Trematodes of the Northumberland coast. No. II / by Marie V. Lebour.

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By Marie V. Lebour, M.Sc.

(Armstrong College, Newcastle-upon-Tyne)

(Plates I.–III.)

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(Plates I.-III.)

Further research among the marine Mollusca and Crustacea of Northumberland has produced several new larval Trematodes. Six were already described from *Paludestrina stagnalis**; to these I now add a seventh. This, however, by no means completes the list of those Trematodes which have their home in this small mollusk, for at least three more have been seen; but owing to their bad preservation I am unable yet to describe them.

The species referred to above belongs to the genus *Gymnophallus*, Odhner. Another cercaria belonging to this genus was found in the little bivalve *Macoma balthica*, and a third in *Tellina tenuis*. The last has been recorded before by me†, but, following Giard‡, I referred it to *Brachycœlium*. In a later paper Giard§ shows that it belongs to *Gymnophallus*, and it certainly possesses all the characteristics of the larval forms of that genus.

Another cercaria previously described by Villot‖, and recently by Pelseneer**, has been found in *Scrobicularia tenuis*. Besides those from Mollusca, several larval Trematodes have been detected in Crustacea. All so far observed in Crustacea belong to the genus *Spelotrema*, Jägerskiöld, and

* "Larval Trematodes of the Northumberland Coast," by the writer, Trans. Nat. Hist. Soc. Northbd., etc., N.S., Vol. I., p. 437, 1907.

† "Notes on Northumbrian Trematodes," Northbd. Fish. Rep. for 1905, p. 7.

‡ *Giard, A.* "Sur un Distome (*Brachicœlium* sp.) parasite des Pélécypodes," Comptes rendus des séances de la Société de Biologie, 1897, p. 956.

§ *Giard, A.* "Sur les Trématodes margaritigènes du Pas de Calais," Comptes rendus des séances de la Société de Biologie, T. LXIII., p. 416, 1907.

‖ *Villot*, "Organisation et Développement de quelques espèces de Trématodes endoparasites marins," Ann. des. Sci. Nat., Zool., 6 Ser., T. VIII., 1879, p. 18.

** *Pelseneer, P.*, "Trématodes parasites de Mollusques marins," Bulletin scientifique de la France et de la Belgique, T. XI., p. 173.

are in the encysted stage. Unfortunately very little structure could be made out in these, as they were in an early stage of development, and usually only the suckers and intestine were clearly seen. Although these have not been fully worked out, I give figures and some measurements of them as a help to future work.

As in my previous paper, I have given provisional names to the larval forms for convenience.

Genus GYMNOPHALLUS, Odhner*.

Cercaria glandosa, nov. (Plate I., fig. 1). I have given the name *glandosa* to this cercaria because of the large and characteristic glands in the head region. It occurs singly and free in the body of its host, *Paludestrina stagnalis*. I have not found it encysted, neither have I been able to find any sporocysts from which, one is justified in inferring by analogy, they are developed: the redia stage being probably omitted as in the case of the 'Pearl Trematodes' of the Mussel, *Mytilus edulis*, the young cercaria (according to Jameson†) occurring in sporocysts in *Cardium edule* and in *Tapes decussata*. It seems doubtful whether the present cercaria has been developed in sporocysts already in *Paludestrina stagnalis*, or has migrated from some other mollusk; the latter alternative is perhaps the more probable owing to the small number of specimens in each individual shell. So far as I am aware this is the first larval *Gymnophallus* found in a Gastropod, all those hitherto known occurring in Pelecypods, *e.g.*, *Cardium edule*, *Mytilus edulis*, *Tapes decussata*, *Saxicava rugosa*, *Tellina tenuis*, *Donax vittatus*, etc.

Cercaria glandosa is oval, and measures 0·20 mm. in length when at rest. It can however be much longer or much shorter when moving. It is tailless; the body is covered all over with small spines and is very transparent, except in the head region, where opaque glands are conspicuous. The oral sucker

* *Odhner, T.* "Gymnophallus, eine neue Gattung der Vogeldistomen," Centralbl. f. Bakt., etc., 1900, p. 22.

† *Jameson, H. L.*, "On the Origin of Pearls," Proc. Zool. Soc., London, 1902, p. 153.

measures 0·05 mm. in diameter. It is much larger than the ventral sucker, which is only 0·033 mm. The latter is situated behind the centre of the body, and its inner margin is distinctly crenulated. The small pharynx follows the oral sucker immediately, and leads into a short œsophagus slightly longer than the pharynx. The intestinal lobes are broad, and extend beyond the centre of the body: these are usually intensely black from food material, with here and there globules of some fatty or oily substance. The excretory vesicle is large, its forks reaching forward in front of the intestinal lobes into the region of the glands, and it opens by a small posterior pore. Behind the vesicle the testes may be seen as two oval masses placed symmetrically one on each side of the body, but no other reproductive organs are apparent. The glands in the head region are a mass of large cells with prominent nuclei. They occupy nearly the whole of the region in front of the intestine, and reach down the sides for more than half the length of the body. They open into ducts which are visible as small apertures round the oral suckers. The presence of these head glands leads one to expect an encysted stage of this Trematode. An encysted *Gymnophallus* has not been found, and Jameson* discovered that his 'Pearl Trematode' did not encyst, but lay resting in a sac made of the epithelial cells of the mantle of its host, the Mussel, this apparently taking the place of an encysted stage. The presence of the other *Gymnophallus* cercariæ in the same position in bivalves (*i.e.*, between the shell and the mantle) suggests that the same state of things exists in these cases, and that they do not, strictly speaking, encyst. The present cercaria is therefore unlike the other species of the genus in its habitat as well as in the presence of these glands, very probably also in having an encysted stage. It does not appear to agree with any known adult form. Its nearest ally (certainly its nearest in size) is probably *Gymnophallus somateriæ* (Levinson), which lives in the intestine of the Eider Duck *Somateria mollissima*. The relative sizes of the

* Op. cit.

suckers are much the same, but the intestine of the present worm is larger and extends further down the body. It differs from the 'Pearl Trematode' described by Jameson and Nicoll* in its smaller size, conspicuous head glands, larger intestine, greater size of the oral sucker in relation to the ventral, and in the shape of the excretory vesicle. The cercaria found by Levinsen† in *Saxicava rugosa*, as well as Jameson's 'Pearl Trematode', is referred by Odhner‡ to *Gymnophallus bursicola*, Odh., which also occurs in the Eider Duck, and agrees with these cercariæ far more closely than does *G. somateriæ*, to which species Jameson originally referred his worm. Nicoll§ however considers that his new species *G. dapsilis* from *Oidemia fusca* and *O. nigra* (Velvet Scoter and Common Scoter) has equally strong claims to be regarded as the adult of the 'Pearl Trematode.' *Cercaria glandosa* occurs in about ten per cent. of the *Paludestrina stagnalis* from Fenham Flats near Holy Island: it is usually found singly, but as many as six specimens have been counted in one animal.

CERCARIA MACOMÆ, nov. (Plate I. fig. 2.) This cercaria occurred in several specimens of *Macoma balthica* from Fenham Flats, between the mantle and shell. Two or three specimens were sometimes found in one mollusk. It is oval and measures 0·70 mm. in length when at rest. The body is covered with spines and is very transparent. The oral sucker measures 0·22–0·26 mm. in diameter and the ventral 0·06–0.07 mm. The latter is situated well behind the centre of the body and its inner margin is crenulated. The oral sucker leads to a small pharynx, and this to a short œsophagus branching into two broad intestinal lobes without much food inside, and in

* *Nicoll, W.*, "Notes on Trematode Parasites of the Cockle (Cardium edule) and Mussel (Mytilus edulis)," Ann. and Mag. Nat. Hist., Ser. 7, Vol. XVII., 1906, p. 148.

† *Levinsen, G. M. R.*, "Bidrag til Kundskab om Gronolands Trematodfauna," Overs. K. D. v. Selsk. Forh., 1881, p. 52.

‡ *Odhner, T.*, "Die Trematoden des Arktischen Gebietes," Fauna Arctica, 1905, p. 313.

§ *Nicoll, W.*, "Observations on the Trematode Parasites of British Birds," Ann. and Mag. Nat. Hist., Ser. 7, Vol. XX., 1907, p. 265.

consequence generally colourless. The lobes reach not quite to the level of the centre of the ventral sucker. The excretory vesicle is clear and somewhat horseshoe-shaped. The reproductive organs are in part well developed, a pair of oval testes lying one each side of the excretory vesicle, and reaching to the level of the centre of the ventral sucker. The ovary lies just in front of the right testis: it is also oval and slightly smaller than that organ. The vitellaria lie below and to the side of the ventral sucker. They consist of two roundish masses of very opaque cells, each giving off a short and rather thick duct which runs forward and unites with its fellow just in front of the ventral sucker. I might mention here a peculiar structure noticed in one or two of the specimens immediately in front of the ventral sucker (see fig. 2, X.) It looked like an oval aperture with a rim and muscles radiating from it. It was not to be seen in preserved specimens, and I am at present unable to account for it.

This cercaria does not agree with any known species of *Gymnophallus*; in relative size the suckers differ from those of all the others. It appears to be nearest to Nicoll's *G. dapsilis* mentioned above. The forward position of the vitellaria is rather similar, but the ventral sucker in the present species is smaller in relation to the oral sucker.

This worm was found in three specimens of *Macoma balthica* out of about twenty examined.

Cercaria strigata (Plate I. fig. 3.) This cercaria, previously referred to *Brachycœlium luteum*, is now considered by Giard to be the larval stage of *Gymnophallus somateriæ*, Levins. It occurs very commonly in *Tellina tenuis* and rarely in *Donax vittatus*, both from Alnmouth. These mollusks are often cast up alive on the beach, and most probably are much eaten by the sea-birds which feed there. The Eider Duck, however, is not common there, and if it ever comes is a rare visitor, whereas it is frequent on Fenham Flats.

Having found this worm abundantly since first recording it from Northumberland, I am now able to give a more correct

figure and description of it, and for convenience have given it the name of *Cercaria strigata*. This cercaria occurs between the mantle and shell of *Tellina tenuis* and *Donax vittatus*; its body is oval and very conspicuously striated by rows of spines. Length 0·30–0·40 mm., oral suckers 0.09 mm., ventral sucker 0·05 mm., agreeing fairly well with Giard's measurement (*i.e.*, length 0·42–05 mm., oral sucker 0·098–0·10 mm., ventral sucker 0·052 mm.). The pharynx (0·03 mm. long) leads to a short œsophagus, and this branches into two broad, clear, and almost circular lobes, reaching a very little way below the anterior margin of the ventral sucker. The excretory vesicle is regularly and gracefully curved, somewhat in the shape of a lyre. A pair of testes are occasionally seen symmetrically placed, one on each side behind the ventral sucker. The hind part of the body is slightly drawn out just where the excretory vesicle opens, giving the cercaria the appearance of having a very short tail, and in some examples this is very conspicuous. This is alluded to by Giard*, and Pelseneer† figures and describes evidently the same cercaria, which he considers to be probably the young form of his fork-tailed *Cercaria syndosmyæ*. The latter cercaria has the suckers nearly equal, which makes it unlikely that this is the same worm. When I first found the cercaria in *Tellina*, I believed it should have been tailed, but since then I have regarded this as erroneous, since no tailed forms of the cercariæ of *Gymnophallus* have ever been seen, and the only younger stage known is that described by Jameson, and later found abundantly by Nicoll and myself in the cockle, *Cardium edule*, and in *Tapes decussata*, where the cercariæ occur in simple sporocysts and are tailless. The cercariæ are often to be seen free, having emerged from the sporocysts, and they never have tails. Although *Cercaria syndosmyæ* is in many ways like a *Gymnophallus*, *e.g.* in the digestive system and excretory vesicle, yet I think it is more likely to belong to some other allied genus.

* Op. cit., Comptes rendus des séances de la Société de Biologie, T. LXIII., p. 419, 1907.

† Op. cit., p. 173 and 185, Pl. X., fig. 22.

As to *Cercaria strigata* being the young of *Gymnophallus somateriæ*, it appears to me to differ in many respects, although as Giard points out, it at the same time agrees with it in many ways. For instance the length of the cercaria is almost identical—in my specimens smaller, which of course is usual in the larval stage. The relative size of the suckers is also almost the same. Again, the arrangement of the testes is the same, but this varies little in all the species of the genus. On the other hand, in my specimens the cercaria is broader than *G. somateriæ*, and the striation is much more conspicuous. The excretory vesicle is curved much more elaborately, and is very definite and constant in its shape; and the lobes of the intestine, which are exceedingly broad, reach to below the anterior margin of the ventral sucker. Finally, ducks feed seldom at Alnmouth, and the occurrence of the cercaria so frequently in *Tellina tenuis* would seem to point to a commoner bird for the final host, such as one of the gulls, many of which are constant feeders on the beach. Several gulls are known to harbour species of *Gymnophallus*, *e.g. G. deliciosus* (Olss.) in *Larus argentatus*, *L. fuscus* and *L. canus*.

This cercaria occurred in every specimen of *Tellina tenuis* examined (about twenty), and it was only once found in *Donax vittatus* out of about a dozen examined.

Genus SPELOTREMA, Jägerskiöld.

Cercaria corophii, nov. (Plate I. fig. 4, 5.) This cercaria occurs in large numbers encysted near the surface of the body and legs of the Amphipods *Corophium grossipes* and *Gammarus duebeni*, especially in the former, just beneath the cuticle. It is enclosed in cysts slightly longer than broad, measuring 0·16 × 0·14 mm., and having thick transparent walls. Within the cercaria is curled up, its oral sucker and part of its digestive system usually visible, and sometimes the ventral sucker. When pressed out of the cyst the cercaria is long and rather narrow, the head end being smaller than the posterior; length 0·34 mm., oral sucker 0·03 mm. across, narrow prepharynx 0·04 mm. long, pharynx 0.016 mm. long.

A long and narrow œsophagus runs to about half way down the body, and there branches into two short lobes. Between these lobes and slightly in front of their termination is the small ventral sucker, 0·023 mm. across.

This *Spelotrema* does not appear to fit in with any known species.

Cercaria balani, nov. (Plate I. fig. 6, 7.) This species occurs encysted in the common barnacle, *Balanus balanoides*, which encrusts the rocks and mussels at Budle and Fenham Flats. The cyst is thin-walled and spherical, measuring 0·04 mm. in diameter. In it is curled up a pale yellow cercaria measuring, when extended, about 1 mm. in length. Unfortunately measurements of the organs were not made and the specimens were preserved badly, so that at present they cannot be determined. The size of this species suggests its being the larval stage of *Spelotrema excellens*, Nicoll* which lives in the Herring Gull *Larus argentatus*, and this would be a very likely host for the worm, as the Herring Gull is one of the common feeders on the coast. It, however, differs from *Spelotrema excellens* in the position of the pharynx, which is situated nearer the intestinal lobes than the oral sucker, thus giving great length to the prepharynx. The intestinal lobes extend slightly beyond the ventral sucker. The body is covered with small spines.

Cercaria carcini, nov. (Plate I., fig. 8-9). This cercaria occurred encysted in *Carcinus mœnas*, the common green crab of our coast. When pressed out of the cyst it corresponds in almost every way with the worm from the same crab described by McIntosh†. It is 0·54 mm. long, its smallest breadth being in the centre of the body. The suckers are almost equal. The œsophagus is more than twice the length of the prepharynx, and the intestinal lobes reach to the level of the anterior margin of the ventral sucker. Two round bodies,

* *Nicoll*, W., Op. cit.. Ann. and Mag. Nat. Hist., Ser. 7, Vol. XX., 1907, p. 248.

† *McIntosh*, "The Trematode Larva and Ascaris of the *Carcinus mœnas*," Journal of Microscopical Science, Vol. V., N.S., 1865, p. 201.

presumably the testes, are faintly visible. The curious thing about this worm is that its cyst is distinctly oval and measures 0·40–0·35 mm., and its walls are very thin, whereas McIntosh's worm came from a spherical cyst with a very thick wall, and measured 0·13 mm. in diameter. This points, I think, to their being different species. Another encysted cercaria was noticed (Plate I., fig. 10) from *Carcinus mænas*, the cyst measuring 0·2 mm. across, and quite spherical. Unfortunately the worm was destroyed in pressing it out of the cyst. The wall of the cyst was thick, and in all probability this was the species described by McIntosh.

In the absence of more detailed measurements it is almost impossible to attempt to fit in these larval forms of *Spelotrema* with any known adults. It is interesting to find that all those so far observed encyst in Crustacea. Villot* found *Distomum brachysomum*, Creplin, which seems to be a species of *Spelotrema*, encysted in *Anthura gracilis*.

Two cases of the younger stages of what are almost certainly species of this genus have been observed in Mollusca; in both cases the cercariæ, which are without tails, occurred in simple round sporocysts. One of these, *Cercaria crispata*, was found by Pelseneer† in *Natica alderi* at Boulogne-sur-Mer; the second was found by myself‡ in *Littorina rudis*. In the latter case many more cercariæ were found in the sporocysts, only two or three occurring in Pelseneer's species. Nicoll§ considers that those from *Littorina rudis* are likely to be an early stage of *Spelotrema claviforme* (Brandes) from *Tringa alpina* and *Aegialites hiaticula* (Dunlin and Ringed Plover), which is a very small species not exceeding 0·40 mm. in length.

Thus so far as we know the genus *Spelotrema* lives in the adult stage in marine birds, the cercaria encysts in Crustacea, and is developed without a tail in sporocysts in a mollusk (in

* Op. cit.

† Op. cit., p. 171, Pl. XI., fig. 39-40.

‡ "Notes on Northumbrian Trematodes," op. cit.. p. 6.

§ *Nicoll, W.*, Op. cit., Ann. and Mag. Nat. Hist., 1907, p. 255.

the two cases known, a Gastropod), the redia stage being omitted.

A word may be said here about the closely allied genus *Maritrema* of Nicoll*. This author suggests that the two cercariæ *C. oocysta* and *C. pirum* discovered by me† encysted in *Paludestrina stagnalis* are larval stages of Trematodes belonging to this genus, and it appears extremely likely that this is the case. *C. oocysta* was found encysted in sporocysts, and *C. pirum* had in all probability also encysted in the sporocysts in which they were developed, although these were not actually seen. The cysts were so packed together that it is unlikely that they came from another host. Tailed forms of *C. oocysta* were also found within the sporocysts, which shows this cercaria to differ from the genus *Spelotrema* in this respect as well as in others. As the sporocysts of *C. pirum* were not found, it was impossible to ascertain whether the cercariæ were tailed or not. It seems rather a curious fact that cercariæ which have no free-swimming stage in their life history, and encyst in the sporocysts, should possess tails, for they can have no use for them. A similar case was observed by me in a Trematode from *Cardium edule*, tailed cercariæ being found in the sporocysts side by side with the encysted forms‡.

A comparison of the scantily known life history of the three genera *Gymmophallus*, *Spelotrema*, and *Maritrema* is here given in tabulated form :—

Genus	*Adult.*	*Encysted stage*	*Cercaria*	*Redia*	*Sporocyst*
Gymnophallus	marine birds	omitted, but a resting stage occurs in Mollusca	no tail (?); developed in sporocysts	omitted	in Mollusca
Spelotrema	,,	in Crustacea	no tail; developed in sporocysts	,,	,,
Maritrema	,,	in sporocysts	tailed; developed in sporocysts	,,	,,

* *Nicoll, W.*, Op. cit., Ann. and Mag. Nat. Hist., 1907, p. 265.

† Op. cit., Trans. Nat. Hist. Soc. Northbd., etc., N.S., Vol. I., p. 445–446.

‡ "On Three Mollusk-infesting Trematodes," Ann. and Mag. Nat. Hist., 1907.

Here I may record another larval Trematode from the small bivalve *Scrobicularia tenuis* from Fenham Flats. This mollusk was found by Villot to harbour several larval Trematodes. One of these (viz., *Echinostomum leptosomum*) has already been described* in a former paper. I am now able to record another of Villot's species, namely, *Cercaria fissicauda*, which as Pelseneer points out† should be named *Cercaria dichotoma*, Müller. The sporocysts occurred in the liver, which was full of them; and in the same specimens the encysted cercariæ of *Echinostomum leptosomum* were found in the foot. Pelseneer found his specimens of *C. dichotoma* in *Tellina solidula* (= *Macoma balthica*).

CERCARIA DICHOTOMA, Müller (Plate II. fig. 1, 2) occurs in long knobbed sporocysts, very transparent and structureless, in which many cercariæ are crowded together. The cercaria is about 0·20 mm. long, including the tail, which is slightly shorter than the body, and forked. Anterior sucker 0·033 mm. across, leading directly into a pharynx. Although Villot did not see this pharynx, and described and figured the worm as having none, yet it was seen by later observers and is very distinct, measuring 0·016 mm. in length. There is a long œsophagus branching beyond the centre of the body into two short lobes. The ventral sucker lies well behind the centre of the body, and measures 0·029 mm. in diameter. An elaborately curved horseshoe-shaped (or perhaps more strictly lyre-shaped) excretory vesicle occupies most of the posterior part of the body, and is continued along the tail and into each fork of it. The granules contained in the vesicle are the most conspicuous features of the cercariæ within the sporocysts.

At present nothing seems to be known about further stages of this Trematode, and it is difficult to suggest to what genus it may belong. I only found it once in about 50 specimens examined. This cercaria was met with by Mr. Andrew Scott

* Op. cit., Trans. Nat. Hist. Soc. Northbd., etc., p. 447.

† *Pelseneer, P.*, Op. cit., p. 173.

in *Cardium edule* on the Lancashire coast*, and by Huet† in the same mollusk in Normandy.

Encysted Trematodes are not uncommon in fish. One frequently found off our coast is from the Dab *Pleuronectes limanda*. This worm is described by Johnstone‡ from the West coast of England, and he refers it to *Distomum valde-inflatum*, Stossich. I have found what seems to be the same species in our local Dabs, especially in the younger specimens, as Johnstone describes. They occur beneath the skin of the under side, and also now and then on the gills. I have also found it, but not so frequently, in the Long Rough Dab *Hippoglossus limandoides*, Lemon Dab *Pleuronectes microcephalus* and Witch *P. cynoglossus*. My specimens (length when pressed out of cyst 2·9–3 mm.) are larger than Johnstone's (about 1·25 mm.), but his are not so far developed as mine. It is possible that they represent different species, but it is more probable that they are the same, for my specimens agree very well with his description so far as it goes; but few measurements are given, and the number of head spines is not stated.

The worm (Plate II., fig. 3, 4, 5, 6) is enclosed in a double sac, the first very thick and tough, and the second transparent and showing the coiled-up worm through its walls. When pressed out of the cyst the worm is seen to have the shape of a very elongated pear, with its body covered with strong spines gradually disappearing towards the posterior end. At the head end they are very conspicuous, and round the anterior sucker there are two rows of very distinct spines. The body spines are slightly curved, but those round the head are straight (see fig. 4) and taper to a point distally. Those of the upper row are shorter than those in the lower (upper spines 0·022 mm. long, lower spines 0·026 mm. long.) The number

* *Johnstone, J.*, "Internal Parasites and Diseased Conditions of Fishes," Lancashire Fisheries Report for 1904, p. 107, Pl. V.

† *Huet*, "Note sur le *Bucephalus haimeanus*," Bull. Soc. Linn. Normandie, sér. 4, T I.I., fig. 3–4.

‡ *Johnstone, J.*, Op. cit., p. 98.

of head spines is variable. I have examined many specimens and find these head spines vary from 48 to 58 in two uninterrupted rows of 24 to 29 spines each. Johnstone's figure of the head shows the lower spines also longer than the upper, but he does not mention the fact. The oral sucker measures 0·26 mm. across, and has a large aperture leading to a long prepharynx about 0·5 mm. long. The pharynx (0·18 mm. long) is thick, and leads to a broad œsophagus branching into two rather thin intestinal lobes which reach almost to the end of the body. Just below the fork of the intestine is the genital aperture, which occurs immediately in front (either median or to the side) of the ventral sucker (0·23–0·26 mm. across). Two small round testes and an ovary lie in a row obliquely across the hinder portion of the body between the ventral sucker and the posterior end, but their positions are somewhat variable, and sometimes they are placed almost straight behind each other. The vasa deferentia are distinctly seen running to a thin, somewhat club-shaped vesicula seminalis, in front of which the cirrus-sac encloses a small spined cirrus. The ovary has a thin duct running from it to the genital opening, but none of the other female organs are yet developed. A large opaque excretory vesicle occupies the posterior region, hiding the testes and ovary, but by gentle pressure the contents of the vesicle are set free, and these organs can be clearly seen.

I do not think this worm is *Distomum valdeinflatum*, Stossich, which, according to Monticelli*, is synonymous with *D. bicoronatum*, Stossich, and *Echinostomum cesticillus*, Molin. *E. cesticillus* is now placed in the genus *Stephanochasmus*, Loos†, and this author recognises both *S. cesticillus* and *S. bicoronatum* as separate species. The former has 35–36 head spines, and the latter 31, the lower row of both species having one spine less than the upper, thus forming a gap in the centre; and the spines of the lower row are shorter than those of the upper, which is exactly the reverse in my specimens.

* *Monticelli*, "Studii sui Trematodi endoparassiti," Zool. Jahrb. Supp. III., 1893, p. 161.

† *Loos, A.*, "Ueber die Fasciolidengenera Stephanochasmus, etc.," Centralbl. f. Bakt., etc., Bd. XXIX., 1901, p. 595.

A far more likely adult seems to be *Stephanochasmus baccatus*, Nicoll*, from the Halibut *Hippoglossus vulgaris*, Flem. This worm has 56 head spines, the lower row being longer than the upper and uninterrupted. The prepharynx is very short, but this is probably due to the action of the preserving medium, and this may also account for the shortness of the body. The reproductive organs, not being fully developed in the larval form, cannot very well be compared with those of Nicoll's specimen. The above characteristics of the head warrant, I think, this worm being provisionally looked upon as the larval form of *Stephanochasmus baccatus*. The variation in the head spines is interesting, especially as Monticelli† thought those of his larval forms from *Box salpa* and *Rhombus lævis* were also variable. On the other hand Loos‡, in all the adults described, finds the number of head spines generally constant for each species.

Derogenes varicus (O. F. Müll.) occurs in many of the local fish, and is perhaps the commonest Trematode from our coast. The host in which I have found it in greatest numbers is the Long Rough Dab, chiefly in the mouth and on the gills, but sometimes in the œsophagus, stomach, and intestine. Odhner§ considers that its presence in the gills is perhaps due to the wandering of the parasite after the death of the host, the true habitat being the stomach. I believe, however, the mouth and gills of the Long Rough Dab to be quite as much the true habitat for the worm as the stomach.

On a specimen of *Derogenes varicus* taken from the mouth of the above-mentioned fish in June, 1907, I found clinging to it a parasitic Copepod (Plate III., fig. 2–3). The Copepod was alive and clung firmly to the worm by two very large hooks at the head end. Now a parasitic Copepod is not likely to inhabit any part of the intestine of a fish, and I

* *Nicoll, W.*, "A Contribution towards a Knowledge of the Entozoa of British Marine Fishes," Ann. and Mag. Nat. Hist., Ser. 7, Vol. XIX., 1907, p. 80.

† Op. cit., p. 161.

‡ *Loos, A.*, Op. cit.

§ *Odhner, T.*, Fauna Arctica, p. 360.

regard this as strong evidence that the mouth is a natural habitat for *Derogenes varicus*.

An ectoparasitic Trematode is known that lives attached to a Copepod parasitic on a fish, *i.e.*, *Udonella caligorum*, Johnson, which lives on the ovisacs and posterior part of *Caligus curtus* on the Cod and other Gadoids*; but this is, so far as I know, the first time that a Copepod has been found parasitic on a Trematode. Unfortunately the specimen is greatly spoiled by the preserving agent, and only very rough sketches were made of the living animal. It appears to be a new species, possibly a new genus, probably nearly allied to *Ergasilus*†, as Mr. T. Scott kindly suggested to me from a sketch submitted to him. The hooks on the head (the antennæ) are much thicker and heavier in my specimen. Only one egg-bag was to be seen, and it was full of well developed eggs of a purplish hue. I give a drawing of *Derogenes varicus* (fig. 1) to compare with figures 2 and 3. It is to be hoped that further specimens may be found to establish this new species (or genus) on a firm foundation. So far much search has produced no more specimens.

STERINGOPHORUS OVACUTUS, n. sp. (Plate III., figs. 4–5).—I shall conclude with a description (unfortunately not quite complete) of a new species of Trematode belonging to the genus *Steringophorus*, Odhner. Only one species of this genus is, I believe, known, and I am pleased to be able to add a second, which I have named *Steringophorus ovacutus*. This Trematode is rare. It was found in the intestine of the Long Rough Dab *Hippoglossus limandoides* (June and November, 1907); only four specimens were found, and each time they occurred singly. It closely resembles *S. furciger* (Olss.) When alive it is bright red, and often appears pear-shaped owing to the head end being stretched out. The colour vanishes immediately after death, which takes place almost directly the worm is taken from the intestine; it then has a pale yellow

* *Scott, T.*, 19th Annual Report of the Fisheries Board for Scotland, 1901, p. 144.

† *Scott, T.*, Op. cit, p. 122.

colour with a patch of bright greenish brown (the eggs) at the posterior part of the body. The cuticle is unarmed. When dead and pressed under a cover slip the worm measures 1·80–2·30 mm. in length, but may be much longer than this when alive. The maximum breadth, about 1·16–1·33 mm., is in the region of the ventral sucker. The shape is a broad oval with the ends more rounded than in *S. furciger*. The ventral sucker is almost exactly in the centre, and behind this the hind end of the body is taken up by the eggs, the uterus winding in many twists and masking most of the other organs. Like *S. furciger* the body has a round section in the anterior part, but flattens in the region of the ventral sucker. Both suckers are circular, the oral measuring 0·32–0·40 mm. across and the ventral 0·60–0·80 mm., their relative sizes being about 1 : 2. The oral sucker opens externally in a large mouth that leads to a very short prepharynx, and this to a muscular pharynx. There is a short and narrow œsophagus, branching very soon into the thin intestinal lobes reaching, as in *S. furciger*, to beyond the testes for about the same length as these organs. The excretory bladder is not so conspicuous as in *S. furciger*, because in all the specimens it is clear instead of full of dark matter. It is forked in much the same way as in *S. furciger*, the single stem lying dorsally and the lobes (which are swollen in front) coming forward ventrally; the latter reach to beyond the posterior level of the oral sucker when the worm is at rest. The hinder part of the excretory and digestive system is usually completely hidden, in pressed examples, by the eggs and vitellaria. The genital pore occurs close to the pharynx, to the left side above the fork of the intestine, the male and female ducts opening into a genital sinus, the male on the right and the female on the left. The form of the sinus and the openings closely resemble those of *S. furciger*. The testes are oval bodies, lying dorsal to and just behind the ventral sucker, and ventral to the intestinal lobes. They are oval and measure 0·12 mm. in length. The vasa deferentia are very thin, and run forwards from the testes to the vesicula seminalis, which is divided into two almost

equal parts, and is enclosed in the cirrus sac. The latter measures 0·30 mm. in length, and is placed somewhat obliquely, the dorsal part being to the right and the ventral to the left; it contains, in addition to the vesicula seminalis and in front of it, a large pars prostatica, the glands of which fill the sac. The cirrus was not seen. The ovary and parts connected with it have not yet been clearly made out, but the former probably occurs much in the same position as in *S. furciger*, as the ducts from the vitellaria join in a small triangular reservoir in much the same position as in that species. The uterus is very long and winding, much longer than in *S. furciger*, and finally runs up in a straight duct to open into the gential sinus. The eggs are a bright brown with a distinct green shade, and are pointed at one end and round at the other; they measure 0·046 × 0·026 mm. It is from the shape of the eggs that the species is named *ovacutus*. The vitellaria occur far forward, beginning anterior to the centre of the ventral sucker and reaching to the level of the fork of the intestine. They are arborescent, and three main ducts run from each of them, which soon unite into one on each side; and finally these join together in the reservoir mentioned above.

It is hoped to describe the female organs in more detail hereafter. Meanwhile, the above characters make it, I think, certain that we are here dealing with a distinct species of *Steringophorus*.

EXPLANATION OF PLATES

The following letters apply to all the figures :—

O. S.	oral sucker	U.	uterus
O.	head glands	R. S.	receptaculum seminis
PH.	pharynx	T.	testes
P. PH.	prepharynx	V. D.	vas deferens
Œ	œsophagus	G. P.	genital pore
I.	intestine	P. P.	pars prostatica
V. S.	ventral sucker	C.	cirrus
E. V.	excretory vesicle	C. S.	cirrus sac
E.	excretory system	V. SEM.	vesicula seminalis
O.	ovary	EG.	eggs

Plate I.

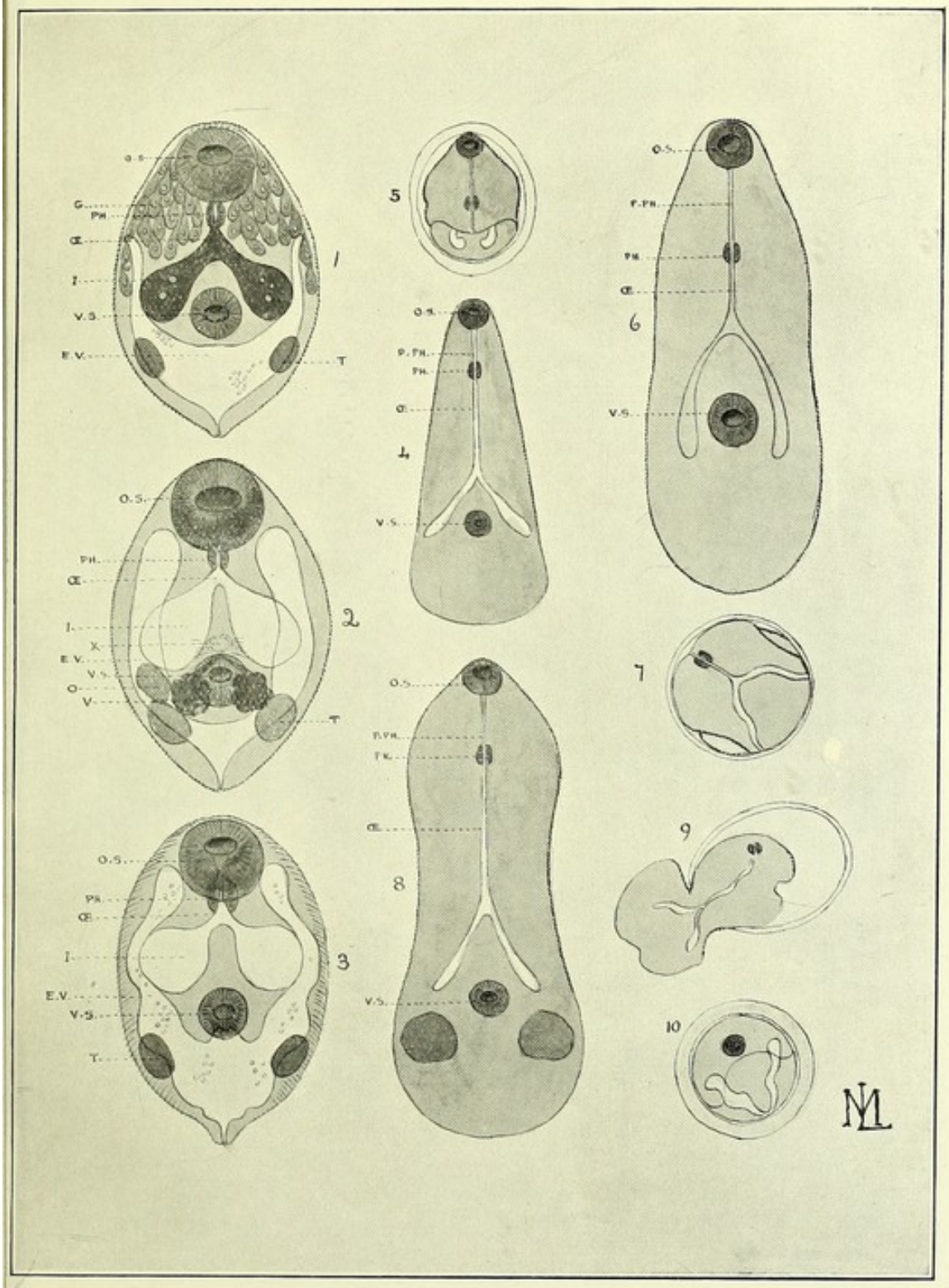
Fig. 1. *Cercaria glandosa* (length 0·20 mm.) from *Paludestrina stagnalis.*
Fig. 2. *Cercaria macomæ* (length 0·70 mm) from *Macoma balthica.*
Fig. 3. *Cercaria strigata* (length 0·40 mm.) from *Tellina tenuis.*
Fig. 4. *Cercaria corophii* (length 0·34 mm.) from *Corophium grossipes.*
Fig. 5. ,, ,, (0·16 × 0·14 mm.) encysted.
Fig. 6. *Cercaria balani* (length about 1 mm.) from *Balanus balanoides.*
Fig. 7. ,, ,, (0·04 mm.) encysted.
Fig. 8. *Cercaria carcini* (length 0·54 mm.) from *Carcinus mænas.*
Fig. 9. ,, ,, (cyst 0·40 × 0·35 mm.) escaping from cyst.
Fig. 10. Cercaria encysted in *Carcinus mænas* (0·13 mm.)

Plate II.

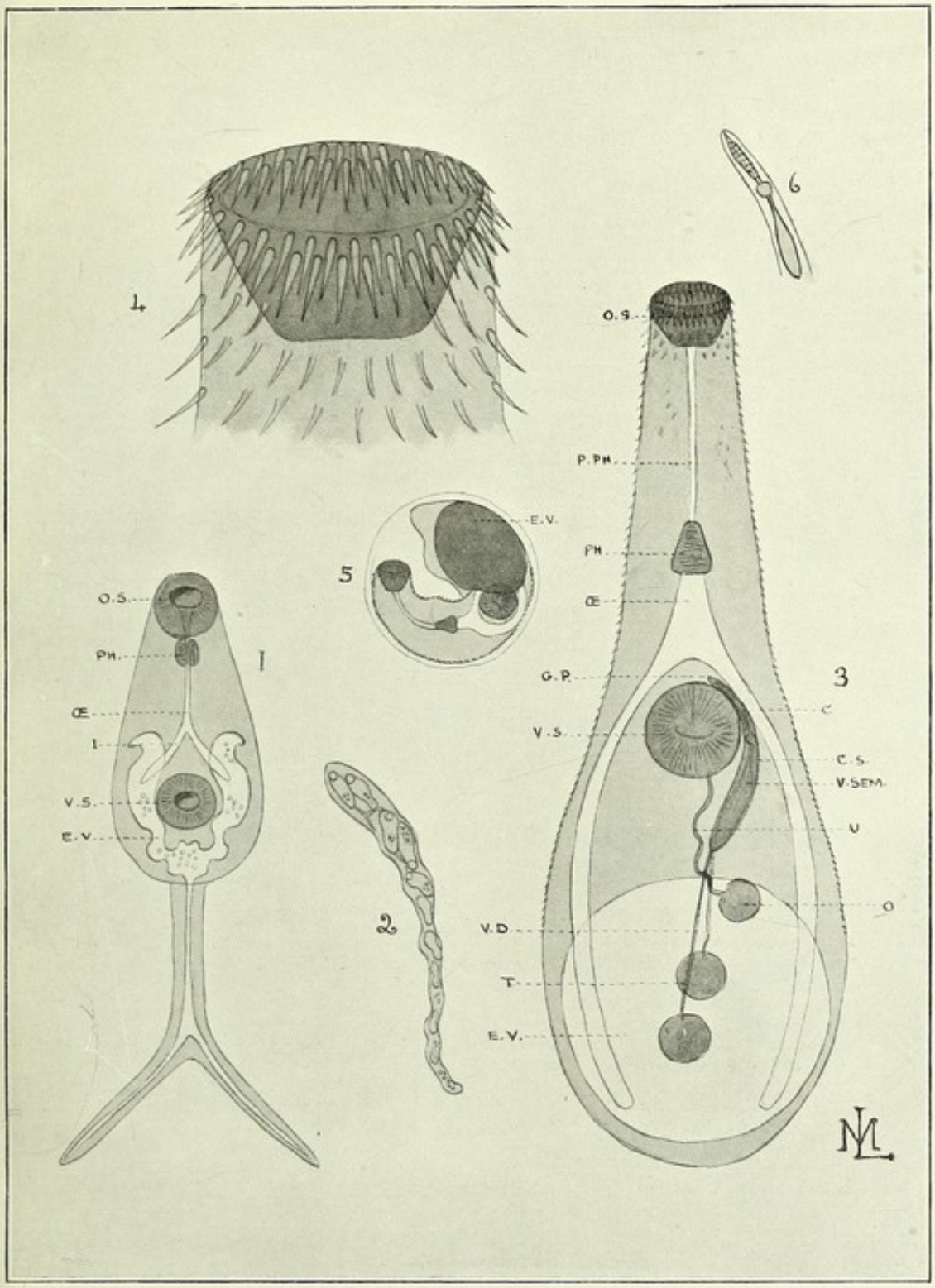
Fig. 1. *Cercaria dichotoma*, Müller (length 0·20 mm.) from *Scrobicularia tenuis.*
Fig. 2. Sporocyst of *Cercaria dichotoma.*
Fig. 3. *Stephanochasmus baccatus*, Nicoll (?), pressed out of cyst (length 2·9 mm.) from Dab.
Fig. 4. ,, ,, (encysted)
Fig. 5. ,, ,, head
Fig. 6. ,, ,, cirrus sac

Plate III.

Fig. 1. *Derogenes varicus* (O. F. Müll.), (length 3 mm.) from Long Rough Dab.
Fig. 2. ,, ,, with parasitic Copepod.
Fig. 3. Parasitic Copepod.
Fig. 4. *Steringophorus ovacutus*, n.sp. (length 2·3 mm.) from Long Rough Dab.
Fig. 5. Egg of *S. ovacutus.*



Trematodes of the Northumberland Coast.



Trematodes of the Northumberland Coast.