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Author(s)	UCHIDA, Tohru; IMAMURA, Taiji
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Some Water-Mites from China[1]

By

Tohru Uchida and **Taiji Imamura**

(Zoological Institute, Faculty of Science, Hokkaido University) (Biological Institute, Hokkaido Gakugei University, Asahigawa)

(*With 20 Text-figures*)

In spite of vast area of the continental China, it has scarcely been known concerning the Hydracarinan fauna of the region. Though there have been published several reports on the water mites, they are all fragmental and represent only the fauna of the peripheral regions, as will be reviewed in the following lines.

Marshall (1919) was the first to describe the following species as new forms from Soochow.

Arrenurus asiaticus Marshall
Arrenurus distinctus Marshall

In 1921 she reported again two new species more from the same localitiy.

Arrenurus soochowensis Marshall
Arrenurus geei Marshall (=*Arr. madarászi* (Daday)

Two years afterwards Walter (1923) described the following species from Kanton.

Koenikea multiscutata (*Piersig*)=*Ecpolopsis multiscutata* Piersig
Arrenurus aculeatifrons Piersig
Arrenurus palembangensis Piersig=*A. madarászi* (Daday)
Arrenurus weigoldi Walter (as a new form)

In 1928 Marshall reported the following nine species collected in the vicinity of Soochow.

Hydrarachna nova n. sp.
Hydrarachna simulans n. sp.
Eylais asiatica Vites
Eylais galeata Vites
Eupatra rotunda Piersig
Neumania geei n. sp.
Limnesia koenikei asiatica n. var.
Arrenurus palembangensis=*A. madarászi* (Daday)
Arrenurus pisciscaudapetiolatus n. sp.

In 1931 Uchida described a new species, *Hydrachna* (*Schizohydrachna*) *china*,

1) Contribution No. 262 from the Zoological Institute, Faculty of Science, Hokkaido University, Sapporo, Japan.

from Kanton and in 1936 Lundblad described in detail eleven species from the neighbourhood of the Etsingol, North-western part of China.

Eylais (*Meteylais*) *hamata* Koenike
Eylais (*Proteylais*) *degenerata* Koenike
Eylais (*Syneylais*) *paradoxa* n. sp.
Eylais (*Eylais*) *mülleri* var. *bucculenta* n. var.
Eylais (*Pareylais*) *bisinuosa* var. *oligotricha* n. var.
Hydryphantes (*Hydrayphantes*) *bayeri* Pisar
Hydryphantes (*Octohydryphantes*) *octoporus* Koenike
Hydryphantes (*Polyhydryphantes*) *flexuosus* Koenike
Hydrachna (*Rhabdohydrachna*) *crassa* n. sp.
Piona (*Piona*) *nodata* var. *lacerata* Sokolow.
Arrenurus (*Arrenurus*) *cyanipes* (Lucas)

In 1938 Viets recorded the following species from Soochow.

Eylais undulosa Koenike
Hydrachna trilobata Viets
Unionicola (*Hexatax*) *crassipes* (Müller)
Unionicola (*Unionicola*) *ypsilophora* (Bonz)
Neumania deltoides (Piersig)
Ecpolopsis multiscutata Piersig
Piona coccinea coccinea (C. L. Koch)

Uchida (1941) reported the following sixteen species from the collection of Manchuria.

Limnochares holosericeus De Geer
Eylais rimosa Piersig
Eylais mülleri (Koenike)
Eylais triarcuata (Piersig)
Eylais setosa Koenike
Eylais soari (Piersig)
Eylais emarginata Piersig
Hydryphantes affinis Sokolow
Diplodontus despiciens (Müller)
Sperchon fluviatilis Uchida
Limnesia maculata (Müller)
Limnesia undulata Müller
Unionicola (*Pentatax*) *setipes* Sokolow
Unionicola (*Hexatax*) *crassipes* (Müller)
Neumania spinipes (Müller)
Arrenurus soochowensis Marshall

As seen in these reports the Hydracarinan fauna of China has been mainly studied in the following three districts ; the coastal region (as Soochow and Kanton), the districts of the Etsingol and Manchuria. As the result the fauna of the central part remains untouched. The specimens here treated were all collected by the junior auther (Imamura) in the following localities on August 18,20 and October 5, 1943 in a pool 2 km apart from Wuchang (武昌), Hupeh and on November 10, 1943 in a pool 25 km apart from Yochow (岳州), Hunan. The pool is connected with Lake Tung Ting (洞庭湖). These localities are both in the central part of China and water mites of the locaities have never been rocorded. The list of the species studied will be given as follows.

1. *Oxus dahli* Piersig
2. *Limnesia undulata* (O. F. Müller)
3. *Hygrobates falcipalpis* Koenike
4. *Hygrobates sinensis* n. sp.
5. *Atax* (*Pentatax*) *affinis* Piersig
6. *Unionicola crassipes* Müller
7. *Neumania deltoides* (Piersig)
8. *Piona coccinea* (C. L. Koch)
9. *Albia rectifrons* Viets
10. *Axonopsis* (*Hexaxonopsis*) *paxillatus* n. sp.
11. *Arrenurus* (*Arrenurus*) *pseudoaffinis* Piersig
12. *Arruenrus* (*Arrenurus*) *distinctus* Marshall

13. *Arrenurus (Arrenurus) agrionicolus* Uchida
14. *Arrenurus (Arrenurus) orientalis* Daday
15. *Arrenurus (Megaluracarus) rostratus* Daday
16. *Arrenurus (Micruracarus) soochowensis* Marshall
17. *Arrenurus (Micruracarus) madarászi* Daday
18. *Arrenurus (Micruracarus) gibberifrons* Piersig
19. *Arrenurus (Micruracarus) forpicatoides* Lundblad
20. *Arrenurus quadrimaculatus* Sokolow
21. *Arrenurus congener* Daday

Among these species, *Limnesia undulata, Unionicola crassipes, Neumania deltoides* and *Piona coccinea* are the cosmopolitan forms. The following three species, *Arrenurus soochowensis, Arrenurus distinctus* and *Arrenurus quadrimaculatus* seem to be widely distributed in the northern and temperate regions of Asia, because they are also found in the Ussuri regions and Manchuria. The group including the following ten species : *Hygrobates falcipalpis, Atax affinis, Arrenurus madarászi, Arr. pseudoaffinis, Arr. agrionicolus* (possibly), *Arr. orientalis, Arr. rostratus, Arr. gibberifrons, Arr. congener, Albia rectifrons,* is widely distributed in the tropical regions, such as India, Malay, Sumatra and Java. Besides them, *Oxus dahli* hitherto known in the New Britains and *Arrenurus forpicatoides* known in Australia are probably also included in the group. Judging from the fact the tropical forms of water mites are distributed fairly far in the temperate region of the Asiatic Continent. The similar facts are also seen in the Japanese islands, as the following tropical forms, *Limnesia papillosa, L. buruensis, Ecpolopsis multiscutata* and *Arrenurus madarászi* are commonly found in Kyushu and the middle parts of Honshu.

Oxus dahli Piersig

Female. Body elongated-elliptical, 1.411 mm long and 0.9 mm wide. Skin soft, transparent and without figures. The interval between two black eyes is 0.45 mm. Maxillar organ 0.154 mm long and 0.08 mm wide. Palpi similar to the figure made by Piersig (1904) on *Oxus dahli*. The second segment, equal in width throughout the whole length, has concave fleoxr edge and convex extensor edge, from which several spines arise. Out of these spines two growing on the distal end are exceedingly longer than the others. The third segment, nearly equal in width throughout the shaft, bears three long distal spines. The fourth segments, slightly narrowed towards both ends, has several hairs on the extensor and flexor edges. The measurement is as follows (in μ) :

Segments	1	2	3	4	5
Extensor edge	53	70	59	89	26
Flexor edge	17	50	40	79	26

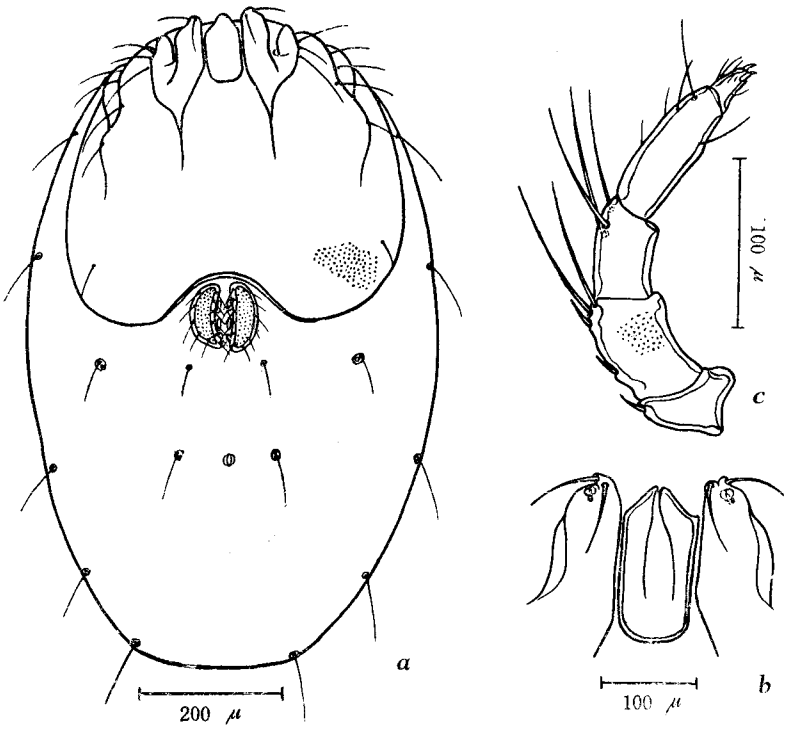

Fig. 1. *Oxus dahli* Piersig (female).
a. Ventral view; b, maxillar organ and first epimera; c, left palpus.

Epimeral plates all fused, covering the area smaller than the anterior half of the whole ventral surface. The first epimera have each two long hairs and a gland at the anterior end. The posterior margin of the epimera is characterized in having rather shallow bay. The measurement of legs is given in the following table (in μ):

Legs \ Segments	1	2	3	4	5	6
I	74	68	91	125	177	171
II	80	80	120	171	211	200
III	91	86	131	194	268	205
IV	108	103	154	205	268	245

The sixth segment of fourth legs bears a long hair, 0.114 mm long. Genital plates

crescent in shape, 0.165 mm long and 0.046 mm wide, furnished with several hairs arranged in a row. The acetabula, six in number, three on each side, are elongated-elliptical in shape. The excretory pore is situated rather anteriorly on midway between the genital area and posterior margin.

Locality. Two females were collected on August 18,1943 from a pond with luxuriant growth of *Nelumbo* in Wuchang, Hupeh.

Remarks. The speciemens are quite similar to the description of *O. dahli* found in the New Britains. The palpi, first epimera and the curvature of the posterior epimeral margin all agree with Piersig's figures.

Limnesia undulata (O. F. Müller)

The cosmopolitan species was found in the collection. Five females and one male on August 20,1943, and two females were collected on October 5,1943 in Wuchang, Hupeh.

Hygrobates falcipalpis Koenike

Female. Body 0.855 mm long and 0.675 mm wide. The interval between

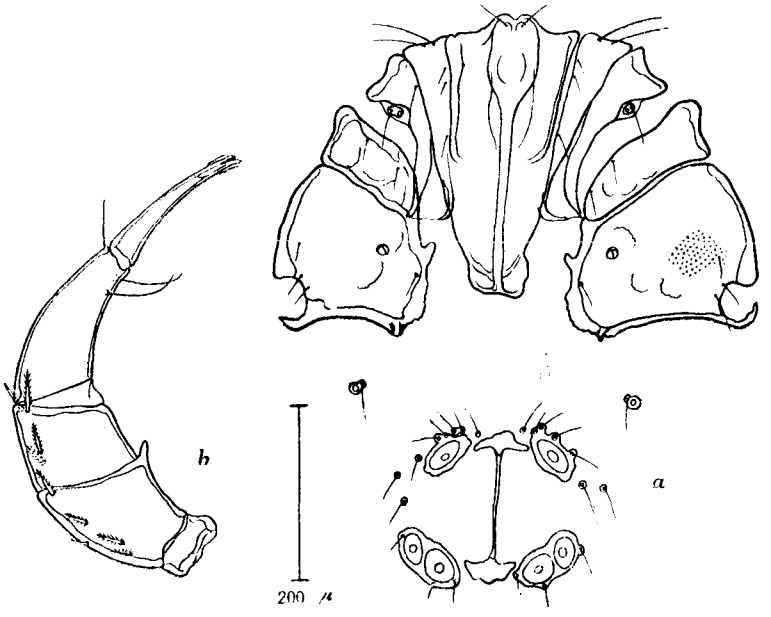

Fig. 2. *Hygrobates falcipalpis* Koenike (female).
a. Ventral view; b, palpus.

eyes is 0.285 mm. Maxillar organ 0.148 mm wide in the anterior portion. Mandibles 0.313 mm long. Palpi well-featured as described by Viets. The measurement is as follows (in μ) :

Segments	1	2	3	4	5
Extensor surface	28	165	103	205	171
Flexor surface	37	91	77	120	165

The legs are measured as follows (in μ) :

Legs \ Segments	1	2	3	4	5	6
I	51	114	143	194	205	200
II	57	114	143	200	211	211
III	69	103	154	200	228	228
IV	114	143	177	251	257	251

Locality. A female was collected on August 18,1943 in Wuchang, Hupeh.

Remarks. The species is known from Java (Koenike, 1909 and Walter, 1929) and India (Viets, 1926). From the form of palpi, genital area and epimera, the speciemen undoubtedly belongs to the Asiatic species distributed in the tropical regions.

***Hygrobates sinensis* n. sp.**

Female. Body oval, 0.463 mm long and 0.4 mm wide. The interval between eyes is 0.131 mm. Mandibles 0.223 mm long. Palpi different from any species of the genus in having remarkable papillae in the second and third segments, and a long hair in the fourth segment. The second segment, largest of all, bears several spines on the extensor edge, of which some are feathered. On the distal end of the flexor edge are found robust papillae forming a group. The third segment nearly equal in width throughout the shaft, is furnished with a few feathered spines on the extensor edge and with a group of robust papillae on the distal end of the flexor surface. The fourth segment, longest of all, is narrowed distally and has a few hairs both on the extensor and flexor edges and also on the distal portion. Among these hairs the proximal one on the flexor edge is exceedingly large. The measurment of the palpi is as follows (in μ) :

Segments	1	2	3	4	5
Extensor egde	19	79	43	93	38
Flexor edge	19	40	33	73	36

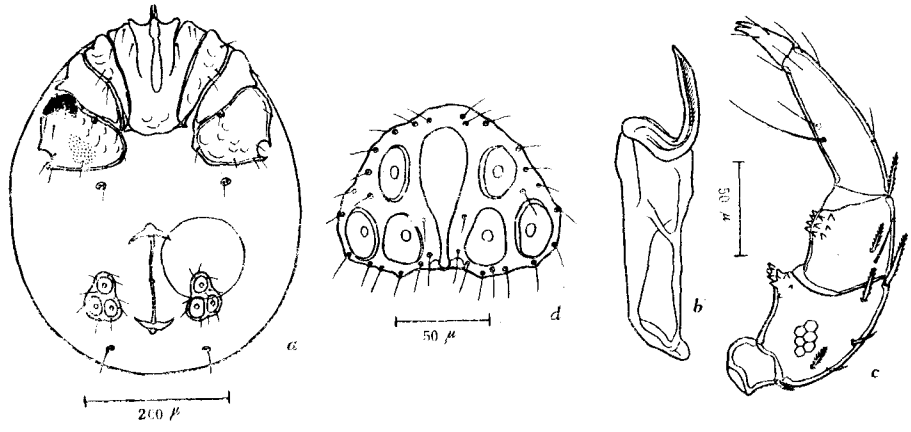

Fig. 3. *Hygrobates sinensis* n. sp.
a, Ventral view of female; b, mandible of male; c, palpus of female; d, genital plate of male.

The first and second epimera are fused along the whole length. The third and fourth epimera form two groups. The epimera-groups are scarcely separated from the epimera-group formed by the first and second ones. The fourth epimera have rather rounded inner edge. Just posterior to the epimera are found glands each with an accesory hair.

The legs are measured as follows (in μ) :

Legs \ Segments	1	2	3	4	5	6
I	34	40	57	74	80	85
II	34	46	57	86	97	97
III	37	51	68	97	120	120
IV	68	63	91	131	143	131

The genital aperture is 0.139 mm long. Three genital acetabula are mounted in a plate, arranged in a group, the anterior one rather round in shape and the posterior two arranged side by side, rather oblong in shape.

Male. Body ovol, 0.45 mm long and 0.375 mm wide. The interval between eyes is 0.125 mm. Mandibles 0.175 mm inclusive of a claw, 0.063 mm long. Palpi similar in shape to those of the female. The measurement is shown in the table of the next page (in μ). The genital plate has an aperture, 0.075 mm long, and three acetabula which are all rather oblong anterio-laterally. On the plate

Segments	1	2	3	4	5
Extensor edge	18	66	33	79	33
Flexor edge	20	36	28	63	33

are found many minute hairs.

Locality. Eight females and three males were obtained on August 18,1943 in Wuchang, Hupeh.

Remarks. The species is unique in smallness of size. The palpi are characterized in the possession of robust papillae present at the flexor end of the second and third segments, and also of the long hair on the flexor edge of the fourth segment.

Atax (*Pentatax*) *affinis* Piersig

Female. Body 0.75 mm long and 0.545 mm wide. The interval between eyes is 0.275 mm. Mandibles 0.132 mm long, and maxillar organ 0.158 mm long and 0.098 mm wide. Palpi similar in form to the figure by Viets (1935), meaured as shown in the table of the next page (in μ).

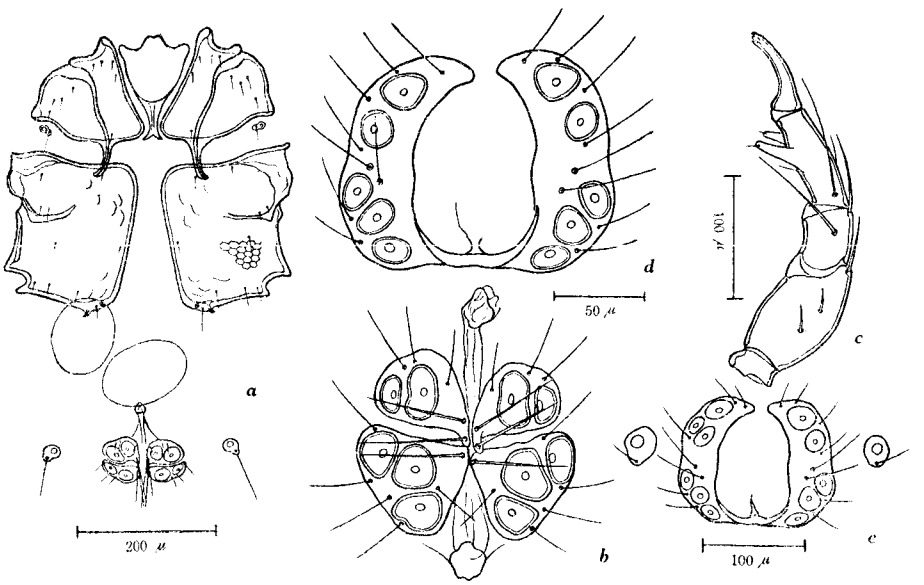

Fig. 4. *Atax* (*Pentatax*) *affinis* Piersig.

a, Ventral view of female; b, genital plate of female; c, right palpus of female; d, genital plate of male; e, abnormal genital plate of male.

Segments	1	2	3	4	5
Extensor surface	12	99	40	83	73
Flexor surface	13	66	27	66	63

Epimera coinsided with the descriptions by Walter (1929) and Viets (1935). Genital acetabula five on each side. Genital opening 0.131 mm long.

Male. Body 0.613 mm long and 0.45 mm wide. The interval between eyes is 0.22 mm. Mandibles 0.125 mm long, including craws. Maxillar organ 0.151 mm long and 0.095 mm wide. Genital opening 0.115 mm. An abnormal male has six acetabula on one side.

Locality. Five females and two males were collected on August 20,1943 in Wuchang, Hupeh.

Remarks. The species has hitherto been recorded only from Java.

Unionicola (*Hexatax*) *crassipes* (Müller)

Several specimens of the cosmopolitan species were found in the collection. The species is already known in Asia from India, Malay Peninsula, China, Ussuri regions and Japan.

Localities. Two males were obtained on November 10,1943 in Lake Tung Ting near Yochow and five females on August 18,1943 near Wuchang, Hupeh.

Neumania deltoides (Piersig)

Female. Body 1.05 mm and 0.795 mm wide. Chitinous skin furnished with fine undulating ridges. The interval between eyes is 0.412 mm. Maxillar organ 0.16 mm long and 0.114 mm wide. Epimera well coincided with those of previous descriptions of the species. Palpi featured in the slender form and in the presence of characteristic spines on the extensor surface of second and third segments. The measurement of the segments is as follows (in μ) :

Segments	1	2	3	4	5
Extensor surface	36	122	59	115	46
Flexor surface	23	73	43	93	46

The legs are measured as shown in the table of the next page (in μ). Genital pore 0.17 mm long. The number of genital acetabula in three speciemens is as follows ; 21,21,20 on the right side and 19,20,20 on the left side, respecitively.

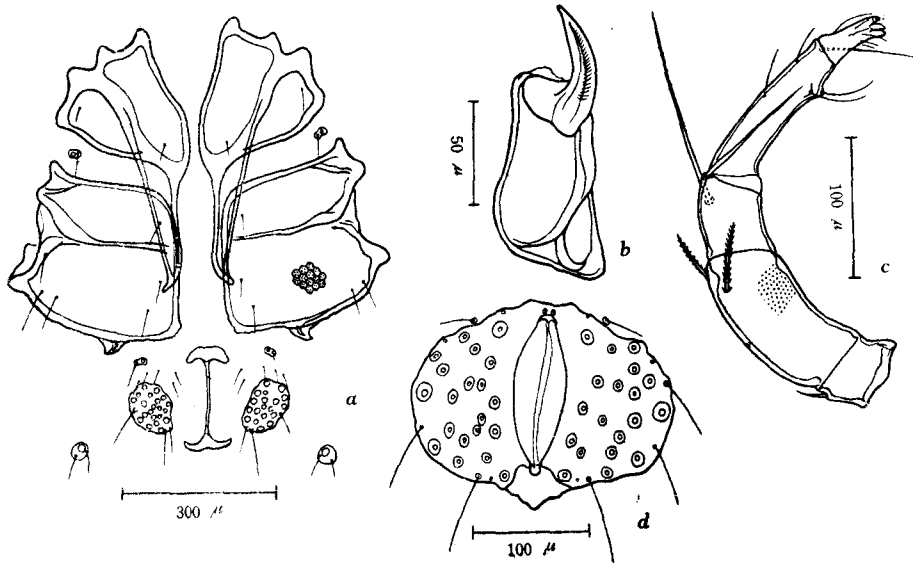

Fig. 5. *Neumania deltoides* (Piersig).
a. Ventral view of female; b, mandible of male; c, palpus of female; d, genital plate of male.

Legs \ Segments	1	2	3	4	5	6
I	63	154	188	285	301	234
II	80	148	183	291	313	240
III	80	114	154	245	268	245
IV	103	148	211	268	319	285

Male. Body 0.725 mm long and 0.575 mm wide. The interval between eyes is 0.3 mm wide. Maxillar organ 0.13 mm long and 0.093 mm wide. Palpi and epimera similar to those of the male. Palpi are measured as follows (in μ):

Segments	1	2	3	4	5
Extensor surface	30	96	53	89	40
Flexor surface	17	56	33	69	40

The legs are measured as is shown in the table given in the next page (in μ).

Segments / Legs	1	2	3	4	5	6
I	63	114	160	217	262	243
II	68	120	165	228	268	251
III	68	97	120	188	217	194
IV	86	131	183	228	268	217

Genital opening 0.114 mm long. The number of acetabula of two speciemens is as follows ; 20,19 on the right side and 19,18 on the left side, respectively. A pair of them situated on the outer side of the wings compalatively large as described by Piersig (1900)

Locality. Seven females and two males were collected on August 18,1943 in Wuchang, Hupeh.

Remarks. The species is common in Europe and is also recorded in Asia from Buchara and Ussuri regions (Sokolow, 1926, 1931). *U. geei* described by Marshall (1928) from China seems to be closely allied to the species.

Piona coccinea (C. L. Koch) var.

Several specimens including the male, female and nymph were collected. The species is widely distributed in Europe, Asia and Africa, and is divided into several varieties. Measurements based on these specimens are as follows.

Male. Body 0.638 mm long and 0.513 mm wide. The interval between eyes is 0.25 mm. Mandibles 0.18 mm long and maxillar organ 0.114 mm wide and 0.125 mm long. From the form of the second segment, the palpi belongs to *stjordalensis*-type. The measurement is as follows (in μ) :

Segments	1	2	3	4	5
Extensor surface	28	137	57	143	80
Flexor surface	28	86	29	114	75

Genital aperture 0.079 mm wide and 0.076 mm long. Genital plate 0.25 mm wide and 0.142 mm long. Penis scaffold 0.137 mm long. The number of genital acetabula is rather few ; 14 on the left and 14 on the right side in one specimen, and 15 on the left and 13 on the right in another one.

Female. Body elliptical in contour, 1.02 mm long and 0.78 mm wide. The interval between eyes is 0.3 mm. Mandibles 0.228 mm long and maxillar organ 0.15 mm long and 0.143 mm wide. The measurement of palpi is as shown in the

table of the next page (in μ).

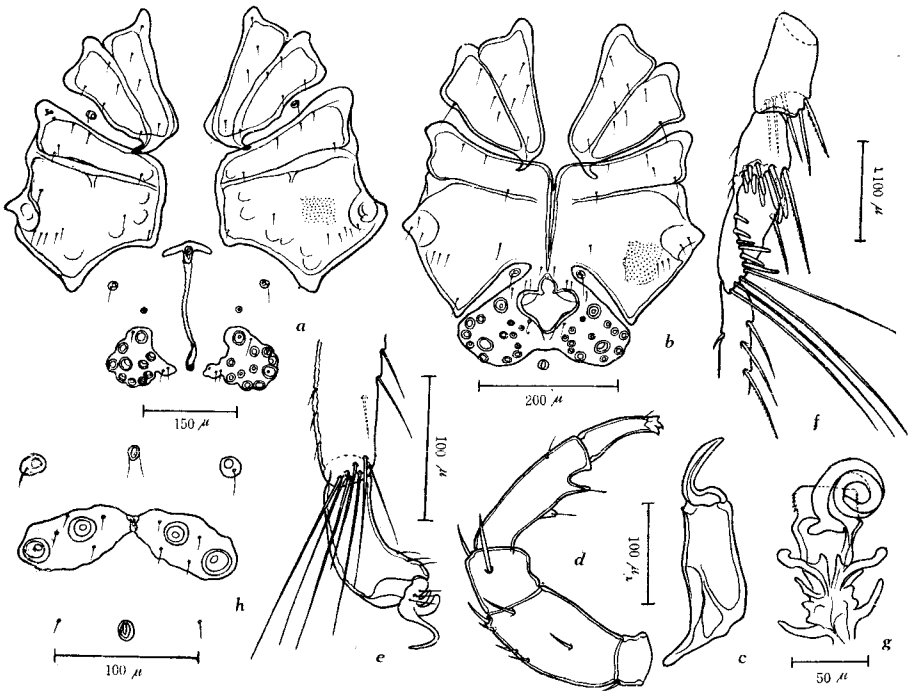

Fig. 6. *Piona coccinea* (C. L. Koch).

a, Ventral view of female; b, ventral view of male; c, mandible of female; d, left palpus of male; e, fifth and sixth segments of left third leg of male; f, from third to fifth segments of left fourth leg of male; g, penis scaffold; h, genital field of nymph.

Segments	1	2	3	4	5
Extensor surface	34	154	63	171	91
Flexor surface	34	91	34	131	86

Genital opening 0.16 mm long. Suspender of genital opening 0.059 mm long and 0.074 mm wide. The number of genital acetabula is rather few as shown in two specimens; 11 and 12 on the left and 10 and 14 on the right side respectively.

Nymph. Body oval in shape, 0.525 mm long and 0.425 mm wide. The interval between eyes is 0.224 mm. Mandibles 0.135 mm and maxillar organ

0.103 mm long and 0.086 mm wide.

Localities. Six males, five famales and 3 nymphs were collected on August 18,1943 and one nymph on August 20 of the year from Wuchang, Hupeh. One male was obtained on November 10,1943 from Lake Tung Ting near Yochow.

Remarks. Judging from the form of palpi these specimens rather belong to *stjordalensis*-type but they seem to be unique in the possession of genital acetabula of few number in the species. The specimens form a new variety.

Albia rectifrons Viets

A single female probably referable to the species was collected. Body dorsoventrally flattened, elliptical in outline, with shouldered anterior margin, 0.663 mm long and 0.537 mm wide. Skin on dorsum and venter porose and finely papillated. Eyes situated in a pair just inside of the souldered margin ; the interval between them being 0.274 mm. Immediately outside of the eyes present conspicuous glands in a pair on the margin. Just axial to the glands are found several minute hairs arising in two groups. On the dorsal plate are arranged 8 pairs of short hairs each with an accessory gland. Besides these glands there are observed several pairs of glands deficient in hair. On the ventral side there are several pairs of glands each with an accessory hair. Out of them a median and two posterior pairs are most remarkable. In the epimeral region there are about twenty short robust spines. Maxillar organ 0.146 mm long and 0.096 mm wide. Palpi, finely papillated, shorter than one half the body length on the extensor surface. First

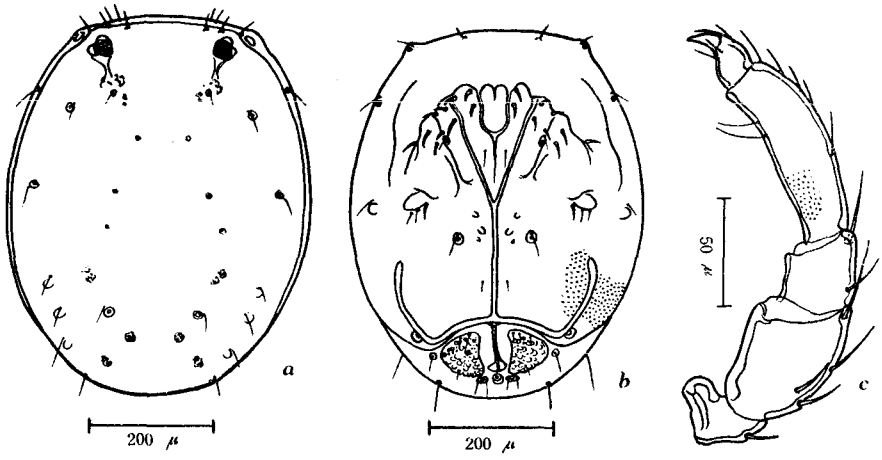

Fig. 7. *Albia rectifrons* Viets.

a. Dorsal view of female ; b, ventral view of female; c, palpus of female.

segment small, having a spine on the extensor surface, Second segment, broadest of all, having several well-pointed spines on the extensor surface. Third segment, shorter and narrower than the former, having two spines on the extensor surface. Penultimate segment longest of all, nearly of the same breath throughout the whole length, bearing several bristles on the extensor surface and two bristles in the distal falf of the flexor edge, the posterior one of them being slightly longer. Fifth segment ending in two claws and having several minute hairs. The measurement of these segments is as follows (in μ) :

Segments	1	2	3	4	5
Extensor surface	33	63	33	92	30
Flexor surface	20	57	23	83	30

Epimera united to form a plate covering the central larger part of the ventral surface, sutures between them being partly obliterated. The anterior pair is situated in fairy inner portion from the body margin and is distinctly marked by the narrow band which meets on the median portion, running towards the posterior end just anterior to the genital area and then again divided into two transverse bands, each of which runs along the genital area and then bends anteriorly, demarcating the fourth epimera. The second pair is oblong, bears four robust spines and is shorter than the anterior one. The third pair is nearly triangular, with more or less indistinct posterior edge. The fourth pair is the largest and demarcated by a narrow band. Legs, stout, longer in posterior ones as in the following measurements (in μ) :

Segments / Legs	1	2	3	4	5	6
I	40	42	51	63	63	57
II	40	46	57	68	68	64
III	46	57	74	80	82	80
IV	51	57	80	91	103	100

Locality. One female was collected on August 18,1843 in Wuchang, Hupeh.

Remarks. The specimen, though slightly different in number of glands and bristles, agrees in the main points with *A. rectifrons* Viets from described in 1935 from South-Sumatra.

***Axonopsis* (*Hexaxonopsis*) *paxillatus* n. sp.**

Male. Body 0.33 mm long and 0.285 mm wide. Wide-oval in outline,

with anterior margin slightly curved inwards. Dorsal plate 0.313 mm long and 0.268 mm wide. The interval between eyes is 0.102 mm. Just posterior to the eyes are found distinct spines in a tuft. Behind the spines are present three large gland plates of which two are situated nearer to the spines. Mandibles 0.102 mm long and maxillar organ 0.069 mm long and 0.04 mm wide. Palpi robust and well-curved. The second segment, broadest of all, bears a few hairs on the extensor edge and is outcurved in the flexor edge. The third segment, with convex extensor edge and concave flexor edge, has a long hair on the extensor edge. The fourth

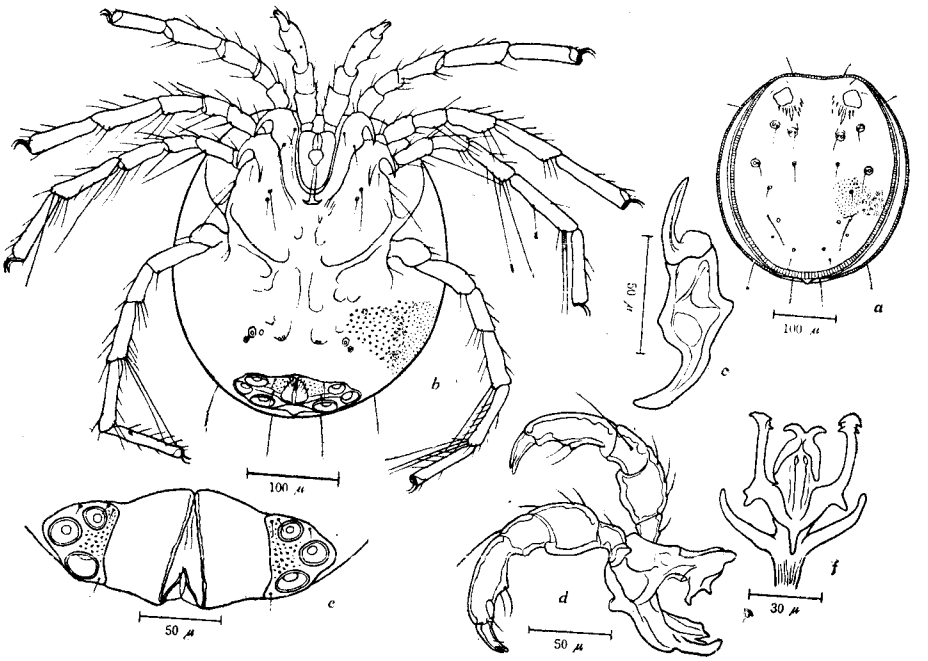

Fig. 8. *Axonopsis* (*Hexaxonopsis*) *pavillatus* n. sp.
a, Doral view of male; b, ventral view of male; c, mandible of male; d, palpi of male; e, genital field of female; f, penis scaffold.

segment, largest of all, has convex extensor edge and well-developed papillae on the flexor edge, The measurement of the palpi is as follows (in μ):

Segments	1	2	3	4	5
Extensor edge	26	43	22	59	25
Flexor edge	14	36	17	46	27

The epimera are fused except the first one. The anterior portions of the first and second epimera are transformed into claw-shaped ends. The second and third epimera are fused, but the fourth epimera merging into the ventral skin are obscure in outline. Between the fourth epimera and genital area are found two pairs of distinct gland plates. The measurement of legs is given in the following table (in μ) :

Legs \ Segments	1	2	3	4	5	6
I	23	31	30	46	63	59
II	30	36	30	50	73	80
III	33	46	36	59	79	89
IV	40	50	53	69	83	89

The genital organ has six acetabula, three on each side, and is provided with a few minute hairs on the surface. Penis scaffold 0.083 mm long and 0.066 mm wide.

Female. Body 0.36 mm long and 0.292 mm wide. The interval between eyes is 0.1 mm. Dorsal plate 0.34 mm long and 0.272 mm wide. Mandibles 0.1 mm long and maxillar organ 0.066 mm long and 0.04 mm wide. Palpi similar to those of the male in form and measurements. Genital organ with six acetabula, three on each side, 0.172 mm wide but 0.07 mm in the ventral view. Genital opening 0.066 mm long in ventral view.

Locality. Three males and thirteen females were collected on August 18, 1943 and one male on August 20,1943 in Wuchang, Hupeh.

Remarks. The Chinese species is similar to *Axonopsis* (*Haxax.*) *spinigera* Viets from Java in the form of epimera and genital organ, but is different in the presence of dorsal spines behind the eyes and also in the form of palpi.

Arrenurus (*Arrenurus*) *pseudoaffinis* Piersig

Male. Body oval, with cauda, 1.036 mm long (with petiolus), 0.645 mm wide and 0.687 mm high. The interval between eyes is 0.27 mm. Mandibles 0.192 mm long and 0.072 mm wide, and maxillar organ 0.194 mm long and 0.12 mm wide. From the side view there are two pairs of conspicuous humps on the dorsum ; one posterior to eyes and another in the dorsal groove, each having a well-developed gland. The area encircled by the dorsal groove, is 0.39 mm wide and connected with the cauda. Cauda with well-developed lateral appendix. Palpi most resembling Walter's figure from a speciemen of India (as *Arr. pseudobruzelii*), measured as follows (in μ) :

Segments	1	2	3	4	5
Extensor surface	30	79	63	99	60
Flexor surface	20	33	13	66	60

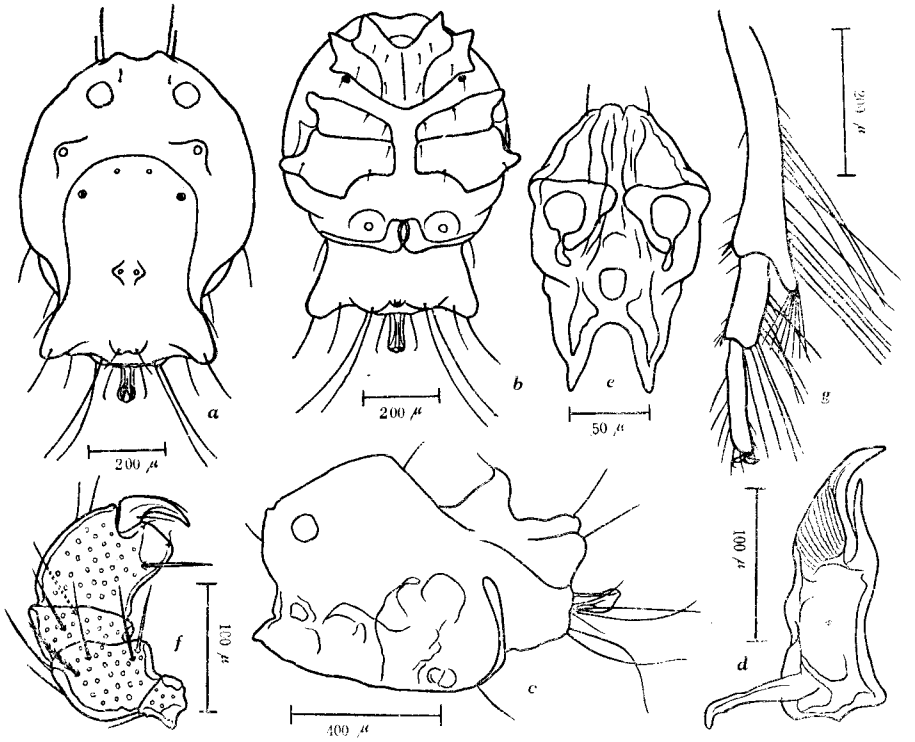

Fig. 9. *Arrenurus* (*Arrenurus*) *pseudoaffinis* Piersig (male).
a, Dorsal view; b, ventral view; c, lateral view; d, mandible; e, maxillar organ; f, palpus; g, from fourth to sixth segements of fourth leg.

Measurements of legs are as follows (in μ):

Legs \ Segments	1	2	3	4	5	6
I	68	74	120	148	143	200
II	80	80	131	171	165	217
III	86	86	120	171	165	205
IV	131	183	222	370	120	160

The fourth legs bear on the fourth segment a spur, from the end of which seven similar hairs arise. The general oultine, epimera and genital area, cauda with petiolus

are all coincided with the figures made by Viets (1935). Genital opening 0.063 mm and petiolus 0.12 mm long.

Locality. A male was collected on November 10, 1943 from Lake Tung Ting, Yochow.

Remarks. The species is known from Sumatra (Piersig 1906), India (Viets, 1925 and Walter, 1928) and Java (Viets, 1935).

Arrenurus (*Arrenurus*) *ditsinctus* Marshall

Male. Body round, with two anterior protruded portions and well developed cauda, 1.156 mm long and 0.748 mm wide. The interval between eyes is 0.34 mm. On the dorsum there are four pairs of humps each carrying a gland, the first outside the dorsal groove, the second inside the dorsal groove, and the third and fourth on the cauda just anterior to the petiolus. These humps can be clearly seen in the lateral view. The dorsal groove is connected with the caudal portion. Mandibles 0.215 mm long and maxillar organ 0.2 mm long and 0.114 mm wide. Palpi similar to the description by Sokolow (1931), characteristic of the second and fourth segments. In the Chinese specimens the spine growing on the fourth segment is not so robust as figured by him. The measurements are as follows (in μ) :

Segments	1	2	3	4	5
Extensor surface	33	79	53	99	63
Flexor surface	17	36	17	66	54

The first and second epimera have each rather acute outer end. The fourth epimera, largest of all, have a blunt posterior angle in the median portion and slightly concave margin in the axial half. Just anterior to the genital area are found two humps each bearing a gland. The genital opening is 0.061 mm long and furnished with two lateral wings which are very narrow and undulated, reaching the lateral margin. Excretory pore situated just anterior between two humps having long hairs. The cauda is provided with two lateral appendix and a median petiolus. The petiolus is nearly coincided with that of Marshall's and Sokolow's specimen but seems to be intermediate in form between them as regards the development of the lamella. The petiolus is 0.299 mm long.

Locality. Two males were collected on August 18,1943 in Wuchang, Hupeh.

Remarks. The species has hitherto been recorded from Soochow by Marshall (1919), China and the Ussuri regions by Sokolow (1931). From the form of petiolus the species is referable to the group including *Arrenurus* (*Arr.*) *ansatus* Walter and *Arrenurus* (*Arr.*) *liberatus* Walter.

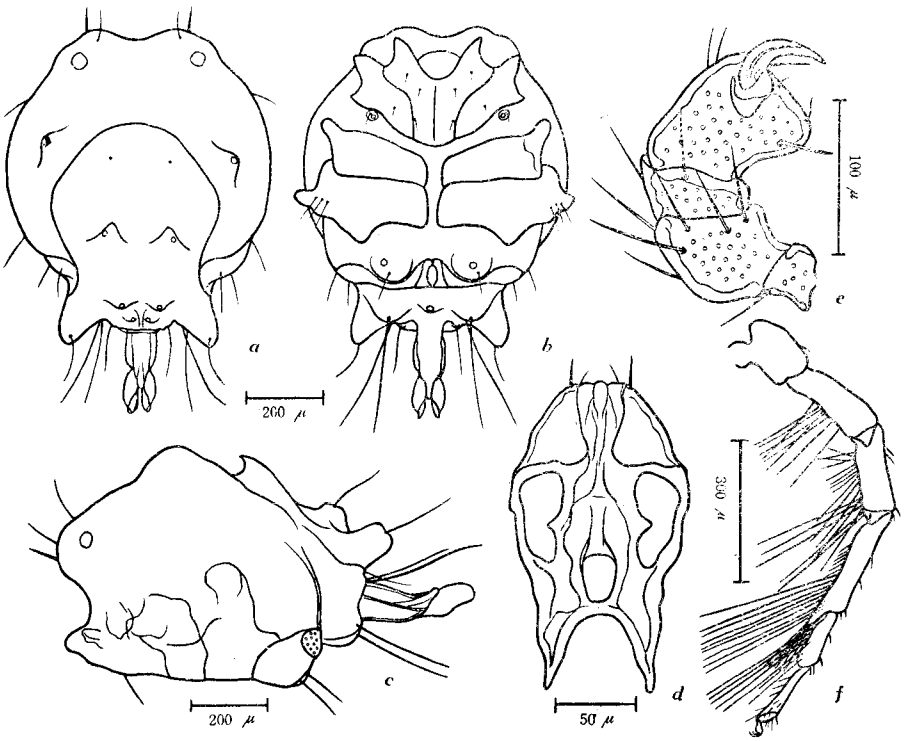

Fig. 10. *Arrenurus* (*Arrenurus*) *distinctus* Marshall (male).
a, Dorsal view; b, ventral view; c, lateral view; d, maxillar organ; e, left palpus; f, fourth leg.

Arrenurus (*Arrenurus*) *agrionicolus* Uchida

Female. Body 1.19 mm long and 1.02 mm wide in the widest part, broadly triangular in shape. Anterior portion of body narrowed and with rather concave margin between two emarginated ends. The interval between two eyes is 0.392 mm wide. On both sides just anterior to the dorsal groove are found prominent glands, each mounted on a rapidly elevated surface. Posterior part gradually constricted and then emarginated laterally. Posterior margin rounded and sightly convex. The area surrounded by the circular groove is 0.855 mm long and 0.705 mm wide. Mandibles 0.217 mm long and maxillar organ 0.2 mm long and 0.131 mm wide. Palpi quite similar to the specimens collected in Kyushu, Japan. The measurement of them is as follows (in μ):

Segments	1	2	3	4	5
Extensor surface	34	103	51	108	68
Flexor surface	17	40	23	74	64

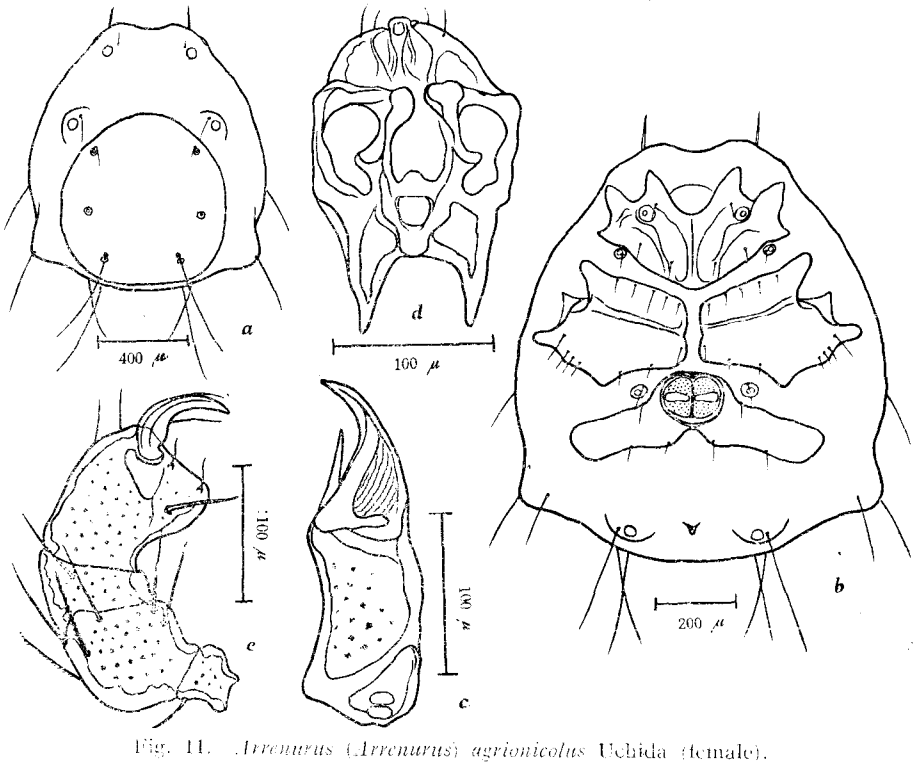

Fig. 11. *Arrenurus* (*Arrenurus*) *agrionicolus* Uchida (female).

a, Dorsal view; b, ventral view; c, mandible; d, maxillar organ; e, left palpus.

Epimera furnished with many minute hairs, fourth pair of them well defined in form,

Legs \ Segments	1	2	3	4	5	6
I	86	86	143	177	177	188
II	86	91	143	200	194	217
III	108	114	137	188	182	205
IV	148	188	188	228	194	194

especially in posterior margin. The measurement of legs is given in the preceeding table (in μ). Genital area closely situated to the epimera, with lateral wings which are 0.313 mm long and curved posteriorly. Genital aperture furnished with two semicircular chininous plates which are located a little anteriorly from the wings.

Locality. Four females were caught on August 18,1943 in Wuchang, Hupeh.

Remarks. The female is closely allied to that of *Arr. daubihensis* from the Ussuri regions in the general form and in epimera, but distinctly differs in the palpi, especially in the fourth segment and in the genital area which is located more close to the epimera. The posterior median incision of fourth epimera is more deep than in the Russian species.

Arrenurus (*Arrenurus*) *orientalis* (Daday)

Female. Body 1.02 mm long and 0.93 mm wide, with narrowed anterior part and truncate posterior portion. The interval between eyes is 0.33 mm. The area encircled by the dorsal groove is oval and 0.675 mm long and 0.615 mm wide. On both sides of the anterior portion of the dorsal plate are found two humps each with a gland. Mandibles 0.222 mm long and 0.068 mm high. Maxillar organ 0.178 mm long and 0.119 mm wide. Palpi coincided with the figure made by Walter (1929) in the main. Second segment provided with several long spines, third segment with concave margin near the end of the flexor side as in Walter's figure and fourth segment featured as Walter's figure, though slightly different in extensor edge. The measurements are as follows (in μ) :

Segments	1	2	3	4	5
Extensor surface	36	79	63	109	55
Flexor surface	23	36	17	76	55

The legs are measured as shown in the following table (in μ) :

Legs \ Segments	1	2	3	4	5	6
I	68	68	131	148	154	188
II	80	86	125	171	154	200
III	103	91	131	165	160	200
IV	125	171	182	205	177	182

Epimera nearly agree with those of Walter's specimen. The genital area is featured by the wings which are widened and rounded in the outer end. Genital plates

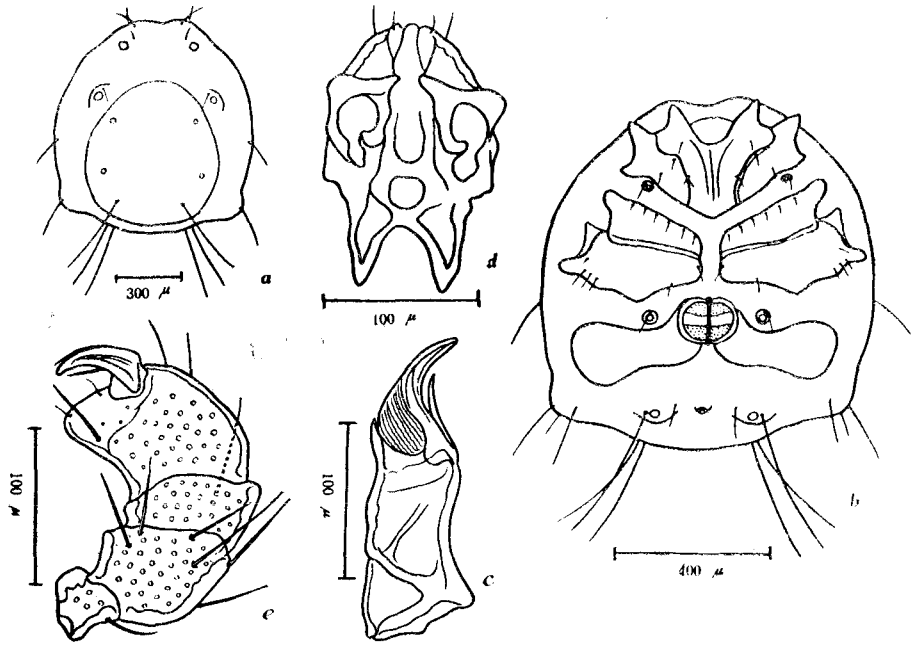

Fig. 12. *Arrenurus* (*Arrenurus*) *orientalis* (Daday). (female).
a. Dorsal view; b, ventral view; c, mandible; d, maxillar organ; e, right palpus.

0.11 mm long and 0.145 mm wide. Genital wings 0.272 mm long. Excretory pore situated between two glands, each on a hump, nearer to the posterior margin than the genital area.

Locality. One female was obtained on November 10,1943 from Lake Tung Ting, Yochow.

Remarks. The Chinese specimen differs from the Indian specimen in wider body and wider dorsal plate. These variations are probably due to the local or individual one.

Arrenurus (*Megaluracarus*) *rostratus* Daday

Female. Body oval, with a protruded anterior part, 0.813 mm long, 0.65 mm wide and 0.555 mm high. The interval between eyes is 0.2 mm. Mandibles 0.122 mm and maxillar organ 0.119 mm long and 0.082 mm wide. On both sides of the acute protruded part of the anterior margin are found two pairs of anteniform hairs. Except these hairs there arise three pairs of hairs from the posterio-lateral

margin of the body. Just anterior to eyes present conspicuous humps. Dorsal groove encircling an area, 0.475 mm wide, opened in the posterior portion. On the dorsum are found pairs of glands, of which two are confined in the dorsal groove.

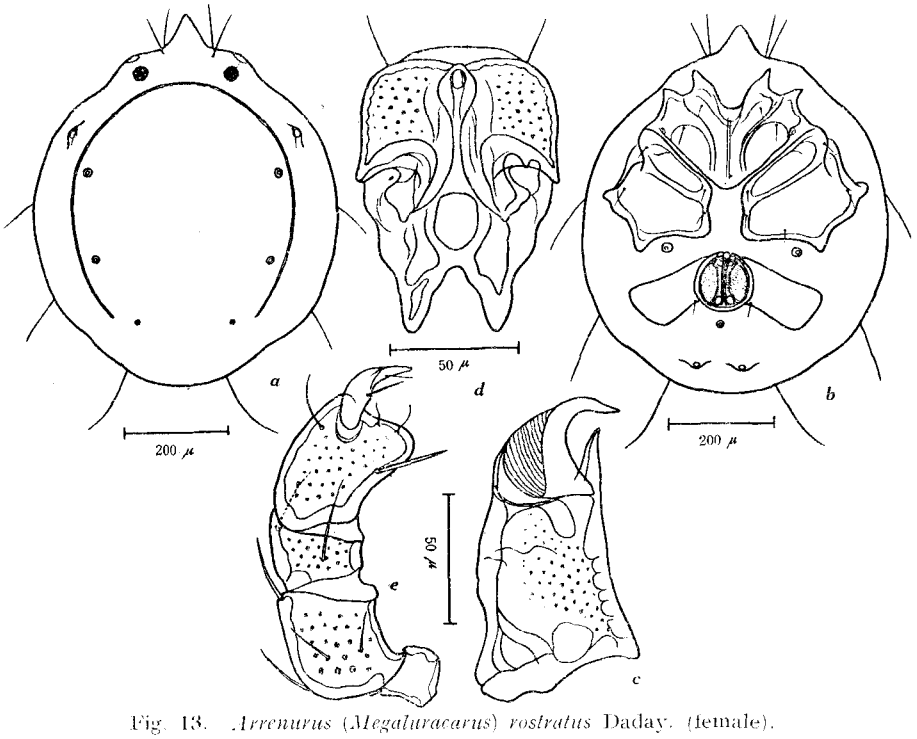

Fig. 13. *Arrenurus* (*Megaluracarus*) *rostratus* Daday. (female).
a, Dorsal view; b, ventral view; c, mandible; d, maxillar organ; e, left palpus.

Palpi somewhat different in form from the original description by Daday. They bear rather few spines but a rather large robust spine on the flexor surface of the fourth segment. The measurements are as follows (in μ):

Segments	1	2	3	4	5
Extensor surface	19	50	36	56	30
Flexor surface	17	43	21	43	26

The epimera agree with the figure by Viets (1927). Genital plates fused to lateral wings which are each slightly widened to the outer end. The wings are slightly

different in shape from those of Daday and Viets. Nephridial pore situated nearer to the genital plates between the genital area and paired elevated glands. Genital opening 0.114 mm and genital wings 0.188 mm long the anterior margin.

Locality. Collected a female on August 18,1943 and two female specimens on October 5,1943 in Wuchang, Hupeh.

Remarks. The species is recorded from Ceylon (by Daday 1898) and Malay (by Viets, 1927). Daday's description, though seemingly insufficient, illustrates enough the specific features. Male unknown.

Arrenurus (*Micruracarus*) *soochowensis* Marshall

The species has hitherto been based on male specimens but in the collection two females probably referable to the species were examined.

Male. Body 0.825 mm long and 0.563 mm wide. Outline rather pyriform, with a relatively long hyaline appendix. The distance between two eyes is 0.287 mm. The area enclosed by the dorsal groove is moderate in size, 0.425 mm long and 0.388 mm wide, rounded anteriorly and narrowed posteriorly, bearing two pairs of glands. On both sides of the central area are found two conspicuous glands each with an accessory hair. The appendix is long and slightly narrowed posteriorly, with a deep median incision which runs into a round opening. Over the opening lies a large and highly developed petiolus which agrees with those figured by Marshall (1921) and Sokolow (1931). On either side of the petiolus are found two pairs of glands each with a long hair. From the posterior margin of the appendix are arising two long hairs. On the laterial sides of the body just behind the genital area are found several hairs arranged in a row. Mandibles 0.132 mm long and 0.05 mm wide. Maxillar organ 0.142 mm long and 0.102 mm wide. Their figures are given in this paper. The measurement of palpal segments is as follows (in μ) :

Segments	1	2	3	4	5
Extensor edge	26	59	40	79	43
Flexor edge	17	23	13	49	40

The second segment bears several long spines on the extensor and lateral sides. The fourth segment, largest of all, has a robust spine on the flexor surface of the distal portion. The segments of legs are measured as follows (in μ) :

Legs \ Segments	1	2	3	4	5	6
I	57	57	91	120	120	182
II	36	68	103	137	131	188
III	70	86	108	143	143	182
IV	97	148	154	217	114	143

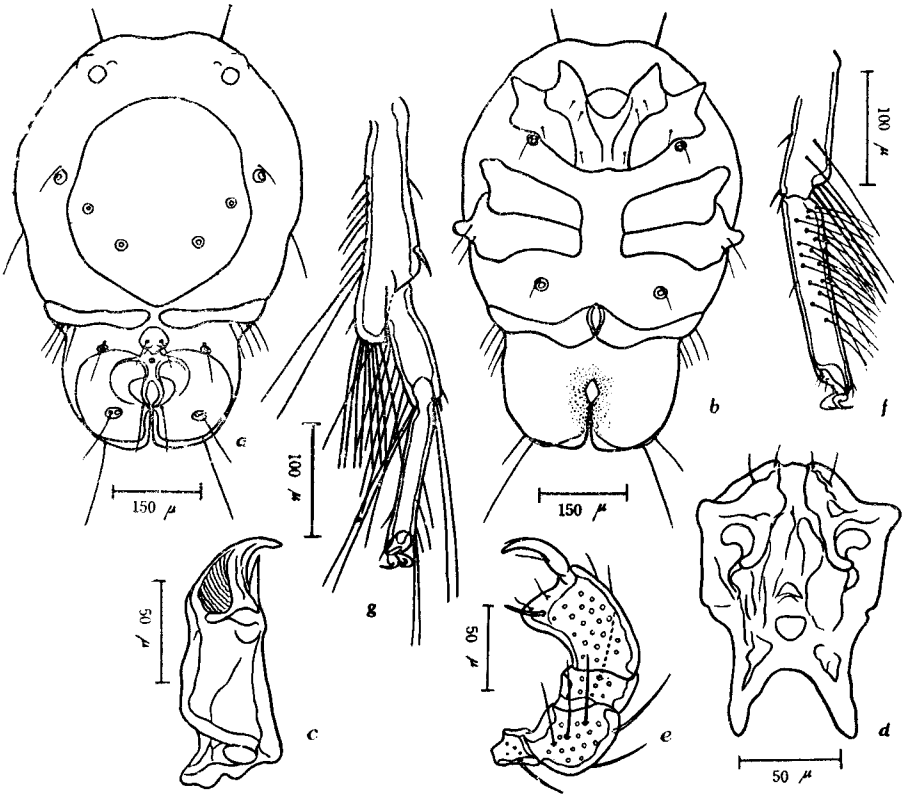

Fig. 14. *Arrenurus* (*Micruracarus*) *soochowensis* Marshall (male).
a, Dorsal view; b, ventral view; c, mandible; d, maxillar organ; e, right palpus; f, fifth and sixth segments of second leg; g, fourth leg.

The sixth segment of the first and second legs bears a bush of numerous minute hairs. The fourth segment of the fourth leg has a broad spur provided with eight hairs as is illustrated here. The genital wings are narrow and extend over nearly to the middle portion of the dorsal surface. The genital opening is 0.045 mm long and almost surrounded by the wings.

Female. Body 0.81 mm long and 0.69 mm wide. Outline elliptical, with undulated margin. The interval between eyes is 0.285 mm. Dorsal grooved area rather large, 0.65 mm long and 0.5 mm wide. In the area are found three hairs of glands, one of them bearing an accessory hair. Slightly anterior to the middle portion of the dorsal surface present a prominent pair of glands. There are two

pairs of long hairs on the posterior margin. On the ventral surface are found four pairs of glands and a median posterior one. Mandibles 0.125 mm long and 0.059 mm high. Maxillar organ 0.148 mm long and 0.106 mm wide. Their figures are given in the paper. Palpi similar to those of the male, measuring as given below (in μ) :

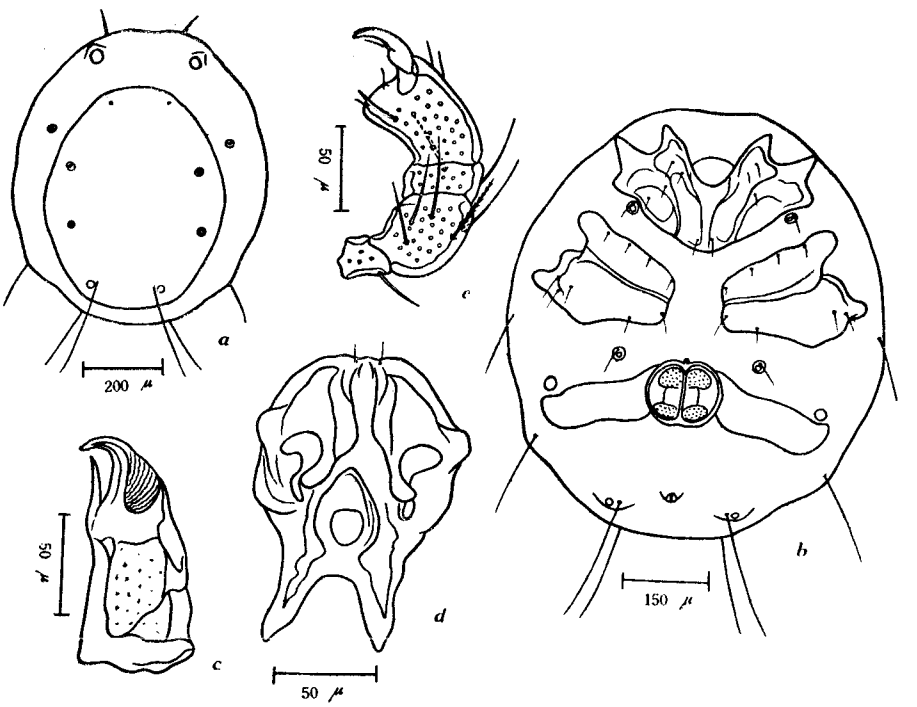

Fig. 15. *Arrenurus* (*Micruracarus*) *soochowensis* Marshall (female).
a, Dorsal view ; b, ventral view ; c, mandible ; d, maxillar organ ; e, right palpus.

Segments	1	2	3	4	5
Extensor surface	30	63	36	82	43
Flexor surface	17	26	13	53	43

Epimeral plates in general similar to those of the male but different in detail. Genital area situated rather nearer to the fourth epimera than the posterior margin of the

body. Two large semicircular genital plates 0.114 mm long and 0.142 mm wide, with a median slit-like aperture between them. These plates are provided with two lateral wings, each 0.194 mm long.

Locality. Captured three males and one female on August 18,1943 and two males and one female on October 5, 1943 in Wuchang, Hupeh.

Remarks. The present species is known from China (by Marshall 1921), Ussuri region (by Sokolow, 1931), and Manchuria (by Uchida, 1941). The description has hitherto been based only on the male. The female here described is probably referable to the species.

Arrenurus (*Micruracarus*) *madarászi* Daday

Male. The specimen agrees exactly with those hitherto collected in Japan. Only the measurements will be given. Body 0.663 mm long and 0.55 mm wide. The interval between eyes is 0.25 mm. Mandibles 0.128 mm long, and maxillar organ 0.145 mm long and 0.106 mm wide. Dorsal grooved area 0.623 mm long and 0.35 mm wide. Palpi measured as follows (in μ) :

Segments	1	2	3	4	5
Extensor surface	30	56	36	86	46
Flexor surface	15	30	17	56	40

The measurement of legs is given in the following table (in μ) :

Segments / Legs	1	2	3	4	5	6
I	51	51	80	97	91	154
II	57	57	86	108	103	165
III	63	57	80	108	108	120
IV	91	103	103	131	120	120

Localities. One male specimen was found on August 18,1948 in Wuchang, Hupeh. One female was obtained on November 10,1943 from Lake Tung Ting.

Remarks. The species is widely distributed in Asia from the tropical region to the middle part of Japan.

Arrenurus (*Micruracarus*) *gibberifrons* Piersig

Female. Body pyriform is outline, with a few protuberances, 0.763 mm long and 0.638 mm wide. The interval between eyes is 0.237 mm. The area en-

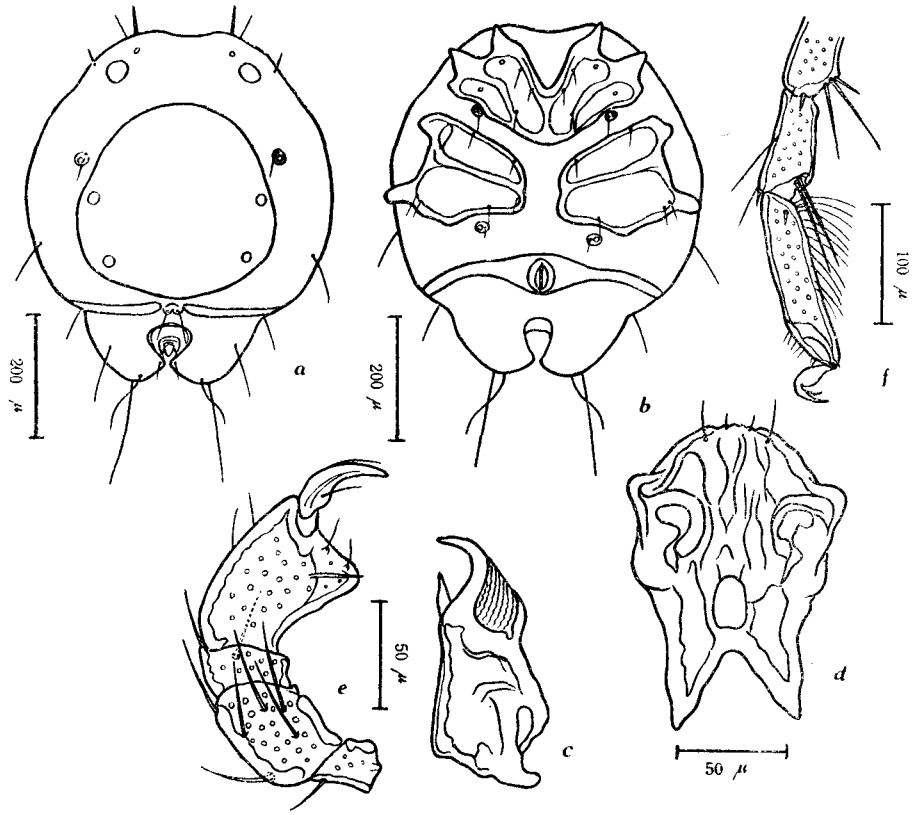

Fig. 16. *Arrenurus* (*Micruracarus*) *madarászi* Daday. (male).
a. Dorsal view; b, ventral view; c, mandible; d, maxillar organ; e, left palpus; f, distal segments of first leg.

circled by the dorsal groove is broadly elliptical, 0.475 mm long and 0.387 mm wide. Anterior to eyes is found a pair of protuberances. There are three pairs of conspicuous humps on the body surfaces, two on the dorsal and one on the ventral near the posterior end. Mandibles 0.132 mm long and 0.056 mm high. Maxillar organ 0.137 mm long and 0.083 mm wide. Palpi similar in form to the figure by Viets

Segments	1	2	3	4	5
Extensor surface	26	60	36	66	40
Flexor surface	17	26	13	48	40

(1927) as *A. proxima*, slightly different in the arrangement of hairs. The measurements are as given above (in μ) :

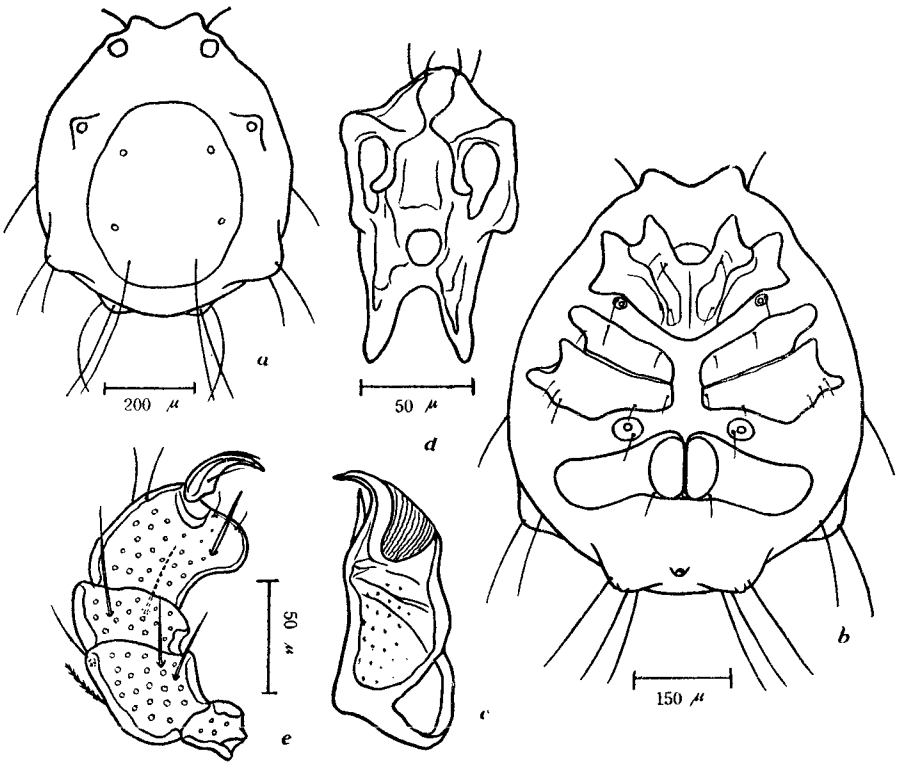

Fig. 17. *Arrenurus (Micruracarus) gibberifrons* Piersig (female).
a. Dorsal view ; b, ventral view ; c, mandible ; d, maxillar organ ; e, left palpus.

The epimera are largely coincided with the figure by Viets. The shape of genital area is slightly different from the figure above mentioned but seems to coincide with Walter's emendations (1929). Genital opening 0.108 mm and 0.12 mm wide. Genital wings 0.165 mm long. No figures on the surface of genital lips.

Locality. Two females were obtained on November 10,1943 in Lake Tung Ting, Yochow.

Remarks. The species is known from Java (Piersig, 1906 and Walter, 1929) and Malay (Viets, 1927). The species seems to be widely distributed in tropical

regions of Asia.

Arrenurus (*Micruracaus*) *forpicatoides* Lundblad

The female specimen agrees with the Australian species (Lundblad, 1947, p. 75), not only in the form of palpi, epimera and genital area, but also in the measurements in several organs. Therefore, we referred the specimen to Lundblad's species which was found in somewhat different locality from the view point of animal distribution.

Female. Short elliptical, 0.81 mm long and 0.705 mm wide (0.81 mm long and 0.707 mm wide in the Australian specimen). The interval between eyes is 0.27 mm. Dorsal plate elliptical, 0.588 mm long and 0.475 mm wide (0.62 mm long and 0.45 mm wide in the Australian specimen). There are three pairs of glands, one outside the dorsal groove and two inside it. Mandibles 0.135 mm long (0.134 mm long in the Australian specimen) and maxillar organ 0.152 mm long and 0.106 mm wide (0.154 mm long in the Australian specimen). Palpi similar to the figure made by Lundbald from the palpi of a male specimen. All the segments resemble those of Lundblad's description, in the form and curvature, and also in the arrange-

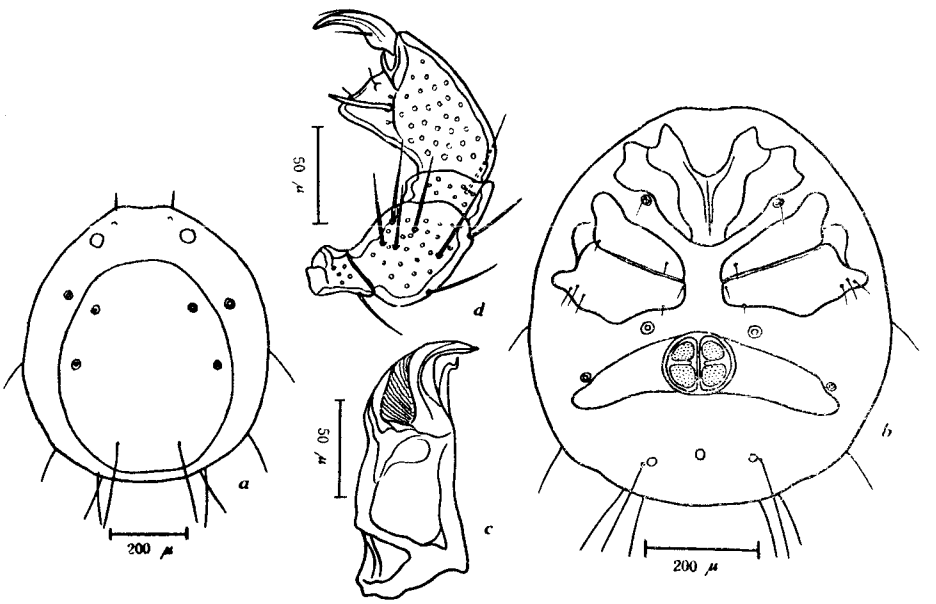

Fig. 18. *Arrenurus* (*Micruracarus*) *forpicatoides* Lundblad (female).
a. Dorsal view; b, ventral view; c, mandible; d. right palpus.

ment of spines. They are measured as follows (in μ) :

Segments	1	2	3	4	5
Extensor surface	33	60	36	89	46
Flexor surface	17	33	13	56	43

The epimera are similar to those of the Australian specimen but somewhat differ in edges of the first and second epimera, which are not as acute as those of the latter, and also in the curvature of the posterior margin. The genital plates and wings are also closely allied to those of the Australian specimen. Genital plates 0.103 mm long and 0.114 mm wide (0.125 mm wide in the Australian specmen). Genital wings 0.245 mm long.

Locality. Collected one female on August 18,1943, and three females on October 5, 1943 in Wuchang, Hupeh.

Remarks. The figure here given was drawn from a female slightly inclined anteriorly. Therefore, there can be seen slight differences in the margin of the fourth epimera, the intermediate area between the epimera and the genital area, the form of genital wings and in the site of the nephridial pore from those of Lundblad's figure.

Arrenurus quadrimaculatus Sokolow

Female. Body elliptical, 0.87 mm long and 0.735 mm wide, having several pairs of long hairs. Chitinous skin rather soft in two specimens. The interval between eyes is 0.28 mm. The area encircled by the dorsal groove is broadly elliptical, 0.69 mm long and 0.525 mm wide. On either side of the anterior part, slightly concave, present a hump carrying a gland. Mandibles 0.132 mm long and 0.065 mm high. Maxillar organ 0.152 mm long and 0.112 mm wide. Palpi exactly coincided with Sokolow's description except the presence of several feathered spines instead of simple ones alone. The measurements are as follows (in μ) :

Segments	1	2	3	4	5
Extensor edge	30	63	33	83	43
Flexor edge	16	26	13	50	—

On the ventral side, the epimera and genital area are similar to those of Sokolow's specimen. Genital opening 0.114 mm long and 0.125 mm wide. Genital wings 0.205 mm.

Locality. Two females were found in November 10, 1943 in Lake Tung

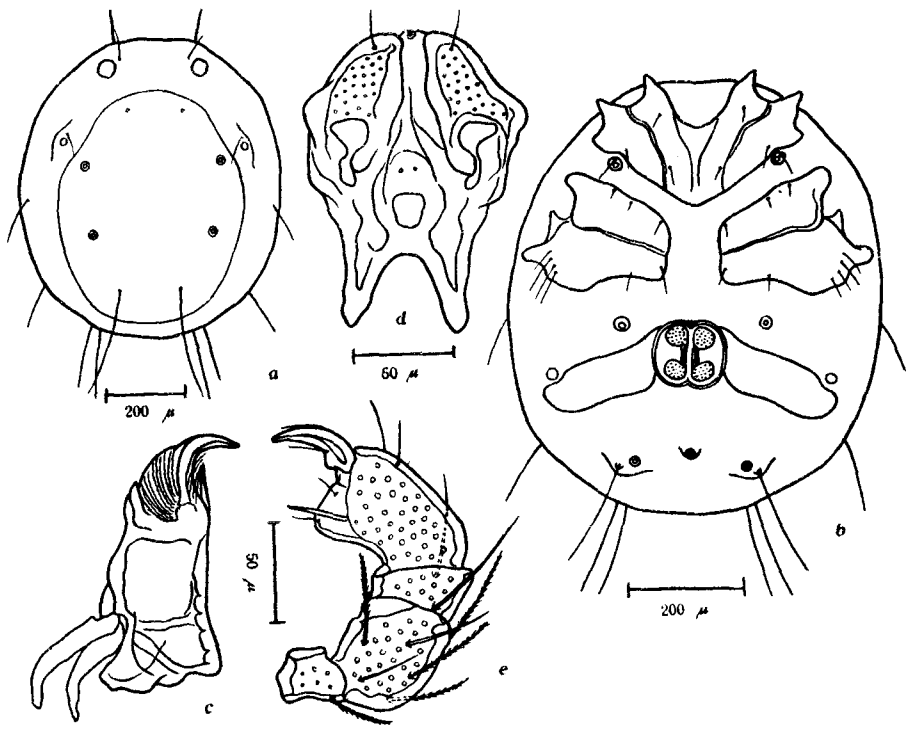

Fig. 19. *Arrenurus quadrimaculatus* Sokolow (female).
a, Dorsal view; b, ventral view; c, mandible; d, maxillar organ; e, right palpus.

Ting, Yochow.

Remarks. Only the female specimen of the species was recorded by Sokolow (1931) from the Ussuri regions.

Arrenurus congener Daday

Female. Body pyriform in outline, 1.02 mm long and 0.901 mm wide. The interval between eyes is 0.34 mm. Anterior portion of the body narrowed and slightly constricted near the end. Posterior part rounded and with two shouldered corners which are more distinct than the description by Walter (1929). On the anterior half of the dorsum are found paired humps each with a gland. The area surrounded by dorsal groove is 0.68 mm long and 0.595 mm wide and seems to be wider than the specimen by Viets (1926). The arrangement of glands and

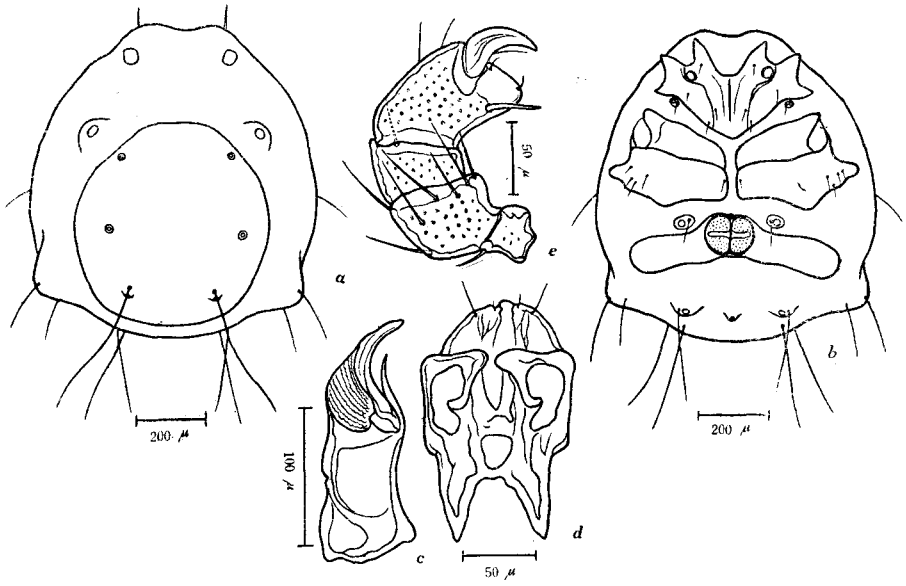

Fig. 20. *Arrenurus congener* Daday. (female).

a. Dorsal view ; b, ventral view ; c, mandible ; d, maxillar organ ; e, left palpus.

hairs nearly agrees with the previous description. Maxillar organ 0.177 mm long and 0.114 mm wide. Palpi quite similar to those of Viets's specimen and measured as follows (in μ) :

Segments	1	2	3	4	5
Extensor surface	34	74	57	91	51
Flexor surface	17	34	17	63	—

The form of epimera is most alike to that described by Walter (1929), but the genital area, though closely allied in shape, is larger than that of Viets's and Walter's specimen. Genital opening 0.131 mm long and 0.16 mm wide. Genital wings 0.265 mm long.

Locality. Two females were obtained on August 18, 1943 in Wuchang, Hupeh.

Remarks. These specimens were identified with the Indian species with query, because the diagnosis of the species is more or less complicated as follows.

The species was first described by Daday (1898) from Ceylon. In 1925 Viets described the species more in detail basing on a specimen collected in India. He found several differences between Daday's description and his specimen. In 1929 Walter examing Daday's specimen made some emendations on the original description of the species and distinguished Viets specimen as *Arr. discrepans* n. sp. On examining the Chinese specimens, we found that they agree largely with Viets' and Walter's description, though different in a few points, such as wider body, wider dorsal grooved area and broader genital area.

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