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Studies on Three Water-Mites from Hokkaido Parasitic on Midges[1]

By

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(*With 27 Text-figures*)

While studying on the life history of water mites in Hokkaido the writer could obtain some data, though fragmental, on the developmental stages of the following three species. Out of them, except the common species *Megapus nodipalpis*, two species seem to be new to science, hence the institution of *Neumania uchidai* n. sp. and *Pionopsis lutescens* var. *japonensis* n. var.

Before going further the author wishes to tender his hearty thanks to Dr. Tohru Uchida, Professor of the Hokkaido University, for his kind guidance in the course of this study.

1. *Megapus nodipalpis* Thor (Figs. 1—8)

Male. Body (Fig. 3) of short ellipse in shape, and 660μ long and 555μ wide. Anterior margin of the body somewhat convexed. Skin soft and transparent without any figures. The interval between eyes 225μ. Maxillar organ 137μ long and 80μ wide. Mandibles slender and 251μ long, including claws. Palpi (Fig. 1) heavy and strong. The second segment of palpi is strongest and characteristic, having a large process with a chitinous transparent point on the flexor side. The

Table 1.

	I	II	III	IV	V
Extensor side	34μ	77	74	97	40
Flexor side	28	40	57	80	40

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

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third segment also broad, having some fine hairs and four moderate spines, of which one feathered. The fourth segment is the longest of all and has two crooked spines in the middle of the flexor side, a club near them and many fine sensory hairs on the extensor surface. The palpal segments being (Table 1, in μ):

Epimera (Fig. 3) divided into four groups, with granulated appearance all over the surface. Protrusions on the suturing lines of the first and the second epimera far protruded than the posterior corners of the first epimera. On the epimeral margins, somewhat notched, exist some minute hairs. Legs destitute of swimming hair. The first legs are characteristic in having fifth segments broadened and sixth segments bent (Fig. 2). Each leg provided with two equal large bladed sickle-shaped claws, bifurcating at the ends. Near the flexor terminal ends of the fifth segments of the first legs present two long sword-like spines. The podal segments being (Table 2, in μ):

Table 2.

	1	2	3	4	5	6
I	51	80	137	210	222	137
II	63	74	120	177	188	182
III	63	68	114	177	188	182
IV	154	97	171	228	245	211

Genital plates (Fig. 3) fusing at both the frontal and the posterior ends, form a rather rounded plate, encircling the genital opening. Each genital plate is provided with three acetabulae and many fine hairs. Genital plates 108μ long and 160μ wide. Genital aperture 80μ long. Body colour reddish brown except the yellow Y-shaped excretory organ. Eyes reddish black.

Female. Body (Fig. 4) larger than the male, 960μ long and 910μ wide. Maxillar organ, mandibles, epimeral plates, legs and body colour are all similar to those of the male. Palpi (Fig. 6) slender than those of the male, having no conical project on the flexor edge of the second segments. The palpal segments being (Table 3, in μ):

Table 3.

	I	II	III	IV	V
Extensor side	34	80	102	125	37
Flexor side	29	46	86	97	40

Eyes interval 300μ, maxillar organ 160μ long, 97μ wide, and mandibles 285μ long including claws. The podal segments being (Table 4, in μ):

Table 4.

	1	2	3	4	5	6
I	51	90	165	240	245	171
II	57	78	137	183	188	160
III	57	78	143	205	212	199
IV	143	120	200	285	296	250

Genital area (Fig. 4) different from that of the male. Genital plates distinctly separated from each other and a large genital aperture situated in the middle of both genital plates. Anterior chitinous suspender of the genital opening larger than that of the posterior. Genital opening 165μ long. Genital plates 130μ long with three acetabulae and many minutes hairs on the outer margins.

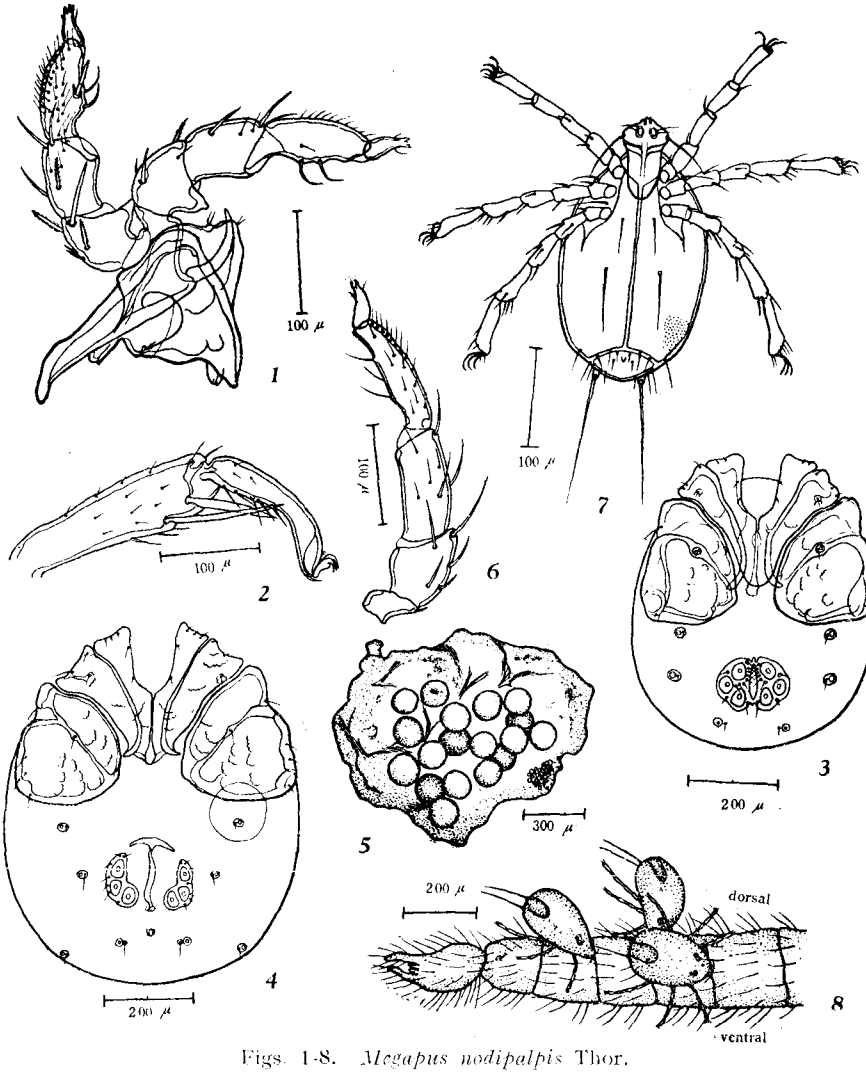
Eggs (Fig. 5) orange and round, 140-145μ in diameter. They were mainly laid on hollow surfaces of stones. They are imbedded in transparent alveolar gelatinous mass, usually not in a layer but somewhat piled up. No septa between eggs in a mass but some pillars are seen here and there. Each egg-mass containing 8, 14, 16 and 21 eggs.

Larva (Fig. 7) ovate in shape, with a proboscis bearing the maxillar organ. Body 228μ long, 150μ wide and light blue in colour except intestine which is brown. Eyes in one pair, large, reddish black and each located in 60μ interval. Dorsal surface covered with a dorsal plate showing granulated appearance. Ventral surface nearly covered with a genital plate and two epimeral plates which indicate granulated figures. Each epimeral plate has two spines : one in the middle long, another in the anterior portion moderately short. Genital plate nearly rhomboid in shape, having four fine hairs. A provisional genital aperture present in the mid-anterior portion of the genital plate. Around the genital plate are found several pairs of small hairs. From the posterior margin of the body two long spines stretch posteriorly. Maxillar organ 80μ long. Legs in three pairs, each having five segments. Fifth segment of each leg provided with sickle-shaped three claws of equal size. Each segment of the legs devoid of swimming hairs and provided with several spines mostly at the terminal end. The podal segments being (Table 5, in μ) :

Table 5.

	1	2	3	4	5
I	25	28	28	34	40
II	23	24	28	32	46
III	29	33	37	46	51

The larva crept out of egg-mass creeps on stone surfaces.



Figs. 1-8. *Megapus nodipalpis* Thor.

Fig. 1. Palpi with maxillar organ of male. Fig. 2. Fifth and sixth segments of male first leg. Fig. 3. Ventral view of male. Fig. 4. Ventral view of female. Fig. 5. Egg-mass. Fig. 6. Palpus of female. Fig. 7. Ventral view of larva. Fig. 8. Nymphochrysalis clung on the abdomen of midge.

Nymphochrysalis. (Fig. 8). The larva clung to the abdomen of midge changes into the first pupa, nymphochrysalis, and after having sucked nourishment from

the host it grows larger and round. The host of the larva is the imagine of a yellow little midge, name of which is not yet determined. Fully grown nymphochrysalis red in colour, measuring 230μ long and 180μ wide. Out of about two hundreds of specimens examined on July and August, only five midges were found to harbour the parasites. The parasites were mostly found on the dorsal and rarely on the sides of the abdomen, especially in the intersegmental region of the host. The numbers of the parasite counted by the author are 1-5 upon a host.

Nymph was not observed.

Locality. The cosmopolitan species is common in the River Ishikari, at Sowunkyo and Asahigawa, Hokkaido. In 1949 and 1950 the author collected the mites from the River Ishikari at Asahigawa and Sowunkyo with the following dates : 3 males and 2 females on July 4, 1949 at Asahigawa ; many males, females and several egg-masses on July 11, 1949 at Sowunkyo ; 8 males, 14 females and several egg-massses on June 19, 1950 at Sowunkyo.

Remarks. *Megapus nodipalpis* Thor was first described from Kyoto and Tokyo by Prof. Tohru Uchida (1931). The species is common in the River Ishikari at Sowunkyo and Asahigawa.

Life-history. Eight males and 10 females of the water mite captured from Sowunkyo were reared at the room temperature in the laboratory of Asahigawa in a glass pot with stones in it on July 11, 1949. The water in the pot was exchanged every day. Three egg-masses were laid in pits of a stone on July 13 and larvae hatched out on July 27, 15 days after the eggs were laid. Next year 5 males and 10 females were reared on June 19. One egg-mass was laid on stone surface on June 21 and larvae hatched out on July 9, 19 days after egg-laying, 4 days latter than the record in the last year. On the other hand, the author captured five imagines of yellow little midge : one at Sowunkyo on July 12, 1949 ; four at Asahigawa on Aug. 22, 1950, which were parastitized by the larvae of *Megapus nodipalpis*.

2. *Neumania uchidai* n. sp.[1] (Figs. 9—17)

Male (type prep. 294). Body (Fig. 10) oval in shape, and 750μ long, 660μ wide and 500μ high. Skin soft and transparent without any fiugres. Eyes one pair, black and with the interval 320μ. Maximillar organ 183μ long and 114μ wide. Mandibles (Fig. 13) 170μ long including claws. Palpi (Fig. 13) slender and long. The second segment of palpi is the largest of all and has three moderate spines ; two on the extensor terminal end, one on the middle portion. The third segment is provided with two long spines on the terminal end. The fourth segment slender, bearing three little papillae. The fifth segment trifurcated in the the distal end, having one moderate hair and some minute hairs. The palpal segments being (Table 6, in μ) :

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

Table 6.

	I	II	III	IV	V
Extensor side	27	102	48	82	34
Flexor side	20	70	34	54	—

Epimera (Fig. 14) divided into four groups, indicating hexagonal patterns in all the surfaces. Protrusions of the first epimeral groups reaching the middle of the fourth epimeral plates. The fourth epimera most chracteristic and rectangular in shape with protruded lateral sides and almost straight posterior edges. Legs long and having no figures on the surfaces as those of the legs of *Neumania spinipes*. The first and the second legs are provided with some jagged spines besides the ordinary spines as shown in the text-figure 12. The third legs (Fig. 11) are each provided with one feathered spine on the terminal end of the fifth segment and some small jagged spines. The fourth legs are each provided with a feathered spine near the terminal end of the fourth and the fifth segments. Each leg provided with two equal sickle-shaped claws on the terminal end of the sixth segment. The podal segments being (Table 7, in μ):

Table 7.

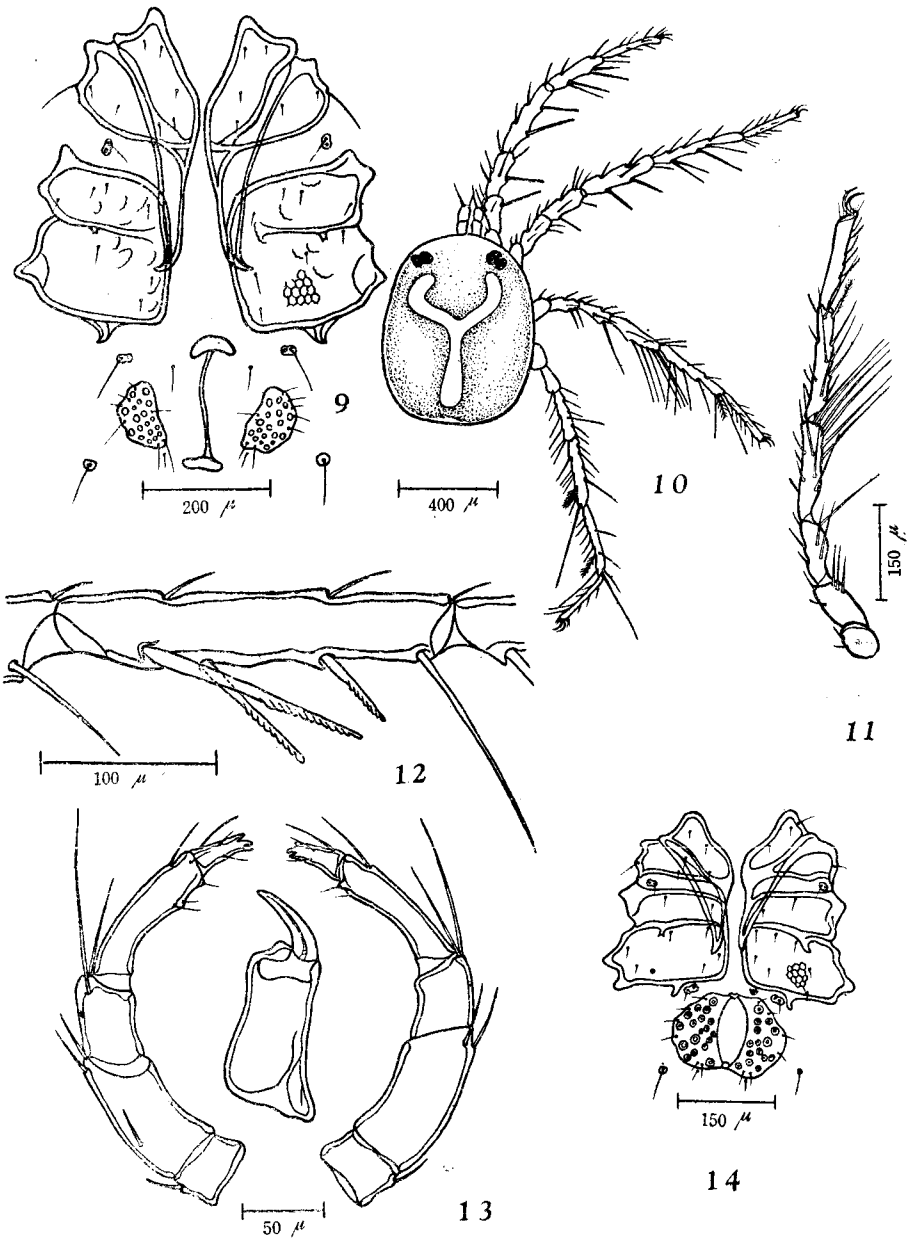
	1	2	3	4	5	6
I	63	120	188	268	297	217
II	97	114	171	280	314	222
III	80	103	143	234	285	251
IV	114	148	194	268	274	280

Genital area (Fig. 14) large, composed of two genital plates, each having 15-18 acetabula and like a halfmoon in shape. Genital opening 120μ long. Colour dark brown except the yellow body margin and the Y-shaped excretory organ.

Female (allotype, prep. 301). Body oval in shape, and 1045μ long, 765μ wide and 740μ high. Palpi, mandibles, maxillar organ, legs and the body colour are all similar to those of the male. Epimera and the genital area (Fig. 9) are different from those of the male. The fourth epimera are not so protruded laterally as those of the male and the posterior margins somewhat rounded and not straight as those of the male. Genital plates distinctly separated from each other, opening

Table 8.

	I	II	III	IV	V
Extensor side	28	108	63	114	40
Flexor side	17	68	34	80	40



Figs. 9-14. *Neumania uchidai* n. sp.

Fig. 9. Epimeral plates and genital organ of female. Fig. 10. Dorsal view of male. Fig. 11. Right 3rd leg of male. Fig. 12. Fourth segment of male 2nd leg. Fig. 13. Palpi and mandible of male. Fig. 14. Epimeral plates and genital area of male.

the large genital opening in the middle of both genital plates. Genital aperture 194μ long. Genital plates about crescent in shape, having 17-20 acetabula on each plate. The interval between eyes 450μ, maxillar organ 183μ long, 114μ wide and mandibles 170μ long, including claws. The palpal segments being (Table 8, inμ) : The podal segments being (Table 9, in μ) :

Table 9.

	1	2	3	4	5	6
I	80	148	188	291	314	228
II	85	131	194	291	336	228
III	80	114	154	245	285	257
IV	97	143	177	240	308	274

Eggs yellow and round, 150μ in diameter. Eggs are imbedded in one layer in transparent alveolar gelatinous mass. No septa between eggs in a mass. Each egg mass contained 5-35 eggs.

Larva (Fig. 15) ovate in shape, 265μ long, 150μ wide, flattened dorso-ventrally and light blue in colour. Eyes in one pair, large, black and with the interval 70μ. Dorsal surface covered with a dorsal plate and the ventral surface nearly covered with epimeral plates except the provisional genital area. These plates showing granulated patterns. The second and third epimeral plates fusing each other on their inner regions, form a large plate on each side. A provisional genital aperture found surrounded with four pairs of small hairs and a pair of moderate long hairs. From the posterior margin of the body are arising a pair of long hairs. Fifth segments of palpi claw-like in shape. Legs in three pairs, each having five segments. Fifth segment of each leg provided with three sickle-shaped claws. The podal segments being (Table 10, in μ) :

Table 10.

	1	2	3	4	5
I	26	33	33	53	56
II	30	26	33	50	60
III	33	33	36	56	66

Larva hatched out of egg mass mostly creeps on the water bottom but never comes near the water surface.

Nymphochrysalis (Fig. 16). Larva crept out of egg mass clings to the abdomen of several species of adult midges. When fully grown on the midge the nymphochrysalis becomes large and round, measuring 313μ long and 250μ wide. The body colour changes gradually into light brown or amber-colour as growth

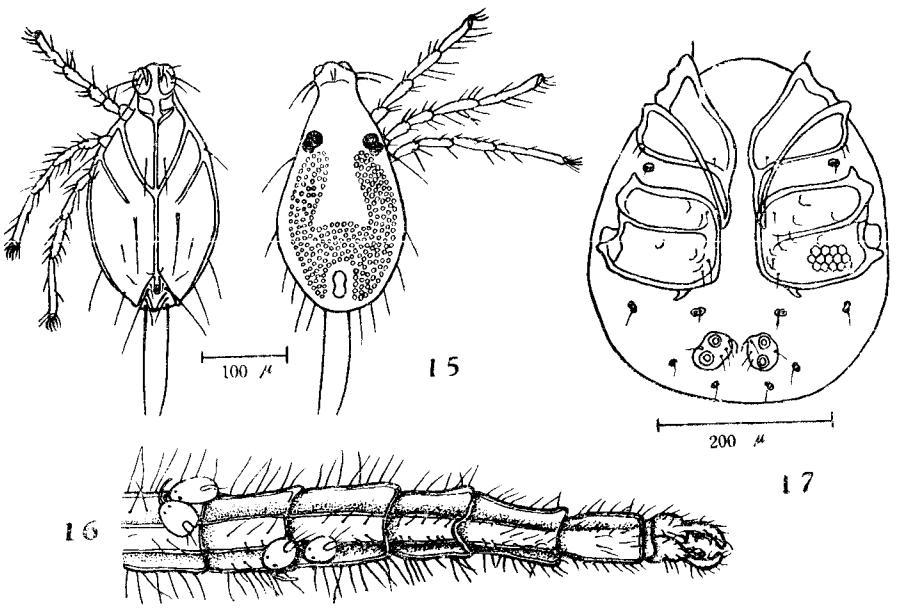
proceeds. The parasites are usually found on the ventral, but few on the lateral and the dorsal surfaces of the abdomen of midges. The parasitic ratio is 42/58 in total. The largest number of the parasites upon a single host was 18.

Nymph. Body (Fig. 17) short oval, 460μ long, 355μ wide in grown-up individual. Skin soft and without figures. Eyes black in one pair with the interval 165μ. Maxillar organ, mandibles, palpi and epimeral plates are all similar to those of the imago. The podal segments being (Table 11, in μ):

Table 11.

	1	2	3	4	5	6
I	46	66	93	122	155	139
II	46	66	93	126	162	145
III	46	66	73	116	139	126
IV	63	70	89	125	155	155

Genital plates each provided with two acetabula and four fine sensory hairs. Genital opening not opend.



Figs. 15-17. *Neumania uchidai* n. sp.

Fig. 15. Larvae (left, ventral view; right, dorsal view). Fig. 16. Larvae prasitizing on the abdomen of midge imago. Fig. 17. Ventral view of nymph.

Locality. From the early summer of 1948 to the autumn of 1950 the author collected the mite from a muddy pool in Tokiwa Park, Asahigawa, Hokkaido as seen in the following dates : 10 males and many females on May 17, 6 nymphs on June 5, 5 males, 10 females and 2 nymphs on June 25, some males, many females and nymphs on July 5, many males, females and 10 nymphs on July 18, 3 males, 8 females and many nymphs on Sept. 15, 1948 ; many males and females on May 14, 6 males, many famales and 8 nymphs on June 18, many nymphs on Aug. 17, 1949 ; many males, females and 4 nymphs on June 29, 6 males, 12 females and 3 nymphs on July 4, 1950. The temperature of the water was 18°C on July 4, 1950.

Remarks. In 1936 a variety of *Neumania spinipes* was recorded from Saghalien by Prof. T. Uchida and then *Neumania spinipes* from Tokyo in 1938 and from Osaka in 1939 by the same investigator. It is noticeable that they were found from a fresh-water mussel in Tokyo. The new species found in a muddy pond, Tokiwa Park of Asahigawa, is in both sexes somewhat similar to *Neumania spinipes*, but the excretory organ is always yellow in colour, the long spines of the palpal third segment are not feathered and the spines of the legs are somewhat different from those of *N. spinipes*. Besides the fourth epimera of male are characteristic as shown in the text-figure 14.

Life-history. Eight males and 15 females of the new species were reared in our laboratory on May 17, 1948. Eggs were first laid on June 12 and the larvae hatched out on June 23, 12 days after the eggs were laid. Next year, 5 males and 10 females were reared on June 10. Eggs were laid on June 12 and the larvae hatched out on June 22, 11 days after the egg-laying. On the other hand, on June 18, 1949 at the same pool the author captured many specimens of adult midges which were abundantly parasitized by the larvae of *Neumania uchidai* n. sp. As was described the nymphs were found in the midsummer or in the autumn, but rare in the early summer.

3. *Pionopsis lutescens* var. *japonensis* n. var.[1] (Figs. 18—27)

Male (type, prep. 473). Body (Fig. 18) 530μ long, 390μ wide and 370μ high. Outline hexagonal with rounded angles. Skin soft, transparent and with no figures. Eyes in one pair with the interval 143μ. Maxillar organ 125μ long, 80μ wide and completely separated from the inner edges of the first epimera. Mandibles (Fig. 21) wide and short, 125μ including claws. Palpi (Fig. 22) relatively slender and long. The second segment of palpi bearing five moderate spines : three on the extensor edge, two on the lateral side. The third segment provided with three spines : two short on the extensor side, one longer on the lateral side. The fourth segment, slender and longest of all, having several fine spines : two on the flexor side, others on the extensor side. The last segment moderately curved, bifurcating at the

1) The new variety is named after the locality where the specimens were collected.

end and provided with several minute hairs. The palpal segments being (Table 12, in μ). :

Table 12.

	I	II	III	IV	V
Extensor side	28	91	40	108	45
Flexor side	23	68	29	97	—

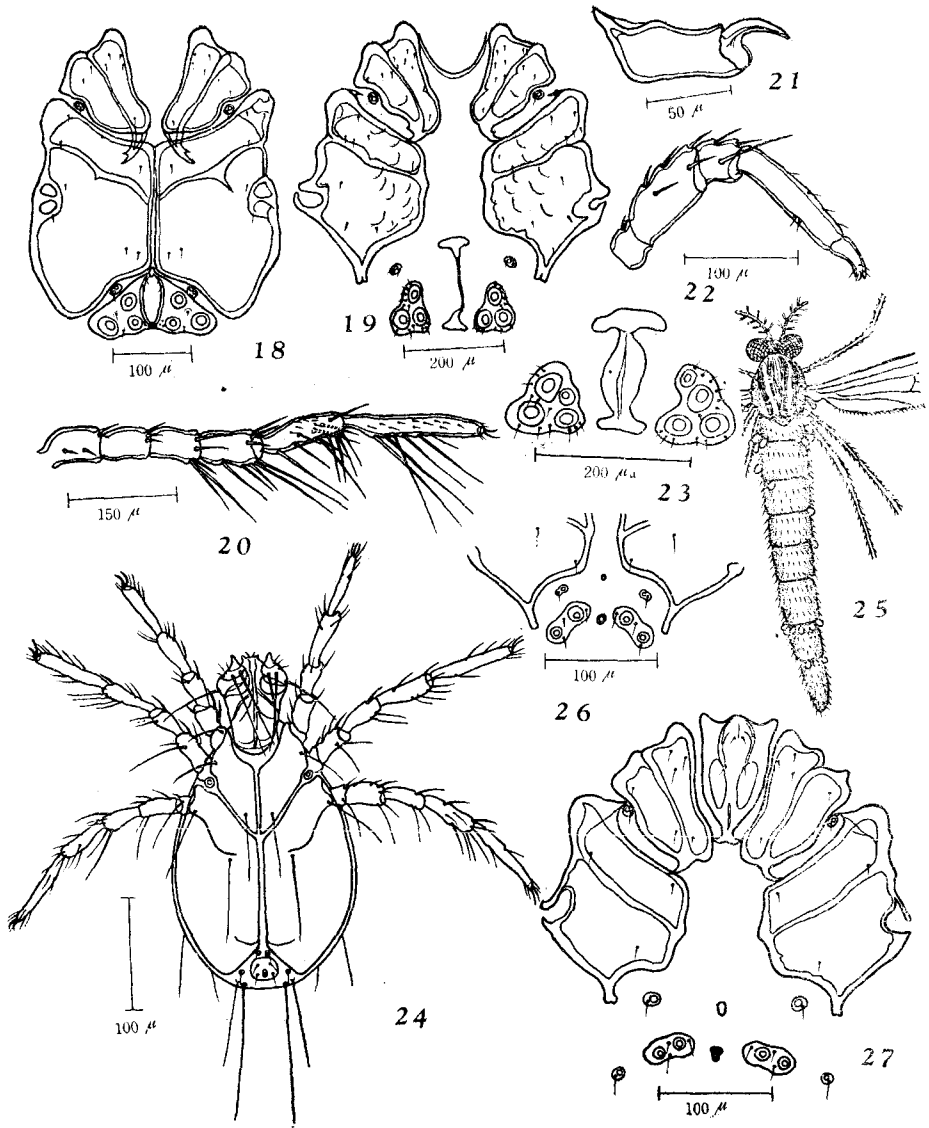
Epimera (Fig. 18) composed of four groups. First epimera almost triangular and small, each with a protruding chitinous project extending posteriorly over the suture of the first and the second epimera. Second epimera are large and almost trapezoid in shape. Ventral side of the body almost covered with the epimeral plates and the genital plates. Legs fairly large and each composed of six segements, the sixth segment of each leg provided with two large claws, both bifurcating and bladed. Fourth segement of the fourth legs (Fig. 20) not expanded as that of the genus *Acercus*. The podal segments being (Table 13, in μ) :

Table 13.

	1	2	3	4	5	6
I	40	74	74	91	97	125
II	40	74	80	108	120	137
III	52	74	68	74	120	154
IV	91	74	68	86	125	194

Genital plates, fusing on the frontal and posterior ends, form a traingular plate, encircling the genital opening. Each genital plate provided with three acetabulae and several fine sensory hairs. Genital plates 95μ long and 170μ wide. Genital aperture 90μ long. Body colour dark brown except the body margin and the excretory organ, which are yellow in colour.

Female (allotype, prep. 474). Body (Fig. 19) larger than the male, 1125μ long, 970μ wide and 730μ high. Palpi, mandibles, maxillar organ and body colour all similar to those of the male. Epimera and genital area different from those of the male. Second group of epimera rhombic with a pointed posterior corner. Epimera grouped on both sides with a wide median space. Genital plates distinctly separated from each other to the left and the right, openig a large genital pore in the middle of both genital plates. Genital opening 170μ long, having conspicuous chitinous suspenders at the anterior and posterior ends of the genital aperture. Genital plate almost triangular, 103μ long, 80μ wide, provided with three acetabula and some minute hairs. An aberrant individual (prep. 471) is provided with four acetabula on each genital plate (Fig. 23). The interval between eyes 345μ, maxillar



Figs. 18-27. *Pionopsis lutescens japonensis* n. var.

Fig. 18. Ventral view of male. Fig. 19. Ventral view of female. Fig. 20. Left fourth leg of male. Fig. 21. Mandible of male. Fig. 22. Palpus of male. Fig. 23. Aberrant genital plates of female. Fig. 24. Ventral view of larva. Fig. 25. Larvae parasitized on midge. Fig. 26. Ventral posterior part of male nymph. Fig. 27. Ventral view of female nymph.

organ 125μ long, and mandibles 190μ long including claws. The palpal segments being (Table 14, in μ):

Table 14.

	I	II	III	IV	V
Extensor side	34	116	48	143	54
Flexor side	21	75	27	108	51

The podal segments being (Table 15, in μ):

Table 15.

	1	2	3	4	5	6
I	74	125	137	188	200	228
II	80	143	148	205	222	222
III	91	160	143	205	257	239
IV	103	182	217	268	296	274

Eggs were round, yellowish white and 158-165μ in diameter. Eggs were layed in the laboratory on under-surfaces of the leaves of *Elodea canadensis*, imbedded in transparent alveolar gelatinous mass. Each egg mass contained 10-43 eggs.

Larva (Fig. 24) ovate in shape, having a proboscis with the maxillar ogran. Body 245μ long, 160μ wide, flattened dorsoventrally and light blue in colour. Eyes in one pair, large, black and with the interval 66μ. Dorsal surface covered with a dorsal plate which is marked with light long hexagonal patterns. Ventral surface nearly covered with three pairs of epimeral plates, also featured with long hexagonal figures. The first epimera, rhomboid in shape and provided with two moderately long hairs. The second and the third epimera make large plates fusing each other on their inner regions. Genital plate nearly round in shape, having four fine sensory hairs. Provisional genital pore opening in the midposterior portion of the genital plate. Around the genital plate are found four small hairs. From the posterior margin of the body are arising two pairs of hairs, of which one is very long. Palpi made up of five segments, the third segment is the most prominent and strong, with a long spine. The fourth segment is provided with several fine spines and two long spines. The fifth segment is claw-like. Legs in three pairs, each having five

Table 16.

	1	2	3	4	5
I	17	31	29	43	57
II	29	34	31	51	71
III	29	31	34	51	71

segments. Sixth segment of each leg provided with two claws of equal size, not bladed and sickle-liked. Each segment of the legs has several spines but no swimming hairs. The podal segments being (Table 16, in μ) :

The larva crept out of egg-mass swims or creeps on the water bottom but never comes to the water surface.

Nymphochrysalis. Immediately after the larva attaches to the midge, it changes into the first pupa, nymphochrysalis, and having sucked nourishment from the host it grows larger. The hosts of the larvae are the imagines of midges. The nymphochrysalis becomes finally spherical and dark purple in colour. As the nymphochrysalis grows, epimeral plates become gradually apart from each other. When fully grown the nymphochrysalis measures 300μ long and 250μ wide. It is very interesting that the larvae of *Hygrobates longipalpis* (Herm.) are also parasitic on the same imagine. The parasites are usually found on surfaces of the abdomen, mostly in the joints of the host (Fig. 25). The parasitic ratio is 38/46 in midges of various species. The largest number of the parasites counted by the author was 28 upon a single midge.

Nymph. Body of the female nymph (Fig. 27) short ellipse, 488μ long and 350μ wide in grown-up individual. Skin soft and with no figures. Eyes black, in one pair with 163μ interval. Maxillar organ similar to that of the imago, 108μ long and 83μ wide. Mandibles, palpi and epimeral plates are all similar to those of the imago. The lengths of the palpal segments being (Table 17, in μ) :

Table 17.

	I	II	III	IV	V
Extensor side	20	51	29	60	31
Flexor side	17	37	15	46	29

The podal segments being (Table 18, in μ) :

Table 18.

	1	2	3	4	5	6
I	23	51	46	68	91	95
II	29	51	57	86	108	114
III	46	63	63	91	125	131
IV	63	74	80	114	131	137

Genital plate provided with two acetabula and three fine hairs. The male nymph (Fig. 26) is smaller than that of the female, measuring 320μ long and 245μ wide in a fully grown individual. The posterior ends of the fourth epimera, sharp more closely situated to the genital plates than those of the female nymph. The

genital plates form almost a right angle but differ in the female nymph as shown in the text-figures.

Locality. One male and 4 females were collected on June 30, 1949 in a pool connected with a spring in Asahigawa, Hokkaido by T. Imamura ; many host midges were captured on Aug. 12, 14, 1950 at the same place by T. Imamura ; 3 males, 11 females and 18 nymphs were collected in the same spring on Aug. 24, 1950 by T. Imamura. The water of the pool is clear, 17°C on Aug. 24, 1950 and water-plants were growing luxuriantly in the water.

Remarks. There is no record on water mites belonging to the genus *Pionopsis* from Japan. The new form is in both sexes very similar to *Pionopsis lutescens* (Herman) common in Europe, but the present form differs in smaller body and in the genital plates of the female from *Pionopsis lutescens.*

Life-history. One male and 4 females of the new variety were reared in the laboratory on June 30, 1949. Two egg-masses were laid on July 4 and larvae hatched out on July 12, 9 days after the egg-laying. On August 12 and 14, 1950 the author collected in the pool several species of midge imagines which were abundantly parasitized by the larvae of *Pionospsis lutescens japonensis* n. var. and *Hygrobates longipalpis.* Many nymphs were captured further on Aug. 24, 1950 by the author.

Literature

Uchida, Tohru 1931. Einige Wassermilben aus Japan. Zool. Anz. Bd. 95, S. 262-268.
———— 1936. Water Mites from Saghalien. Biol. Soc. Jap. Vol. 6, pp. 309-323.
———— 1938. Water Mites in the Environs of Tokyo. Fauna Musashinensis 2, pp. 1-3.
———— 1939. Water Mites in the Vicinity of Osaka. Vol. Jub. Prof. Sadao Yoshida. pp. 449-451.
Viets, Karl 1936. Wassermilben oder Hydracarina. II. Tierwelt Deutschlands. Teil 32, Spinnentiere od. Arachnoidea.