

Some Helminth Parasites of the Chaetognatha from Suruga Bay, Central Japan

By

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Helminth parasites described below were found by Ms. Sachiko NAGASAWA in the formalin-preserved chaetognaths collected in Suruga Bay, off the Pacific coast of Central Japan, and sent to the author for identification. They were stained with alum carmine or Heidenhain's iron haematoxylin, and mounted in balsam. The specimens are deposited in the collection of the National Science Museum, Tokyo.

The literature on the parasites of the Chaetognatha was reviewed by HYMAN (1959) and ALVARIÑO (1965). A more extensive review on this subject appeared in an unpublished thesis by WEINSTEIN (1972). DOLLFUS (1960 a) catalogued nearly all the records of digenetic trematodes in the phylum.

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TREMATODA

DIGENEA

Accacoeliidae

Tetrochetus sp. metacercaria

(Figs. 1-2)

A single specimen was found free in the trunk coelom of *Sagitta enflata* GRASSI (1 Nov. 1972).

Specimen No. NSMT-PI-1803.

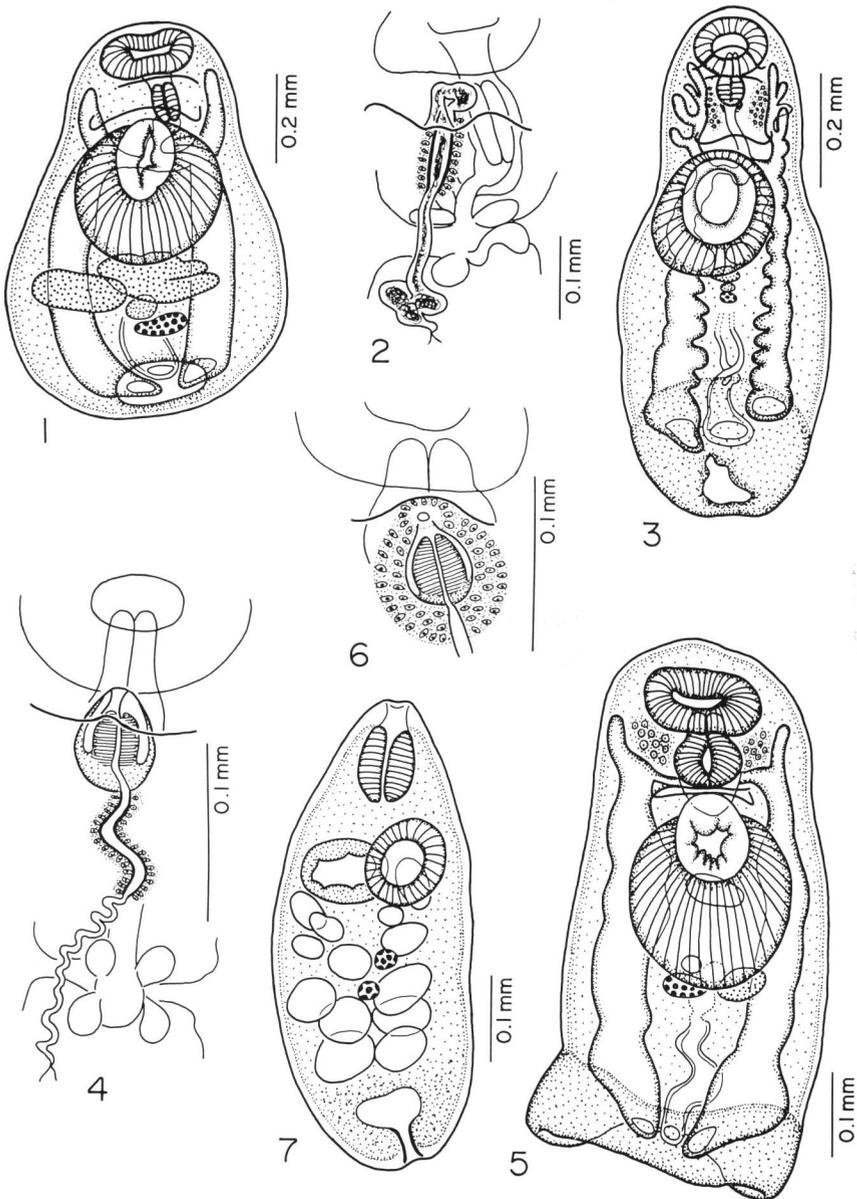
Description. Metacercaria, not encysted. Body pyriform, non-spinous, 0.914 mm long, 0.625 mm wide at level of testes in hindbody, with a ventral depression between two suckers. Oral sucker 0.094 mm long by 0.200 mm wide, surmounted with a ventrally folded perioral lip. Ventral sucker spherical, 0.340 mm long by 0.319 mm wide, slightly anterior to mid-level of body; its anterior wall single; its aperture elliptical, located in its anterior half, with a muscular collar. Prepharynx present. Pharynx elongate-ellipsoidal, 0.105 mm long by 0.046 mm wide. Oesophagus moderately long, surrounded by a mass of cells in its anterior portion, with several glandu-

lar outgrowths at its posterior end dorsal to anterior half of ventral sucker. Intestines H-shaped; main intestines simple, thick, separately opening into uroproct; anterior caeca not diverticulate. Testes double, diagonally contiguous, posterior to ventral sucker; anterior one somewhat lobed, 0.119 mm long by 0.255 mm wide; posterior one ovoid, 0.085 mm long by 0.213 mm wide. Seminal vesicle (=vas deferens) external, winding, submedian, extending from level slightly posterior to intestinal bifurcation to mid-level of oesophagus. Pars prostatica tubular, lateral to oesophagus and pharynx, encompassed with prostatic cells free in parenchyma in a dense layer. Cirrus pouch and cirrus absent. Ovary transversely ellipsoidal, post-testicular, median, 0.043 mm long by 0.119 mm wide. Mehlis' gland compact, 0.045 mm long by 0.085 mm wide, between testes and ovary. Uterus and metraterm not observed. Genital atrium funnel-shaped, opening with a wide genital pore on top of a gentle protuberance of ventral body surface behind oral sucker. Genital cone absent. Spermatozoa already occurring in seminal vesicle, pars prostatica, and genital atrium. Vitellaria not observed. Excretory vesicle tubular, extending forward as far as genital glands; uroproct present, wide; pore ventro-terminal.

Discussion. The present accacoeliid metacercaria belongs to the genus *Tetrochetus* LOOSS, 1912, in the following features: The genital atrium is devoid of a genital cone; both the main intestines and their anterior caeca are simple; the anterior wall of the ventral sucker is single; and the oesophagus has posterior glandular outgrowths. It closely resembles, except for a little difference in the dimensions, the unidentified metacercariae of the genus described by OKADA (1932) and DOLLFUS (1960 b) from the Portuguese man-of-war, *Physalia utriculus* (LA MARTINIÈRE) (Coelenterata, Siphonophora, Physaliidae) from the Inland Sea of Japan. DOLLFUS (1960 b) provisionally regarded the latter as the metacercarial stage of *T. hamadai* FUKUI et OGATA, 1935, the adult stage of which was found by FUKUI and OGATA (1935) in the puffer, *Spheroides spadiceus* (RICHARDSON), and by YAMAGUTI (1938) in a *Spheroides* sp. fish, respectively, both off the Pacific coast of Central Japan. There is not sufficient evidence to determine the specific identification of the present trematode as *T. hamadai*.

DOLLFUS (1960 a) briefly described an accacoeliid metacercaria, about 0.49 mm long by 0.30 mm wide, from *S. inflata* [sic] GRASSI taken in the Bay of Algiers, the Mediterranean Sea. He assumed that his specimen might be related to the genus *Accacladocoelium* ODHNER, 1928, owing to the "autre ventouse" of the ventral sucker. The autre ventouse seems a muscular collar from his figures 23 and 24. DOLLFUS' trematode is similar in general morphology to the present metacercaria, although the description of its terminal genitalia has not been given.

DOLLFUS *et al.* (1954) obtained accacoeliid metacercariae, probably belonging either to the *Tetrochetus* or to the genus *Accacladium* ODHNER, 1928, from *S. inflata* [sic] collected in the Bay of Bengal near Madras, but failed to establish conclusively the generic determination of them, because the genital atria of them had not yet fully differentiated. An unidentified specimen resembling those of DOLLFUS *et al.* (1954) was reported by DOLLFUS (1960 a) from *S. hexaptera* D'ORBIGNY from Açores. REIMER



Figs. 1-7. — 1-2. *Tetrochetus* sp. metacercaria from *Sagitta enflata* GRASSI; 1, entire body, ventral view; 2, terminal genitalia, ventral view. — 3-4. *Guschanskiana* sp. metacercaria from *S. enflata*; 3, entire body, ventral view; 4, terminal genitalia, ventral view. — 5-6. *Guschanskiana* (?) sp. metacercaria from *S. enflata*; 5, entire body, ventral view; 6, terminal genitalia, ventral view. — 7. *Monilicaecum*-group metacercaria from *S. nageae* ALVARIÑO, entire body, ventral view.

et al. (1975) also recorded similar metacercariae from *S. bipunctata* QUOY et GAIMARD, *S. decipiens* FOWLER, *S. enflata*, *S. friderici* RITTER-ZAHONY, *S. minima* GRASSI, and *S. serratodentata* KROHN, all collected in the Atlantic Ocean, off North-west Africa.

Guschanskiana sp. metacercaria

(Figs. 3–4)

The following description is based on one specimen obtained free from the trunk coelom of *S. enflata* (2 Nov. 1972).

Specimen No. NSMT-PI-1804.

Description. Metacercaria, not encysted. Body elongate-pyriform, 0.914 mm long, 0.247 mm wide in forebody, 0.370 mm wide in hindbody, with a ventral pit in front of ventral sucker. Cuticle aspinose, transversely striated. "Sucker-like cuticular thickening" present at posterior end of body, deeply stained with carmine, not papillate, 0.136 mm long by 0.306 mm wide. Oral sucker subterminal, 0.097 mm long by 0.126 mm wide, surmounted with a ventrally bending perioral lip. Ventral sucker slightly anterior to mid-level of body, 0.217 mm long by 0.213 mm wide; its opening situated in its anterior half, with a thick collar 0.032 mm high. Prepharynx muscular, short. Pharynx club-shaped, 0.099 mm long by 0.046 mm wide, anteriorly protrudent into oral sucker through prepharynx. Oesophagus undulating, 0.147 mm long, extending to level of anterior wall of ventral sucker, encircled with a mass of cells in its anteriormost portion, giving off four small glandular outgrowths from its posterior end. Intestines H-shaped; main intestines with many, short, wide diverticula, separately opening into uroproct; each of anterior extensions consisting of at least four, moderately long diverticula. Testes double, transversely ovoid, diagonal, close to each other; anterior one 0.027 mm long by 0.045 mm wide; posterior one 0.020 mm long by 0.063 mm wide, just dorsal to posterior border of ventral sucker. Seminal vesicle external, coiling, lateral to intestinal bifurcation. Pars prostatica somewhat S-shaped, surrounded by prostatic cells free in parenchyma in a dense layer, ventral to oesophagus. Cirrus pouch and cirrus absent. Ovary spherical, median, slightly behind posterior testis, 0.015 mm long by 0.032 mm wide. Mehlis' gland compact, 0.020 mm long by 0.030 mm wide, immediately anterior to ovary. Genital atrium muscular, ventrally curved, containing at its base a muscular genital cone measuring 0.045 mm long by 0.034 mm wide. Genital pore median, slightly posterior to oral sucker. Vitellaria not observed; a mass of larger cells present on each side of pharynx and oesophagus, possibly representing a developing vitellarium. Excretory vesicle thick-walled, about 0.120 mm long; main collecting canals dorso-ventrally oblique; uroproct large, situated in sucker-like cuticular thickening; pore ventro-terminal.

Discussion. The present accacoeliid metacercaria is referred to the genus *Guschanskiana* SKRJABIN, 1959, for the following reasons: The conspicuous sucker-like cuticular thickening is present at the posterior end of the body; both the main intestines and their anterior extensions are diverticulate; and the genital cone is well developed.

The genus contains only one species, *G. alveolata* (ROBINSON, 1934) SKRJABIN, 1959, which was first placed in the *Accacladocoelium* by ROBINSON (1934) but later transferred to a new genus *Guschanskiana* by SKRJABIN (1959). In the adult worms of *G. alveolata* from the intestine of the sun-fish, *Orthogoriscus mola* BLOCH, caught in Britain, the anterior intestinal extensions have six diverticula each, and the sucker-like cuticular thickening is densely papillate and honeycomb in tangential sections (ROBINSON, 1934). In the present metacercaria, on the other hand, each of the anterior intestinal extensions is provided with four diverticula, and the sucker-like cuticular thickening is not papillate. It remains uncertain whether the present specimen is the metacercaria of *G. alveolata* or that of an undescribed species of the genus.

Guschanskiana (?) sp. metacercaria

(Figs. 5-6)

A single specimen was found free in the trunk coelom of *S. enflata* (13 June 1976).
Specimen No. NSMT-PI-1805.

Description. Metacercaria, not encysted. Body bell-shaped, 0.612 mm long by 0.340 mm wide in hindbody, with a ventral depression anterior to ventral sucker. Cuticle thick, smooth. Sucker-like cuticular thickening present at posterior end of body, deeply stained with carmine, inverted dish-shaped, large, not papillate, 0.110 mm long by 0.340 mm wide. Oral sucker 0.069 mm long by 0.147 mm wide, surmounted with a ventrally folded perioral lip. Ventral sucker globular, 0.204 mm in diameter, near middle of body; its aperture located in its anterior third, with a muscular collar. Prepharynx probably present. Pharynx pear-shaped, 0.072 mm long by 0.063 mm wide, anteriorly inserted into oral sucker. Oesophagus probably recurved, enclosed with a mass of cells in its descending part; oesophageal glandular outgrowths not seen. Intestines H-shaped; main intestines thick, somewhat sinuous, not diverticulate, separately opening into uroproct; anterior caeca simple. Testes double, diagonal, located a short distance from each other; anterior one 0.036 mm long by 0.072 mm wide, dorsal to ventral sucker; posterior one 0.024 mm long by 0.054 mm wide, just dorsal to postero-lateral margin of ventral sucker. Seminal vesicle, pars prostatica, cirrus pouch, and cirrus not observed. Ovary 0.018 mm long by 0.054 mm wide, a little post-testicular, submedian. Mehlis' gland compact, 0.024 mm in diameter, immediately anterior to ovary. Genital atrium oval, ventral to oesophagus and pharynx, containing at its base a muscular genital cone measuring 0.026 mm long by 0.023 mm wide. Genital pore median, slightly posterior to oral sucker. Excretory vesicle tubular, sinuous, short; main collecting canals possibly running forward at least to ventral sucker in median field; uroproct very large, located in sucker-like cuticular thickening; pore very wide, terminal.

Discussion. The present accacoeliid metacercaria is tentatively assigned to the *Guschanskiana* owing mainly to the sucker-like cuticular thickening at the posterior end of the body and the genital cone, although neither the main intestines nor their

anterior caeca are branched.

DOLLFUS (1960 a) briefly described unidentified accacoeliid metacercariae found in *S. inflata* [sic] from Villefranche-sur-Mer, Alpes-Maritimes. In his worms stained with carmine, the main intestines and their anterior caeca are both devoid of diverticula, and the posterior end of the body is occupied by "une masse annulaire, intensément colorée, nettement délimitée, . . . , qui correspond peut être à une invagination de la partie terminale." If the region occupied by the masse is not an invagination of the posteriormost portion of the body but corresponds to the sucker-like cuticular thickening, then DOLLFUS' worms may be similar to the present metacercaria.

Didymozoidae

Monilicaecum-group metacercariae

(Figs. 7-10)

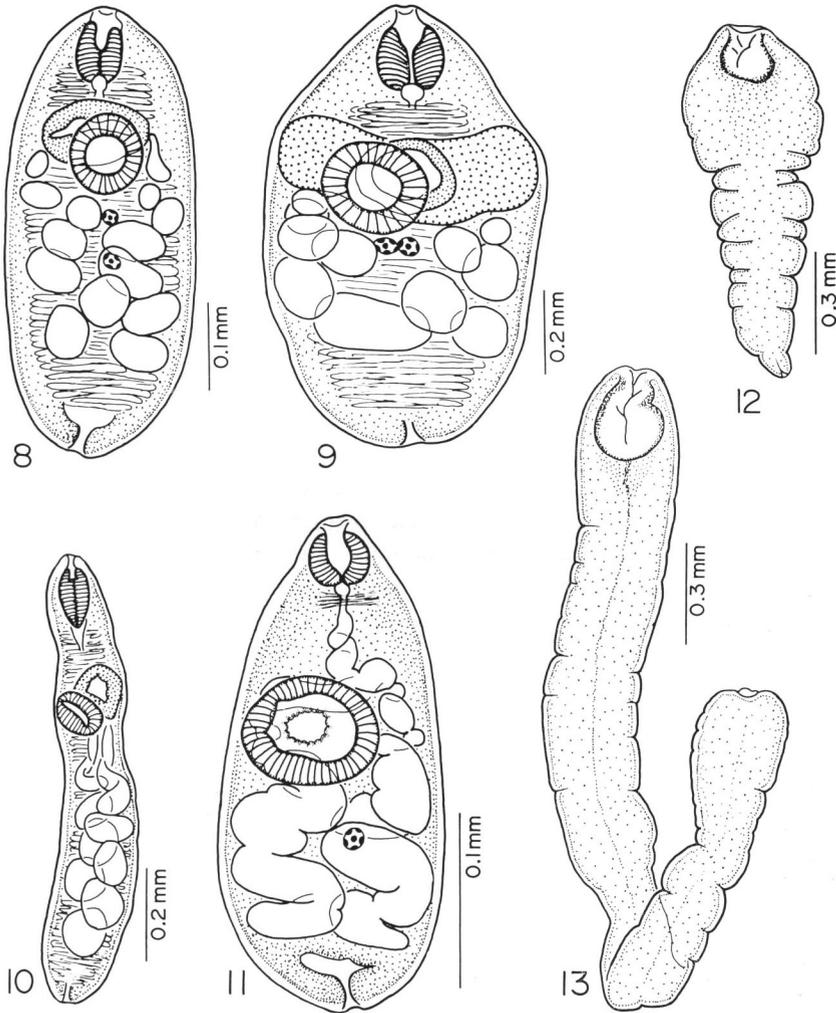
A total of 35 specimens were obtained from five species of chaetognaths: three from *S. enflata* (1-2 Nov. 1972); one from *S. ferox* DONCASTER (12 June 1976); 11 from *S. nage* ALVARIÑO (9 May 1969, 12-3 June 1976, and 7 Aug. 1976); ten from *S. neglecta* AIDA (26-7 Sept. 1975); two from *S. pacifica* TOKIOKA (1 Nov. 1972 and 26 Sept. 1975); and eight from *S. regularis* AIDA (26-7 Sept. 1975). They were found free commonly in the trunk coelom, or rarely in the head coelom or the ovary, of these hosts, one parasite per one host. The following description is based on 20 better-prepared whole-mounts. Of the 35 specimens 11 have been lost during the preparation.

In the trunk coelom of the fresh raw *S. nage*, one trematode was observed to wander about and to penetrate through the host's intestinal wall quite easily, probably without injuring it so much (NAGASAWA, pers. comm.).

Specimen Nos. NSMT-PI-1806~1827.

Description. Metacercariae, not encysted. Body oval, elongate or not, flattened, 0.100-0.180 mm long by 0.050-0.090 mm wide, when contracted; or spindle-shaped, 0.185-0.383 mm long by 0.042-0.084 mm wide, when extended. Cuticle thick, not spinous, transversely striated. Parenchyma partly transversely vesicular. Oral sucker usually ellipsoidal, sometimes globular, 0.011-0.042 mm long by 0.010-0.023 mm wide, slightly embedded into anteriormost portion of body. Ventral sucker almost round, 0.019-0.042 mm long by 0.020-0.048 mm wide, usually embedded in body parenchyma, near level of anterior third of body. Pharynx not seen. Oesophagus not clearly observed, sometimes forming at its beginning portion a small swelling (? pharynx) about 0.006 mm in diameter in larger specimens. "Stomach" present at intestinal bifurcation, thick-walled, globular or transversely ovoid, anterior, dorsal or lateral to ventral sucker, sometimes enclosed in a transversely rectangular structure nearly as wide as body proper. Intestinal caecum of each side moniliform, consisting of a series of 4-8 inflated chambers, which are very thin-walled and filled with fluid stainable with carmine, become progressively larger towards the posterior end of the

body, and end near the posterior third of the hindbody. Genital anlagen numbering two, variable in position, usually median, posterior to ventral sucker. Excretory vesicle saccular, small, behind ends of intestinal caeca; pore terminal.



Figs. 8–13. — 8–10. *Monilicaecum*-group metacercariae (continued); 8, a contracted worm from *Sagitta pacifica* TOKIOKA, entire body, ventral view, showing a small swelling at the beginning portion of the oesophagus; 9, another contracted worm from *S. regularis* ATDA, entire body, ventral view, showing a small swelling at the beginning portion of the oesophagus and the stomach enclosed in a transversely rectangular glandular structure; 10, an extended worm from *S. naga* ALVARIÑO, entire body, latero-ventral view. — 11. *Torticaecum*-group metacercaria from *S. minima* GRASSI, entire body, ventral view. — 12–13. Tetraphyllidean plerocercoids; 12, worm from *Eukrohnia hamata* (MÖBIUS), entire body; 13, worm from *Pterosagitta draco* KROHN, entire body.

Discussion. The present metacercariae or larvae belong to the group *Monilicaecum* of the family Didymozoidae POCHE, 1907, in possessing the stomach, the chambered intestines, and the ventral sucker. They cannot be identified even to the generic level. The name *Monilicaecum* is in use as a collective larval-group-name (YAMAGUTI, 1970). The group in Hawaiian fishes comprises the larvae representing several different genera and species (YAMAGUTI, 1970).

The host chaetognaths may have acquired the present larvae chiefly by swallowing small infected copepods, presumably the second intermediate host, thus possibly serving as paratenic hosts to transport them to other paratenic hosts such as small fish or to the fish final host itself, when ingested by these animals. YAMAGUTI (1970) has discussed in detail the life history of the Didymozoidae.

REIMER *et al.* (1975) reported didymozoid metacercariae in a copepod, a polychaete, five coelenterates, and eight chaetognaths (*Pterosagitta draco* KROHN, *S. bipunctata*, *S. enflata*, *S. friderici*, *S. hexaptera*, *S. minima*, *S. serratodentata*, and *Spadella* sp.) from the Atlantic Ocean, off North-west Africa. They stated that "Die Exemplare liessen meist eine sog. Magenbildung erkennen, waren also den Larvengenus Torticaecum zuzuordnen." On account of the stomach, however, their larvae are very likely to be placed in the *Monilicaecum*.

DOLLFUS (1960 a) described a metacercaria as a new species, *Metacercaria sagittae*, from *S. inflata* [sic] taken in the Mediterranean Sea, off Algiers. He did not mention whether his trematode had the stomach or not. He stated that "Je ferai seulement remarquer que l'extrémité antérieure avec sa ventouse orale axiale continuée par le pharynx rappelle celle des *Didymocystis* [Didymozoidae], . . ." *M. sagittae* is indeed similar to the didymozoid metacercariae known from the invertebrate hosts, but it seems distinct from all of them because of the pharynx larger than the oral sucker. DOLLFUS recognized in his specimen, as small as 0.26 mm long by 0.06 mm wide, two very large, globular testes located symmetrically just behind the ends of the intestines. This is questionable. A re-examination of *M. sagittae* is needed.

A *Monilicaecum*-group larva (NSMT-PI-1828) was found free in a plankton sample including chaetognaths (*S. neglecta* and *S. regularis*), copepods, and other lower forms of marine life, taken in Sagami Bay, off Jôgashima, adjacent to Suruga Bay, on 23 June 1977 (NAGASAWA's data). Its morphology and measurements were: somewhat fusiform body 0.171 mm long by 0.050 mm wide; oral sucker curved, not measured; ventral sucker 0.014 mm long by 0.021 mm wide; stomach 0.011 mm long by 0.020 mm wide, enclosed in a glandular structure; intestines 5-chambered; and elongate excretory vesicle 0.030 mm long. It is possible that this larva may have emerged from its host, such as a chaetognath or a copepod, injured during the sampling.

Torticaecum-group metacercariae

(Fig. 11)

The following description is based on two specimens obtained free from the trunk

coelom of *S. minima*, one parasite from one host (1–2 Nov. 1972).

Specimen Nos. NSMT-PI-1829 and 1830.

Description. Metacercariae, not encysted. Body contracted, oval, 0.150–0.280 mm long by 0.067–0.126 mm wide. Parenchyma partly vesicular. Cuticle non-spinous, transversely wrinkled. Oral sucker nearly globular, 0.019–0.032 mm long by 0.016–0.038 mm wide, slightly embedded into anteriormost portion of body. Ventral sucker 0.025–0.063 mm long by 0.029–0.072 mm wide, embedded in body parenchyma, in front of mid-level of body. Pharynx not seen. Oesophagus winding, with a small swelling at its beginning portion. Stomach absent. Intestinal caeca tortuous or partly spiralling, very thin-walled, filled with fluid stainable with carmine, terminating within middle third of hindbody, with their bifurcation in front of ventral sucker. Genital anlagen small, three in one specimen and one in the other; in the former, anterior two smaller, tandem, submedian, dorsal to ventral sucker, and posterior one larger, median, just behind ventral sucker. Excretory vesicle saccular, small, in posterior third of hindbody; pore terminal.

Discussion. In lacking the stomach and in having the tortuous intestines, the present didymozoid metacercariae are assigned to the group *Torticaecum*, a collective larval-group of YAMAGUTI (1970), which is distinguished from the *Monilicaecum* principally by the absence of the stomach (YAMAGUTI, 1942). They cannot be identified further. YAMAGUTI (1970) found that the *Torticaecum*-group larvae in Hawaiian fishes also included several different species.

The metacercaria (NSMT-PI-1831) obtained free from the trunk coelom of *S. pacifica* (26 Sept. 1975) appeared to be lacking in the stomach and therefore to belong to the *Torticaecum*. Its measurements were: body 0.178 mm long by 0.084 mm wide; oral sucker 0.028 mm long by 0.021 mm wide; ventral sucker 0.044 mm long by 0.043 mm wide.

Didymozoid metacercariae were reported by REIMER *et al.* (1971) from a copepod, a chaetognath (*S. elegans* VERRILL), a polychaete, a ctenophore, and six coelenterates, all collected in the North Sea. The stomach's measurements were given in the morphological description of them, but they do not seem to possess the stomach from the figure 2 by REIMER *et al.* (1971). Later, they were placed in the *Torticaecum* by REIMER *et al.* (1975). The writers (1971) considered the copepod to be a second intermediate host and the others reservoir (or paratenic) hosts.

CESTODA

EUCESTODA

Tetraphyllidea fam. gen. sp. plerocercoids

(Figs. 12–13)

The following description is based on two specimens found free in the trunk coelom of *Eukrohnia hamata* (MÖBIUS) (13 June 1974) and *P. draco* (19 Feb. 1977).

Specimen Nos. NSMT-PI-1832 and 1833.

Description. Plerocercoids. Body elongate-oval, 1.080 mm long by 0.408 mm wide in one specimen; and filiform, 2.999 mm long by 0.265 mm wide in the other; not segmented. Antermost portion of scolex invaginated; organs of attachment not observed. No calcareous corpuscles seen.

Discussion. It is very probable that the present metacestodes belong to the order Tetraphyllidea CARUS, 1863, although the morphology of the scolex could not be revealed. Without more information of the morphology of the attachment organs of scolex, it is impossible to identify them even to the family level.

WEINSTEIN (1972) found tetraphyllidean plerocercoids of the type *Scolex pleuronectis* (= *S. polymorphus*) with four bothridia in *S. elegans* from the Gulf of St. Lawrence. Plerocercoids of the same type, but possessing one apical sucker as well as four bothridia, were reported from *S. elegans* by REIMER *et al.* (1971) in the North Sea and by KULACHKOVA (1972) in the White Sea, respectively. For older records of cestode parasites in chaetognaths, readers are referred to HYMAN (1959), ALVARIÑO (1965), or WEINSTEIN (1972).

Unclassified Parasites

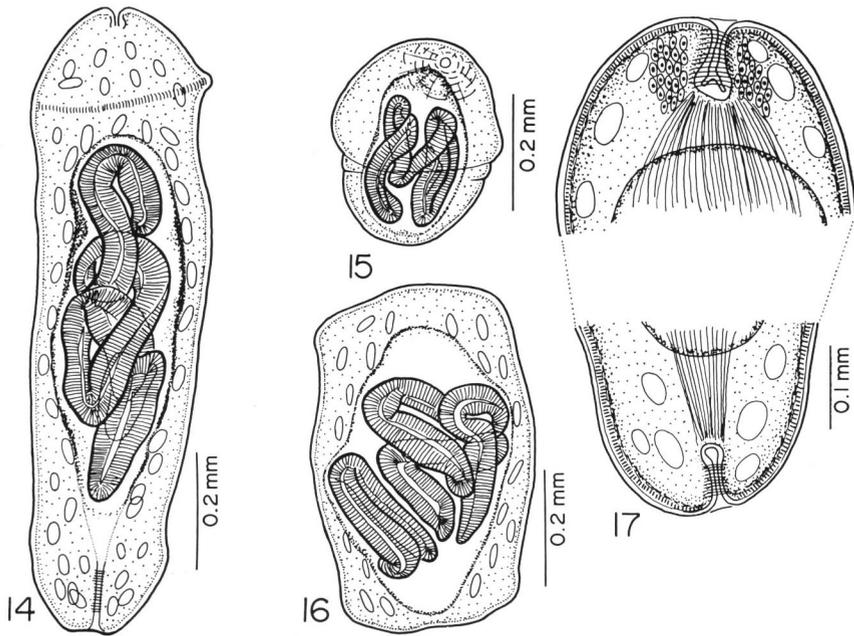
(Figs. 14-17)

The following description is based on five specimens found free in three species of chaetognaths: one in *P. draco* (19 Feb. 1977); three in *S. enflata* (1-2 Nov. 1972); and one in *S. pacifica* (12 June 1976). All the infected chaetognaths harboured one parasite each in their trunk coeloms.

Specimen Nos. NSMT-PI-1834~1837.

Description. Body cylindrical, elongate-pyriform, or globular, not segmented, 0.289-1.142 mm long by 0.272-0.383 mm wide, devoid of any cyst. Ends of body truncated, rounded, or somewhat concave, each having a deep, possibly caecal depression, which is encircled with a layer of circular muscle fibres and probably connected with the opposite one by a bundle of longitudinal muscle fibres. Polarity of body not determined. Organs of adhesion or attachment not seen. Cuticle covering body, thick, not spinous nor ciliated. Subcuticular musculature composed of at least two muscle layers, an outer circular and an inner longitudinal one. Parenchymatous construction present, containing many transparent spherical bodies as large as 0.015 by 0.054 mm. Organs of digestive system not observed. A hollow cavity situated in middle region of body, with a thin, possibly muscular bounding sheath. A band-like organ convoluted in cavity, probably tubular, slightly flattened, about 0.06 by 0.08 mm in cross sections, made up chiefly of an outer layer (consisting of an outer circular and an inner longitudinal muscle layer) and an inner layer of columnar cells, probably not opening anywhere. Nervous and excretory systems not worked out. Neither reproductive organs nor their anlagen observed. No embryonic hooks seen.

Discussion. The present larval helminth parasites are so strange that they are



Figs. 14-17. Unclassified helminth parasites. — 14. Worm from *Sagitta pacifica* TOKIOKA, entire body. — 15. Worm from *S. enflata* GRASSI, entire body. — 16. Another worm from *S. enflata*. — 17. End portions of the body of the worm from *Pterosagitta draco* KROHN, showing a depression in each of them and a bundle of longitudinal muscle fibres probably connecting the two depressions.

difficult to classify. Their anatomical characteristics, such as the cuticle covering the body, the subcuticular musculature, the parenchymatous construction, and the probable lack of digestive organs, suggest that they may be related to the class Cestoda CARUS, 1863. However, it is best to suspend a possible allocation of them to the Cestoda, seeing the exact nature of the cavity in the middle region of the body, of the curious band-like organ in the cavity, or of the spherical bodies in the parenchyma is not known yet. It does not appear that the second organ is the digestive canal.

Summary

From the Chaetognatha collected in Suruga Bay, off the Pacific coast of Central Japan, seven helminth parasites are described. They are: a metacercaria of the genus *Tetrochetus* LOOSS (Trematoda, Digenea, Accacoeliidae) from *Sagitta enflata* GRASSI; a metacercaria of the genus *Guschanskiana* SKRJABIN (Accacoeliidae) from *S. enflata*; a metacercaria tentatively assigned to the *Guschanskiana* from *S. enflata*; metacercariae of the group *Monilicaecum* of YAMAGUTI (Didymozoidae) from *S. enflata*, *S. ferox* DONCASTER, *S. nagae* ALVARIÑO, *S. neglecta* AIDA, *S. pacifica* TOKIOKA, and *S. regularis*

AIDA; metacercariae of the group *Torticaecum* of YAMAGUTI (Didymozoidae) from *S. minima* GRASSI; plerocercoids of the order Tetrphyllidea CARUS (Cestoda, Eucestoda) from *Eukrohnia hamata* (MÖBIUS) and *Pterosagitta draco* KROHN; and unclassified larvae from *P. draco*, *S. enflata*, and *S. pacifica*. The taxonomic position of the last is unknown, but it would seem near to the class Cestoda CARUS. In connection with each of the present parasites, worms previously recorded chiefly from chaetognaths are discussed.

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