LANCASHIRE AND CHESHIRE FAUNA COMMITTEE.—No. 103.

# PARASITES OF ENCHYTRAEID WORMS.

(Found in Lancashire and Cheshire.)

By the Rev. H. Friend.

## I.—The Family ANOPLOPHRYIDAE.

In the year 1896 I was in Lancashire collecting Annelids. (3). On February 15th a visit was paid to Askam, near Furness, where I found some Enchytraeids of both kinds, viz., Pachydrilids or red-blooded, and those with colourless fluid. Among these were two species of parasitic ciliates, such as the earlier writers called Opalines. Fortunately I made sketches of the living forms, so that after an interval of twenty years it is still quite easy to identify the species.

Since that time, and more particularly during the past year or two, the subject of Enchytraeid parasites has claimed much of my attention. Up till the present no attempt has been made by any of the authorities on this group of parasites, whether in England or abroad, to work them out systematically. Casual references to the existence of Ciliate Infusoria in the Enchytraeids may be found in the Memoirs devoted to parasites, but heretofore the workers among worms have not specialised on parasites, any more than the authorities on parasites have mastered the Enchytraeids.

I am therefore glad of this opportunity of showing, by local illustrations, something of what is already known on the subject, and what may be expected to result from a careful survey of the material from other parts of the country.

The parasites of Enchytraids are of various kinds—Nematodes, Gregarines, Infusoria, and several other forms being constantly encountered. I begin with the Ciliates first, because these were among the earliest to be observed ; secondly,

because they are probably the most widely known and studied; and lastly, because they occur much more frequently than most of the other forms.

It is not necessary that we should go fully into the history of the subject, as a complete historical survey would take up much time and space, and is the theme of an exhaustive paper which I shall in due course publish elsewhere.

For something like a century internal parasites have been from time to time recorded as occurring in the Enchytræids. In 1862 Claparède described specimens found in the Hebrides (2). But it was not till Cépède (1) took up the subject about a decade ago that the previous chaos began to give place to order, and the family Anoplophryidæ was created. He divided the family into six subfamilies, and defined a large number of genera and species; but did not give any systematic study to those species which are found in Enchytraeids. We gather, however, from a careful collation of his records that three or four different parasites belonging to this family had been described. He definitely names *Anoplophrya filum* Clap., and *A. pachydrili* Clap., together with *Mesnilella fastigata* Möb., and possibly *M. secans* Stein, as Enchytraeid parasites; and in error (p. 525, 569) refers to this family of worms a parasite found in association with an injured Lumbriculid. Curiously enough I have found the same parasite in connection with an injured Enchytraeid from Rostherne, Cheshire, to which reference will be made in due course.

The parasites under review so far known to occur in our district belong to three genera, *Anoplophyra*, *Mesnilella*, and *Lada*. The latter, though at present regarded as the representative of a different family (Ladidæ) is here taken with the Anophlophryidæ for convenience of arrangement. Eight species have up till the present come under my observation, not counting the Opalines and others which will come up for consideration later.

It may be said, generally, that the Ciliate Infusoria included in this paper are minute internal parasites, floating freely in the coelomic fluid or infesting the intestine of Enchytraeids. There is no mouth or other organ for prehensive or suctorial purposes, but the body is covered with cilia externally, and marked internally by contractile vacuoles, a macronucleus, and, in the case of *Mesnilella*, by a whip-like organ extending through a greater or lesser portion of the body. Some species divide transversely, while others produce posterior buds.

## 1. **Anoplophrya filum** Clap.

This parasite was first described in 1862 as *Opalina filum* from specimens found in *Clitellio arenarius* O. F. M., a coastal Tubificid frequently found on our shores. Saville Kent (4) placed it with other species under the genus *Anoplophrya*, and there it remains. It has been found by Vejdovsky, Cépède, and others in *Enchytraeus albidus* Heule, *Fridericia hegemon* Vejd., and *F. galba* Hoffm. In February, 1918, I received a collection of worms from Mr. Coward, containing specimens of *E. albidus* infested with this parasite. Figures are to be found in the works of Claparède, Kent, and Cépède. The description is as follows :—

"Body ribbon-like, flattened, long and slender, about 12 times as long as broad ; cuticular surface finely ciliate throughout, the cilia at the posterior extremity slightly longer, forming a somewhat brush-like tuft (resembling *Paramœcium aurelia*) ; cuticular surface granular, not conspicuously striate ; contractile vesicles minute, numerous, about twenty in number, forming a single subcentral row ; increasing, as in *A. lineata* and *A. prolifera*, by posterior segmentation." (S. Kent, Vol. 2, p. 567, after Claparède). Cépède remarks that the vacuoles may number 30, the macronucleus is ribbon-like, and extends through almost the entire length of the body, while the micronucleus (first described by Cépède *op. cit.*, p. 443) is spherical, granulose, and 3 microns in diameter. Each author gives a different system of measurements. According to Kent the length is 1-65", Claparède reads 0mm. 4, while Cépède gives "jusqu à 500 micron de longuer."

First found by Claparède in Clitellio, chiefly if not entirely confined to the anterior portion, it has since been found in the Enchytraeids named above—a point of interest which may be borne in mind when we come to study *Ano naidos* and others. The synonomy and bibliography will be found in Cépède.

## 2. **Anoplophrya pachydrili** Clap.

We again owe the original description to Claparède, who found the species in the Hebridies with the foregoing. S. Kent gives four lines to it—"Body irregularly ovate or subpyriform ; widest and truncate posteriorly, pointed and narrowest anteriorly : two or three contractile vesicles forming a row on each lateral border. Endoplast not observed. Hab. marine, within the intestine of *Pachydrilus verrucosus* Clap." (*Op. cit.* 568). Kent gives no figure. The original adds "Opaline à peine une fois et demi aussi large que longue," while Cépède's expression is " la longuer atteint à peine une fois et demi la

plus grande largeur située postérieurement." Neither macro- nor micronucleus has yet been observed.

Again the authors adopt different systems of measurement. Claparède says the parasite "n'est longue que l'environ 0mm. .07; Saville Kent, "Length 1-350″"; and Cépède "Cette Anoplophrya ne mesure que 70microns de longuer."

*Lumbricillus verrucosus* Clap. reached me in January, 1918, from Mr. Clegg, of Rochdale, and contained three species of parasites, of which *A. pachydrili* Clap. was one. One of my figures exactly agrees with that of Claparède, and I found the average length to be ·08mm. The vacuoles were usually 6 or 7 in number, but I could not find nuclei in the living form, and was unable to preserve it for further study under reagents. It presented a curious appearance as it rolled over and over, and in some aspects one might be deluded into the idea that the macronucleus was well defined, and extended through the whole length of the body. (See Stirrup, Pl. XLVII., figs. 9a and 9b).

### 3. **Anoplophrya nodulata** O.F.M.

This is one of the parasites which I found in the Pachydrilid at Askam. Saville Kent says (*op. cit.* 564): "This species, more generally known by the name of *Opalina lineata*, conferred upon it by Max Schultze (7), is undoubtedly identical with the type inhabiting the same host figured and described by O. F. Müller (6) under the title of *Leucophrya nodulata.* This earlier investigator has not only clearly indicated in his drawings (*op. cit.* Taf. lxxx., figs. a—i) the respective contours and plan of disposition of the central endoplast and double line of contractile vesicles, but also attests to the manner of multiplication through the separating off of a small nodular segment only of the posterior region of the body. Sometimes two imperfectly separated segments are recorded as remaining consentaneously attached to the primary gooid, such reproductive phenomenon preparing the way for the very remarkable modification of the process that obtains in *Ano. prolifera.*

Kent's brief definition is—"Body elongate, ovate or elliptical, usually somewhat widest anteriorly; cuticul ar surface longitudinally striate; entirely and finely ciliate; endoplast axial, band-like; contractile vesicles numerous, forming a linear series on each side of the endoplast."

It has been found in *Paranais litoralis* O.F.M. and in *Clitellio arenarius* O.F.M. by Müller, Schultze, and Claparède. I have taken it in *Marionina appendiculata* Friend at Askam, Lancs. (February 15th, 1896), and in *Enchytraeus albidus* Heule from Rostherne, Cheshire, February, 1918. I take it that this

is the species figured by Stirrup (*op. cit.* Pl. XLVI, fig. 7) in spite of the fact that his second row of vacuoles is imperfect. His chain, like that of Cépède (after Claparède) consists of six individuals and the shape of the parent is in exact accord with my own drawings,

Cépède gives "Jusqu' à 355 microns" as the length, and Saville Kent 1-200". While Kent keeps *A. prolifera* separate from *A. nodulata* Cépède (to judge by his figure) regards them as synonymous, and in this judgement I agree.

### 4. **Anoplophrya naïdos** Dujardin.

This parasite is by no means rare, and is not confined to the naids. I first found it at Askam with the foregoing, infesting alike *L. verrucosus* and *M. appendiculata*. It has also been frequently met with elsewhere. The synonymy is fully given by Cépède (p. 533), who also supplies full details and bibliography. There is only one row of contractile vacuoles and the body is rounded at both extremities. I transcribe some of Saville Kent's definitions and notes in preference to those of the French and German authorities. "Body variable in form, elongate or elliptical, averaging from three to four or five times as long as broad; cuticular surface longitudinally furrowed or striate, entirely ciliate; contractile vesicles numerous; endoplast axial, thick and band-like, coarsely granular, extending nearly the whole length of the body.

"The highly developed contractile vesicles of this species were not recognised by Dujardin when he first described it under the name of *Opalina naidos*, but have since been successfully demonstrated by Prof. E. Ray Lankester (5). As intimated by this last-named authority, a satisfactory exhibition of these structures in their natural condition is best attained by examining the creatures immersed within the intestinal fluids of the host. A species apparently identical with the present one, but of much larger size was obtained by Prof. Lankester from a species of Lumbriculus." Length, according to Kent (p. 563) 1-200", or "jusqua'à 200 microns" in the words of Cépède. It is curious that Cépède insists on calling the naids polychete and marine worms.

### 5. **Anoplophrya maupasi** Cépède.

First described in 1909-10 by Cépède (1) from a freshwater worm (Aeolosoma), this species has reached me recently in *L. verrucosus*, collected at Rochdale by Mr. Clegg, January 1918. Its chief peculiarity is found in the absence of contractile vesicles —in which character it resembles Opalina and Opalinopsis— while it has the chain-like arrangement of *Ano. nodulata*. The

macronucleus is ribbon-like, occupying almost the longitudinal axis of the parasite, while the micronucleus is spherical. My specimens agree exactly with the description and figures fully supplied by the first discoverer, so that it only remains to refer to his original account (*op. cit.* 411-419: fig. 111 and Pl. XIII).

### 6. **Mesnilella fastigata** Möbius.

Mesnilella is distinguished from Anoplophrya by the presence of a somewhat rigid rod-like body, running like a slender backbone down a greater or lesser portion of the parasite. Only four species have heretofore been described, and it is probable that the whole of them occur in the cœlom or intestine of the Enchytræid worme. *M. secans* Stein is sad by Cépède (op. cit. 375) to have been found parasitic in *Enchytræus vermicularis* (—*albidus* Heule), while *M. fastigata* has been frequently observed in the same host. It was figured and described as British by Stirrup in 1913 as *M. fastigiata* (8). I have found it in whiteworms from almost every part of the country, and it was exceedingly abundant in Mr. Coward's Cheshire gleanings of February, 1918. This ciliate reaches an average length of .3 to .4mm, but I have seen it attaining half a millimetre without including the posterior buds. It has been often described since the days of Möbius (1888), and I am not aware that anything can be added to the very exact account supplied by Cépède (*op. cit.* 553 *seq.*) The contractile vesicles are in two rows, in each of which as many as 20 to 25 vacuoles may be observed. The micronucleus is at present unknown, but the macronucleus is easy to observe. It is ribbon-like, equal in diameter, and extends through the major part of the body. Care is needed in the examination of these parasites, as it is no unusual thing to find three or four different species in one individual host, and as they are frequently in every stage of development one may easily confuse them and be led to give an inaccurate description.

### 7. **Lada wrzesniowskii** Vejd.

Although the genus Lada has been separated from the parasites already described and made the type of a distinct family, I include it here because it comes very near the Anoplophryidæ, though it is easily distinguished therefrom by its shape. It was first described by Vejdovsky (9) in 1882, from specimens found in a drop of water in which an injured worm was being examined. He concluded that *Lada* was an internal parasite on account of its structure. Curiously enough I found a specimen of the parasite in exactly the same way while examining a fragment of *Fridericia magna* Friend received from Rostherne through Mr. Coward in February, 1918. This curious creature is characterised by a peculiar fold or enlargement of the

anterior portion, which closely resembles a horseshoe in shape. It has a single contractile vacuole and an elliptical macronucleus, and is figured by Cépède (*op. cit.* p. 569).

To this study of seven species of Ciliates found in the Enchytræid worms, I have to add one further record. It relates to a parasite belonging to the family Anoplophryidæ, which does not appear to have been recorded by any previous observer. As a detailed description has not yet been published, owing to the peculiar difficulties of the times, I can only supply a popular diagnosis here.

## 8. **Anoplophrya** sp. nov.

In shape the new species closely resembles *A. nodulata* when it has thrown off its posterior buds, so that the parent form remains solitary. The hindmost extremity is concave and somewhat narrower than the convex anterior, giving the body a balloon shaped contour. But the most arresting feature is to be found in the contractile vesicles which are in *two double rows*. I do not regard this as a generic character; but if we include the new species under Anoplophrya it will be necessary to extend the definition. We shall then say that the vacuoles of the genus are either absent (*Ano. maupasi*) or present. When present they may form a single or double row, and the double row may again be paired.

I must reserve the other parasites of these worms found in Lancs. and Cheshire for treatment in another communication.

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