

NEW TREMATODE PARASITES FROM FISHES OF THE ENGLISH CHANNEL.

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(With Plate XI.)

DURING August and September 1909 I had an opportunity, thanks to the Government Grant Committee of the Royal Society, of making a fairly comprehensive examination of the parasites of fishes from the English Channel at the Marine Biological Laboratory, Plymouth. During that time nearly five hundred fishes, belonging to about 80 species, were dealt with and a very extensive collection of parasites made. A considerable number of species were obtained many of which are new to British waters but the number of absolutely new species amounted to very few. Of these I am describing here four of the most noteworthy, three of which appear to be of new generic type. A complete account of the investigations will be published later.

Three of these species were rather uncommon. The fourth was comparatively frequent in the pipe fishes and was found in association with a better known species of the same genus, namely *Podocotyle atomon*.

***Podocotyle syngnathi* n. sp.**

(Figs. 1, 2.)

This species was a not uncommon parasite of the pipe fishes, *Syngnathus acus*, *Nerophis aequoreus* and *Siphonostoma typhle*. In the first it occurred in four out of nine, in the second in four out of eight and in the third in one out of six. It was not met with in any of the eight specimens of *Nerophis lumbriciformis* examined. Its frequency

in those fishes is therefore nine out of 31, i.e. about 29 %. It did not occur in any other species of fish so that it is in all probability a specific parasite of the Lophobranchii. In *Nerophis aequoreus* it was accompanied by *Podocotyle atomon*.

It bears a very close resemblance to the other species of *Podocotyle* but differs from them chiefly in the noticeable shortness of the cirrus pouch.

The specimens varied in length from 2.2 mm. to 5.9 mm. The smallest specimen was obtained from *Nerophis aequoreus* and had just begun to produce ova, so that evidently this species does not attain maturity so early as *P. atomon*. Some mature specimens of the latter measuring little over 1 mm. were obtained from the same fish.

Measurements were made of five of the largest specimens, the average length of which was 5.36 mm. (4.55–5.95 mm.). The greatest breadth (0.78 mm.) occurred usually at the testicular region, but the breadth across the ventral sucker was almost as great and in one case greater. The greatest breadth is therefore about 1/7 of the length. In a fully extended specimen it may be as small as 1/9. The species is therefore more elongated than *P. atomon* but less so than *P. reflexa*. The body is not much flattened and the ventral sucker is usually prominent.

The oral sucker has a diameter of .38 mm. and the ventral sucker measures 0.43×0.55 mm. The latter is situated at a distance of 1.25 mm. from the anterior end, the neck therefore being somewhat more than 1/4 of the body length.

There is a very short prepharynx and the pharynx measures 0.19 mm. in diameter. The oesophagus is about as long as the pharynx (0.17 mm.), and the intestinal diverticula extend nearly to the posterior end of the body becoming slightly dilated during their course.

The excretory vesicle reaches the anterior border of the ovary.

The testes are separated from each other by a short distance (0.21 mm.). They are oval with their long axes slightly tilted from the middle line, the anterior end in both cases being usually directed towards the left side. They overlap the intestinal diverticula only to a very slight extent. Their dimensions are 0.57×0.47 mm. Between the posterior testis and the end of the body there is a space a little over 1 mm. (1/5 of the body length, but this varies from 1/6 to 1/4). The genital aperture is situated a little in front of the intestinal bifurcation, decidedly towards the left side. The cirrus pouch is short and rather stout, extending at most not further than the middle of the ventral sucker. The vesicula seminalis is accordingly much more compact than it is in

the other species of the genus. The ductus ejaculatorius is also short.

The ovary lies in front of the anterior testis and is separated from it by a variable space (about 0.1 mm.). It has the trilobate posterior border characteristic of the genus and measures about 0.42×0.29 mm. The shell-gland complex resembles that in *P. atomon* but the receptaculum seminis lies rather further forward. The yolk glands are somewhat more limited in extent, stopping a short distance behind the ventral sucker. They are most voluminous posteriorly but are frequently interrupted at the level of the second testis on one or both sides. They do not fill up the inter-testicular space. The transverse yolk ducts unite in front of the ovary. The uterus extends between the receptaculum seminis and the ventral sucker and is confined between the intestinal diverticula. It usually contains about 50 eggs, measuring $0.082\text{--}0.102 \times 0.045\text{--}0.050$ mm., the average being 0.092×0.047 mm.

***Lepidauchen stenostoma* n. g., n. sp.**

(Fig. 3.)

Only two specimens of this form were found on one occasion in the intestine of *Labrus berggylta*, and it is apparently an uncommon parasite. It is a moderately flat and broad species measuring 2.9–3.25 mm. in length and 1.3 mm. in greatest breadth which occurs about the middle of the body. It tapers slightly towards the ends, which are broadly rounded.

The surface of the anterior part of the body is closely covered with stout spines but these appear to be entirely absent in the posterior part beyond the middle of the body.

The globular oral sucker is subterminal and has a diameter of 0.55 mm. It is characterised by a peculiar aperture which presents the appearance of a longitudinal slit inflated at its anterior end. The ventral sucker is much smaller, measuring only 0.27 mm. in diameter. It is situated at a distance of 1.12 mm. from the anterior end. The neck is thus about $\frac{3}{8}$ of the body length.

There is a very small prepharynx followed by a pharynx of comparatively enormous size, its dimensions being 0.31×0.34 mm. There is no oesophagus, the intestinal diverticula separating immediately behind the pharynx and passing out at a wide angle towards the sides of the body; they extend almost to the posterior end.

The excretory system was not observed.

The two moderately large globular testes lie in the posterior half of the body, one in front of the other and contiguous. The posterior testis is separated from the end of the body by a space equal to its diameter which is 0.45 mm. The cirrus pouch is small and stout, lying immediately and entirely in front of the ventral sucker. It contains a comparatively large and globular vesicula seminalis but other details of its internal structure were obscured by the presence of eggs in the genital sinus. The genital aperture is in the middle line a little in front of the intestinal bifurcation.

The ovary is situated just in front of, and contiguous with, the anterior testis, but displaced towards the right side. It is transversely oval and measures about 0.37×0.26 mm. The yolk glands are very voluminous filling up the greater part of the posterior half of the body and extending along each side to the level of the middle of the pharynx. The follicles are somewhat small and are arranged in a peripheral layer, which in front of the ventral sucker extends right across the body dorsally but only for a short distance ventrally. At the level of the ovary the ventral layer begins to extend in towards the middle line overlapping the edges of the ovary and anterior testis and almost completely covering the posterior testis. Behind the latter the follicles from each side merge and completely fill the post-testicular space. There is no receptaculum seminis but the initial two or three convolutions of the uterus are packed with sperm. No Laurer's canal was observed. The uterus fills up the region between the ovary and the ventral sucker, and is confined within the space bounded by the intestinal diverticula. The eggs do not exceed 100 in number. They are brownish yellow and of moderate size, measuring $0.078-0.084 \times 0.046-0.050$ mm.

The systematic position of this species is a matter of some difficulty. It is obviously related to the groups of which *Lepocreadium* and *Stephanochasmus* are the chief representatives, but it presents such a combination of the characters of the two groups that it is difficult to decide to which it is more nearly related. Thus, for instance, it has the reduced ventral sucker of the Lepocreadiinae but, on the other hand, it lacks the vesicula seminalis externa and the receptaculum seminis of this group. Again it has the uterine receptaculum seminis and the large pharynx characteristic of the Stephanochasminae but it lacks the crown of cephalic spines. For the present it must be regarded as an intermediate type. It does not appear to be closely allied to any other known form. Its generic characters may be summarized as follows:

Lepidauchen n. g.

Body broad and flat; covered with spines anteriorly. Oral sucker much larger than ventral, which lies in front of the middle of body. Prepharynx short, pharynx very large, oesophagus absent. Genital aperture median, near intestinal bifurcation. Cirrus pouch short and stout. Receptaculum seminis absent. Otherwise as in Allocreadiinae

Type species: *L. stenostoma* from intestine of *Labrus berggylta*.

Hemipera ovocaudata n. g., n. sp.

(Figs. 4, 5.)

This peculiar and interesting form was found in the stomach of four out of 24 specimens of *Lepadogaster gouanii*. In all but one case only a single immature example was obtained; in the fourth three examples occurred, two of which contained eggs.

The species is small and delicate, elongated and sub-cylindrical in shape, with somewhat pointed ends. The largest specimen measured 1.54 mm. in length with a breadth of 0.56 mm. across the ventral sucker. The surface of the body is smooth and has no cuticular spines.

Both suckers are globular. The oral sucker is subterminal and measures 0.22 mm. in diameter. The ventral sucker is much larger, measuring 0.40 mm., and is situated at a distance of 0.87 mm. from the anterior end of the body, *i.e.* distinctly behind the middle.

Contiguous with the oral sucker is a medium sized pharynx having a diameter of 0.066 mm. It is followed by a very short oesophagus. The diverticula pass out at right angles to the oesophagus but after a short distance bend abruptly backwards and run down the sides of the body to the posterior end, their ends being very close together. The excretory vesicle resembles that of *Derogenes* and the Hemiuridae. The median stem, which is very narrow, divides into two near the posterior border of the ventral sucker. The paired limbs pass out towards the sides of the body but at the level of the pharynx they turn in and unite dorsal to the pharynx.

The testes are symmetrically situated near the posterior end of the body, from which they are separated by a space equal to half their length. Each slightly overlaps the corresponding intestinal diverticulum and they are separated from each other by a narrow space through which runs the excretory vesicle. They are elongated oval bodies, measuring 0.22 × 0.14 mm. Their long axes are slightly oblique.

The genital aperture lies in the middle line immediately behind

the intestinal bifurcation. The somewhat elongated cirrus pouch contains only the pars prostatica and the ductus ejaculatorius. The vesicula seminalis lies entirely outside the pouch, with which it is connected by a fairly long duct, which is bent up alongside the pouch. The pouch is divided into two parts by a distinct constriction about its anterior third. The posterior part is entirely filled with the pars prostatica. The vesicula seminalis, which lies alongside the cirrus pouch and somewhat behind it, is a little smaller than the posterior portion of the pouch.

The ovary lies to the right of the middle line immediately behind the ventral sucker. It is a small globular body of 0.09 mm. diameter. The yolk glands lie on either side of it and a little in advance. Both overlap the intestinal diverticula. Each consists of a compact ovoid mass of follicles, which is somewhat larger than the ovary but smaller than the testes (0.15×0.08 mm.). The yolk ducts pass behind the ovary and a fairly conspicuous yolk reservoir is formed. There is a large shell gland and a small receptaculum seminis but Laurer's canal is apparently absent. It is somewhat doubtful if the receptaculum seminis is a constant structure. In the living specimen it appeared at times to be quite distinct but sometimes it seemed to be merely a dilatation of the oviduct. In no case did it contain more than a few spermatozoa. In the preserved specimens its presence could not be detected. The uterus is of no great extent and the largest specimen contained less than thirty eggs. Possibly none were completely mature. The eggs were scattered around the ovary and along the left side of the ventral sucker. They are remarkable in possessing a single long filament extending from the anopercular pole. The filaments were directed backwards and to some extent intertwined. The eggs are slightly curved and measure about 0.10×0.027 mm. and the filaments about 0.2 mm.

The systematic position of this form will be discussed after the next species has been described.

***Derogenoides ovacutus* n. g., n. sp.**

(Fig. 6.)

This is a form which bears a much greater resemblance to *Derogenes varicus* than the preceding species does, though it presents one or two marked features of difference. Numerous specimens were met with on one occasion in the stomach of *Trachinus draco*. The only other specimen of this fish which I have had an opportunity of examining was obtained from the North Sea and was not infected with this

parasite. Along with this new species there occurred a small number of specimens of *Derogenes varicus*.

It is a rather small form, mature specimens measuring only 0.6–0.9 mm. in length. 0.6 mm. appears to represent its minimum adult length as all the specimens below that were immature. Its shape is elongated, sub-cylindrical with rounded ends. The greatest breadth in an average specimen (0.73 mm. long) is 0.18 mm. The breadth, however, is fairly uniform. The cuticle is smooth and unarmed.

The oral sucker is subterminal with a small fleshy lobe projecting in front of it. It is globular with a diameter of 0.066 mm. The ventral sucker is also globular with a diameter of 0.123 mm. It lies 0.34 mm. from the anterior end, *i.e.* a very little in front of the middle of the body.

Contiguous with the oral sucker is a moderately large pharynx, measuring 0.039 mm. in diameter. The oesophagus is short and in no case longer than the pharynx. The intestinal diverticula are simple and fairly straight, reaching almost to the posterior end of the body.

The excretory vesicle resembles that in *Derogenes*, the unpaired median stem dividing some distance behind the ventral sucker (between the testes) and the paired limbs uniting dorsal to the pharynx.

The disposition of the genital glands also resembles that in *Derogenes*, the testes being approximately symmetrical with a slight tendency to obliquity. They are separated from the ventral sucker by a space of about 0.04 mm. and measure 0.12×0.096 mm. Their axes are oblique, the anterior pole in each case being directed outwards. Immediately behind the testes lies the large transversely oval ovary, the dimensions of which are 0.07×0.12 mm. Behind this again lie the globular yolk glands, which are practically symmetrical. In front of the ovary and between the posterior ends of the testes lies a small receptaculum seminis. The shell gland complex is situated on the dorsal side of the ovary.

The uterus is not very voluminous and contains only about 40 eggs. These are situated for the most part behind the yolk glands. The terminal part of the uterus passes up between the testes, over the right side of the ventral sucker and unites with the proximal end of the cirrus pouch. The eggs differ from those of *Derogenes* in having the anopercular pole drawn out into a sharp point. In their passage through the uterus the pointed end is always directed backwards. They measure $0.033\text{--}0.042 \times 0.015\text{--}0.019$ mm., the average being 0.038×0.018 mm.

The terminal part of the male organs bears a general resemblance to that of *Derogenes* but differs from it in detail. It is in the first place not so elongated, the vesicula seminalis being small and globular. The

pars prostatica is considerably shorter and the prostatic cells much fewer in number. The pseudo-cirrus pouch, however, is distinctly longer, being somewhat cylindrical instead of globular. The posterior end is slightly inflated. The genital aperture lies immediately over the intestinal bifurcation.

The two foregoing species present not a few features of considerable taxonomic interest. They obviously belong to the small group of forms, inhabiting the stomach, of which *Derogenes varicus* is the best known example. *Hemipera* differs from all the forms which may be included in this group by reason of the structure of its cirrus pouch, which contains not only the ductus ejaculatorius but also the pars prostatica. In all other members the latter is free. It presents the further peculiarity of having the testes situated behind the ovary. In this respect it resembles *Liocerca*, to which it is probably more closely allied than to any other genus.

Derogenoides, on the other hand, is a typical member of the group with a free pars prostatica and the testes in front of the ovary. It bears, indeed, a very close resemblance to *Derogenes*. The somewhat different structure of the terminal male organs, however, together with the more anterior position of the ventral sucker and the genital glands and the characteristically shaped eggs, appear sufficient grounds for excluding it from this genus.

The systematic position of *Derogenes* has for long been a difficulty. It was included in the family Hemiuridae by Lühe (1901) and its somewhat isolated position in this family was recognised by Odhner (1904) who suggested that a separate sub-family would probably be required for its reception. On the other hand, Looss (1907) definitely excluded it from this family. There can be little doubt, however, of its Hemiurid affinities. Its whole structure, apart from the absence of an appendix, gives evidence of this and there appears no very strong reason why it should for the present be excluded from this family. At the same time it displays considerable affinity with the Syncoeliinae and the inclusion of *Derogenes* within the Hemiuridae would necessitate the inclusion of this sub-family as well. Odhner (1911), indeed, has advocated the advisability of this step, including *Derogenes* actually within the sub-family Syncoeliinae. He extends the family moreover to include the Accacoeliinae and the group of which *Hirudinella clavata* is the chief representative. In this reconstructed family Looss's Hemiuridae takes the position of a sub-family.

In view of the great variety of structure which occurs in these forms Odhner's arguments in favour of a wider conception of the family

group appear to be well founded. It is particularly in regard to the terminal part of the male organs that the finer distinctions have arisen, but it seems inadvisable to allow the consideration of these to outweigh the value of other structural features. The various modifications of the cirrus pouch which are met with in the true Hemiurids appear again in the *Derogenes* group, and if the same narrow limits of classification were adopted in this group the necessity would arise of creating a number of small sub-families and of erecting the Syncoeliinae into a separate family. I am on that account in agreement with Odhner in considering that, for the present at any rate, such a scheme of sub-division would not be advantageous.

Obviously the two genera, *Hemipera* and *Derogenoides*, must be included in the sub-family Syncoeliinae, *Derogenoides* in close relation to *Derogenes* and *Hemipera* to *Liocerca*. In the event of further sub-division eventually becoming necessary it is apparent that these two pairs would form the nuclei of smaller groups, both differing from the true Syncoeliid type in having the ends of the intestines free, and the *Liocerca-Hemipera* group being further distinguished by the inverted position of the ovary and testes.

The inclusion of these two forms within the family Hemiuridae, *sensu lat.*, involves slight modifications of Odhner's amended definition, namely: Pars prostatica usually free but not in *Hemipera*. Ova 0.015–0.100 mm., usually oval, but sharply pointed at one end in *Derogenoides*, and filamented in *Hemipera*.

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EXPLANATION OF PLATE XI.

- Fig. 1. *Podocotyle syngnathi*. Ventral view. $\times 20$.
 Fig. 2. *Podocotyle syngnathi*. Cirrus pouch and vagina. $\times 80$.
 Fig. 3. *Lepidauchen stenostoma*. Ventral view. $\times 30$.
 Fig. 4. *Hemipera ovocaudata*. Ventral view. $\times 66$.
 Fig. 5. *Hemipera ovocaudata*. Shell gland complex. $\times 130$. Semi-diagrammatic.
 Fig. 6. *Derogenoides ovacutus*. Ventral view. $\times 150$.



