

ON THE ENTOZOA OF FISHES FROM THE
FIRTH OF CLYDE.

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(With Plate XXIX.)

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INTRODUCTION.

THE material on which the following notes are founded was collected during a short residence at the Marine Biological Laboratory, Millport, in August, 1908. A comprehensive survey of the marine fauna was impossible in so limited a time, but a fair idea of the parasites of some of the common fishes was obtained. I have to thank the Government Grant Committee of the Royal Society for enabling me to undertake this work. It is also necessary to gratefully acknowledge the courtesy of several members of the West of Scotland Marine Biological Association and of Mr Elmhirst, the director of the Millport Laboratory.

A considerable experience on the East coast of Scotland has shown that many species, particularly of Trematodes, common in certain regions along the western shores of Europe never occur in the fishes obtained from the Scottish part of the North Sea. For instance *Peracreadium genu* (Rud.), *Peracreadium commune* (Olss.), *Lebouria alacris* (Lss.), *Helicometra pulchella* (Rud.), *Proisorhynchus crucibulum*

(Rud.), and *Prosorhynchus aculeatus* (Odh.) have never been met with. Five of these species are plentiful on the Norwegian coast and at least two have been obtained from the coast of Belgium. The reason for their absence from the Scottish coast is to be found in the fact that their hosts are absent, in some cases the final host, in others the intermediate. *Labrus berggylta*, the chief and almost the only final host of the *Peracreadium* species, does not occur on the East coast of Scotland and probably in this case the absence of the parasite is correlated with the absence of its definite host. The same applies to *Lebouria alacris* (Lss. nec. Nicoll 1909), which occurs only in the *Labridae*. This can hardly be the case with *Helicometra pulchella*, however, for it parasitizes many hosts, some of which are not uncommon in the North Sea. Here we probably have to reckon with the absence of the intermediate host. In the case of the *Prosorhynchus* species, I have not had an opportunity of examining a sufficient number of congers, the specific host of the parasite, to express any opinion.

It was partly with the view of gaining some information on this matter that the work at Millport was undertaken. The six species above mentioned were obtained there, mostly in great abundance, and are now recorded for the first time from British fishes. An attempt (Nicoll and Small, 1909) was made to discover the larval forms, in the course of which several of the common invertebrates were examined, but without success.

My main object was to examine several species of fish which could not be readily obtained from St Andrews Bay and to institute if possible a comparison between the parasitic fauna of the East and West coasts. As to the latter, the insufficiency of the material hardly admits of a just comparison, although in a certain proportion of cases such a comparison is not altogether impossible. As at St Andrews most of the widely distributed European species were met with; in many cases they are recorded here from new hosts. Most of these forms, e.g. *Hemiurus communis* (Odh.), *Hemiurus lühei* (Odh.), *Derogenes varicus* (Müller), *Zoogonoides viviparus* (Olsson), *Lecithaster gibbosus* (Rud.) and *Leioderma furcigerum*¹ (Olss.) occur in fishes both from deep and inshore water.

The equally widely-distributed *Podocotyle atomon* (Rud.) occurs only in littoral fishes. On the East coast several hundred deep-water

¹ The distribution of this species, however, is possibly not so widespread as might have been expected, for I have failed to obtain it on the South coast of England (Aug.—Sept. 1909).

fishes have been examined without a single specimen of that parasite being obtained, whereas almost all the littoral fishes are infected with it. In the enclosed waters of the Firth of Clyde, however, additional hosts in the shape of *Gadus virens*, *Gadus pollachius* and *Pleuronectes limanda* presented themselves. These were all young fish and were captured close inshore. Whether or not they rid themselves of the parasite when they leave the inshore waters and grow to maturity I have not been able to ascertain, but it certainly has not been found in any of the few adult specimens of saithe or pollack which I have had an opportunity of examining. From this the conclusion which may with justice be drawn, is that *Podocotyle atomon* is essentially an inshore form and that its cercaria encysts in some littoral invertebrate. In connexion with this species another point which I was enabled to confirm, is the fact that although plentiful in the salt-water stickleback (*Gasterosteus aculeatus* var. *trachurus*) it does not occur in the fresh-water variety (var. *gymnurus*).

Of the 29 species of fishes obtained, 17 had already been examined on the East coast, seven have since been examined, while the remainder were only met with on the West. The latter however were mostly isolated individuals and the only typically western fish which was examined in any number was *Labrus berggylta*. Elasmobranchs were not dealt with. Amongst the Teleosteans only two Lophobranchs (*Syngnathus acus* and *Nerophis lumbriciformis*) were examined and they yielded no parasites.

Infection on the whole reached almost the same degree as on the East coast. 80 % of the total number of fish examined were infected with helminths of one or more kinds. Most numerous amongst these were Nematodes which were present in 76 %, Trematodes were found in 70 %, Cestodes in 46 % and Echinorhynchi in 13 %. In the case of Nematodes however, in only a little over 4 % were they found in the alimentary canal. Almost a third of the fishes harboured immature or larval Nematodes in their body cavity or encysted in the peritoneum. The great preponderance of Cestode infection was in the form of scolices, chiefly *Scolex polymorphus*, which occurred in 17 %. Only about 6 % were infected with adult tapeworms. This agrees very closely with the figures found at St Andrews and we may therefore take it that tapeworms are the most uncommon form of parasite in marine Teleostean fishes. This has also been noted by Linton (1910) in the case of American fishes.

By far the commonest parasite was undoubtedly *Podocotyle atomon*

which occurred in nearly a quarter of all the fishes. It was especially frequent in the gadoid fishes, to the extent of nearly 40 %. Next to *Podocotyle atomon*, *Zoogonoides viviparus* and *Ascaris clavata* were the commonest parasites, each occurring in over 16 %, the former especially in the PLEURONECTIDAE (61 %) the latter in the GADIDAE (65 %).

Altogether 22 species of Trematodes were obtained. This compares favourably with St Andrews where over a much longer period only 25 species were met with; and with the Northumbrian coast where Miss Lebour (1908) has determined the presence of 22 species of digenetic Trematodes. From these three localities a total of 40 species has now been recorded.

SYSTEMATIC SECTION.

TREMATODES.

Sub-family I. ALLOCREADIINAE Looss 1899.

Next to *Allocreadium* Looss *sens. str.*, *Peracreadium* Nicoll 1909 appears to be the most typical genus of this sub-family. It diverges from the fundamental type in the enormous development of the cirrus-pouch and in the extensive distribution of the yolk-glands. It resembles *Allocreadium* in almost every other particular. The main lines along which, in the sub-family, variations from the type proceed, are in the direction of (1) the displacement of the genital aperture; (2) the lengthening or shortening of the cirrus-pouch; (3) the lobing of the ovary; (4) the more extensive distribution of the yolk-glands and (5) the growth of filaments on the ova.

In the first direction *Podocotyle* (Duj.) Odhn. 1904 represents the extreme and it also presents a transition stage in respect of the ovary, cirrus-pouch and occasionally of the yolk-glands. The position of the genital aperture distinguishes the genus from all the other genera but in *Lebouria* Nicoll 1909 we have a well-defined intermediate stage in which the displacement has proceeded only a very short distance. There is not wanting evidence, moreover, in several as yet imperfectly known species to indicate that more intermediate forms exist. With regard to the cirrus-pouch *Allocreadium*, *Helicometra* Odhn. 1902 and *Lebouria* represent the typical short, plump form, although in the last named there has entered a modification of the pars prostatica which is met with again in *Podocotyle*. This genus and *Cainocreadium* Nicoll 1909 are the intermediate stages towards the extreme development in *Peracreadium*. The typical form of the ovary must be regarded as

round, with entire margin. The first modification of this is apparent in *Podocotyle* with its characteristic trilobate ovary. In *Cainocreadium* the lobes, still three in number, are more pronounced, while finally in *Helicometra* the number may be increased to five. The increasing distribution of the yolk-glands can be traced very distinctly from *Allocreadium* through *Podocotyle* and *Lebouria* to *Peracreadium* in which it attains its maximum. Under normal circumstances *Podocotyle* agrees with *Allocreadium* in having the yolk-glands limited by the level of the ventral sucker, but as I have shown (1909 *a*, p. 452), in certain specimens of *Podocotyle atomon* (Rud.) an asymmetrical group of follicles makes its appearance in front of the ventral sucker on the right side. Exactly the reverse condition will be shown later to occur in a species of *Lebouria* where the yolk-glands normally extend in front of the ventral sucker, but in some cases are entirely absent on one side in front of the sucker. The eggs in most *Allocreadiinae* show a distinct thickening of the shell at the anopercular end. Occasionally this may be so marked as to form a slight knob, but it is only in *Lebouria* that this assumes any size and becomes at all frequent. In many cases an unmistakable spine is formed, but this is by no means constant, for a large number of the ova have no spines and even hardly a trace of a knob. That the condition in *Lebouria*, however, is the forerunner of the filaments in *Helicometra* there can hardly be any doubt, unless, perchance, evolution has proceeded in the reverse direction.

There is thus no direct line of development through these six genera and the facts seem to point to their origin from a hypothetical common type, closely resembling *Allocreadium*. This supposition is strengthened by the probability that it was from some such form that the nearly-related sub-families *Lepocreadiinae*, *Stephanochasminae*, and possibly *Echinostominae*, also arose. The position of the testes and ovary and the uniform restriction of the yolk-glands behind the ventral sucker (except in a few genera of *Echinostominae*) are remarkably constant throughout these sub-families.

Genus i. *Peracreadium* Nicoll 1909.

Species 1. *Peracreadium genu* (Rud. 1819).

This species was found frequently in considerable numbers in the rectum of *Labrus berggylta* and usually in association with *Helicometra*

pulchella (Rud.). It is a species which appears to be almost exclusively confined to this particular host; it certainly did not occur in any other fish at Millport. The best existing description of the form is that of Odhner (1902, pp. 497—9, Pl. 33, fig. 3). It has not hitherto been met with in British waters and appears to be entirely absent on the East coast.

The body has an elongated shape, somewhat flattened, but showing considerable thickness in the region of the ventral sucker. The colour is neutral grey, forming a striking contrast to the rich brown of *Helicometra pulchella*, a difference which renders easy the separation of the two species when occurring together in the same host.

All my specimens are adult and measure 1·5—2·4 mm. The average length is 2 mm. and all the following measurements will refer to a specimen of that length. The greatest breadth, at the level of the ventral sucker, is 0·6 mm. The breadth diminishes gradually towards each end.

The oral sucker is globular and has a diameter of 0·2 mm., i.e. $\frac{1}{10}$ th of the body length. The ventral sucker is situated at a distance of 0·8 mm. ($\frac{2}{3}$ ths of the body length) from the anterior end. It is transversely oval and measures $0\cdot32 \times 0\cdot355$ mm. It is therefore less than twice as large as the oral sucker and about $\frac{1}{4}$ th of the body length.

The prepharynx is very short. The pharynx is large and round, measuring 0·13 mm. both in length and breadth. The somewhat rectangular shape noted by Odhner was not observed in my specimens, except occasionally in the living state. The oesophagus is a trifle shorter than the pharynx, having a length of 0·11 mm. The diverticula extend quite to the posterior end of the body.

The excretory vesicle is a simple one, reaching forward to the level of the anterior border of the anterior testis.

The genital aperture is median and is situated exactly at the level of the intestinal bifurcation. The cirrus-pouch is of great length and extends back to the level of the ovary. In young specimens it is usually not quite as long. Owing to its length, the characteristic club shape is not so well marked as in other members of the *Allocreadiinae*, the thickness being almost uniform. It contains a highly convoluted vesicula seminalis, a distinct though small pars prostatica, and a long slightly convoluted ductus ejaculatorius. In many specimens the cirrus was exerted and of great length. In not a few it was found inserted into the vagina of the same individual. This appears to be of rather frequent occurrence in this genus, for Olsson (1868) figures a specimen

of *P. commune* showing the same condition. It is suggestive of self-fertilisation.

The testes are situated in the posterior third of the body, the post-testicular space being $\frac{2}{3}$ ths of the body length. They are always directly tandem and contiguous. The shape is somewhat irregular but approaches a transverse oval, the breadth being always greater than the length. In size they vary considerably but the longer diameter is usually about $\frac{1}{3}$ th of the body length.

The ovary is situated immediately in front of the anterior testis, generally separated from it by the yolk-reservoir. It is on the right side of the middle line, of globular shape and somewhat smaller than the testes. The receptaculum seminis is of large size and lies slightly behind and dorsal to the ovary. It is in intimate connexion with the oviduct, there being no intervening receptacular duct. Laurer's canal is given off directly from the receptaculum.

The yolk-glands are unusually voluminous and of rather characteristic distribution. They fill up the post-testicular space and the lateral margins of the body as far forward as the posterior border of the ventral sucker, overlapping the testes and ovary to a slight extent. At the level of the ventral sucker they are entirely absent on each side but they again become voluminous in the neck, forming a continuous wedge-shaped mass in front of the ventral sucker, and extending forward to the level of the posterior border of the pharynx. The follicles are of moderate size, about 0.04 mm. in diameter.

The uterus is short and never contains more than 30 ova. The vagina is well marked and begins about the posterior border of the ventral sucker. The ova are rather large and broad, light yellow in colour and the shell is slightly thickened at the anopercular pole. The size varies considerably, *i.e.* 0.080—0.088 mm. in length and 0.044—0.056 mm. in breadth. The average size is 0.0845×0.051 mm. The rather great amount of variation in the breadth may possibly be due to the fact that the eggs are not completely circular in section but are flattened slightly from side to side.

Species 2. *Peracreadium commune* (Olsson 1868).

This species was also confined to *Labrus berggylta*, occurring along with, but much less frequently than *Peracreadium genu*. Only two specimens were obtained altogether. It bears a very close resemblance

to *P. genu*, but is not unreadily distinguishable from it by the difference in the distribution of the yolk-glands.

The two species are about the same size but *P. commune* is broader and flatter than *P. genu*. The colour has a tinge of brown in it. The suckers have much the same size and relative position but the ventral sucker is distinctly more oval than in *P. genu*. In a 2 mm. specimen it measures 0.22×0.31 mm. The pharynx presents one of the distinctive features of the species. It is almost fusiform in shape and much more elongated than in *P. genu*. Its size is 0.12×0.08 mm. The oesophagus is usually only about half the length of the pharynx. The diverticula extend to the posterior end.

In respect of the genitalia the two species are practically identical. The genital aperture has the same situation and the cirrus-pouch the same extent. The latter is possibly a little more dilated at its posterior end. The testes and ovary are decidedly smaller than in *P. genu* (about $\frac{2}{3}$ rds the size). It is to the yolk-glands that we must look for the most distinctive feature of the species. Their extent and distribution are almost exactly the same as in *P. genu*, except that they are not interrupted at the ventral sucker. From the small amount of material at my disposal I am not able to confirm Odhner's observation that this is a constant feature of difference between the two species, and in view of the amount of variation in the yolk-glands which is possible in other *Allocreadiinae*, it is not to be denied that the two species might verge into each other. Taken, however, with the other less striking specific features, namely the elongated pharynx, the oval ventral sucker and the small ovary and testes, it forms a reliable enough distinguishing feature.

According to Odhner the ova appear to be much narrower than in *P. genu*, but that is not the case in my specimens.

Genus ii. *Lebouria* Nicoll 1909.

Species 1. *Lebouria varia* n. sp. = (*Lebouria*) *alacris* (Lss.) Nicoll 1909.

The doubt with which I regarded the identity of this form with *Distomum alacre* Lss. has now been resolved into a certainty that they are distinct. The differences are, however, not by any means striking owing to the rather considerable amount of variation which occurs.

The species is almost exclusively confined to *Callionymus lyra* in which it occurs fairly frequently, but rarely in number exceeding half a dozen. It appears to be distributed round the whole of the British

coast for I have obtained it at St Andrews and also at Plymouth. It has however not been recorded from the East coast of England. The only other host in which I have found the species is *Pleuronectes platessa*, in which immature specimens were obtained twice. Its occurrence in this host is rare and is possibly fortuitous. The two fishes have four other parasites in common, and thus it is not altogether unexpected to meet a frequent parasite of the one occasionally in the other.

The specimens obtained in the Clyde were all immature but I have since collected a number of mature individuals from the South coast. The following description will be made mainly from the latter.

The species has the typical Allocread shape, broadest at the ventral sucker, tapering gradually towards the posterior end, which is blunt, and more rapidly towards the anterior end. The colour is dull greyish yellow. The length of egg-bearing specimens varies from 1.25—1.75 mm. the average being 1.5 mm. The greatest breadth is about $\frac{1}{3}$ rd of the length. The length 1.25 mm. seems to represent the maturity size, for quite a number of specimens were observed of sizes from 1.1—1.2 mm. in which egg production had not yet begun. The smallest specimen measured 0.32 mm. and the cereasia is evidently, therefore, of very small size.

The cuticle is unarmed and there are numerous subcuticular glands especially on the ventral surface anteriorly.

In an average specimen of 1.5 mm. length to which all the following measurements refer the oral sucker is subterminal and globular, with a diameter of 0.18 mm. The ventral sucker is transversely oval and may be raised on a pedicle in certain states of extension, as is the case to a greater or less extent with all the members of the sub-family. It is situated a little more than $\frac{1}{3}$ rd of the body length from the anterior end (0.56 mm.). Its diameters are respectively 0.29 mm. and 0.35 mm. The diameter of the oral sucker is thus about $\frac{1}{5}$ th of the body length and the diameters of the ventral sucker $\frac{1}{6}$ th and $\frac{1}{4}$ th respectively. The ratio of the transverse diameter of the suckers is very nearly 1:2.

There is a short prepharynx and a large pharynx, the diameter of which is more than half the diameter of the oral sucker. It is almost globular, the breadth being usually a little greater than the length (0.10 × 0.11 mm.). The oesophagus is short, being always shorter than the pharynx, about 0.06 mm. The intestinal diverticula diverge widely and terminate a little beyond the testes and thus at an appreciable distance from the posterior end of the body.

The excretory vesicle is a short simple sac, not extending further forward than the level of the anterior testis.

The genital aperture is situated a little in front of the intestinal bifurcation and is displaced somewhat to the left of the middle line. This would appear to be the characteristic position in the genus *Lebouria*. The cirrus-pouch is club-shaped, with a slight bend, and extends on to the dorsum of the ventral sucker but does not reach further back than the centre of the latter. It encloses a convoluted vesicula seminalis, much resembling that of *L. idonea*. The ductus ejaculatorius is short and almost straight, but occasionally it is somewhat convoluted. As in *L. idonea*, a pars prostatica is not distinctly differentiated, although prostatic cells are present. The testes are situated a little behind the middle of the body. They are placed invariably contiguous and obliquely, the anterior testis being always a little to the left. In only an occasional immature specimen were the testes directly tandem; in adults they were always oblique. No instance of amphitypy was observed. This oblique position of the testes would appear to be another characteristic of the genus for it occurs also in *L. alacris*, *L. obducta* and also, though not invariably, in *L. idonea*. They are of irregular ovoid shape, frequently approximating to a rounded triangular outline. The posterior testis is not uncommonly somewhat heart-shaped, with the apex directed backwards. They have never the transverse oval shape that commonly occurs in *L. idonea*. Their average diameter is about 0.2 mm. or a little less than $\frac{1}{4}$ th of the body length. The post-testicular space (*i.e.* space between posterior testis and end of body) is 0.28 mm. in length, that is, nearly $\frac{1}{4}$ th of the body length or somewhat less than one and a half times the diameter of the testis.

The ovary is situated midway between the anterior testis and the ventral sucker. The position, however, varies with the state of the animal, so that it may at one time be contiguous to the anterior testis, at another almost immediately behind the ventral sucker. Normally it is separated from the latter by a loop of the uterus and from the testis by the receptaculum seminis or occasionally the yolk-reservoir. It invariably lies to the right of the middle line and is a globular body with entire margins and a diameter of 0.105 mm.

The receptaculum seminis is pear-shaped and is situated on the same level as the anterior testis and contiguous with it as well as with the posterior testis and the ovary. Occasionally it lies almost dorsally to the ovary, as occurs in *L. idonea*. It is usually of considerable size,

Laurer's canal is given off directly from the receptaculum seminis and is of no great length. The shell-gland lies a little to the left of the ovary, between it and the yolk-reservoir, which is situated almost in the middle of the body.

The yolk-glands are very voluminous especially in the posterior half of the body. Their disposition is mainly lateral but they extend well to the inner side of the intestinal diverticula. They completely fill the post-testicular space. Further forward they overlap the margins of the testes and ovary to a variable extent. At the level of the ventral sucker they are as a rule sparse and may even be absent. In front of the sucker they increase again but are much less voluminous than in the posterior region. The glands from the two sides rarely if ever cross the middle line to unite in front of the ventral sucker as they do in *L. alacris*. Occasionally however a few stray follicles may be observed dorsal to the ventral sucker or cirrus-pouch. The anterior limit of the glands is subject to some slight variation. In most cases they stop a little behind the posterior border of the pharynx, but in a few specimens they reach the pharynx, in others they terminate at the level of the intestinal bifurcation. This, however, does not represent the full extent to which variation may proceed, for in at least one case the glands were entirely absent on the left side in front of the ventral sucker, although they were present to the normal extent on the right. The follicles are usually of large size with a diameter of 0.055 mm.

The uterus is very restricted in extent, being closely packed between the ventral sucker, the ovary and the anterior testis and containing only a small number of ova, never exceeding 20 in my specimens. The ova are almost exactly elliptical except that the opercular pole is blunted, almost flattened in fact. At the anopercular pole the shell is thickened, forming a slight knob but not nearly so pronounced as in *L. idonea*. They are of considerably larger size than in the latter species being 0.085—0.092 mm. in length and 0.038—0.051 mm. in breadth. The average size is about 0.088×0.045 mm.

This species must for the present be regarded as peculiar to *Callionymus lyra*. Its occurrence in *Pleuronectes platessa* can only be considered as accidental or at least very rare.

Species 2. *Lebouria alacris* (Looss 1901).

What I must now regard as the species actually described by Looss, was met with only once at Millport in *Labrus berggylta*. On the

South coast, however, I have obtained the species in considerable numbers from various LABRIDAE. It is not difficult to distinguish from *Lebouria varia* in the living state, but when preserved the differences are less marked and can be made out only by careful examination. At first sight the obvious difference in the disposition of the yolk-glands is striking, but beyond that there is little to go upon. On close inspection, however, one or two other differences will appear.

This species has much the same shape and appearance as *L. varia* but is distinctly lighter in colour, a fact which may be attributed to the less density of the yolk-glands and to the more delicate texture of the body in general. It is also much smaller than that species, being as a rule only about $\frac{2}{3}$ rds its size. The specimens from the South coast were all mature and measured 0.8—1.45 mm. in length. Looss's specimens therefore were of maximum size (1.5 mm.). The average of my specimens is almost exactly 1 mm. The greatest breadth at the level of the ventral sucker is 0.46 mm. or rather less than half the length. The oral sucker has a diameter of 0.155 mm. and is thus between $\frac{1}{4}$ th and $\frac{1}{3}$ th of the body length. The ventral sucker is transversely oval and measures 0.22×0.26 mm. Its greater diameter is therefore a little more than $\frac{1}{4}$ th of the body length. The ratio of the transverse diameter of the suckers is approximately 3:5. The ventral sucker is situated at a distance of 0.46 mm. from the anterior end and it is thus considerably nearer the centre of the body than is the case in *L. varia*.

There is a short prepharynx followed by a large pharynx measuring 0.077×0.066 mm. It is therefore absolutely smaller than that of *L. varia*, but proportionally it is actually of much the same size. The oesophagus as a rule is slightly longer than the pharynx, 0.09 mm. in length. The excretory vesicle has the same extent as in *L. varia*.

The genital aperture has also the same situation although it is perhaps a trifle further forward. The cirrus-pouch appears shorter owing to the backward displacement of the ventral sucker. Its posterior end only extends a short distance beyond the anterior border of the sucker. The disposition of the genital glands is almost precisely the same as in *L. varia*. The testes however are a little further back so that the post-testicular space comprises only $\frac{1}{4}$ th of the body length. The testes in addition are relatively smaller being only 0.12 mm. in diameter so that again the post-testicular space is equal to about one and a half times the diameter of a testis. The diameter of the ovary is about 0.085 mm.

In the yolk-glands we find the chief distinguishing character of the species. In the posterior part of the body they are exclusively marginal and rarely extend to the inner side of the intestinal diverticula. In the post-testicular space they do not unite and thus leave a vacant space behind the posterior testis. There is however occasionally a certain amount of proliferation. In no case do they overlap the testes or ovary. They are always continuous at the level of the ventral sucker and immediately in front begin to proliferate to such an extent that they extend right across the body. This extension however is entirely under the dorsal surface. They thus form a dorsal layer which extends from over the ventral sucker to well in front of the intestinal bifurcation. The anterior limit of the marginal follicles is about the level of the middle of the pharynx. Sometimes they barely reach the pharynx.

The uterus is confined in the same way as in *L. varia* and never contains more than 20 ova. The latter are a trifle shorter and broader but have otherwise the same shape. They measure 0.081—0.088 mm. in length by 0.041—0.054 mm. in breadth: average 0.083×0.049 mm.

To sum up the differences between the two foregoing species we find that the yolk-glands are differently disposed, that the ventral sucker is nearer the middle of the body in *L. alacris* and that the suckers are proportionally somewhat larger. The testes and post-testicular space are somewhat smaller and the oesophagus is longer. In addition *L. alacris* is a much smaller species than *L. varia* and begins to produce ova at a considerably smaller size (0.8 mm. as contrasted with 1.25 mm. in the case of *L. varia*).

With the addition of these two species the original definition (1909 *a*, p. 450) of the genus *Lebouria* requires slight modification as follows: Genital aperture slightly displaced from the middle line towards the left. Testes usually oblique, the anterior one being to the left. Ova measuring 0.065—0.09 \times 0.035—0.05 mm.

Genus iii. *Podocotyle* (Duj.) Odhner 1904.

Species 1. *Podocotyle atomon* (Rud.) 1802.

This species has already been exhaustively described by Odhner (1904, p. 320), Lebour (1907, p. 36) and myself (1907, p. 73, 1909 *a*, p. 451, 1909 *b*, p. 6). It is the commonest parasite of inshore fishes. At Millport it was found in *Cottus scorpius*, *Cottus bubalis*, *Pholis gunnellus*, *Gadus pollachius*, *Gadus virens*, *Pleuronectes limanda* and *Pleuronectes platessa*.

Genus iv. *Helicometra* Odhner 1902.

To this genus five species have now been referred, viz. *H. pulchella* (Rud.), *H. fasciata* (Rud.), *H. sinuata* (Rud.) *H. mutabilis* (Stossich 1902) and *H. flava* (Stossich 1903). Two other species described by Stossich, namely *Distomum gobii* and *D. labri*, also belong to this genus, but the latter was found by Odhner (1902) to be identical with *H. pulchella*. The identity of all the species, however, can hardly be regarded as beyond question. The genus *Helicometra* as defined by Odhner (1902, p. 161) forms a distinct systematic unit, the outstanding feature of which, separating it from all other *Allocreadiinae*, is the filamented condition of the ova. At the same time it is unfortunate that the genus should have been founded on a type-species which is, strictly speaking, still a *species inquirenda*, for Odhner failed to elucidate the anatomy of *Distomum pulchellum* Rud. on a point which may prove to be of the greatest importance, namely the condition of the testes. Odhner's identification (1902, p. 160, note 2) as the type specimens of *Distomum pulchellum* Rud. certain specimens in the Berlin collection labelled "*Distomum* Sp. *Labrus cynaedus* Neapel. Coll. Rudolphi" is itself open to dispute, although the probabilities are very much in its favour. Still more questionable is his conclusion that *Distomum labri* Stossich (1887) is identical with the form which he describes as *H. pulchella* (Rud.). It is almost inconceivable that Stossich could have described the testes as multilobate, with five to six lobes, had such not been the case. Yet Odhner examined one or more of Stossich's specimens and found them to agree with his own, in which the testes are entire (*ganzrandig*), the statement of which fact being underlined. It is evident that some discrepancy has entered here, the significance of which Odhner either ignored or failed to grasp. A possible explanation will be offered in the following notes.

By the kindness of Professor Monticelli of Naples, specimens of *Distomum gobii* (from *Gobius jozo*) and *Helicometra mutabilis* (from *Anguilla vulgaris*) from Stossich's collection were placed at my disposal. Specimens of *Distomum labri* and *Helicometra flava* were not available. From an examination of this material I have not the slightest doubt that the first two species are identical with each other and with the form which I am describing here as *Helicometra pulchella*. *Distomum labri* is also certainly identical with these and there is more than a

suspicion that the same might be said about *Helicometra flava*. Three at least, therefore, of Stossich's species are synonymous with each other and probably also with *Helicometra pulchella* (Rud.). I have as yet, unfortunately, not been able to examine specimens from Odhner's collection.

My specimens do not agree with Odhner's description, but correspond much more closely with Stossich's *Distomum labri* (1887). Considering that Rudolphi's and Stossich's specimens were collected in adjacent localities it is not improbable that they are identical, but that the form obtained by Odhner from the northern Labridae is the same species is somewhat doubtful.

Species 1. *Helicometra pulchella* (Rud.) 1819.

Synonyms. *Distomum gobii* Stossich 1883.

Distomum labri Stossich 1883.

Loborchis mutabilis Stossich 1902.

Helicometra mutabilis Stossich 1903.

This form occurred in the lower part of the intestine of *Labrus berggylta* and *Conger conger*, in about 60 % of the former and 33 % of the latter. It is usually met with in moderate numbers up to about twenty in a single host. It is readily distinguished in the intestinal contents by its rich brown colour. Young specimens, however, are comparatively colourless.

Its shape is like that of most ALLOCREADIINAE but the post-acetabular part is much flattened and leaf-like, with a fairly uniform breadth. The neck narrows gradually forwards from the ventral sucker, but is, as usual, capable of great extension. The length of adult specimens is 1.3—4.3 mm. the average being 2.5 mm. Those from the conger were particularly large. In the wrasse they never exceeded 3 mm. and in other fishes from which I have obtained the species elsewhere the average size was usually about 2 mm. It appears to attain maturity at a size of about 1.25 mm. but specimens containing a few malformed eggs have been found as small as 1.1 mm.

In an average specimen of 2.5 mm. length, the maximum breadth at the ventral sucker is 0.83 mm. Both suckers are globular. The ventral sucker retains this shape, no matter how the animal is killed or pressed. In this respect it differs from other ALLOCREADIINAE in which, during life, the ventral sucker may appear globular, but, on

death, it always assumes a transverse oval shape. It is, moreover, more sessile than usual. The oral sucker has a diameter of 0.23 mm. or rather less than $\frac{1}{10}$ th of the body length. The diameter of the ventral sucker is 0.35 mm. so that the ratio is 2:3. The ventral sucker is situated a little more than $\frac{1}{3}$ rd of the body length (0.9 mm.) from the anterior end. There is a very short prepharynx and the almost globular pharynx measures about 0.1 mm. in diameter. The oesophagus is barely half as long again as the pharynx and the bifurcation takes place about midway between the pharynx and the anterior border of the ventral sucker.

The excretory vesicle is simple and extends forward to the level of the ovary.

The testes are situated just behind the middle of the body, always directly tandem and contiguous. The post-testicular space comprises about $\frac{1}{4}$ th of the body length, but it varies from $\frac{1}{8}$ th to $\frac{1}{10}$ th. The posterior testis is always the larger of the two. They are confined between the intestinal diverticula and are never overlapped by yolk-glands. The outline of each testis is irregularly lobed, the lobing being in the majority of cases well-marked and unmistakable. The number of lobes is not constant, but there are usually from five to seven. In addition each lobe is frilled or sub-divided into smaller lobules. The lobing is entirely lateral and posterior. The anterior surface from which the vas efferens issues is comparatively even. The anterior testis is less lobulated than the posterior. The condition is most pronounced in young specimens; in old specimens the lobes appear to get pressed out by distension so that on a cursory examination the outline looks merely uneven. On careful inspection, however, the traces of the lobes can always be made out. Even in the largest specimens the testes are frequently as much cut up as in the younger ones. In specimens which have been incompletely fixed the outline of the testes is not uncommonly indefinite and under such circumstances it might be regarded as unlobed. The breadth of each testis is about 0.37 mm. The length of the anterior one is slightly less; that of the posterior rather more.

The genital aperture is situated in the middle line, in front of the intestinal bifurcation and near the middle of the oesophagus. The cirrus-pouch is short and narrow. It is straight or very slightly curved and extends back to the anterior border of the ventral sucker, or a little beyond it. It contains a convoluted vesicula seminalis and a moderately long ductus ejaculatorius which is also slightly convoluted.

A distinct pars prostatica appears to be absent as in the case of *Podocotyle* and *Lebouria*, but a number of gland-cells are present within the cirrus-pouch, which discharge irregularly into the ductus.

The ovary is situated immediately in front of and contiguous to the anterior testis and is much smaller than it. It may be either in the middle line or a little to the right or left. It is irregularly lobed, there being usually three or four main lobes each with an irregular outline. The anterior part from which the oviduct takes origin may also be considered an additional lobe. Most commonly its breadth greatly exceeds its length, but occasionally it is more compact. The receptaculum seminis is pear-shaped and of large size. It lies usually on the right side of the ovary, but not infrequently it is found on the left. From it a long Laurer's canal is given off. From the receptaculum the oviduct proceeds inwards to the ootype, receiving on its course the yolk-duct. The yolk-reservoir is small and lies in front of the ovary. The yolk-glands are extensive and have a definite and fairly constant configuration. Their greatest variation occurs in the neck. Here they usually stop short of the posterior end of the pharynx, but they may extend a little in front of this or terminate at the level of the middle of the pharynx. They are mainly lateral in position, following the course of the intestinal diverticula. They thus proceed inwards towards the intestinal bifurcation and in some cases the follicles unite in the middle line dorsally. In a few specimens there was a certain amount of proliferation in this region but in the great majority no union takes place. Behind the ventral sucker the follicles are entirely to the outer side of the intestinal diverticula, except at the level of the uterus where they overlap to a certain extent. At the level of the testes the yolk-glands never completely overlap the diverticula. In the post-testicular space their distribution is characteristic. They follow the outer border of the diverticula to their termination, turn there and follow the inner border of the diverticula to the posterior end of the second testis. No fusion of the follicles takes place in this space, the excretory vesicle always serving as a dividing mark between those on either side.

The uterus is confined to the space between the ovary and the ventral sucker. The condition of the ova gives it a configuration which is peculiar to the genus and unique amongst the ALLOCREADIINAE. In mature specimens it is arranged in the form of a spiral of three to five loops, superimposed on each other, and each a little in advance of the one below. Each ovum at its anopercular end is provided with a long filament, which is six to eight times as long as the ovum. These

are directed backwards and become intertwined into a spiral. Together they form a continuous thread on which the ova have the appearance of being stuck. The ova are all situated on the inner side of the spiral and at equal distances apart. In the vagina they tend to become separated from the spiral and are probably deposited singly although I have observed a complete spiral extruded. The filaments are not motile.

The ova number about fifty. They are dark brown in colour, with a moderately thick shell and have a characteristic shape. From the lateral aspect, which is the view usually obtained, they appear comma-shaped with the broad end pointing forward and the narrow end tapering off into the filament. One surface is therefore convex, the other concave, and the former is that which lies along the spiral. When turned over on to one or other of these surfaces the outline appears ovoid, the broad end again being anterior. In size they vary considerably. The length is 0.063—0.084 mm.; the transverse breadth 0.032—0.037 mm. and the breadth from convex to concave surfaces 0.027—0.33 mm. at its maximum. The average of these, to which the majority approximated, is $0.073 \times 0.033 \times 0.030$ mm. No segmentation takes place before the deposition of the eggs.

It is obvious that the foregoing description does not agree with that of Odhner (1901 and 1902) but that it agrees very closely with Stossich's description of *Distomum labri* (1887) and *Distomum gobii* (1883). The chief differences contained in Odhner's description are (1) the testes are entire and oblique; (2) the yolk-glands overlap the intestinal diverticula posteriorly, and form a continuous narrow band across the post-testicular space; (3) the genital aperture is just over the intestinal bifurcation and the cirrus-pouch extends to the middle of the ventral sucker; (4) the shape of the ovary is somewhat different and it is not directly in front of the testes. These differences, if constant, would be sufficient to constitute a difference in species. The probability, however, that they are not without the limits of variation induced me to examine carefully every individual specimen, amounting to nearly 200, in my collection. These were mostly obtained on the South coast of England and from such varied hosts as *Trigla pini*, *Gobius paganellus*, *Blennius pholis* and *gattorugine*, *Lepidogaster gouanii*, *Labrus mixtus*, *Ctenolabrus rupestris*, *Zeugopterus punctatus* and *Anguilla vulgaris* but a remarkable degree of uniformity was observed, and that they all belonged to one species there can be no question. In not one single case were the testes otherwise than strictly tandem; in almost every instance they

were distinctly lobed and in the exceptions, where distension had occurred, the lobing could be made out without much difficulty. The disposition of the yolk-glands in the post-testicular space was also always as I have described it. Upon these three features mainly the identity of the species depends. As already remarked, it is highly probable that the British form is identical with the Mediterranean form and therefore, with Rudolphi's original. The form described by Odhner, if errors of observation be excluded, may be regarded as a northern variety or species. The extreme degree of obliquity of the testes noted by Stossich in *Loborchis mutabilis* suggests that obliquity may be a possible variation in the species even although it has not been observed in my specimens.

Sub-family II. STEPHANOCHASMINAE Looss.

Genus i. *Stephanochasmus* Looss 1899.

Species 1. *Stephanochasmus baccatus* Nicoll 1907.

About half a dozen immature specimens were found in the intestine of a single *Cottus scorpius*. Being immature they can hardly be identified with certainty, but the number of cephalic spines, namely 28 in each row, points almost unmistakably to *S. baccatus*. In two of the specimens there were only 27 in each row, but variation in the number to this extent appears to be found in all the species of *Stephanochasmus*. The length of the spines was 0.024—0.032 mm.

The specimens measure 1.25—2.05 mm. in length. The maturity size must be about 2.2 mm. In the largest specimen the oral sucker measures 0.17 mm. and the ventral sucker 0.22 mm. The neck being well extended the prepharynx is two and a half times as long as the pharynx, which measures 0.13 × 0.10 mm. The cirrus-pouch extends only a short distance behind the ventral sucker.

The encysted larva of this species was found under the skin in *Pleuronectes limanda* (Nicoll and Small 1909) and has later been found by Elmhirst at Millport in *Drepanopsetta platessoides*.

Species 2. *Stephanochasmus pristis* (Deslongch).

A few immature specimens of this species were taken from the pyloric coeca of a cod (*Gadus callarias*). Miss Lebour (1908) was the first to record the occurrence of this species in the cod, but it is not at all common. She met with it in only 2 %.

The length of my specimens is about 1 mm., the breadth 0.15 mm. The suckers are approximately equal with a diameter of 0.12 mm. the oral being if anything larger than the ventral. The latter is situated 0.36 mm. from the anterior end. The cephalic spines are in two rows of 18 each and each row forms a complete uninterrupted circle. The spines are comparatively stout.

Sub-family III. LEOCREADIINAE Odhner 1904.

Genus i. *Lepidapedon* Stafford 1904 = *Lepodora* Odhner 1904.

Species 1. *Lepidapedon rachiaëum* (Cobbold 1858).

This species was found in considerable numbers in the intestine, usually towards the anterior end, of *Gadus pollachius* (55 %) and *Gadus virens* (45 %). Odhner has recorded it from *Gymnocanthus ventralis*, but in British waters it appears to be confined to the *Gadidae* and in particular to the two above-mentioned species together with *Gadus aeglefinus*. In *Gadus callarias* its place is taken by *Lepidapedon elongatum* (Lebour) and in *Gadus merlangus* by *Pharyngora bacillaris* (Molin). It has been fully described by Odhner (1904, pp. 332—7), Lebour (1908, pp. 59—60) and myself (1907, pp. 77—80).

Genus ii. *Pharyngora* Lebour 1908.

Species 1. *Pharyngora bacillaris* (Molin 1859).

Synonyms. *Distomum increscens* Olsson 1868, pro parte.
Pharyngora retractilis Lebour 1908.

The species on which the definition of the genus *Pharyngora* was founded by Miss Lebour was regarded by her as distinct from *Distomum bacillare* Molin, but that the two are identical there can be little doubt. From an examination of some specimens from *Gadus merlangus* which Miss Lebour was good enough to send me I have been able to assure myself that they are the same as those which I have obtained in large numbers from *Scomber scombrus* at Millport and elsewhere. Molin's original description (1859, p. 818), of the species is very incomplete, but it is accurate so far as it goes. It was redescribed and figured by Stossich (1887, p. 92, Pl. X, fig. 38) but two of the most important characters were omitted, namely the external vesicula seminalis and the cuticular spines. This is not surprising for the species is of great delicacy

and rapidly begins to macerate after the death of its host. Unless the parasite be obtained alive it is extremely difficult to discern the outline of the vesicula seminalis externa, and the spines are so minute that they might readily escape detection. Otherwise the resemblance is so great that there is little doubt Stossich was dealing with the same species¹. The species described by Olsson (1868, p. 36, Pl. 4, fig. 83) as *Distomum increescens* is also, as already noted by Odhner (1904, p. 332, note 4), in part identical with *Distomum bacillare*.

Pharyngora bacillaris (Molin) is the commonest parasite of the mackerel and was found at Millport in over 80 %. That figure is probably above the normal, but it certainly occurs in well over 50 % on other parts of the coast. It was not met with in any other fish in the Firth of Clyde, but elsewhere it is met with frequently in *Cyclopterus lumpus*, *Capros aper* and not uncommonly in *Gadus merlangus*. The infection is generally in considerable numbers and in *Cyclopterus* it may be enormous.

All the specimens from Millport were immature or just beginning to produce ova, so the following description will be based on specimens obtained elsewhere.

It is a delicate and slender form, generally colourless except for the uterus, which has the usual brownish yellow colour. Older specimens frequently have a rusty brown colour. The specific name is rather apt, for it is elongated and of almost uniform breadth. Dorso-ventrally it is considerably flattened. In life its movements are comparatively sluggish, resembling in this respect those of *Lepidapedon rachiaemum*, and they are mostly of a forward and backward character. It shows less tendency than other Distomes to curl from side to side. This may be correlated with the reduction in size of the ventral sucker, and may also account for the fact that specimens always die straightened out.

The length of mature individuals is 2—4.5 mm. The maturity size appears to lie almost exactly at 2 mm., but an occasional specimen without ova was met with over this length. No smaller specimen, however, was seen with eggs. The breadth is very uniform. It is usually greatest at the level of the testes but there is little difference up to the level of the ventral sucker. In front of that it gradually narrows to the square-cut anterior end. The posterior end is slightly

¹ From the examination of some of Stossich's specimens, kindly sent me by Professor Monticelli, I have been able to make certain that Stossich was dealing with the same species as I am here describing.

rounded but comes to a point at the extreme tip. In an average specimen of 2.75 mm. length the maximum breadth is 0.36 mm.

The cuticle is entirely covered with minute scale-like spines, most closely set in the neck and becoming sparse towards the posterior end. There is no special cephalic armature. A distinctive feature, which has escaped the notice of previous observers, is the presence of a pair of large pigment patches, one on each side of the pharynx. They consist of a number of points of deep brown colour, considerably scattered and lying towards the anterior end of the pharynx. They are present even in the oldest specimens.

The oral sucker is practically terminal, although its aperture has a ventral inclination. Its uncommon shape has suggested to Miss Lebour the name for the genus. It differs from the ordinary globular sucker in having its posterior end drawn out and it appears as if somewhat constricted about its middle part. Moreover, the posterior pole, where the prepharynx joins on, is usually slightly introverted, forming a sort of papilla in the bottom of the sucker. In specimens which have died before being collected, a variety of appearances may present themselves. In many the wide-mouthed funnel shape, figured by Stossich, is seen and this in conjunction with other circumstances suggests that Stossich's specimens had been dead some time before he obtained them. This would account for the absence of external seminal vesicle, spines and pigment patches in his figure. Frequently the sucker is found so greatly retracted that it is drawn quite within the body and communicates with the exterior only by a minute aperture. In several cases, again, the pharynx is found completely enclosed in the sucker and in one or two cases it had been actually ejected through the mouth. All these appearances point to a comparatively enormous muscular development of the anterior part of the body, and this again may be correlated with the relative weakness of the ventral sucker and the rest of the body. The sucker presents the further peculiarity of having the ventral border of its aperture notched in the middle line. This is a constant feature.

Although the oral sucker has an elongated appearance its length is really not greatly in excess of its maximum diameter and frequently indeed it is less. In a 2.75 mm. specimen the maximum diameter is 0.21 mm. The ventral sucker is situated at a distance of 0.95 mm. from the anterior end and the neck is thus a little more than a third of the body-length. The sucker is circular and flat but it is capable of being raised to a small extent above the surface of the body. Its diameter is 0.16 mm. and the ratio to the oral sucker is very nearly 3 : 4.

The alimentary system is of a unique type. There is a distinct though short prepharynx. Its length is usually about a third of the length of the pharynx. Frequently it is less and occasionally it is nearly as long as the pharynx. I have never observed a specimen in which it was three times as long as the pharynx, as noted by Miss Lebour. This could only occur when the animal was alive and the anterior end in a state of hyper-extension. In this respect Stossich's figure shows the normal state. The pharynx is rather small but very muscular. It measures 0.145×0.105 mm. and is usually thickest at its posterior end. The oesophagus, though apparently of great length, is in reality very short. What has hitherto been described as the oesophagus, is, as first noted by Odhner (1904, p. 338), not a true oesophagus, but is actually the initial parts of the intestinal diverticula fused together. It is lined with ciliated epithelium continuous with that of the gut. The intestinal bifurcation, therefore, takes place actually in the intestine and not at the junction of the oesophagus with the diverticula. The whole of the tract between the pharynx and the bifurcation, however, is not of the same nature for there is a short oesophagus with the usual structure and not lined with intestinal epithelium. This comprises about $\frac{1}{4}$ th of the total length from the pharynx to the bifurcation, which is 0.39 mm. The oesophagus therefore measures on an average 0.055 mm. and is thus about the same length as the prepharynx. The pseudo-oesophagus, as it has been termed by Odhner, is capable of considerable dilatation. The diverticula are of normal structure and extend quite to the posterior end of the body.

A converse type has already been described (Nicoll, 1909 *a*, p. 407) in the case of *Stephanophiala laureata* (Zed.) and some allied species, in which the intestinal bifurcation takes place actually in the oesophagus, so that the initial parts of the diverticula are morphologically portions of the oesophagus.

The excretory vesicle, described by Miss Lebour as extremely small, is on the contrary of great size. It is a long narrow sac stretching from the posterior end to well in front of the intestinal bifurcation. As far as can be made out, however, it is not invariably as large as this and it appears to be capable of a certain amount of contraction. An even larger excretory vesicle is met with in the allied genus *Lepocreadium*. In living specimens the main excretory tubules are very conspicuous especially in the neck. They are highly convoluted.

The testes are situated in the posterior third of the body, always directly behind each other. They are frequently contiguous, but never

pressed against each other. They may be separated by a small space occupied to some extent by yolk-glands. They are elongated oval in shape and of moderate size, the dimensions being 0.20×0.18 mm. In living specimens the outline is usually slightly crenated but this disappears on preservation. The post-testicular space is about $\frac{1}{4}$ th of the body-length or equal to twice the length of a testis.

The terminal part of the male reproductive organs consists of a muscular cirrus-pouch, containing a simple vesicula seminalis, pars prostatica and ductus ejaculatorius. In addition there is a vesicula seminalis externa, lying free in the parenchyma outside the cirrus-pouch and connected with the internal seminal vesicle by a short duct. It is sac-like, elongated and a little larger than the internal vesicle. It usually lies immediately behind the cirrus-pouch. The internal vesicula seminalis is small and almost globular. It opens directly into the pars prostatica, which is also somewhat globular. The ductus ejaculatorius traverses the remaining part of the cirrus-pouch. It is usually slightly convoluted and of nearly uniform calibre but sometimes it appears almost straight. No spines are present in it and I have never seen it exerted. The cirrus-pouch extends behind the ventral sucker for a distance rather greater than the diameter of the sucker.

The ductus opens into a comparatively large genital sinus, which is constantly oval in shape and lies on the left anterior border of the ventral sucker. Its representation by Miss Lebour on the right side is apparently an oversight.

The ovary is situated immediately in front of the anterior testis and may be contiguous with it or separated by a short distance. It is displaced from the middle line slightly to the right side and is considerably smaller than either testis. It is almost heart-shaped in outline, the apex being directed towards the middle line and from it the oviduct issues. The shell-gland complex is of normal type, the oviduct, yolk-duct and receptaculum seminis all opening into the proximal end of the ootype, and from the junction Laurer's canal is given off. The ootype is short and the shell-gland is diffuse. The receptaculum seminis lies to the left of and somewhat dorsal to and behind the ovary. Usually it is small and pear-shaped but occasionally it is found greatly distended and almost globular.

The yolk-reservoir lies between the ovary and the receptaculum seminis. The yolk-glands are dense but somewhat circumscribed. They fill the whole of the post-testicular space, uniting there across the middle line, and extend forward along the sides of the body to the

level of the posterior end of the cirrus-pouch. They cover the intestinal diverticula and overlap the testes to a slight extent. The variation in the anterior limit of the yolk-glands is very small and they never reach the ventral sucker as is shown in Miss Lebour's figure of *Pharyngora retractilis*.

The uterus occupies the space between the ovary and the ventral sucker but it is poorly developed. It consists of only a few small convolutions and the ova lie freely in them. The ova rarely exceed 50 in number. They are of regular shape, with uniform shell slightly thickened at the anopercular pole. They vary greatly in size, the limits in length being 0.072—0.091 mm. and in breadth 0.042—0.053 mm. The average dimensions are about 0.081×0.047 mm.

The larva of this species was obtained from some material brought in by a coarse-meshed tow-net at Plymouth in August. It was quite free when found and there was no evidence to show that it had escaped from any of the numerous Copepods and larval crustacea included in the haul. A number of them were examined but no cysts could be found. The specimen measured about 0.4 mm. and there could be no mistake as to its identity. The peculiarly shaped oral sucker, the conspicuous pigment patches, the long oesophageal tube and the large excretory vesicle, extending well in front of the ventral sucker, all combine to render its identity practically certain.

From the foregoing it is evident that Miss Lebour's original definition of the genus *Pharyngora* requires modification in certain important points. The changes and additions which require to be made are as follows:

LEPOCREADIINAE of delicate structure and elongated body; pigment patches alongside the pharynx, persisting in the adult; prepharynx comparatively short, pharynx small, oesophagus short but continued by a long pseudo-oesophagus lined with intestinal epithelium; excretory vesicle greatly elongated; genital aperture on the left anterior border of the ventral sucker; genital sinus capacious, ovoid in shape; vesicula seminalis externa lying free in the parenchyma and not surrounded by any specialized membrane or glands; cirrus-pouch elongated, extending behind the ventral sucker; vesicula seminalis in terminal communication with the pars prostatica.

Type and only species *Pharyngora bacillaris* (Molin 1859). Habitat, intestine of marine fishes.

It is also apparent that, as already indicated by Odhner, it falls naturally into the sub-family LEPOCREADIINAE, but its inclusion

necessitates some slight modification of the definition of that sub-family. It is more closely related to *Lepocreadium* than to *Lepidapedon*, and it is only separated from the former by the shape of the oral sucker, the presence of pigment patches, the short prepharynx and the presence of the pseudo-oesophagus. The changes which might be suggested in the definition of the sub-family are as follows:

Includes forms of 1—6 mm. in length; ventral sucker feebly developed and usually smaller than the oral sucker; prepharynx usually elongated but may be short; initial parts of intestinal diverticula may be fused to form a pseudo-oesophagus; Laurer's canal not arising directly from the receptaculum seminis.

The last-mentioned feature is a further point of distinction between this sub-family and the ALLOCREADIINAE, in which Laurer's canal arises directly from the distal end of the receptaculum seminis.

Sub-family V. FELLODISTOMINAE Nicoll 1909.

Genus i. *Leioderma* Stafford 1904.

Synonym. *Steringophorus* Odhner 1904.

I have hitherto used the name *Steringophorus* for this genus, but Stafford's name has priority, although at the same time his definition is inadequate.

Species 1. *Leioderma furcigerum* (Olsson 1868).

This species is evidently not nearly so common in the Firth of Clyde as on the East coast. It was found only in *Pleuronectes limanda* in 33 per cent. Taking all the *Pleuronectidae* examined, its occurrence was only to the extent of 12 per cent. In my experience it is twice as common on the East coast and according to Miss Lebour it is four times as common on the Northumberland coast. Its place in the Firth of Clyde appears to be taken to a large extent by the allied species *Leioderma cluthense*. On the South coast of England it seems to be entirely replaced by that species.

A very full account of the form is given by Odhner (1904, pp. 305—310) and Miss Lebour (1908, pp. 53—55).

Species 2. *Leioderma cluthense* Nicoll 1909.

This species was found in every specimen of *Pleuronectes microcephalus* and in no other host. A fairly complete description has already been published (Nicoll, 1909 a, pp. 472—475).

Sub-family VI. ZOOGONINAE Odhner 1902.

Genus i. *Zoogonoides* Odhner 1902.Species 1. *Zoogonoides viviparus* (Olsson 1868).

Next to *Podocotyle atomon* this was the commonest species found at Millport. It occurred in *Pleuronectes limanda* (67 %), *Pl. microcephalus* (100 %), *Pl. platessa* (67 %), and *Callionymus lyra* (80 %). It is thus extremely frequent in each of these hosts. In a previous paper (1909 *b*, p. 16) I remarked that the species occurred in *Pleuronectes flesus* at Millport, but that was in error for *Pl. limanda*. The former fish was not examined at Millport. The number of British hosts of the species is therefore only eight. Six of these are flat fish so that the species is a typical Pleuronectid parasite, notwithstanding the fact that *Callionymus lyra* is probably the most frequent individual host.

It almost invariably occurs in large numbers, 100 or more, even in young fish. As a rule it is most numerous in the rectum but frequently it extends throughout the intestine.

It is described in detail by Odhner (1902), Miss Lebour (1908) and myself (1907).

Sub-family VII. (DEROGENINAE).

Genus i. *Derogenes* Lühe 1900.Species 1. *Derogenes varicus* (O. F. Müller).

This occurred in the oesophagus and stomach of seven hosts, namely, *Cottus scorpius* (60 %), *Gadus callarias* (17 %), *Gadus merlangus* (100 %), *Gadus minutus* (50 %), *Gadus pollachius* (71 %), *Gadus virens* (14 %) and *Pleuronectes platessa* (17 %). Of these the last four are new British hosts. The total number of the latter is now 19, but this does not by any means exhaust the list, as I shall have occasion to show later. The species is the most widely distributed of all marine Trematodes. The infection in each host, however, rarely exceeds half a dozen.

Numerous descriptions of the species exist. The most recent are those by Odhner (1902), Johustone (1907) and Miss Lebour (1908).

Sub-family VIII. LECITHASTERINAE Odhner 1905.

Genus i. *Lecithaster* Lühe 1901.Species 1. *Lecithaster gibbosus* (Rud.) 1802.

This species was comparatively frequent. It was met with in the intestine of *Trigla pini*, *Gobius ruthensparri*, *Labrus berggylta*, *Gadus merlangus* and *Drepanopsetta platessoides*. With the exception of *Gadus merlangus* all these species are new British hosts of the parasite. In its wide distribution and in the fact that few specimens occur in each host, it resembles *Derogenes varicus*, but the numbers which occur are even much less than in the case of the latter species. In most of its hosts only a stray specimen occurs, but in *Gadus merlangus* quite a large infection may be met with. In *Drepanopsetta platessoides* also I found nearly a dozen specimens but they were all immature.

For a description see Odhner (1902), Lebour (1908), and Nicoll (1909 b).

Sub-family IX. STERRHURINAE Looss 1907.

Genus i. *Lecithochirium* Lühe 1901.Species 1. *Lecithochirium rufoviride* (Rud.) 1819.

This species is confined to the conger-eel, in practically every specimen of which it is to be found. It is a stomach parasite and occurs in enormous numbers. It has already been recorded from Millport by Elmhirst and Martin (1910).

It is a well-known species and has been frequently described, most recently by Johnstone (1907, pp. 177—180, as *Distomum ocreatum* Molin) and Looss (1908, pp. 144—147).

Sub-family X. (DINURINAE Looss 1907.)

Genus i. *Lecithocladium* Lühe 1901.Species 1. *Lecithocladium excisum* (Rud.) 1819.

This species also is confined to one host, *Scomber scombrus*, in the stomach of which it is frequently found, although never in such large numbers as is the case with the preceding species. The two are rather like each other in size, shape and colour but their internal structure is greatly different.

The last description is that by Looss (1908, pp. 131—2).

Sub-family XI. HEMIURINAE (Lühe 1901) Looss 1907.

Genus i. *Hemiurus* (Rud. 1819) Looss 1907.

Species 1. *Hemiurus communis* Odhner 1904.

This species was found in the stomach of six different fishes, namely, *Labrus berggylta*, *Gadus callarias*, *Gadus minutus*, *Gadus pollachius*, *Gadus virens* and *Drepanopsetta platessoides*. With the exception of the cod these are all new British hosts. It is now known to occur in 17 British fishes but that number will be largely added to. Like *Derogenes varicus* it is essentially a parasite of Gadoid fishes, but to a more marked degree. It also occurs in somewhat larger numbers than that species.

It has been described by Odhner (1904, p. 351), Lebour (1908, pp. 56—57) and myself (1907, pp. 86—88 and 1909 *b*, pp. 20—21).

Species 2. *Hemiurus lühei* Odhner 1904.

This species was found only in the herring (*Clupea harengus*) to the extent of 25 %. It is described by Odhner (1904, p. 352), Looss (1908, p. 105) and myself (1907, pp. 85—95 and 1909 *b*, 21—22).

Sub-order GASTEROSTOMATA Odhner 1904.

Genus i. *Prosorhynchus* Odhner 1904.

Species 1. *Prosorhynchus aculeatus* Odhner 1904.

This species is a frequent parasite of the intestine of the conger and has been met with by several observers. It was confused with *Prosorhynchus crucibulum* (Rud.) and it was only first recognised as distinct from that species by Odhner. It occurs in moderate numbers and is apparently confined to the conger.

Except in young specimens it possesses a distinct yellowish-brown colour. The body is thick, but slightly flattened dorso-ventrally; of almost elliptical shape but pointed towards each end. The cuticle is entirely covered with regular scale-like spines.

The length of mature specimens is 1—2.5 mm. Egg-production begins at a length a little over 1 mm. The maximum breadth is at the middle of the body and is about half the length. The dimensions of an average full-grown specimen are 2×0.95 mm. At the anterior end the

rhynchus (or rostellum) may be protruded like a small button, or retracted. In the latter case a shallow sucker-like depression is formed. The rhynchus is of simple, almost ovoid shape and its diameter is nearly twice its depth; it measures 0.27×0.15 mm. The mouth is situated little more than one quarter of the body length from the posterior end. The pharynx is flat and circular with a diameter of 0.14 mm. The intestine is a simple sac, extending forward from the mouth but not reaching the centre of the body. The excretory vesicle extends from the posterior end of the body as far forward as the level of the anterior testis, *i.e.* a short distance in front of the pharynx. It is a simple sac.

The testes are somewhat variable in position. They are of longitudinally oval shape and situated one on each side of the pharynx. The left testis is always in advance and its most usual position is on the level of the anterior border of the pharynx, while the right testis lies on the level of the posterior border of the pharynx. They vary about these positions, occasionally approximating the same level, but they are never absolutely symmetrical. Their dimensions are 0.26×0.20 mm. The cirrus-pouch is thick and of moderate length, extending forward to the posterior border of the left testis or to about a third of the body length from the posterior end. It thus extends a little in front of the pharynx, but occasionally just reaches the centre of the latter. It is invariably directed towards the left side of the body. An oval vesicula seminalis of medium size is situated outside the distal end of the cirrus-pouch and overlying it. It is connected with the pars prostatica by a narrower portion lying within the cirrus-pouch. The genital aperture is near the posterior end of the body.

The ovary lies on the right side almost exactly on the level of the middle of the body. It is thus a little further forward than the left testis. It is longitudinally oval in shape and not much smaller than the testes. The yolk-glands form a very symmetrical arc in the anterior part of the body. The transverse portion of this arc crosses the body about 0.4 mm. from the anterior end; the lateral portions extend back along each side to near the middle of the body, *i.e.* to near the level of the ovary. The follicles are large, and regularly disposed. Alternate follicles are situated on either side of the yolk-duct. The right yolk duct passes immediately in front of the ovary towards the centre of the body but the left duct has a longer course. It passes inwards in front of the left testis, crosses the intestine, then turns forwards to join the other at the level of the ovary. A receptaculum seminis is absent but Laurer's canal is present. The uterus is of great length and is thrown

into numerous convolutions. Beginning on the inner side of the ovary it passes backwards towards the right testis then turns and winds round the outer side of the ovary. Within the arc formed by the yolk-glands it makes a number of intertwining loops. It then passes round the left testis and so towards the genital sinus. This arrangement is almost peculiar to the species. The uterus is for the most part in front of the pharynx but it does not extend in front of the yolk-glands. The ova are numerous and of regular broad oval shape. They measure 0.026—0.031 mm. in length and 0.016—0.020 mm. in breadth, the average being 0.0285×0.0185 mm.

Species 2. *Prosorhynchus crucibulum* (Rud. 1819).

This is the second and larger of the two Gasterostomes, which are harboured by the conger. Like *P. aculeatus* it occurs in no other host. It was met with only half as frequently but it is probably quite as common as the other species.

Hitherto, although encountered by a number of observers, the species has not been correctly described. Originally described by Rudolphi as a *Monostomum*, it was redescribed by Molin (1858 and 1861) as a new species of Gasterostome. Rudolphi's description was recognised and amplified by Olsson (1876) who, however, curiously enough, failed to see that it was identical with Molin's species. With the latter he confused *P. squamatus* and *P. aculeatus*. Odhner (1904) disentangled this confusion and succeeded in defining the three species fairly accurately. His diagnosis of *P. crucibulum*, however, based as it was on rather scanty material, is the least satisfactory of the three, and does not give an adequate idea of the form. Strictly speaking it is incorrect.

My material consists of about a dozen adult specimens from the Clyde and a large number of immature and a few adult specimens from the South coast. The length of adult individuals is 2—3.7 mm. Egg production does not occur under 2 mm. Molin gives the length as 4—6 mm. Odhner's size-limits (1.75—2.25 mm.) are, therefore, much too restricted.

The shape of the body is different from that of *P. aculeatus*; it is elongated, squarely cut at the anterior end and pointed posteriorly. It is slightly flattened and the greatest breadth (about $\frac{3}{8}$ ths of the length) occurs near the middle. An average mature specimen measures 3.15×1.1 mm.

Large specimens have a rich yellowish-brown colour, due largely but not entirely to the numerous ova. Young ones are almost colourless. The whole body is covered with scale-like spines, most densely set anteriorly. The rhynchus is of very large size. In outline it is wedge-shaped, the apex of the wedge penetrating deeply into the body, and the base, forming the anterior end of the animal, being rounded and expanded. In certain cases the apex of the wedge is twisted, giving the rhynchus the "cornucopia" shape described by Molin. Frequently, especially in young specimens, the rhynchus forms a protruding button-like structure. Under normal circumstances the edge of the expanded anterior end is drawn out somewhat to form a projecting ridge, completely encircling the rhynchus. This is only well seen when the animal is alive. In a 3.15 mm. specimen the dimensions of the rhynchus are 0.62×0.57 mm. The histological structure closely resembles that of *Prosorhynchus squamatus* as described by Odhner.

The mouth is situated almost exactly in the centre of the body. The pharynx is circular and measures 0.21 mm. in diameter. The intestine extends forwards for a distance of about 0.3 mm. from the pharynx. It is an ovoid or globular sac, connected with the pharynx by a narrower portion. The excretory vesicle is comparatively short, extending forward about a third of the body length from the posterior end, *i.e.* to the level of the right testis.

The position of the genital glands is a feature on which no two descriptions agree. Molin places the testes symmetrically midway behind the pharynx and the ovary in front of the left testis. Olsson was able to see only two of the glands, one on each side of the pharynx and almost on the same level. In all probability the one on the right was the ovary. According to Odhner they have the same relative positions as in *P. squamatus*. I have found specimens corresponding with those described by Olsson and Odhner but never one in which the ovary was on the left side. Molin's drawing, however, was almost certainly made from the dorsal surface. The species, in respect of the genital glands, is by far the most variable which I have ever examined. No two specimens are absolutely alike and it is difficult on that account to indicate what may be considered the normal or typical structure. From my specimens it would appear that the condition more nearly approaches that in *P. aculeatus* than in *P. squamatus*, in so far as the testes are much more frequently placed across the body than one behind the other. In every case they are behind the pharynx, but nearer it than the posterior end of the body. In the majority they are placed one

towards each side of the body, with the left testis somewhat in advance of the right. They however may approach each other and even overlap, the left still being in advance. The right one, on the other hand, may be in advance, and from this overlapping position they may diverge till they come to lie obliquely tandem with the right in advance. In this position they are never widely separated and generally lie towards the right side of the body. The position of the ovary varies correspondingly. When the testes are in the first position described, it is usually situated immediately behind the pharynx, in the middle line. As the testes change in position it tends to move obliquely forwards to take up a limiting position at the right side of the pharynx.

It is impossible then to describe in a word the topography of the genital glands, but if that be attempted it were best summed up in: Ovary towards the right side, just behind the level of the pharynx; testes, oblique, a short distance behind the pharynx.

The testes are usually almost globular and have a diameter of 0.28 mm. The cirrus-pouch is short and stout and its extremity lies about a third of the body length from the posterior end. It usually lies towards the left side. Its internal structure is similar to that in *P. aculeatus*.

The diameter of the ovary is 0.25 mm. and it is thus little less than the testes. Just behind it lies a large shell-gland, with a Laurer's canal but no receptaculum seminis. The yolk-glands form a continuous arc across the body behind the rhynchus. The follicles are more irregular in size and disposition than those of *P. aculeatus*, and they are more massed together. The lateral follicles extend back to about the level of the blind end of the intestine, there being usually a slight inequality on the two sides so that those of the left reach a trifle further back than those on the right. The yolk-ducts are very long and pass down one on each side to unite behind the ovary.

The uterus is as a rule not so voluminous as in *P. aculeatus* and it is only in specimens over 3 mm. that it attains any great length. In smaller specimens it is confined very much to the left side and consists merely of an ascending limb from the ovary to the middle of the yolk-glands and thence a descending limb to the genital sinus. It increases in size by sending a loop down on the right side of the cirrus-pouch, but mainly by forming several convolutions in front of the pharynx, between it and the yolk-glands. The ova are very numerous and light yellow to dark brown in colour. They measure 0.026—0.030 mm. by 0.016—0.021 mm. the average being 0.029×0.019 mm. They are therefore of much the same size as those of *Proisorhynchus aculeatus*.

CESTODA.

As already remarked, Cestode parasites were rather uncommon, the only fish to harbour adult tapeworms being *Cottus scorpius* and *Gadus pollachius*. In 40% of the former *Bothriocephalus bipunctatus* Zeder was found, and in 55% of the latter *Abothrium rugosum* (Goeze) occurred. Both of these parasites are common and well-known forms and require no additional description. *B. bipunctatus* is an exceptionally frequent parasite of the turbot (*Bothus maximus*) and *Abothrium rugosum* is a typical Gadoid parasite.

Bothriocephalus scolices were found in the intestine of *Gobius ruthensparri* and *Labrus berggylta* but in very scanty numbers.

Scolex polymorphus Rud., which, in one or other of its various forms, is probably the commonest parasite of marine Teleostean fishes, was found in the alimentary canal of ten different fishes. It occurred most frequently in *Drepanopsetta platessoides*, *Conger conger* and *Labrus berggylta*, being present in at least 50% of these fishes. Of the total number of fish examined at Millport 16% were infected by this parasite. This figure is exceeded only by *Podocotyle atomon* (22%).

This peculiar scolex is a composite form and includes the larvae of several species of *Calliobothrium* which become adult in the intestine of Elasmobranch fishes. A full description of it will be found in Zschokke (1889, pp. 251—259, Pl. VI, figs. 103—4).

A LIST OF THE FISHES EXAMINED, WITH THEIR PARASITES.

ACANTHOPTERYGII.

Scomber scombrus.

Pharyngora bacillaris (Molin).	Intestine.
Lecithocladium excisum (Rud.).	Stomach.
Scolex polymorphus Rud.	Intestine.

Cottus scorpius.

Podocotyle atomon (Rud.).	Intestine.
Stephanochasmus baccatus Nicoll.	Rectum.
Derogenes varicus (Müller).	Stomach.
Bothriocephalus bipunctatus Zeder.	Intestine.
Scolex polymorphus Rud.	Intestine.

Cottus bubalis.

Podocotyle atomon (Rud.)	Intestine.
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ACANTHOPTERYGII (*cont.*).*Callionymus lyra.*

Lebouria varia Nicoll.	Stomach and intestine.
Zoogonoides viviparus (Olss.).	Rectum and intestine.
Scolex polymorphus Rud.	Intestine.

Trigla pini.

Lecithaster gibbosus (Rud.).	Intestine.
Scolex polymorphus Rud.	Intestine.

Gobius ruthensparri.

Lecithaster gibbosus (Rud.).	Intestine.
Bothriocephalus scolex.	Intestine.

Pholis gunnellus.

Podocotyle atomon (Rud.).	Intestine.
Scolex polymorphus Rud.	Intestine.

PHARYNGOGNATHI.

Labrus berggylta.

Peracreadium genu (Rud.).	Rectum.
Peracreadium commune (Olss.).	Rectum.
Lebouria alacris (Lss.).	Intestine.
Helicometra pulchella (Rud.).	Rectum and intestine.
Lecithaster gibbosus (Rud.).	Intestine.
Hemiurus communis Odhn.	Intestine.
Scolex polymorphus Rud.	Rectum.
Bothriocephalus scolex.	Rectum.

ANACANTHINI.

Gadus minutus.

Derogenes varicus (Müller).	Stomach.
Hemiurus communis Odhn.	Stomach.
Scolex polymorphus Rud.	Coecca.

Gadus callarias.

Stephanochasmus pristis (Deslongch).	Coecca.
Derogenes varicus (Müller).	Stomach.
Hemiurus communis Odhn.	Stomach.
Scolex polymorphus Rud.	Gall bladder.

Gadus virens.

Podocotyle atomon (Rud.).	Coecca and intestine.
Lepidapedon rachiaeum (Cobbold).	Intestine.
Derogenes varicus (Müller).	Stomach.
Hemiurus communis Odhn.	Stomach.

Gadus merlangus.

Lecithaster gibbosus (Rud.).	Intestine.
Derogenes varicus (Müller).	Stomach.

ANACANTHINI (*cont.*).*Gadus pollachius.*

Podocotyle atomon (Rud.).	Intestine.
Lepidapedon rachiaeum (Cobbold).	Intestine.
Derogenes varicus (Müller).	Stomach.
Hemiurus communis Odhn.	Stomach.
Abothrium rugosum Goeze.	Coecca and intestine.
Scolex polymorphus Rud.	Intestine.

Pleuronectes limanda.

Podocotyle atomon (Rud.).	Intestine.
Stephanochasmus baccatus Nicoll (larva).	Muscles.
Leioderma furoigerum (Olss.).	Intestine.
Zoogonoides viviparus (Olss.)	Rectum and intestine.

Pleuronectes microcephalus.

Leioderma cluthense Nicoll.	Coecca and intestine.
Zoogonoides viviparus (Olss.).	Rectum and intestine.

Pleuronectes platessa.

Lebouria varia Nicoll.	Intestine.
Podocotyle atomon (Rud.).	Intestine.
Zoogonoides viviparus (Olss.).	Rectum and intestine.
Derogenes varicus (Müller).	Stomach.
Cryptocotyle concava (Crepl.) (larva).	Muscles.

Drepanopsetta platessoides.

Lecithaster gibbosus (Rud.).	Intestine.
Hemiurus communis Odhn.	Stomach.
Scolex polymorphus Rud.	Intestine.

PHYSOSTOMI.

Clupea harengus.

Hemiurus lühei Odhn.	Stomach.
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Conger conger.

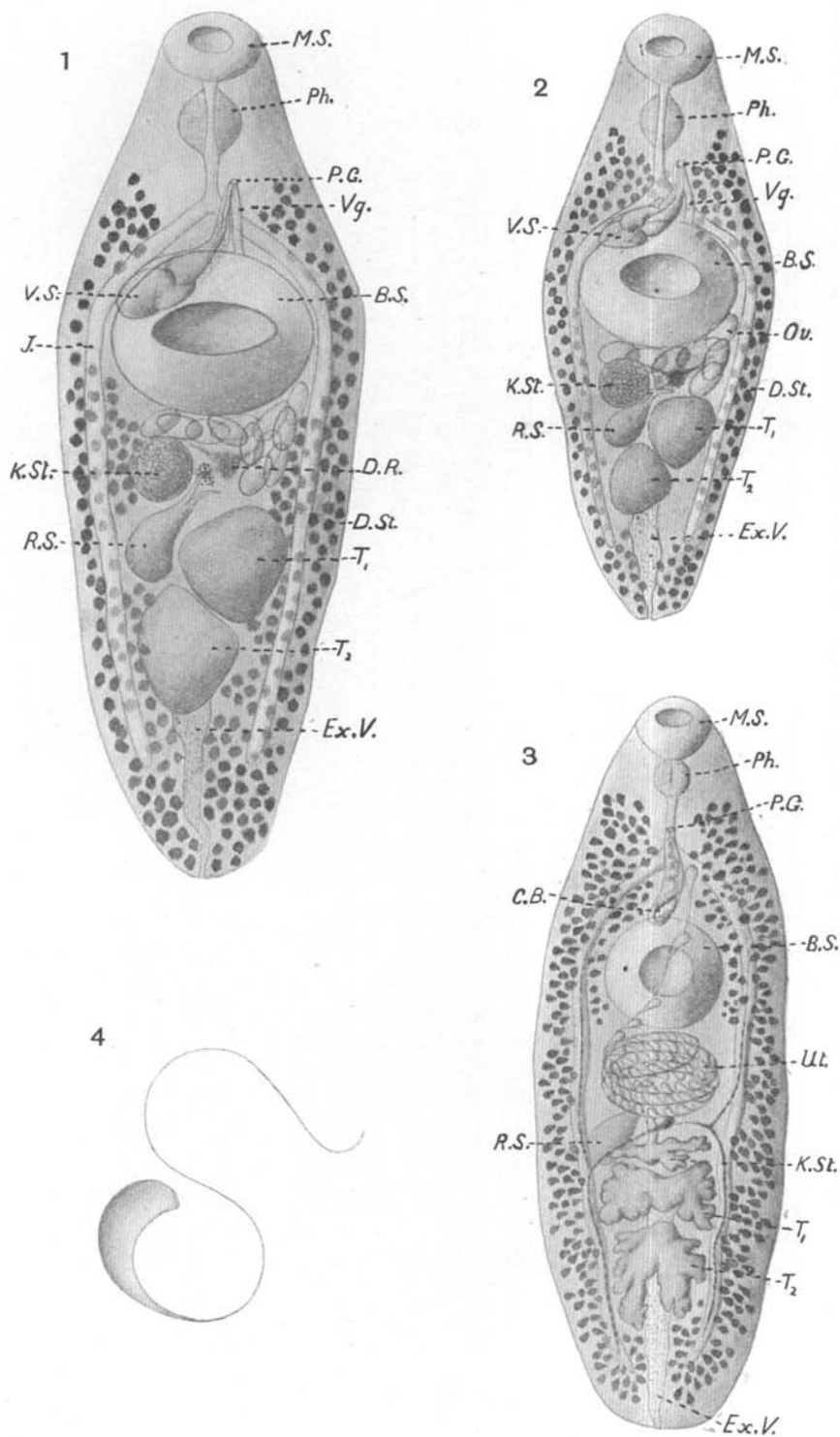
Helicometra pulchella (Rud.).	Rectum.
Lecithochirium rufoviride (Rud.).	Stomach.
Prosorhynchus aculeatus Odhn.	Intestine.
Prosorhynchus crucibulum (Rud.).	Intestine.
Scolex polymorphus Rud.	Rectum.

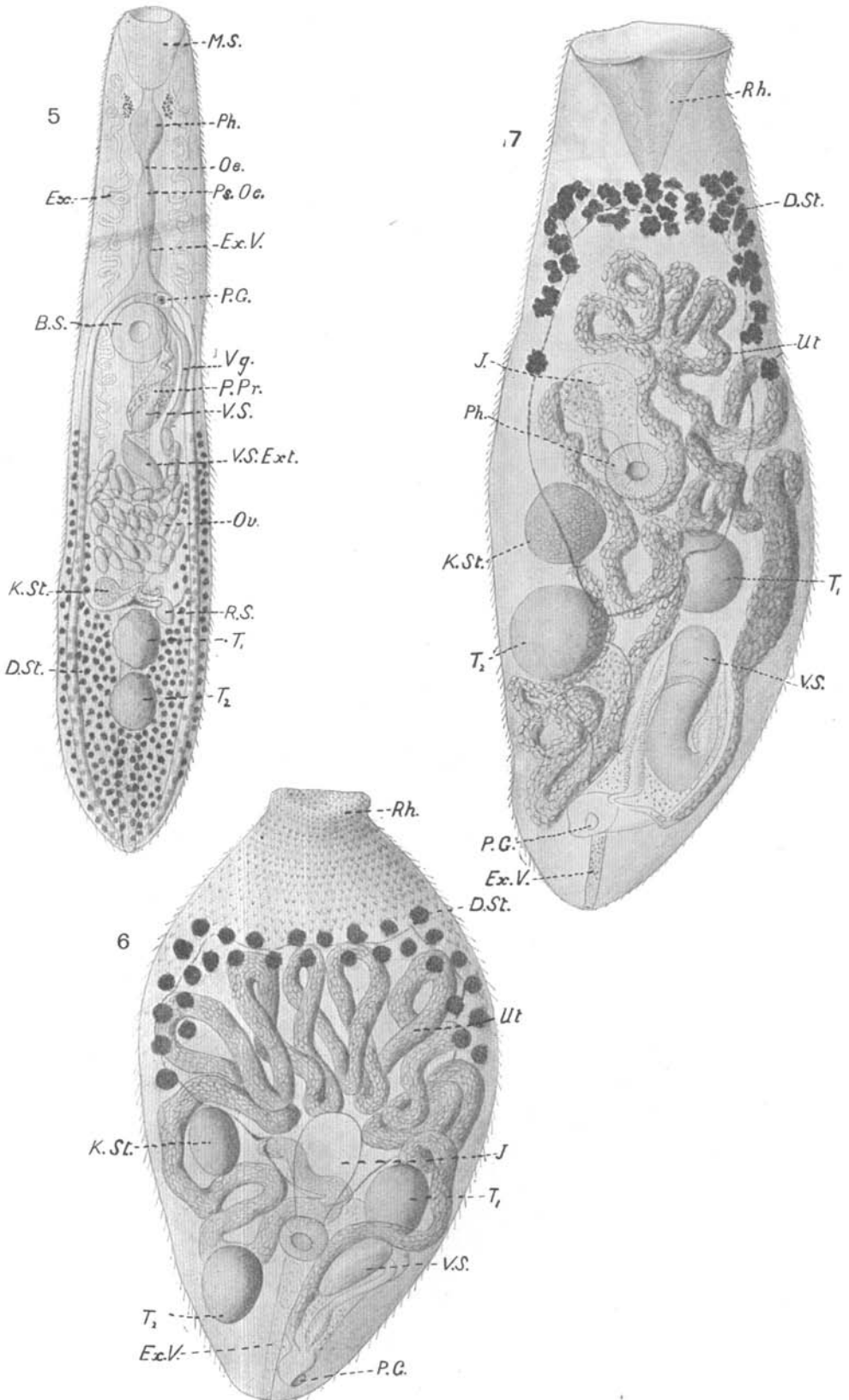
The following fishes contained no platyhelminth parasites:

Agonus cutaphractus, *Trigla gurnardus*, *Gasterosteus aculeatus* (var. *gymnurus*), *Gastrea spinachia*, *Ctenolabrus rupestris*, *Pleuronectes cynoglossus*, *Scophthalmus umaculatus*, *Anguilla vulgaris*, *Syngnathus acus*, *Nerophis lumbriciformis*.

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EXPLANATION OF PLATE XXIX.

The following letters apply to all the figures:—

<i>B.S.</i>	Ventral sucker.	<i>Ph.</i>	Pharynx.
<i>C.B.</i>	Cirrus pouch.	<i>P.Ph.</i>	Prepharynx.
<i>D.E.</i>	Ductus ejaculatorius.	<i>Ps.Oe.</i>	Pseudo-oesophagus.
<i>D.St.</i>	Yolk glands.	<i>P.Pr.</i>	Pars prostatica.
<i>Ex.V.</i>	Excretory vesicle.	<i>Pr.</i>	Prostate glands.
<i>Ex.</i>	Excretory tubules.	<i>Rh.</i>	Rhynchus.
<i>J.</i>	Intestinal diverticula.	<i>R.S.</i>	Receptaculum seminis.
<i>K.St.</i>	Ovary.	<i>S.D.</i>	Shell gland.
<i>L.C.</i>	Laurer's canal.	<i>T₁, T₂.</i>	Testes.
<i>M.S.</i>	Oral sucker.	<i>Ut.</i>	Uterus.
<i>Oe.</i>	Oesophagus.	<i>Vg.</i>	Vagina.
<i>Ov.</i>	Ova.	<i>V.S.</i>	Vesicula seminalis.
<i>P.G.</i>	Genital aperture.	<i>V.S.ext.</i>	Vesicula seminalis externa.

- Fig. 1. *Lebouria varia*, n.sp. Ventral view. $\times 80$.
- Fig. 2. *Lebouria alacris* (Lss.). Ventral view. $\times 80$.
- Fig. 3. *Helicometra pulchella* (Rud.). Ventral view. $\times 50$.
- Fig. 4. " " " Ovum. $\times 275$.
- Fig. 5. *Pharyngora bacillaris* (Molin). Ventral view. $\times 66$.
- Fig. 6. *Prosorhynchus aculeatus* Odhner. Ventral view. $\times 45$.
- Fig. 7. *Prosorhynchus crucibulum* (Rud.). Ventral view. $\times 45$.