The Genus *Passaloecus* Shuckard of Japan, with Ethological Observations on Some Species

(Hymenoptera, Sphecidae, Pemphredoninae)

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The Genus *Passaloecus* Shuckard of Japan, with Ethological Observations on Some Species[1)]

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Only two species of the genus *Passaloecus* Shuckard (1837) have so far been recorded from Japan.[2)] The recent examination of the writer's collection, however, revealed that five species at least, including one new species, could further be added to the fauna of the group of this country. According to the comparative study with the foreign representatives, three species out of the known seven possess characters worthy of separation as a distinct geographical race of the European (two) and the North American (one) species respectively. It is by no means a surprising fact that we find among the examples captured in Japan some geographical races or subspecies of the European representatives, but it is a quite different matter and rather an event that we find an American factor in the constitution of the insect fauna of eastern Asia without any connection with the European fauna. The fact, however, may be due to insufficiency of both the absolute and comparative investigations.[3)] Moreover, it seems of not less interest than above from the phylogenetic point of view that among the remainder of the Japanese species the curious Passaloecid, *P. abnormis* Kohl is included. This species possesses very aberrant morphological distinctions and has hitherto been known only from a restricted region of eastern Europe.

All the specimens dealt with in the present paper were collected by the writer and are in his collection except for those particularly mentioned.

Genus *Passaloecus* Shuckard, 1837

Type : *Pemphredon insignis* Vander Linden (=*monilicornis* Dahlbom)

Generic characters : Small wasps having the body length less than 10 mm. Black, usually with a few yellowish markings on head and thorax, legs partly

1) Contribution No. 8 from the Biological Laboratory, Fukui University, Japan. Aided by the Co-operate Research Fund from the Ministry of Education.

2) *P. monilicornis* Dahlbom and *P. gracilis* Curtis.

3) According to the observation of the writer, at least two of the North American species of this genus seem to be Holoarctic, since they are quite similar to and probably identical with the already known Palaearctic species.

brownish. Mandibles always bidentate at apex in ♂, either bi- or tridentate in ♀, very long, somewhat spoon-shaped, usually placed across in front of clypeus; labrum large, flattened, mostly cordiform, produced from beneath clypeus or folded beneath head; antennal flagellum carinated in middle in ♂; pronotum short; mesonotum convex, gibbous anteriorly, provided with two short longitudinal furrows in front; mesopleuron with longitudinal and transverse crenate furrows which are variable in pattern of combination with species; propodeum rather closely reticulate (meshes ususlly subquadrate); abdomen petiolate, petiole short, shorter than the subsequent segment, apical tergite without pygidial area (♀♂) or with very indistinct one (♀). Forewing with one radial and two cubital cells, lst cubital cell nearly thrice as long as 2nd, the latter more or less narrowed anteriorly, both the cubital cells receiving lst and 2nd recurrent nervure respectively; legs simple.

The members of this wasp-group closely resemble to one another and can be distinguished with some difficulty. In the keys to the species and subspecies given later, the classification system hitherto generally used by the authorities is also employed in the main.

Biology: The wasps of this genus are either tube-renters or tunnel-burrowers, or both. Probably their basic nature is to utilize the ready-made holes as their nests, because even when they burrow in dead wood, they do not dig their tunnels from the beginning, but always seek for the abandoned beetle burrows and the like. Inside the tunnel where the wood tissue becomes soft they dig their galleries and brood-cells for the first time. Sometimes the nest is very complicated in structure (Fig. I). Usually the brood-cell is not more enlarged than the gallery. At times, however, it is slightly widened. The partition walls for each cell are, as a rule, made of resin of coniferous trees, which is very delicately and skillfully spread across the tunnel. Only *P. gracilis* (Curtis) has been known to utilize grains of earth etc. as partitioning or closing material. A geographical race of this species occurring in Japan retains the similar habits (p. 10). In the crowded colony which is usually found among the mountains on the wooden posts and cross-pieces of old houses having numerous beetle-holes, it is observed that the same burrow is utilized from season to season by the successive generations of the wasps.

As food for the larvae various species of aphids are hunted by the wasps. The number and the species of the prey show an inclination to be constant with the wasp species. The egg of the wasp is invariably found attached to one of the aphids located toward the middle of the brood-chamber. It has not been corroborated, however, whether it is laid during the course of the provisioning work or after the work is finished and just before closing the cell, although it is supposed that the latter case may be true, judging from the habits of the wasps of the allied genera. The larva does not turn vermillion in colour when it becomes the prepupa as observed in some species of *Pemphredon* (*Cemonus*). The

cocoon is very thin in structure and semitransparent as is usually the case in Pemphredoninae.

According to the knowledge obtained up to the present on the Japanese species, *P. monilicornis* Dahlbom, *roettgeni* Verhoeff and *gracilis yamato* ssp. nov. emerge twice a year, while *abnormis* Kohl, *annulatus nipponicola* ssp. nov., *dubius* sp. nov. and *corniger hakusanicus* ssp. nov. annually repeat only one generation.

Key to the species and subspecies

♂ ♀

1 Inner margins of eyes remarkably convergent toward clypeus (Fig. 16), mesopleuron with ⌐-shaped crenate furrows (left side), clypeus : Fig. 16 or Fig. 19, frontal process distinct and long, apically somewhat thickened, abdomen constricted between lst ant 2nd segments (Fig. 20). Europe (Austria), Korea (*loc. nov.*) and Japan (Hokkaido and Honshu, *loc. nov.*)

abnormis Kohl, 1888 (p. 12)

– Inner margins of eyes not strongly convergent toward clypeus, mesopleural furrows otherwise 2

2 Antennae moniliform (Fig. 4) or nearly (Fig. 5). (Joints 4 – 10 or 11, or 5 – 10, with a distinct lunate carina, mesopleuron with ⌊-shaped crenate furrows (left side), mandibles irregularly tridentate at apex) ... 3

– Antennae not moniliform 4

3 Labrum white or yellowish, anterior margin of flagellar joints not roundly produced (Fig. 5). Europe, Siberia (the Ussuri region) (?) and Japan (Hokkaido and Honshu, *loc. nov.*)

roettgeni Verhoeff, 1890 (p. 9)

– Labrum blackish, anterior margin of flagellar joints roundly produced (Fig. 4). Europe, Siberia (?), Kamtschatka, Korea and Japan (Hokkaido, Honshu and Kyushu)

monilicornis Dahlbom, 1842 (s. Faester) (p. 6)

4 3rd joint of antennae nearly twice as long as wide at apex, greater part of hind tibia black. (Frontal process short, mandibles bidentate at apex, mesopleuron with ⌊-shaped crenate furrows) 5

– 3rd joint of antennae only slightly more than as long as wide at apex, at least greater part of hind tibiae reddish yellow 6

5 Humeral angles usually black, head seen from above gently roundly convergent backward (Fig. 7), hind tibiae at base dark brown. Europe

gracilis gracilis (Curtis, 1834)

– Humeral angles white, head seen from above steeply convergent backward (Fig. 10), hind tibiae at base yellowish white. Saghalien (*loc.*

nov.), Hokkaido (*loc. nov.*) and Honshu
gracilis yamato subsp. nov. (p. 9)

6 Antennal flagella medianly widened, joints 3 – 12 with a whitish ring at each apex (Fig. 28), mandibles bidentate at apex. (Mesopleuron with upper longitudinal furrow very short and obsolete). Japan (Honshu)
annulatus nipponicola subsp. nov. (p. 13)

– Antennal flagella rather filiform (Figs. 33 and 36), without whitish rings, joints 7 – 12 beneath at apex prolonged, covering base of each subsequent joint (Figs. 32 and 35), mesopleuron provided with ⊏-shaped furrows (left side) 7

7 Antennal flagella wholly black or brownish, rather distinctly tapered toward apex (Fig. 33), provided with carina on joints 8 – 12. (Head seen in front : Fig. 46). Europe
corniger corniger Shuckard, 1837

– Antennal flagella light brown, beneath yellowish, not remarkably tapered apically (Fig. 36), provided with carina on joints 8 – 13 (Fig. 35). Japan (Honshu)
corniger hakusanicus subsp. nov. (p. 19)

♀ ♀

1 Mesopleuron with two crenate furrows, one horizontal and the other vertical, forming the right angle. (Mandibles bidentate or nearly bidentate at apex, anterior margin of clypeus not tridentate) 2

– Mesopleuron with two horizontal and one vertical crenate furrows, forming ⊏-shaped area (left side). (Mandibles tridentate at apex, 3rd antennal joint nearly as long as wide at apex, clypeus with anterior margin shortly tridentate) 6

2 Mesopleural crenate furrows ⌜-shaped (left side), inner orbital lines remarkably convergent toward clypeus, clypeus with a large somewhat lamellate projection on each side of anterior margin (Fig. 18), frontal process distinct and long, apically somewhat thickened. Europe (Krain), Korea (*loc. nov.*) and Japan (Hokkaido and Honshu, *loc. nov.*)
abnormis Kohl, 1888 (p. 12)

– Mesopleural crenate furrows L-shaped (left side), inner orbital lines parallel or nearly, clypeus without a peculiar projection on each side of anterior margin (3rd antennal joint approximately twice as long as wide at its apex) 3

3 Abdomen somewhat constricted between lst and 2nd segments, clypeus anteriorly in middle slightly roundly produced, or bluntly tridentate, with extreme margin narrowly lamellate and somewhat raised, frontal process short, length 3.5 – 5.0 mm 4

– Abdomen not constricted between lst and 2nd segments, clypeus anteriorly in middle produced, and at apex truncate or feebly roundly emarginate, without lamellate fringe at extreme apex, frontal process moderately long, pointed at apex, length usually 5.0 – 7.5 mm ····· 5

4 Humeral angles black, only rarely posterior portion whitish, head seen from above with temples feebly roundly convergent backward (Fig. 6). Europe

gracilis gracilis (Curtis, 1834)

– Humeral angles distinctly and broadly white, head seen from above
7 rather strongly and steeply convergent backward (Fig. 8). Japan (Hokkaido and Honshu) and saghalien (*loc. nov.*)

gracilis yamato subsp. nov. (p. 9)

5 Labrum dark brown or black. (The lunate hollow along the outside of postocelli comparatively well outlined on its outer margin). Europe, Siberia (the Ussuri and Kamtschatka regions) (?), Korea and Japan

monilicornis Dahlbom, 1842 (s. Faester, 1951) (p. 6)

– Labrum white or pale yellowish. (The hollow outside the postocelli not well outlined on its outer border, legs largely black). Europe, Siberia (?) and Japan (Hokkaido and Honshiu, *loc. nov.*)

roettgeni Verhoeff, 1890 (p. 9)

6 Mandibles pitchy black except apical portion, head nearly 1.7 times as wide as long (Fig. 30). (2nd cubital cell of forewing slightly widened toward posterior margin (Fig. 37) cubital nervure of hind wing elbowed
2 nearly in middle, discoidal nervure apically approaching to anal nervure (Fig. 38), mesopleural furrows strongly crenate) Japan (Honshu)

dubius sp. nov. (p. 17)

– Mandibles brownish. head nearly 1.5 times as wide as long (Fig. 43).
6 (Cubitus in hindwing parallel to anal nervure (Figs. 40 and 42)) ····· 7

7 2nd cubital cell of forewing widened toward posterior margin (Fig. 39), upper longitudinal furrow of mesopleuron strong, crenate, cubitus of hindwing elbowed before middle, two longitudinal furrows on anterior portion of mesonotum distinct, crenulate, posterior slope of propodeum coarsely reticulate. Europe

corniger corniger Shuckard, 1837

– 2nd cubital cell of forewing not widened below (Fig. 41), upper longitudinal furrow of mesopleuron not strong, without costae, cubitus of hindwing elbowed nearly in middle, anterior mesonotal furrows weak,
3 not crenulate, posterior slope of propodeum transversely finely feebly rugose-striate. Japan (Honshu)

corniger hakusanicus subsp. nov. (p. 19)

4 All the figures shown in this paper were drawn in proportion to the rela-

tive values obtained by measurements of every possible part.

Descriptions of the species and subspecies

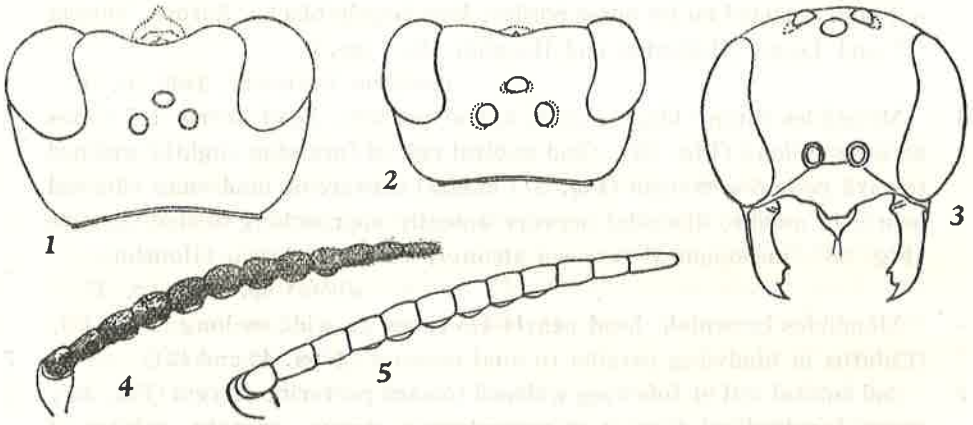
1. *Passaloecus monilicornis* Dahlbom, 1842 (s. Faester, 1951)

Passaloecus shuckardi Yasumatsu, Mushi, VII, 1, p. 36. 1934 (Korea and Honshu) ; — Masuda, Idem, pp. 41 - 53 (biology).
Passaloecus monilicornis D. var. *dahlbomi* Yasumatsu, Mushi, VII, 2, p. 113, 1934; Idem, XI, 2, p. 175, 1938 (without referring to var.).
Passaloecus monilicornis Faester, Ent. Medd., XXV, p. 450, 1951.

This is the commonest species of *Passaloecus* in Japan and is very abundant in Hokkaido and in high altitude of Honshu. It is also known to occur in Kyushu.

Large sized Passaloecid, having the body length of 5.5 - 7.5 mm (♀♂).

Head : Fig. 1 (♀), Figs. 2 and 3 (♂). Antenna : Fig. 4 (♂). The specimens collected in Japan differ slightly from those of Europe in the following points :



Figs. 1 - 4 ..... *Passaloecus monilicornis* Dahlbom
Fig. 5 ..... *Passaloecus roettgeni* Verhoeff (antenna .. ♂)

(1) Carinae on antennal joints in males were defined on joints 4 - 10 as a rule, sometimes, however, joint 11, rarely even 12 (a small tubercle) carries the carina. In the European specimens examined they were observed on joints 4 - 11. (2) The specimens of our regions seem to be darker in colour, especially of the legs. (3) Vertex somewhat more sparsely punctured and more shining. (4) Apical teeth of the mandibles more distinct in form, nearly tridentate (Fig. 3).

Specimens examined : 1 ♀ 2 ♂♂ Korea (Mt. Hakuto, 2. VIII. 1943); 63 ♀♀ 86 ♂♂ Hokkaido (Sapporo, Atsubetsu, Garugawa, Jôzankei, Sôunkyô); 53 ♀♀ 87 ♂♂ Honshu (Mt. Haku, Sabae, Nikko, Nasu and Towada).

Biology. The biology of this species occurring in Japan was already investigated by H. Masuda (1934) and K. Iwata (1938). Regarding the European representatives several excellent observations have been published. In Koike, at the foot of Mt. Haku, Fukui Pref., this species lives in large colonies in the posts, beams and wooden walls of houses which carry a large number of small holes made by beetles. About a half of the openings of these holes is closed by the wasps with resin which melts in hot summer days and enlarges into brown spots around the entrances of the holes, giving the place appearance of a sort of scattered figures. These holes seem to be repeatedly used from generation to generation. In the same place they are observed to be nesting also in thatches of the roof.

The following observation made upon a wasp in Sapporo by the present writer seems to be of some interest in that the nest included as large number of brood cells as 22. It was made in decayed wood of a standing dead tree through an abandoned beetle hole. Its structure was shown in Fig. I, and the dimentions of the larval cells in Table 1. The wasp was observed to be at work early in July, but when the nest was dug open on the 12th of the same month it had already been completed and the wasp could not be seen. Judging by the fact that out of 18 larval cells containing the progeny of the wasp only 3 had a pupa respectively within, others all containing a prepupa, or a fully or considerably grown larva, it seems that the wasp completed such a large number of brood-chambers during a comparatively short period of time. In the following, some data collected during the writer's observation will be presented. *Prey* : Aphids parasitic on *Sambucus Buergeriana* var. *aurantiana* Nakai, all being wingless form ; the number in one cell ranges from 25 – 37 ; they are pressed to death or paralysis between the mandibles of the wasp.

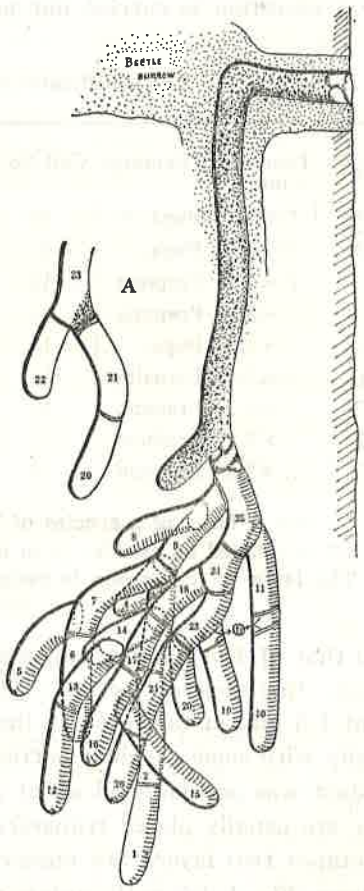


Fig. I ····· A nest of *Passaloecus monilicornis* Dahlbom. The cell numbers indicate the presumed order of their construction.
A ··· Posterior view of branching point of cell No. 21 and No. 22, showing a small amount of sawdust accumulated on the resin partition of cell No. 21.

The wasp seizes the victim between her mandibles by the cephalic portion from behind and carries it on the wing holding it beneath her head. The prey is rather loosely packed in the cell as compared with the status in *Pemphredon* spp., their bodily position being inconstant, contray to the case of the majority of hunting wasps. *Larva* : Medianly thickened and fairly remarkably tapered toward both ends. *Cocoon* : Very thin and almost transparent, closely attached to the cell-wall; when the cell is very long it does not fill the space of the chamber and ends half way with the top flattened, as if trancated; the larval cots (several black particles) are found outside and beneath the cocoon. This means that the larval excretion is carried out prior to spinning the cocoon. The habit agrees

Table 1. The brood-cells of a nest of *Passaloecus monilicornis* Dahlb.

Cell No.	Dimention (mm)	Remarks	Cell No.	Dimention (mm)	Remarks	Cell No.	Dimention (mm)	Remarks
1	12×3.5	Pupa	10	17×3.3	Prepupa	19	12×3.8	Prepupa
2	14×3.5	Pupa	11	13×3.3	Prepupa	20	8×3.5	Larva
3	12×3.5	Prepupa	12	14×3.5	Prepupa	21	14×3.3	Larva
4	11×3.3	Prepupa	13	11×3.5	Prepupa	22	10×3.5	Larva
5	9×3.5	Pupa	14	10×3.3	——	23	8×3.5	Larva
6	13×3.5	Parasite*	15	17×3.5	Prey**	24	7×10.0	——
7	14×3.3	Prepupa	16	13×3.5	Prepupa	25	10×4.0	——
8	12×3.2	Prepupa	17	7×3.5	Larva			
9	12×3.5	Prepupa	18	8×3.5	Larva			

* ..... A larva of a species of Dermestidae.
** ..... Dried up aphids, 29 in number.
The larva in the cocoon is designated as "Prepupa" for convenience' sake.

with that of *Pemphredon* spp. and is rather exceptional in the world of hunting wasps. *Partitions of the cell* : Made of resin, probably of *Abies sachalinensis*, about 1.5 mm in thickness at the periferal portions and 0.5 mm in the centre, usually with some sawdust particles glued to the upper surface (in cell No. 21 sawdust was accumulated about 3 mm in thickness above the resin partition). They are usually placed transversely across the tunnel, but sometimes aslant, sometimes two layers are observed in one cell with a very short interval in between (Fig. I, D); in the entrance tunnel several lumps of resin are placed at an interval of about 3 mm at the lowermost portion and the rest of the gallery is stuffed with sawdust.

From the larval wasps kept in the laboratory, the first female adult wasp emerged on the 22nd of the same month. This indicates that at least two generations are repeated in a year even in Hokkaido.

2. *Passaloecus roettgeni* Verhoeff, 1890

Passaloecus roettgeni Faester, Ent. Medd., XXV, p. 452, 1951; — Ribaut, Bull. Soc. ent. France, 1952, p. 26.

According to the comparison with the female specimens from Europe, the Japanese examples show the following differences in characters :

1) Pronotum very short, medianly rather linear, hardly visible from above, except the lateral angles. Its lateral portions are very feebly, rather obsoletely longitudinally striate in contranst with the strong and sharp costae in the European specimens. But the difference relating to the first point may be not of great significance, since the character is fairly variable in its allied species, *P. monilicornis*. The second point, too, is not regarded as very important. 2) Two short longitudinal furrows on mesonotum are in Europena specimens rather broad and distinctly costate, while in the Japanese specimesn much narrower and not costate. 3) Sculpture on dorsal surface of propodeum coarsely irregularly reticulate in the European representatives, but in the Japanese ones it consists of finer and square meshes, composed chiefly of close longitudinal, less strong carinae connected with the adjacent ones by weaker bars.

This species seems to live together with *P. monilicornis* in Japan. The occurrence of the species, however, is everywhere very rare. Antenna (♂) : Fig. 5. Characters other than those given in the keys are similar to those of *P. monilicornis*.

Specimens examined : 1 ♀, Honshu (Kurobe), 21. VI. 1931 (K. Takeuchi leg.); 1♀, Hokkaido (Garugawa, near Sapporo), 25. VI. 1944; 1 ♀, Honshu (Shiramine, at the foot of Mt. Haku, Ishikawa Pref.), 28. VII. 1953; 1 ♀, Honshu (Sabae), 14 V. 1955; 4 ♂♂, Hokkaido (Sapporo), 15. VI, 7. VII. 1947, 12. VII. 1949, 29. VI. 1952.

3. *Passaloecus gracilis yamato* subsp. nov.

? *Passaloecus tenuis* Yasumatsu, Mushi, VII. 2. p. 112, 1934.
? *Passaloecus gracilis* Yasumatsu, Idem, XI. 2, p. 175, 1938.

The new subspecies founded upon the specimens listed below differs from the original race — *P. gracilis* (Curtis, 1834) — in having the head more strongly and steeply narrowed backward (Figs. 8 and 10, cf. Figs. 6 and 7), with the surface more sparsely punctured and shining, and in having the humeral angles always distinctly and broadly coloured white[4]. Generally speaking, the coloration of the new race is brighter in other bodily portions also as compared with the nominate race : Mandibles and scapes in front more distinctly coloured white, tarsi of fore and middle legs in ♂ bright testaceous, those of hind legs more broadly whitish. The elevation on the upper portion of episternum of mesopleuron

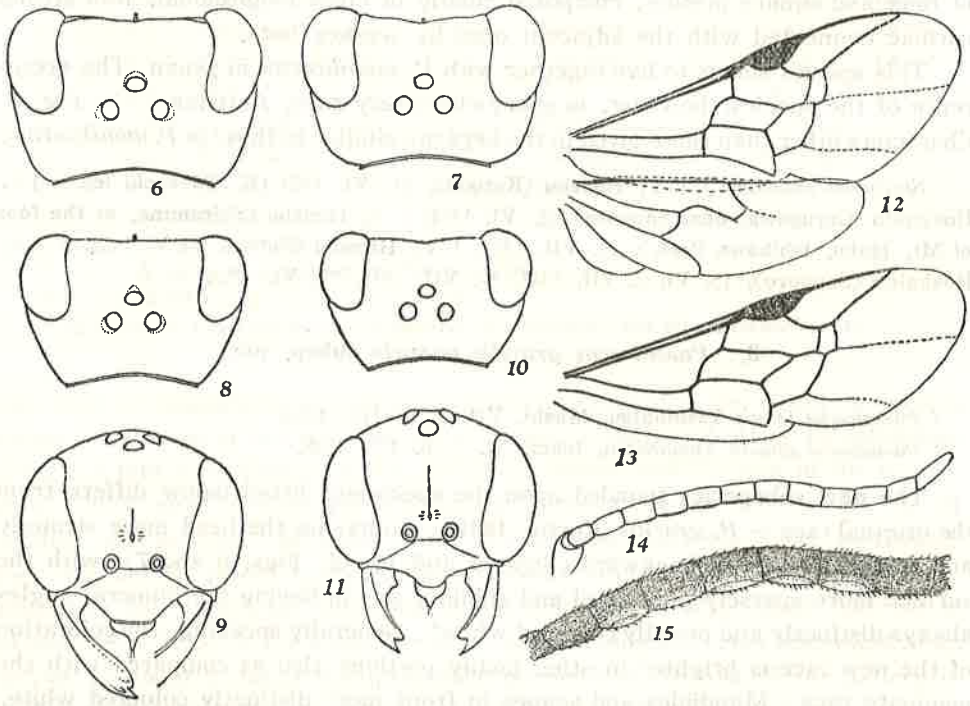
4) H. Libaut (1952) referred to the fact that somewhat similar form rarely occurs in Europe.

seems to be more striking in general, giving the lower margin of the elevation an appearance of being grooved in certain light.

Head seen in front : Figs. 9 (♀) and 11 (♂), clypeus (dittos) with surface convex (♀♂), anterior margin narrowly lamellate and slightly raised in ♀, but normal and gently roundly produced anteriorly in ♂. Antennal joints 3 (apically only) - 9 weakly carinated in ♂ (Fig. 14), carinae testaceous, thick and shining (Fig. 15). Wingvenation : Fig. 13. Length 3.5 - 4.7 mm.

The wasp of this subspecies is not rare at least in Hokkaido and in Fukui Pref. and seems to emerge twice a year.

Specimens : **Holotype : ♂, Hokkaido (Jozankei), 13. VIII. 1949.**
Allotype : ♀, Hokkaido (Nopporo), 16. VI. 1949.
Paratypes : 22 ♀♀ 6 ♂♂, Hokkaido (Sapporo, Nopporo, Ebetsu, Otaru, Jozankei, Kyogokumura near Kucchan), 24. V, 17. VI, 1 - 25. VII, 1 - 25. VIII, 2 - 29. IX, 1945 - 52; 1♀, Saghalien (Otani), 24. VIII. 1914 (Adachi et Isshiki leg. Coll. Hokkaido University); 12 ♀♀, Honshu (Utsunomiya, Sabae), 23. IX. 1940, 7. VI, 20. VII, 4. X. 1953.



Figs. 6 (♀) and 7 (♂) ..... *Passaloecus gracilis gracilis* (Curtis)
Figs. 8, 9 (♀) and 10, 11 (♂), 13 - 15 ..... *Passaloecus gracilis yamato* subsp. nov.
Fig. 12 ..... *Passaloecus abnormis* Kohl

Biology. The nesting habits of the present subspecies are similar to those of

the original race (Kennedy 1838, Goureau 1857, Giraud 1866, Verhoeff 1891, Borries 1897, Adlerz 1910). The wasp nests in the beetle burrow of dead trees or in the

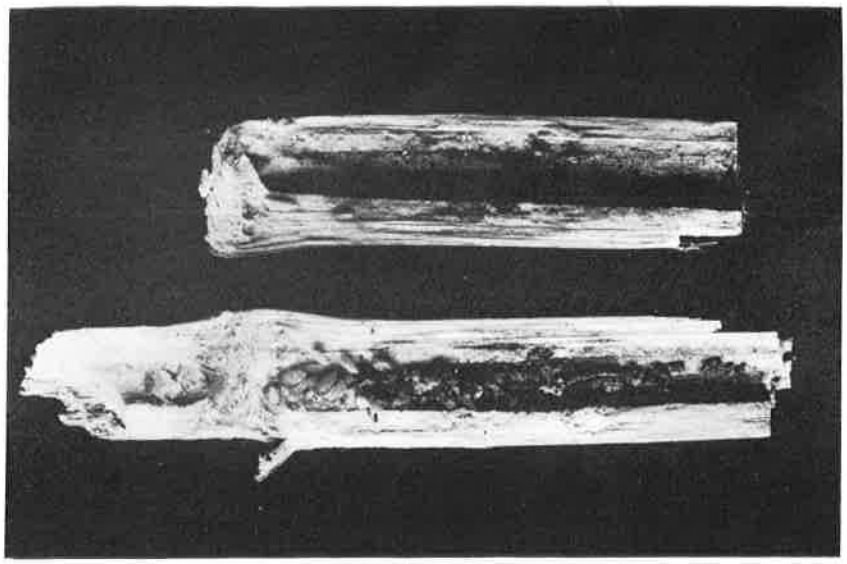


Fig. II …… A nest of *Passaloecus gracilis yamato* subsp. nov. (×2)

hollow of thatches. They seem to prefer in our country to make their brood-cells in the dead bamboo-grass, partitioning the hollow with tampons of grains of sand and small lumps of earth or of insects' cots, instead of pellets of resin. A nest observed on August 1, 1949 by the writer at Jozankei, Hokkaido was also made in the hollow of a dead bamboo-grass which still stood aslant. The wasp was carrying in the hollow from the upper opening pellet by pellet of partitioning material. After observing a while the wasp was captured and the grass was cut off and brought to his laboratory.

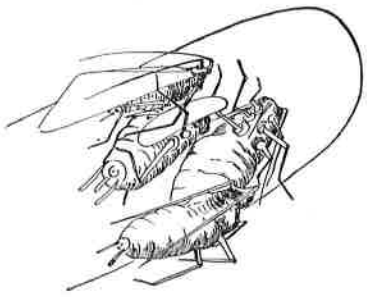


Fig. III …… Victims of *Passaloecus gracilis yamato* mihi one of which carries the wasp's egg

Upon examining it was made clear that the wasp had been closing the first cell which had just been completed. The pellets which were composed of small lumps of earth, caterpillars' cots and some grains of sand could be counted as many as 65. At the bottom, just on the septum of the outermost node was made a brood-cell which was stuffed with 29 moderate-sized green aphids, all but two being wingless form (Fig. II). On one of the victims, the 6th aphid from the interior (not the innermost one !) was found the wasp's egg. It was attached to the ventral surface of the abdomen of the victim with its anterior end, with

the posterior end directed anteriorly and freely produced in the air beyond the head (Fig. III). It was about 1 mm in length, slightly curved and posteriorly somewhat tapered. In colour it was wax-white with a faint tint of yellow. The cell was about 10 mm long and 2.7 mm wide. The contents of the brood chamber was wholly transferred into a glass tube having the same diameter as the natural cell and it was closed with slightly moistened cotton plugs at both ends. The egg hatched after about 48 hours and grew normally in the artificial cell, first chewing two or three victims and then devouring the remainder one after the other and finally spun the cocoon. It consisted of a semitransparent layer of silky substance smeared on the inner wall of the tube. The cots of the larva were found outside the cocoon as in the majority of the members of Pemphredoninae. The adult wasp was found moving in the glass tube on May 24, the next year.

4. *Passaloecus abnormis* Kohl 1888

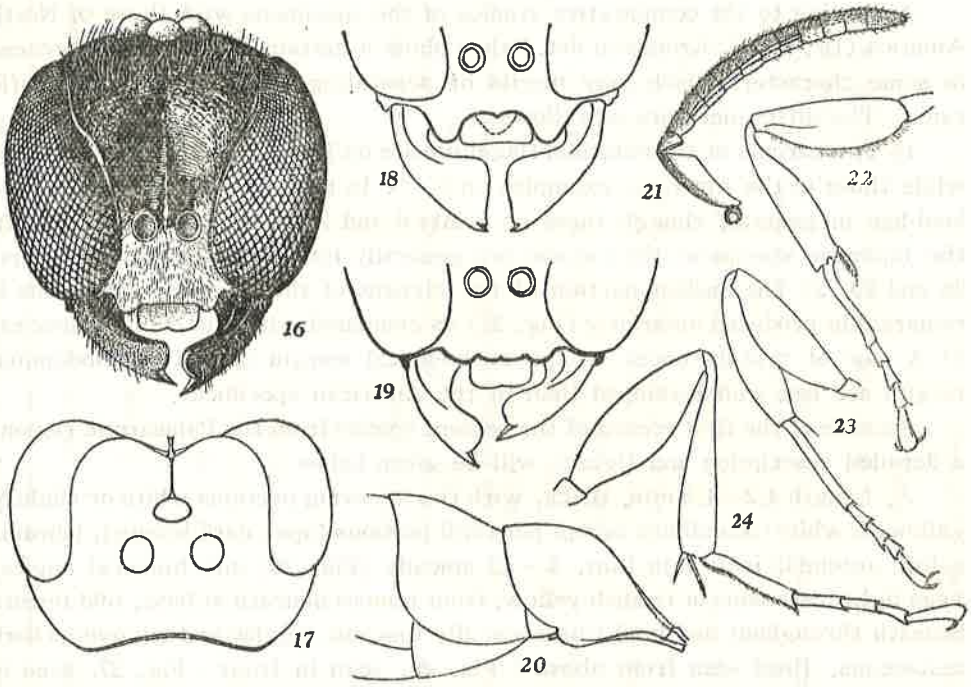
Although the specimens listed below fairly well agree in characters with the descriptions of the European specimens, lack of the comparable example makes it impossible to determine the subspecific relationship of the East-Asiatic representative. The chief characters of the specimens are as follows :

♀. Length 3.8 – 4.8 mm. Black. Scapes of antennae in front yellowish, humeral angles white, labrum transparent yellow, mandibles with apical third chesnut brown, antennal flagella dark brown, beneath testaceous turning darker toward apex; palpi, tibiae and tarsi of fore and mid legs, base and apex of all femora, base of hind femora and hind tarsi testaceous. Head seen in front remarkably long, with inner margins of eyes strongly convergent toward clypeus; clypeus, mandibles and lahrum : Fig. 18; mesonotum much more developed than in allied species, its anterior slope nearly vertical and very high, seen from above the anterior margin medianly gently roundly emarginate; propodeum on the dorsal surface medianly broadly, rather finely reticulate, but laterally obliquely, posteriorly transversely striate, posterior slope abruptly truncate and bordered on its upper edge by the transverse carina, the surface transversely, rather indistinctly rugulose, only posteriorly somewhat coarsely rugose, its upper median line deeply cxcavated; sides of the segment obliquely finely closely striate. Abdomen between the lst and 2nd segments somewhat constricted (Fig. 20). Wing venation also abnormal (Fig. 12).

♂. Length 3.8 – 4.3 mm. Similar to ♀, but scapes in front yellow and humeral angles black, sometimes posterior margin only whitish, fore femora except posterior margin and mid femora beneath testaceous. Head seen from above : Fig. 17, seen in front : Fig. 16, antenna : Fig. 21, joints 3 – 9 carinated, the carina not distinct; lubrum slightly different in form from that of ♀ (Figs. 16 and 19, cf. 18) and thicker, in colour black with periferal portions brownish;

legs : Figs. 22 (fore), 23 (mid) and 24 (hind).

Specimens examined : 1 ♀, Korea (Keijo), 19. IX. 1943; 3 ♀♀, Hokkaido (Jozankei), 13. VIII. 1947, 9. VIII. 1949; 41 ♀♀ 3 ♂♂, Honshu (Koike, Fukui Pref.) 28. VII - 19. VIII. 1954 - 55.



Figs. 16 - 24 ..... *Passaloecus abnormis* Kohl (18 ··· ♀, others ··· ♂)

Biology. The wasp of this species seems to prefer the hollow of thatches of rooves to nidificate to the abandoned burrow of beetles found on the wooden parts of houses or on rotten trees. The nesting site of this species is usually choiced in the shaded place, such as the northern side of houses or under a roof of dense foliage of trees.

5. *Passaloecus annulatus nipponicola* subsp. nov.

It was not a little surprise to the writer that he found the species, *P. annulatus* (Say, 1837) which has been known from North America only, among the specimens collected in Mid Japan, because not a single example of this species has ever been captured by him in Hokkaido, despite his enthusiastic collection during his nine years' residence in that northernmost region of Japan, or the region having the closest geographical relation to North America, where

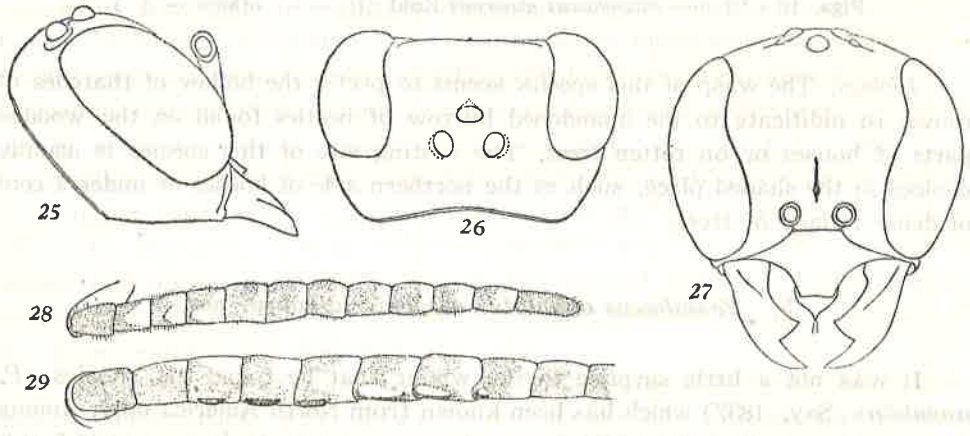
it seems most probable to find such an American faunistic factor, had it not come to Japan through the Eurasian Continent. But the fact may be ascribed to the insufficient covering of his collecting trips in both space and time. Anyhow, the discovery of this species in Japan is especially of interest and worthy of attention from the phylogenetic point of view.

According to the comparative studies of the specimens with those of North America (Dr. K. V. Krombein det.) they show a certain degree of differences in some characters which may merits of separating them at the subspecific rank. The differences are as follows :

1) The carinae of the antennal flagellum are on joints 4 – 9 in our specimens, while those in the American examples on 5 – 8. In the latter all the carinae are keel-like in general, though those on joints 6 and 7 are somewhat swollen. In the Japanese specimens the carinae are generally incrassate as shown in Figs. 28 and 29. 2) The median portion of the clypeus of the Japanese specimens is remarkably produced anteriorly (Fig. 27) as compared with the original species. 3) A pair of protuberances on the medio-apical margin of the 6th abdominal tergite are less well-developed than in the American specimens.

Because of the first record of the present species from the Palaearctic region, a detailed description and figures will be given below :

♂. Length 4.2 – 4.5 mm. Black, with the following portions white or slightly yellowish white : Mandibles except periferal portions (apex dark brown), labrum, palpi, antennal joint 1 in font, 3 – 12 apically (Fig. 28) and humeral angles. Legs light testaceous or reddish yellow; front femora beneath at base, mid femora beneath throughout and hind tibiae apically fuscous; tegulae and wingveins dark testaceous. Head seen from above : Fig. 26, seen in front : Fig. 27, seen in



Figs. 25 – 29 ····· *Passaloecus annulatus nipponicola* subsp. nov. (♂)

profile : Fig. 25; clypeus, labrum (Fig. 50) and mandibles : Fig. 27. On vertex the impression outside postocelli not sharply outlined on its outer margin, frontal

Table 2. Comparison of characters between *P. corniger corniger*, *P. c. kakusanicus* and *P. annulatus nipponicola* (♂)

Characters \ Species	*corniger corniger*	*corniger hakusanicus*	*annulatus nipponicola*
Length of body	5.2 - 5.8 mm	4.5 - 5.0 mm	4.2 - 4.5 mm
Head seen in front	Fig. 46	Fig. 45	Fig. 27
Labrum :	Fig. 48	Fig. 49	Fig. 50
Mandible	Tridentate (Fig. 46)	Tridentate (Fig. 45)	Bidentate (Fig. 27)
Clypeus	Very short (Fig. 46)	Moderate (Fig. 45)	Long (Fig. 27)
Relative distance between eyes at upper front : at base of clypeus	22 : 20	21 : 16 (!)	23 : 9
Structure of antenna	Figs. 32 and 33	Figs. 35 and 36	Figs. 28 and 29
Colour of antenna	Black or dark brown	Above yellowish brown, beneath yellow	Black with whitish ring on each joint
Mesonotal furrows*	Strong and crenate	Less strong, obsoletey crenate	Fine, weak, obsoletely crenate
Mesopleural furrows	Upper one distinct, crenate, shorter than lower one	Upper one less strong, almost without costae, longer than lower one	Upper furrow very short, almost none. Lower one distinct, crenate
Sculpture on dorsal aspect of propodeum	Fine and strong reticulation	Finer and strong reticulation, laterally finest, closest oblipue striae	Less strong moderate sized reticulation, laterally weak rough oblique striae
Sculpture on posterior aspect of propodeum	Strong and coarse rugosity	Weak and very close rugosity	Without distinct rugosity
Colour of legs	Base and apex of femora, tibiae and tarsi of all lege testaceous	All the legs wholly testaceous except coxae	Coxae and posterior margin of front and mid legs black, rest testaceous
Venation of forewing	Similar to that of ♀ (Fig. 39)	Similar to that of ♀ (Fig. 42)	Similar to Fig. 42.
Venation of hindwing	Similar to Fig. 42.	Idem	Idem

* Two longitudinal furrows on the anterior portion of pronotum.

median groove indistinct, facial process above sockets of antennae very slight; sides of lower front, area between sockets of antennae and clypeus densely covered with appressed silvery hairs. Antenna : Figs. 28 and 29, joints 4 - 9 posteriorly carinated, carina on joints 7 and 8 very incrassate, on 9 similar but very small. Pronotum very short, anterior margin in middle carinated, sometimes the carina completely attached to the anterior surface of mesonotum, the latter with two anterior longitudinal furrows shallow and not crenate, its posterior margin imcompletely costate. On mesopleuron epicnemial area in front of the vertical furrow not particularly modified, only very faintly marginated on its posterior border (defined in certain light only), upper longitudinal furrow vestigial, at the most it is shortly defined on anterior portion alone, sometimes it appears merely a slight elongation of one of the punctures in the vertical furrow; lower longitudinal crenate furrow strong, abruptly terminated near middle of its supposed whole length. Propodeum with dorsal surface medianly finely reticulate, the net work composed chiefly of longitudinal striae; laterally obliquely, more remotely and posteriorly very faintly striate; posterior surface rather flattened, sometimes bordered on upper margin by a keel-like transverse striae, the surface very weakly transversely imcompletely rugulose, with distinct median longitudinal furrow on upper portion. The sides of the segment obliquely, rather obsoletely striate. Abdomen somewhat constricted between lst and 2nd segments; the hollow at the base of 2nd sternite rather deep, laterally outlined but posteriorly open, attaining only before middle of the segment, slight tubercles on latero-posterior portions of the sternite are rather well-defined. Metatarsi of mid legs seen from behind slightly sinuate and gradually incrassate toward apex, hind legs with tarsal joints 1 and 2 somewhat incrassate and the former somewhat sinuate; relative lengths between hind tibia, tarsal joints 1 and 2 are 27 : 15 : 7.5. In forewing 2nd cubital cell in form similar to Fig. 41, but 2nd recurrent nervure received by the 2nt cubital cell beyond middle of the cell; venation of hindwing similar to Fig. 42. Chief characters of this species was shown, with those of near relatives, in Table 2.

♀. Unknown, but judging from the characters of the original species it is supposed to be similar to *roettgeni* in the general structure of the body as well as in the coloration of the labrum, but it will have the legs nearly entirely adorned with bright testaceous.

Holotype : ♂, **Koike, Fukui Pref.** (about 1000 m high), 31. VII. 1954.

Paratypes : 2 ♂♂, **Mitsudani, near Koike,** 2 - 3. VIII. 1954; 2 ♂♂, **Koike,** 4 - 5. VIII. 1954.

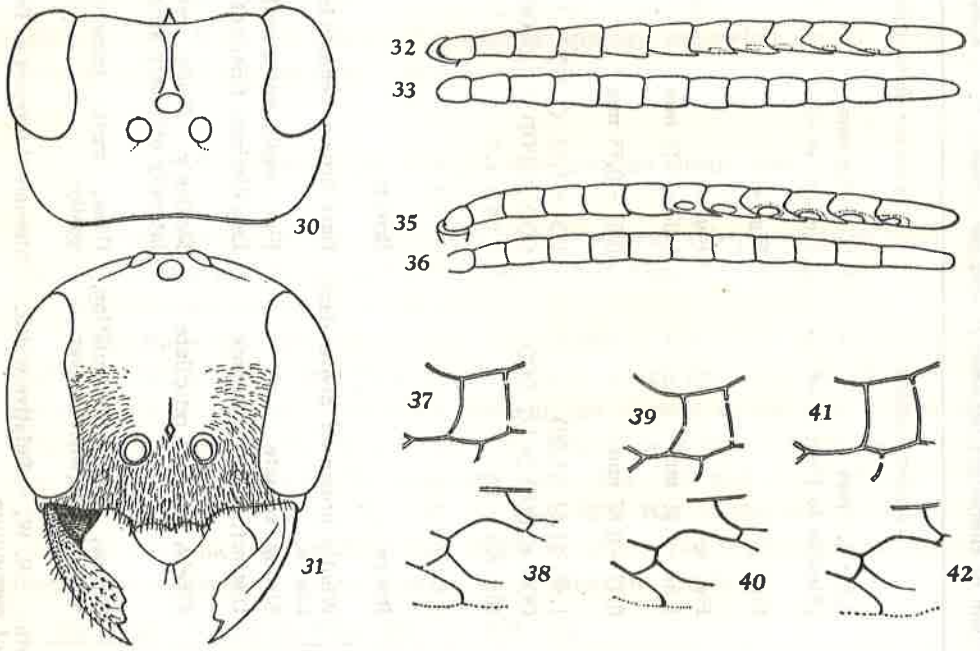
Remarks. The specimens were collected on the wooden wall of a cottage which was situated among the scattered trees of *Cryptomeria japonica* D. Don.

6. *Passaloecus dubius* sp. nov.

This species is so closely allied to *P. corniger corniger* Shuckard (♀) and *P. corniger hakusanicus* subsp. nov. that the differences between them are given in detail in Table 3 in order to facilitate the identification.

The form of the head : Figs. 30 and 31. The 2nd cubital cell of fore-wing : Fig. 37, the cubitus of hindwing : Fig. 38. Other characters in Table 3.

There is some doubt that the present species may be the true female of *P. corniger hakusanicus* subsp. nov. and that the specimens referred to the female of this subspecies may represent quite another species. Because these forms live side by side in nature, and moreover, there is no conclusive evidence as to the sexual combination of *P. c. hakusanicus* of which no question can be raised as



Figs. 30, 31, 37 and 38 ····· *Passaloecus dubius* sp. nov.
Figs. 32, 33 (♂), 39 and 40 ····· (♀) *Passaloecus corniger corniger* Shuckard
Figs. 35, 36 (♂), 41 and 42 ····· (♀) *Passaloecus corniger hakusanicus* subsp. nov.

regards the taxonomic position of the male. However. *dubius* was placed out of the sexual combination of *P. c. hakusanicus* according to some morphological distinctions. Detailed explanation will be given in connection with this subspecies.

It must be mentioned further why the present species was allocated as a different species from the form referred to *P. c. hakusanicus* ♀. The reason is that, although the differences of characters listed in Table 3 are by no means

Table 3. Comparison of characters between *P. corniger corniger*, *P. c. hakusanicus* and *P. dubius* (♀)

Characters \ Species	*corniger corniger*	*corniger hakusanicus*	*dubius*
Length of body	4.8 - 6.2 mm	5.0 - 5.8 mm	5.5 - 7.4 mm
Head seen from above and in front	(Similar to Figs. 43 et 44)	Figs. 43 et 44	Figs. 30 et 31
The 2nd cubital cell of fore-wing	Fig. 39	Fig. 41	Fig. 37
Cubital nervure of hindwing	Fig. 40	Fig. 42	Fig. 38
Width of head seen from above (W)	1.07 - 1.31 mm	1.03 - 1.19 mm	1.24 - 1.53 mm
Length of head seen from above (L)	0.72 - 0.87 mm	0.67 - 0.75 mm	0.78 - 0.87 mm
L : W (average)	1.49 - 1.51 (1.50)	1.54 - 1.59 (1.57)	1.59 - 1.76 (1.68)
OOD : POD : OCD	OOD < POD > 1/2 OCD	OOD > POD ≒ 1/2 OCD	OOD > POD ≒ 1/2 OCD
R. L.* of antennal joints 2 : 3 : 4	10 : 8.5 : 8.5	8 : 6 : 6.2	10 : 9 : 9
R. W.* of antennal joints 2 : 3 : 4	7.5 : 7 : 7.5	6 : 5 : 5	8 : 7 : 7
Colour of mandible and labrum	Brown	Brown	Black, apex brown
Colour of antenna	Wholly brown or above dark brown	Dark brown, beneath brownish	Above black, beneath apically brownish
Mesonotal furrows*	Strong, crenate	Fine, weak, not crenate	Very strong, crenate
Upper longitudinal furrow on mesopleuron	Distinct, strongly crenate	Less distinct, fine, not crenate	Deep, very distinct, strongly crenate
Sculpture on dorsal aspect of propodeum	Finely, strongly reticulate	Medianly finely reticulate, laterally obliquely striate	Finely or roughly reticulate, often anterior lateral portions more roughly obliquely striate
Sculpture on posterior aspect of propodeum	Strong, coarse reticulation, upward somewhat weaker	Close, weak, transverse rugosity	Strong, coarse reticulation, sometimes upward transversely rugose

* R. L. ··· Relative length. R. W. ··· Relative width. Mesonotal furrows ··· Two short longitudinal furrows on the anterior portion of mesonotum.

large, yet they are so stable in each form that both the forms can easily be distinguished without any intermediate states by the aid of such characters, and furthermore, they occur in the same natural habitat, indicating that they must be sexually isolated by some means or other.

♂. Unknown.

Holotype : ♀, Mitsudani, near Koike, Ishikawa Pref. (at the foot of Mt. Haku), 3. VIII. 1954.

Paratypes : 64 ♀♀, Koike, Ichinose and Mitsudani (all at the foot of Mt. Haku), 28. VII. - 5. VIII. 1954 - 55.

Biology. This species, so far as has been observed, to make the nest in the small beetle burrow opened on the wooden posts and beams of houses, partitioning the tunnel with resin of coniferous trees. The wasps emerge once a year in mid summer with the second generation of *P. monilicornis* Dhlb. and live in the same habitats with them. However, this species appears somewhat earlier than the progeny of the early summer wasps of *monilicornis*.

7. *Passaloecus corniger hakusanicus* subsp. nov.

The differences of the characters of the present subspecies from those of the typical race are shown in Tables 2 and 3 and Figs. 32 - 38 and 43 - 49. The chief differences are given in the keys.

In the male the difference is most remarkable in the colour of the antennae and legs, and in the frontal view of the head in which the inner margins of the eyes are more strongly convergent toward the clypeus in the new subspecies (Fig. 45, cf. Fig. 46). In the antennae the flagellum is not so narrowed toward the apex (Fig. 36) as in the nominate race (Fig. 33) and the status of the carinae is also dissimilar (Fig. 35, cf. Fig. 32). But in the structure of the genitalia no note-worthy difference could be discovered between them. In the female the difference is less striking as is given in Table 3.

Holotype : ♂, Koike, Fukui Pref., 31. VII. 1954.

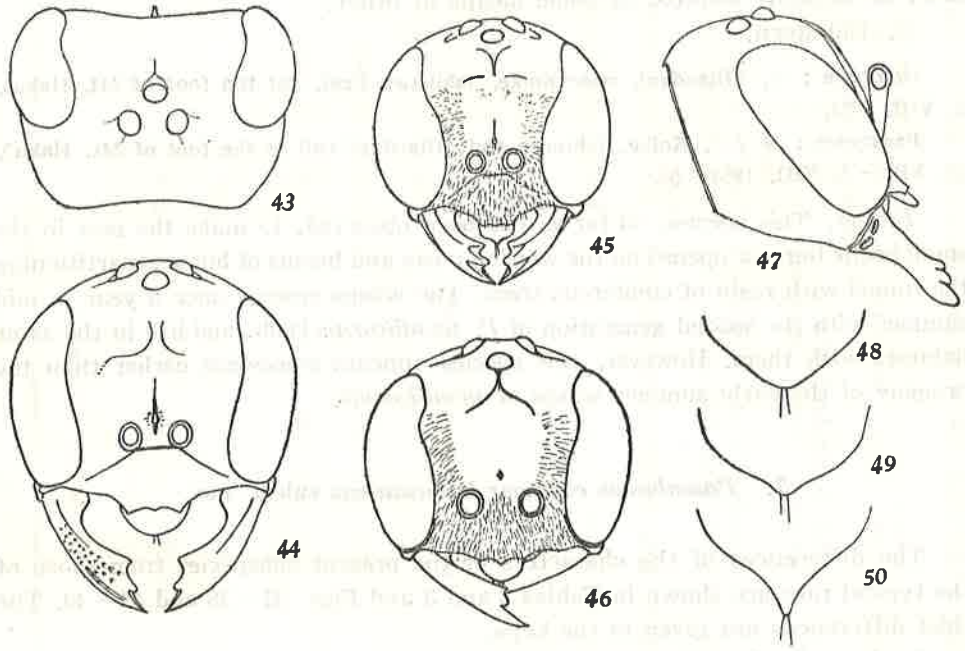
Allotype : ♀. Mitsudani, Ishikawa Pref., 3. VIII. 1954.

Paratypes : 6 ♂♂ 37 ♀♀, Koike; 1 ♂ 4 ♀♀, Mitsudani; 28. VII. - 5. VIII. 1954 - 55.

Remarks. There is some doubt as to the correct combination of sexes in this subspecies, because in the natural habitats of this race occurs also the female of *P. dubius* sp. nov. which has the closest affinity with the present subspecies (♀) and the male of which remains still unknown. According to the comparative studies between the forms in question, the specimens dealt with here as the female of *P. c. hakusanicus* have closer resemblance in the form of the head and of the mandible and in the general coloration toward *P. corniger s. str.* than the specimens named *P. dubius*. Moreover, in the structure of the mesopleural

* R. L. ... Relative length. R. W. ... Relative width. Mesonotal furrows ... Two short longitudinal furrows on the anterior portion of mesonotum.

crenate furrows and of the mandible and in some characters of the forewing venation[5] the specimen referred to the female of the present subspecies is



Figs. 43, 44, 47 (♀), 45 and 49 (♂) ..... *Passaloecus corniger hakusanicus* subsp. nov.
Figs. 46 and 48 ..... *Passaloecus corniger corniger* (♂)
Fig. 50 ..... *Passaloecus annulatus nipponicola* subsp. nov. (♂)

closer to the male of *P. corniger hakusanicus*, the holotype of this subspecies. On the basis of such characters the sexual combination of the present subspecies has, rather provisionally, been determined.

Biology. The period of activity, the nesting site and other general habits of this subspecies are much the same as in *P. dubius* m.

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5) In *P. c. hakusanicus* (♂) the 2nd recurrent nervure of the forewing is received by the 2nd cubital cell always somewhat before the middle of its lower nervure. The specimens which are treated here as the female of this race have the same venation. While, in *dubius* (♀) it is received in or beyond the middle of the lower nervure of the 2nd cubital cell.

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