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A List of the Fresh-Water Rhabdocœlids found
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Descriptions of New Species

By

K. OKUGAWA

With Plates III and IV

(Received January 22, 1930)

Our knowledge of the marine Rhabdocœlids continues to grow. Two new species of *Vorticeros* were described by F. TOSAWA (1917), *Hofstenia atroviridis* was described by S. BOCK (1923) and some parasitic Rhabdocœlids were reported by T. KABURAKI (1927). No fresh-water forms, however, have hitherto been identified, although it is pretty well known that some cosmopolitan species abound in our rivers, ponds and lakes. In my experience, the rice-fields, which are common everywhere in middle Japan, are the most favourable situation for this group of animals, since this area contains warm and very fertile water from May to October every year.

The object of the present note is to enumerate all the species which I was able to determine and to give brief descriptions of species and varieties that are considered to be new.

The research, extending over a period of two years, has been carried on for the most part at the Ôtsu Hydrobiological Station on Lake Biwa under the supervision of Prof. T. KAWAMURA, director of the Station, to whom I wish to express my sincere gratitude. I am indebted also to Dr. N. NASSONOW of Russia, who just happened to

visit Japan last July, for teaching me his method of collecting specimens. Through the kindness of Mr. M. KONDO, of the Ôsaka Municipal Waterworks, I was able to learn of some forms of this group.

The detailed description of the new species which I propose to establish in this paper will be reported in the next account with some Dalyellidæ and Typhloplanidæ.

Subleg. Rhabdocœla

Fam. Catenulidæ

1. *Catenula lemnae* ANT. DUGÈS 1832

One- or two-zoid individuals were first collected in July 1928 near the shore by the Station. Then in June 1929 a great mass of material was collected in a ditch in the neighbourhood of the city of Ôtsu, all being 8-zoid individuals. Length of the 2-zoid forms 1.2 mm. and of the 8-zoid, 3 mm.

2. *Stenostomum leucops* (ANT. DUGÈS) 1828

Appears almost throughout the year in many ponds, pools, ditches, lakes and rice-fields. Length of 4-zoid form 1.3 mm.

3. *Stenostomum unicolor* O. SCHMIDT 1848

Obtained in August 1928 on the shore by the Station. The anterior part of the body and the intestine was blue in colour. Length of 2-zoid form 1.2 mm.

4. ? *Stenostomum agile* var. *japonica*

Collected once in July in a rice-field at Miyazu, Kyôto prefecture when Dr. N. NASSONOW suggested to me that it certainly differs from *Stenostomum agile* (SILLIMAN) with respect to the light-refracting organ and that he should describe it under the above-mentioned name.

Fam. Microstomidæ

5. *Microstomum lineare* (O. F. MÜLLER) 1774

Observed from early summer to autumn, almost everywhere in lakes, ponds and pools as well as in the rice-fields. Length 6 mm. (8-zoid).

6. ? *Microstomum giganteum* HALLEZ 1878

Collected in June 1928 in a ditch at the temple of Tôji-in near the City of Kyôto. I am inclined to call this specimen *Mic. giganteum*, since the pre-oral sack of the intestine reaches nearly the anterior end of the body and the posterior termination of the same approaches the end of the body; no adhesive papillae at the posterior end. But in the absence of the eye-pigment it agrees with some forms of *Mic. lineare*. Length 10 mm. (8-zoid).

7. *Macrostomum appendiculatum* (O. FABRICIUS) 1886

Less frequently met with than the other species of the genus. Found in a rice-field, in a bay of brackish water at Miyazu, and also on the shore of Lake Biwa, all in August 1928. Length 2.5 mm.

8. *Macrostomum tuba* var. *gigas* var. nov. (Figs. 1 to 5)

Observed in numbers during the summer among algae and water-weeds in Lake Biwa, some ponds, and the rice-fields near Kyôto and Ôsaka. The anterior end is rather pointed but not very sharply, posteriorly becoming gradually broader and reaching a maximum breadth at the middle portion of the body. The posterior end forms a spatula-shaped tail with adhesive cells. The eyes are black and kidney-shaped with a distinct lens (Fig. 5). The ovaries and the testis are similar in structure to those of *Mac. tuba*. The chitinous portion of the penis is slightly curved and longer than in *Mac. tuba*; its terminal opening forms a spherically inflated "Mundstück" (Figs. 3, 4). The other type of penis described by A. LUTHER was never met with.

Thus it differs from *Mac. tuba* in the general contour of the body, the form of the eyes, and the shape of the penis.

The chitinous portion of the penis is more than 200 μ in length. Length of the body 3.5 mm. Width 0.8 mm.

9. *Macrostemum kawamurai* sp. nov. (Figs. 6 to 9)

This new form can be collected during the summer in great numbers among algae and water-weeds in Lake Biwa. Its size varies from 0.8 to 2.5 mm. in length, the width is 0.3 to 0.5 mm. The anterior end is bluntly pointed, while posteriorly it is thinned toward the truncated tail. The body is as a whole somewhat flatter than *Mac. japonicum* but not more so than *Mac. tuba* var. *gigas*. In colour this worm is paler than others of the genus. The black eyes are kidney-shaped with a distinct lens, situated at the antero-dorsal portion of the pharynx. The intestine is light yellow in colour. The rhabdites are abundant; in threes or fours. They are straight or curved rods, being pointed at one end and blunt at the other.

The reproductive organs are conspicuous by their gray tint, the testes are distinct in contour but somewhat opaque in detail. They begin at the ventral posterior region and extend in two lateral branches up to the level of the posterior end of the pharynx. The vesicula seminalis is connected with the vesicula granulorum by means of a fine canal (Fig. 7). The ovaries seem to be lobed. The male copulatory apparatus differs from that of other species of the genus in the chitinous portion which does not lie in a plane. This speciality is also found in *Mac. viride* in which the chitinous portion is spiral. But in the present species the terminal portion is somewhat irregularly twisted and the tip is bent nearly perpendicular to the axis of the main portion (Figs. 7, 8). In two more details our worm differs from *Mac. viride*: (i) in the form of the main portion which is an almost straight tube, instead of S-shaped, and (ii) in the position of the terminal opening which is situated at the distal tip of the penis instead of at a point proximal to that. The terminal opening is always truncated obliquely

so that it is elliptical in form, in some younger individuals this opening appears circular. The chitinous portion is ca. 150 μ . in length.

The spermatozoa resemble those of *Mac. tuba*, consisting of a spindle-shaped head and a short tail (Fig. 9). At a point between the head and the tail it has two long flagellae which are inconspicuous by their rapid vibration.

10. *Macrostomum japonicum* sp. nov. (Figs. 10 to 13)

This abounds in August and September in many lakes, ponds and pools in middle Japan. It measures 0.6 to 2 mm. in length and 0.2 to 0.4 mm. in breadth in the middle part of the body. The body is more cylindrical than in *Mac. kawamurai*. The black eye is a small round dot with an indistinct lens. The colour appears rather dark, the intestine yellowish-brown. The rhabdites are present in large numbers, in twos to sixes; smaller and more compact in their distribution than in both *Mac. kawamurai* and *Mac. tuba* var. *gigas*. The ovary is lobed as in *Mac. kawamurai*. The vesicula seminalis is large in relation to the vesicula granulorum. The chitinous penis is very long and slender; its main portion is somewhat waved while its terminal portion is bent to a right angle, or nearly so, to the axis of the main portion. Its terminal end is not sharply pointed, but provided with a small circular aperture. In some specimens the terminal end is slightly inflated. This chitinous portion of the copulatory apparatus is ca. 170 μ in length. The spermatozoon is a very slender fibre, consisting of a small round head and a long winding tail.

Fam. Dalyelliidæ

11. *Dalyellia triquetra* (FUHRMANN) 1879 (Figs. 14, 15)

This was found in August 1929, in a rice-field in the Island of Awaji. The median projection (Medianrinne) of the male chitinous penis is longer than the lateral arms (seitliche Seitenarmen). Length 1.2 mm.

12. *Dalyellia armiger* (O. SCHMIDT) 1861 (Fig. 16)

Can be observed in summer in ponds and rice-fields near Kyôto and Ôsaka. Once observed in summer in a pool of water at the Ôsaka municipal waterworks. The number of the spines in the jointed terminal branch is mostly 8. Length 1.2 mm.

13. *Dalyellia bivac* sp. nov. (Fig. 17)

This form appears during the summer in numbers in Lake Biwa as well as in some ponds near Kyôto. The form of the body is like that of *Dal. armiger*. The kidney-shaped eyes are situated at the anterior margin of the pharynx. Colour of mesenchym varies from yellowish brown to dark brown. The pharynx is relatively large and rather long as in *Dal. armiger*. The thick walled bursa copulatrix is large with some ring muscles. The genital pore opens at the posterior margin of the intestine in the median line of the ventral surface. The chitinous penis consists of two longitudinal stalks and two horizontal, or transverse, pieces. The latter may be arranged in an irregular ring. The two terminal branches of the chitinous penis have each three spines. The number of spines is 10 to 12 in all. Length of the worm is 1 mm.

14. ? *Dalyellia brevispina* HOFSTEN 1909 (Fig. 18)

Four specimens of this were observed in July 1929 in a pool at the Ôsaka municipal waterworks. Its chitinous penis differs from that of *Dal. brevispina* in that each terminal branch is provided with 11 and 7 spines instead of 20 and 10 respectively. Furthermore, the two stalks are rather short and the median projection is longer than the terminal branches, instead of being surpassed by the latter as in *Dal. brevispina*. The materials may perhaps be young. Length 1 mm.

15. *Dalyellia striata* (PLOTNIKOW) 1905

Collected in August 1929 in a rice-field in the Island of Awaji.

Length 0.8 mm.

16. *Dalyellia gracilis* sp. nov. (Figs. 19, 20)

This worm was found in August 1929 in a rice-field in the Island of Awaji. It is rather striking in general appearance due to the relative slenderness of form and to the more or less pointed anterior end of the body. The posterior end forms a long tail. The eyes are very small, situated at the anterior margin of the pharynx which is also rather small compared with the size of the body. Colour of mesenchym is dark-brown. The chitinous penis is very characteristic, its two stalks being very short and its four terminal branches equally longer than the median projection. Two of these four terminal branches are situated on the dorsal side of the other two. One of the two dorsal terminal branches is lantern-shaped, as is illustrated in my sketch and is composed of ca. ten terminal spines fused together. Length of the worm is 1.2 mm.

17. *Dalyellia inflata* sp. nov. (Figs. 21, 22, 23)

This worm was collected at the same time and in the same place as the foregoing. In the general appearance it differs very much from any other members of the same genus on account of its flattened body. It is somewhat convex towards the dorsal side in the middle part of the body. The anterior end is conical with a blunt end, while the posterior tip is introduced into a cylindrical process or tail. The middle part of the body is three times as broad as the anterior end. The pharynx is very small and round, reminding one of a ball. The vitellarine glands are very characteristic, showing two dendritic structures lying on the dorsal side of the intestine. The bursa copulatrix and the ovary are very small but could be clearly recognized. The chitinous penis is also very small, entirely destitute of the stalks and terminal branches and recognizable as a mere tube consisting of ca. 12 spines arranged in a parallel direction. Length of the worm 0.7 mm.

18. *Dalyellia japonica* sp. nov. (Fig. 24)

Collected in July 1929 in the mud at the bottom of a pool at the Ôsaka municipal waterworks. The anterior end is blunt while the posterior tail is somewhat pointed. Colour of mesenchym is light-brown and the intestine is orange. The eyes are kidney-shaped and are situated in front of the pharynx. The very characteristic chitinous penis is an elegant structure, composed of a broad ring belt and of a series of ca. 20 bifurcated spines. The tip of the latter is armed with a sharp terminal spine. Length of the worm 1 mm.

Fam. Typhloplanidæ

19. *Strongylostoma radiatum* (O. F. MÜLLER) 1779

Collected during early summer 1928 and 1929 at the bottom of Lake Biwa 4 m. deep. Length 0.9 mm.

20. *Rhynchomesostoma rostratum* (O. F. MÜLLER) 1774

This was taken at two places: a temporary ditch at Ôtsu, and a rice-field in the Island of Awaji. In the latter case, in August, the worm was carrying three or four eggs. The body was transparent without pigment and the colouration could not be observed because of perivisceral liquid. Length 2.5 mm.

21. *Typhloplana viridata* (ABILDGAARD) 1789

Four specimens of this species were caught in June 1928 in a patch of moss by a water-mill near the Kiso Stream and Forest Biological Station, Naganoken, with *Goccentrophora sphyrocephala*. Length 0.7 mm.

22. ? *Castrada hofmanni* M. BRAUN 1858

This worm was observed in November 1929 in a pond (Benkeino-ashigata-ike) near Kyôto. Length 0.8 mm.

23. *Mesostoma productum* (O. SCHMIDT) 1774

A large number were observed from June to September in the rice-fields in many places of middle Japan. Seems to get sexually mature in August. Length 3 mm.

24. *Mesostoma lingua* (ABILDGAARD) 1787

This species appears from July to September in many rice-fields accompanied by *Mesostoma productum*. Length 4.5 mm.

25. *Bothromesostoma personatum* (O. SCHMIDT) 1858

Observed in July in a rice-field at Miyazu and in August in a similar situation at Ôtsu. Length 4.2 mm.

Fam. Polycystididæ

26. *Polycystis goettei* BRESSLAU 1906

Observed three times in July 1929 in the pools at the Ôsaka municipal waterworks. The worm had always a large full-grown egg. Length 2.2 mm.

Fam. Gytracidæ

27. *Gytrix hermaphroditus* EHRENBERG 1831

This species is found from spring to autumn in ponds, pools and rice-fields in middle Japan. Length 1.2 mm.

Subleg. Alloecœla

Fam. Prorhynchidæ

28. *Geocentrophora sphyrocephala* (DE MAN) 1876

This species was observed in June 1928 creeping on the moss as mentioned above (cf. No. 21) at Kiso and also found in August 1928 on the moss at the Tôji-temple, Kyôto. Length 2.5 mm.

29. *Prorhynchus stagnalis* M. SCHULTZE 1851

In a ditch at Ôtsu in summer and also in mud taken up from the bottom of Lake Biwa. Our specimen may be smaller than Europeans. Length 2.5 mm.

Fam. Plagiostomidæ30. *Plagiostomum lemani* (DU PLESSIS) 1874 (Figs. 25, 26)

Found in numbers in the mud from a ditch at Otsu in summer and autumn. The specimen appeared to agree rather closely with *Plag. lemani* var. *quadrioculatum* which O. ZACHARIAS had described in 1895, in general contour and size of body. But the eye-pigment is somewhat different from that of the above-mentioned variety and the specimen of *Plag. lemani* which N. VON HORSTEN described in 1907. There is distinct transverse commissure between the eyes as illustrated in my sketch (Fig. 26). The black net under the epithelium is, however, darker and more compact in the posterior region of the body. Length 5 mm.

Fam. Bothrioplanidæ31. *Bothrioplana semperi* M. BRAUN 1881

Appeared in numbers in summer in many pools at the Osaka municipal water-works. Length 4 mm.

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EXPLANATION OF PLATES

Plate III.

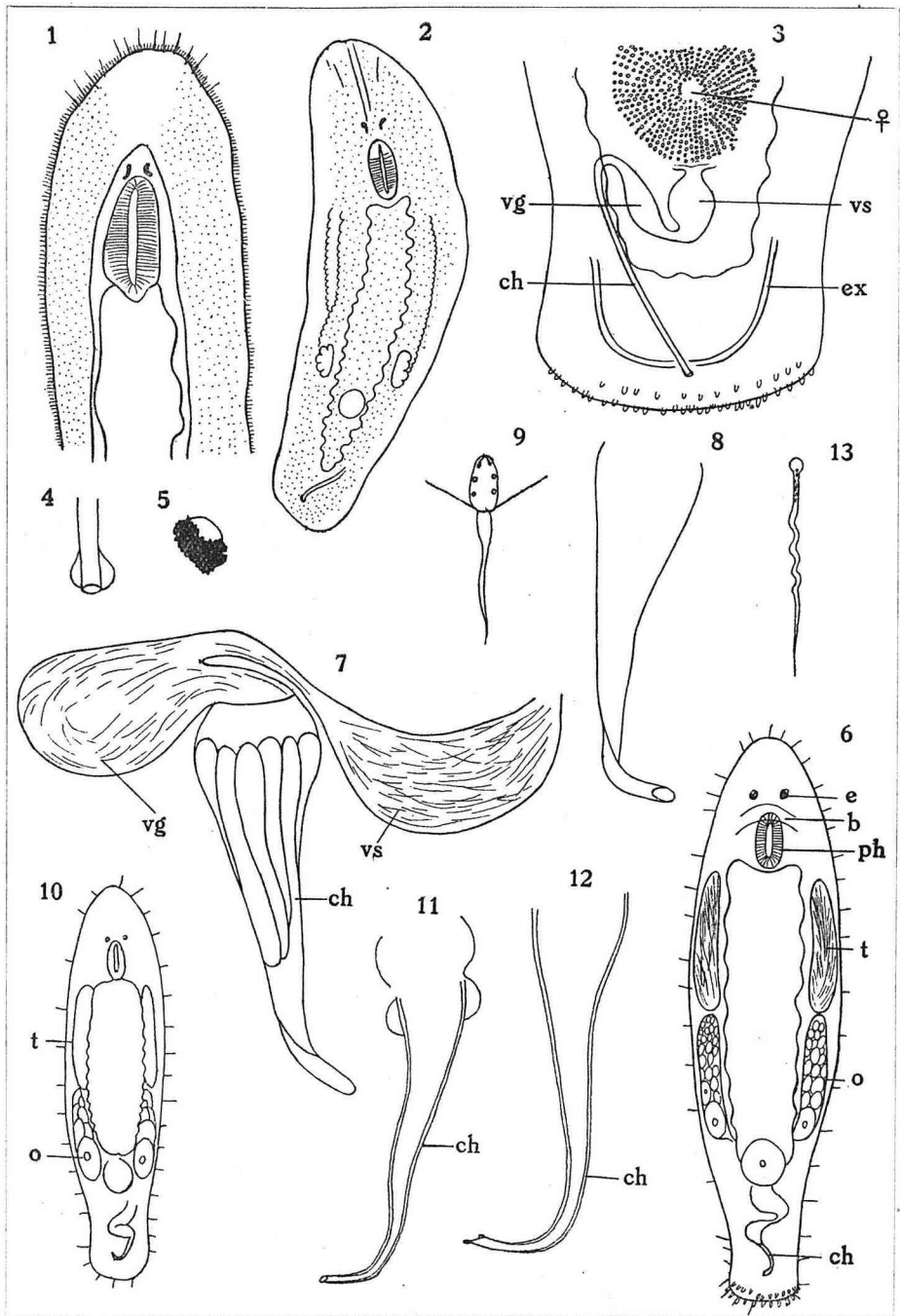
- Fig. 1. *Macrostomum tuba* var. *gigas* var. nov.) Anterior portion of worm, $\times 80$
 Fig. 2. do., Diagram of resting worm; ventral view, $\times 50$
 Fig. 3. do., Posterior portion of worm, $\times 150$
 Fig. 4. do., Terminal opening of chitinous penis, $\times 120$
 Fig. 5. do., Eye, $\times 450$
 Fig. 6. *Macrostomum kawamurai* sp. nov. Diagram of worm, $\times 60$
 Fig. 7. do., Male copulatory organ, $\times 300$
 Fig. 8. do., Chitinous portion of penis, $\times 80$
 Fig. 9. do., Spermatozoon, $\times 800$
 Fig. 10. *Macrostomum japonicum* sp. nov. Diagram of worm, $\times 50$
 Fig. 11. do., Chitinous portion of penis, $\times 45$
 Fig. 12. do., Chitinous portion of penis, $\times 45$
 Fig. 13. do., Spermatozoon, $\times 800$

Plate IV.

- Fig. 14. *Dalyellia triquetra*. Male copulatory organ, $\times 300$
 Fig. 15. do., Chitinous penis (compressed), $\times 350$
 Fig. 16. *Dalyellia armiger*, Chitinous penis (compressed), $\times 300$
 Fig. 17. *Dalyellia biwae* sp. nov. Male copulatory organ (slightly compressed), $\times 300$
 Fig. 18. ? *Dalyellia brevispina*. Male copulatory organ (compressed), $\times 400$
 Fig. 19. *Dalyellia gracilis* sp. nov. Diagram of worm, $\times 80$
 Fig. 20. do., Male copulatory organ (slightly compressed), $\times 400$
 Fig. 21. *Dalyellia inflata* sp. nov. Diagram of worm, $\times 100$
 Fig. 22. do., Eyes,
 Fig. 23. do., Chitinous penis, $\times 350$
 Fig. 24. *Dalyellia japonica*. Chitinous penis (compressed), $\times 500$
 Fig. 25. *Plagiostomum lemani*. Diagram of worm, $\times 20$
 Fig. 26. *Plagiostomum lemani*. Eyes, $\times 50$

ABBREVIATIONS

b	brain	ph	pharynx
ch	chitinous penis	st	stalk
c	eye	tb	terminal branch
ex	excretory canal of tail region	vit	vitellarine gland
int	intestine	vg	vesicula granulorum
l	terminal branch of lantern shape	vs	vesicula seminalis
la	lateral arm	♀	female genital pore
m	median projection		
o	ovary		



OKUGAWA del.

OKUGAWA : Rhabdocœlida

