



Title	Some Stenophilous Water-Mites from Hyogo Prefecture (With 8 Text-figures)
Author(s)	IMAMURA, Taiji
Citation	北海道大學理學部紀要, 11(2), 261-276
Issue Date	1953-04
Doc URL	<a href="http://hdl.handle.net/2115/27125">http://hdl.handle.net/2115/27125</a>
Type	bulletin (article)
File Information	11(2)_P261-276.pdf



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

By

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(With 8 Text-figures)

Uchida (1934) described from Hyogo Prefecture the following three rheophilous water-mites:

*Sperchon (Hispidio.) plumifer* Thor  
*Pseudosperchon verrucosus* (Proz) var.  
*Aturus ovalis* Uchida

In the autumn of 1950 the author had a chance to collect some stenophilous water-mites from his home village, a hilly region, Okuyokawa-mura, Minô-gun in Hyogo Prefecture. This report is mainly based on the specimens collected on the trip of collection, and partly on the specimens captured by Dr. H. Yamaguchi from Kawabô-gun in Hyogo Prefecture on April 1, 1938 and deposited in the collections of Prof. Tohru Uchida. The list of the species studied here is as follows.

1. *Hydrodroma despicens* (O. F. Müller)
2. *Limnesia (Limnesia) undulata* (O. F. Müller)
3. *Unionicola (Polyatax) japonensis* Viets
4. *Neumania (Neumania) nodosa* (Daday)
5. *Tiphys scaurus* (Koenike)
6. *Piona coccinea coccinea* (C. L. Koch)
7. *Piona rotunda* (Kramer) var.
8. *Arrenurus (Arrenurus) japonicus* Uchida & Imamura
9. *Arrenurus (Arrenurus) hadai* Imamura
10. *Arrenurus (Micruracarus) madarászi* (Daday)

Among these, *Tiphys scaurus* and *Piona coccinea coccinea* are newly recorded from Japan.

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

This study has been supported by a grant from the Fundamental Scientific Research of the Ministry of Education.

*Jour. Fac. Sci., Hokkaido Univ., Ser. VI, Zool. 11, 1953.*

Before proceeding further the author wishes to express his most grateful thanks to Dr. Tohru Uchida, Professor of Hokkaido University, for his kind guidance and encouragement in the course of this study and forgiving the specimens from his custody at the author's disposal. His hearty thanks must be extended here to Dr. H. Yamaguchi, Professor of Hokkaido Gakugei University, collected a part of the collection in this study, and to Dr. Isao Taki, Head Curator of Zoology in the National Science Museum, Uéno Park, Tokyo, for his kindness in identifying the host snails of *Unionicola japonensis*.

### 1. *Hydrodroma despiciens* (O. F. Müller)

*Locality.* Several males and females were collected by the author on Oct. 13, 1950 in a pool in Okuyokawa-mura, Minô-gun.

*Remarks.* This cosmopolitan species was reported by the author in 1952 from Kyushu District and Hiroshima Prefecture.

### 2. *Limnesia (Limnesia) undulata* (O. F. Müller) (Fig. 1)

*Female.* Body oval in shape, 960  $\mu$  long and 800  $\mu$  wide. Skin soft, colourless, transparent and finely striated on all the surface. A postero-dorsal plate (Fig. 1, e) is found and measured 68  $\mu$  wide and 53  $\mu$  long. Interval between eyes 272  $\mu$  in frontary pair and 304  $\mu$  in posterior one. Maxillar organ 326  $\mu$  long and 200  $\mu$  wide in the widest portion. Mandibles 505  $\mu$  long, inclusive of a claw in each and 118  $\mu$  high. The sizes of the palpal segments are measured as in Table 1 (in  $\mu$ ).

Table 1.

Segments	1	2	3	4	5
Extensor surface	30	259	170	363	133
Flexor surface	67	163	111	259	126

First segment very short and hairless. Second segment the thickest, bearing many short feathered or non-feathered spines on the extensor surface. On the surface of the second segment sprouts a conical process with a spine on its summit. Third segment with four spines on the extensor surface. Fourth segment the longest, slender and with two hairs on the flexor surface. Epimera composed of four groups. Anterior groups small, and the right and left ones fusing each other. Posterior groups almost triangular in shape and three groups of porous-patterns as shown in Fig. 1, a. The dimensions of the pedal segments are given in Table 2 (in  $\mu$ ).

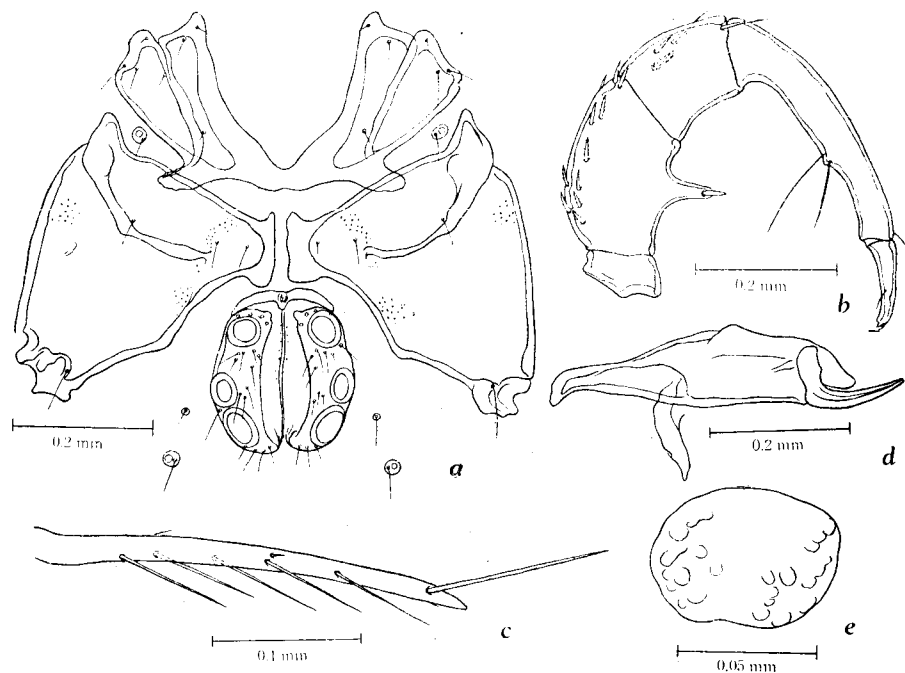


Fig. 1. *Limnesia (Limnesia) undulata* (O. F. Müller) (female).  
 a. Epimera and genital area. b. Palpus. c. Terminal segment of right IVth leg. d. Mandible. e. Postero-dorsal plate.

Table 2.

Legs	Segments	1	2	3	4	5	6
I		80	120	160	180	224	204
II		88	140	180	244	296	276
III		120	128	160	240	292	252
IV		184	180	220	316	356	360

Swimming hairs on legs found two on fourth segment of second leg, two on fourth segment and six on fifth segment of third leg, and two on third segment, four on fourth segment and eight on fifth segment of fourth leg. Terminal spine of the fourth legs 130  $\mu$  long. Genital plates banana-like in shape, having three large acetabula and several minute hairs on the surface. Anterior genital suspender

large, measuring 144  $\mu$  long. Nephridial pore lying at the posterior portion of genital organ. Body colour brown. Eyes reddish black.

*Locality.* Two females were collected by the author on Oct. 13, 1950 from a pond in Okuyokawa-mura, Minô-gun.

*Distribution.* Europe, Asia, North America, South Africa.

*Remarks.* The present cosmopolitan form was described by T. Uchida from Tokyo in 1931 and 1938, from Saghalien in 1936 and a variety from the Kurile Islands in 1936. The author collected males, females and nymphs of this species from Tokyo in Oct. 1949.

### 3. *Unionicola (Polyatax) japonensis* Viets (Fig. 2)

*Female.* Body long ellipsoidal in shape, 860  $\mu$  long and 560  $\mu$  wide. Eyes large and interval 230  $\mu$ . Maxillar organ rather small, 200  $\mu$  long and 143  $\mu$  wide. Mandibles stout, short, measuring 172  $\mu$  long, inclusive of a claw in each. Palpi thick and strong. First segment very short. Second segment thickest of all, bearing four spines near the extensor margin. Third segment provided with a long spine on the inner basal surface. Fourth segment with three papillose protrusions on the flexor side near the terminal end. Fifth segment bifurcated at its terminal end, claw-like in shape. Palpal segments measured as in Table 3 (in  $\mu$ ).

Table 3.

Segments	1	2	3	4	5
Extensor surface	8	129	82	122	61
Flexor surface	12	82	34	88	34

Epimera composed of four groups as shown in Fig. 2, a. First leg the strongest and with long spines: one pair in the second segment, two pairs in the third to fifth segments respectively. Claws of the first legs the largest, and bifurcated in the middle portion. Second legs rather slender having several long spines, not so long as those in the first legs. Claws of the second legs small and each

Table 4.

Legs	Segments					
	1	2	3	4	5	6
I	68	109	177	245	190	184
II	68	102	177	258	197	204
III	82	109	143	204	177	184
IV	109	120	170	252	299	231

bifurcated near the tip. In the second to fourth segments of fourth legs moderately long spines arise, but these spines not so long as those in the first and second legs. The fifth segment has comparatively short spines. The claws of the fourth legs are similar in shape but smaller than those in the first legs. Pedal segments measured as in Table 4 (in  $\mu$ ).

Genital organ locating at postero-ventral margin of body and composed of four genital plates. Ventral pairs of plates having each a remarkable chitinous protrusion, probably utilized for spawning. Numbers of acetabula, found on the genital plates, counted as in Table 5. Devoid of excretory pore. Body colour bluish black. Eyes black.

Table 5.

Specimen's numbers	Dorsal plates		Ventral plates	
	Right	Left	Right	Left
504	7	7	4	5
507	6	5	4	4
508	6	6	5	4
509	6	5	4	4

*Male.* Body larger than the female, measuring 960  $\mu$  long, 600  $\mu$  wide and 540  $\mu$  high. Body shape, colour and organs all similar to those of the female, but the genital organ (Fig. 2, b) is different from that of the female, composing of two plates which are connected at their dorsal terminal ends. There are 16-20 acetabula on each genital plate which is measured 184  $\mu$  long and 170  $\mu$  wide in the widest part. Genital aperture 150  $\mu$  long.

*Nymph.* Body almost of short ellipse in shape, 500  $\mu$  long and 345  $\mu$  wide. Body colour and organs all alike to those of the adult. Four round acetabula and four hairs found in the provisional genital field as shown in Fig. 2, d.

*Locality.* Six males, fifteen females and a nymph were collected by the author on Oct. 14, 1950 in the mantle cavities of fresh-water snails, *Viviparus malleatus* and *Viviparus japonicus*,<sup>1)</sup> captured from ponds at Okuyokawa-mura, Minô-gun.

*Remarks.* The present species was recorded by Dr. Karl Viets in 1933 as a new subgenus and a new species on females and nymphs, captured by Prof. Tohru Uchida in May 1930 in a pond in Kichijôji, Tokyo in free living. Afterwards Dr. Uchida himself described the species in 1938 from Tokyo on fresh-water mussels and snails and in 1939 from Osaka. Specimens collected also by Mr. Jun

1) These fresh-water snails were identified by Dr. Isao Taki, Head Curator of Zoology in the National Science Museum, Uéno Park, Tokyo.

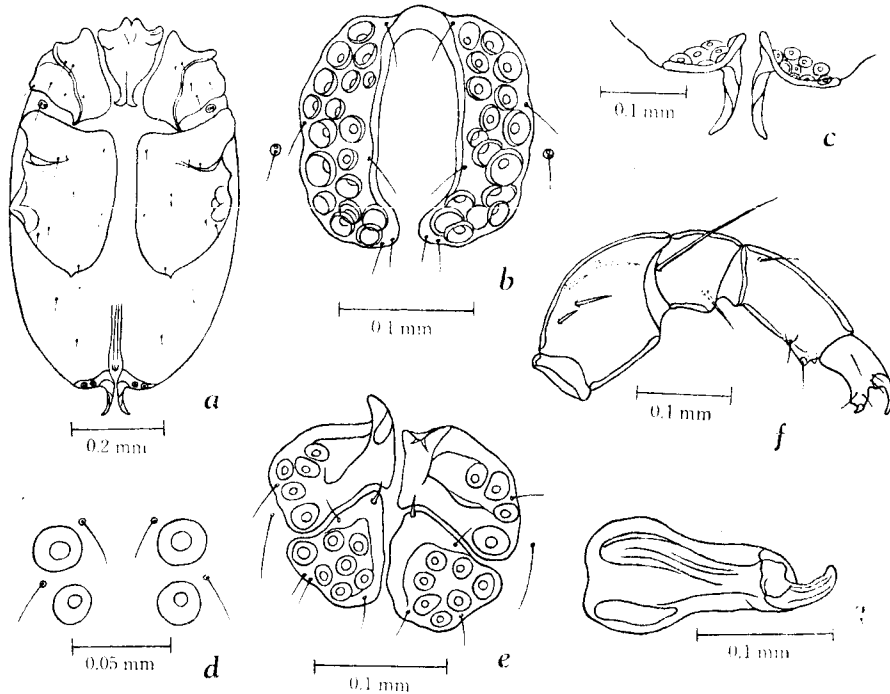


Fig. 2. *Unionicola (Polytax) japonensis* Viets.

a. Ventral view of female. b. Genital plates of male. c. Dorsal view of female genital organ. d. Provisional genital organ of nymph. e. Genital organ of female. f. Left palpus of male. g. Mandible of male.

Miyazaki, in Gifu Prefecture, in 1950 in the mantle cavity of *Viviparus malleatus*. The parasitic ratios of this water-mites in fresh-water snails examined by the author on the specimens captured from Hyogo Prefecture are 47/126 in *Viviparus malleatus* and 6/23 in *Viviparus japonicus*. The numbers of the mites parasitic on a single snail are 1-3.

#### 4. *Neumania (Neumania) nodosa* (Daday) (Fig. 3)

*Male*. Body oval in shape, 688  $\mu$  long and 500  $\mu$  wide. Skin soft, colourless, transparent and finely striated. Interval between eyes 263  $\mu$ . Mandibles stout, 135  $\mu$  long, inclusive of a claw in each and 51  $\mu$  high. Measurement of palpi given in Table 6 (in  $\mu$ ).

Table 6.

Segments	1	2	3	4	5
Extensor surface	30	96	51	108	39
Flexor surface	21	66	33	84	30

First segment with a bristle in the extensor terminal end. Second segment with three feathered spines, two of which are long, on the extensor surface. Third segment provided with two long non-feathered spines in the extensor distal end. Fourth segment slender, curved a little outwards, having two papillous protrusions, each with a hair, on the flexor surface and several fine hairs on the extensor surface. Fifth segment curved a little and trifurcated in the distal end. Epimera illustrated in Fig. 3, a and covered with hexagonal pattern. Legs measured as in Table 7 (in  $\mu$ ).

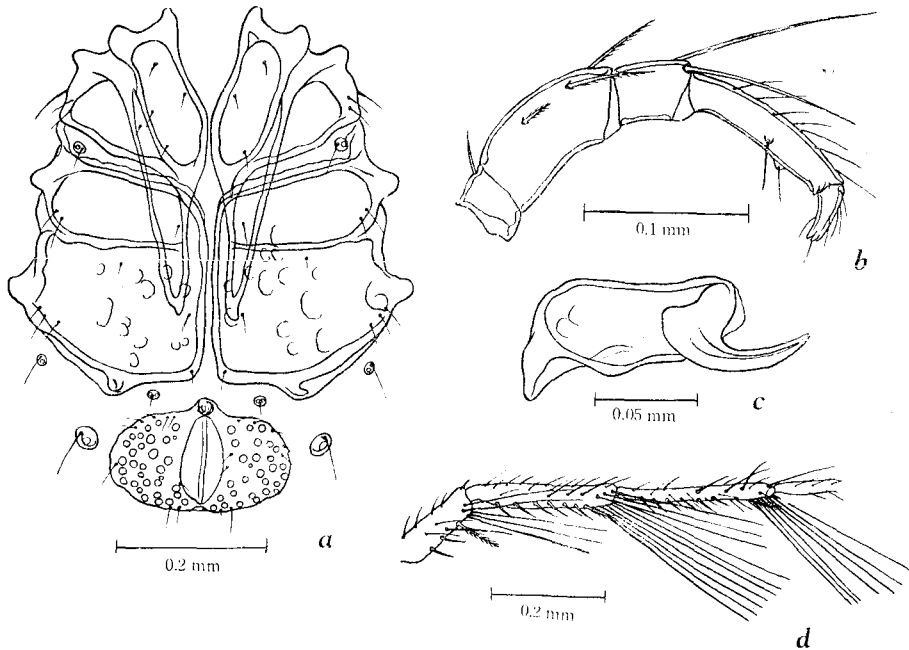


Fig. 3. *Neumania (Neumania) nodosa* (Daday) (male).  
a. Ventral view. b. Palpus. c. Mandible. d. 3rd 6th segments of left IVth leg.



Table 7.

Legs	Segments					
	1	2	3	4	5	6
I	57	120	171	251	274	240
II	74	114	177	274	285	245
III	68	103	143	240	280	268
IV	91	148	200	268	285	—

Though scarce of spines in the first to third legs, the fourth legs have many swimming hairs in the distal end of each segment: five in the third, ten in the fourth, seven in the fifth segments. Genital plates of half-moon in shape, measured  $142 \mu$  long and  $233 \mu$  wide, including both sides, with 25–30 acetabula in each plate. Genital aperture  $114 \mu$  long.

*Locality.* One male captured by the author on Oct. 13, 1950 in a pond in Okuyokawa-mura, Minô-gun.

*Distribution.* Ceylon, Burma, Malay Peninsula, New Caledonia, India, Java, Sumatra, Bali and Palau Islands.

*Remarks.* This oriental species was recorded by Prof. T. Uchida from Palau Islands in 1935 and from Kyushu in 1937.

### 5. *Tiphys scaurus* (Koenike) (Fig. 4)

*Male.* Body ellipsoidal in shape,  $660 \mu$  long and  $475 \mu$  wide. Skin soft, colourless, transparent and finely striated on all the surface except epimera and genital plates. Antenniform hairs found in the anterior portions of eyes. Interval between eyes  $162 \mu$ . Maxillar organ  $108 \mu$  long and  $103 \mu$  wide. Mandibles  $168 \mu$  long, inclusive of a claw in each and  $84 \mu$  high in the highest portion. The sizes of the palpal segments are given in Table 8 (in  $\mu$ ).

Table 8.

Segments	1	2	3	4	5
Extensor surface	33	99	48	132	51
Flexor surface	24	66	24	84	45

First segment short, with a bristle on the extensor surface. Second segment the thickest, with several short spines on the extensor edge. Third segment of trapezoid in shape with two hairs, one of them on the outer surface being prominently long. Fourth segment the longest and with two conical elevations on the flexor side. Shapes of epimera illustrated in Fig. 4, a. Posterior epimera groups fused each other with the right and left ones. Epimera region measured

537  $\mu$  long and 375  $\mu$  wide, occupying almost all the venter. The dimensions of the pedal segments are given in Table 9 (in  $\mu$ ).

Table 9.

Legs	Segments					
	1	2	3	4	5	6
I	74	74	120	165	194	256
II	68	80	120	165	188	262
III	80	57	57	68	125	171
IV	125	85	51	177	234	290

Figures of sperm claws in third legs, and fourth leg illustrated in Fig. 4, d, e. Fourth segment of fourth leg broadly rounded but very thin, with many slender

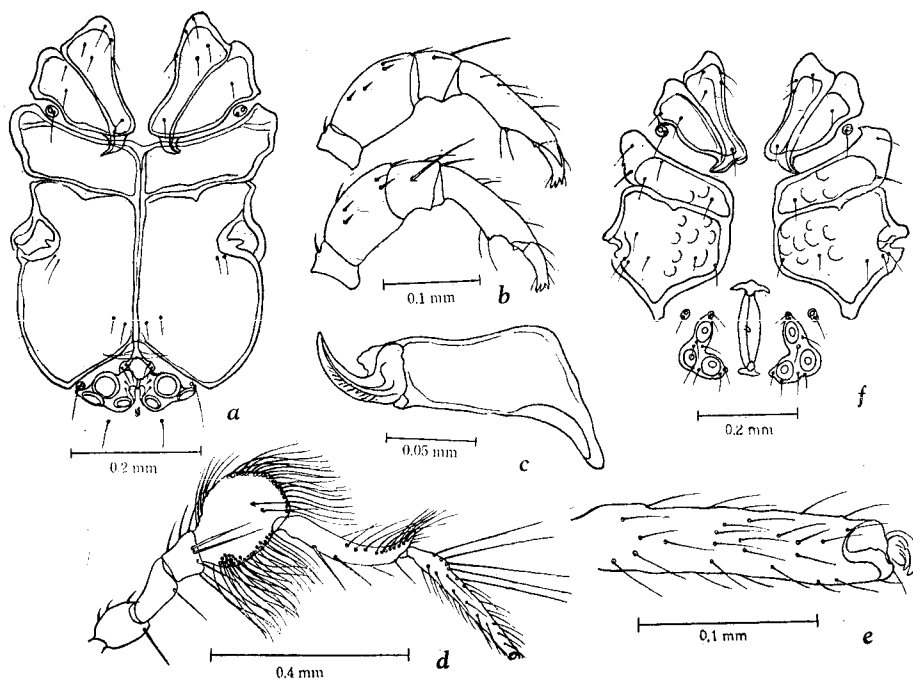


Fig. 4. *Tiphys scaurus* (Koenike).

a. Epimera and genital organ of male. b. Palpi of male. c. Mandible of male. d. Right IVth leg of male. e. Sperm claws attached to the terminal segment of left IIIrd leg. f. Epimera and genital organ of female.

hairs on its marginal surface. Genital plates almost triangular in shapes, fused each other with the right and left ones, each with three acetabula. Excretory pore opening just behind the posterior portion of genital organ. The body colour cannot be decided in the preservative.

*Female.* Body of oval in shape, larger than the male, 1070  $\mu$  long and 843  $\mu$  wide. Skin similar to that of the male. Interval between eyes 275  $\mu$ . Maxillar organ 133  $\mu$  long and 126  $\mu$  wide. Mandibles 208  $\mu$  long, including a claw in each and 96  $\mu$  high in the highest portion. Palpi similar to those of the male, measured the segments as in Table 10 (in  $\mu$ ).

Table 10.

Segments	1	2	3	4	5
Extensor surface	40	136	64	156	60
Flexor surface	28	80	40	108	52

Epimera region measured 550  $\mu$  long and 616  $\mu$  wide in the widest portion. Legs measured as in Table 11 (in  $\mu$ ).

Table 11.

Legs	Segments					
	1	2	3	4	5	6
I	60	88	160	220	228	224
II	60	100	172	240	248	240
III	64	104	164	228	268	232
IV	140	124	212	296	328	302

Devoid of the sperm claws in the sixth segment of third legs and the enlarged part of the fourth segment of fourth legs as noticed in those of the male. Genital plates illustrated in Fig. 4, f, each with three circular acetabula and several minute hairs, measuring 145  $\mu$  long and 56  $\mu$  wide at the widest middle part. Genital aperture 160  $\mu$  long, excluding suspenders.

*Locality.* Two males and many females were captured by Dr. H. Yamaguchi on April 1, 1938 in a pool in Inano-mura, Kawab<sup>6</sup>-gun.

*Distribution.* Europe, a variety from Asia.

*Remarks.* The Japanese specimens are well coincided with the European ones. This is the first record of this species from Japan.

## 6. *Piona coccinea coccinea* (C. L. Koch) (Fig. 5)

Viets (1938) described *Piona coccinea coccinea* from Soochow, afterwards

Uchida & Imamura (1951) described also the males, females and nymphs of *Piona coccinea* var. from Lake Tung Ting near Yochow and Wuchang, Hupeh, Middle China. But this species has never been reported from Japan. The specimens captured from Hyogo Prefecture are somewhat different from the male specimens from Middle China in shape of various organs, but are well coincided with those of the European species, inspite of few number of genital acetabula as illustrated in the text-figures. Genital acetabula in two specimens counted as in Table 12.

Table 12.

Specimen's numbers	912	913
Right side	20	18
Left side	14	20

The Japanese species can probably be identified with *Piona coccinea cocinea* in spite of the presence of slight differences from the European one.

*Locality.* Two males were captured by Dr. H. Yamaguchi on April 1,

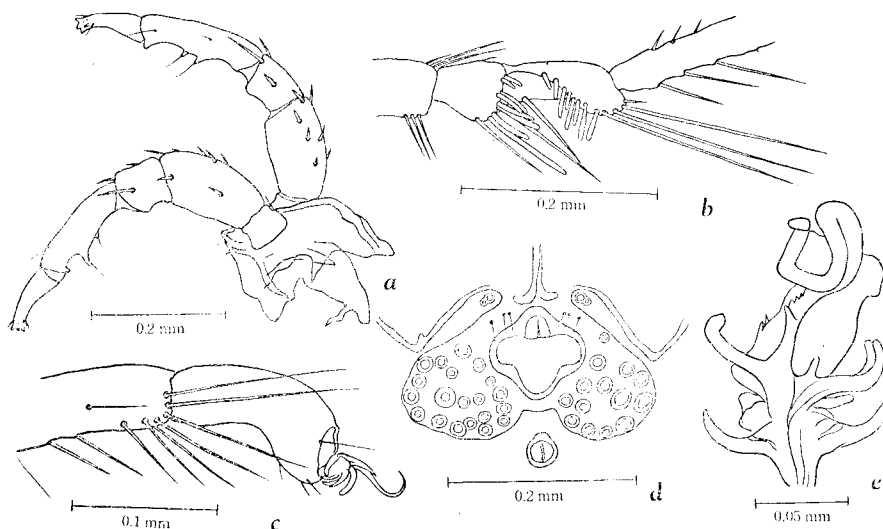


Fig. 5. *Piona coccinea cocinea* (C. L. Koch) (male).

- a. Palpi attached to maxillar organ. b. 3rd-5th segments of right IVth leg.  
 c. 5th & 6th segments, with sperm claws, of right IIIrd leg. d. Genital organ  
 e. Penis scaffold.

1938 in a pond Konyô-iké, Kawabé-gun.

*Distribution.* Europe, Asia, Africa.

**7. *Piona rotunda* (Kramer) var.** (Fig. 6)

*Male.* Body ellipsoidal in shape, 650  $\mu$  long and 600  $\mu$  wide. Skin thin, colourless, transparent and finely striated on all the surface, except epimera and genital plates. Interval between eyes 370  $\mu$ . Maxillar organ 148  $\mu$  long and 140  $\mu$  wide. Mandibles 112  $\mu$  high and 212  $\mu$  long, including a claw in each. The sizes of the palpal segments are given in Table 13 (in  $\mu$ ).

Table 13.

Segments	1	2	3	4	5
Extensor surface	22	164	84	192	60
Flexor surface	24	124	44	144	52

Second segment well arched in the extensor and flexor edges, having on the surface several spines, two of them are feathered. Third segment short, with three spines and dented on the flexor edge. Fourth segment slender and long with two conical blunt pegs in the flexor surface. The shape of epimera and genital organ is illustrated in Fig. 6, a. Epimera region measured 550  $\mu$  long and 534  $\mu$  wide in the longest dimensions. The sizes of the pedal segments are given in Table 14 (in  $\mu$ ).

Table 14.

Legs \ Segments	1	2	3	4	5	6
I	60	104	144	212	240	180
II	60	104	160	236	256	180
III	80	124	160	212	256	124
IV	120	124	176	216	280	224

The fourth segment of fourth legs is indicated in Fig. 6, b. Genital plates measured 320  $\mu$  wide with both sides. The acetabula on genital plates in four specimens are counted as in Table 15.

Table 15.

Specimen's numbers	908	909	910	911
Right plate	26	25	26	28
Left plate	25	8	21	36

In the specimen no. 909, the acetabula in the left plate are very few in number, the fact seems to be aberrant. Genital aperture  $44\ \mu$  long. Nephridial pore located, not included in genital plates, behind the mid-posterior margin of genital plate. The body colour can not be decided in the preservative.

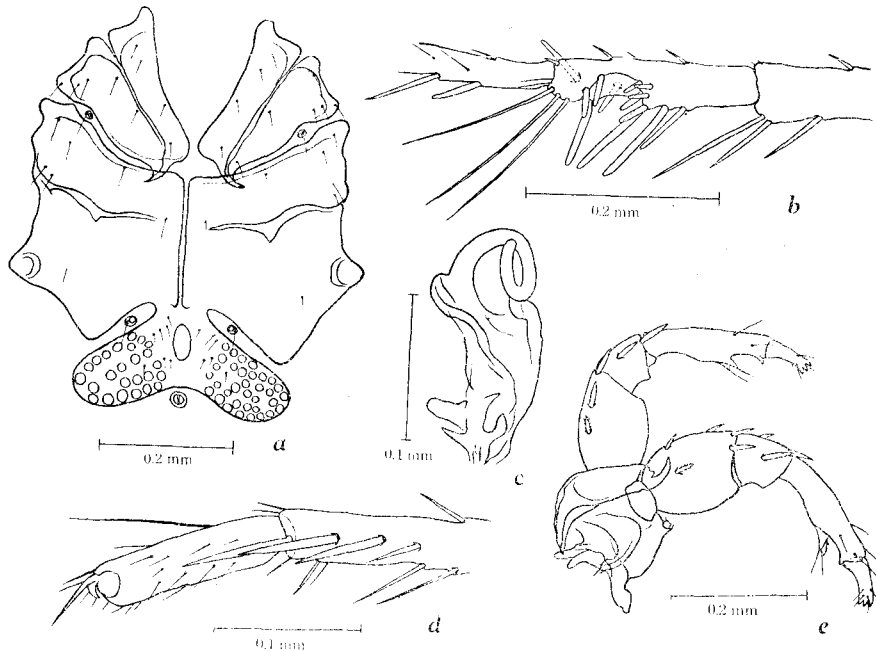


Fig. 6. *Piona rotunda* (Kramcr) var. (male).

a. Epimera and genital plates. b. 3rd 5th segments of left IVth leg.  
c. Penis scaffold. d. 5th 6th segments of left IIIrd leg. e. Palpi attached to maxillar organ.

*Locality.* Four males were collected by Dr. H. Yamaguchi on April 1, 1938 in a pond Konyô-iké, Kawabô-gun.

*Remarks.* Uchida (1936) described *Piona rotunda* from Sakhalin, reporting the species also in Hokkaido. The specimens captured from Hyogo Prefecture are different in having rather numerous genital acetabula from the European and Sakhalinese ones, and it seems to be a new local form.

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

*Locality.* One male and two females captured by the author on Oct. 13,

1950 in a pond in Okuyokawa-mura, Minô-gun.

*Remarks.* This species was reported by the author in 1952 from Kyushu District and Hiroshima Prefecture.

**9. *Arrenurus (Arrenurus) hadai* Imamura (Fig. 7)**

*Male* (allotype, prep. 889). Body almost oval in shape, 810  $\mu$  long, including petiolus, 535  $\mu$  wide and 400  $\mu$  high. Interval between eyes 211  $\mu$ . Dorsal groove broad and the area encircled by the groove is spherical and 372  $\mu$  wide in the longest diameter. Elevations found near the postero-lateral margins of the encircled area. Postero-lateral process of body short, forming almost a straight line in the posterior margin of body. In the middle portion of posterior body margin, are found three sharp pointed conical protuberances and besides them, half-mooned hyaline lobes. Petiolus very characteristic of shape as shown in Figs. 7, a-c. On dorsum of petiolus, with two prominent spines. Maxillar organ moderate in size, 138  $\mu$  long and 84  $\mu$  wide. Mandibles 120  $\mu$  long, inclusive of a claw in each and 54  $\mu$  high. Palpal segments measured as in Table 16 (in  $\mu$ ).

Table 16.

Segments	1	2	3	4	5
Extensor surface	20	56	44	68	34
Flexor surface	16	28	16	56	—

Second segment provided with five bristles, two on the extensor surface and the rest on the inner surface. Measurement of pedal segments given in Table 17 (in  $\mu$ ).

Table 17.

Legs \ Segments	1	2	3	4	5	6
I	60	56	84	108	104	148
II	64	60	96	120	120	160
III	80	72	96	140	140	160
IV	125	144	140	196	88	132

Spur of fourth segment in fourth leg very short, with five equally long hairs in its summit. Genital wings slender and long, curving roundly as shown in Fig. 7, b. Nephridial pore opening near the mid-posterior margin behind genital aperture. Body colour green. Eyes black.

*Locality.* Five males and six females were captured by the author on Oct. 13, 1950 in a pool in Okuyokawa-mura, Minô-gun.

*Remarks.* The present endemic species was recorded by the author in 1952 as a new species on a single female specimen, captured from Hiroshima Prefecture. Now male and female specimens were collected from Hyogo Prefecture, so this species is clarified more as a new to science. The male of the present species, though resembles the Javanese species *Arrenurus ansatus* Walter, is distinctly different from it in the shape of petiolus.

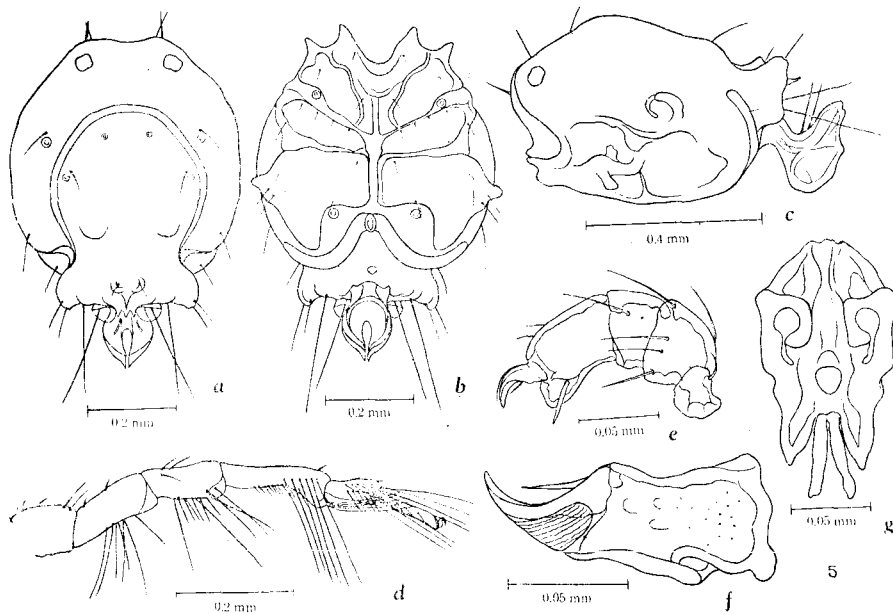


Fig. 7. *Arrenurus (Arrenurus) hadai* Imamura (male).

a. Dorsal view. b. Ventral view. c. Lateral view. d. Right IVth leg.  
e. Right palpus. f. Mandible. g. Maxillar organ.

**10. *Arrenurus (Micruracarus) madarúszki* (Daday) (Fig. 8)**

*Locality.* Eleven males and twelve females captured by the author on Oct. 13, 1950 in several ponds in Okuyokawa-mura, Minô-gun.

*Distribution.* Ceylon, Java, Sumatra, Bali, India, Malacca, China, Japan (Kyushu, Hiroshima Pref., Osaka City, Tokyo).

*Remarks.* One female specimen, collected from Okuyokawa-mura, is aberrant in body contour on the posterior margin as shown in Fig. 8.



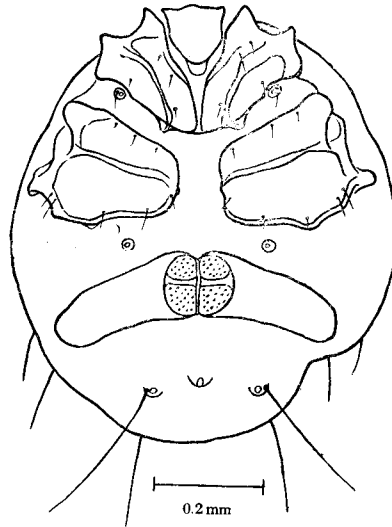


Fig. 8. Aberrant female specimen of *Arrenurus* (*Micruracarus*) *madarászi* (Daday) (ventral view).

### Literature

- The Other literature, consulted in this study, has been given in the previous papers (1952, 1953).
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