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Parasitology

THE *DIDYMOZOIDAE* TREMATODES
IN THE NORTH-EAST ATLANTIC *LAMPRIS GUTTATUS* (BRÜNNICH, 1788)
PRZYWRY *DIDYMOZOIDAE* U *LAMPRIS GUTTATUS* (BRÜNNICH, 1788)
Z PÓŁNOCNO-WSCHODNIEGO ATLANTYKU

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A detailed morphological description of a species, in the literature referred to as *Didymozoon tenuicolle* (Rudolphi, 1819) is given, the species being transferred to a newly-erected genus *Neolamprididymozoon*. Differences in the parasites size relative to their location in hosts were found. Additionally, the *Lampris guttatus* muscles were found to contain *Metadidymocystis cymbiformis* Yamaguti, 1970, previously recorded only in the Pacific; the dimensions and drawings of the trematodes are given.

INTRODUCTION

The presence of *Didymozoidae* in *Lampris guttatus* has seldom been mentioned in the literature. The trematodes were described for the first time from muscles of *L. guttatus* caught in Groningen (a North Sea port) by Rudolphi (1819) under the name of *Monostoma tenuicolle*. Subsequently Lönnberg (1891)* recorded the parasites as *Didymozoon lampridis* n.sp. on the *L. guttatus* gills. Later on, Odhner (1907) concluded that the two trematodes belonged to the same species. His opinion was supported by Kossack (1911) who considered *D. lampridis* Lönnberg, 1891 to be synonymous with *D. tenuicolle* (Rudolphi, 1819). He found Rudolphi's original material in the Berlin

*The information is given by Skrjabin (1955), the original paper being inaccessible to the author.

Museum and re-described the species, overlooking in his description the male reproductive organs.

In the Pacific *Lampris regia* (Bonnaterre)** additional two trematode species were recorded. In 1940, Yamaguti described *Nematobothrium lampridis* n. sp. in gills, the species being subsequently transferred to the genus *Lamprididymozoon* Yamaguti, 1971. The other species is *Metadidymocystis cymbiformis* Yamaguti, 1970 found in the same host's palate muscles and beneath the skin.

The objective of the present paper is to give a detailed description of morphology, including the so-far undescribed male genital system, of a species hitherto referred to as *Didymozoon tenuicolle* (Rud.). The observations made by the author necessitated the erection of a new genus. It was considered worthwhile to describe the didymozoid trematodes as a new record for the Atlantic.

MATERIAL AND METHODS

The *Lampris guttatus* (Brünnich, 1788) individual examined was caught in the North-East Atlantic (the English Channel) on 27 July 1977 and delivered frozen to the laboratory. The *longitudo corporis* and *longitudo totalis* measurements of the individual were 51.0 and 60.5 cm, respectively.

After thawing, the skin, fins, gill cavity, and muscles were examined. The parasites were squeezed or fixed in 75% alcohol without squeezing, alum carmine-stained, dehydrated in the alcohol series, rinsed in xylene, and mounted in Canada balsam. Some trematodes were examined unmounted after rinsing in glycerin. A total number of 40 *Neolamprididymozoon tenuicolle* (Rud., 1819) trematodes were measured: 22 individuals collected from gills and 18 ones found on the operculum and dorsal fin base muscles. Additionally, measurements were made on 12 trematodes of *Metadidymocystis cymbiformis* Yamaguti, 1970.

RESULTS AND DISCUSSION

The fish specimen examined yielded two trematode species of the sub-family *Didymozoinae*: *Metadidymocystis cymbiformis* Yamaguti, 1970 and *Neolamprididymozoon tenuicolle* (Rudolphi, 1819) hitherto classified with the genus *Didymozoon* Taschenberg, 1878. The observations showed, however, that the species possessed characters which did not comply with those of *Didymozoon* (Table 1). A new genus, *Neolamprididymozoon*, was therefore erected; the genus shows the closest affinities to the genera *Lamprididymozoon* Yamaguti, 1971 and *Metadidymocystis* Yamaguti, 1970 (Table 1). The key character of the new genus is the absence of pharynx.

**According to Hureau and Monod (1973) *Lampris regia* (Bonnaterre) is synonymous with *L. guttatus* (Brünnich).

Table 1

Comparison of *Didymozoon*, *Lamprididymozoon*, *Metadidymocystis*, and *Neolamprididymozoon*

Character	<i>Didymozoon</i> Taschenberg, 1878	<i>Lamprididymozoon</i> Yamaguti, 1971	<i>Metadidymocystis</i> Yamaguti, 1970	<i>Neolamprididymozoon</i> gen. n.
Shape of body	Anterior part narrow, posterior part broadened, curved, straight or spiral	Anterior part narrow, posterior part broadened – sub-cylindrical	Anterior part narrow, posterior part broadened, navicular	Anterior part narrow, posterior part broadened, sickle-shaped
Pharynx	Present	Present	Present	Absent
Ventral sucker	Absent	Present	Present in juveniles	Present
Testes	Elongated, located in proximal part of posterior section	Long, tubular, in terminal part of anterior section, entering posterior section	Long, tubular, occupying terminal part of anterior section, extending almost to the end of body	Long, tubular, occupying smaller or larger part of anterior section, not reaching posterior end
Ovary	Single, in posterior section past testes, very seldom bifurcated	Single, running in transverse coils from proximal posterior section to gonad fusion, occupying from 1:2 to 1:3.5 of the first	Single, running in transverse coils from proximal posterior section to gonad fusion, occupying proximal posterior section	Single, running in transverse coils from proximal posterior section to gonad fusion occupying about 1/3 of this part
Vitellarium	Single or branched (usually not reaching testes)	Single, running from gonad fusion to body end	Single, running from gonad fusion to body end where forms straight or bifurcated tube	Single, running from gonad fusion to body end

Table 2

Dimensions of *Didymozoidae* in *Lampris guttatus*

Species	<i>Neolamprididymozoon tenuicolle</i> (Rudolphi, 1819)				<i>Metadidymocystis cymbiformis</i> Yamaguti, 1970	
Location in host	Gills		Operculum and muscles		Subcutaneous muscles	
Size (mm)	Range	Mean	Range	Mean	Range	Mean
Total length	9.577–16.100	12.211	30.850–84.900	50.950	10.050–22.700	15.307
Length of anterior section	3.111– 6.800	4.386	9.000–26.200	14.703	3.050– 7.500	4.377
Length of posterior section	5.560–10.650	7.825	20.600–64.100	36.274	7.000–17.700	10.930
Width of anterior section	0.732– 1.098	0.916	1.000– 2.100	1.498	0.198– 0.415	0.314
Width of posterior section	1.098– 2.501	1.780	4.000–10.700	5.889	1.220– 2.600	1.750
Oral sucker	0.403– 0.647	0.511	0.512– 0.915	0.716	0.054– 0.085	0.069
Pharynx	–	–	–	–	0.027– 0.037*	0.033*
					x 0.032– 0.039	x 0.035
Ventral sucker	x 0.053– 0.068*	x 0.058*	x 0.078– 0.088*	x 0.081*	x 0.029– 0.068*	x 0.048*
	x 0.042– 0.061	x 0.051	x 0.068– 0.092	x 0.083	x 0.042– 0.068	x 0.053
Testes	0.065– 0.158	0.090	0.101– 0.378	0.211	0.025– 0.071	0.040
Ovary	0.029– 0.058	0.042	0.050– 0.119	0.071	0.027– 0.058	0.042
Vitellarium	0.025– 0.043	0.035	0.036– 0.079	0.059	0.034– 0.068	0.045
Eggs	x 0.013– 0.015*	x 0.014*	x 0.013– 0.014*	x 0.014*	x 0.014– 0.016*	x 0.015*
	x 0.009– 0.011	x 0.010	x 0.009– 0.010	x 0.010	x 0.010– 0.011	x 0.010

Neolamprididymozoon gen. n.

Entirely hermaphroditic, encysted in pairs. The body divided into an anterior section, thin, elongated, slightly broadened past the oral sucker, and a posterior one, strongly broadened and sicklecurved, the anterior section being shorter than the posterior one. The oral sucker located atop the body opens directly into a relatively short esophagus bifurcating into 2 narrow branches of the intestine. The pharynx absent. The ventral sucker present, located at some distance from the intestinal bifurcation.

Testes tubular, long, located in the anterior section; they occupy a smaller or larger part of it and extend along about 4/5 of the posterior section. Short ducts stemming from the testes fuse anteriorly to the ventral sucker into the vas deferens. The latter runs along the dorsal side of the uterus to the gonad pore located at the base of the oral sucker. The ovary long, thin, transversely coiling, extending from the proximal end of the posterior section to the gonad fusion at 1/3 of the section. The seminal vesicle present. The single vitellarium forms transverse loops extending from the gonad fusion to the posterior end of the body. The uterus transversely coiled, extending from the gonad fusion to the beginning of the posterior section and then directed backwards. At the end of the body it is re-directed forwards and as a straight, more or less broadened duct extends along the entire posterior section; the duct clearly narrows in the anterior section and reaches the oral sucker. Eggs oval, small.

Parasites of marine fishes, occurring on gills, operculum, and in muscles.

Neolamprididymozoon tenuicolle (Rudolphi, 1819)

Synonyms: *Monostoma tenuicolle* Rudolphi, 1819; *Didymozoon lampridis* Lönnberg, 1891; *Didymozoon tenuicolle* (Rudolphi, 1819)

Encysted parasites occurred on gills, operculum, and in muscles close to the basal radii of the anterior part of the dorsal fin, 19–33 cysts per gill arch being observed. The parasites occurred always between the gill lamellae at the fusion of the opposite lamellae (Fig. 1), 2 cysts only being found on the surface of a lamella. The cysts were oval or spherical in shape and measured 3–5 mm. Cyst walls were very thin and translucent. Similar but much larger (10–20 × 11–30 mm) cysts were found on the internal side of the operculum (6 cysts) and at the dorsal fin base (6 cysts) (Fig. 2). Each cyst contained 2 mature hermaphroditic trematodes. The individuals from one cyst were identical.

The body of *N. tenuicolle* is divided into two clearly differing sections. The anterior section is thin, elongated and slightly broadened past the oral sucker and fuses asymmetrically with the proximal end of the posterior section, the latter being strongly broadened and sickle-curved filled with numerous coils of the uterus and other reproductive organs (Figs. 3 and 4). The anterior section is always shorter than the posterior one. Detailed measurements of the parasites and their organs are given in Table 2.

The trematodes found differed in size depending on their location in host (Fig. 5, Table 2). The individuals found on the operculum and in muscles were more than 4 times

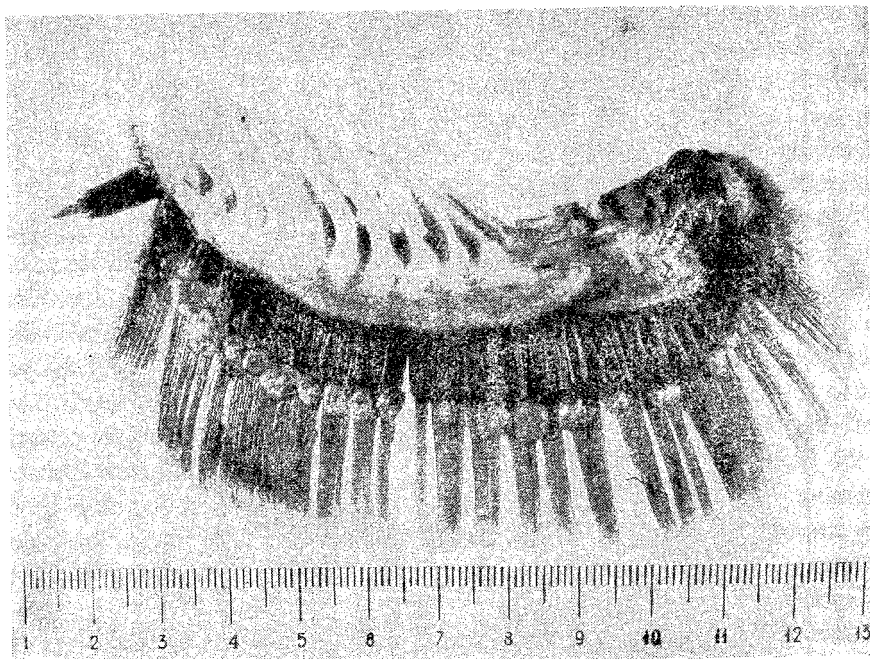


Fig. 1. *Neolamprididymozoon tenuicolle* cysts on gills of *Lampris guttatus*



Fig. 2. *Neolamprididymozoon tenuicolle* cyst in muscles at *Lampris guttatus* dorsal fin base; the arrow denotes a scar left by a cyst

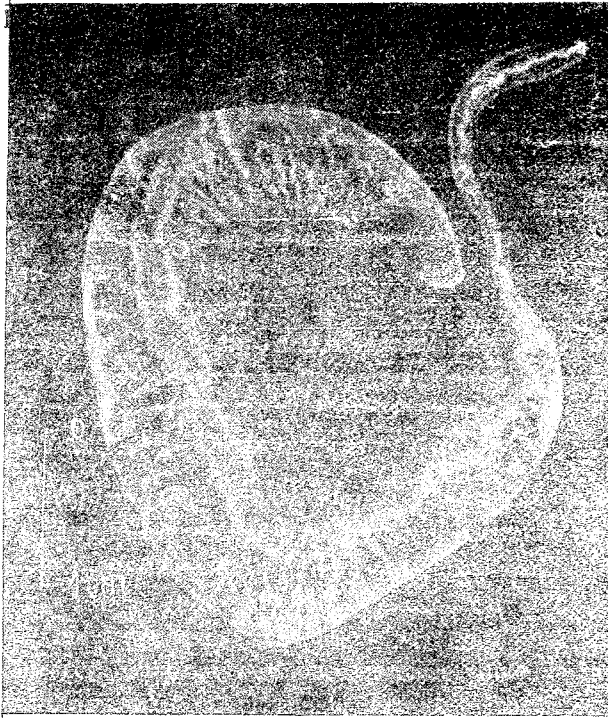


Fig. 3. *Neolamprididymozoon tenuicolle* isolated from muscles

those from gills, the differences being much greater in the extremal cases. The suckers and gonads of the gill trematodes were also somewhat smaller, their maximum sizes, however, corresponding to the lower limit of the respective ranges for the operculum and muscles parasites. No difference was found between the sizes of eggs.

The digestive tract in the species begins with a large oral sucker atop the anterior section, the sucker being connected with the esophagus (1–2 mm long) bifurcating into two branches of the intestine (Fig. 6). The mounts made of frozen individuals yielded poorly visible and inconspicuous digestive tracts. The ventral sucker is very small. In the gills individuals it is most often located just past the midpoint of the anterior section, while in those individuals from the operculum and muscles it is in a much more anterior position.

The tubular, very long paired testes begin at about one-fifth of the distance from the broadened part of the body (Fig. 4). They are situated at both sides of the body and terminate in the anterior section, not reaching the ventral sucker. Two short ducts fuse into the vas deferens in front of the ventral sucker. The vas deferens extends on the dorsal side along the terminal part of the uterus to the oral sucker base (Fig. 6).

The long thin ovary beginning near the proximal margin of the posterior section (Fig. 4) forms transverse loops and at one-third of the section length slightly broadens. Here it fuses with the vitellarium, uterus, and a short duct with the seminal vesicle. The latter is usually oval in shape. Mehlis's glands, covering also the anterior part of the uterus are visible in place where the organs fuse. The vitellarium, slightly thinner than the oviduct, in numerous loops extends to the end of the body. Transverse coils of the uterus extend forwards from the fusion and reach the beginning of the broadened part, then direct backwards dorsally and dorso-laterally along this entire part. Near the end of the

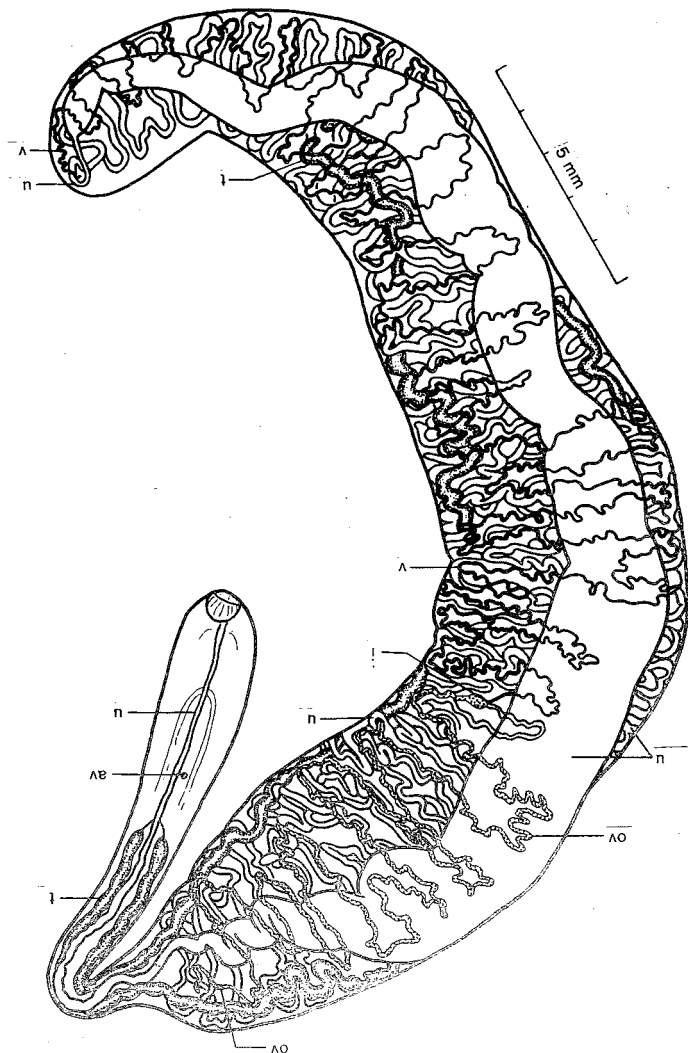


Fig. 4. *Neolampridymozzon tenuicollis* from muscles (ventral view): av — acetabulum ventrale, i — juncture, ov — ●varium, t — testis, u — uterus, v — vitellarium

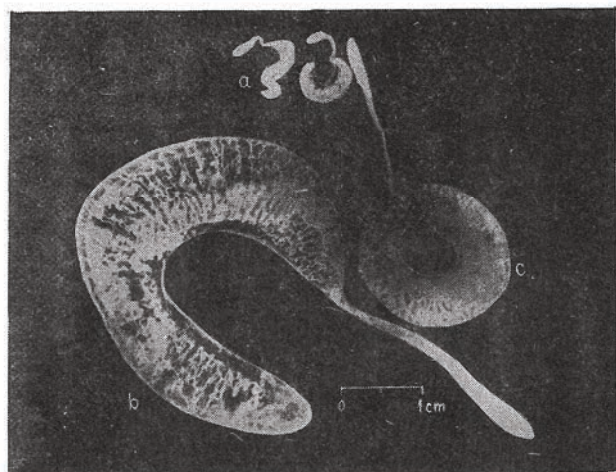


Fig. 5. *Neolamprididymozoon tenuicolle* – a – from gills, b – from muscles, c – from operculum

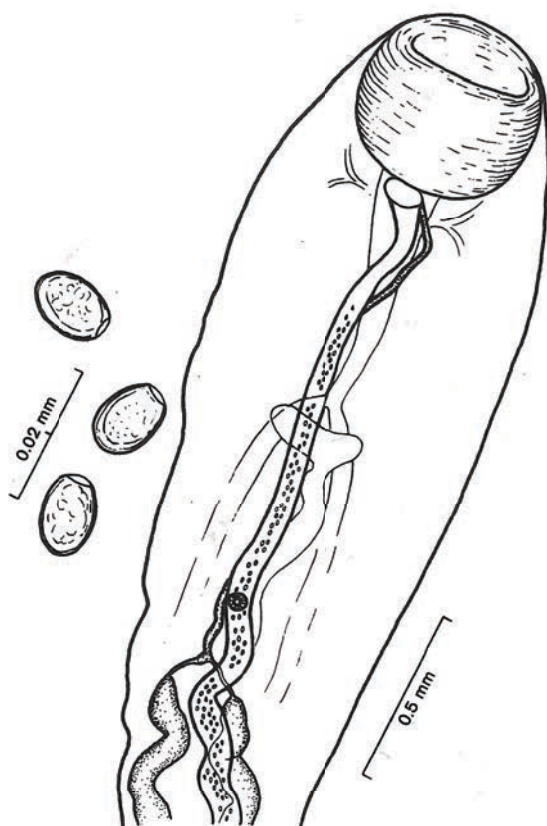


Fig. 6. Anterior section of *Neolamprididymozoon tenuicolle* from gills (ventral view)

body the uterus as a relatively straight duct extends along the ventral side to the oral sucker. In older individuals the uterus is strongly broadened and narrows in the anterior section. The narrowing uterus duct and the part of uterus in the anterior section show fairly well-visible orbicular muscles disappearing at some distance before the terminal

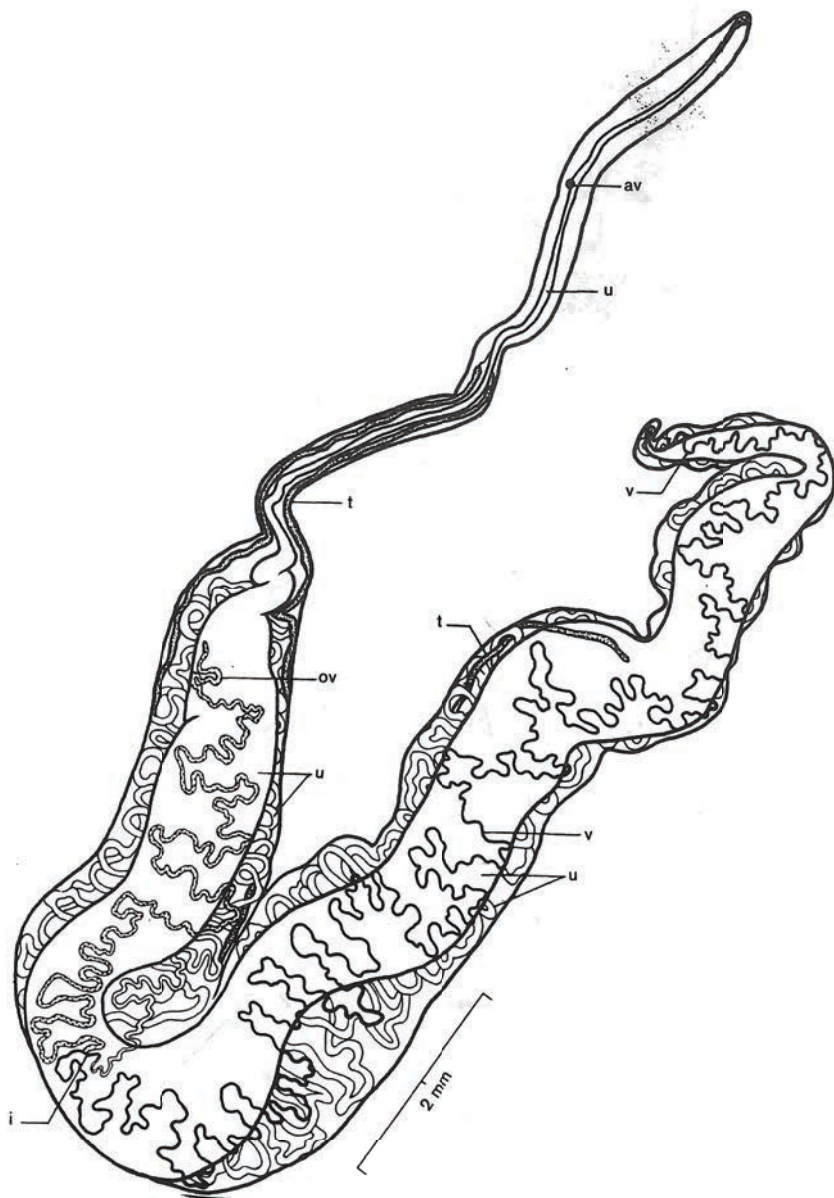


Fig. 7. *Metadidymocystis cymbiformis* isolated from muscles of *Lampris guttatus* (ventral view): symbols as in Fig. 4

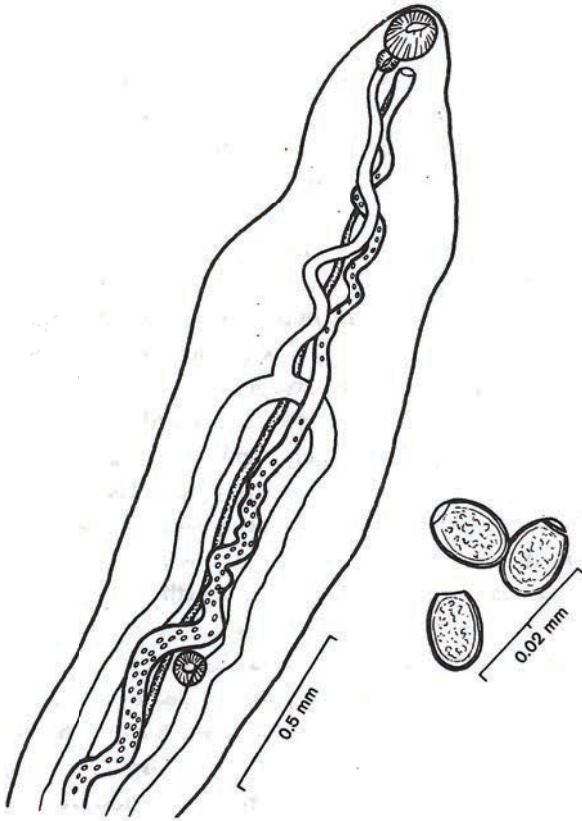


Fig. 8. Anterior section of *Metadidymocystis cymbiformis* (ventral view)

part. The uterus terminates with a slight broadening at the oral sucker base. The uterus is filled with very numerous, fine, oval eggs provided with flat covers (visible only on squeezing) (Fig. 6).

When comparing my description with that given by Kossack (1911), no difference in the body shape and female reproductive system has been found. The measurements given by that author, except for the esophagus, correspond with the present findings for the muscles trematodes. However, Kossack did not mention the ventral sucker and the male reproductive system. He stated that the maximum length of the anterior section in trematodes found by Lönnberg (1891) on gills was 14 mm, while in the present material the corresponding length in the gill individuals is 6.8 mm only. Nevertheless, the general features of the *Didymozoon lampridis* Lönnberg drawing published by Odhner (1907) deviate neither in shape nor in body proportions from the trematodes described here.

Metadidymocystis cymbiformis Yamaguti, 1970

The parasites were located in muscles beneath the skin down to 5 mm. Pairs of them were found in elongated, oval or irregular caverns with smooth surface, measuring $2-3 \times 4-10$ mm. Occasionally 4 individuals were found together. The invasion intensity in the *L. guttatus* specimen examined was high. The parasites occurred on the entire surface of the muscular layer, forming large aggregations at some places.

The trematodes found were hermaphroditic (Figs. 7 and 8). They were fully mature and filled with very numerous eggs. The parasites dimensions are given in Table 2.

Comparisons of the trematodes examined with the description of the genus *Metadidymocystis* and the drawing of *M. cymbiformis* published by Yamaguti (1971) failed to reveal any significant differences except for the ventral sucker. In the material presented, this sucker occurred in mature individuals and was more or less well-visible depending on the number of eggs in the uterus and the course thereof. Yamaguti (1971) is of the opinion that the sucker is present in juveniles. The length and width of the present trematodes agree well with the lower limits given by that author. Moreover, the location of these parasites suggests that they belong to *M. cymbiformis*. The species differs from *Lamprididymozoon lampridis* in the length of testes and location in host. *L. lampridis* was recorded on gills only and possessed shorter testes (Yamaguti, 1940).

It can be, however, noted that the genera *Metadidymocystis* and *Lamprididymozoon* are very similar (Table 2). Basically, they differ by the absence of the ventral sucker in the adults of the first. A suggestion may be put forward that we are dealing with one species of a varying location in host and a high intraspecific variability rather than with different genera. The lack of material from gills, however, allows no definite conclusions to be drawn.

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PRZYWRY DIDYMOZOIDAE U *LAMPRIS GUTTATUS* (BRÜNNICH, 1788)
Z PÓŁNOCNO-WSCHODNIEGO ATLANTYKU

Streszczenie

U strojnika *Lampris guttatus* złowionego w Północno-Wschodnim Atlantyku na wysokości Kanału La Manche stwierdzono dwa gatunki przywr.

Jednym z nich jest *Neolamprididymozoon tenuicolle* (Rudolphi, 1819) zaliczany dotychczas do rodzaju *Didymozoon* Taschenberg, 1878. Obserwacje wykazały, że gatunek ten nie odpowiada jednak cechom rodzaju *Didymozoon*. W związku z tym utworzono nowy rodzaj *Neolamprididymozoon*, który jest najbliższy rodzajom *Lamprididymozoon* Yamaguti, 1971 i *Metadidymocystis* Yamaguti, 1970. Istotną cechą nowego rodzaju jest brak gardzieli.

Przywry *N. tenuicolle* występowały ocystowane na skrzelach, wieczkach skrzelowych i w mięśniach przy promieniach bazylnych płetwy grzbietowej. W każdej cyście znajdowały się po dwa dojrzałe, hermafrodytyczne pasożyty. Podano szczegółowy opis morfologiczny tego gatunku. Stwierdzono różnice w wielkości przywr w zależności od lokalizacji w rybie.

Drugim gatunkiem jest *Metadidymocystis cymbiformis* Yamaguti, 1970 występujący w całej powierzchniowej warstwie mięśni ryby miejscami tworząc większe zagęszczenie. Przywry te były hermafrodytami całkowicie dojrzałymi, najczęściej występowały parami; zamieszczono ich wymiary i rysunki. Pasożytów tych nie notowano dotychczas w Atlantyku.

И. Вержбицка

ТРЕМАТОДЫ DIDYMOZOIDAE У *LAMPRIS GUTTATUS* (BRÜNNICH, 1788)
ИЗ СЕВЕРО-ВОСТОЧНОЙ АТЛАНТИКИ

Резюме

У рыбы *Lampris guttatus* выловленной в Северо-Восточной Атлантике на высоте канала Ла-Манш обнаружено 2 вида трематод. Один из них засчитывали до сих пор к роду *Didymozoon* Taschenberg, 1878. Это *Neolamprididymozoon tenuicolle* (Rudolphi, 1819). Наблюдения показали что этот вид не соответствует чертам рода *Didymozoon*. В связи с этим создали новый род *Neolamprididymozoon*, который является наиболее близким родом *Lamprididymozoon* Yamaguti, 1971 и *Metadidymocystis* Yamaguti, 1970. Существенной чертой нового рода является отсутствие горла. Трематоды *N. tenuicolle* наблюдались в кистах на жабрах, жаберных крышках и в мышцах у базальных лучей спинного плавника. В каждой кисте находились 2 взрослые гермафродитические паразиты. Дается частное морфологическое описание этого вида.

Обнаружено различия в величине трематод в зависимости от места размещения в рыбе. Вторым видом это *Metadidymocystis cymbiformis* Yamaguti, 1970, наблюдаемый в целой поверхностной зоне мышц рыб. В некоторых местах он образует большие концентрации. Трематоды эти были совсем зрелыми гермафродитами. Они наиболее часто находились попарно: даются их размеры и рисунки. Эти паразиты до сих пор не были отмечены в Атлантике.

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