22. *Life-history of a Water-mite Parasitic on Anopheles.*

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Through the kindness of Professor T. Esaki, of the Fukuoka Imperial University, a protocol concerning the life habits of a water mite parasitic on mosquitos, described by the junior author, was sent to the senior author together with several specimens of the mite. In former literature, the larvae of the water-mites parasitic on Chironomidae and Culicidae have often been reported, but from a hydrachnological point of view these reports are mostly without value, since the species (even the genus) of the parasites has not been determined, and their life history has been utterly unknown. On the basis of the protocol and specimens, the senior author, after consulting the literature, puts on record the following report.

The water-mite seems to be identical with *Arrhenurus Madarászi* Daday, which, according to Walter (1929),¹⁾ has been described under the following names, *A. palembangensis*, *A. kraepelini*, *A. geei*, *A. procursus*, *Anurania gottlandica*, from several localities in tropical Asia, from India through the Malay Peninsula, including Ceylon, Sumatra and Java, to the southern and central part of China, as Canton and Soochow. The Japanese specimens have been abundantly collected from Yatsushiro, on the western coast of Kyushu, across the Eastern Sea, situated opposite Soochow. The description of the water-mite being more or less different among former investigators, figures and important characters will be given below.

Male bluish green in colour, 0.62 mm long and 0.52 mm wide. Body broadly oval, with a small posterior appendix. Anterior end of body narrowed, slightly emarginate near the eyes, bearing two pairs of antenniform bristles. Dorsal groove enclosing a more or less round area. Cauda narrower than the body but well-developed, becoming narrow posteriorly and having a median incision which is largest at the upper end. Above (not between) the incision projects a petiolus which tapers to a point and has on either side a hyalin claw-like piece.

1) Ann. Mus. Nat. Hungarici, XXVI, p. 265.

Fig. 1. a, dorsal view of male; b, ventral view of male; c, ventral view of female; d, right palpus of male.

Genital area lying at the junction of body and cauda, bearing small papillae sparsely distributed. Distal end of fourth segment of fourth pair of legs without a spur. Palpi having a broad fourth joint.

Female brownish green in colour, 0.77 mm long and 0.65 mm wide. Outline broadly oval with shallow constrictions on the postero-lateral corners. Dorsal groove enclosing a large oval area. Genital area with two wings slightly sloping posteriorly. Genital lips large.

The life habits of the species have been observed by the junior author during the summers 1933-1934, at Yatsushiro, in the neighbourhood of Kumamoto. The water-mite is commonly found in rice-fields and pools. The eggs, yellowish brown in colour, are laid in

July-August on the under surface of leaves of water plants. They are embedded in a jelly-mass and are generally 5-17 in number in one deposit. The six-legged larvae hatch out from the eggs 4-5 days after the egg-laying. Léger and Motas (1928) reported that the larva of *Piona disparilis* attaches to the female of *Cricotopus biformis* (Chironomid) at the time of the oviposition of the latter. The larva of the Japanese water-mite searches for and is parasitic on pupae of *Anopheles* and *Culex*. Contrary to Uchida's observations (1932) on *Acercus ornatus* parasitic on the pupa of *Chironomus thummi*, the larva seems not to suck the juice of the pupa, because it does not swell out as that of *Acercus ornatus*. At the time of the emergence of these mosquitos, the parasite seeks the soft parts of the adult to which it clings. It is observed that in *Culex* the parasite is mostly found attaching itself around the neck and thorax, and rarely to the abdomen, while in *Anopheles* it is found mostly on the under surface of the abdomen. In nature the parasite is generally found on *Anopheles* and only uncommonly on *Culex*. During the parasitism the parasite becomes gradually widened and, in 1-2 days, develops to a nymphophan which is already separated from the host and remains motionlessly on the water-bottom. Two or 3 days afterwards a nymph hatches out from the nymphophan and preys violently on Diaptomids. They are at first about 0.3 mm long and 0.2 mm wide, but become 0.6 mm long 0.5 mm wide just before the teleiophan stage. Ten days after emergence, the nymph lurks among leaves of water plants and undergoes its metamorphosis. About 2 days afterwards, the adult emerges from the teleiophan and soon begins to catch water-fleas. The copulation of newly hatched adults takes place as described by Uchida (1922), Motas (1925) and in greatest detail by Lundblad (1929).

According to the observations of the junior author, the water-mite is hoped to be an important enemy against these harmful mosquitos, since the insects bearing more than 4 individuals of the water-mite were inactive and did not attack human beings. On the other hand, the parasitism of the mite on adult *Anopheles* is very frequent as shown in the following table.

Number of parasites on an <i>Anopheles</i>	Number of <i>Anopheles</i> examined	Percentage of parasitism
80-89	1	0.3
70-79	1	0.3
60-69	3	0.9
50-59	5	1.5
40-49	6	1.8
30-39	13	3.8
20-29	17	5.0
10-19	44	13.0
1- 9	109	32.2
0	140	41.3

In conclusion, it must be very interesting to recall the distribution of the water-mites, which generally corresponds to that of harmful mosquitos causing malaria.