A New Water Mite, *Arrenurus daisetsuensis* n. sp., with a Note on its Life-History[1]

By

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(*With 17 Text-figures*)

As regards the life-history of the Hydracarinan genus *Arrenurus*, Münchberg (1935) reported that 24 European species of *Arrenurus* were parasitic on the Odonata. From Japan, Uchida & Miyazaki (1935) reported on the life-history of *Arrenurus madaraszi* which is a parasite to the malaria-mosquito, *Anopheles hyrcanus sinensis*. In 1937 Uchida described *Arrenurus agrionicolus* as parasitic on a dragon-fly, *Coeagrion quadrigerum*. The next year Münchberg (1938) also reported that 16 species of *Arrenurus* were parasitic on mosquitos and that the parasites belong to the following subgenera: *Micruracarus*, *Truncaturus*, *Megaluracarus* and *Arrenurus*. According to him *Anopheles maculipennis* was the main host of these mites. In the summer of 1937 a species of *Arrenurus* was collected by the writer together with Prof. T. Uchida from a bog marsh at Numanodaira, Mt. Daisetsu in Hokkaido. The author afterwards (1948, 1949) again collected the same species of *Arrenurus* from the bog marsh Hisagonuma, Mt. Daisetsu. On closer examination the species seems to be new to science as described as follows:

Arrenurus (*Arrenurus*) *daisetsuensis* n. sp.[2]

Male (type, prep. 361). Body (Figs. 1-3) 1170 μ long, 750 μ wide and 730 μ high and ovate in shape, slightly bulged out over each eyes. Anterolateral margins moderately depressed close to the eyes. Dorsal enclosed area depressed. The side angles of caudal appendix are somewhat curved inwards. The posterior

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2) The species is named after the locality where the specimens were collected.

margin of the cauda with two cones, having several pairs of hair of which the two pairs are prominently long. The crooked pair of hairs are shorter than the petiolus. Petiolus 305 μ long, wider in its quadrated tip. Eyes-interval 423 μ. Maxillar organ (Fig. 5) 136 μ long and 125 μ wide. Mandibles (Fig. 7) 216 μ

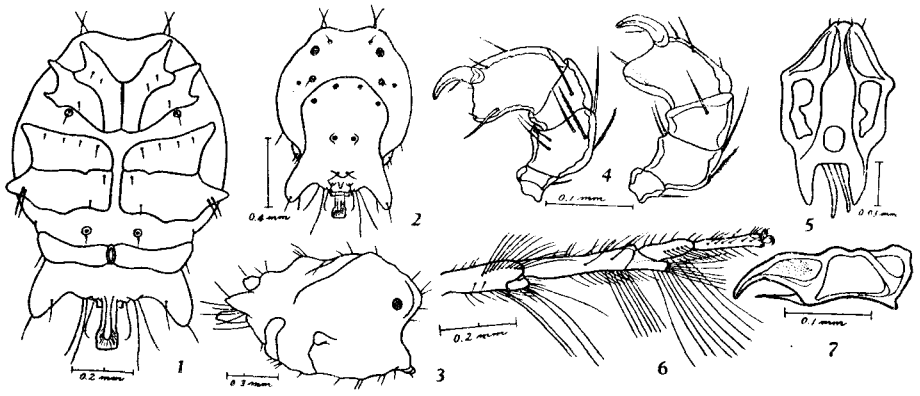


Fig. 1-3. *Arrenurus* (*Arrenurus*) *daisetsuensis* n. sp. (♂). 1. Ventral view of body. 2. Dorsal view of body. 3. Side view of body. Figs. 4-7. *Arrenurus* (*Arrenurus*) *daisetsuensis* n. sp. (♂). 4. Palpi. 5. Maxillar organ. 6. 3-6 segments of IV leg. 7. Mandible.

long, having a stout claw. Palpus (Fig. 4) also stout. The second segment of palpi has six large bristles ; two feathered and simple one on the extensor edge, the other five on the lateral side. The third segment are provided with long and having a stout claw. Palpus (Fig. 4) also stout. The second segment of palpi has six large bristles ; two feathered and simple one on the extensor edge, the other five on the lateral side. The third segment are provided with two bristles ; one on each side. The fourth segment is the largest of all, having four bristles ; among them one is strong and movable. The fifth segment is claw-like and moderately curved. The palpal segments being (in μ) :

	I	II	III	IV	V
Extensor side	29	93	70	104	64
Flexor side	25	52	23	81	—

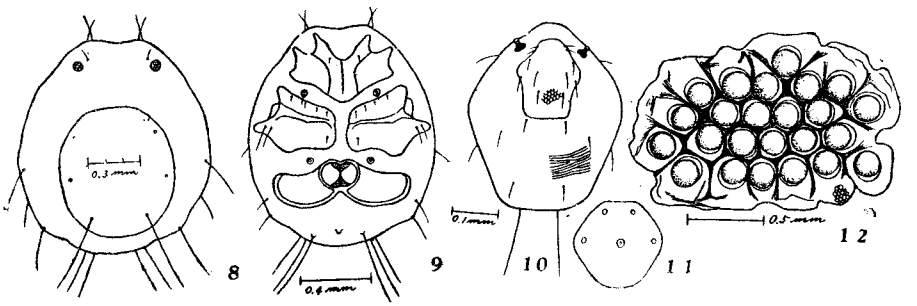
The fourth pair of epimera (Fig. 1), the largest of all, having two spines on its posterior outer corner. The fourth leg (Fig. 6) is rather stout, the fourth segment being provided with a strong spur which bears seven long hairs. The last two segments are conspicuously short. The lengths of the legs are (in μ) : I. 800, II. 814, III. 887, IV. 1140. Genital wings (Fig. 1) moderately broad, rised forwards to the outer parts. They are completely separated

from each other on both sides of the genital aperture. Body colour greenish blue. Eyes reddish black.

Female (allotype, prep. 363). Body (Figs. 8, 9) broadly ovate, measuring 1190 μ long, 970 μ wide and 973 μ high. Anterior end of the body narrowed and ending in flat margin slightly concaved posteriorly. Postero-lateral corner somewhat angulated and running to the rounded posterior margin. Dorsal groove elliptical round. Eyes interval 393 μ and shorter than that of the male. Maxillar organ 186 μ long, 145 μ wide, and mandibles 174 μ long. The palpal segments being (in μ) :

	I	II	III	IV	V
Extensor side	41	99	64	110	64
Flexor side	23	52	35	80	—

The lengths of the legs are (in μ) : I. 800, II. 814, III. 887, IV. 1140. Genital wings moderately curved, ending in rounded outer tips, large and semicircular in shape.



Figs. 8-9. *Arrenurus* (*Arrenurus*) *daisetsuensis* n. sp. (♀). 8. Dorsal view. 9. Ventral view. Figs. 10-12 *Arrenurus* (*Arrenurus*) *daisetsuensis* n. sp. 10. Dorsal view of nymphochrysalis. 11. Nymphophanorgan. 12. Egg-mass.

Eggs (Fig. 12). Yellow and round, 185 μ in diameter. The eggs are various in size even in one egg mass. They are imbedded in transparent alveolar gelatinous mass which is divided by many septa surrounding each ovum. Each egg mass contained 6-30 eggs.

Larva (Fig. 13). Body almost pear-shaped, with the maxillar organ forming the proboscis. Posterior end of the body somewhat conical. Body 286 μ long, 170 μ wide, flattened dorso-ventrally and bluish brown in colour. The H-shaped intestinal organ can be seen through the integument from dorsal, containing many brownish yellow granules. Eyes paired, large and reddish black. In front of the eyes stands 2 little sensory hairs on each side. Posterior margin

of the body with several pairs of hairs of which one is very long, stretching posteriorly. Ventral surface nearly covered with 3 pairs of moderate sized epimeral plates. Each epimeral plate has 1 or 2 long hairs. Genital plate almost hexagonal in shape, having 4 fine hairs. Genital pore not opened. Palpi made up of 5 segments, the 3rd being the most prominent and strong, with one long spine. The 4th segment is very short and has several claw-like spines and one feathered long spine. The 5th segment is claw-like. These spines, hairs, and the claw-like segment must be beneficial to cling to their host insects. Legs in three pairs, each having 5 segments. The lengths of the legs are (in μ) : I. 230, II. 245, III. 258. Each leg has several long feathered hairs on 3rd and 4th segments. The larva crept out from the egg mass swims quickly in water and frequently comes to water surface, but does not stay long on water surface as the larvae of Protziidae. The larva does not creep on water bottom.

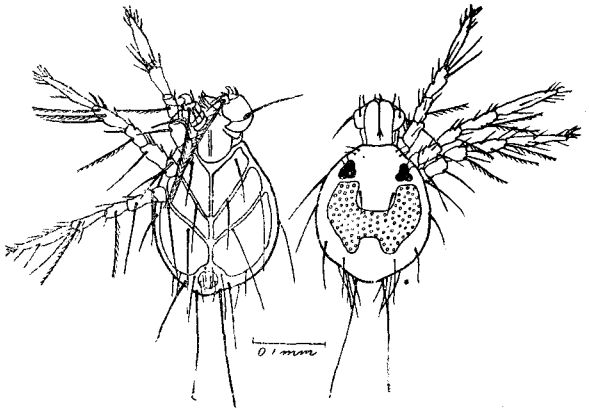
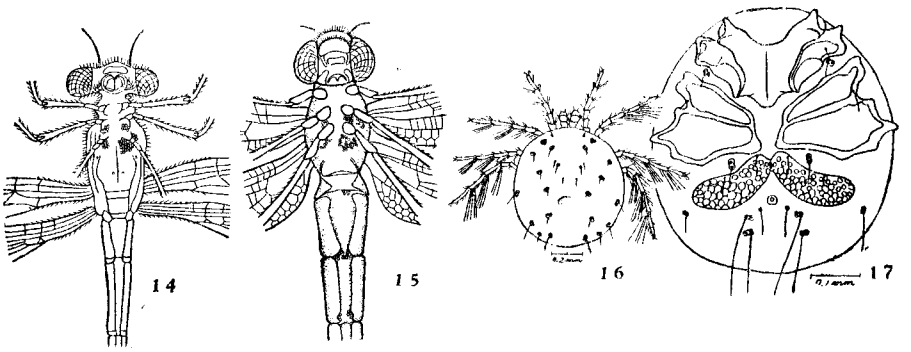


Fig. 13. Larvae of *Arrenurus* (*Arrenurus*) *daisetsuensis* n. sp.

Nymphochrysalis. Immediately after the larva has attached to the dragonflies, *Enallagma deserti yezoensis* or *Aeschna nigroflava*, it changes into the first pupa, nymphochrysalis, and having sucked nourishment from the hosts it grows larger. The nymphochrysalis becomes finally spherical and reddish yellow in colour. When fully grown-up, the nymphochrysalis (Fig. 10) measures 475 μ long and 375 μ wide. Dorsal plate measuring 29 μ in length, 32 μ in width, orange in colour, indicating a scale-like figure and bearing several fine hairs. Dorsal skin generally striated and transparent. As the nymphochrysalis grows, epimeral plates become gradually apart from each other. Nymphophanorgan (Fig. 11) having an original pore in its center. As to the relationship between the parasites and the hosts Wesenberg-Lund (1918) described "From these observations we know that

the nymphs of Libellulidae in the course of the winter or nearly spring are infested with larvae of mites which fasten themselves between head and thorax. During the metamorphosis the larvae leave the skin, wander over the thorax to the furrows on the abdomen of the imago." In a specimen of the dragon-fly, *Aeschna nigroflava* collected on August 7, 1949 at Hisagonuma the writer found 38 smaller (about 290 μ length) and 28 larger (about 475 μ length) nymphochrysalis of mites ; the smaller ones being flat, bluish brown and very similar to the larval stage in shape, but the larger ones round in shape and reddish brown in colour. The parasites (Figs. 14, 15)are usually found in the hosts on the ventral surface of the thorax and partly intersegmental grooves of the abdomen. The largest number of the parasites counted by the writer is 96 upon a single specimen of *Aeschna nigroflava* and 65 on *Enallagma deserti yezoensis*. The parasitic ratio is 22/38 in *E. deserti yezoensis* and 5/6 in *Aeschna nigroflava* respectively.



Figs. 14-15. Host dragon-flies of *Arrenurus* (*Arrenurus*) *daisetsuensis* n. sp. 14. Ventral view of *Enallagma deserti yezoensis* Asahina. 15. Ventral view of *Aeschna nigroflava* Martin. Figs. 16-17. Nymphs of *Arrenurus daisetsuensis* n. sp. 16. Dorsal view. 17. Ventral view.

Nymph. Body (Figs. 16,17) alomst round, 460 μ long, 410 μ wide and 375 μ high in an individual freshly crept out from the nymphophan. Eyes in one pair, black and triangular, their interval being 185 μ. On the dorsal surface are found 9 pairs of epithelial glands and 4 pairs of sensory hairs. One sensory hair on each plate of the glands. On the ventral side 3 groups of epimera, 2 genital wings, 5 pairs of glands and an excretory pore are observed. The 1st and 2nd epimera on both sides fused each other making a group. The 3rd and 4th epimera form a connected plate on both sides. Between the genital wings opens a rudimentary genital orifice. Posterior to the genital orifice opens a round large excretory pore. Palpi, mandibles and the maxillar organ are similar to those of the imago. Mandibles 140 μ long including the claw, maxillar organ 116 μ long

and 99 μ wide, and the palpal segments being (in μ) :

	I	II	III	IV	V
Extensor side	17	64	46	81	52
Flexor side	15	29	17	52	—

In the early stage the nymph is yellowish green in colour, but gradually becomes greenish blue. The full-grown nymph measures 815 μ long, 770 μ wide and 660 μ high.

Localities. The species is common in a bog marsh of Numanodaira (1380 m above the sea level) and Hisagonuma (950 m above the sea level), of Mt. Daisetsu in Hokkaido. Several males, many females and nymphs were collected on August 10, 1937 in Numanodaira by Tohru Uchida & T. Imamura ; one female was captured on July 26, 1947 in Hisagonuma by M. Akiyama ; 1 male, 8 females and 44 nymphs were captured on July 24, 1948 from Numanodaira by T. Imamura ; 2 males and 7 females were collected on July 21, 1949 in Hisagonuma by T. Imamura ; 1 male, 10 females and 26 nymphs were captured on July 26, 1949 from Numanodaira by T. Imamura ; 3 males, 11 females and 37 nymphs were collected on August 7, 1949 in Hisagonuma by T. Imamura. The water of these marshes is clear and reddish brown in colour. The border of these bogs forms swamps and is rich with the insectivorous plants *Drosera rotundifolia* which catch many dragon-flies, *Enallagma deserti yezoensis* in summer. The bogs are shallow, about 2 m deep and have scarcely water plants. There were found the egg-mass and the larvae of the salamander *Hynobius retardatus* but no fish. The red Copepod, *Achanthodiaptomus pacificus* var. *yamanacensis* was also found. Water temperature was 17°–18°C in July.

Remarks. The new species in both sexes, though very similar to *Arrenurus* (*A.*) *bicuspidator* Berlese common in Europe, is always greenish-blue in colour, the male genital wings are broader than in the European species and also the female wings are somewhat different in shape from the latter. The male of the present species is also akin to the American species, *A.* (*A.*) *americanus*, but the posterior appendages are more slender and extruded more laterally than those of the American species.

Life-history. On July 24, 1948 at Numanodaira and On July 21, 1949 at Hisagonuma the author collected dragon-flies, *Enallagma deserti yezoensis* Asahina which were abundantly parasitized by the larvae of *A.* (*A.*) *daisetsuensis* n. sp. On July 26, 1949 the dragon fly *Aeschna nigroflava* Martin was also found to harbour the same larvae at Numanodaira. These dragon-flies bearing the parasites were again collected on August 8, 1949 at Hisagonuma. On the other hand, a male and 5 females of the new water mite from Numanodaira were reared at the room temperature in the laboratory of Asahigawa on July 25, 1948. Several eggs were laid on July 27 and larvae hatched out on August 6. On the other hand, on July

26, 1948, 5 nymphs were reared and on October 16 they became immobile upon the bottom of a beaker probably as the teleiochrysalis. As the third set one male and 7 females were collected from Hisagonuma and were reared on July 23, 1939. Several eggs were laid on July 24 and the larvae hatched out on August 6. As the fourth set one male and 8 females collected from Numanodaira were reared on July 26, 1949. On July 29 the eggs were laid and on August 9 the larvae appeared. From the facts above described, the following surmise is probable : The eggs are laid at the end of July and the larvae hatch out 12–14 days after egg-laying. These larvae become parasitic upon the body of the dragon-flies, *Enallagma deserti yezoensis* Asahina and *Aeschna nigroflava* Martin. In autumn the nymph changes into the teleiochrysalis.

In concluding the author wishes to acknowledge his cordial thanks to Professor Dr. Tohru Uchida for his guidance in the course of this research. His acknowledgement must also be paid to Dr. Syôjirô Asahina for his kind identification of the host insects. Moreover, his thanks must be extended to Mr. Terué Inomata and the students of the Hokkaido Gakugei University for their kindness in helping in collection and in field observations at the places where we were in constant danger of meeting bears.

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