hsien (Chihsinliao), Formosa, 19. IV. 1965, T. Saigusa leg. (Coll. Kyushu Univ.)

13. *Passaloecus annulicornis* sp. nov.

This species belongs to the group of *P. abnormis* Kohl and is characteristic in the structure and colour of the mandibles and antennae and in the sculpture of the area dorsalis.

♂. Length about 4.0 mm. Black. Mandibles reddish ferruginous, at base slightly darker. Antennae ferruginous, above slightly darkened, joint 1 (scape) beneath yellowish white, apically somewhat darkened, from joint 2 apically each joint dark annulated at base, the annuli narrow and pale toward base and wider and darker toward middle portion and again narrowed toward apex, ultimate joint further blackish on apical half. Wing tegulae and all legs also ferruginous, the latter more or less variegated with brown: Front and mid coxae nearly wholly and hind coxae at base black or dark brown, front and mid femora at base and more or less on outer margin dark brown, also outer margin of front and mid tibiae brownish, brown on the legs similar in pattern on all pairs, but posteriorly progressively larger in extention and on hind legs brown covers much broader part of femora and tibiae; hind tarsi also apically slightly brownish. Wings hyaline, slightly darkened throughout and strongly iridescent, stigma and veins brown. Clypeus covered with appressed silvery hairs, temples and sides of thorax with whitish pubescence.

Head from above: Fig. 28, oceller region slightly raised, anterior ocellus smaller than posterior ocellus, OOD : POD : OCD = 4 : 4 : 5; head in front: Fig. 29, lower frons on central area transversely roundly impressed, median carina disappeared for some distance above the supra-antennal spine, the spine fine, short, truncate at apex, clypeus with anterior margin bluntly quadridentate, mandible broad, apical margin subtruncate, with a tooth on outer apical corner. Antennae short, comparatively hairy, flattened beneath, each joint except basal and apical ones



Figs. 28-30. *Passaloecus annulicornis* sp. nov., ♂. 28, 29, head. 30, fore wing.

less than as long as broad (under curved state apical 2 or 3 joints appear as long as wide), ultimate joint 1.7 times as long as wide at base. Pronotum depressed far delow the level of mesonotum as usual, mesonotum with prescutal sutures reaching 1/5 of the scutum, finely crenulate, parapsidal sutures in short carinae, in length about 1/4 of scutum, scuto-scutellar furrow medianly with a single crena, scutellum subquadrate, postscutellum about half the length of scutellum; on mesopleuron scrobal suture and anterior oblique suture in a ⅂-shaped furrow (right side), distinct, the latter crenulate; on propodeum area dorsalis completely lacking, dorsal aspect medianly broadly reticulate, meshes larger posteriorly, on its lateral portions the surface odliquely feebly striate, the striae not reaching the verge of the dorsal aspect, leaving a smooth zone posteriorly, posterior inclination with a broad smooth space (under 60× enlargement periferal regions finely coriaceous) at the centre which is medianly excavated by the broad (rather elliptic) furrow, remaining portions of posterior inclination moderately grossly and rather weakly reticulate, sides of the segment obliquely finely closely (posteriorly much more so) striate. Abdominal petiole subquadrate, slightly shorter than wide, tergite 2 at base (under normal attitude covered by tergite 1) constricted as usual; legs normal, wing venation: Fig. 30.

Vertex and upper frons finely sparsely punctured, intervals very minutely coriaceous (under 60×), lower frons on upper portion transversely, somewhat arcuately and closely ruguloso-striate, middle and lower portions similarly but much more coarsely striate, inner-orbital furrows coarsely crenate, head in profile with outer-orbital and occipital furrows weakly crenulate. Mesonotum, scutellum, postscutellum and mesopleuron closely punctured, with intervals minutely corisceous (60×), half mat; abdominal tergites sparsely scattered with very fine hair-bearing points.

Holotype: ♂, Tokunoshima Is. (Mikyo), the Ryukyus, 27. VII. 1963, J. L. Gressitt leg. (Malaise trap) (Coll. Bishop Mus.)

LITERATURE

Beaumont, J. de. 1937. Les Psenini(Hym. Sphecid.)de la région paléarctique. Mitt. Schweiz. Ent. Ges., **17** : 33–93.

Bingham, C. T. 1896. On some exotic fossorial Hymenoptera in the collection of the British Museum with description of new species and a new genus of Pompilidae. Jour. Proc. Linn. Soc., Zool., **25** : 422–445.

——— 1897. The fauna of British India, including Ceylon and Burma, Hymenoptera, I : 1–597.

Cameron, P. 1899. Description of a new genus and some new species of fossorial Hymenoptera from the oriental region. Ann. Mag. Nat. Hist. (7) **4** : 55–56.

——— 1890. Hymenoptera Orientalia, or contributions to a knowledge of the Hymenoptera of the Oriental Zoological Region. Mem. Manchester Lit. Phil. Soc., (4) **3** : 239–284.

——— 1902a. Descriptions of new genera and species of Hymenoptera collected by Major C. S. Nurse at Deesa, Simula and Ferozepore. Jour. Bombay Nat. Hist. Soc., 14 : 267–293.

——— 1902b. Descriptions of new species of fossorial Hymenoptera from the Khasia Hills, Assam. Ann. Mag. Nat. Hist. (7) **10** : 54–69.

——— 1904. Descriptions of new species of Aculeate and Parasitic Hymenoptera from northern India. Ann. Mag. Nat. Hist. (7) **13** : 211–233.

——— 1906. Hymenoptera of the Dutch Expedition to New Guinea in 1904 and 1905, Part I. Tijds. Ent., **49** : 215–233.

——— 1907a. A contribution to the knowledge of the Hymenoptera of the Oriental Zoological Region. Ann. Mag. Nat. Hist., (7) **20** : 81–92.

——— 1907b. Description of new species of Hymenoptera from Borneo. On two new species of *Mellinus*. Jour. Str. Br. Asiat. Soc., **48** : 22–25.

Eversmann, E. 1849. Fauna Hymenopterologica Volgo-Uralensis. Bull. Soc. Imp. Nat. Moscou, **22** : 359–(Fox, W. J. 1898. The species of Psen inhabiting America North of Mexico. Trans. Amer. Eut. Soc., **25** : 1–18.)

Gussakovskij, V. 1932. Verzeichnis der von Herrn Dr. R. Malaise im Ussuri und Kamtschtka gesammelten aculeaten Hymenopteren. Ark. Zool., **24 A. 10** : 1–66.

——— 1934a. Beitrag zur Kenntnis der Pseninen- und Pemphredoninen-Fauna Japans (Hymenoptera, Sphe-

cidae). Mushi, **7** (2) : 79-89.
——— 1934b. Schwedisch-Chinesische wissenschaftliche Expedition nach den nordwestlichen Provinzen Chinas etc., 41. Hymenoptera, 6, Sphegidae. Ark. Zool., **27 A**, **21** : 1-15.
——— 1937. Espèces paléarctiques des genres *Didineis* Wesm., *Pison* Latr. et *Psen* Latr. (Hymenoptera Sphecoidea). Trav. Inst. Zool. Acad. Sci. URSS. **4** : 599-698.
Lith, J. P. van. 1959. Contribution to the knowledge of the Indo-Australian Pseninae (Hymenoptera, Sphecidae). Part I. *Psen* Latreille. Zool. Verh., **39** : 1-69.
——— 1962. idem, Part II. *Psenulus* Kohl, 1896. Ibid., **52** : 1-118.
——— 1965. idem, Part III. New species of the subgenera *Psen* Latreille and *Mimumesa* Malloch and a review of East-Asiatic and Indo-Australian *Psen* Latreille, s. l. Ibid., **73** : 1-80.
Maidl, F. 1925. Fauna Sumatrensis (Beitrag Nr. 11), Sphegidae (Hym.). Ent. Mitt., **14** : 376-392.
Nurse, C. G. 1903a. New species of Indian Hymenoptera. Jour. Bombay Nat. Hist. Soc., **15** : 1-26.
——— 1903b. New species of Indian Aculeate Hymenoptera. Ann. Mag. Nat. Hist., (7)**11** : 511-526, 529-549.
Pagden, H. T. 1933. Two new Malayan Sphecoids. Trans. Ent. Soc. Lond., **8** : 93-101.
Ritsema, Oz., C. 1876. Description of two new exotic Aculeate Hymenoptera of the families Thynnidae and Crabronidae. Ent. Mon. Mag., **12** : 185-186.
——— 1880. On two new exotic species of fossorial Hymenoptera. Notes Leyden Mus., **2** : 225-226.
Rohwer, S. A. 1910. Some new Hymenpterous insects from the Philippine Islands. Proc. U. S. Nat. Mus., **37** : 657-660.
——— 1921. Descriptions of new Philippine wasps of the subfamily Pseninae. Phil. Jour. Sci., **18** : 309-323.
——— 1923. New Malayan wasps of the subfamily Pseninae. Phil. Jour. Sci., **22** : 593-601.
Smith, F. 1958. Catalogue of the Hymenopterous insects collected at Ssrawak, Borneo; Mt. Ophir, Malacca and at Singapore, by Mr. A. R. Wallace. Jour. Proc. Linn. Soc., Zool., **2** : 43-130.
——— 1861. Descriptions of new species of Hymenopterous insects collected by Mr. A. R. Wallace at Celebes. Ibid., **5** : 57-93.
——— 1964. Catalogue of Hymenopterous insects collected by Mr. A. R. Wallace in the islands of Mysol, Ceram, Waigiou, Bouru and Timor. Ibid., **7** : 6-48.
——— 1965. Descriptions of new species of Hymenopterous insecte from the islands of Sumatra, Sula, Gilolo, Salwatty, and New Guinea, collected by Mr. A. R. Wallace. Ibid., **8** : 61-94.
Strand, E. 1915. H. Sauter's Formosa Ausbeute. Crabronidae und Scoliidae. III. Die Gattung *Psenulus* nebst Nachtrag zu Sphex. Arch. Naturg., A. 1915 (**7**) : 19-23.
Tsuneki, K. 1951. The genus *Pemphredon* Latreille of Japan and the adjacent regions (Hymenoptera, Pemphre donidad). Jour. Fac. Sci. Hokkaido Univ., VI, **10** (2) : 163-208.
——— 1954a. The genus *Stigmus* Panzer of Europe and Asia, with descriptions of eight new species (Hymenoptera, Sphecidae). Mem. Fac. Lid. Arts, Fukui Univ. II, **3** (1) : 1-38.
——— 1954b. Descriptions and records of wasps of the families Chrysididae and Sphecidae of Japan (Hymenoptera). Ibid., **4** (5) : 37-54.
——— 1959. Contributions to the knowledge of the Cleptinae and Pseninae faunae of Japan and Korea (Hymenoptera, Chrysididae and Sphecidae). Ibid., **9** (1) : 1-78.
——— 1961. Some Fossorial Hymenoptera collected by the Osaka City University Biological Expedition to Southeast Asia 1957-58. Nature and Life in Southeast Asia, **1** : 383-393.
——— 1962a. The Aculeate Hymenoptera collected on the Island of Amami-Ohshima, the Ryukyus. Life Study (Fukui), **6** (1) : 1-9.
——— 1962b. Mandibular character of *Psen* (s. str.) *santaro* Yasumatsu ♂. Ibid., **6** (3) : 40.
——— 1963. Chrysididae and Sphecidae from Thailand (Hymenoptera). Etizenia (Occ. Publ. Biol. Lab. Fukui Univ.), **4** : 1-50.
Turner, R. E. 1912. Notes on Fossorial Hymenoptera. X. On new species from the Oriental and Ethiopian regions. Ann. Mag. Nat. Hist., (8) **10** : 361-377.
——— 1920. Notes on Fossorial Hymenoptera. Ann. Mag. Nat. Hist., (9) **5** : 265-271.
Yasumatsu, K. 1942. Sur quelques formes nouvelles ou peu connues des Psenini en Extrême Orient (Hym., Sphecoidea). Mushi, **14** : 93-97.