

Studies on the Japanese Trechiniæ (VI)
(Coleoptera, Harpalidae)¹⁾

By

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In the preceding part of this series, the writer began to set up a revisional monograph of cave-dwelling trechids of the Island of Shikoku and the Kii Peninsula.²⁾ Since that time, many caves have been explored, and total fifty-nine limestone caves in the Island of Shikoku have been examined by biospeologists. Of these, eight are found in Tokushima Prefecture, thirty-five in Kôchi Pref. and sixteen in Ehimé Pref., and in nineteen caves of them, cave-dwelling trechids have been found (*cf.* Fig. 1). The writer himself has surveyed forty-six out of these fifty-nine caves, including all nineteen, from where cavernicolous trechids have been known. This paper is the second and final part of the monograph of the cavernicolous trechids of Shikoku.

The writer wishes to express his hearty thanks to Prof. Kenji NAKAMURA of Kyoto University for his continuous encouragement, to Prof. Teiso ESAKI of Kyushu University for the loan of Mr. HABU's type-specimen, and to Prof. René JEANNEL of the Muséum national d'Histoire naturelle of Paris for his kind advice. His hearty thanks are also due to the following colleagues and friends for their kind assistance rendered at field works: Chikaichi ABE, Sadanari HISAMATSU, Jûjirô ISHIKAWA, Tetsuo KAWASAWA, Naomasa KOBAYASHI, Mutsuo MIYATAKE, Kuniyasu MORIKAWA, Katsura MORIMOTO, Shigeo TANAKA, Masazi UOZUMI and Hiroshi YAMAUTI.

Trechiana (Pseudotrechiana) chikaichii S. UÉNO, sp. nov.

(Figs. 2-3)

Length: 6.0-6.6 mm (from front margin of clypeus to anal end).

Apterous and depigmented; body surface glabrous. Colour reddish brown to dark reddish brown, shiny, translucent when alive, though sometimes weakly iridescent according to individuals; palpi pale, antennae becoming paler towards apices; legs and sternites more or less paler than the body.

1) Contribution No. 5 from the Spelaeological Society of Japan.

2) UÉNO, 1955 c.

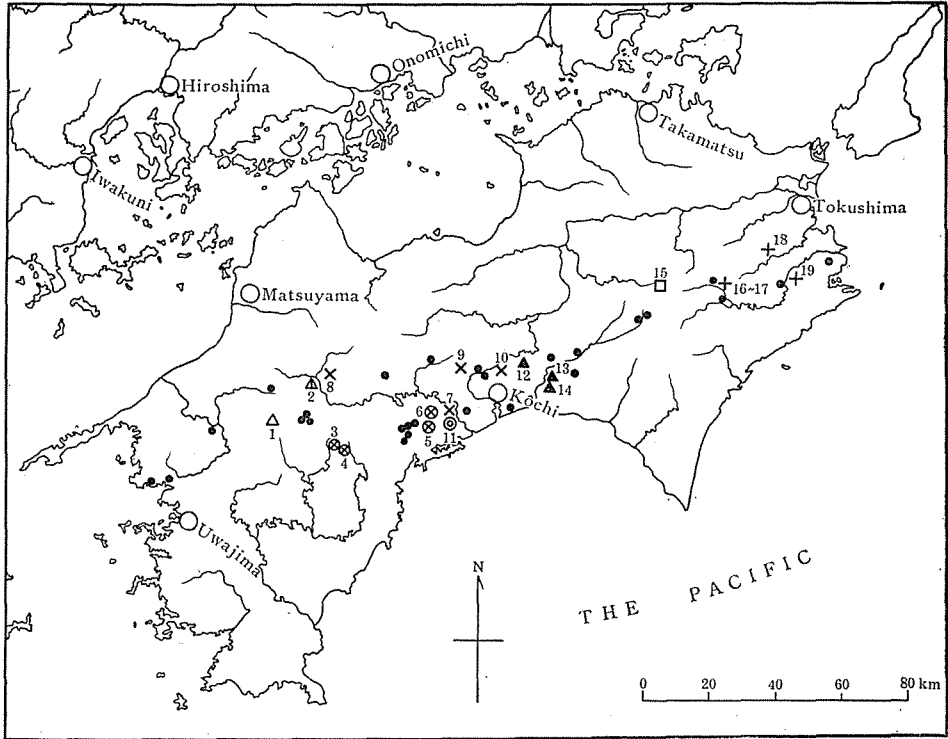


Fig. 1. Map showing the distribution of cavernicolous trechids in the Island of Shikoku; black spots indicating the location of the investigated limestone caves, where no trechid has been found.—1. Rakan-ana Cave (*Rakantrechus* (s. str.) *kawasawai* S. UENO).—2. Kuroiwa-dô Cave (*R. (Yamautidius) pubicollis* sp. nov.).—3. Furumiya-dô Cave (*Ishikawatrechus* (s. str.) *cerberus* sp. nov.).—4. Inaba-dô Cave (*I. (s. str.) cerberus* sp. nov.).—5. Saruta-dô Cave (*I. (s. str.) nipponicus* HABU).—6. Ishida-dô Cave (*I. (s. str.) humeralis* sp. nov.).—7. Ohchi-dô Cave (*I. (Nipponotrechus) intermedius* sp. nov.).—8. Anagami-dô Cave (*I. (N.) subtilis* sp. nov.).—9. Shiroya-dô Cave (*I. (N.) uozumii* (S. UENO)).—10. Shôbu-dô Cave (*I. (N.) ishikawai* (S. UENO) and *Ryugadous* sp.).—11. Narukawa-no-Shimizu-dô Cave (*Yua-dorgus uozumii* S. UENO).—12. Wakamiya-dô Cave (*Ryugadous ciliatus* S. UENO).—13. Ryûga-dô Cave (*R. ishikawai* HABU).—14. Mizuidé-dô Cave (*R. sp.*).—15. Fudô-no-iwaya Cave (*Trechiana (Pseudotrechiana) chikaichii* sp. nov.).—16~17. Tôgen-daiichi-dô Cave and Tôgen-daisan-dô Cave (*Awatrechus pilosus* sp. nov.).—18. Zenjô-kutsu Cave (*A. religiosus* sp. nov.).—19. Ryû-no-iwaya Cave (*A. hygrobis* S. UENO).

Head quadrate, rather flat on dorsal side though both supraorbital areas and front moderately convex; frontal furrows deep throughout, not angulate at middle and not strongly divergent in front; microsculpture not deeply impressed, composed of fine reticulation; eyes not faceted, their position discernible only by a fold present on each side just behind the insertion of antenna; genae slightly convex and

glabrous; mandibles slender, slightly hooked at apices; mentum tooth stout, narrowly truncated or emarginate at the tip according to individuals; ligula wide, not strongly rounded at apex; palpi slender; antennae slender but not very long, nearly reaching the middle of elytra.

Pronotum cordate and convex, 1.5 times wider than head, about as wide as or a little wider than long, widest at about two-thirds from base; lateral sides narrowly bordered and reflexed, widely and moderately rounded in front, deeply sinuate at one-fourth to one-fifth from base; there are both lateral and postangular setae, of which the former is placed at the widest part and the latter removed some distance before hind angle; apex nearly straight or slightly emarginate, a little narrower than base, which is nearly straight; front angles slightly advanced and widely rounded, hind angles more or less sharp but not very acute, projecting slightly backwards and a little more outwards; median line deep, almost reaching apex and widening near base; apical transverse impression slight; basal transverse impression wide and shallow, provided with a longitudinal fovea on each side of median line, and merging on each side into basal fovea, which is large, fairly deep and somewhat extending anteriorly; postangular carina very obtuse; surface smooth, partly with vague transverse striations; microsculpture formed by fine transverse lines.

Elytra oblong-oval and convex, 1.65-1.75 times wider than pronotum, 1.55-1.6 times longer than wide, widest at about middle; shoulders effaced, prehumeral borders very oblique; lateral sides rather widely explanate and reflexed, gently rounded at middle and very slightly emarginate before apices, which are rounded; striae moderately impressed and faintly crenulate, inner striae more or less deepening near base, outer striae evidently shallower than

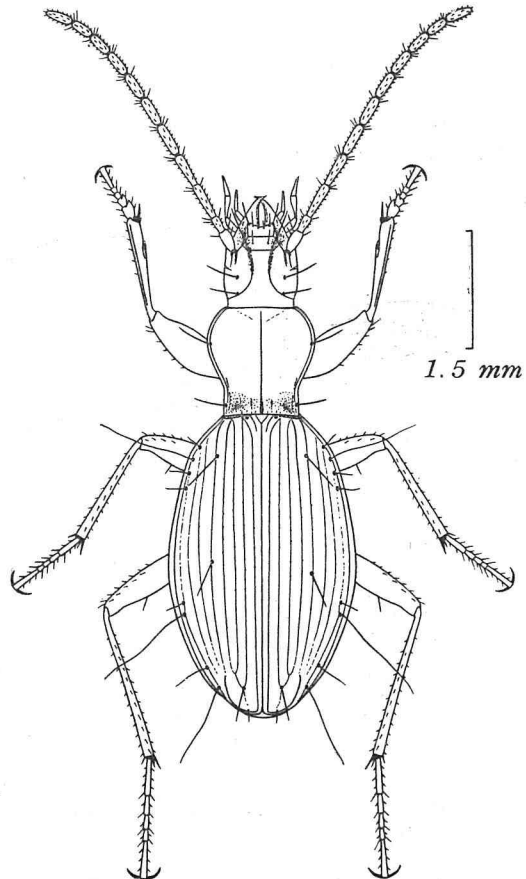


Fig. 2. *Trechiana* (*Pseudotrechiana*) *chikaichii* sp. nov., ♂, of Ryōtsurugidani on Mt. Tsurugi.

inner ones; scutellar striole short, though distinct; apical striole deep, curved and joining or almost joining stria 5; apical carina prominent; intervals flat and smooth, interval 5 somewhat raised near base; stria 3 without dorsal pores, preapical pore placed on the meeting point of striae 2 and 3 and rather close to apex, stria 5 with two setiferous dorsal pores located at one-seventh to one-sixth from base and usually a little behind middle respectively (the position of posterior dorsal pore variable to some extent according to individuals); microsculpture composed of fine transverse lines though rather indistinct.

Ventral surface glabrous; anal sternite with one seta on each side in ♂, two in ♀. Legs long and fairly slender; protibiae deeply grooved on the external face.

Male genital organ well chitinized. Aedeagus robust, large and wide, tapering towards apex, which is prolonged and dorsally denticulate at the tip in profile; basal part very large and strongly bent towards ventral side, with a sagittal aileron very small and narrow; basal orifice large, with lateral sides deeply emarginate; ventral side nearly straight at middle and gently concave before apex; in dorsal aspect, apical lamella curving to left side, moderately long and fairly wide even near apex. Inner sac armed with a well developed copulatory piece and two groups

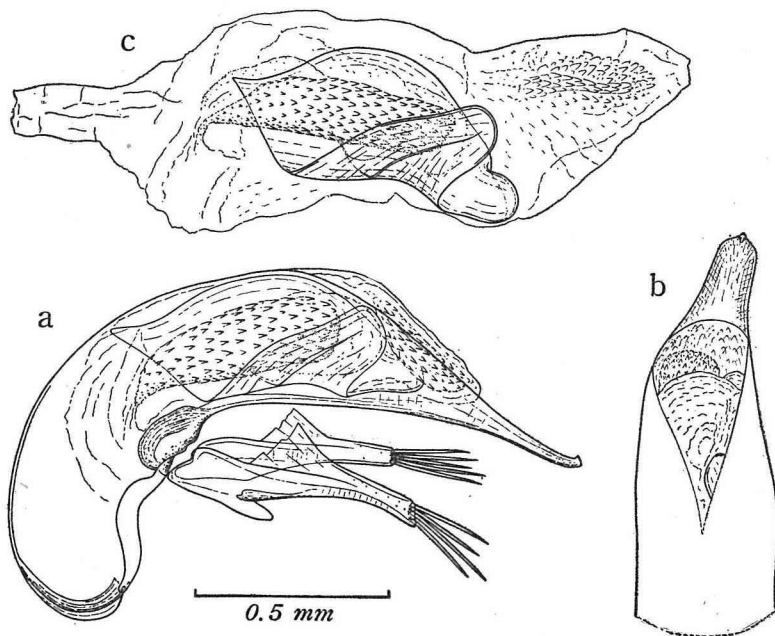


Fig. 3. Male genital organ of *Trechiana chikaichii* sp. nov., of Ryōtsurugidani on Mt. Tsurugi; left lateral view (a); apical part of aedeagus, dorsal aspect (b); and, inner sac, showing copulatory piece and two groups of teeth (c).

of teeth; copulatory piece remarkably large, moderately rolled and placed at the right side inside the sac, with dorsal side semicircularly rounded; ventral margin of the piece produced into a wide lamella, which extends along the aedeagal wall from the ventral to the left dorsal sides; apical part of the piece somewhat twisted and produced, with the apical margin regularly rounded; a cylinder composed of a group of teeth being enfolded in the longitudinal concavity of copulatory piece, the other group of teeth placed near apical orifice at the right dorsal side inside the sac. Styles rather narrow, left style obviously longer than right style; in the holotype, four apical setae present on left style and five apical setae on right one, while, in the paratype, five apical setae present on left style and four apical setae on right one.

Holotype: ♂, allotype: ♀ (Ryōtsurugi-dani, 3-VI-1957, collected by S. UÉNO). Paratypes: 1♂ (Ryōtsurugi-dani, 3-VI-1957, by S. HISAMATSU); 1♀ (Ryōtsurugi-dani, 3-VI-1957, by M. MIYATAKE); 1♀ (Fudō-no-iwaya Cave, 3-VI-1957, by S. UÉNO).

One of the paratypes (collected by MIYATAKE) is deposited in the collection of the Entomological Laboratory of Ehime University, Matsuyama. All the other type-specimens are preserved in the writer's collection.

Type-locality: Mt. Tsurugi, Ryōtsurugi-dani (1,700-1,750 m in altitude) and a limestone cave called "Fudō-no-iwaya" (1,800 m above sea level), Tokushima Pref., on the central massif of the Island of Shikoku.

The present new species may be distinguishable from the other four species of the subgenus *Pseudotrechiana* chiefly by the large size of body, the shape of elytra which is oblong-oval and with very oblique prehumeral borders, and the peculiar form of copulatory piece. It also differs in general appearance from those of the other species of *Pseudotrechiana*, and resembles that of *Ishikawatrechus nipponicus*. This resemblance is, however, superficial, and there remains hardly any doubt on the taxonomic position of the new species.

Among the subgenus *Pseudotrechiana*, the present species may form a special group, which may be placed between the group of *Trechiana habei*~*T. imadatei* and that of *Trechiana oni*~*T. kosugei*. *T. chikaichii* is similar in several important features to those of the typical group of the subgenus, i. e., the structure of mentum tooth and the presence of a well developed copulatory piece inside the aedeagal inner sac are common to *T. chikaichii*, *T. habei* and *T. imadatei*. While, the shape of its aedeagus resembles that of *T. oni*, its body form differs from those of both the groups of *T. habei* and *T. oni* as mentioned above, and the elytral striae are intermediate between the two groups. The writer is, however, of the opinion at present that *T. chikaichii* is more closely related to the group of *T. habei* than to the group of *T. oni*, which may have been separated from the group of *T. habei* and of *T. chikaichii* probably since Miocene.

The discovery of a species belonging to the genus *Trechiana* was unexpected in the Island of Shikoku, for the genus had been considered not to be distributed over Shikoku and Kyushu. Its finding let the writer suppose that the ancestral forms of the groups of *T. habei* and *T. chikaichii* might spread over the eastern part of

the ancient Kuma-Kii mountain range, and that the ancestor of the group of *T. oni* might settle the ancient peninsula of Eastern Chûgoku. Later, according to the subsidence of Kii Channel, the ancestor of *T. chikaichii* might have been isolated from those of *T. habeii* and its allies. Besides, these *Pseudotrechiama*-species may have been adapted to endogean habitats and may become cavernicolous in rather recent times. This presumption partly comes from that *T. chikaichii* inhabits the endogean habitats in high altitudes and is not found at lower mountains. Some other evidence for this presumption will be discussed in another paper.

Mt. Tsurugi is 1,955 m above the sea and is of the second height in the Island of Shikoku. There are large outcrops of limestone on the north-eastern slope at higher elevations. On one of those, lying near the summit of the peak at an altitude of about 1,800 m, there open the mouth of Fudô-no-iwaya Cave. This cave is, though small, situated at the highest altitude among the limestone caves of Japan. Its entrance is vertical and a subterranean torrent runs through the bottom. Cavernicolous animals are extremely scarce in this, where no troglobiont appears to inhabit. Of ten species of animals obtained there, three (a diplopod, a grylloblattid and the trechid) seems to be troglophilous and the other seven may be troglonexous. Only a single individual of the new trechid was found under leaf litter, which fell in the cave and heaped just below the shaft of the entrance.

The trechid was found also in a valley called "Ryôtsurugi-dani" 50-100 m below Fudô-no-iwaya Cave. The water of the subterranean torrent which runs through the bottom of the cave seems probably to flow out into this valley in the beech forest zone. The beetle was found under large stones buried in the soil, being associated with *Pterostichus*-species and a salamander, *Hynobius naevius*.

Genus *Rakantrechus* S. UÉNO.

Rakantrechus S. UÉNO, 1951, Ent. Rev. Japan, Osaka, 5, p. 88; type-species: *Rakantrechus kawasawai* S. UÉNO, 1951; 1953, Shin Konchû, Tokyo, 6 (11), p. 44.—JEANNEL, 1953, Notes Biospéol., 8, p. 128.

Subgen. *Yamautidius* S. UÉNO, nov.; type-species: *Rakantrechus pubicollis* S. UÉNO, sp. nov.

This genus was established by the present writer in 1951 based upon a single type-species. At that time, he did not know the presence of many kinds of cave-dwelling trechids in Japan, and he had no acquaintance even with *Ishikawatrechus*, to which *Rakantrechus* was related. Moreover, in his original description of *Ishikawatrechus*, HABU gave no details with regards the chaetotaxy and male characters. Consequently, the original description of *Rakantrechus*, which was prepared under these circumstances, was not sufficient to recognize the genus. Judging from such descriptions, JEANNEL concluded in 1953 that both *Ishikawatrechus* and *Rakantrechus* were certainly synonymous with his genus *Trechiana*.

Rakantrechus is, however, different from *Trechiana* in many respects. The humeral group of the marginal series of umbilicate pores is not aggregated but represents a primitive status; the hind angles of pronotum are nearly rectangular

and never salient outwards or backwards; the copulatory piece is well developed and placed at the ventral position inside the inner sac³⁾. It is also distinguished from *Ishikawatrechus* by the structure of the pronotal hind angles, the arrangement of the umbilicate series on elytra and the structure of male genital organ. Moreover, the number of species belonging to *Rakantrechus* has rapidly increased as the results of recent explorations, and the genus may be divided into several subgenera. A complete redescription of the genus (in a new sense) should be required. However, it is not the writer's intention to set up a monograph of 'new' *Rakantrechus* in this paper, the aim of which is to make clear the cave-trechid fauna of the Island of Shikoku. Therefore, only a diagnosis of the representatives of Shikoku will be given here, full account leaving in future.

Body small in size; apterous and depigmented; head and elytra glabrous on dorsal surface; pronotum glabrous in *R. kawasawai*, sparsely pubescent in *R. pubicollis*; colour pale reddish brown or yellowish brown.

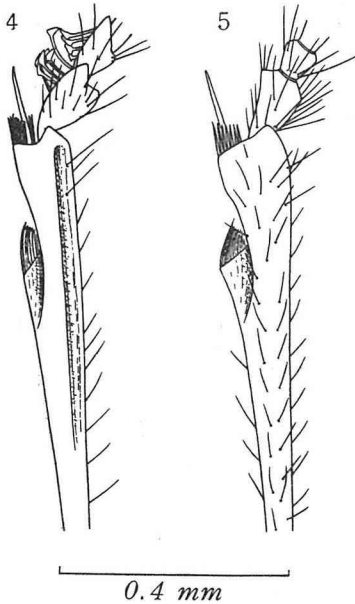
Head large, with deep entire frontal furrows which are not angulate and fairly distant from one another; eyes vanished, the positions of them presumable on each side only by a plica existing behind the insertion of antenna; genae convex and pubescent; two supraorbital pores present; mentum not fused with submentum in *R. kawasawai*, partly fused in *R. pubicollis*; mentum tooth stout and distinctly emarginate at the tip; submentum with three setae on each side. Palpi relatively stout; apical segments tumid at the basal half and subacuminate towards apices; penultimate segments dilated towards apices, shorter than apical segment and asetose in maxillary palpus, about as long as apical one and inwardly bisetose in labial palpus. Antennae filiform and fairly stout.

Pronotum cordate and convex, strongly contracted behind; lateral sides narrowly but entirely bordered, distinctly sinuate before hind angles; there are both lateral and postangular setae, of which the latter is removed forwards; hind angles nearly rectangular, not projecting backwards and without postangular carina; median line distinct, not reaching apex. Propleura expanding outwards together with prepisterna and visible from above⁴⁾.

Elytra fused together (at least partly), oval and without basal depression; shoulders rounded; lateral sides rather narrowly explanate and reflexed; striae vestigial though visible on the disk, scutellar striole present but slight, apical striole deep, curved and suddenly interrupted at the end, though apparently directed to the site of stria 5; intervals smooth and flat; apical carina more or less prominent, close to the marginal border; stria 3 with two setiferous dorsal pores before middle, stria 5 with one setiferous dorsal pore behind middle, preapical pore located on the

3) The copulatory pieces are not developed in two undescribed subgenera from Kyushu and the Chūgoku district.

4) This expansion of the ventro-lateral sides of prothorax is hardly visible in the original figure of *R. kawasawai*, and is not mentioned in its original description.



Figs. 4-5. Right protibia of the genus *Rakantrechus* S. UENO; anterior face, somewhat oblique. —4. *R.* (s. str.) *kawasawai* S. UENO, ♂, of Rakan-ana Cave. —5. *R.* (*Yamautidius*) *pubicollis* sp. nov., ♀, of Kuroiwa-dô Cave.

meeting point of the trace of striae 2 and 3. Humeral group of umbilicate pores irregular and not aggregated; the first pore removed backwards, not adjoining marginal gutter and located close to the second pore though still in front of the level of the latter; the second, third and fourth pores ranged nearly equidistantly, but the distances between them wider than usual, the third and fourth pores distant from marginal gutter.

Ventral surface glabrous; sternites 3-5, each provided with a few hairs on the median part along the hind margin; anal sternite with one seta in ♂, two in ♀ on each side. Legs slender; protibiae externally grooved and glabrous even at the apical part in *Rakantrechus* (s. str.), not externally grooved and entirely pubescent in *Yamautidius*; tarsal segment 4 with a long ventral apophysis; protarsal segments 1 and 2 dilated, inwardly produced at apices and furnished beneath with sexual adhesive appendages in ♂.

In *R. kawasawai*, male genital organ small. Aedeagus short and slightly arcuate; basal part large and without sagittal aileron; basal orifice small. Inner sac armed with a well developed copulatory piece and covered on the left wall with a patch composed of large teeth; the copulatory piece placed at the ventral position inside the

sac and not bifid. Styles fairly slender; left style longer than right one and provided with four apical setae, while right style provided with only three apical setae.

This genus is conspicuous in having the first umbilicate pore of the marginal series in the primitive status. In Japanese trechids, the same character has been known only in the subgenus *Suzuka* of *Ishidatrechus*⁵⁾, though it is commonly found among the troglobiontic genera of European trechids. Another peculiarity is found in the position of copulatory piece as shown by *R. kawasawai*. In the Japanese species, however, the development and position of copulatory piece seem to be of secondary importance, because the differentiation of the piece seems not yet to be settled to some solid direction in these archaic species. The structure of the inner sac may be useful in discriminating genera or subgenera of Japanese trechids, but should not be used for a higher rank. In the combination of characteristics, *Rakan-*

5) Cf. UENO, 1956, pp. 71, 72, 77

trechus may be derived from a *Trechiana*-like ancestor. The Shikoku species of the genus are, on the other hand, ones of the most evolved forms among the cavernicolous trechids of Japan. They have probably been preserved in the central massif of Shikoku at least since Miocene.

The new species *R. pubicollis* which has striking characters resembles *R. kawasawai* in its appearance. They are of similar size, of the same disposition of depigmentation and the constriction of pronotum, and of the same type of chaetotaxy. However, the difference in the pubescence of protibiae between these two species is important. Such a difference is usually identified with generic rank. If there were no such similarities between these two species, the writer would not hesitate to establish an independent genus for *R. pubicollis*. At present, however, the writer prefers to let it belong to *Rakantrechus*, giving only a special subgenus for it. It is regretful that the male characters of *R. pubicollis* are unknown, which may serve some confirmations for this arrangement.

Key to the subgenera

- 1 (2) Protibiae glabrous on the anterior face and externally grooved; mentum not fused with submentum; pronotum glabrous *Rakantrechus* s. str.
 2 (1) Protibiae entirely pubescent and not externally grooved; mentum partly fused with submentum; pronotum sparsely pubescent
 **Yamautidius** S UÉNO, subgen. nov.⁶⁾

***Rakantrechus* (s. str.) *kawasawai* S. UÉNO.**

(Figs. 4, 6)

Rakantrechus kawasawai S. UÉNO, 1951, Ent. Rev. Japan, Osaka, 5, p. 89, pl. 4, fig. B;
 type-locality: Rakan-ana Cave in Ehimé Pref.; 1953, Shin Konchû, Tokyo, 6 (11), p. 44, fig. 1.

Length: 3.5 mm (from front margin of clypeus to anal end).

Colour pale reddish brown, shiny, translucent when alive, with appendages paler.

Head large, surface moderately convex; frontal furrows deep and entire, the narrowest part of the space between these furrows placed rather in front than usual, from where the furrows gradually diverge behind; genae well convex; mesh-like microsculpture present, though not sharply impressed; mandibles slender, sharply hooked at apices; mentum tooth stout, widely sulcated on median line, slightly but distinctly emarginate at the tip; antennae long but fairly stout, nearly reaching the middle of elytra.

Pronotum cordate, convex, about 1.2 times wider than head, nearly as wide as long, *widest at about seven-ninths from base*⁷⁾; lateral sides rather strongly rounded

6) This subgenus is named in honour of Hiroshi YAMAUTI, an excellent speleologist, whose aid made the writer possible to explore the limestone cave "Kuroiwa-dô".

7) Read this line (*italics*) for "widest at about 2/9 from base" in the original paper.

in front, nearly straight at middle and sinuate before hind angles; base slightly arcuate and somewhat produced backwards, five-sixths as wide as apex; front angles not advanced but rounded, hind angles nearly rectangular though somewhat denticulate laterally; median line distinct, becoming deeper near base; apical transverse impression shallow though obvious, with vague longitudinal wrinkles; basal transverse impression wide and shallow, interrupted at middle and with a deep longitudinal fovea on each side of median line; basal foveae fairly deep, somewhat extending forwards parallel with the side-borders; disk with fine, irregularly transverse striations, microsculpture consisting of transverse lines but indistinct.

Elytra oval, moderately convex but rather flat on the disk, about 1.8 times wider than pronotum, 1.55 times longer than wide, widest at about middle; shoulders rounded though distinct, prehumeral borders oblique and very slightly emarginate,

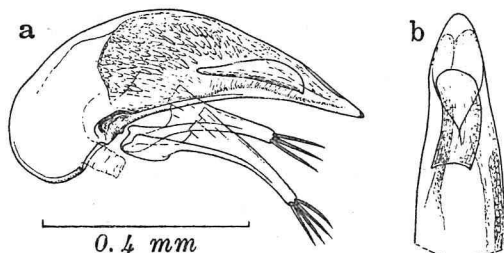


Fig. 6. Male genital organ of *Rakantrechus kawasawai* S. UÉNO, of Rakan-ana Cave; left lateral view (a), and apical part of aedeagus, dorsal aspect (b).

lateral sides weakly rounded at middle and slightly emarginate before apices which are rounded; striae vestigial but visible on the disk, indistinctly subcrenulate, stria 5 somewhat deepening near base; stria 3 with two dorsal pores located at about one-fifth and two-fifths from base respectively, stria 5 with a single dorsal pore at about two-thirds from base; microsculpture composed of fine transverse lines though indistinct.

Legs slender and weak.

Male genital organ small and weakly chitinized. Aedeagus short and wide, rather suddenly attenuated towards the blunt apex; basal part large; ventral side slightly concave. Inner sac armed with a well developed copulatory piece and covered on the left side with a patch composed of large teeth; the copulatory piece spatulate, placed at the ventral side inside the sac with the convex face below. Styles fairly slender, left style distinctly longer than right one.

Female unknown.

Locality: A limestone cave called "Rakan-ana", at Koya, Sôgawa, Nomura-chô, Ehimé Pref., on the central massif of the Island of Shikoku.

With the exception of *R. pubicollis*, no close relative of this species has hitherto been found in Shikoku, while it resembles in many respects the forms found in the limestone caves in Southern Kyushu⁸⁾. An ancestral form of *Rakantrechus* might have inhabited the western part of the ancient massif of the Kuma-Kii mountain

8) These undescribed species from Kyushu are usually not so evolved as *Rakantrechus kawasawai* and *R. pubicollis*.

range during Miocene and have evolved separately in Shikoku and Kyushu during Pliocene and Pleistocene. This presumption would have been confirmed if any allied form had been discovered in the caves located on the western coast of Shikoku. However, no cavernicolous trechid was obtained in the caves in such an area (e. g., Takayama-dô Cave, Ana-no-gozen Cave, Ohkawa-dô Cave, etc.), in spite of careful surveys made by the present writer, Jûjirô ISHIKAWA and Ryôsuke ISHIKAWA.

Rakan-ana Cave is located at the north-western foot of Ohnogahara Karst and is open in the forest of Japanese cedar. The cave is well known among natives by its large size and by the variation of cave products. The habitats in this cavern vary greatly, i. e., there are pools, silty floors, sand beds, rockfallings, large amounts of bats' guano and decayed wood, and many other different elements. The fauna has been investigated repeatedly by Jûjirô ISHIKAWA, Tetsuo KAWASAWA and Toshifumi KUBOTA, and many cave animals were brought to light. *Rakantrechus kawasawai* is, however, never re-obtainable since 1950. The writer himself has investigated this cavern on March 13th, 1957, but all his efforts have failed in obtaining fresh specimens of this interesting species.

***Rakantrechus* (*Yamautidius*)
pubicollis S. UÉNO, sp. nov.
(Figs. 5, 7)**

Length: 3.35 mm (from front margin of clypeus to anal end).

Colour yellowish brown, shiny, translucent, with appendages paler.

Head large, with frontal furrows deep throughout and diverging both in front and behind; genae regularly convex; surface moderately convex, microsculpture formed by reticulation but not sharply impressed; mandibles slender, sharply hooked at apices; mentum tooth stout and deeply emarginate at the tip; antennae long and fairly stout, reaching the middle of elytra, with segment 4 nearly as long as segment 3 or segment 5.

Pronotum cordate and strongly

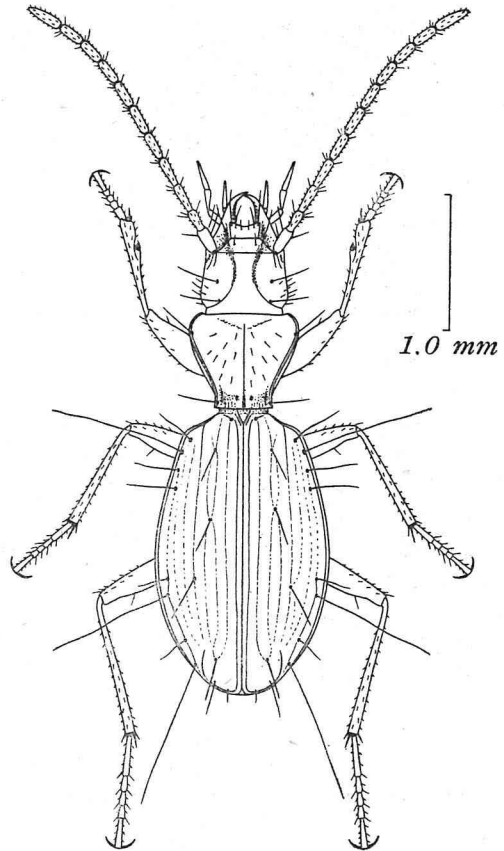


Fig. 7. *Rakantrechus* (*Yamautidius*) *pubicollis* subgen. et. sp. nov., ♀, of Kuroiwa-dô Cave.

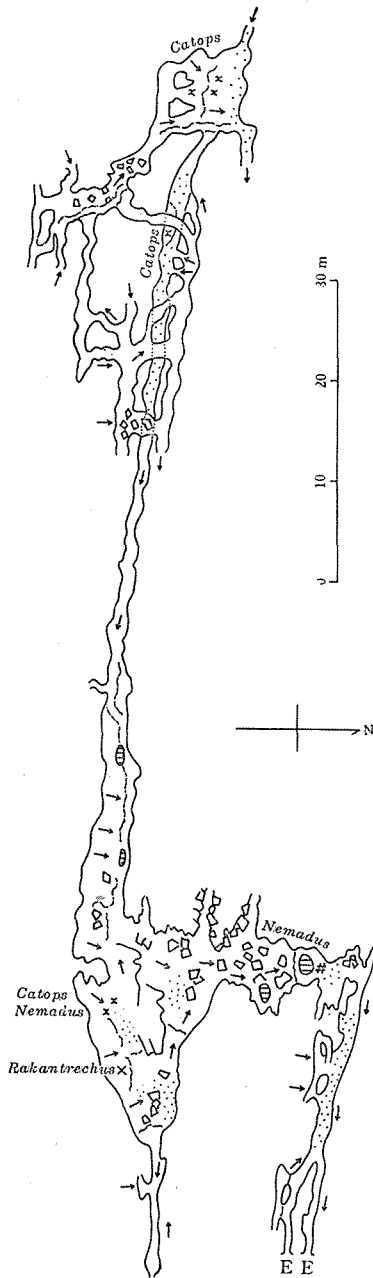


Fig. 8. Map of Kuroiwa-dô Cave; E—entrance. (Adopted from YAMAUTI, 1951).

contracted posteriorly, surface convex and covered with sparse suberect pubescence, fully 1.25 times wider than head, about 1.15 times wider than long, widest at about five-sixths from base; lateral sides strongly but narrowly rounded near front angles, nearly straight at middle and sinuate just before hind angles; apex widely emarginate, about 1.4 times wider than base, which is somewhat produced backwards at middle; front angles not correct, hind angles nearly rectangular; median line deep, apical transverse impression vague, indicated by vague longitudinal wrinkles; basal transverse impression fairly deep, interrupted at middle, provided with a deep longitudinal fovea on each side of median line and merging on each side into basal fovea, which is moderately deep and extends anteriorly along the side-border; microsculpture composed of fine transverse lines though indistinct.

Elytra oblong-oval and convex, nearly 1.6 times wider than pronotum, longer than wide in a same proportion, widest at about middle; shoulders rounded but obvious, prehumeral borders oblique and distinctly emarginate, lateral sides regularly but not strongly rounded at middle; apices rounded; punctate-striate though faint, striae visible on the disk, becoming fainter at the sides and discernible only as the rows of minute punctures, stria 5 deeply impressed near base; apical carina prominent; stria 3 with two dorsal pores placed at about one-seventh and three-eighths from base respectively, stria 5 with one dorsal pore at three-fifths from base; microsculpture indistinct.

Legs slender and weak.

Male unknown.

Holotype: ♀ (15-IV-1956, collected by S. UENO and preserved in his collection).

Type-locality: A limestone cave called "Kuroiwa-dô", at Tsutsumi, of Kuroiwa, in Hirokata, Mikawa-mura, Ehimé Pref., on the central massif of the Islands of Shikoku.

Besides the subgeneric characters, the present new species may easily be distinguished from *R. kawasawai* by the shape of pronotum, the elongate elytra and the emargination of prehumeral borders.

Kuroiwa-dô Cave is open at the foot of a large outcrop of limestone on the right side of the Kuma-gawa River, and develops along the joint-plane. At about 40 m inside the entrances, there is a vertical dry fall, which prevents explorers from entering into the depth of the cave. Inside of the dry fall, the cave floor varies greatly in its aspect from place to place. A large room placed at the south-eastern part of this cave is formed mainly by roof fall. The floor of this room is humid and is inhabited by many cave animals, such as a snail, a pseudoscorpion, arachnids, an opilionid, diplopods, a chilopod, springtails, a cave-cricket, catopids and the trechid. A single type-specimen of the trechid was found walking on the under side of a large rock fallen from the ceiling. The other parts formed chiefly by erosion are inhabited by a small number of animals.

Genus *Ishikawatrechus* HABU.

Ishikawatrechus HABU, 1950, Mushi, Fukuoka, 21, p. 49; type-species: *Ishikawatrechus nipponicus* HABU, 1950.—S. UÉNO, 1951, Ent. Rev. Japan, Osaka, 5, p. 88; 1953, Shin Konchû, Tokyo, 6 (11), p. 45.—JEANNEL, 1953, Notes Biospéol., 8, p. 128.

Subgen. *Nipponotrechus* S. UÉNO, 1951, Ent. Rev. Japan, Osaka, 5, p. 85; type-species: *Nipponotrechus ishikawai* S. UÉNO, 1951.—JEANNEL, 1953, Notes Biospéol., 8, p. 128.—*Yasutakea* S. UÉNO, 1951, Ent. Rev. Japan, Osaka, 5, p. 86; type-species: *Nipponotrechus uozumii* S. UÉNO, 1951; 1953, Shin Konchû, Tokyo, 6 (11), p. 45.—JEANNEL, 1953, Notes Biospéol., 8, p. 128.

The genus *Ishikawatrechus* was originally described by HABU as a relative of the Pyrenéan genus *Geotrechus*, but his description was not sufficient to define the genus. Moreover, the taxonomic position of the genus remained in obscurity for several years due to an error made in the original description. The writer and his colleagues endeavoured to find *I. nipponicus* in Ryûga-dô Cave, where was indicated by the original author as the type-locality of the species. All their efforts failed, however, in rediscovering it in this cavern. Under such a condition, *Ishikawatrechus* was taken into account by the present writer to be closely allied to or even synonymous with *Rakantrechus* and by JEANNEL to be a synonym of *Trechiana*. The true position of the genus had been wrapped up in mystery till the time when the writer rediscovered *I. nipponicus* in a limestone cave called "Saruta-dô".

During the exploration of limestone caves in Shikoku made by the present writer and his colleagues in the spring of 1953, the writer succeeded to obtain a couple of specimens of the type-species of the genus. After careful examination of them, he has come to a conclusion, that *Ishikawatrechus* is not synonymous with either *Rakantrechus* or *Trechiana* but is really a close relative of *Nipponotrechus*. Such fundamental features as the chaetotaxy, the glabrous protibiae and the structure of aedeagus are common to both *Ishikawatrechus* and *Nipponotrechus*. The buccal

appendages of *I. nipponicus* are of similar formation to those of *N. ishikawai* and *N. uozumii*, excepting the shape of mentum tooth. On the other hand, there are found some differences between these typical species of the two genera. In *I. nipponicus*, the body surface is glabrous, the genae almost glabrous, and the shoulders of elytra are effaced, while, in *N. ishikawai* and *N. uozumii*, the body surface and genae are pubescent, and the shoulders of elytra are obviously tuberculate. Most of these gaps were, however, bridged by the discovery of several new forms in the areas that lie between the localities of those typical species. That the body surface is glabrous in *Ishikawatrechus* and is pubescent in *Nipponotrechus* is only a difference remaining at present between them. In this paper, therefore, *Nipponotrechus* is arranged as a subgenus of *Ishikawatrechus*, the description of which is revised as seen below.

Troglobiontic genus. Body surface glabrous (*Ishikawatrechus* s. str.) or pubescent (*Nipponotrechus*); apterous and depigmented; colour reddish brown.

Head with frontal furrows deep, moderately separated from one another, not angulate at middle and diverging both in front and behind; eyes vanished; genae more or less convex, glabrous (*I. cerberus*), almost glabrous (*I. nipponicus*) or pubescent (*I. humeralis* and subgen. *Nipponotrechus*); surface glabrous in *Ishikawatrechus* s. str., almost glabrous but sometimes with several minute hairs on vertex in *Nipponotrechus*; two supraorbital pores present. Labrum emarginate at apex, sexsetose. Mandibles slender, bidentate and hooked at apices. Mentum free, not fused with submentum, with epilobes projecting well beyond lateral lobes; mentum tooth stout, bifid or at least obviously emarginate at the tip; submentum with three setae on each side⁹⁾; ligula rounded at apex and octosetose, two median setae long; paraglossae narrow, extending beyond ligula. Palpi slender; apical segments subacuminate towards the tips; penultimate segment shorter than apical segment and asetose in maxillary palpus, about as long as or slightly longer than apical one and inwardly bisetose in labial palpus. Antennae long and filiform, with segment 3 much longer than segment 2.

Pronotum elongate-cordate or cordate, convex; lateral sides narrowly and entirely bordered, rounded in front and distinctly sinuate behind, with both lateral and postangular setae, the latter of which is always inserted some distance before hind angles; front angles a little advanced and rounded, hind angles sharp and salient, without carina; median line distinct, widening near base and not reaching apex; basal transverse impression deep, interrupted at middle, provided with a longitudinal fovea on each side of median line and merging on each side into basal fovea.

Elytra fused together (at least partly), oval or oblong-oval and convex, with a transverse furrow on basal peduncle; basal area more or less depressed, the depression usually limited on each side by a basal carina composed of intervals 5 and 6;

9) The submentum of *Nipponotrechus* was originally described as being "quadrisetose". This is a fault of description since a pair of setae close to the buccal fissure was overlooked.

shoulders variable, effaced and widely rounded in *I. nipponicus*, rounded but distinct in *I. cerberus*, *I. intermedius* and *I. subtilis*, salient and forming a humeral tubercle in the other species; prehumeral borders oblique, complete to the base of stria 5 in *I. nipponicus* and *I. intermedius*, incomplete and disappearing beneath a remarkable fold composed of the merged basal parts of intervals 5 and 6 in the other species; lateral sides moderately explanate and reflexed; striae not very deep though usually distinct, scutellar striole present; apical striole deep, interrupted at the end and usually not joining any stria though directed to the termination of stria 5, sometimes joining stria 5, and rather frequently (e.g. in *I. ishikawai*) directed to the termination of (or even joining) stria 7; intervals flat or slightly convex, smooth in *Ishikawatrechus* s. str., with an irregular row of pubescence on the middle in *Nipponotrechus*; apical carina distinct; stria 3 with two setiferous dorsal pores before middle, stria 5 with one setiferous dorsal pore behind middle, preapical pore located on the meeting point of striae 2 and 3; humeral group of umbilicate pores not aggregated, first three pores ranged nearly equidistantly and adjoining marginal gutter but the fourth widely distant from the others.

Ventral surface glabrous in *Ishikawatrechus* s. str., more or less with scattered pubescence in *Nipponotrechus*; anal sternite with one seta in ♂, two in ♀ on each side.

Legs slender; protibiae grooved externally and glabrous even at apex; tarsal segment 4 with a long ventral apophysis; proximal two segments of protarsi in ♂ dilated, inwardly produced at apices and provided beneath with sexual adhesive appendages.

Aedeagus more or less arcuate and attenuated towards apex; basal part large, with a sagittal aileron more or less developed; apex pointed, with a sharp hook in the apical end of the ventral groove; apical orifice large, lateral sides of basal orifice more or less deeply emarginate; inner sac always without differentiated copulatory piece and rarely with a group of large teeth, some portions of the sac membrane sometimes covered with weakly chitinized scales. Styles rather narrow, left style always longer than right style, each provided usually with four apical setae. The number of these apical setae on styles varies from three to seven according to the species or even individuals.

The remarkable sharp hook present on the ventral side of aedeagal apex is a characteristic feature of the genus *Ishikawatrechus*, which has been known in none of the genera of the Japanese trechids. Further, the genus may be characterized by the shape of pronotal hind angles, the arrangement of the humeral umbilicate series and of setiferous dorsal pores, the glabrous protibiae and the absence of copulatory piece inside the inner sac of aedeagus. Among the genus *Trechiana*, there are found several species which resemble *Ishikawatrechus* in their appearance. In these species of *Trechiana*, however, the humeral umbilicate series is always aggregated, the fifth elytral stria with two setiferous dorsal pores, and the aedeagal apex is not armed with a sharp hook on the ventral side. Some undescribed species

belonging to *Rakantrechus* also resemble the members of this genus, but are distinguished from the latter by the structure of pronotal hind angles and the absence of the ventral hook of aedeagal apex.

The subgenus *Yasutakea* was established by the present writer for a depository of *Nipponotrechus uozumii*, based upon a character of pubescence on the ventral surface. There is, however, no necessity to support the subgenus, as was already stated by the present writer himself and by JEANNEL.

The emergence of the adults of *Ishikawatrechus* seems to occur in various seasons, as will be known from the following collecting dates for teneral specimens:

- I. cerberus*: 11-IV-1956 (1 ♂, 1 ♀)
I. nipponicus: 19-III-1953 (1 ♀)
I. intermedius: 3-VIII-1952 (2 ♂♂)
I. ishikawai: 22-XII-1948 (1 ♀), 1-V-1950 (1 ♀)
I. uozumii: 9-IV-1956 (1 ♂)

These data, though not rich, may be sufficient to show the fact that the dates of emergence of these beetles are scattered all the year round. It has long been said that the breeding periodicity has been lost in many troglobiontic animals. One example of such a case was reported by the present writer from Japan¹⁰⁾, and the present record may supply an example seen also among the cave-trechids of Japan.

Key to the subgenera and species

- 1 (6) Body surface glabrous; genae glabrous or almost glabrous (except *I. humeralis*) *Ishikawatrechus* s. str.
- 2 (5) Genae glabrous or almost glabrous; shoulders of elytra rounded and hardly tuberculate; larger species (more than 4.8 mm), with deeper elytral striae.
- 3 (4) Prehumeral borders of elytra incomplete and disappearing anteriorly beneath the basal fold; lateral sides of pronotum more narrowly rounded in front and nearly straight at middle; pronotal apex more or less wider than base; length: 4.8-5.8 mm; (Inaba-dô Cave and Furumiya-dô Cave) *I. cerberus* sp. nov.
- 4 (3) Prehumeral borders of elytra complete to the base of stria 5, basal fold not distinctly formed; lateral sides of pronotum widely rounded in front; pronotal apex as wide as base; length: 5.9-6.3 mm; (Saruta-dô Cave) *I. nipponicus* HABU.
- 5 (2) Genae pubescent; shoulders of elytra forming a remarkable humeral tubercle; smaller species, with shallower elytral striae; length: 4.6 mm; (Ishida-dô Cave) *I. humeralis* sp. nov.

10) Cf. UÉNO, 1957, p. 276.

- 6 (1) Body surface pubescent; genae always pubescent
 *Nipponotrechus* S. UÉNO.
- 7 (12) Pronotal apex almost as wide as or a little wider than base; dorsal surface densely pubescent; ventral surface pubescent, at least on the lateral sides of thoraces and on the hind parts of sternites.
- 8 (9) Prehumeral borders of elytra very oblique, not emarginate and complete to the base of stria 5; basal part of stria 5 not forming distinct basal fold; shoulders rounded, not forming humeral tubercles; striae deeper; length: 4.5-5.7 mm; (Ohchi-dô Cave)..... *I. intermedius* sp. nov.
- 9 (8) Prehumeral borders of elytra much less oblique, distinctly emarginate and disappearing beneath a remarkable fold at the base of stria 5; shoulders prominent and forming on each side a remarkable humeral tubercle; striae shallower.
- 10 (11) Pubescence on the ventral surface not reduced; elytra narrower, with lateral sides less rounded and with humeral tubercles less prominent; aedeagus short and robust, rather suddenly attenuated towards apex, which is narrowly produced, with a small apical hook on the ventral side; styles shorter; length: 4.3-5.0 mm; (Shiroiwa-dô Cave).....
 *I. uozumii* (S. UÉNO).
- 11 (10) Pubescence on the ventral surface usually reduced to the lateral sides of thoraces and the hind parts of sternites; elytra wider, with lateral sides more strongly rounded and with humeral tubercles more prominent; aedeagus fairly large, elongate and gradually attenuated towards apex, which is thick, with an apical hook on the ventral side evidently larger; styles more elongate; length: 4.9-5.7 mm; (Shôbu-dô Cave)
 *I. ishikawai* (S. UÉNO).
- 12 (7) Pronotal apex distinctly wider (about 1.2 times wider) than base; dorsal surface sparsely pubescent; ventral surface almost glabrous, only sternites 3-5 with a few hairs on the median part along respective hind margin; shoulders of elytra rounded, not forming humeral tubercles; elytral striae superficial; length: 4.4-4.6 mm; (Anagami-dô Cave)
 *I. subtilis* sp. nov.

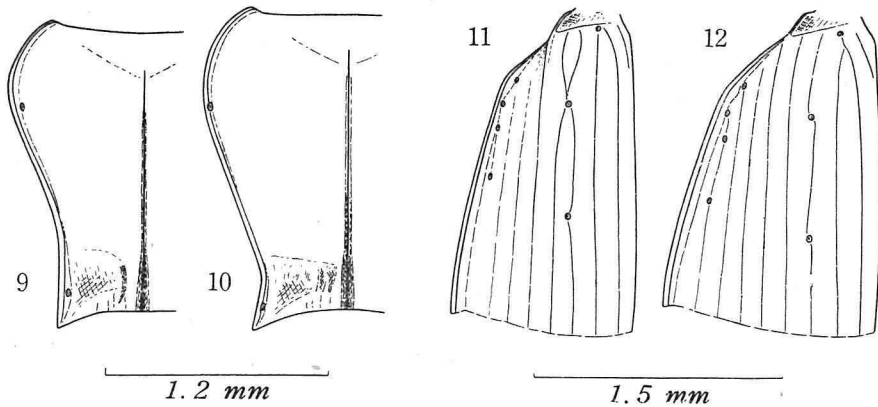
***Ishikawatrechus* (s. str.) *cerberus* S. UÉNO, sp. nov.**

(Figs. 9, 11, 13)

Length: 4.8-5.8 mm (from front margin of clypeus to anal end).

Colour reddish brown, shiny, translucent when alive; palpi, apical segments of antennae and legs pale reddish brown.

Head subquadrate, with frontal furrows deep throughout, supraorbital areas and front moderately convex; genae entirely glabrous and not strongly convex; micro-sculpture formed by well impressed reticulation; mentum tooth clearly bifid; antennae long and slender, reaching apical one-third of elytra.



Figs. 9-12. Outlines of the left side of pronotum and the humeral part of left elytron.—9, 11. *Ishikawatrechus* (s. str.) *cerberus* sp. nov., ♀, of Inaba-dō Cave. —10, 12. *Ishikawatrechus* (s. str.) *nipponicus* HABU, ♀, of Saruta-dō Cave.

Pronotum elongate-cordate, convex, 1.4–1.45 times wider than head, a little longer than wide, widest at three-fourths to four-fifths from base according to individuals; lateral sides moderately rounded in front, nearly straight at middle and sinuate before hind angles; apex slightly but widely emarginate, a little wider than base which is widely emarginate; front angles a little produced and rounded, hind angles sharp, projecting moderately outwards and strongly backwards; median line deep, not reaching apex and widening near base; apical transverse impression shallow, somewhat wrinkled; basal transverse impression wide and deep, merging on each side into basal fovea, which is large and deep; surface with vague transverse striations, both apical and basal areas more or less uneven, microsculpture composed of fine transverse lines.

Elytra oblong-oval and convex, 1.7–1.8 times wider than pronotum, fully 1.5 to fully 1.6 times longer than wide, widest at about or a little behind middle according to individuals; basal area evidently depressed; at the outer limit of this depression, intervals 5 and 6 obtusely raised, with stria 5 on the ridge, of which the basalmost part is distinctly carinate; shoulders distinct, somewhat prominent especially in large individuals and rounded; prehumeral borders oblique and slightly emarginate, disappearing anteriorly beneath the basal carina of intervals 5 and 6; lateral sides slightly emarginate behind shoulders, moderately rounded at middle and slightly emarginate again before apices; striae moderately impressed on the disk and becoming shallower on both sides, faintly crenulate, striae 1 and 2 deepening near base; intervals smooth, somewhat convex on the disk but flat on the sides; stria 3 with two dorsal pores placed at one-seventh to one-sixth and about one-third from base respectively, stria 5 with one dorsal pore at three-fifths to two-thirds from base; microsculpture composed of fine transverse lines. Legs slender.

Male genital organ moderately chitinized. Aedeagus slender, regularly arcuate

and gradually attenuated towards apex, which is pointed and slightly turned up, with an apical hook on the ventral side small and sharp; in profile, dorsal side semicircularly rounded; ventral side regularly concave; basal part not strongly bent, lateral sides of basal orifice deeply emarginate; sagittal aileron rather narrow; inner sac inerm. Styles fairly long, each provided at apex with four setae, sometimes five setae present on one of the two styles.

Holotype: ♂, allotype: ♀ (Inaba-dô Cave, 11-IV-1956, collected by S. UÉNO). Paratypes: 8 ♂♂, 12 ♀♀ (Inaba-dô Cave, 11-IV-1956, by S. UÉNO and T. KAWASAWA); 4 ♂♂, 1 ♀ (Furumiya-dô Cave, 10-IV-1956, by S. UÉNO).

The type-specimens are preserved in the writer's collection.

Type-localities: A limestone cave called "Inaba-dô", at Miyako, north of Funato, and a limestone cave called "Furumiya-dô", at Shimo-no-gô, both in Higashi-Tsunomura, Kôchi Pref., on the central massif of the Island of Shikoku.

This new species is closely allied to *I. nipponicus*, but may easily be distinguished from the latter chiefly by the bifid mentum tooth, the shape of pronotum which is widest at a more anterior part and contracted behind more strongly, the presence of a remarkable fold at the basal parts of intervals 5 and 6, and the structure of aedeagus.

Mt. Irazu, a calcareous mountain of 1,336.4 m above sea level, is situated circa 18 km east of Ohnogahara Karst and between two branches of the upper courses of the Shimanto-gawa River, one of the large rivers in the Island of Shikoku. Of these two branches of the Shimanto-gawa, the one called the Matsuba-gawa runs the eastern foot of Mt. Irazu, and the other, the Kita-gawa, flowing the western foot of the mountain. Inaba-dô Cave is open on the right side of the Matsuba-gawa only a few metres above water of the ravine, while Furumiya-dô Cave opens the entrance on the left side of the Kita-gawa about 6,800 m westward of Inaba-dô. Furumiya-dô Cave lies, therefore, at the opposite side over Mt. Irazu from the latter grotto.

Although the entrance of Inaba-dô Cave is of moderate size, the passage inside it is formed by a narrow crevice, which continues to the upper edge of a vertical shaft. An underground stream runs through the rooms at the bottom of the shaft. The floors of the rooms seem to be frequently immersed by floods, being covered with layers of silt. In this grotto, organic matters are very scarce and the fauna is poor. Only a few specimens of troglobiontic animals other than the present trechid were obtained there. It is surprising that the trechid is, despite of such an extreme environment, fairly abundant, running under stones or among pebbles on the debris of inundation.

Furumiya-dô Cave is an effluent cave, a subterranean brook flowing through it. Some distance inside the entrance, there is a side passage without water, where many noticeable troglobiontic animals were found. They are, for instance, an earthworm, a pseudoscorpion, arachnids, a chilopod, diplopods, springtails, cave-cricket and so on. An individual of the present trechid was also obtained there, but the

beetle was more frequently found under pebbles along the brink of the underground stream in the depth of the grotto.

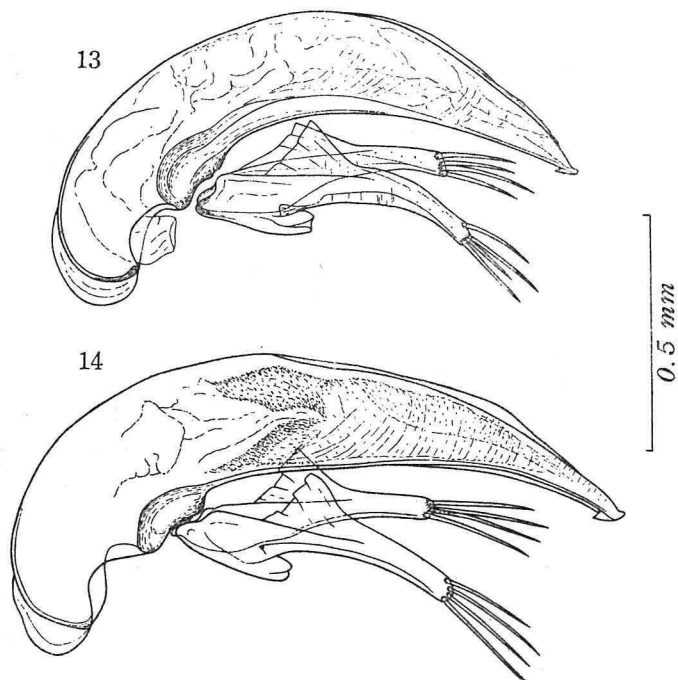
A fungus belonging to Laboulbeniaceae and a kind of parasitic mite are frequently found on the body surface of this new trechid, though these parasites have not been identified as yet.

***Ishikawatrechus* (s. str.) *nipponicus* HABU.**

(Figs. 10, 12, 14)

Ishikawatrechus nipponicus HABU, 1950, Mushi, Fukuoka, 21, p. 50, pl. 8; type-locality: Saruta-dô Cave in Kôchi Pref.¹¹⁾—S. UÉNO, 1953, Shin Konchû, Tokyo, 6 (11), p. 44.

Prof. ESAKI was kind enough to permit the writer to re-examine the holotype of this species, which proved to be conspecific with the specimens taken in Saruta-dô Cave. The original description is good, but some account must be added to complete it as given below.



Figs. 13-14. Male genital organ, left lateral view.—13. *Ishikawatrechus* (s. str.) *cerberus* sp. nov., of Inaba-dô Cave.—14. *Ishikawatrechus* (s. str.) *nipponicus* HABU, of Saruta-dô Cave.

11) *Vide* remarks.

Length: 5.9–6.3 mm (from front margin of clypeus to anal end).

Head with frontal furrows deep and entire; genae slightly convex and glabrous, but the vestiges of a few hairs rarely visible under high magnification; mentum tooth stout, slightly but distinctly emarginate at the tip¹²⁾. Pronotum elongate-cordate and convex; lateral sides widely and gently rounded in front, sinuate just before hind angles; apex as wide as base; front angles a little advanced and rounded, hind angles large and sharp, well projecting both outwards and backwards; basal transverse impression wide, merging on each side into basal fovea which is large and deep; surface with vague transverse striations, microsculpture formed by fine transverse lines but indistinct.

Elytra convex, with basal area evidently depressed, this depression limited on each side by interval 5, the basal part of which is somewhat raised; shoulders effaced, prehumeral borders very oblique, not emarginate and complete to the base of stria 5; lateral sides moderately rounded at middle and slightly emarginate before apices, each one of which is obtusely angulate; striae fairly deep and faintly crenulate, becoming shallower on both sides, striae 1–3 deepening near base; intervals slightly convex on the disk but flat on the sides.

Male genital organ moderately large and well chitinized. Aedeagus not strongly arcuate and tapering towards apex; basal part fairly large and moderately bent towards ventral side, with a sagittal aileron rather large; basal orifice large, lateral sides of which are deeply emarginate; apical part narrowly prolonged and slightly curved to ventral side, apex slightly turned up and armed on the ventral side with a sharp hook, which is triangular and rather large; ventral side nearly straight at middle and concave before apex; inner sac inerm, though covered with a patch composed of numerous, weakly chitinized scales at the middle of the left wall. Styles stout, left style a little longer than right style.

HABU did not give the sex of the holotype, but a close examination by the present writer made evident that it was a female. The allotype will be settled as follows:

Allotype: ♂ (19-III-1953, collected by S. UÉNO and deposited in his collection).

Further specimens examined: 1 ♀ (19-III-1953, by S. UÉNO); 1 ♀ (7-IV-1956, by S. UÉNO and N. KOBAYASHI).

Type-locality: A limestone cave called "Saruta-dô", at Saruta, Kusaka, Hidakamura, Kôchi Pref., on the Pacific coast of the Island of Shikoku.

This is an *Ishikawatrechus*-species which resembles most closely *Trechiana* in its appearance. This let JEANNEL consider that the species belonged to the latter genus. However, *I. nipponicus* is really an extreme form in the genus *Ishikawatrechus*, which is not only independent but involves *Nipponotrechus* as a subgenus.

12) HABU has written "dent of mentum triangular, not bifid, slightly truncate at the tip", but the tooth is distinctly emarginate in *I. nipponicus*.

The similarity between the species of this genus and several species of *Trechiana* should be regarded as a superficial convergence.

It was already noticed that HABU's indication was erroneous regarding the type-locality of this species¹³⁾. As the article by the present writer was written in Japanese, it may be better to note again the circumstances how this mistake was brought about.

The holotype of *I. nipponicus*, which is now preserved in the collection of the Entomological Laboratory of Kyushu University, bears a single blue type-label inscribed "TYPE *Ishikawatrechus nipponicus* HABU, sp. nov." and no locality label. There is no way to know the type-locality from this specimen.

ISHIKAWA, the discoverer of *I. nipponicus*, told the writer when the species was described by HABU, that he was not sure where he had obtained the type-specimen. He suggested, however, the true locality must be one of two caves, Ryûga-dô and Saruta-dô, of which the latter might be more probable than the former. His presumption was proved by the present writer as mentioned before. *I. nipponicus* is endemic to Saruta-dô Cave so far as known up to the present. HABU did not know at that time the occurrence of different cave-beetles in the Japanese Islands and believed that only a cave in which blind beetles had been discovered was Ryûga-dô¹⁴⁾. Therefore, the error could not be responsible to HABU. To know the precise locality is, however, so important for analysing the distribution of cavernicolous trechids in the Island of Shikoku, as the writer has repeated.

Saruta-dô Cave (sometimes called "Saruta-no-ana Cave") is a dangerous labyrinth, situated at the north-eastern end of a small ridge. The entrance is horizontally open at the foot of the ridge about 30 m above sea level. On the ridge, there is another opening in a form of pot-hole. Narrow passages are developed one above another between these two openings, all these passages being connected by chimneys, shafts and cat-holes. The writer does not know the total length of the cavern, but it may be considerably large. On the lowermost passage that is horizontal and developed on the level of ground water table, there are many pools, some of which are very deep. Crustaceans, a remarkable cave-leech and a snail are inhabiting there.

At the upper passages, there are both stalagmitic floors and silty places as well as deposits of bats' guano and decayed wood. It is considerably wet throughout the cave-system, and the animals are rich both in numbers of species and individuals. Although it is difficult to the writer to give here the details of the cave-fauna, he should like to note that four species of troglobiontic beetles were obtained in the cavern, i. e. the trechid, two pselaphids and a catopid. The latter three species are not rare, being obtainable on the deposits of bats' guano or under decayed wood or

13) UÉNO, 1953, (11), pp. 44-45.

14) At least eight species of such trechids had been found in Japan before 1949. They are: *Trechiana ohshimai*, *T. habei*, *Ishikawatrechus nipponicus*, *I. ishikawai*, *I. uozumii*, *Ryugadous ishikawai*, *R. ciliatus* and *Kurasawatrechus eriophorus*.

often walking on the stalagmitic floor, but the trechid seems to be extremely rare. The cavern has been visited four times by the writer himself and has been explored many times by his colleagues. The trechid was, however, obtained only three times in four individuals, including the holotype. A couple of specimens collected in 1953 were found under stones on the silty floor at the depth of one of the upper passages, where organic matters were hardly perceptible. The fourth specimen collected in 1956 was found under a piece of decayed wood in a room which was situated at the bottom of the pot-hole.

***Ishikawatrechus* (s. str.) *humeralis* S. UÉNO, sp. nov.**

(Fig. 15)

Ishikawatrechus humeralis S. UÉNO, 1953 (in litt.), Shin Konchû, Tokyo, 6 (11), p. 45.

Length: 4.6 mm (from front margin of clypeus to anal end).

Colour reddish brown, very shiny, translucent when alive; legs and the ventral side of hind-body pale reddish brown; palpi pale, antennae becoming paler towards apices.

Head subquadrate, with frontal furrows deep throughout and rather strongly divergent both in front and behind, supraorbital areas and front fairly convex; genae moderately convex and pubescent; micro-sculpture consisting of well marked reticulation; mentum tooth bifid at the tip; antennae slender, extending beyond the middle of elytra.

Pronotum elongate-cordate, convex, fully 1.3 times wider than head and a little longer than wide, widest at four-fifths from base; lateral sides moderately but narrowly rounded in front, slightly but widely sinuate behind; apex very slightly emarginate, about 1.1 times wider than base, which is reduced at middle; front angles a little produced but rounded, hind angles acute, projecting moderately backwards and slightly outwards;

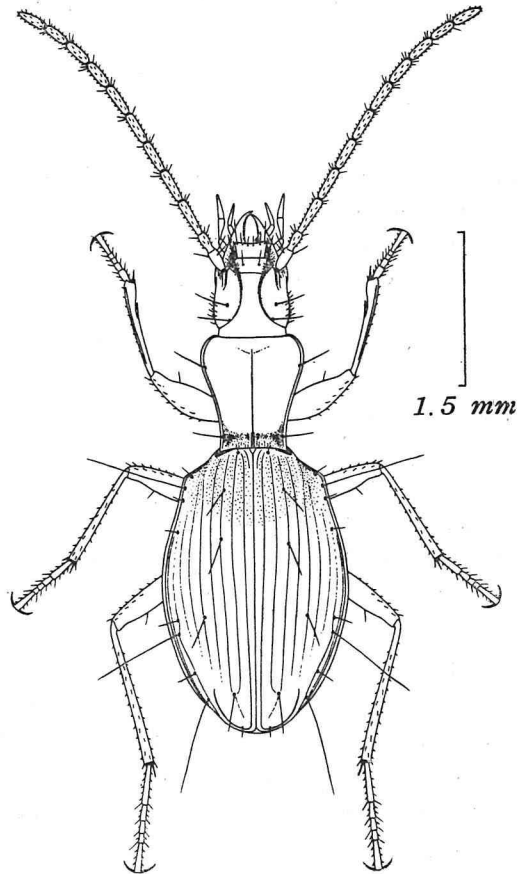


Fig. 15. *Ishikawatrechus* (s. str.) *humeralis* sp. nov., ♀, of Ishida-dô Cave.

median line deep, widening near base; apical transverse impression slight; basal transverse impression wide and fairly deep; basal foveae deep; surface partly with vague transverse striations, apical area somewhat uneven, microsculpture formed by fine transverse lines but inconspicuous.

Elytra oblong-oval or rather ovate, convex, 1.8 times wider than pronotum, about 1.5 times longer than wide, widest at about or slightly behind middle; basal area distinctly depressed, this depression limited on each side by a ridge, which is similarly formed to that of *I. cerberus* but is less prominent than that of the latter; humeral angles salient, each forming a remarkable tubercle; prehumeral borders oblique, evidently but not deeply emarginate, and disappearing anteriorly beneath the basal carina of intervals 5 and 6; lateral sides slightly emarginate behind humeral tubercles, then moderately rounded, and slightly emarginate again before apices which are rounded; striae faintly crenulate, shallow especially on both sides, so that outer striae slight, stria 1 deepening basally; intervals smooth and flat; stria 3 with two dorsal pores located at one-seventh to one-sixth and one-third to two-fifths from base respectively, stria 5 with one dorsal pore at about four-sevenths from base; microsculpture composed of fine transverse lines but indistinct.

Legs slender; protibiae deeply grooved on the external face.

Male unknown.

Holotype: ♀ (19-III-1953, collected by S. UÉNO). Paratype: 1 ♀ (7-IV-1956, by S. UÉNO).

The type-specimens are deposited in the writer's collection.

Type-locality: A limestone cave called "Ishida-dô", at Ishida, Kusaka, Hidakamura, Kôchi Pref., on the Pacific coast of the Island of Shikoku.

The present new species has the features indicating something between *Ishikawatrechus* and *Nipponotrechus*, having the essential characters of the former and two features analogous to the latter, i.e. the pubescent genae and the tuberculate humeral angles of elytra. The male characteristics of this species are still unknown, but its great rarity has made the captures of additional examples impossible.

Ishida-dô Cave is a small grotto that is situated at circa 2,300 m north-east of Saruta-dô Cave. From the small vertical entrance, which is open on the slope near the north-western foot of a small range, a narrow curved corridor leads explorers to the first room, where there is rich in organic matters and is inhabited by many troglomorphic animals, e.g., springtails, diplopods, arachnids, a catopid, a pselaphid and so on. Two other narrow passages connect the room with the innermost one, where there is very wet and muddy but is almost no visible organic matter. The type-specimens were obtained in this innermost room under collapses of stalactites.

Ishikawatrechus (Nipponotrechus) intermedius S. UÉNO, sp. nov.

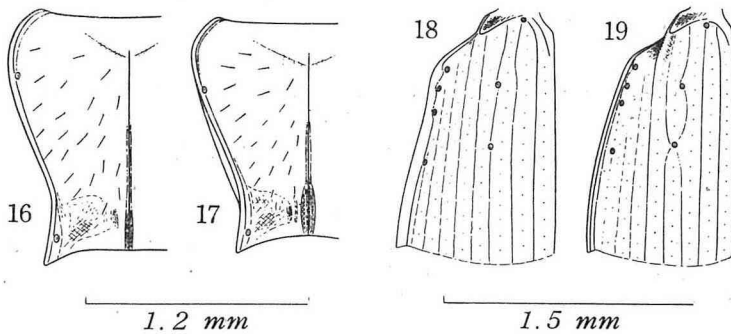
(Figs. 16, 18, 21)

Nipponotrechus intermedius S. UÉNO, 1953 (in litt.), Shin Konchû Tokyo, 6 (11), p. 45.

Length: 4.5–5.7 mm (from front margin of clypeus to anal end).

Allied to *I. uozumii* and coming perfectly under the description of the latter (see later), with the exception of the following features.

Genae slightly less convex; mentum tooth distinctly bifid. Pronotum somewhat wider and widest more in front, 1.45–1.5 times wider than head, usually a little wider than long, widest at about four-fifths from base; lateral sides more narrowly but rather strongly rounded in front, nearly straight at middle and widely sinuate behind; apex usually a little wider than base, but sometimes almost as wide as the latter according to individuals; base more or less arcuate and reduced at middle.



Figs. 16–19. Outlines of the left side of pronotum and the humeral part of left elytron.—16, 18. *Ishikawatrechus (Nipponotrechus) intermedius* sp. nov., ♂, of Ohchi-dô Cave.—17, 19. *Ishikawatrechus (Nipponotrechus) subtilis* sp. nov., ♂, of Anagami-dô Cave.

Elytra more regularly oval, about 1.7 times wider than pronotum, 1.5–1.6 times longer than wide according to individuals, widest a little behind middle; shoulders rounded though distinct, not forming humeral tubercles; prehumeral borders complete to the base of stria 5, much more oblique than those in *I. uozumii* and *I. ishikawai*, and not emarginate; lateral sides very slightly emarginate behind shoulders and gently rounded to the slight emargination before apices; striae distinct, obviously deeper than those in *I. uozumii* and *I. ishikawai*, moderately crenulate; intervals a little convex on the disk but flat on the sides, interval 5 moderately raised near base, though not forming distinct basal fold.

Ventral surface pubescent as in *I. uozumii*.

Aedeagus slender and arcuate, with basal part rather elongate and strongly bent towards ventral side; apical part gradually attenuated towards the tip and narrowly prolonged in profile; apex slightly turned up and with a small sharp hook on the ventral side; ventral side regularly concave at middle and slightly convex

before apex; lateral sides of basal orifice moderately emarginate; sagittal aileron narrow though well developed; inner sac inerm, the sac membrane covered with weakly chitinized scales at the left side. Styles rather narrow, each provided with six to seven apical setae.

Holotype: ♂ (3-VIII-1952, collected by M. UOZUMI). Allotype: ♀ (18-III-1953, by S. UÉNO). Paratypes: 3♂♂ (3-VIII-1952, by M. UOZUMI); 1♂ (10-I-1954, by J. ISHIKAWA).

The type-specimens are deposited in the writer's collection.

Type-locality: A limestone cave called "Ohchi-dô" (sometimes called "Hakuja-dô"), at Ohchi, Kawauchi, Ino-chô, Kôchi Pref., on the Pacific coast of the Island of Shikoku.

The present new species is related to *I. uozumii* and *I. ishikawai*, but differs from these two species chiefly in the structure of the humeral parts of elytra, of elytral striae and of aedeagus.

Ohchi-dô Cave is situated on the same range of low mountains as the caves Ishida-dô and Narukawa-no-Shimizu-dô lie, about 3,500 m east of the former and about 3,000 m north-east of the latter. The entrance is open on the western slope of a calcareous ridge at an altitude of about 100 m. There is no subterranean stream, but there exist pools, silty places, rockfallings, stalagmitic floors, large amounts of bats' guano and decayed wood, and many other elements as the habitats of cave animals. The cave fauna is relatively rich¹⁵⁾, and the present new trechid is, no doubt, one of the most striking species among these cavernicoles. It was found under stones or decayed wood in the depth of the cavern.

***Ishikawatrechus* (*Nipponotrechus*) *uozumii* (S. UÉNO).**

(Fig. 22)

Nipponotrechus (*Yasutakea*) *uozumii* S. UÉNO, 1951, Ent. Rev. Japan, Osaka, 5, p. 87, pl. 4, fig. C; type-locality: Shiroiwa-dô Cave in Kôchi Pref.

Nipponotrechus uozumii, S. UÉNO, 1953, Shin Konchû, Tokyo, 6 (11), p. 45.

The original description of this species is not so perfect that the writer prefers to redescribe it below.

Length: 4.3-5.0 mm (from front margin of clypeus to anal end).

Colour reddish brown, shiny, translucent when alive; palpi, apical segments of antennae and legs pale reddish brown or yellowish brown.

Head subquadrate, surface moderately convex, with deep frontal furrows; genae not strongly convex, densely pubescent; microsculpture well impressed, formed by wide meshes; mentum tooth bifid, or at least distinctly emarginate at the tip; antennae long and slender, reaching apical two-fifths of elytra.

Pronotum cordate and convex, 1.4-1.45 times wider than head, almost as wide

15) Cf. ISHIKAWA, 1954, 3, p. 36.

as long, but sometimes a little wider than long or slightly longer than wide according to individuals, widest at three-fourths to seven-ninths from base; lateral sides rather strongly rounded in front and widely sinuate behind; apex slightly but widely emarginate, about as wide as base, though sometimes slightly wider than the latter, which is nearly straight at middle; front angles slightly advanced and rounded, hind angles sharp, projecting slightly outwards and strongly backwards; median line deep and widening near base; apical transverse impression vague, more or less wrinkled; basal transverse impression wide and rugose, merging on each side into basal fovea which is fairly deep; surface somewhat rugose, both apical and basal areas with longitudinal striations, microsculpture composed of fine transverse lines.

Elytra oval and well convex, 1.65-1.75 times wider than pronotum, 1.5-1.55 times longer than wide, widest at about or a little behind middle; basal area distinctly depressed, basal fold at the base of stria 5 rather obtuse but obvious; shoulders forming on each side a remarkable humeral tubercle, though the tubercle somewhat less prominent than that in *I. ishikawai*, prehumeral borders oblique and distinctly emarginate; lateral sides slightly emarginate just behind humeral tubercles, moderately rounded at middle and hardly emarginate before apices, which are rounded; striae crenulate and shallow, especially on the sides; intervals flat; stria 3 with two dorsal pores placed at about one-seventh and one-third from base respectively, stria 5 with one dorsal pore at about three-fifths from base; microsculpture formed by fine transverse lines.

Ventral surface pubescent. Legs slender though not very long.

Male genital organ well chitinized. Aedeagus short and robust, large and wide before middle and rather suddenly attenuated towards apex, which is narrowly produced and slightly turned up at the tip in profile; apical hook on the ventral side small and sharply triangular; basal part very large and well bent towards ventral side, with a sagittal aileron relatively narrow; lateral sides of basal orifice moderately emarginate; ventral side nearly straight at middle and slightly concave before apex; inner sac inerm, the sac membrane covered with weakly chitinized scales at the left dorsal side near apical orifice. Styles relatively short and wide, each provided with five apical setae.

Allotopotype: ♂ (9-IV-1956, collected by S. UÉNO and deposited in his collection).

Further specimens examined: 1 ♀ (17-VII-1949, by M. UOZUMI); 1 ♀ (17-III-1953, by S. UÉNO); 1 ♂ (9-IV-1956, by S. UÉNO).

Type-locality: A limestone cave called "Shiroiwa-dô", Kagami-mura, Kôchi Pref., on the Pacific coast of the Island of Shikoku.

This species is closely allied to *I. ishikawai*, and, after the examination of some additional specimens of the two species, the difference between them, given in the original description, has become insufficient to discriminate species, except the difference in the pubescence on the ventral surface. These two species are,

however, clearly distinguishable by the different shape of their aedeagi. The peculiar short robust form of aedeagus is characteristic of *I. uozumii* and may support the independency of the species.

Shiroiwa-dô Cave is open on the right side of the Kagami-gawa River only several metres above water and extends horizontally. The cave floor is very wet and mostly covered with silt. *I. uozumii* is a rare species and is usually found at the innermost room under fragments of rocks fallen from the ceiling. The fauna of this grotto was enumerated by ISHIKAWA¹⁶⁾.

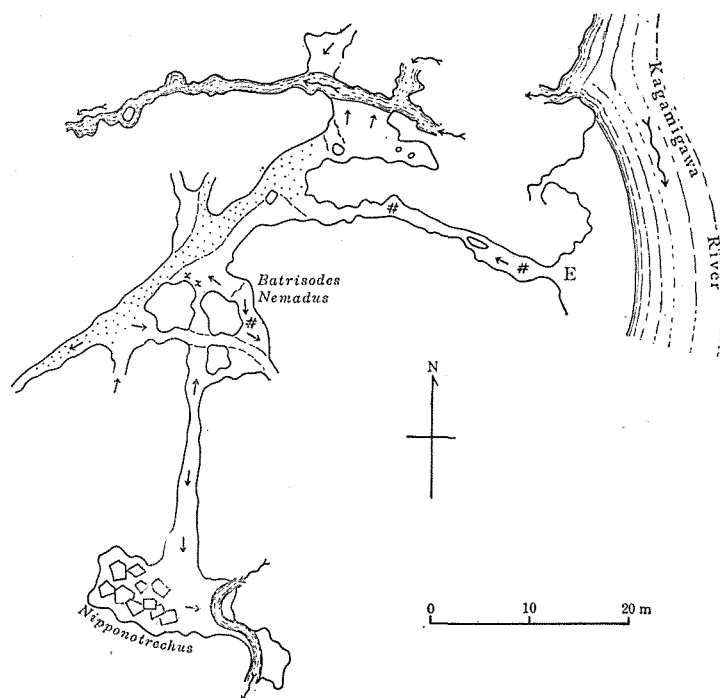


Fig. 20. Map of Shiroiwa-dô Cave; E—entrance.
(Adopted from YAMAUTI, 1931).

***Ishikawatrechus* (*Nipponotrechus*) *ishikawai* (S. UÉNO).**

(Fig. 23)

Nipponotrechus (s. str.) *ishikawai* S. UÉNO, 1951, Ent. Rev. Japan, Osaka, 5, p. 86, pl. 4, fig. D; type-locality: Shôbu-dô Cave in Kôchi Pref.

Nipponotrechus ishikawai, S. UÉNO, 1953, Shin Konchû, Tokyo, 6 (11), p. 45.

Some important characters are added below to complete the original description.

16) ISHIKAWA, 1954, 2, pp. 94-95. His list contains several mistakes, but the writer refrains to revise it at present.

Length: 4.9–5.7 mm (from front margin of clypeus to anal end).

Head subquadrate, both supraorbital areas and front moderately convex, genae slightly convex and rather densely pubescent; mentum tooth bifid, sharply cleft at the tip.

Pronotum elongate-subcordate and convex, 1.4–1.45 times wider than head, a little longer than wide, widest at about four-fifths from base; lateral sides gently rounded in front, widely sinuate behind; apex slightly wider than base, though sometimes almost as wide as the latter according to individuals; hind angles sharp, projecting slightly outwards and much backwards; basal transverse impression shallow and rugose, merging on each side into basal fovea, which is large and deep.

Elytra oval and well convex, fully 1.8 times wider than pronotum, 1.5–1.55 times longer than wide¹⁷⁾, widest at about middle; basal area remarkably depressed, forming a large circular fovea, basal fold at the basal part of stria 5 conspicuous; shoulders prominent and forming on each side a remarkable humeral tubercle, prehumeral borders distinctly emarginate; lateral sides emarginate just behind humeral tubercles, rather strongly rounded at middle and slightly emarginate again before apices, which are rounded; striae shallow, faintly crenulate and becoming shallower on the sides; intervals flat.

Ventral surface more or less pubescent, but the pubescence reduced to the lateral sides on the ventral side of thoraces and to the hind parts of sternites 3–5.

Male genital organ fairly large and well chitinized. Aedeagus elongate and weakly arcuate, gradually attenuated towards apex, which is thick and slightly turned up at the tip in profile; apical hook on the ventral side large and sharp; basal part moderately bent towards ventral side and with a sagittal aileron; lateral sides of basal orifice deeply emarginate; ventral side slightly convex at middle and slightly concave before apex; inner sac inerm. Styles relatively elongate, left style provided with four apical setae, while right style with three apical setae only.

Further specimens examined: 2 ♀♀ (22–XII–1948, collected by T. KAWASAWA and M. UOZUMI); 1 ♀ (8–IV–1956, by S. UÉNO).

Locality: A limestone cave called “Shôbu-dô”, at Shôbu, Tosayama-mura, Kôchi Pref., on the Pacific coast of the Island of Shikoku.

Ishikawatrechus ishikawai is a relatively large species in the subgenus, having well developed humeral tubercles of elytra and large aedeagus. It was found by KAWASAWA and UOZUMI for the first time in 1948, and was not very rare in the depth of Shôbu-dô Cave before 1950. Since then, however, the habitats of the species have been gradually destroyed and the beetle has become one of rare species.

A brief note was given in the original description regarding the habitats of this species. ISHIKAWA also described an outline of the environment in Shôbu-dô Cave and the cave fauna¹⁸⁾. Some troglobiontic animals have been described from the

17) The ratio of length to width of elytra is misprinted in the original description as the elytra are “1.7 times longer than wide”.

18) ISHIKAWA, 1954, 2, pp. 93–94.

cave since that time¹⁹⁾, and a revision of ISHIKAWA's list should be required. At present, however, the writer has no intention to delineate the details of up-to-date knowledges of the cave fauna.

Ishikawatrechus (Nipponotrechus) subtilis S. UENO, sp. nov.

(Figs. 17, 19, 24)

Length: 4.4–4.6 mm (from front margin of clypeus to anal end).

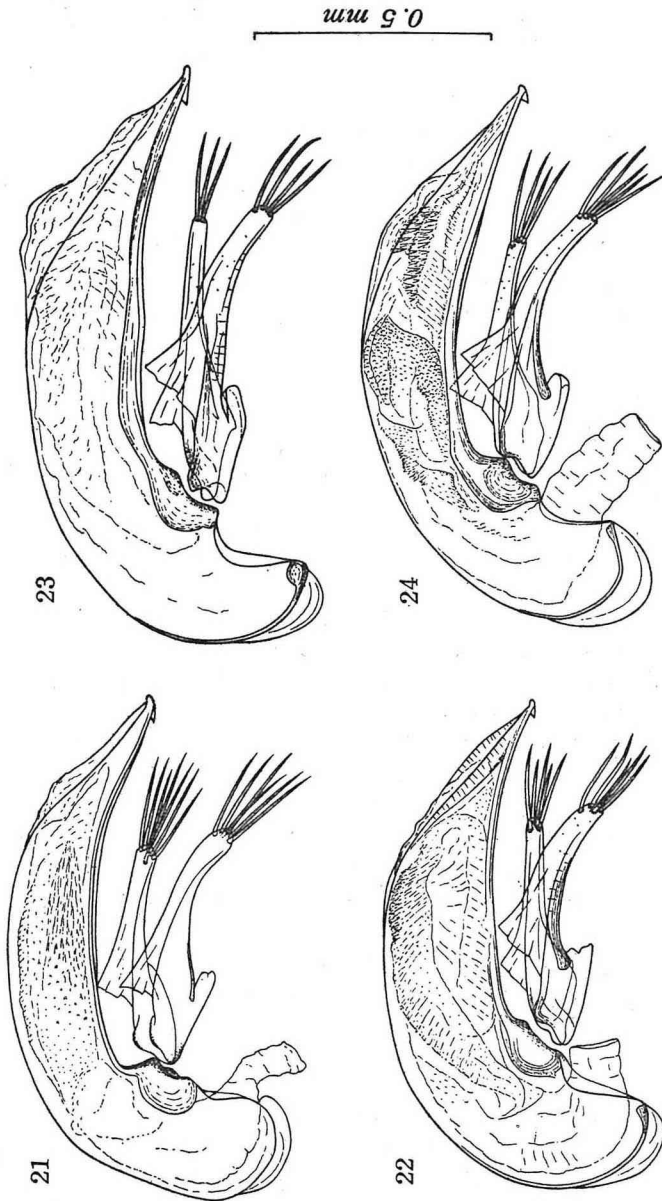
Body surface rather sparsely pubescent. Colour reddish brown, shiny, translucent when alive; palpi, apical segments of antennae and legs pale reddish brown.

Head large, with deep frontal furrows, both supraorbital areas and front convex; genae well convex and pubescent; microsculpture composed of wide meshes; mentum tooth bifid or distinctly emarginate at the tip; antennae relatively stout, extending beyond the middle of elytra.

Pronotum cordate, contracted behind and convex, fully 1.3 to fully 1.4 times wider than head, always a little wider than long, widest at about five-sixths from base; lateral sides narrowly and strongly rounded in front, widely sinuate behind the widest part though the narrowest part between them placed relatively close to hind angles; apex widely but not deeply emarginate, distinctly wider than base, which is about five-sixths of the width of apex, arcuate and reduced at middle; front angles a little advanced and widely rounded, hind angles sharp, projecting slightly outwards and strongly backwards; median line distinct, widening near base; apical transverse impression vague, more or less wrinkled, basal transverse impression fairly deep and rather wide, merging on each side into basal fovea, which is fairly large, deep and smooth; surface covered with sparse suberect pubescence, both apical and basal areas with irregularly longitudinal striations, microsculpture moderately marked, formed by fine transverse lines. Ventro-lateral sides of prothorax somewhat expanding outwards and slightly visible from above.

Elytra oval and convex, about 1.6 times wider than pronotum, 1.6–1.65 times longer than wide, widest at about middle; basal depression evident though not very deep, basal fold at the basal part of interval 5 obvious and forming a remarkable carina at the basalmost portion; shoulders distinct though rounded, not forming humeral tubercles; prehumeral borders oblique and slightly emarginate, disappearing anteriorly beneath a basal fold; lateral sides hardly emarginate behind shoulders, gently rounded at middle and slightly emarginate before apices, each one of which is subangulate; striae superficial and indistinctly crenulate, outer striae nearly obsolete, striae 1 and 2 deepening near base; apical striole deep; intervals flat, each with a row of rather sparse pubescence; stria 3 with two dorsal pores located at one-seventh to one-sixth and one-third from base respectively, stria 5 with one dorsal pore at four-sevenths to three-fifths from base according to individuals; microsculpture consisting of fine transverse lines.

19) E. g., *Allochthonius ishikawai* MORIKAWA, 1954, *Epanerchodus spinosus* MIYOSI, 1955, *Onychiurus ishikawai* YOSHII, 1956, *Cavernobrya shobuensis* YOSHII, 1956, etc.



Figs. 21-24. Male genital organ, left lateral view.—21. *Ishikawatrechus (Nipponotrechus) intermedius* sp. nov., of Ohchi-dô Cave.—22. *Ishikawatrechus (Nipponotrechus) uozumii* (S. UENO), of Shiroiwa-dô Cave.—23. *Ishikawatrechus (Nipponotrechus) ishikawai* (S. UENO), of Shôbu-dô Cave.—24. *Ishikawatrechus (Nipponotrechus) subtilis* sp. nov., of Anagami-dô Cave.

Ventral surface almost glabrous, but sternites 3-5 with a few hairs on the median part along respective hind margin. Legs slender.

Male genital organ rather large and moderately chitinized. Aedeagus slender and arcuate, with the dorsal side semicircularly rounded in profile; basal part fairly elongate and not strongly bent towards ventral side; apical part gradually tapering towards apex, which is narrowly produced in profile and slightly turned up at the extremity; apical hook on the ventral side small and sharply triangular; ventral side slightly and widely concave at middle; lateral sides of basal orifice rather deeply emarginate; sagittal aileron large and hyaline; inner sac armed with a group of large teeth from the left to the dorsal sides near apical orifice and also covered with weakly chitinized scales at the left side before middle. Styles slender and arcuate, each provided with four apical setae, but sometimes five setae present on one of the two styles.

Holotype: ♂, allotype: ♀, paratypes: 5 ♂♂ (12-IV-1956, collected by S. UÉNO and preserved in his collection).

Type-locality: A limestone cave called "Anagami-dô", at Tsutsujô, Shinagawa, Mikawa-mura, Ehime Pref., on the central massif of the Island of Shikoku.

This is a remarkable new species rather isolated in the subgenus *Nipponotrechus*. It may easily be separated from the other three species of the same group by the following combination of features: the pubescence on the body surface is sparser; the genae are well convex; the pronotum is evidently contracted behind and with narrower base; the shoulders of elytra are not tuberculate, with the humeral borders emarginate; the ventral surface is almost glabrous except a few hairs on sternites; the aedeagus is slender and not strongly bent towards ventral side at the basal part; and, the inner sac is armed with a group of large teeth.

Anagami-dô Cave is located about 42 km west of Shiroiwa-dô Cave, about 3,500 m east of Kuroiwa-dô Cave and some 300 m above the level of the latter. It is an effluent cave, opening the entrance under an outcrop of limestone on the north-western slope of a range and being developed along the fault as a stream passage. The underground stream, which issues from under the roof fall at the innermost part, runs through all the length of the cave, and sweeps the inhabitants and their nutriment away from the passage. Cave animals are, therefore, extremely scarce in the passage from the entrance to the innermost, as stated by ISHIKAWA²⁰). There are, however, two-storeyed platforms on the left side of the subterranean stream near the innermost of the cave. No flood of the stream appears to reach the platforms, where there are rich in organic matters such as bats' guano or decayed wood. Many troglobiontic animals were obtained there by the present writer, i.e. arachnids, a pseudoscorpion, a chilopod, diplopods, springtails, cave-crickets, a catopid and the trechid. The present new species was found under fragments of rocks and pieces of rotten boards or walking on a heap of guano.

20) ISHIKAWA, 1954, 3, p. 40.

Genus *Awatrechus* S. UÉNO.

Awatrechus S. UÉNO, 1955, Mem. Coll. Sci. Univ. Kyoto, (B), 22, p. 36; type-species: *Awatrechus hygrobii* S. UÉNO, 1955.

This genus was established for a single troglobiontic species found in a limestone cave in the Province of Awa. As the result of a recent expedition to the mountainous regions of the same province, two other members of the genus were obtained in three different limestone caves. These species are remarkable in showing the grade of variations in the chaetotaxy and the pubescence on the body surface. The diagnosis of the genus will, therefore, be revised as seen below.

Body anophthalmoid; apterous and depigmented; head glabrous on dorsal surface; pronotum always covered with dense suberect pubescence; elytra either glabrous (*A. hygrobii* and *A. religiosus*) or pubescent (*A. pilosus*).

Head with deep entire frontal furrows which are not angulate; eyes absent; genae convex and pubescent; mentum free, not fused with submentum; mentum tooth simple and triangular; submentum with three setae on each side; palpi slender, with apical segments acuminate towards the tips.

Pronotum cordate and convex; lateral sides narrowly but entirely bordered, with both lateral and postangular setae, the latter of which is removed forwards considerably; hind angles sharp and salient. Elytra fused together (at least partly), convex, with a transverse furrow on basal peduncle; basal area more or less depressed; shoulders usually salient though regularly rounded in *A. pilosus*, pre-humeral borders oblique; lateral sides rather widely explanate and reflexed; striae entire, scutellar striole short but obvious; apical striole distinct, joining stria 5 in *A. hygrobii* and *A. religiosus*, but joining stria 7 in *A. pilosus*; apical carina obtuse though distinct; stria 3 without dorsal pores in the type-species, but with one setiferous dorsal pore near base in *A. religiosus* and *A. pilosus*, stria 5 with two setiferous dorsal pores, preapical pore located on the meeting point of striae 2 and 3; humeral group of umbilicate pores not aggregated, first three pores ranged nearly equidistantly but the fourth isolated, the first pore adjoining marginal gutter.

Prosternum with a few pubescence. Sternites pubescent in *A. pilosus*, but, in *A. hygrobii* and *A. religiosus*, the pubescence reduced to a few minute hairs existing along the median part of respective hind margin of sternites 3-5; anal sternite with one seta in ♂, two in ♀ on each side. Legs slender; protibiae externally grooved and almost glabrous, but with several minute hairs on the apical portion of the anterior face²¹⁾; tarsal segment 4 with a long ventral apophysis; in ♂ protarsal segments 1 and 2 dilated, inwardly produced at apices and furnished beneath with sexual adhesive appendages.

Male genital organ rather large. Aedeagus arcuate especially in basal half and

21) These hairs are so minute as to be difficult to perceive them in some individuals. Under high magnification, however, the trace of these hairs is always detectable.

attenuated towards apex, which is prolonged and dilated into a compressed circular plate; sagittal aileron absent. Inner sac armed with a copulatory piece and covered with numerous teeth; copulatory piece more or less developed, not bifid at apex and placed at the right or right ventral side inside the sac. Styles more or less arcuate, left style longer than right style, each provided with four setae at apex.

One of the features described above, the peculiar structure of aedeagal apex, seems to be particularly important to characterize the genus. Such a striking apical plate of aedeagus has never been known in the trechid genera which are distributed over the Japanese Islands and the adjacent territories.

In the type-species, there is no dorsal pore on the 3rd elytral stria. On the contrary, one setiferous dorsal pore is present on the basal part of the 3rd elytral stria in the two new species described later. However, the presence or absence of a setiferous dorsal pore on the 3rd elytral stria seems to be a character of less importance and may have no more than specific value.

A. pilosus is a rather isolated species in the genus in having the pubescent elytra and the peculiar structure of the apical striole on elytra. That the apical striole is joining the 7th stria and not joining the 5th is a character which seems to have been unknown among the trechid genera. However, the structure of male genitalia of this species is of quite the same type as those of the other two species. The homogeneity of the genus is also proved by the conformity of some other important characters. It seems, therefore, not to be necessary to separate *A. pilosus* from the other two species with generic or even subgeneric rank. Similar condition of the apical striole is also found in several individuals of *Ishikawatrechus ishikawai* as well as in an undescribed species of *Pseudotrechiana* which inhabits a lava cave at the foot of Mt. Fuji.

Key to the species

- 1 (4) Elytra glabrous, with apical striole joining stria 5; copulatory piece rounded at apex.
- 2 (3) Elytral stria 3 without dorsal pore; prehumeral borders very oblique; copulatory piece smaller than the apical plate of aedeagus; smaller species, of slenderer body form; length: 4.0-4.5 mm; (Ryû-no-iwaya Cave) *A. hygrobius* S. UÉNO.
- 3 (2) Elytral stria 3 with one dorsal pore near base; prehumeral borders less oblique; copulatory piece evidently larger than the apical plate of aedeagus; large species, of robuster body form; length: 4.5-5.0 mm; (Zenjô-kutsu Cave)..... *A. religiosus* sp. nov.
- 4 (1) Elytra pubescent, with apical striole joining stria 7; elytral stria 3 with one dorsal pore near base; dorso-apical angle of copulatory piece produced into a sharp tooth; length: 4.1-4.7 mm; (Tôgen-daiichi-dô Cave and Tôgen-daisan-dô Cave) *A. pilosus* sp. nov.

Awatrechus religiosus S. UÉNO, sp. nov.

(Figs. 25-27)

Length: 4.5-5.0 mm (from front margin of clypeus to anal end).

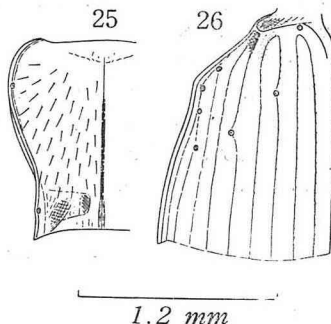
Closely allied to *A. hygrobicus* and well accord with the description of the latter²²⁾ excepting the features noted below.

Head wider, with genae a little more convex and more densely pubescent than those in *A. hygrobicus*; antennae extending a little beyond the middle of elytra. Pronotum wider than that in *A. hygrobicus*, with the widest part more posteriorly; about 1.45 times wider than head, a little wider than long, widest at about three-fourths from base; lateral sides more widely and strongly rounded in front, widely and deeply sinuate behind; apex as wide as or a little wider than base, which is bisinuate; hind angles large and sharp, protruding both outwards and backwards.

Elytra evidently wider than those in *A. hygrobicus*, oval and convex; about 1.65 times wider than pronotum (the ratio somewhat variable according to individuals), about 1.5 times longer than wide, widest a little behind middle; basal depression somewhat deeper than that in *A. hygrobicus*, with basal carina at the base of interval 5 a little more prominent; shoulders much more prominent and prehumeral borders distinctly less oblique than those in *A. hygrobicus*; lateral sides slightly emarginate behind shoulders (though the emargination somewhat deeper than in *A. hygrobicus*), more strongly rounded at middle than in the type-species; intervals smooth, moderately convex near suture but flat on the sides; stria 3 with one dorsal pore located at one-seventh to one-sixth from base, stria 5 with two dorsal pores at about one-fourth and four-sevenths from base respectively.

Sternites 3-5, each with an irregular row of several hairs along the median part of hind margin.

Aedeagus thicker in apical half than that of *A. hygrobicus* and rather suddenly attenuated towards apex, with basal part narrower and much less strongly bent towards ventral side; apical plate more regularly circular than that in *A. hygrobicus*; lateral sides of basal orifice moderately emarginate; copulatory piece spatulate, of similar form to that of *A. hygrobicus* but much larger, placed at the right ventral side inside inner sac; the patch of numerous teeth not separated into two groups and twisted from dorso-proximal to left apical. Styles slender and arcuate as those in *A. hygrobicus*.



Figs. 25-26. *Awatrechus religiosus* sp. nov., ♂, of Zenjō-kutsu Cave; outlines of the left side of pronotum (25) and the humeral part of left elytron (26).

22) Cf. UÉNO, 1955c, pp. 38-40, figs. 1-2.

Female unknown.

Holotype: ♂, paratypes: 9♂♂ (30-IV-1957, collected by S. UÉNO and deposited in his collection).

Type-locality: A limestone cave called "Zenjô-kutsu", at Kanjôdaki, Takahoko, Kamikatsu-chô, Tokushima Pref., on the eastern part of the Shikoku mountain range.

Zenjô-kutsu Cave is situated at a place about 16 km south-west of Tokushima City and about 12.5 km north-west of Ryû-no-iwaya Cave. Its mouth is not large, opening on a large outcrop of limestone, which lies on the southern slope of a hill about 650 m above sea level. The cave has been possessed by a temple as a sacred place and has long been well known among natives. It is formed by a winding corridor, which is so narrow at several points as to be difficult to pass through. The floor is either silty or stalagmitic, and in the depth, it is covered with half-decayed logs, notwithstanding that it appears to be very difficult to bring them in. The cave animals are not so rich in the number of species, probably due to the limitation of their habitats. The troglobionts obtained are arachnids, diplopods, springtails, the trechid and an anchomenid (*Jujiroa* sp.). The present new trechid was rather frequently found under logs or stones on the silty floor. Such a habitat of it is much different from that of *A. hygrobicus*, which is found on the bank of a subterranean stream.

***Awatrechus pilosus* S. UÉNO, sp. nov.**

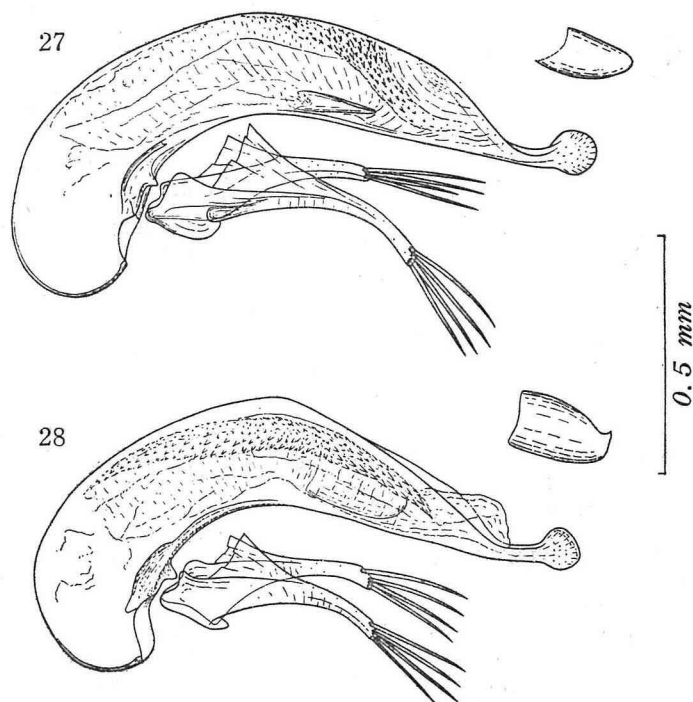
(Figs. 28-29)

Length: 4.1-4.7 mm (from front margin of clypeus to anal end).

Colour reddish brown, shiny, translucent when alive; palpi pale, antennae becoming paler towards apices, legs and sternites pale reddish brown.

Head fairly wide, both supraorbital areas and front moderately convex; frontal furrows deep and not strongly divergent in front; microsculpture well marked, formed by reticulation; genae moderately convex and densely pubescent; antennae rather stout and relatively short, reaching the middle of elytra.

Pronotum cordate and convex, about 1.45 times wider than head (the ratio variable to some extent according to individuals), about 1.1 times wider than long, widest at about three-fourths from base; lateral sides widely and gently rounded in front, widely but not deeply sinuate behind; apex slightly emarginate, usually a little wider than base, but rarely about as wide as the latter according to individuals; base nearly straight at middle or slightly bisinuate; front angles a little advanced and widely rounded; hind angles sharp, projecting a little outwards and much backwards, though not so strongly protruding as in the other two species of the genus; median line distinct but not very deep, not reaching apex and widening near base; apical transverse impression vague, more or less wrinkled; basal transverse impression wide and deep, merging on each side into basal fovea, which is large, deep and more or less uneven; surface more or less uneven, especially on



Figs. 27-28. Male genital organ, with separated copulatory piece; left lateral view.—27. *Awatrechus religiosus* sp. nov., of Zenjō-kutsu Cave.—28. *Awatrechus pilosus* sp. nov., of Tōgen-daichi-dō Cave.

the disk, both apical and basal areas with longitudinal striations; microsculpture formed by fine transverse lines though indistinct.

Elytra oval and well convex, 1.65-1.7 times wider than pronotum, about 1.4 times longer than wide (the ratio somewhat variable according to individuals), widest at about or slightly behind middle; basal depression obvious but not deep; shoulders distinct though rounded, prehumeral borders oblique; lateral sides very slightly emarginate behind shoulders, moderately rounded at middle and slightly emarginate again before apices, which are rounded; striae superficial and crenulate, striae 1 and 2 deepening near base; apical striole shallow and not strongly curved, joining or nearly joining stria 7; intervals flat, each with a row of suberect pubescence on the middle, the basal part of interval 5 moderately raised but not forming a distinct basal carina; stria 3 with one dorsal pore placed at one-eighth to one-seventh from base, stria 5 with two dorsal pores at one-fifth to one-fourth from base and a little behind middle respectively; microsculpture formed by fine transverse lines though indistinct.

Ventral surface sparsely pubescent. Legs relatively stout; protibiae deeply grooved on the external face.

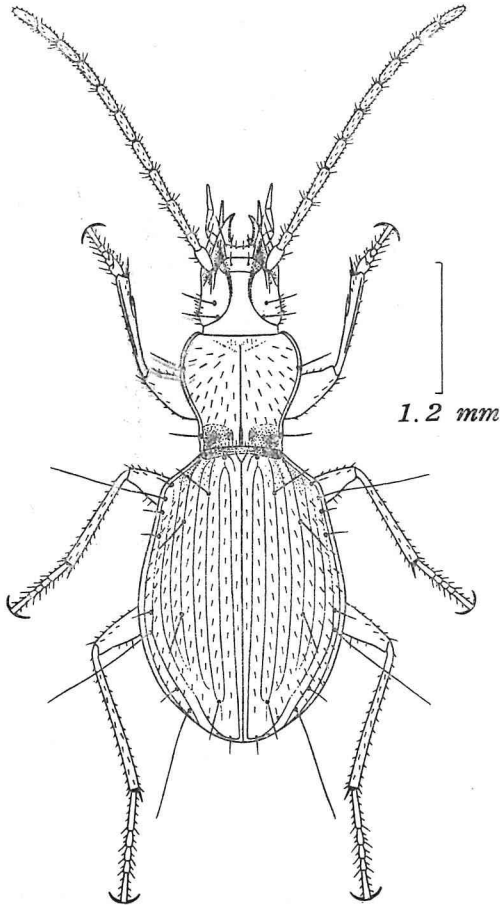


Fig. 29. *Awatrechus pilosus* sp. nov., ♂, of Tōgen-daiichi-dō Cave.

“Tōgen-daisan-dō”, on Mt. Hizuka, at Takano, in Sawadani, Kisawa-mura, Tokushima Pref., on the central massif of the Island of Shikoku.

As mentioned before, this new species is remarkable in the pubescent elytra, the elytral apical striole which joins the 7th stria, and the toothed apex of copulatory piece. Further, it is easily distinguished from the other two species of the genus by the short prothorax and the short oval form of elytra.

The three limestone caves Tōgen-daiichi-dō, Tōgen-daini-dō and Tōgen-daisan-dō were discovered in the summer of 1955. They are located on the southern slope of Mt. Hizuka at an elevation of about 900 m and are placed closely each other. The situation of the caves is about 23 km west of Ryū-no-iwaya Cave on Mt. Tai-

Male genital organ moderately chitinized. Aedeagus strongly arcuate, fairly thick in basal half and gradually attenuated towards apex in apical half; apex prolonged, gently turned up and dilated into a circular plate; basal orifice fairly large, with lateral sides moderately emarginate; ventral side well concave before middle, nearly straight or slightly convex in apical half; copulatory piece large and gutter-shaped, with apex rounded on ventral side but produced into a sharp tooth on dorsal side; a longitudinal patch of numerous teeth spreading almost all over the dorsal side of inner sac. Styles rather stout, left style a little longer than the right.

Holotype: ♂, allotype: ♀ (Tōgen-daiichi-dō Cave, 2-V-1957, collected by S. UÉNO). Paratypes: 1 ♀ (Tōgen-daiichi-dō Cave, 28-VII-1955, by C. ABE); 1 ♂, 3 ♀♀ (Tōgen-daiichi-dō Cave, 2-V-1957, by S. UÉNO); 1 ♀ (Tōgen-daisan-dō Cave, 2-V-1957, by S. UÉNO).

The type-specimens are preserved in the writer's collection.

Type-localities: Limestone caves called “Tōgen-daiichi-dō” and

ryûji, about 15.5 km south-west of Zenjô-kutsu Cave at Kanjôdaki and about 18 km east of Fudô-no-iwaya Cave near the summit of Mt. Tsurugi.

Tôgen-daiichi-dô Cave is open on a large outcrop of limestone and consists of two storeyed galleries. The floor of the lower gallery is stalagmitic, very humid and scanty of organic matters, while the upper gallery is relatively dry and rich in bats' excreta. The present new trechid was found mainly in the depth of the lower gallery, under stones or walking on the stalagmitic floor. Many other cavernicoles were also obtained in this grotto, i.e., a snail, arachnids, a mite, an opilionid, a pseudoscorpion, a terrestrial isopod, diplopods, springtails, cave-cricket, a catopid and a pselaphid.

Tôgen-daini-dô Cave is a pot-hole and has not been surveyed by the present writer nor by any other biospeologist up to the present.

Tôgen-daisan-dô Cave is a narrow winding corridor, opening the small mouth under an outcrop of limestone. The cave floor is relatively dry and covered throughout with fragments of rocks. Cave animals are not rich in this small grotto both in the number of species and individuals. Besides the trechid, there were obtained only six species of cavernicolous animals: two arachnids, two diplopods, a springtail and a grylloblattid.

There are several other limestone caves in the village of Kisawa-mura, e.g. Myôjin-no-iwaya Cave at Obataké in Sawadani, Gongen-no-ana Cave at Takayama in Sakashû and so on. No cave trechid was found in these caves.

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Explanation of Plate I

- Fig. 1. Entrance of Saruta-dô Cave in Kôchi Pref.
- Fig. 2. Entrance of Shiroiwa-dô Cave in Kôchi Pref.; taken from the inside of the cave.
- Fig. 3. Entrance of Anagami-dô Cave in Ehime Pref.
- Fig. 4. Entrance of Kuroiwa-dô Cave in Ehime Pref.

