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## Some Water-Mites from Hiroshima Prefecture<sup>1)</sup>

By

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(With 39 Text-figures)

There has been no record on water mites from Hiroshima Prefecture and its vicinity. The author made a trip of collection for water mites in Pref. Hiroshima on the advice of Dr. T. Uchida last autumn (1951) and captured 35 species of water mites, including both stenophilous and rheophilous ones. The specimens here consulted were all collected by the author in the following localities: on Oct. 9 in a stream in Shinjô-mura, Yamagata-gun; on Oct. 10 in pools in Ōasa-mura, Yamagata-gun, both mountaneous region of the Chugoku range of mountains; on Oct. 11 in Sandan-kyo torrent of the same mountain range; on Oct. 12 in a pool in Kumano-mura, a hilly region about 15 km southeast from Hiroshima City which suffered the attack of an atomic bomb in 1945. The list of the species studied is as follows:

1. *Hydrachna* sp.
2. *Calonyx hadai* n. sp.
3. *Hydrodroma despiciens* (O. F. Müller)
4. *Sperchon* (*Hispidosperchon*) *plumifer* Thor
5. *Sperchon* (*Hispidosperchon*) *violaceus* Walter var.
6. *Sperchon* (*Hispidosperchon*) *uchidai* n. sp.
7. *Lebertia* (*Pilolebertia*) *leioderma* Viets
8. *Torrenticola* (s. str.) *elliptica* Maglio
9. *Torrenticola* (s. str.) *iaponica* n. sp.
10. *Torrenticola* sp.
11. *Limnesia* sp.
12. *Hygrobates* (*Hygrobates*) *papillosus* n. sp.
13. *Hygrobates* (*Hygrobates*) *longiporus* Thor
14. *Hygrobates* (*Hygrobates*) *calliger* Piersig
15. *Hygrobates* (*Hygrobates*) *minutus* n. sp.

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1) Contribution from the Biological Institute, Hokkaido Gakugei University.

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16. *Atractides* (s. str.) *spatiosus* (Viets)
17. *Atractides* (s. str.) *gracilis* (Sokolow)
18. *Atractides* (s. str.) *izuensis* (Enami)
19. *Atractides* sp.
20. *Unionicola* (*Hexatax*) *crassipes* (O. F. Müller)
21. *Brachypoda* *versicolor* (O. F. Müller)
22. *Aturus* *duplex* Thor
23. *Aturus* *miyashitai* Uchida
24. *Aturus* *uchidai* n. sp.
25. *Aturus* *hiroshimaensis* n. sp.
26. *Aturus* *rotundus* n. sp.
27. *Kongsbergia* *hiroshima* n. sp.
28. *Kongsbergia* *uchidai* n. sp.
29. *Kongsbergia* *enami* n. sp.
30. *Arrenurus* (*Arrenurus*) *agrionicolus* Uchida
31. *Arrenurus* (*Arrenurus*) *japonicus* Uchida & Imamura
32. *Arrenurus* (*Arrenurus*) *petiospinus* n. sp.
33. *Arrenurus* (*Arrenurus*) *hadai* n. sp.
34. *Arrenurus* sp.
35. *Arrenurus* (*Micruracarus*) *madarászi* (Daday)

Among these, *Hydrodroma despiciens* and *Unionicola crassipes* are the cosmopolitan forms. The following five species; *Hydrachna* sp., *Torrenticola* sp., *Limnesia* sp., *Atractides* sp. and *Arrenurus* sp. could not be decided their specific names, because only the nymphs were examined. Four species; *Sperchon plumifer*, *Torrenticola elliptica*, *Hygrobates longiporus* and *Brachypoda versicolor* seem to be widely distributed from Europe to the East-Siberia. As European forms were counted the following three species; *Sperchon violaceus*, *Lebertia leioderma* and *Hygrobates calliger*. *Atractides spatiosus* has hitherto been known in Java, *Atractides gracilis* in Ussuri-regions and *Aturus duplex* in Turkey. As the forms peculiar to Japan the following four species were found; *Atractides izuensis*, *Aturus miyashitai*, *Arrenurus agrionicolus* and *Arrenurus japonicus*. *Arrenurus madarászi* is widely distributed in the Orient. All the other 13 species seem to be new to science.

Before proceeding further the author wishes to express his cordial thanks to Dr. Tohru Uchida, Professor of Zoology in Hokkaido University, for his kind guidance and encouragement in the course of this study. His hearty thanks must be extended here to Dr. Yosine Hada, a limnologist in Hiroshima Prefecture, for his kind management in collecting materials.

### 1. *Hydrachna* sp. (Fig. 1)

*Nymph*. Body globular in shape, 0.92 mm long and 0.82 mm wide. Skin soft, colourless and covered with scale-like small papillae. Interval between eyes 345  $\mu$ . Frontal organ large, round in shape and situated between dorsal plates at the anterior parts. Anterio-dorsal plates 415  $\mu$  long, 207  $\mu$  wide and indicate

some notches on the surface. Mandibles spine-like in shape, measuring  $656 \mu$  in length. Palpi with six short spines in the second segment : one on the inner lateral side and the other five on the extensor surface. The measurement is given in Table 1 (in  $\mu$ ).

Table 1.

Segments	1	2	3	4	5
Extensor surface	148	128	164	72	38
Flexor surface	92	92	120	24	32

The measurement of legs is as in Table 2 (in  $\mu$ ).

Table 2.

Legs \ Segments	1	2	3	4	5	6
I	60	124	88	124	148	156
II	72	168	112	188	248	240
III	88	176	120	256	288	240
IV	160	188	164	316	332	236

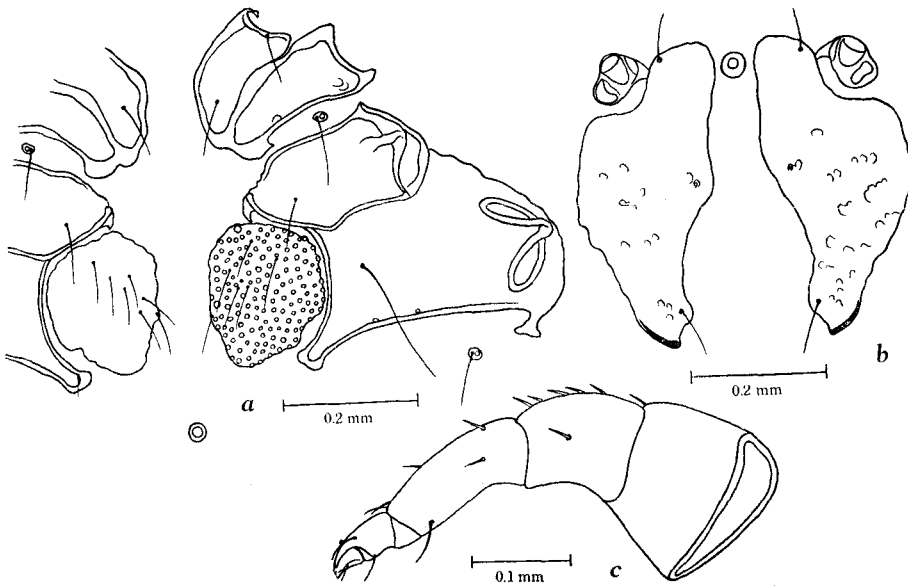


Fig. 1. *Hydrachna* sp., nymph.

a. Epimera and provisional genital organ. b. Anterio-dorsal plates and frontal organ. c. Right palpus.

Provisional genital plates almost round in shape, yet the margins somewhat irregularly rugged. Each plate is measured 208  $\mu$  long and 160  $\mu$  wide, provided with six to seven fine hairs on the surface. Colour red. Eyes reddish black.

*Locality.* A nymph captured on Oct. 12, 1951 in a pond in Kumano-mura.

*Remarks.* In the subgenus *Diplohydrachna*, only the nymphal stage of *Hydrachna (Diploh.)* sp. has been recorded from Japan by Prof. T. Uchida (1931) in the environs of Tokyo, who has described the nymphophan as parasitic on legs of a water-scorpion *Ranatra chinensis*. The species here described is somewhat different in the shape of antero-dorsal plates from those of Uchida's figure. The present nymph is coincided in the dorsal plates with *Hydrachna goldfeldi* and *H. cruenta*, it is different from them in frontal organ which is very large and situated more anterior than them. The nymph here described is coincide most with Soar's (1908) figure of *H. thoni* found in England.

## 2. *Calonyx hadai* n. sp.<sup>1)</sup> (Fig. 2)

*Male.* Body small, 0.48 mm long, 0.42 mm wide, almost oval in shape, expanding at the shoulders, straight at its frontal margin and round in the posterior contour in dorsal view as given in the figure. Skin without chitinous plates. Frontal organ rather small and colourless, lying on the midway between eyes. The dorso-glandularia and sensory hairs both arranged in rows are given in Text-figure 2. Near the lateral ends of the anterior margin, in front of eyes, there are several short filiform papillae which seem to be utilized as sensory organs. Interval between eyes 262  $\mu$ . Maxillar organ 180  $\mu$  long and 140  $\mu$  wide. Rostrum moderately projected as in the text-figure. Mandibles characteristically thick and strong, measuring 70  $\mu$  high and 216  $\mu$  long inclusive of each a claw 60  $\mu$  long. The bristles on palpi are few. The second segment has three spines: one feathered situating on lateral side and two others, one feathered and another trifurcated, situated on the extensor surface near the terminal portion. The third segment is provided with two spines, one on each lateral side. The measurement of the segments is given in Table 3 (in  $\mu$ ).

Table 3.

Segments	1	2	3	4	5
Extensor surface	12	81	42	108	30
Flexor surface	24	21	36	48	27

The bristles on the epimera are moderate in number. The first epimera are long-

1) The new species has been named in honour of a limnologist Dr. Yosine Hada in Hiroshima Prefecture.

triangular in shape, bearing four spine-like bristles on the anterior margin and a fine hair in the posterior part. The second epimera are trapezoidal in contour with three spines and a hair. The third pair have three and the fourth two spines.

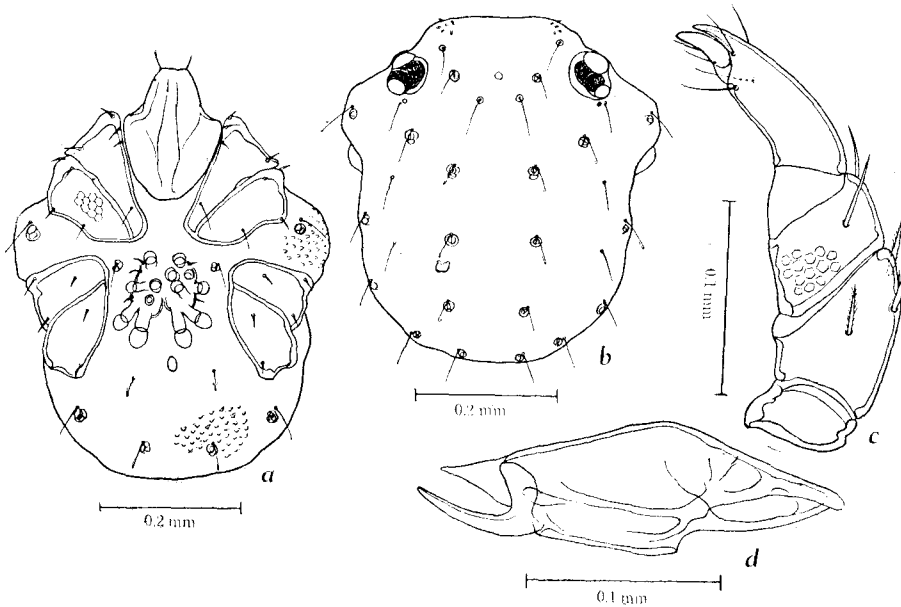


Fig. 2. *Calonyx hadai* n. sp., male.

a. Ventral view. b. Dorsal view. c. Right palpus. d. Maudible.

The last segment of all legs is considerably thickened toward the distal end, which is provided with two strong comb-toothed claws. Each claw consists of a central tooth of considerable length and thickness and a great number of short and thinner lateral teeth. The claw-teeth, exclusive of a central one, of legs are counted as in Table 4.

Table 4.

Legs	1	2	3	4
Outer side	3	3	3	3
Inner side	13	10	12	13

The measurement of legs is given in Table 5 (in  $\mu$ ).

Table 5.

Legs \ Segments	Segments					
	1	2	3	4	5	6
I	64	72	96	112	128	144
II	68	68	96	120	140	148
III	64	72	100	128	148	164
IV	84	80	128	160	172	172

Genital organ lying between the posterior epimera-groups, having thirteen stalked acetabula: six on the right side and seven on the left side. Surrounding the genital acetabula, very poorly developed genital plates, one on each genital lip, are present. The plates are long and bent roundly forward at the posterior portion as indicated in the text-figure. Nephridial pore lying at about a third anterior portion between the genital area and the posterior body margin. Colour vermilion red. Eyes reddish black.

*Locality.* Only a male captured on Oct. 11, 1951 in Sandan-kyo torrent.

*Remarks.* Though somewhat resembling *Calonyx rotundus* in Europe and *C. japonicus* in Hokkaido, the new species differs from both the species in the shape of epimera, in the fewness of number of the genital acetabula and in the body size.

### 3. *Hydrodroma despiciens* (O. F. Müller) (Fig. 3)

*Nymph.* Body globular in shape, 0.77  $\mu$  long and 0.67  $\mu$  wide. Eyes in double pairs and their interval is each 384  $\mu$  in anterior pair and 448  $\mu$  in posterior one. Maxillar organ and mandibles both similar to those of the imago, measuring 140  $\mu$  long and 96  $\mu$  wide, and 180  $\mu$  long including a claw in each and 46  $\mu$  high respectively. The palpi are also alike to those of the imago. The measurements are as in Table 6 (in  $\mu$ ).

Table 6.

Segments	1	2	3	4	5
Extensor surface	28	48	36	120	56
Flexor surface	32	20	20	46	52

Epimera plates almost the same as those of the imago except less number of hairs. Legs also poor in the number of hairs as compared with those of the imago. Provisional genital organ provided with four large round acetabula, arranged in a quadrate position, and two fine hairs between the fore and hinder acetabula.

Genital pore not opened. Excretory pore located behind the provisional genital organ. Colour orange red. Eyes blackish red.

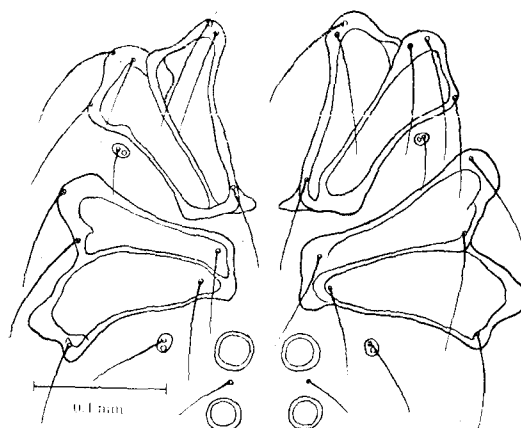


Fig. 3. *Hydrodroma despiciens*, nymph.  
Epimera and provisional genital organ.

*Localities.* Collected many males, females and five nymphs on Oct. 10, 1951 in a pond in Ōasa-mura, Yamagata-gun and many males, females and two nymphs in a pool in Kumano-mura on Oct. 12, 1951.

*Remarks.* The common species was firstly recorded from Japan by the author in 1952 from Kyushu with the description of male. The present species has been collected also by the author from Hyogo Prefecture, Tohoku District and Hokkaido.

#### 4. *Sperchon (Hispidosperchon) plumifer* Thor (Figs. 4, 5)

*Male* (Fig. 4). Body blobular in shape, 0.53 mm long and 0.52 mm wide in the widest portion. Anterior margin of body in dorsal view rather straight. Skin thick and marked with figures of hexagonal net-work, bearing innumerable minute hairs. On closer examination, fine striations can be seen besides the hexagonal net-work just mentioned. The glandular plates and accessory hairs in dorsum and venter are shown in the text-figures. Interval between eyes 285  $\mu$ . Maxillar organ moderate in size, 185  $\mu$  long and 125  $\mu$  wide. Mandibles rather short, 208  $\mu$  long, including a claw in each and 48  $\mu$  high. Palpi very thick in the basal portion and becoming slender in the terminal portion. Second segment, broadest of all, with a process at the distal portion of the flexor surface and on the rounded extensor surface, provided with eight spines, three of which are feathered.



The process is  $44 \mu$  long and bears three spines on its summit. Third segment bearing several unfeathered spines on extensor surface only. Fourth segment very slender and long curving moderately. The measurement of segments is as in Table 7 (in  $\mu$ ).

Table 7.

Segments	1	2	3	4	5
Extensor surface	24	100	144	200	36
Flexor surface	20	60	92	168	36

Epimera plates shown in Text-figure 4. Legs, stout and long, having claw-like spines on each leg. Third to fifth segments of fourth legs provided with several short feathered hairs on the extensor surface. The legs are measured as in Table 8 (in  $\mu$ ).

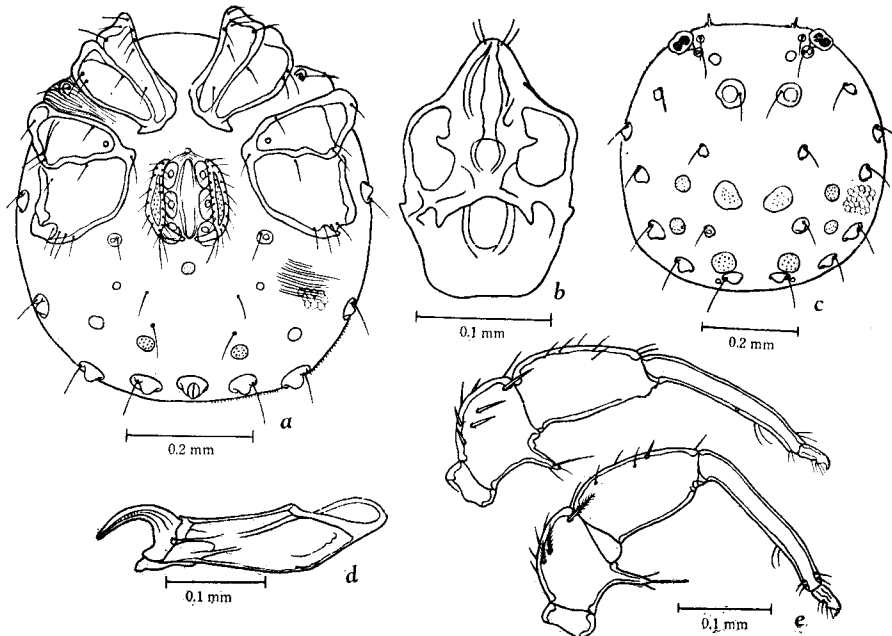


Fig 4. *Sperchon (Hispidosperchon) plumifer*, male.

a. Ventral view. b. Maxillar organ. c. Dorsal view. d. Mandible. e. Palpi.

Table 8.

Legs	Segments						
		1	2	3	4	5	6
I		46	57	68	137	131	137
II		63	57	86	154	154	154
III		74	63	91	171	182	182
IV		97	97	108	200	211	200

Genital organ lying between the posterior pairs of epimera. Genital plates having many hairs on their margins, measuring  $132 \mu$  in length. Excretory pore located fairly close to the posterior extremity behind the genital area. Colour reddish brown. Eyes black.

*Nymph* (Fig. 5). Body shape, maxillar organ, mandibles, epimera plates and legs all similar to those of the imago. Skin almost the same as that of the imago, but glandular plates not so prominent. Chitin plates, indicating dotted figures on the surface in imago, absent. Different from the imago in featherations of antenniform spines in anterior body and in genital organ. Four acetabula and two slender chitinous plates, surrounding roundly the acetabula and furnished with two spines, found between the fourth epimera plates. Devoid of genital opening. The measurements are as in the following. Body  $0.28 \text{ mm}$  in length and in width. Interval between eyes  $180 \mu$ . Maxillar organ  $120 \mu$  long and  $92 \mu$  wide. Mandibles  $130 \mu$  in length. Palpi as in Table 9 (in  $\mu$ ).

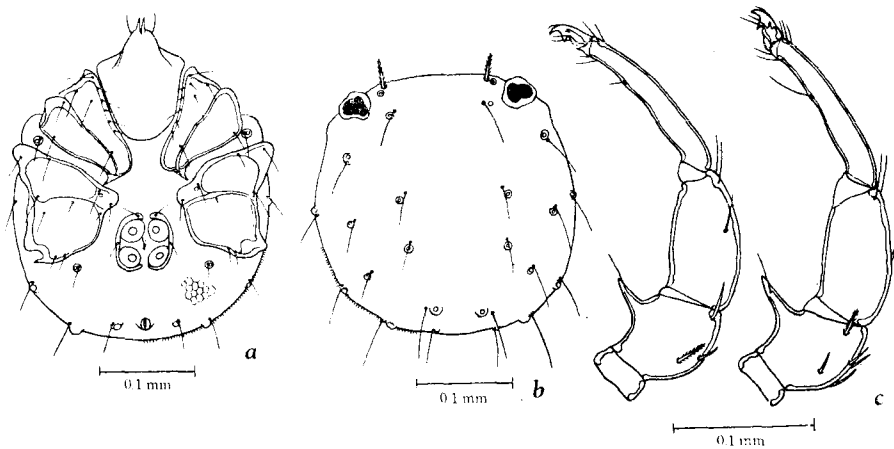


Fig. 5. *Sperchon* (*Hispidosperchon*) *plumifer*, nymph.  
a. Ventral view. b. Dorsal view. c. Palpi.

Table 9.

Segments	1	2	3	4	5
Extensor surface	15	66	93	123	27
Flexor surface	15	54	69	102	27

Pedal segments as in Table 10 (in  $\mu$ ).

Table 10.

Legs \ Segments	1	2	3	4	5	6
I	36	39	45	78	81	96
II	36	42	48	90	90	105
III	36	42	51	93	102	111
IV	63	57	60	120	120	123

Genital plates 60  $\mu$  long.

*Localities.* Captured two males on Oct. 9, 1951 in a stream in Shinjô-mura, Yamagata-gun and one nymph on Oct. 11, 1951 in Sandan-kyo torrent.

*Remarks.* Prof. T. Uchida first recorded the present species from Hokkaido in 1934 and secondary *S. plumifer* var. from Kyushu in 1937. The species here consulted coincides on the whole with the descriptions by Dr. Uchida (1934) and Sokolow (1934). The present species seems to be widely distributed in Europe, Siberia and the Far-East.

##### 5. *Sperchon (Hispidosperchon) violaceus* Walter var. (Fig. 6)

Syn. *Sperchon denticulatus* Koen., ♂, Maglio, 1909.

*Sperchon denticulatus* Koen., ♂, Viets, 1930, 1936.

*Male.* Body oval in shape, 0.58 mm long and 0.5 mm wide in dorsum excluding epimera plates. Skin surface reticulated. Dorsum hard, forming a dorsal shield, and without chitinous figures except the glandular portions. In front of eyes there exist a pair of little antenniform papillae. Frontal organ small but distinctly discerned at the mid-anterior portion. In venter are found seven chitin plates: large and circular one situated just behind the genital organ and six other lateral ones in three pairs. Eyes double in a capsule somewhat projected over the body margin. The interval between eyes is 262  $\mu$ . Maxillar organ large as compared with the body, measuring 245  $\mu$  long and 160  $\mu$  wide. Mandibles 296  $\mu$  long, including a claw in each and 68  $\mu$  in height. Palpi stout and strong. First segment short and deficient in spines. Second segment, broadest of all, having a prominent process at the distal portion of flexor side. The process bears

two spines, one long and another short, on inner middle portion. About twenty spines growing on the surface: twelve on inner surface, five on extensor surface and other three on outer surface. Third segment having six spines: three on inner

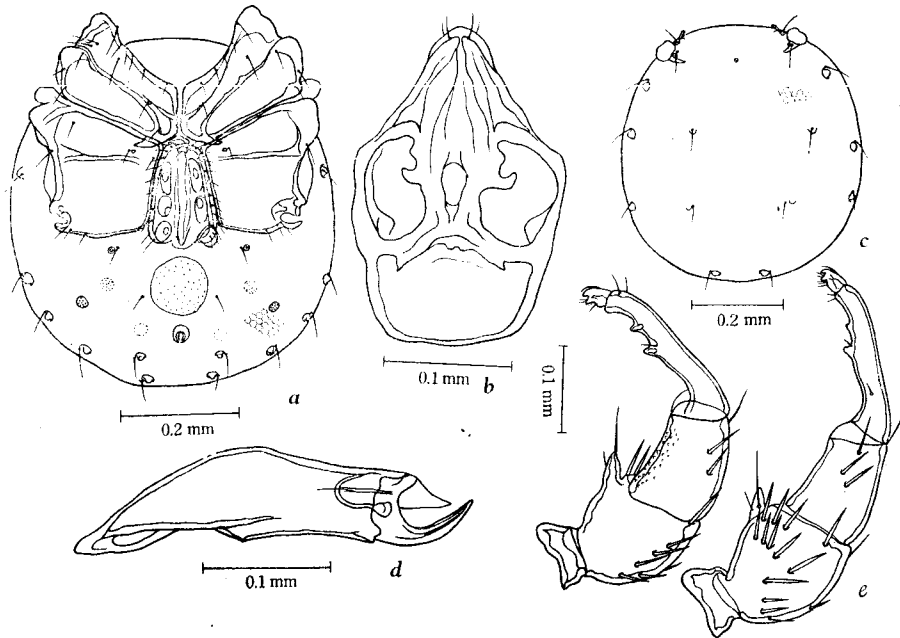


Fig. 6. *Sperchon (Hispidosperchon) violaceus* Walter var., male.  
a. Ventral view. b. Maxillar organ. c. Dorsal view. d. Mandible. e. Palpi.

surface, two on outer surface and the last one on extensor terminal end. Two blunt pegs, situated on the flexor side, are prominent as are indicated in Text-figure 6. Terminal segment rather thick and short. The measurement is given in Table 11 (in  $\mu$ ).

Table 11.

Segments	1	2	3	4	5
Extensor surface	36	144	124	196	36
Flexor surface	36	108	100	160	34

Four epimera groups and a genital organ situated very closely each other, leaving

no space between them. Genital plates long, measuring  $160 \mu$  in length. The shape of epimera and genital organ are shown in Text-figure 6. Legs measured as in Table 12 (in  $\mu$ ).

Table 12.

Legs	Segments					
	1	2	3	4	5	6
I	57	57	68	154	137	154
II	63	74	86	154	177	160
III	63	74	91	171	205	200
IV	108	85	92	200	210	205

Excretory pore not included in the chitin plate which situated behind the genital organ, but apart a little behind from the circular plate. Colour reddish purple in all the chitin surface: epimera, legs, skin of dorsum and venter.

*Locality.* Seven males collected on Oct. 9, 1951 in a stream, not of specially cold water, in Shinjô-mura, Yamagata-gun.

*Remarks.* The present species clearly agrees with *S. violaceus* Walter 1944 in the body colour and the location of the nephridial pore, but forms a variety because of more spines upon the second segment of palpi as compared with the European species. The species is common in Switzerland and various places in Europe. This is the first record of the species from Japan.

#### 6. *Sperchon (Hispidosperchon) uchidai* n. sp.<sup>1)</sup> (Fig. 7)

*Male.* Body oval in shape,  $505 \mu$  long and  $460 \mu$  wide. The skin surface indicates reticulated areolation of irregular polygonal forms, covered with minute conical papillae. Dorsum not hardened as that of *Sperchon violaceus*. In venter between the genital organ and epimera plates are found fine striations. Surface of epimera, legs and maxillar organ porose. In dorsum, there are three pairs of chitinous plates, transparent and devoid of any patterns. Antenniform bristles moderate in size. Eyes double in a capsule which is  $48 \times 36 \mu$  broad and the interval between them is  $244 \mu$ . Maxillar organ rather thick and short, measuring  $236 \mu$  long and  $168 \mu$  wide. Mandibles stout,  $300 \mu$  long, including a stubborn claw in each and  $76 \mu$  high. Palpi rather slender and long. First segment deficient in spines. Second segment bearing many short spines, some of them are feathered on outer and extensor surfaces. Distal portion of the flexor surface besets of a prominent process which bears two long spines. In third segment, provided with several spines and hairs on mostly middle extensor surface and many small conical tooth-like papillae on flexor and inner surfaces. Fourth

1) The new species has been named in honour of Prof. Tohru Uchida.

segment slender and long, having two glandular plugs in the flexor surface about at the middle portion. The measurements are as in Table 13 (in  $\mu$ ).

Table 13.

Segments	1	2	3	4	5
Extensor surface	32	160	208	256	44
Flexor surface	32	92	136	212	—

Epimera covering ventral surface more than a half and situated closely each other, having a genital organ in the center. Legs rather long. Their segments measured as in Table 14 (in  $\mu$ ).

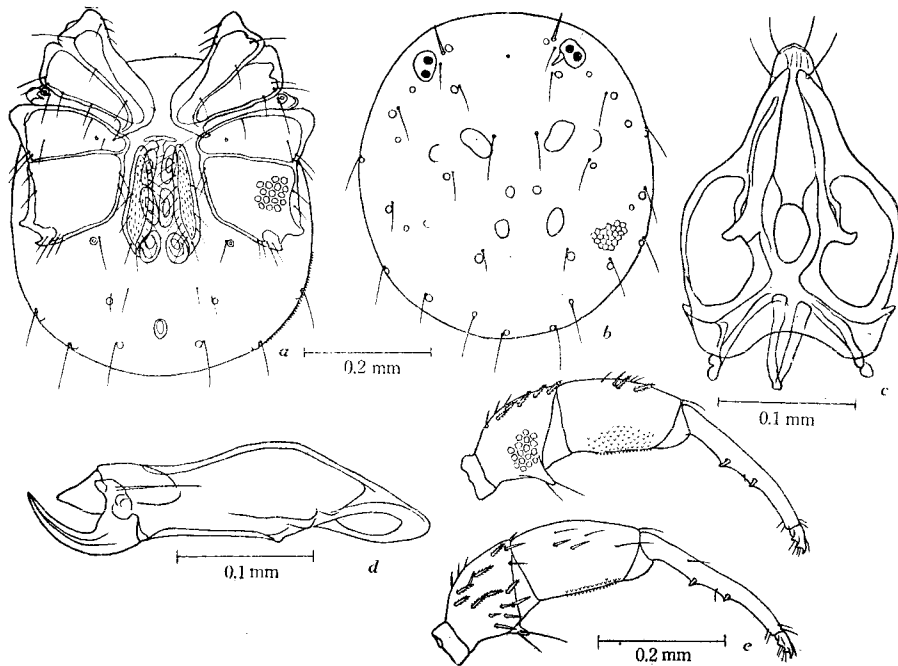


Fig. 7. *Sperchon* (*Hispidosperchon*) *uchidai* n. sp., male.  
a. Ventral view. b. Dorsal view. c. Maxillar organ. d. Mandible. e. Palpi.

All legs devoid of swimming hairs and feathered hairs as those found in the legs of *Sperchon plumifer* but with several spines on each segment. Genital organ lying

Table 14.

Legs	Segments					
	1	2	3	4	5	6
I	53	89	118	201	183	171
II	59	89	124	206	224	212
III	59	89	124	158	242	224
IV	118	130	142	283	289	271

between the posterior epimera groups. Genital plates porose, measured  $165 \mu$  in length. Nephridial pore lying near the posterior extremity. Colour reddish brown.

*Locality.* Two males captured on Oct. 9, 1951 in a brook in Shinjô-mura, Yamagata-gun.

*Remarks.* Though similar to *Sperchon denticulatus* Koen. in C. Walter's (1944) description, the present species is devoid of any anal chitinous plate and postero-ventral plates, and its dorsum is not hardened. The present species also akin to *S. clupeifer* Piersig, different in palpi having many small tooth-like papillae on the flexor surface of the second palpal segments.

### 7. *Lebertia (Pilolebertia) leioderma* Viets (Fig. 8)

*Female.* Body globular in shape, 1.15 mm long and 1.06 mm wide. Skin thin and transparent, with granulated appearances. Maxillar organ  $240 \mu$  long and  $92 \mu$  wide. Mandibles  $272 \mu$  long. Palpi well coincided with Viets's figure of 1936. The length of the segments is as in Table 15 (in  $\mu$ ).

Table 15.

Segments	1	2	3	4	5
Extensor surface	40	148	116	176	52
Flexor surface	32	108	64	160	48

Spines and hairs on the surface of palpi not feathered. Epimera plates indicating granulated figures, almost circular in shape as given in Text-figure 7. The area of epimera is measured  $768 \mu$  in length and  $752 \mu$  in width. The number of swimming hairs in legs is 4 in fifth segment of the second legs, 5-6 in fourth segment of third legs and 9-10 in fifth segment of fourth legs. The pedal segments are measured as in Table 16 (in  $\mu$ ).

Genital plate  $194 \mu$  long and  $68 \mu$  wide. The suspender of the genital opening is  $68 \mu$  wide in the anterior and  $165 \mu$  wide in the posterior one. Nephridial pore opening ventrally. Colour greenish brown. Epimera plates and legs light purplish

Table 16.

Legs	Segments					
	1	2	3	4	5	6
I	48	92	124	172	188	144
II	56	104	136	204	248	216
III	60	124	160	228	280	244
IV	132	148	200	268	304	248

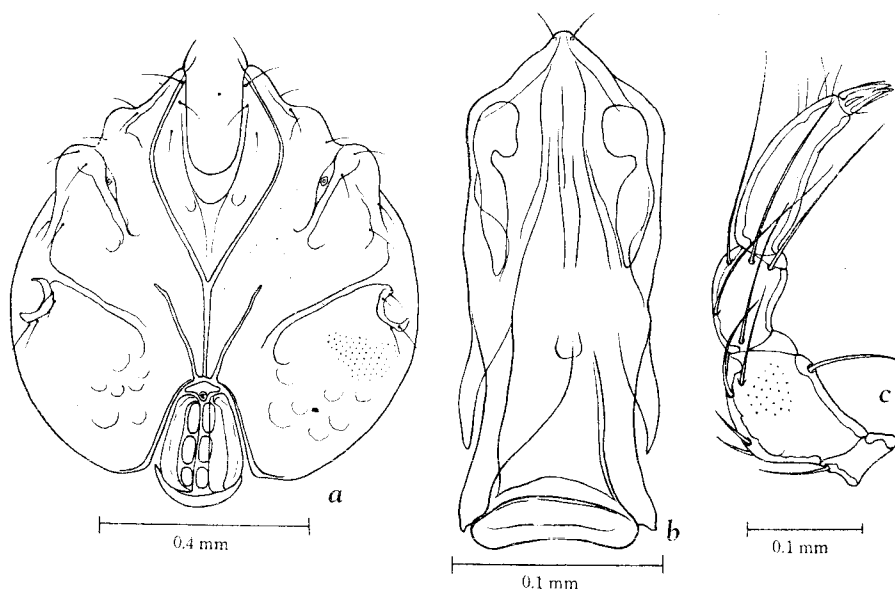


Fig. 8. *Lebertia (Pilolebertia) leioderma*, female.  
 a. Epimera and genital organ. b. Maxillar organ. c. Left palpus.

black. Eyes black.

*Locality.* One female was captured on Oct. 11, 1951 in Sandan-kyo torrent.

*Remarks.* The German species was recorded by Dr. M. Enami (1940) from the Izu Peninsula. The specimen is well coincided with the original description.

### 8. *Torrenticola (s. str.) elliptica* Maglio (Fig. 9)

*Male.* Body elliptical in shape, 0.57 mm long and 0.44 mm wide. Anterior shoulder portions form a blunt protrusions. The shields all illustrate porous pattern in dorsum and venter. Anterior pair of accessory shields are narrower



and smaller than the posterior pair, provided with a glandular pore at the rear portions. Posterior accessory shields have two hairs: one in anterior and the other on posterior parts. A pair of porous patterns are observed at approximately median portion of principal shield. Maxillar organ  $294\ \mu$  long and  $70\ \mu$  wide. Mandibles  $333\ \mu$  in length. Palpi, shorter than the maxillar organ, measured as in Table 17 (in  $\mu$ ).

Table 17.

Segments	1	2	3	4	5
Extensor surface	24	84	52	80	16
Flexor surface	18	76	36	56	16

The third and fourth segments are provided on the extensor surface with a minute club-shaped hairs, of which tip is expanded a little globularly. Palpi shown in Text-figure 8. Epimera covering almost the whole ventral surface. Legs measured as in Table 18 (in  $\mu$ ).

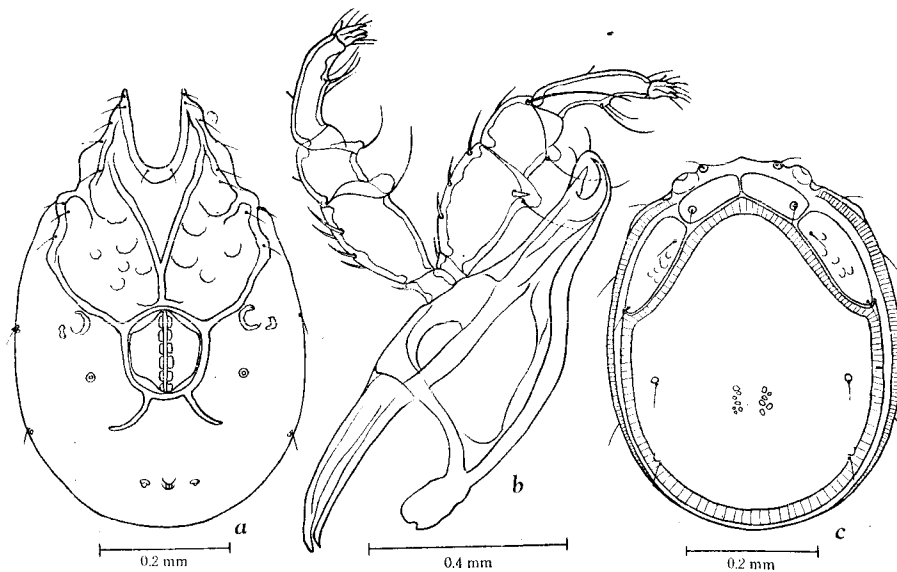


Fig. 9. *Torrenticcla* (s. str.) *elliptica*, male.  
a. Ventral view. b. Maxillar organ with palpi. c. Dorsal view

Table 18.

Legs	Segments					
	1	2	3	4	5	6
I	32	52	64	72	84	80
II	40	56	64	76	96	96
III	52	60	72	100	124	140
IV	100	84	108	128	140	150

Genital plates rather broadened at antero-lateral corners, rounded at posterior margin, measuring 136  $\mu$  long and 112  $\mu$  wide. Acetabula twelve in number, arranged in two rows. Colour reddish brown. Eyes reddish black.

*Locality.* A male captured on Oct. 9, 1951 in a brook in Shinjō-mura, Yamagata-gun.

*Remarks.* A female specimen was recorded from the Izu Peninsula by Dr. M. Enami (1940). The species is widely distributed in Europe and Siberia.

### 9. *Torrenticola (s. str.) japonica* n. sp.<sup>1)</sup> (Fig. 10)

*Female.* Body spherical in shape, measuring in dorsum 0.64 mm long excluding epimera (including epimera, 0.75 mm) and 0.57 mm wide. Antenniform bristles moderately long. Accessory shields in dorsum are all completely separated from the principal one. These accessory plates are rounded at margins and the posterior pair are shorter than those of any other species as shown in Figure 10. Though the accessory shields indicate scale-like appearance, the principal shield has porous figures. A pair of porous figures can be noticed in approximately median portion of the principal shield. Maxillar organ 285  $\mu$  long, 74  $\mu$  wide and 120  $\mu$  high. Mandibles slender in shapes, measuring 340  $\mu$  in length. Palpus rather thin in form. Second segment short, beset with three spines on the extensor surface and provided with a hyaline protrusion on the flexor terminal portion. Third segment short, curved roundly at extensor margin. Hyaline process, similar to that of the former segment, seen at the distal extremity of flexor surface. Fourth segment rather narrow, tapering distally. Measurement given in Table 19 (in  $\mu$ ).

Table 19.

Segments	1	2	3	4	5
Extensor surface	24	96	64	106	24
Flexor surface	20	80	40	80	24

1) The new species has been named in connection with the country where the specimen was found.

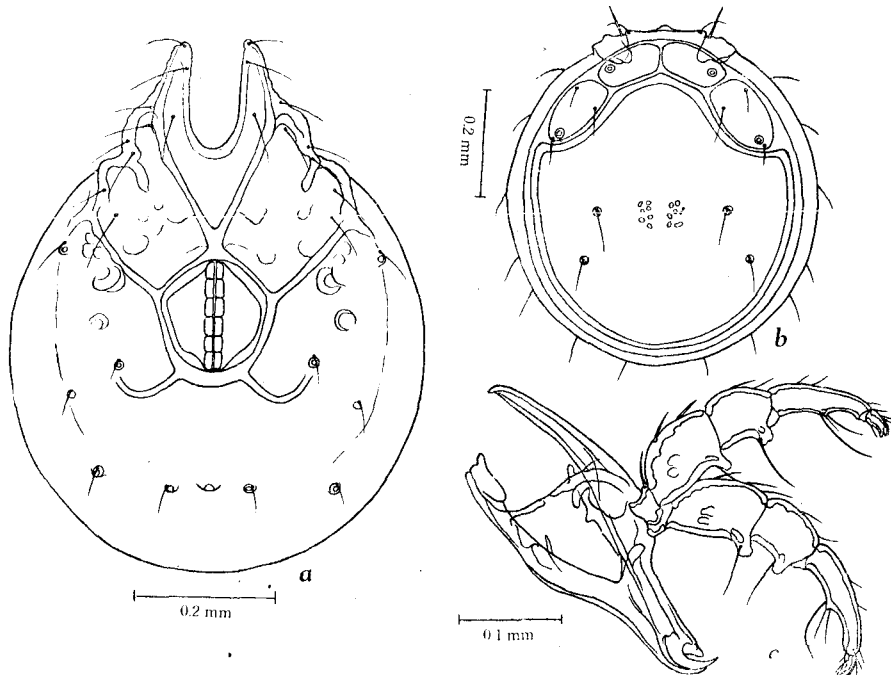


Fig. 10. *Torrenticola (s. str.) japonica* n. sp., female.  
a. Ventral view. b. Dorsal view. c. Maxillar organ with palpi.

Pocket for the maxillary base narrow and deep. The first epimera elongated to just anterior extremity of a genital field. Pedal segments measured as in Table 20 (in  $\mu$ ).

Table 20.

Legs \ Segments	1	2	3	4	5	6
I	40	64	76	88	100	84
II	44	60	72	92	112	104
III	48	60	80	112	136	108
IV	96	100	116	152	168	152

Genital field developed in antero-lateral corners, measuring 154  $\mu$  long and 143  $\mu$  wide. Colour reddish brown. Eyes reddish black.

*Locality.* A single female was captured on Oct. 9, 1951 in a stream in

Shinjô-mura, Yamagata-gun.

*Remarks.* Though similar to *T. longilostris* (Szalay) from Garamrév (Kom. Bars), the present species different in the following points: the posterior accessory shields in dorsum are shorter than those of the latter; the posterior extremity of the first epimera reaches nearer to the anterior margin of a genital field. Although the new species also resembles *T. brevirostris* (Halbert), *T. anomalus* (Koch), *T. waddellicus* (Marshall) and *T. circulooides* (Halik), it is distinguished from these species in the shapes of posterior accessory shields and palpi.

#### 10. *Torrenticola* sp. (Fig. 11)

*Nymph.* Body globular in shape in dorsum, 0.31 mm long excluding epimera plates and 0.28 mm wide. Venter 0.37 mm long, including epimera plates. Dorsal shield composed of four plates: anterior one flattened pentagonally and somewhat convex posteriorly at the posterior margin; the middle ones are triangular, making a pair; posterior one, largest of all, pentagonal in shape, with rounded posterior margin. Maxillar organ 178  $\mu$  long, 53  $\mu$  wide and 76  $\mu$  high. Mandibles 200  $\mu$  in length. Palpi shown in Text-figure 11. Measurement given in Table 21 (in  $\mu$ ).

Table 21.

Segments	1	2	3	4	5
Extensor surface	13	49	33	66	16
Flexor surface	13	40	20	43	16

Epimera composed of six plates. The measurement of legs is given in Table 22 (in  $\mu$ ).

Table 22.

Legs	Segments					
	1	2	3	4	5	6
I	23	36	46	56	66	66
II	23	36	43	56	73	83
III	30	40	46	69	86	96
IV	66	63	69	89	109	109

Genital field almost right triangular in shape, 96  $\mu$  long and 100  $\mu$  wide. Four acetabula in each side: two situated anteriorly, other two posteriorly. Nephridial pore opening just behind the genital organ. Colour brownish red.

*Locality.* A nymph captured on Oct. 11, 1951 in Sandan-kyo torrent.

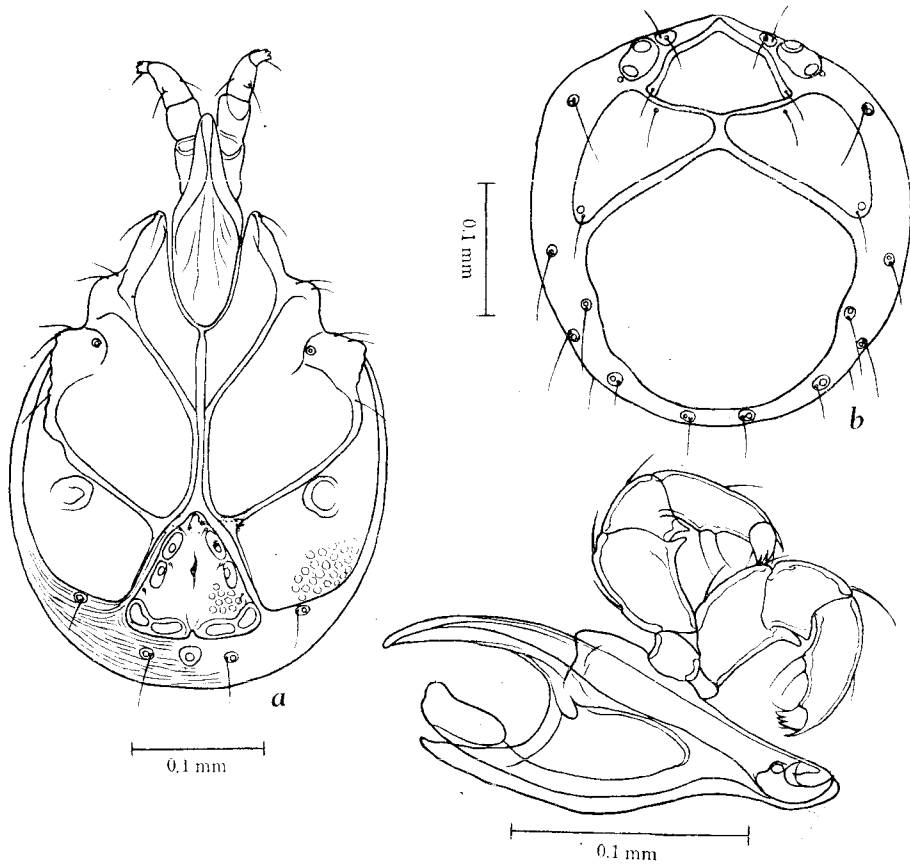


Fig. 11. *Torrenticola* sp., nymph.  
 a. Ventral view. b. Dorsal view. c. Maxillar organ with palpi.

*Remarks.* Though the present nymph is akin to *T. wolgaensis* (Thor) of Wolga district in genital organ, it is different in the relations of area occupied by epimera plates and genital organ in venter. Further inquiries must be paid for proving the specific name.

### 11. *Limnesia* sp. (Fig. 12)

*Nymph.* Body oval in shape, 0.68 mm long and 0.53 mm wide. Skin thin, colourless and transparent, covering all the surface with finely striated figures.

In dorsum there are two chitinous plates far behind the eyes and a postero-dorsal plate,  $29\ \mu$  long and  $27\ \mu$  wide. Four papillous chitinous protrusions can be noticed on the plate surface. Eyes in two pairs, the interval between them are  $150\ \mu$  in anterior one and  $200\ \mu$  in posterior one. Palpi rather thick. Second segment furnished with three feathered bristles on the extensor surfaced. Third segment narrowed distally, having two spines, moderately long. Fourth segment curved towards its distal portion. The segments are measured as in Table 23 (in  $\mu$ ).

Table 23.

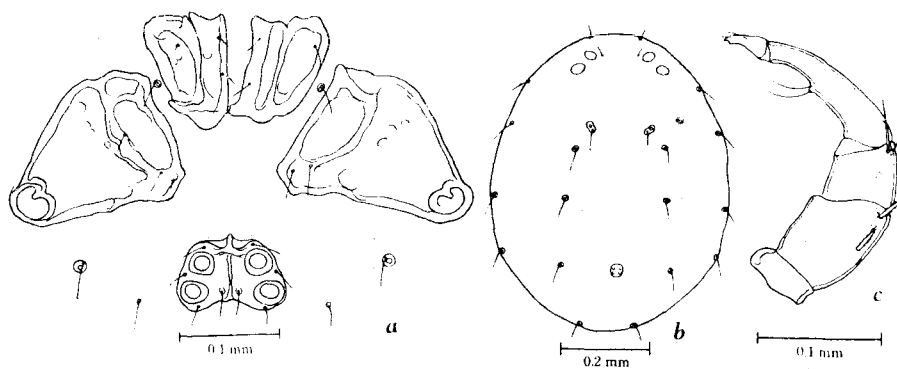
Segments	1	2	3	4	5
Extensor surface	12	87	61	125	32
Flexor surface	19	49	34	87	27

Measurement of legs given in Table 24 (in  $\mu$ ).

Table 24.

Legs \ Segments	1	2	3	4	5	6
I	38	46	65	68	84	95
II	38	46	72	95	110	122
III	49	49	68	99	122	122
IV	76	68	91	130	167	194

Terminal spine of fourth legs  $140\ \mu$  in length. Genital plate almost trapezoidal in shape,  $77\ \mu$  long and  $110\ \mu$  wide in the widest portion. On the plate there are

Fig. 12. *Limnesia* sp., nymph.

a. Epimera and provisional genital organ. b. Dorsal view. c. Right palpus.

four large acetabula and eight minute hairs, arranged as in Text-figure 12. Colour light brown.

*Locality.* A nymph captured on Oct. 12, 1951 in a pond in Kumano-mura.

*Remarks.* The postero-dorsal plate is smaller than that of *L. papillosa*.

**12. *Hygrobates (Hygrobates) papillosus* n. sp.<sup>1)</sup>** (Fig. 13)

*Female.* Body almost globular in shape, 0.7 mm long and 0.64 mm wide. Skin characteristic of figure, moderately thick, covering all the surface with fine papillae rather sparsely distributed. No chitinous thickening is present except around the glandular plates. Maxillar organ fused with the first pair of epimera in the posterior half. Mandibles 385  $\mu$  long, including a claw which is 125  $\mu$  long and 89  $\mu$  high. Palpi rather short, being measured as in Table 25 (in  $\mu$ ).

Table 25.

Segments	1	2	3	4	5
Extensor surface	32	152	88	168	68
Flexor surface	32	84	74	128	64

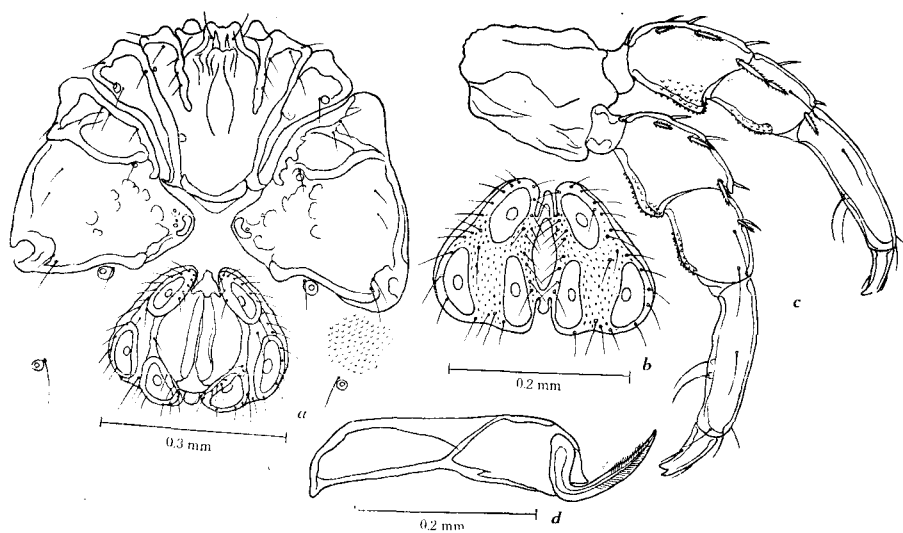


Fig. 13. *Hygrobates (Hygrobates) papillosus* n. sp.

a. Epimera and genital organ of female. b. Male genital organ. c. Palpi of female. d. Mandible of female.

1) The new species is named in association with the papillated skin.

First segment short, having a bristle at the extensor distal end. Second segment, broadest of all, having nine spines, six of which on the lateral side near extensor margin being feathered. Along flexor margin, many chitinous denticles are provided on the terminal half portion. Third segment endowed with fine spines and three hairs on the extensor surface and chitinous denticles on the flexor surface. Fourth segment rather thick, short, somewhat curved extensorly. Epimera plates amber brown in colour, indicating fine granulated and net-work, somewhat scale-like figures. First and second epimera triangular in shape, fused each other, with maxillar organ between them. Inner angles of fourth epimera are pointed, making right angles, as shown in the text-figure. Legs with spines and bristles in every segment mostly on the terminal ends, devoid of swimming hairs. The measurement of legs is given in Table 26 (in  $\mu$ ).

Table 26.

Legs	Segments					
	1	2	3	4	5	6
I	60	100	130	183	195	188
II	65	112	142	200	218	201
III	71	112	171	242	277	242
IV	142	160	218	295	307	283

Genital organ situated very near at the postero-inner corners of fourth epimera and characteristic of the shape of genital plates as indicated in the figure. Surface of genital plates, except acetabula, granulated. Plate measured 225  $\mu$  long and 75  $\mu$  wide in the widest portion. Genital opening 138  $\mu$  in length. Nephridial pore opening near at the posterior ventral margin. Colour light brown. Epimera, legs and genital plates all amber in colour. Eyes black.

*Male.* Body, skin and organs, except genital organ, all similar to those of the female. The measurements are given as follows. Body 0.69 mm long and 0.56 mm wide. Interval between eyes 258  $\mu$ . Mandibles 385  $\mu$  long and 92  $\mu$  high. Palpal segments measured as in Table 27 (in  $\mu$ ).

Table 27.

Segments	1	2	3	4	5
Extensor surface	28	116	84	148	56
Flexor surface	28	72	60	112	56

Pedal segments measured as in Table 28 (in  $\mu$ ).



Table 28.

Legs	Segments					
	1	2	3	4	5	6
I	67	74	111	148	170	163
II	74	81	126	178	192	192
III	67	96	148	215	259	229
IV	141	133	185	259	259	237

Genital plates almost triangular in shape, larger in breadth than in length, with a deep incision at the portions of anterior corner and in the middle portion of posterior margin. Three acetabula, which are very long, situated far apart from each other on a plate as indicated in the text-figure. Genital plates measured 178  $\mu$  long and 237  $\mu$  wide. Genital opening 82  $\mu$  in length. Colour same as that of the female.

*Locality.* Two males and a female captured on Oct. 9, 1951 in a brook in Shinjō-mura, Yamagata-gun.

*Remarks.* Though similar to *H. longiporus*, the species is easily distinguished from it and any other species by the skin, all the surface being covered with fine conical papillae rather sparsely distributed than in the Thyasidae and Protziidae.

### 13. *Hygrobatas (Hygrobatas) longiporus* Thor (Figs. 14, 15)

*Male* (Fig. 14). Body oval in shape, 0.64 mm long and 0.58 mm wide. Skin thin and colourless, having no figures. Interval between eyes 280  $\mu$ . Mandibles 385  $\mu$  long, inclusive of a claw which is 140  $\mu$  long and 89  $\mu$  high. Maxillar organ 120  $\mu$  wide. Palpi moderate in size. First segment provided with a prominent spine on the extensor terminal end. Second segment, highest of all, having nine spines, six of which are feathered. On the flexor side are found many denticles and the terminal end elevated a little conically. Third segment with three feathered spines, two non-feathered and the third haired. Denticles disposed of on the flexor surface. Fourth segment slender and long. Segments measured as in Table 29 (in  $\mu$ ).

Table 29.

Segments	1	2	3	4	5
Extensor surface	36	148	98	184	58
Flexor surface	34	88	76	140	60

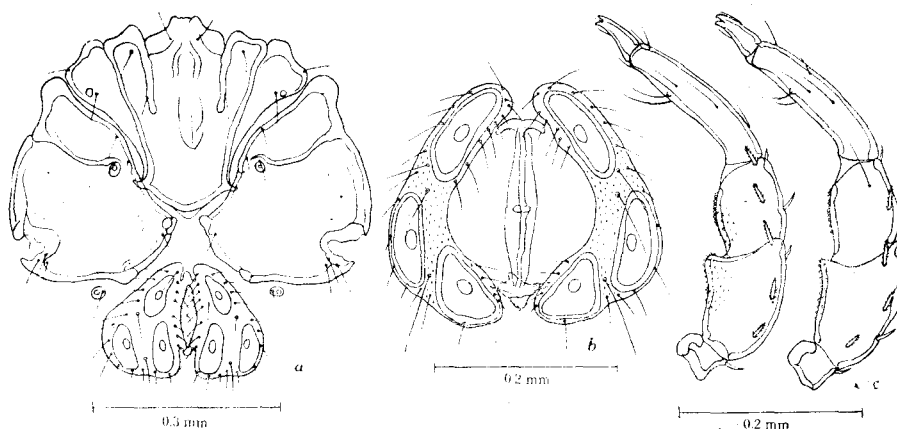
Epimera granulated, net-work in appearance and yellowish brown in colour.

Epimera region shown in Text-figure 14. Legs having no porous figures, wholly destitute of swimming hairs. Pedal segments measured as in Table 30 (in  $\mu$ ).

Table 30.

Legs	Segments					
	1	2	3	4	5	6
I	60	104	148	212	220	204
II	60	104	156	228	224	216
III	60	112	172	256	280	220
IV	136	144	216	292	312	200

Genital organ lying in the central portion of venter barely between the fourth epimera. Genital plates porose,  $188 \mu$  long and  $248 \mu$  wide. Anterior and posterior parts of genital plate form deep incisions. Acetabula on the genital plates all very long. Genital opening  $104 \mu$  long. Excretory pore opening midway between the genital area and the posterior body margin. Colour light brown. Eyes black.

Fig. 14. *Hygrobates (Hygrobates) longiporus*.

- a. Epimera and genital organ of male. b. Genital organ of female.  
c. Palpi of male.

*Female* (Fig 14). Body shape, colour, skin and organs, except genital organ, all alike to those of the male. Measurements given in the following. Body  $0.8 \text{ mm}$  long and  $0.72 \text{ mm}$  wide. Interval between eyes  $0.3 \text{ mm}$ . Mandibles

450  $\mu$  long inclusive of a claw in each. Maxillar organ 110  $\mu$  wide in the widest portion. Palpi measured as in Table 31 (in  $\mu$ ).

Table 31.

Segments	1	2	3	4	5
Extensor surface	40	180	128	240	68
Flexor surface	44	112	100	180	68

Measurement of legs given in Table 32 (in  $\mu$ ).

Table 32.

Legs \ Segments	1	2	3	4	5	6
I	74	133	185	266	281	252
II	74	133	215	296	318	181
III	74	148	237	326	370	318
IV	215	192	281	384	407	333

Genital plates long, bent like the letter L and measured 266  $\mu$  long and 82  $\mu$  wide in the widest portion, showing porous figure. Genital acetabula in three pairs: anterior and middle ones of long-ellipse; posterior one triangular in shape. Genital opening 185  $\mu$  in length.

*Nymph* (Fig. 15). Body oval in shape, 0.38 mm long and 0.29 mm wide in the widest part. Skin soft without figures. Interval between eyes 135  $\mu$ . Maxillar organ 60  $\mu$  in width. Palpal segments measured as in Table 33 (in  $\mu$ ).

Table 33.

Segments	1	2	3	4	5
Extensor surface	18	62	44	92	36
Flexor surface	20	36	34	68	36

First segment destitute of spine. In second segment are found two strong spines and a feathered spine on the extensor surface, and coarse denticles on the flexor surface. Third segment provided with chitinous denticles on flexor surface and a spine at the extensor terminal end. Fourth segment longest of all. Epimera shown in Text-figure 15. Inner margins of the posterior groups of epimera rather sharply angled than those of the imago. Legs destitute of swimming hairs, the segments are measured as in Table 34 (in  $\mu$ ).

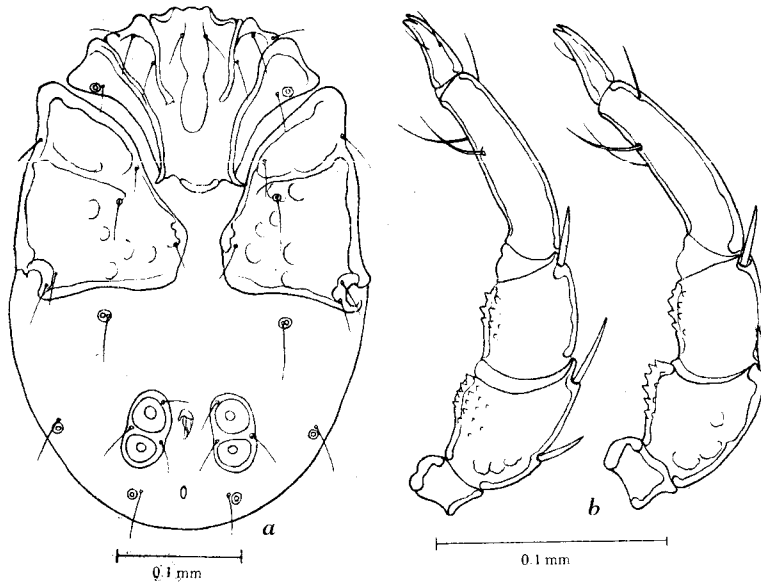


Fig. 15. *Hygrobatas (Hygrobatas) longiporus*, nymph.  
a. Ventral view. b. Palpi.

Table 34.

Legs \ Segments	1	2	3	4	5	6
I	32	48	76	112	124	120
II	36	52	80	124	144	136
III	40	56	92	144	168	160
IV	84	80	120	172	188	172

Though having long spines, legs destitute of swimming hairs. Provisional genital organ composed of two plates. Genital opening not opened. On the plates are found each two large circular acetabula and three hairs. Nephridial pore lying at the posterior portion of genital organ. Colour light brown. Eyes black.

*Locality.* Collected two males, one female and three nymphs on Oct. 11, 1951 in Sandan-kyo torrent.

*Remarks.* The species is widely distributed in Europe and East-Siberia. This is the first record of the species from Japan.

**14. *Hygrobatas (Hygrobatas) calliger* Piersig (Fig. 16)**

*Male.* Body globular in shape, 0.63 mm long and 0.54 mm wide. Skin soft, thin and finely striated on all the body surface except epimera and genital plates. Interval between eyes 215  $\mu$ . Mandibles 268  $\mu$  long, including a claw in each. Palpi measured as in Table 35 (in  $\mu$ ).

Table 35.

Segments	1	2	3	4	5
Extensor surface	32	96	84	128	56
Flexor surface	28	60	60	100	50

Conical process, arising on the flexor terminal end of second segment, high, covered with coarse chitinous denticles. Epimera and genital plates light purplish black in colour. Posterior extremity of the first epimera ending in gently rounded protrusion. Legs slender, wholly destitute of swimming hairs. Pedal segments measured as in Table 36 (in  $\mu$ ).

Table 36.

Legs \ Segments	1	2	3	4	5	6
I	52	68	96	140	144	148
II	68	68	100	152	168	168
III	72	76	116	184	212	188
IV	128	112	152	216	240	220

Genital plates almost round in shape, provided with three acetabula on each side. Mid-posterior portion of the plate directed anteriorly. Genital plates are fringed by a number of minute hairs. Genital opening 72  $\mu$  long. Penis scaffold 177  $\mu$  long and 148  $\mu$  wide. Nephridial pore opening almost midway between the genital area and the posterior body margin. Colour dark brown. Eyes black.

*Female.* Almost equal in body shape, colour and organs, except genital organ, to those of the male. Body 0.79 mm long and 0.67 mm wide. Interval between eyes 288  $\mu$ . Mandibles 284  $\mu$  in length, inclusive of a claw in each. Palpi measured as in Table 37 (in  $\mu$ ).

Table 37.

Segments	1	2	3	4	5
Extensor surface	32	104	92	140	56
Flexor surface	28	68	64	104	52

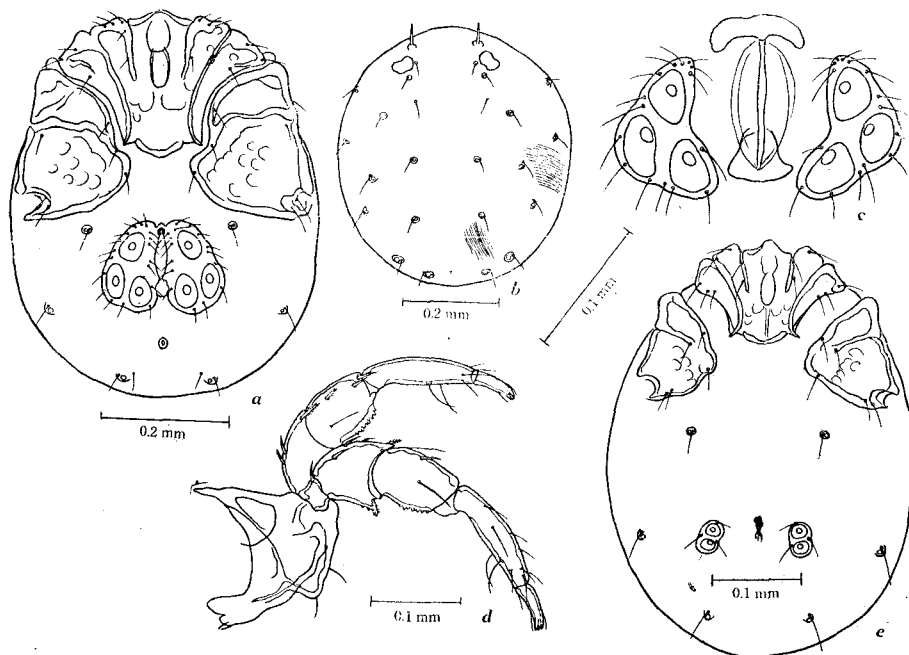


Fig. 16. *Hygrobates (Hygobates) calliger*.  
 a. Ventral view of male. b. Dorsal view of male. c. Genital organ of female. d. Male palpi. e. Ventral view of nymph.

Pedal segments measured as in Table 38 (in  $\mu$ ).

Table 38.

Segments	1	2	3	4	5	6
Legs						
I	51	63	97	148	148	143
II	57	68	103	154	177	172
III	57	80	120	194	205	194
IV	120	120	211	228	239	211

Genital plate  $74 \mu$  long and  $56 \mu$  wide in the widest part. Genital opening  $103 \mu$  in length. Anterior genital suspender  $63 \mu$  in width.

*Nymph*. Body long oval in shape,  $0.44 \text{ mm}$  long and  $0.34 \text{ mm}$  wide. Interval between eyes  $122 \mu$ . Skin finely striated as that of the imago. Palpi almost equal in shape to those of the imago. Epimera region covering only

one-third the venter as shown in Text-figure 16. Measurement of legs as in Table 39 (in  $\mu$ ).

Table 39.

Legs	Segments					
	1	2	3	4	5	6
I	32	32	44	72	76	84
II	32	32	48	76	80	92
III	36	36	56	88	104	100
IV	60	56	72	112	128	116

Genital plates short and broad, measuring 40  $\mu$  long and 24  $\mu$  wide. Colour brown. Eyes black.

*Locality.* Three males, a female and nymph collected on Oct. 9, 1951 in a brook in Shinjō-mura, Yamagata-gun.

*Remarks.* This European species was recorded from the Izu Peninsula, middle Japan by Dr. M. Enami (1940).

#### 15. *Hygrobates (Hygrobates) minutus* n. sp.<sup>1)</sup> (Fig. 17)

*Female.* Body oval in shape, 0.46 mm long and 0.39 mm wide. Interval between eyes 148  $\mu$ . Skin soft, transparent and finely striated. Mandibles 288  $\mu$  long, including a claw in each. Palpi moderately long. First segment having a spine at the extensor terminal end. Second segment, broadest of all, at the flexor terminal end, provided with a protrusion, which is covered with small chitinous denticles. On extensor surface are seen seven spines, one at the terminal end feathered. Third segment with four spines on extensor surface, one hair on the inner surface and denticles on the flexor surface. Fourth segment slender and moderately long, having several hairs. Fifth segment rather long. The segments are measured as in Table 40 (in  $\mu$ ).

Table 40.

Segments	1	2	3	4	5
Extensor surface	30	108	88	136	52
Flexor surface	28	66	64	104	50

Epimera occupying almost one half the venter, finely granulated, with net-work in appearance and light brownish-yellow in colour. Inner margin of the fourth epimera forming rather a sharp angle, bending a little forward. Legs long

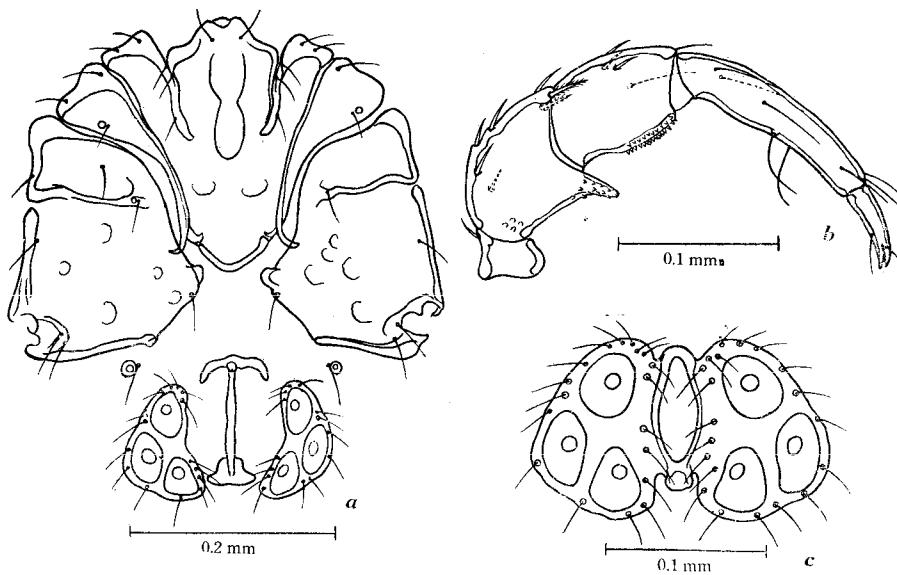
1) The new species has been named on account of the smallness of body.

compared with the body size, destitute of swimming hairs. The measurement is as in Table 41 (in  $\mu$ ).

Table 41.

Legs	Segments					
	1	2	3	4	5	6
I	52	68	92	140	148	140
II	52	72	100	160	172	172
III	52	76	120	196	220	184
IV	120	120	156	228	252	214

Genital plates  $120 \mu$  long and  $64 \mu$  wide at the widest portion. Genital acetabula large, occupying most of the surface of genital plates. Genital opening  $108 \mu$  in length. Anterior genital suspender  $68 \mu$  wide. Colour brown. Eyes black.

Fig.17. *Hygrobatas (Hygrobatas) minutus* n. sp.

a. Epimera and genital organ of female. b. Female palpus. c. Male genital organ.

*Male.* Colour, shape, size, skin and organs, except genital organ, are all same as those of the female. Measurement as follows. Body  $0.46 \text{ mm}$  long and  $0.39 \text{ mm}$  wide. Interval between eyes  $162 \mu$ . Mandibles  $250 \mu$  long, including



a claw in each. Palpi measured as in Table 42 (in  $\mu$ ).

Table 42.

Segments	1	2	3	4	5
Extensor surface	24	96	80	124	48
Flexor surface	24	60	60	96	46

Pedal segments in Table 43 (in  $\mu$ ).

Table 43.

Legs	Segments	1	2	3	4	5	6
I		60	66	92	140	144	144
II		60	64	100	152	168	164
III		68	76	116	184	208	188
IV		116	108	156	216	240	200

Genital plates show an ellipse in both, measuring 116  $\mu$  long and 144  $\mu$  wide. In the front and the rear portions of genital aperture are found dents of genital plate. Genital aperture 68  $\mu$  long.

*Locality.* Collected five males and three females on Oct. 9, 1951 in a stream in Shinjō-mura, Yamagata-gun.

*Remarks.* Though akin to the following species, *H. calliger* and *H. porrectus* in Europe in palpi and genital plates, the present species is different from them in shape of epimera plates and in body size.

#### 16. *Atractides (s. str.) spatiosus* (Viets) (Figs. 18, 19)

*Female* (Fig. 18). Body oval in shape, 0.48 mm long and 0.43 mm wide in dorsum excluding epimera plates. Interval between eyes 0.17 mm. Skin thin, colourless and finely striated in appearance. Glandular plates in dorsum large and round in shape, having a spine-like long hair. In venter, glandular plates smaller than those in dorsum. Antenniform spines very prominent. Maxillar organ 123  $\mu$  long and 60  $\mu$  wide in the widest part. Palpi measured as in Table 44 (in  $\mu$ ).

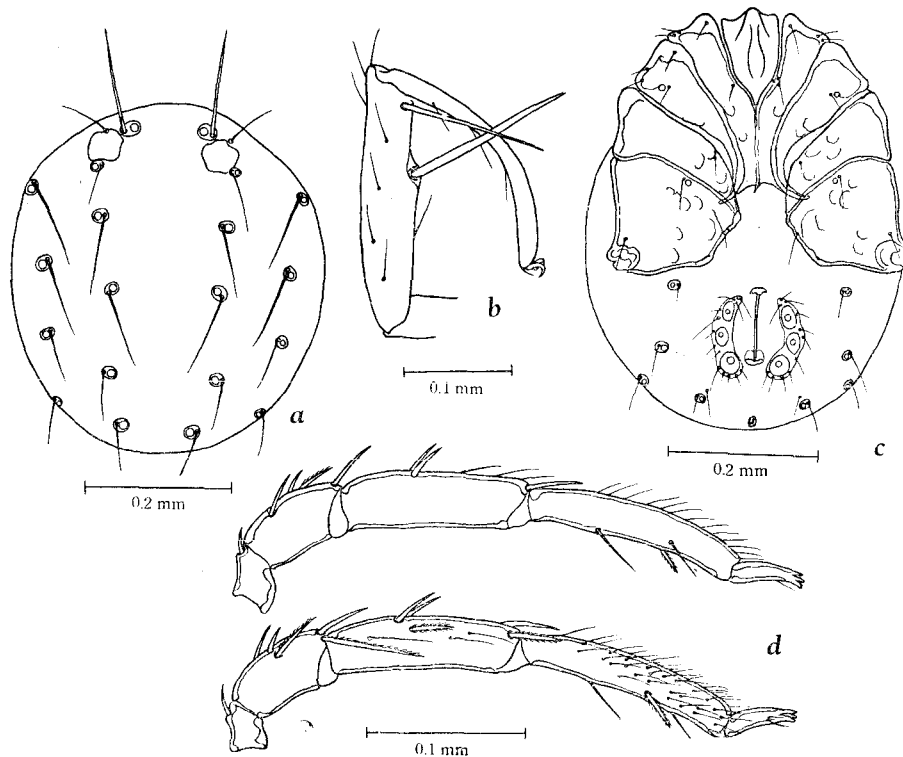
Table 44.

Segments	1	2	3	4	5
Extensor surface	30	72	120	134	39
Flexor surface	24	42	99	114	—

Flexor side of the second to fourth segments almost straight. The feathered spine at the extensor terminal end of second segment is long. Sword-like spine on the flexor side of fourth segment feathered. Epimera region occupying more than a half the venter. The shape of epimera is shown in Text-figure 18. Measurement of legs given in Table 45 (in  $\mu$ ).

Table 45.

Legs	Segments	1	2	3	4	5	6
I		60	124	232	320	268	228
II		56	88	156	204	200	180
III		64	88	160	228	240	192
IV		128	136	224	284	312	252

Fig. 18. *Atractides* (s. str.) *spatiosus*, female.

a. Dorsal view. b. Fifth and sixth segments of right first leg. c. Ventral view. d. Palpi.

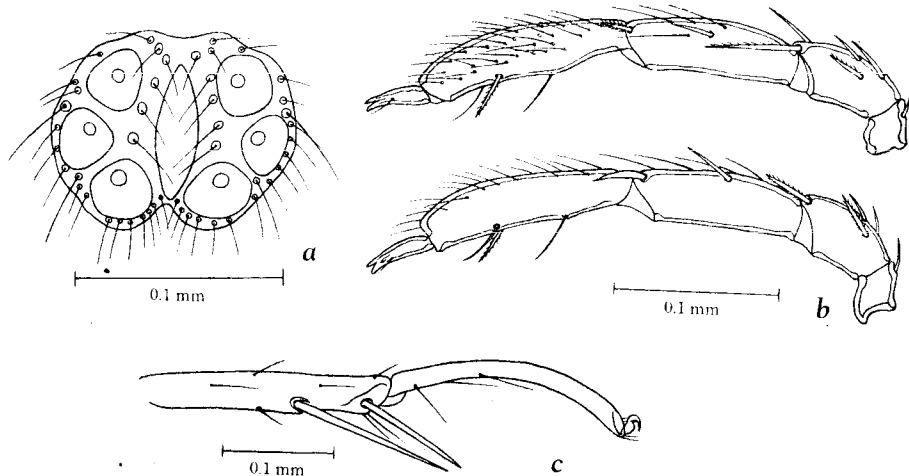
First legs prominently large and strong. Fifth segment of first leg is strong, bearing two sword-like long spines on the flexor side. Last segment slender and bent. Legs all destitute of swimming hairs. Genital plate of banana-shape, provided with three acetabula, the hindest one being the largest of all. Genital plate 108  $\mu$  in length. Vagina 100  $\mu$  long, excluding suspenders. Nephridial aperture found at the posterior extremity of venter. Colour reddish brown. Eyes black.

*Male* (Fig. 19). Body a little smaller than that of the female, measuring 0.4 mm long and 0.33 mm wide in dorsum, excluding epimera plates. Interval between eyes 140  $\mu$ . Maxillar organ 105  $\mu$  long and 60  $\mu$  wide in the widest portion. Mandibles 159  $\mu$  long, including a claw in each. The segments of palpi are measured as in Table 46 (in  $\mu$ ).

Table 46.

Segments	1	2	3	4	5
Extensor surface	33	63	99	129	40
Flexor surface	21	36	78	114	40

Though the palpi are, especially of fourth segment, thicker a little than that of the female, almost equal in shape. Pedal segments measured as in Table 47 (in  $\mu$ ).

Fig. 19. *Atractides (s. str.) spatiosus*, male.

a. Genital organ. b. Palpi. c. Fifth and sixth segments of left first leg.

Table 47.

Legs	Segments					
	1	2	3	4	5	6
I	52	104	200	280	236	204
II	52	72	136	184	176	160
III	60	72	140	208	212	176
IV	116	120	208	256	276	228

Genital organ 108  $\mu$  long and 116  $\mu$  wide. Genital aperture 72  $\mu$  long. Colour reddish brown. Eyes black.

*Locality.* Three males and four females captured on Oct. 11, 1951 in Sandan-kyo torrent.

*Remarks.* The present species is well coincided with the Javanese species described by Karl Viets (1935). This is the first record of the species from Japan.

#### 17. *Atractides (s. str.) gracilis* (Sokolow) (Fig. 20)

*Female.* Body globular in shape, 0.91 mm long and 0.8 mm wide in dorsum, excluding epimera plates. Interval between eyes 288  $\mu$ . Skin finely striated. Glandular plates in dorsum and venter prominent but not so large as those of the preceding species. Maxillary organ small in relation to the body, measuring 112  $\mu$  long and 72  $\mu$  wide in the widest part. Mandibles 196  $\mu$  long, including a claw in each. Palpi very slender in shape, measuring the segments as in Table 48 (in  $\mu$ ).

Table 48.

Segments	1	2	3	4	5
Extensor surface	40	76	120	140	44
Flexor surface	26	40	100	124	—

A spine at the extensor terminal end of second segment is feathered. Flexor sides of second and third segments straight. Three spines on the flexor surface of fourth segments wholly non-feathered. Epimeral region occupying only one-third the venter. Urpores enclosed in the postero-outer portions of the second epimera. Jagged at the posterior margins of second epimera and inner and posterior margins of the posterior epimera groups. Legs measured as in Table 49 (in  $\mu$ ).

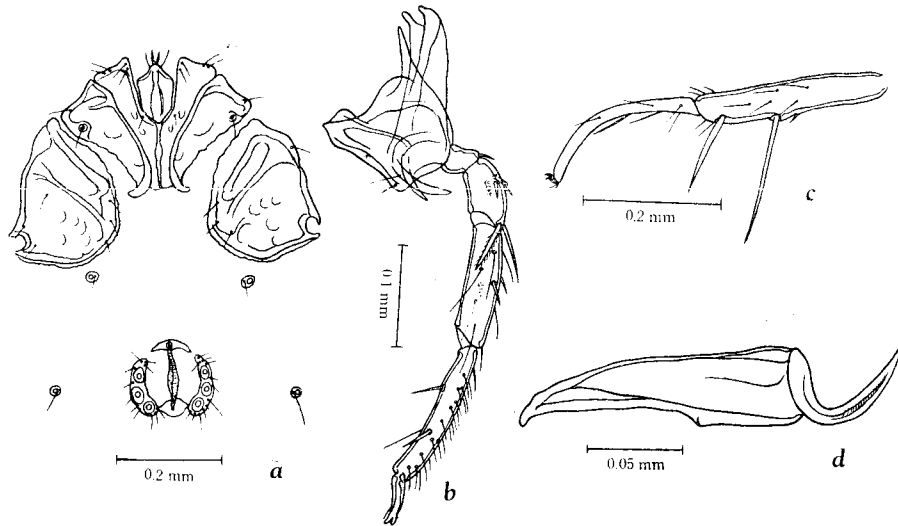


Fig. 20. *Atractides* (s. str.) *gracilis*, female.  
 a. Epimera and genital organ. b. Left palpus c. Fifth and sixth segments of right first leg. d. Mandible.

Table 49.

Legs \ Segments	1	2	3	4	5	6
I	62	130	235	336	274	235
II	62	86	163	211	122	178
III	67	82	163	235	245	202
IV	149	149	235	288	312	254

Legs slender and devoid of swimming hairs. Fifth and sixth segments of first legs shown in the text-figure. Genital plates long and of banana-shape, measuring  $112 \mu$  in length. Genital opening  $120 \mu$  long, excluding suspenders. Frontal suspender  $72 \mu$  in width. Colour dark brown. Eyes black.

*Localities.* A female captured on Oct. 9 in a brook in Shinjō-mura, Yamagata-gun and four females on Oct. 11, 1951 in Sandan-kyo torrent.

*Remarks.* The species was first recorded from Ussuri-regions by Sokolow (1934). The present specimens generally agree with the Ussuri's materials except minute differences in spines of palpi and shape of anterior epimera groups. This is the first record of the species from Japan.

**18. *Atractides (s. str.) izuensis* (Enami) (Fig. 21)**

*Male.* Body oval in shape, 0.4 mm long and 0.34 mm wide in dorsum, excluding epimera plates. Interval between eyes 148  $\mu$ . Skin soft, transparent and finely striated. No chitinous plates in dorsum except glandular plates which are prominent and round in shape, each having a long spine. Antenniform bristles stout and very long. Maxillar organ rather small, measuring 136  $\mu$  long and 80  $\mu$  wide in the widest portion. Mandibles 212  $\mu$  long, including a claw in each. The measurement of palpi is given in Table 50 (in  $\mu$ ).

Table 50.

Segments	1	2	3	4	5
Extensor surface	24	72	76	92	36
Flexor surface	24	44	46	70	34

First segment small with almost straight extensor edge and well-arched flexor side. Second segment, broadest of all, elevated on the extensor edge remarkably. Flexor edge forming large triangular chitinous process. On extensor side are found five spines, one of which stands at the terminal end is very long and feathered. Third segment with three spines, one feathered bristle and several fine hairs. Fourth segment, longest of all, gradually narrowed towards proximal and distal ends. On the inner and extensor edges of fourth segments are found number of fine hairs. A strong spine, club-shaped, arising near the flexor edge at approximately the median portion of the inner side, and two long bristles found on both sides of the flexor edge. Fifth segment tapered distally. Epimera region very wide, occupying almost three-fourths the venter. First pair narrow and long. Posterior extremity of the first epimera ending in a conical protrusion. Shape and figure of epimera shown in Text-figure 21. Measurement of legs given in Table 51 (in  $\mu$ ).

Table 51.

Segments	1	2	3	4	5	6
I	48	64	88	160	176	120
II	60	56	88	124	140	140
III	68	56	104	156	168	164
IV	116	108	168	212	220	192

Fifth segment of first legs provided with two stout spines in the flexor terminal

end. Sixth segment of first legs rather thick, curved a little. All legs destitute of swimming hairs. Genital organ almost round, concave in the middle of the posterior margin, and  $100\ \mu$  long and  $128\ \mu$  wide. Genital aperture  $76\ \mu$  long. Colour brownish black. Eyes black.

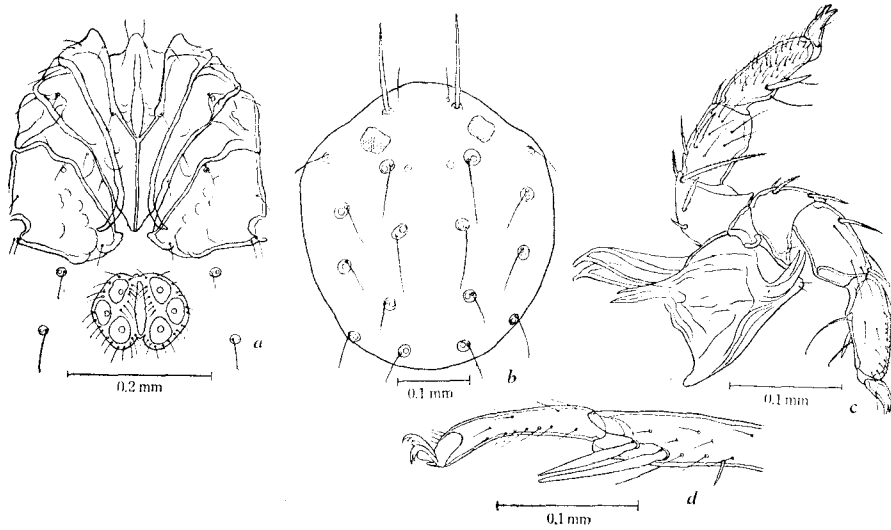


Fig. 21. *Atractides (s. str.) izuensis*, male.

a. Epimera and genital organ. b. Dorsal view. c. Maxillar organ with mandibles and palpi. d. Fifth and sixth segments of right first leg.

*Locality.* A male captured on Oct. 9, 1951 in a brook in Shinjō-mura, Yamagata-gun.

*Remarks.* The species was recorded from the Izu Peninsula by Dr. M. Enami (1940) as a new species. Though the specimen of Hiroshima Prefecture is somewhat different from the one in Enami's report in body size and spines on the palpal second and third segments, it generally coincides with the materials of the Izu Peninsula. Further, the specimen is akin also, especially in the shape of palpi, to the Sumatran species, *M. angulipalpis* Viets 1935 but different in the shape of genital organ.

#### 19. *Atractides* sp. (Fig. 22)

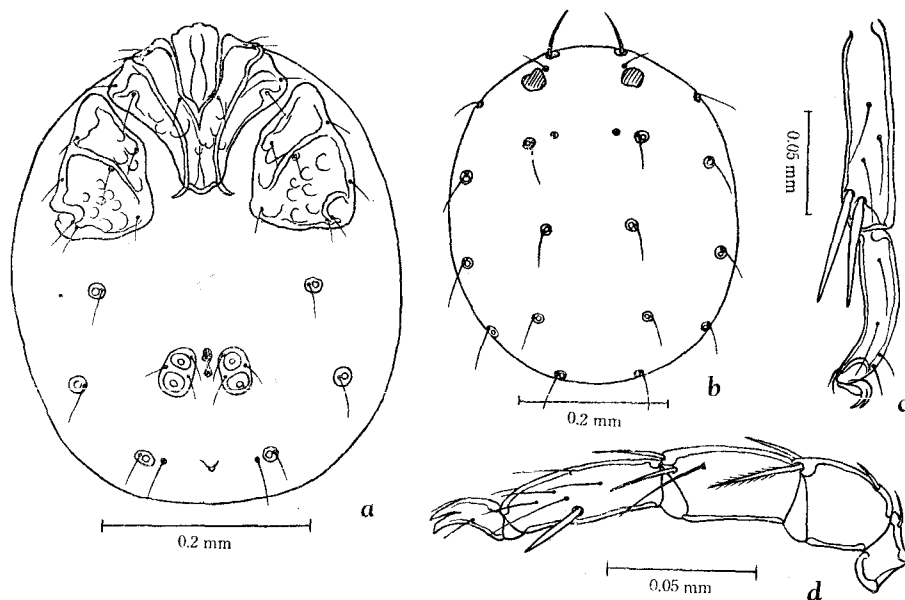
*Nymph.* Body ellipsoidal in shape, 0.46 mm long and 0.39 mm wide. Skin soft, colourless, transparent, having no striated figure. No chitinous plates except glandular plates. Interval between eyes  $134\ \mu$ . Maxillar organ  $70\ \mu$

long and  $42\ \mu$  wide. Mandibles  $120\ \mu$  long, including a claw in each. Palpi thick and stout, measured as in Table 52 (in  $\mu$ ).

Table 52.

Segments	1	2	3	4	5
Extensor surface	15	39	42	54	24
Flexor surface	12	21	30	45	21

Second segment round on the extensor edge but straight on the flexor side. Two moderately long spines, one of which is feathered, are provided with at the extensor terminal end. Third segment also stout, provided with three spines. Fourth

Fig. 22. *Atractides* sp., nymph.

a. Ventral view. b. Dorsal view. c. Fifth and sixth segments of right first leg. d. Right palpus.

segment having a stout spine in approximately the median portion of the inner surface near the flexor margin. Fifth segment roundly curved extensorly. Epimera region small, occupying only two-fifths the venter. Legs measured as in Table 53 (in  $\mu$ ).



Table 53.

Legs	Segments					
	1	2	3	4	5	6
I	24	36	57	90	102	66
II	30	30	45	63	72	71
III	30	30	48	81	93	93
IV	51	51	84	111	126	114

Sixth segment of first legs big and curved a little. Legs all destitute of swimming hairs. Provisional genital organ formed of two genital plates. Genital plate elliptic in shape, 48  $\mu$  long, 30  $\mu$  wide and provided with two acetabula and three minute hairs on it. Genital aperture not opened. An excretory pore is found. Colour dark brown. Eyes black.

*Locality.* A nymph captured on Oct. 9, 1951 in a brook in Shinjô-mura, Yamagata-gun.

*Remarks.* Although the last segment of first legs is similar to that of the preceding species *A. izuensis*, the present species is devoid of striation of skin and different in shape of epimera.

#### 20. *Unionicola (Hexatax) crassipes* (O. F. Müller)

Many males and females of the cosmopolitan species were collected on Oct. 12, 1951 in a pool in Kumano-mura. The species was recorded by Prof. T. Uchida from Tokyo (1938), Osaka (1939), by Uchida & Imamura from Middle-China (1951) and by T. Imamura from Kyushu (1952).

#### 21. *Brachypoda versicolor* (O. F. Müller) (Fig. 23)

*Female.* Body elliptical in shape, 0.56 mm long and 0.45 mm wide, dorso-ventrally flattened. Dorsal shield porose, elliptical in outline except the posterior margin. Interval between eyes 0.2 mm. On dorsal shield two pairs of porous patterned groups present, one pair of them immediately posterior to eyes and another pair near the posterior extremity of shield. Antenniform bristles moderately long and not feathered. Maxillar organ small, measuring 80  $\mu$  long and 48  $\mu$  wide. Mandibles also small, 132  $\mu$  long, including a sharp claw in each and 40  $\mu$  high at the highest portion. Palpal segments measured as in Table 54 (in  $\mu$ ).

Table 54.

Segments	1	2	3	4	5
Extensor surface	30	51	30	75	30
Flexor surface	18	45	21	60	27

First segment narrow but moderately elongated and curved extensorly, having a bristle on the extensor surface. Second segment, broadest of all, having five spines on the extensor surface and two prominent process at the distal extremity of flexor surface on both sides. Third segment having three bristles: one on the

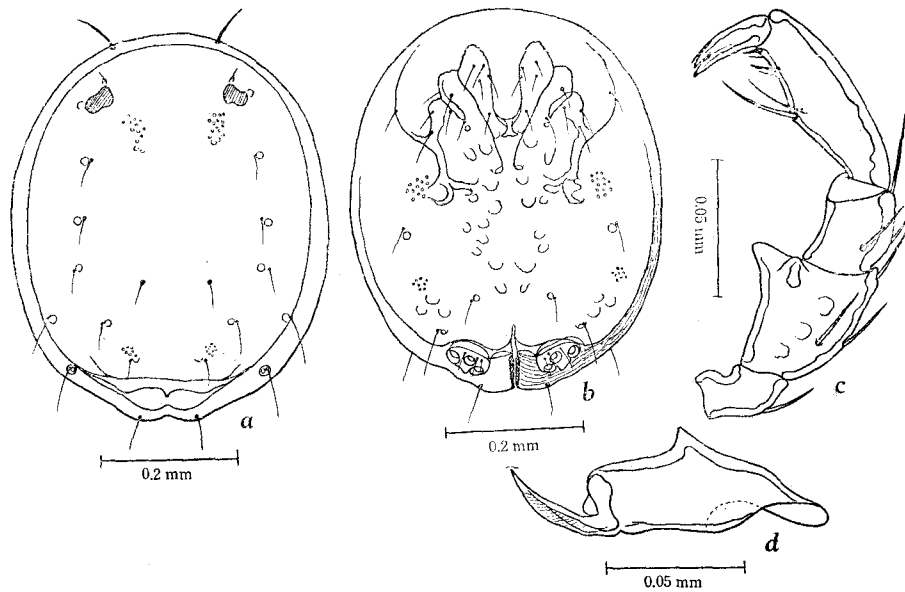


Fig. 23. *Brachypoda versicolor*, female.  
 a. Dorsal view. b. Ventral view. c. Left palpus. d. Mandible.

flexor terminal extremity; two others on the proximal lateral sides, one on each side. Fourth segment characteristic of the flexor surface, elevated in the median portion, in which two strong bristles grow. Fifth segment rather long, tapering toward terminal end. Epimera united to form a broad ventral plate covering

Table 55.

Legs \ Segments	1	2	3	4	5	6
I	—	40	45	63	69	66
II	—	44	51	75	78	72
III	—	52	60	84	99	93
IV	63	63	66	90	102	99

almost the whole part of venter, except the posterior portion occupied with genital organ. The epimera are shown in the text-figure. Two pairs of porose areas noticed: one pair in the lateral median portion; another far behind the former. Legs short, measured as in Table 55 (in  $\mu$ ).

Fifth segment of third and fourth legs provided with several swimming hairs in terminal portion. Genital organ lying close to the posterior extremity of venter, immediately posterior to epimera region. Genital plate almost triangular in shape, having three acetabula and several hairs. Colour purplish brown. Eyes black.

*Locality.* Captured three females on Oct. 11, 1951 in Sandan-kyo torrent.

*Remarks.* The species is widely distributed in Europe, Siberia and Ussuri-regions. In 1940 Dr. M. Enami described *Brachypoda versicolor* var. from the Lzu Peninsula. The present female coincides for the most parts with the description and figure by Viets (1936) and Enami (1940).

## 22. *Aturus duplex* Thor (Figs. 24, 25)

*Male* (Fig. 24). Body almost pentagonal in shape, a little rounded in the posterior contour. Incaved in almost the median portion of dorsum. Body measuring 0.32 mm long and 0.315 mm wide in the widest portion of dorsum,

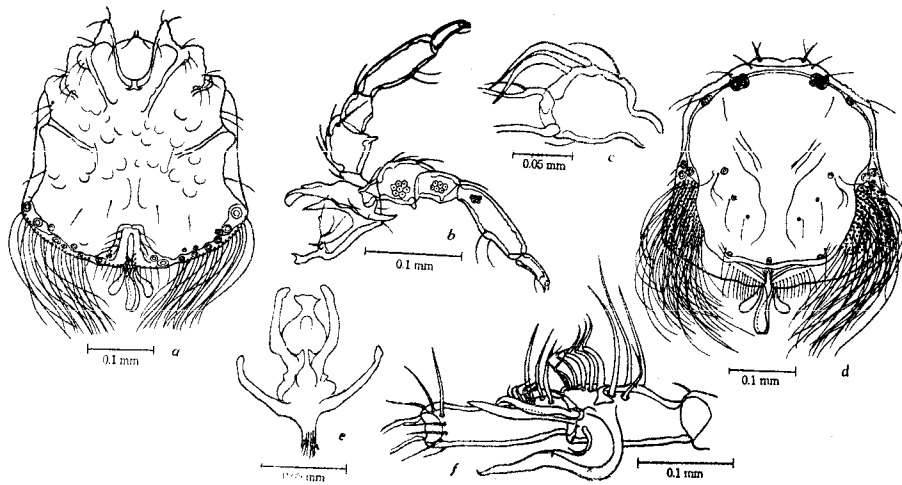


Fig. 24. *Aturus duplex*, male.

a. Ventral view. b. Maxillar organ with mandibles and palpi. c. First and second segments of left fourth leg in dorsal view. d. Dorsal view. e. Penis scaffold. f. Fourth and fifth segments of left fourth leg.

excluding epimera plates. A pair of antenniform spines at the anterior extremity. Dorsal shield covering almost all the surface of dorsum. There are five pairs of glands, bearing one or two hairs. Many long silver-white hairs, crooked roundly, arising from the postero-lateral areas. In median parts near posterior margin, there is a pair of hair-columns as in the text-figure. Two pairs of caudal hyaline appendages present, the inner pair being longer than the outer one. Maxillar organ  $83 \mu$  long and  $59 \mu$  wide. Mandibles  $125 \mu$  long, including a claw in each. Palpi rather slender, measured as in Table 56 (in  $\mu$ ).

Table 56.

Segments	1	2	3	4	5
Extensor surface	23	63	33	96	42
Flexor surface	20	40	26	79	40

Contour given in Text-figure 24. Epimera plates fused to form an almost pentagonal shape, covering the whole surface of venter. There are a pair of hair lines along the posterior body margin. Legs measured as in Table 57 (in  $\mu$ ).

Table 57.

Segments	1	2	3	4	5	6
I	34	40	63	91	114	114
II	34	46	63	91	108	108
III	40	57	74	125	148	132
IV	85	91	85	125	148	136

Fourth legs characteristic of shape in the first, fourth and fifth segments. First segment provided with two sword-like bristles and a spine on dorsal surface as in Text-figure 24. Bristles on fourth and fifth segments sufficiently figured in the text-figure. Genital acetabula arranged on lateral extremities in a long row along the posterior body margin. Penis scaffold broad, measuring  $100 \mu$  long and  $90 \mu$  wide. Nephridial pore opening in dorsum at the median extremity of the dorsal plate. Colour red. Eyes black.

*Female* (Fig. 25). Body oval in shape,  $0.42 \text{ mm}$  long and  $0.32 \text{ mm}$  wide in dorsum excluding epimera. Several pairs of glandular plates, provided each with a hair, in dorsum. Interval between eyes  $0.1 \text{ mm}$ . Dorsal plate elliptical in shape, having a pair of papillous areas immediately behind eyes and two pairs of glands. Maxillar organ  $86 \mu$  long and  $56 \mu$  wide. Mandibles  $128 \mu$  long, including a claw in each. Measurement of palpi as in Table 58 (in  $\mu$ ).

Table 58.

Segments	1	2	3	4	5
Extensor surface	23	49	36	63	36
Flexor surface	20	33	28	46	34

Pedal segments measured as in Table 59 (in  $\mu$ ).

Table 59.

Legs \ Segments	1	2	3	4	5	6
I	34	30	42	57	65	68
II	38	34	46	61	68	76
III	42	38	49	76	87	95
IV	65	61	65	91	95	103

In venter, almost the whole surface occupied with epimera plates which are fused. Genital acetabula in three specimens counted as follows: each 11 on the right side; 11, 10 and 11 on the left side. Excretory pore opening in dorsum near the posterior extremity.

*Localities.* A male captured on Oct. 11 from Sandan-kyo torrent and

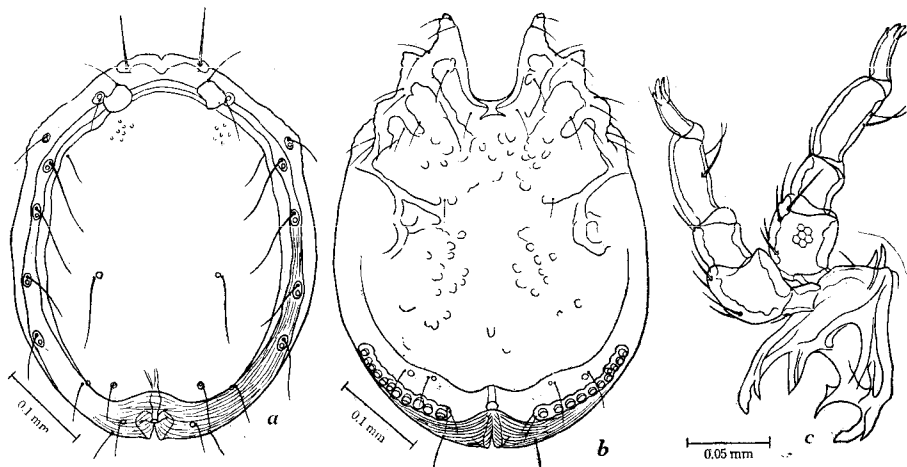


Fig. 25. *Aturus duplex*, female.

a. Dorsal view. b. Ventral view. c. Maxillar organ with palpi.

a female on Oct. 9, 1951 in a stream in Shinjō-mura, Yamagata-gun. The present species has been collected abundantly by the author from various spots in Hokkaido.

*Remarks.* The present species has been examined by Prof. Uchida, but not yet reported from Japan. The Japanese specimens mostly coincide with the Turkish species described by S. Thor (1930). Though also similar to *A. complexus* Sokolow 1934 of Ussuri-regions, the male is somewhat different in body shape and the bristles on the fourth and fifth segments of fourth legs. This is the first record of the species from Japan.

### 23. *Aturus miyashitai* Uchida (Fig. 26)

*Male.* Body dorso-ventrally flattened, 0.38 mm long and 0.28 mm wide in dorsum, excluding epimera plates. Outline oval, with a deep incision at the posterior end. Posterior one-third the part of dorsum depressed, showing traverse wrinkles. Interval between eyes short, measuring 63  $\mu$ . Dorsal shield almost pentagonal in shape, having a straight posterior margin. Between dorsal and ventral shields runs a narrow line coarsely undulating. In dorsal groove several pairs of glands, from which grows a long hair, mostly bifurcated in its terminal portion. In the posterior part along the extremity are inserted numerous minute hairs in two rows. Maxillar organ 86  $\mu$  long and 50  $\mu$  wide. Mandibles 115  $\mu$  long including a claw in each. Palpi measured as in Table 60 (in  $\mu$ ).

Table 60.

Segments	1	2	3	4	5
Extensor surface	21	53	33	66	33
Flexor surface	16	33	20	50	33

Epimera fused each-other to form a broad ventral shield occupying the whole surface of venter. Surface of epimera coarsely porose. Legs destitute of swimming hairs. Measurement of legs given in Table 61 (in  $\mu$ ).

Table 61.

Legs \ Segments	1	2	3	4	5	6
I	36	40	53	73	83	89
II	40	43	59	83	89	99
III	42	53	70	106	115	113
IV	92	102	92	135	122	135

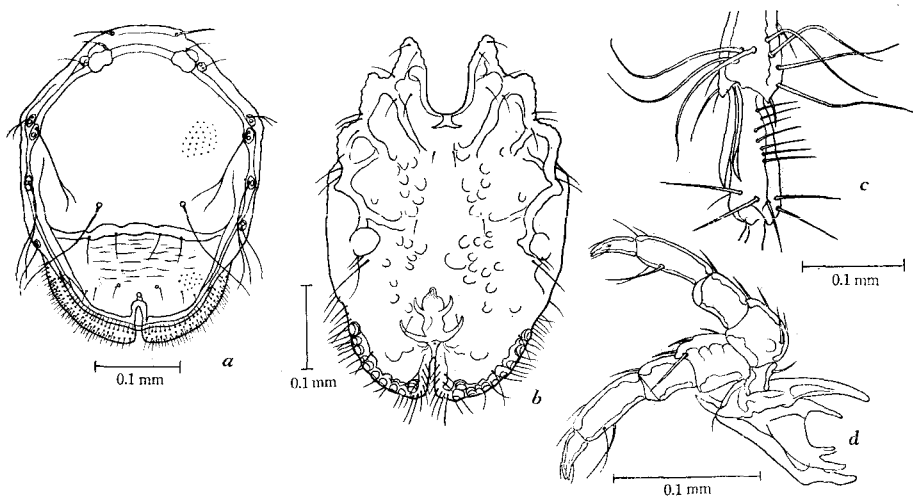


Fig. 26. *Aturus miyashitai*, male.

a. Dorsal view. b. Ventral view. c. Fourth and fifth segments of right fourth leg. d. Maxillar organ with mandibles and palpi.

Fourth legs sexually characterized. The fourth and fifth segments are shown in Text-figure 26. Genital aperture opening in the posterior fissure. Along the postero-lateral margins are arranged about ten acetabula on both sides of the genital opening. Nephridial pore opening in dorsum. Colour red. Eyes black.

*Localities.* A male captured on Oct. 11, 1951 in Sandan-kyo torrent. The species were also collected by the author from various places in Hokkaido.

*Remarks.* The present species was first described by Prof. T. Uchida in 1934 from the River Yura, Kyoto Prefecture. Afterwards Dr. Enami (1940) reported it from the Izu Peninsula. The species seems common everywhere in Japan.

#### 24. *Aturus uchidai* n. sp.<sup>1)</sup> (Fig. 27)

*Male.* Body almost pentagonal in shape, rounded in its corners. Dorsal surface, excluding epimera, 0.31 mm long and 0.26 mm wide. Interval between eyes 103  $\mu$ . A pair of antenniform bristles, moderately long and slender, arise from the anterior portion of eyes. In dorsal groove are found four pairs of remarkable glandular plates, each with a hair. Dorsal plate square in shape with a sharpened posterior end. Mid-posterior half portion of the plate somewhat

1) The species has been named in honour of Dr. Tohru Uchida, Professor of Hokkaido University, Sapporo.

incaved, having a pair of papilla-groups in lateral portions as shown in Text-figure 27. A minute frontal organ found in midway between eyes. In the anterior lateral portions of dorsal plates there are two pairs of feathered hairs. Along antero-lateral margins are arranged many slender hairs, almost in two rows, some of them being feathered. On both sides of genital opening are attached three pairs of hyaline appendages. Mandibles 96  $\mu$  long, including a claw in each. Palpi moderately stout, measuring as in Table 62 (in  $\mu$ ).

Table 62.

Segments	1	2	3	4	5
Extensor surface	21	45	30	69	30
Flexor surface	15	33	21	60	28

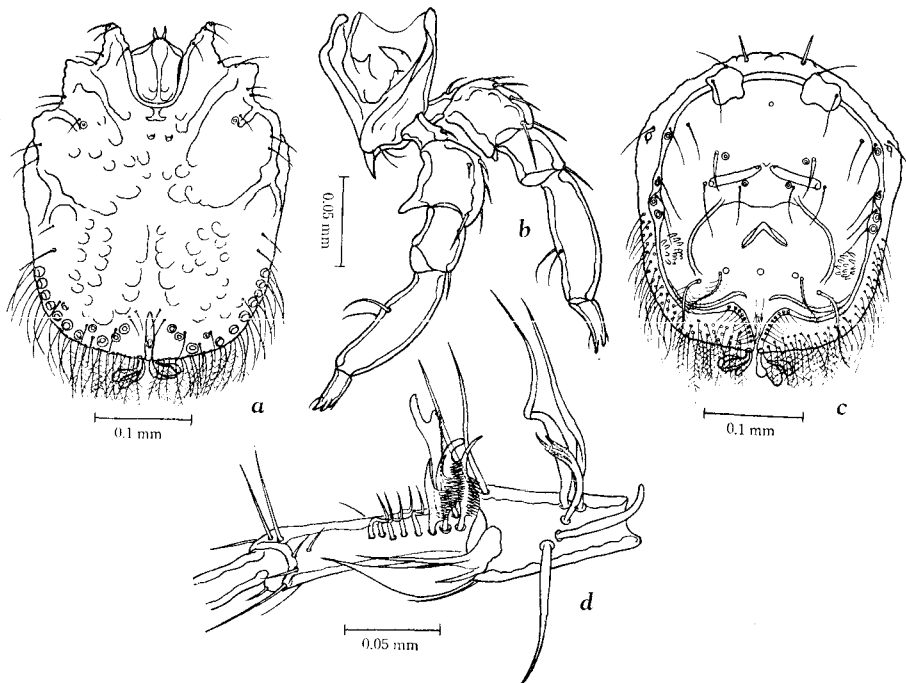


Fig. 27. *Aturus uchidai* n. sp., male.  
 a. Ventral view. b. Maxillar organ with palpi. c. Dorsal view. d. Fourth to sixth segments of left fourth leg.



On the flexor extremity of second segment, there are two conical protrusions, one on the outer side being more remarkable than another on the inner side. Legs moderately stout. Fifth segment of third legs with many swimming hairs, rather short, on the terminal half. Fourth and fifth segments of fourth legs armed with many bristles, which are characteristic and complicated in shape as shown in the text-figure. Comb-toothed peculiar bristles, five in number, one of which is remarkably longer than the others, found on fifth segment. Measurement of segments given in Table 63 (in  $\mu$ ).

Table 63.

Legs	Segments					
	1	2	3	4	5	6
I	30	30	33	63	75	81
II	33	33	51	66	81	87
III	36	45	63	88	123	111
IV	63	60	63	96	114	123

Venter occupied with epimera which form a ventral shield. In the postero-lateral parts along extremities, there are arranged acetabula in a row on both sides. Penis scaffold 63  $\mu$  wide. Colour somewhat purplish red.

*Locality.* A male captured on Oct. 9, 1951 in a stream in Shinjô-mura, Yamagata-gun.

*Remarks.* Though the present male resembles the following several species: *A. scitulus* C. Angelier; *A. natangensis* Protz; *A. scutelliferus* Walter; *A. fontinalis* Lundblad and *A. elongatus* Walter, it is different from these species in the feature of dorsum and in shape of bristles on the fourth and fifth segments of fourth legs.

### 25. *Aturus hirosimaensis* n. sp.<sup>1)</sup> (Fig. 28)

*Female.* Body almost elliptical in shape, 0.263 mm wide and 0.325 mm long in dorsum excluding epimera plates. Interval between eyes 80  $\mu$ . In dorsum present two pairs of papilla-groups, one just behind eyes and another near the postero-lateral margins of dorsal shield. Maxillar organ 82  $\mu$  long. Mandibles 0.1 mm long, each including a claw. Palpal segments measured as in Table 64 (in  $\mu$ ).

Table 64.

Segments	1	2	3	4	5
Extensor surface	18	48	30	60	33
Flexor surface	15	32	21	48	30

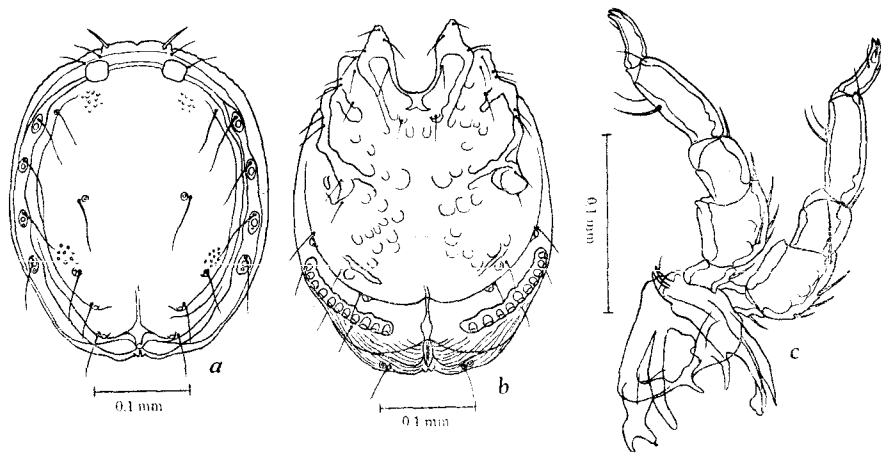
1) The specific name refers to the locality where it was found.

Flexor terminal end of second segment not so protruded as that of the male of *Aturus uchidai* n. sp. Epimeral region rather small and almost circular in shape. Legs wholly destitute of swimming hairs, with segments as in Table 65 (in  $\mu$ ).

Table 65.

Legs	Segments					
	1	2	3	4	5	6
I	24	24	36	48	60	66
II	27	27	39	48	60	69
III	30	30	42	60	81	87
IV	45	48	57	69	90	84

Genital acetabula 11 on right and 10 on left side. Nephridial pore opening in dorsum near the posterior extremity. Colour blackish red. Legs purplish black. Eyes black.

Fig. 28. *Aturus hirosimaensis* n. sp., female.

a. Dorsal view. b. Ventral view. c. Maxillar organ with mandibles and palpi.

*Locality.* Two females were captured on Oct. 9, 1951 in a stream in Shinjō-mura, Yamagata-gun.

*Remarks.* Though the present female may be the female of the preceding species *A. uchidai* n. sp., the author is still doubtful, because the body is too small and also too blackish comparing with the female of the preceding species. This

female seems new to science, though similar to the female of *A. elongatus* Walter, differing in details in figures of dorsum and genital plates.

**26. *Aturus rotundus* n. sp.<sup>1)</sup>** (Fig. 29)

*Female.* Body almost round, 0.332 mm wide and 0.384 mm long in dorsum, excluding epimera. The spaces between hinder parts of dorsum and ventral shields are small. Interval between eyes 120  $\mu$ . Antenniform bristles moderately long standing just anterior to eyes. Dorsal shield porose, large and round. Maxillar organ 84  $\mu$  long and 64  $\mu$  wide. Mandibles 126  $\mu$  long, including a claw in each. Palpi measured as in Table 66 (in  $\mu$ ).

Table 66.

Segments	1	2	3	4	5
Extensor surface	23	57	33	81	40
Flexor surface	21	36	21	66	36

Epimera porose, their shapes being given in the text-figure. Legs destitute of swimming hairs with segments as in Table 67 (in  $\mu$ ).

Table 67.

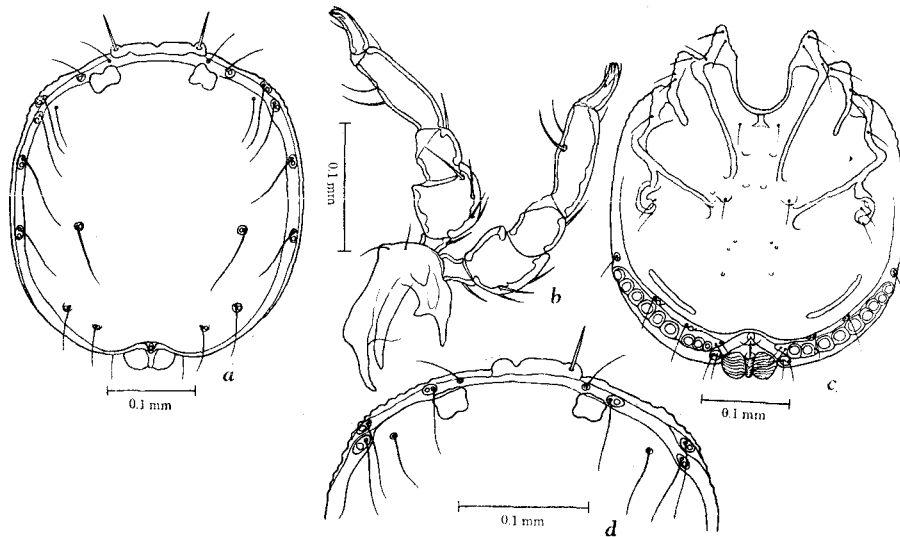
Legs \ Segments	1	2	3	4	5	6
I	28	30	39	57	75	84
II	36	36	48	63	78	87
III	39	39	51	78	99	96
IV	51	63	69	93	108	111

Genital lips striated and roundly protruded posteriorly. Genital acetabula counted in two specimens as follows: 9 and 6 on right side; 9 and 8 on the left. Excretory pore opening in dorsum just anterior to the genital opening.

*Locality.* Two females, one of which is aberrant in anterior part of dorsal shield, captured on Oct. 11, 1951 from Sandan-kyo torrent.

*Remarks.* Though similar to that of the Javanese species *A. obtusisetus minutus* Viets 1935 and the Japanese species *A. miyashitai* Uchida 1934, the present female is somewhat different in body size, shape and genital lips.

1) The new species has been named according to the almost globular body shape in dorsum.

Fig. 29. *Aturus rotundus* n. sp., female.

a. Dorsal view. b. Palpi. c. Ventral view. d. Anterior part of dorsum in an aberrant specimen.

### 27. *Kongsbergia hiroshima* n. sp.<sup>1)</sup> (Fig. 30)

*Male*. Body oval, 256  $\mu$  long in dorsum, excluding epimera plates and 200  $\mu$  wide in the widest part. Interval between eyes 80  $\mu$ . Many transverse wrinkles found in dorsum. Antenniform bristles moderately long. Maxillar organ 78  $\mu$  long and 48  $\mu$  wide. Mandibles 102  $\mu$  long, including a claw in each. Palpi prominently large, measuring as in Table 68 (in  $\mu$ ).

Table 68.

Segments	1	2	3	4	5
Extensor surface	12	63	31	63	36
Flexor surface	13	36	15	42	36

Second segment, largest of all, with four bristles, three of which are feathered, on the extensor surface, and two conical protrusions on the flexor surface of the lateral sides almost at the basal portion. Third segment short, having two bristles,

1) The specific name refers to the locality where it was found.

one of which on the inner surface is larger than another on the outer surface, in the extensor terminal end. Fourth segment long. Epimera fused, forming a ventral shield as a whole. Legs devoid of swimming hairs, provided with several stout bristles around the margin of segments. Legs measured as in Table 69 (in  $\mu$ ).

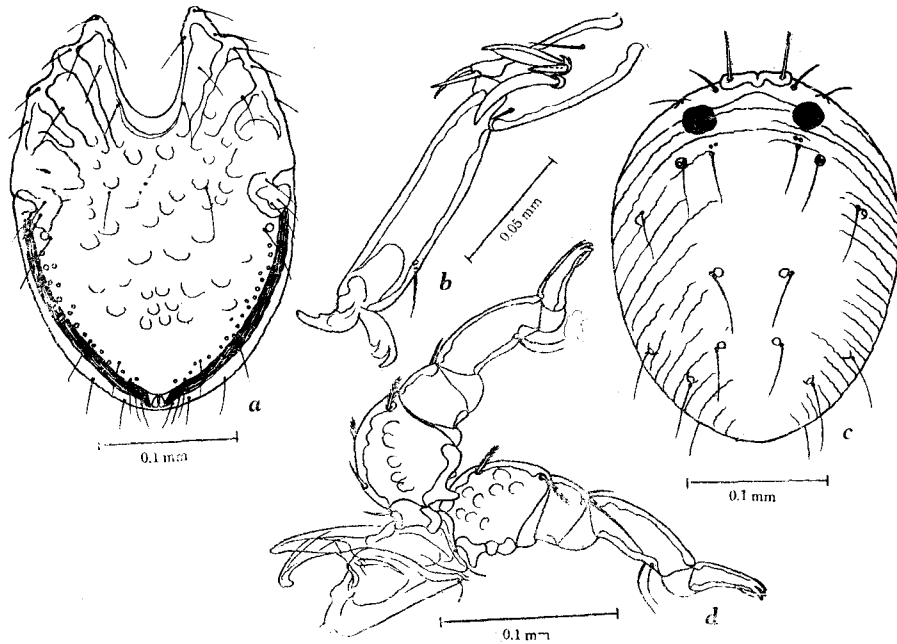


Fig. 30. *Kongsbergia hirosima* n. sp., male.  
a. Ventral view. b. Fifth and sixth segments of left fourth leg. c. Dorsal view. d. Palpi attached to maxillary organ.

Table 69.

Legs	Segments					
	1	2	3	4	5	6
I	27	30	33	39	66	60
II	27	30	33	42	57	63
III	30	30	39	45	66	75
IV	45	60	45	51	66	84

Fifth segment of fourth legs characteristic of bristles as shown in Text-figure 30.

Genital opening lying near the posterior extremity of body in venter. On both sides of genital opening, along the postero-lateral margins of the ventral shield, are arranged numerous minute acetabula nearly in two rows. Nephridial pore opening in venter immediately posterior to the genital opening. Colour brownish red. Epimera and legs purplish black. Eyes black.

*Locality.* A male captured on Oct. 9, 1951 in a brook in Shinjō-mura, Yamagata-gun.

*Remarks.* Though the present species resembles much the European species *K. materna*, it is different in bristles on the fifth segment of fourth legs.

### 28. *Kongsbergia uchidai* n. sp.<sup>1)</sup> (Fig. 31)

*Male.* Body oval, somewhat pointed in posterior contour, 0.3 mm long in dorsum, excluding epimera plates and 0.216 mm wide in the widest portion. Interval between eyes 92  $\mu$ . Though similar as a whole to the preceding species *K. hiroshima* n. sp., the palpal segments are different in details for bristles on second segments, measured as in Table 70 (in  $\mu$ ).

Table 70.

Segments	1	2	3	4	5
Extensor surface	12	84	32	76	36
Flexor surface	16	44	18	48	32

Eight bristles, five of which are feathered, inserted on the surface of the second segment mostly on the extensor surface. Third to fifth segments all similar to those of *K. hiroshima* n. sp. Ventral shield also akin to that of *K. hiroshima* n. sp. Pedal segments measured as in Table 71 (in  $\mu$ ).

Table 71.

Legs	Segments	1	2	3	4	5	6
I		24	33	39	48	63	66
II		27	36	42	45	69	72
III		33	33	48	57	81	90
IV		60	66	60	57	72	78

Legs devoid of swimming hairs. Fifth segment of fourth legs characteristic of bristles. Near the distal end of fifth segment two bristles, one horn-shaped and

1) The specific name has been endowed in honour of Dr. Tohru Uchida.

another minutely comb-toothed, are found. Genital opening and excretory pore open near the posterior extremity in venter. Colour blackish red. Epimera and legs purplish black. Eyes black.

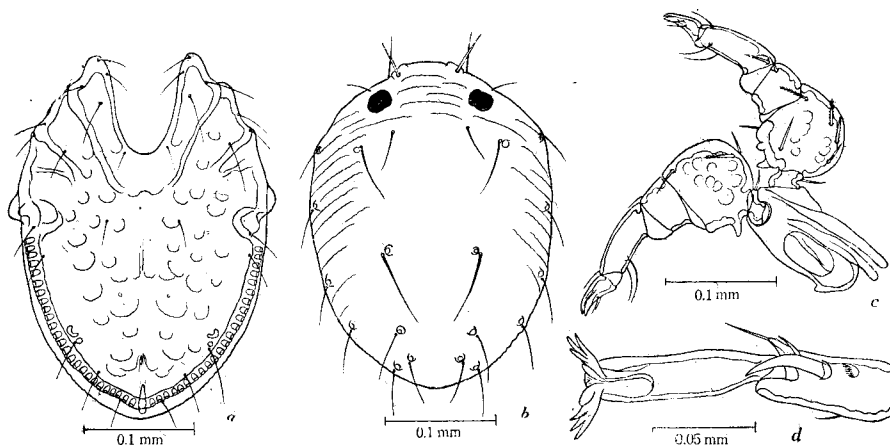


Fig. 31. *Kongsbergia uchidai* n. sp., male.

a. Ventral view. b. Dorsal view. c. Maxillar organ with palpi. d. Fifth and sixth segments of left fourth leg.

*Locality.* A male captured on Oct. 9, 1951 in a brook in Shinjō-mura, Yamagata-gun.

*Remarks.* Although the present species is very akin to the preceding species *K. hiroshima* n. sp., it is different in the bristles on the fifth segment of fourth legs, i.e. in having a minutely comb-toothed bristle. There is no record of a species having such a comb-toothed bristle on the fifth segment of fourth legs.

### 29. *Kongsbergia enamii* n. sp.<sup>1)</sup> (Fig. 32)

*Male.* Body oval in shape, 0.35 mm long and 0.24 mm wide in dorsum, excluding epimera plates. Interval between eyes 96  $\mu$ . Maxillar organ 130  $\mu$  long and 75  $\mu$  wide, situated in a deep maxillar bay. In dorsum can be seen many traverse wrinkles. Palpi prominently thick and stout, with segments as in Table 72 (in  $\mu$ ).

1) The new species has been named in honour of Dr. M. Enami, Associated Professor of Hiroshima University.

Table 72.

Segments	1	2	3	4	5
Extensor surface	15	117	54	96	45
Flexor surface	21	51	21	48	42
Height	40	108	68	38	20

First segment very short, having a bristle on the extensor terminal end. Second segment characteristically thick provided with nine bristles, three of which are feathered, on extensor surface and two papillous protrusions on flexor surface. A spine on the extensor terminal inner side is long. Third segment also thick compared with that of the other species and very short. Fifth segment triangular in the side view. Legs all destitute of swimming hairs and rather short except fourth leg which is stout and long. Pedal segments measured as in Table 73 (in  $\mu$ ).

Table 73.

Legs \ Segments	1	2	3	4	5	6
I	27	36	42	54	75	75
II	27	36	39	51	78	84
III	36	45	54	60	90	96
IV	69	75	72	72	87	87

Fifth segment of fourth legs characteristic of shape. Distal half of the flexor margin concave. At the proximal end of this concaved area are present a large horn-shaped bristle and a small accessory bristle. Ventral shield large, stretched out from the body in epimera margins of the anterior half. On both sides of the genital opening and along the postero-lateral margins in venter are arranged numerous minute acetabula in three to four rows. Excretory pore opening in venter. Body colour brownish red. Palpi, epimera and legs purplish black. Eyes black.

*Locality.* A male was captured on Oct. 11, 1951 in Sandan-kyo torrent.

*Remarks.* Though similar to the European species *K. materna*, the present species is different in palpi which are stouter, especially in second segment, and also in the bristles on the second segment. The species which was described as *K. materna* by Enami (1940) from the Izu Peninsula seems to the author not to be *K. materna*, but belongs to the present species.



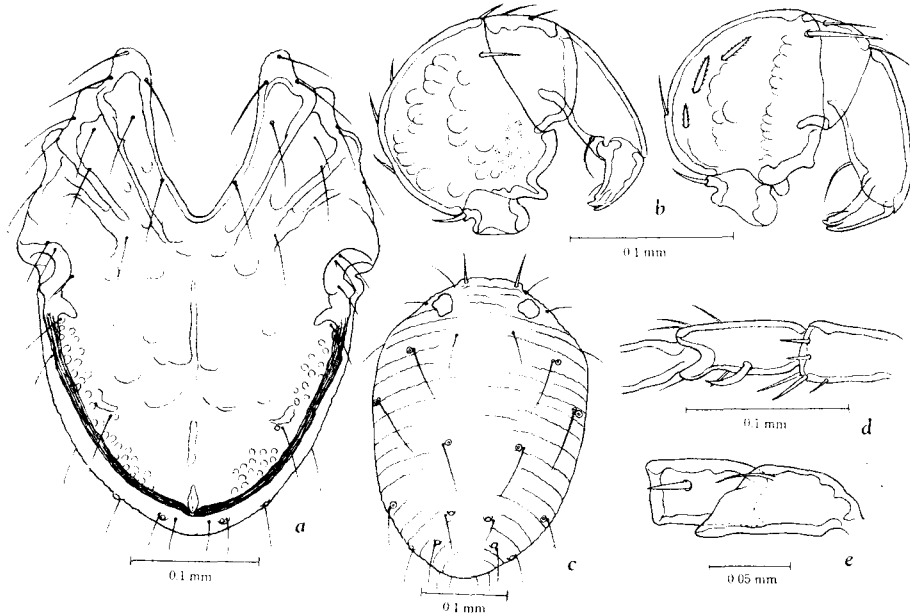


Fig. 32. *Kongsbergia enamii* n. sp., male.

a. Ventral view. b. Palpi. c. Dorsal view. d. Fourth to sixth segments of right fourth leg. e. First and second segments of right fourth leg.

**30. *Arrenurus (Arrenurus) agrionicolus* Uchida (Figs. 33, 34)**

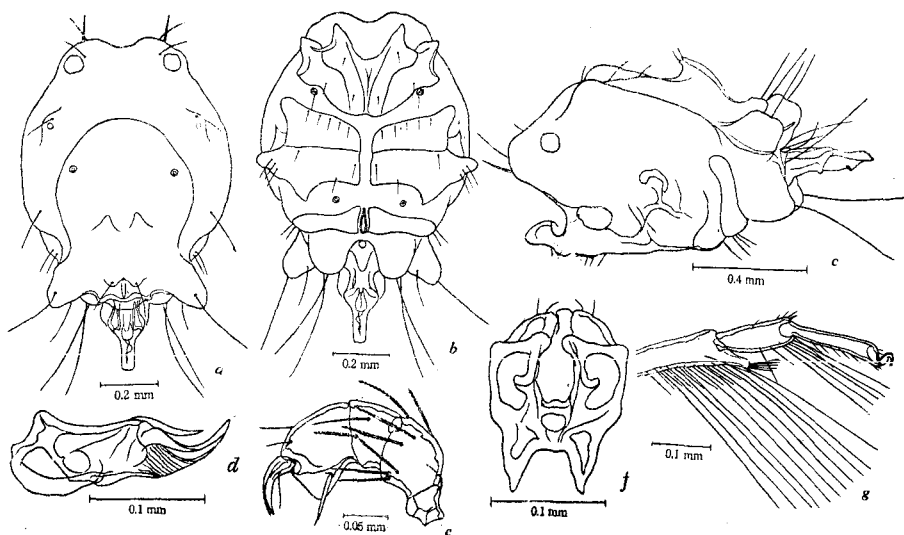
*Male* (Fig. 33). Body 1.152 mm long, including petiolus, 0.72 mm wide in the widest portion and 0.608 mm high. Interval between eyes 352  $\mu$ . Body contour in dorsal view nearly oval with shouldered antero-lateral margins, having postero-lateral protrusions, moderately developed. Dorsum well arched, having a pair of glandular elevations outside the dorsal groove, one pair of conical protuberances, somewhat bent forward in its summits, in the middle, and a pair of elevations in the middle portion near the posterior extremity. The area enclosed by dorsal groove is moderate in size measuring 464  $\mu$  wide in the widest portion. Posterior margin of cauda having two shallow incisions, from which several pairs of hairs sprout. Petiolus stout and characteristic of shape, almost rhomboid, measuring 260  $\mu$  long from base to tip and 140  $\mu$  wide in the middle widest portion. Terminal half part of petiolus hyaline and the posterior extremity finely indented. Lateral crooked hairs slightly longer than a half of petiolus and curved towards it with their tips. Maxillar organ thick and short measuring

164  $\mu$  long and 120  $\mu$  wide. Mandibles 196  $\mu$  long, including a claw in each and 76  $\mu$  high. Palpi measured as in Table 74 (in  $\mu$ ).

Table 74.

Segments	1	2	3	4	5
Extensor surface	32	84	72	100	64
Flexor surface	18	40	28	68	60

Second segment with seven bristles, five of which are feathered. Third segment bearing two bristles, one on each side near the extensor surface. Fourth segment, largest of all, with two minute spines near the extensor terminal extremity, and

Fig. 33. *Arrenurus (Arr.) agrionicolus*, male.

a. Dorsal view. b. Ventral view. c. Lateral view. d. Mandible. e. Right palpus. f. Maxillar organ. g. Fourth to sixth segments of left fourth leg.

a sword-shaped movable bristle on the flexor inner margin. Fifth segment slender claw-like. Epimera plates shown in the text-figure. Posterior margin of fourth pair characteristically pointed in its middle portion. Legs measured as in Table 75 (in  $\mu$ ).

Table 75.

Legs	Segments	1	2	3	4	5	6
I		86	92	140	180	172	252
II		100	108	148	200	196	272
III		112	124	144	184	184	232
IV		140	192	200	228	136	176

On terminal end of fourth segment of fourth legs is provided with a spur 76  $\mu$  long. On its summit are provided with six spines, rather short and unequal in length. Genital wings, in ventral and lateral view, contoured in the text-figures. Genital opening 88  $\mu$  long. Excretory pore opening immediately posterior to the genital opening. Colour bluish green. Eyes black.

*Female* (Fig. 34). Body oval in shape, 1.136 mm long and 0.976 mm wide at the widest portion. Interval between eyes 384  $\mu$ . Grooved area in dorsum almost round in shape, 784  $\mu$  long and 704  $\mu$  wide. Anterior end of body narrowed

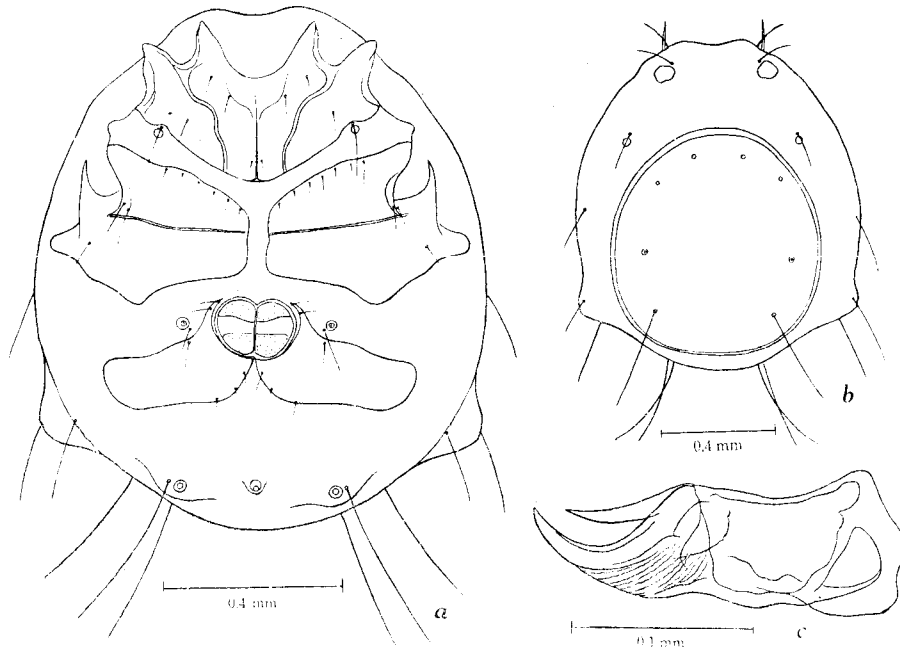


Fig. 34. *Arrenurus* (*Arr.*) *agrionicolus*, female.  
a. Ventral view. b. Dorsal view. c. Mandible.

and concave a little in the middle of the margin. Postero-lateral corners protrude conically. Posterior margin rounded enough. Maxillar organ, mandibles and palpi all completely same in shape as those of the male. Maxillar organ 192  $\mu$  long and 140  $\mu$  wide. Mandibles 210  $\mu$  long and 80  $\mu$  high. Palpal segments measured as in Table 76 (in  $\mu$ ).

Table 76.

Segments	1	2	3	4	5
Extensor surface	36	92	72	104	68
Flexor surface	20	40	24	76	64

Epimera plates somewhat different from those of the male, posterior margin of fourth epimera not so sharpened posteriorly as those of the male. Measurement of legs given in Table 77 (in  $\mu$ ).

Table 77.

Legs \ Segments	1	2	3	4	5	6
I	88	80	144	180	164	200
II	96	100	148	208	196	216
III	112	120	152	200	192	204
IV	216	188	204	240	204	204

Genital plate of one side 118  $\mu$  long and 82  $\mu$  wide. Genital wing wide in its basal portion, tapering toward the terminal portion and measured 296  $\mu$  long at the anterior margin. Nephridial pore located near the extremity in venter. Body and eyes same in colour as those of the male.

*Locality.* Collected eleven males and a female on Oct. 12, 1951 in a pool in Kumano-mura.

*Remarks.* The present species was first recorded by Prof. Tohru Uchida as a new species from Yatsushiro, Kyushu, reporting that the larva is parasitic on a dragon-fly belonging to the Agrionidae. The female of the species was also reported by Uchida & Imamura (1951) from a lake at Wuchang, Middle-China. Though the Chinese female specimens have a few differences in detail from the Japanese specimens, it seems to be a local variation.

### 31. *Arrenurus (Arrenurus) japonicus* Uchida & Imamura

Collected three males and females on Oct. 10 in a pond in Oasa-mura, Yamagata-gun and six males and two nymphs on Oct. 12, 1951 in a pool in Kuma-

no-mura. Though the present species was recorded as a new species by Uchida & Imamura in the paper of Imamura (1952) on specimens from Kyushu, it had already been found from Tokyo and provisionally reported by Prof. Uchida in 1938. This species seems common in Japan, because specimens have been collected by Dr. Uchida and the author from the following localities: Hokkaido, Tokyo, Nagoya, Hyogo Pref., Kyushu.

32. *Arrenurus (Arrenurus) petiospinus* n. sp.<sup>1)</sup> (Figs. 35-37)

*Male* (Fig. 35). Body large, 1.248 mm long including petiolus, 0.865 mm wide in the widest portion and 0.768 mm high. Body contour almost globular, having posterior large protuberances. Interval between eyes 416  $\mu$ . Dorsum well-arched, provided with a pair of glandular elevations outside the dorsal groove, a pair of conical protuberances, of which summits bent forwards, in the middle, and two pairs of small elevations near the posterior extremity. The area encircled by a dorsal groove is spherical in shape and 500  $\mu$  wide in the widest diameter. The area of caudal extremity is described in the text-figure. Petiolus prominently

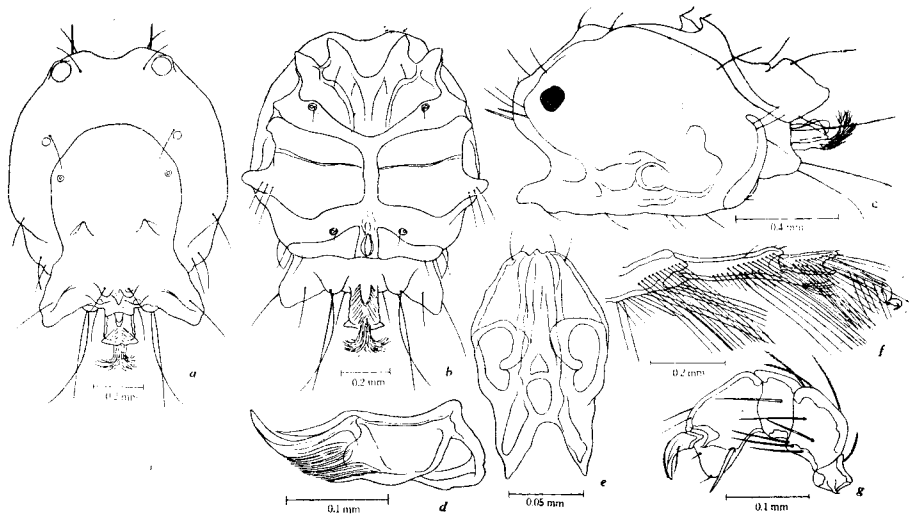


Fig. 35. *Arrenurus (Arrenurus) petiospinus* n. sp., male.

a. Dorsal view. b. Ventral view. c. Lateral view. d. Mandible. e. Maxillar organ. f. Fourth to sixth segments of right fourth leg. g. Right palpus.

1) The new species has been named in connection with the spiniated petiolus

large and characteristic of shape, having a bundle of crooked spines at the ventral terminal extremity as shown in the text-figures. Petiolus 250  $\mu$  long, including spiniated portion and 140 $\mu$  wide in the widest part. Maxillar organ longer than that of *A. japonicus* measuring 230  $\mu$  long and 136  $\mu$  wide. Mandibles 232  $\mu$  long, including a claw in each and 90  $\mu$  high. Palpi measured as in Table 78 (in  $\mu$ ).

Table 78.

Segments	1	2	3	4	5
Extensor surface	36	88	72	120	68
Flexor surface	20	44	24	90	68

First segment provided with a feathered bristle on the extensor terminal portion. Second segment with eight bristles, three on the extensor surface all feathered. In third segment inserted two bristles, one on each lateral side. Fourth segment rather straight on extensor surface and roughly curved on the flexor surface. Pedal segments measured as in Table 79 (in  $\mu$ ).

Table 79.

Legs \ Segments	1	2	3	4	5	6
I	96	103	163	200	185	281
II	89	118	178	222	222	303
III	141	141	170	230	222	281
IV	178	237	244	281	148	185

Spur of fourth segment in fourth legs 81  $\mu$  long, provided with five equally long hairs on its summit. Genital wings long and slender except the broad basal portions as shown in the text-figures. Genital opening 87  $\mu$  long. Colour yellow ochre. Eyes reddish black.

*Female* Fig. 36). Body almost globular in shape, 1.136 mm long and 1.04 mm wide. Anterior margin somewhat concaved posteriorly and the posterior margin almost straight but a little rounded, having conical elevations at the postero-lateral corners. Interval between eyes 416  $\mu$ . In dorsum a pair of glandular elevations are found outside the dorsal groove and three pairs of gland plates, each attended with a hair, in the dorsal grooved area which is circular in shape, 752  $\mu$  long and 700  $\mu$  wide in the widest part. Maxillar organ, mandibles and palpi all entirely equal in shape to those of the male. Maxillar organ 220  $\mu$  long and 136  $\mu$  wide. Mandibles 230  $\mu$  long and 84  $\mu$  high. Palpi measured as in Table 80 (in  $\mu$ ).

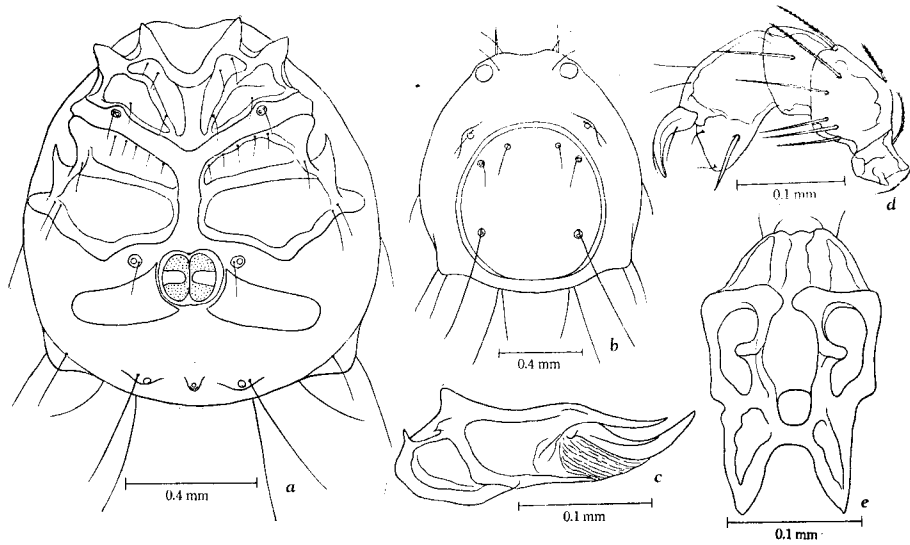


Fig. 36. *Arrenurus* (*Arr.*) *petiospinus* n. sp., female.  
a. Ventral view. b. Dorsal view. c. Mandible. d. Right palpus. e. Maxillar organ.

Table 80.

Segments	1	2	3	4	5
Extensor surface	40	92	72	112	68
Flexor surface	38	42	28	92	68

Measurement of legs as in Table 81 (in  $\mu$ ).

Table 81.

Legs \ Segments	1	2	3	4	5	6
I	92	92	160	200	176	232
II	108	108	172	228	204	244
III	120	120	164	216	204	244
IV	160	208	228	260	208	220

Genital plate 148  $\mu$  long and 81  $\mu$  wide. Genital wings 260  $\mu$  long on anterior margin of one wing. Excretory pore opening near the extremity in venter.

Colour same as that of the male.

*Nymph* (Fig. 37). Body oval in shape, 0.516 mm long and 0.472 mm wide. Skin not hardened, covered on all the surface with fine striations. Interval between eyes 220  $\mu$ . Maxillar organ, mandibles and palpi all almost alike to those of the imago. Palpal segments measured as in Table 82 (in  $\mu$ ).

Table 82.

Segments	1	2	3	4	5
Extensor surface	20	64	48	80	58
Flexor surface	10	26	12	56	56

First segment destitute of bristles. Second segment with four bristles, two of which on the extensor surface feathered. Third to fifth segments similar as a whole

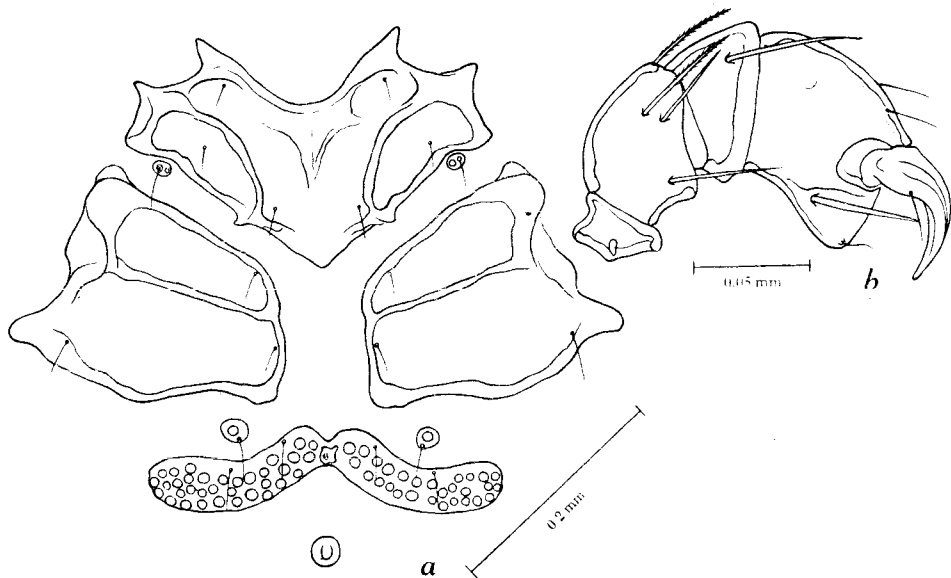


Fig. 37. *Arrenurus* (*Arr.*) *petiospinus* n. sp., nymph.  
a. Epimera and provisional genital organ. b. Left palpus.

to those of the imagines. Epimera shown in the text-figure. Measurement of legs as in Table 83 (in  $\mu$ ).



Table 83.

Legs	Segments					
	1	2	3	4	5	6
I	48	48	80	104	112	148
II	52	52	88	116	124	148
III	56	56	80	112	120	148
IV	76	92	116	136	132	140

Epimera and legs porose. Genital wing 144  $\mu$  in anterior margin. Colour yellow. Eyes black.

*Locality.* Collected five males, six females and a nymph on Oct. 12, 1951 in a pond in Kumano-mura.

*Remarks.* The male of the present species is characteristic of the petiolus which has a peculiar spine bundle on its tip.

### 33. *Arrenurus (Arrenurus) hadai* n. sp.<sup>1)</sup> (Fig. 38)

*Female.* Body oval in shape, 0.63 mm long and 0.547 mm wide. Interval between eyes 214  $\mu$ . In dorsum a pair of glandular small elevations outside the dorsal groove. There are three pairs of glands in dorsal plate which is encircled by a dorsal groove. Maxillar organ 87  $\mu$  wide. Mandibles 114  $\mu$  long, including a claw in each and 54  $\mu$  high. Measurement of palpi given in Table 84 (in  $\mu$ ).

Table 84.

Segments	1	2	3	4	5
Extensor surface	—	64	40	72	36
Flexor surface	—	28	20	56	32

Second segment with six bristles. The figure of each segment is illustrated in the text-figure. Epimera, genital organ and genital wings shown in the text-figure, and pedal segments in Table 85 (in  $\mu$ ).

Table 85.

Legs	Segments					
	1	2	3	4	5	6
I	42	48	84	100	100	104
II	45	56	92	112	108	112
III	60	64	88	120	120	120
IV	92	100	116	132	132	136

1) The new species has been named in honour of Dr. Yosine Hada, a limnologist in Hiroshima Prefecture.

Genital plates area oval, broadened in posterior portion,  $143\ \mu$  long and  $137\ \mu$  wide. Genital wing  $182\ \mu$  long on the anterior margin and  $86\ \mu$  wide in the widest part. Excretory pore lying in venter between genital organ and posterior body margin. Colour green. Eyes black.

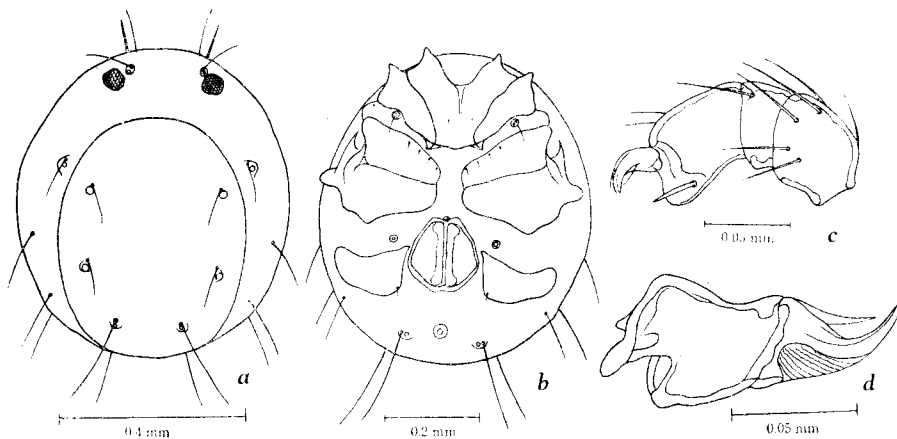


Fig. 38. *Arrenurus (Arr.) hadai* n. sp., female.  
a. Dorsal view. b. Ventral view. c. Right palpus. d. Mandible.

*Locality.* Only a female was captured on Oct. 10, 1951 in a pond in Ōasa-mura, Yamagata-gun.

*Remarks.* Though the present female is most akin to the Javanese species *A. (Arr.) ansatus* Walter, it is different in body size, shape of genital wings and in fourth segment of palpi from the latter. The males<sup>1)</sup> and females were collected from Hyogo Prefecture by the author. The present species is specially characterized in the form of the male.

#### 34. *Arrenurus* sp. (Fig. 39)

*Nymph.* Body almost globular in shape, 0.577 mm long and 0.535 mm wide. Skin not hardened all the surface covered with fine striations. Interval between eyes  $222\ \mu$ . Maxillar organ rather long,  $117\ \mu$  long and  $81\ \mu$  wide in the widest portion. Mandibles stocky,  $93\ \mu$  long, including a claw in each and  $48\ \mu$  high. The figure of palpi is as in the text-figure. Sword-shaped bristles at the flexor margin of fourth segment comparatively longer than that of the preceding

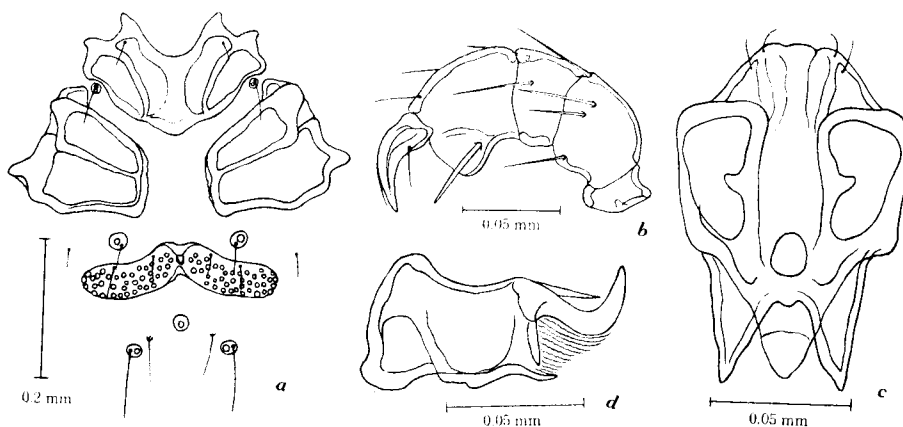
1) The author will describe the male in the near future.

species *A. (Arr.) hadai* n. sp. Segments measured as in Table 86 (in  $\mu$ ).

Table 86.

Segments	1	2	3	4	5
Extensor surface	18	51	42	63	48
Flexor surface	12	21	15	42	45

Epimera and legs porose. Measurement of legs given in Table 87 (in  $\mu$ ).

Fig. 39. *Arrenurus* sp., nymph.

a. Epimera and provisional genital organ. b. Right palpus. c. Maxillar organ.  
d. Mandible.

Table 87.

Segments	1	2	3	4	5	6
Legs						
I	36	36	66	81	90	99
II	42	45	69	93	105	120
III	48	51	69	96	102	126
IV	63	75	96	120	123	144

*Locality.* A nymph captured on Oct. 12, 1951 in a pool in Kumano-mura.

*Remarks.* Although the present nymph appears at a glance as the nymph of the preceding species *A. (Arr.) hadai* n. sp., it can not be definitely concluded

from the body size, palpi etc.

### 35. *Arrenurus (Micruracarus) madarászi* (Daday)

Collected five males and six females on Oct. 10 in a pond in Ōasa-mura, Yamagata-gun; two males and a female on Oct. 12, 1951 in a pool in Kumano-mura. The species is common in Asia from the tropical region to the middle part of Japan.

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