

ARCHIVES

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Some new or little known parasitic nematodes of sea fish.

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Among the parasitic nematodes known in USSR and outside, those living in marine fish seem to be the least known. During three years of our research on parasites we were able to collect a considerable number of roundworms and among these, besides certain widely diffused species, there appeared a few new species; also Ascarophis morrhuae, Beneden, a parasite of codfish of which until now we have had only a partial description of males. In this study we present a description of new species of nematodes in the Baerens Sea and of the structure of males and females of Ascarophis morrhuae.

The examination of our material demonstrated that between the genus Ascarophis described by Beneden in 1871 and the genus Capillospirura, described by academician Skrjabin in 1924 there is no difference that would justify a division of these genera. For this reason both genera have to be classified as one; according to the principle of priority Ascarophis is the valid name with Capillospirura as a synonym. The motivation of this change in the systematology of nematodes Spirurata is given below after the description of the species. In addition to the members of the suborder Spirurata we found in the intestine of Salvelinus alpinus a new species of the genus Capillaria, the description of which follows in due place.

Our material has been collected at the Murmansk Biological Station of the Academy of Sciences USSR. The research itself has been made in the laboratories of the Parasitology Department of the Zoological Institute.

Ascarophis morrhuae, Van Beneden

In 1871, Van Beneden, in a work on fish parasites of the Belgian Sea coast, gave us a short and incomplete description of this small nematode living in the intestine of codfish, a female one, which he called Ascarophis morrhuae. Another description of the same species from Cottus bubalis, also incomplete, was given by Nicoll in 1907. Our material taken from the stomach and intestine of the codfish and haddock, available in several hundreds of individuals, males and females, enabled us to give a full description of A. morrhuae and clarify the question of the classification of this species in the system of the round worms.

Females: Thin, fusiform worms. Length 5.35-7.24 mm.; breadth anteriorly 0.042-0.052 mm.; in the middle 0.093-0.14 mm. In the first third of the body, cuticula is provided with spines which are sharp and turned down (Fig. 1,1). In the anterior part they start at the level of the nerve ring (Fig. 1,2) at a distance of 0.10-0.12 mm. from the anterior end. In the second third of the body they gradually disappear; they vanish completely at the posterior end. The distance between the prongs of cuticula, 0.005-0.006 mm. The tail part is slightly displaced on the dorsal side (1,3). Distance anus-posterior end, 0.034-0.046 mm. At both sides of the mouth opening are located two not very developed lips which resemble two short sticks. The mouth opening leads to the pharynx which is slightly widened at the anterior end. The pharynx is lined with cuticula. Its length is 0.072-0.092 mm. The pharynx is distinctly separated from the oesophagus (Fig. 1,2). The total length of oesophagus together with the pharynx is 1.23-1.72 mm. The oesophagus is composed of a very short muscular section (0.25 mm.) and a longer glandular section. In A. morrhuae both sections are not separated from each other distinctly. Around the anterior section of the oesophagus there is a well developed and wide nerve ring. The vulva is located near the middle of the body. The relation $\frac{\text{front end-vulva}}{\text{back end-vulva}}$ varies

between 1.09-1.41. It has a double uterus (1,4) and two ovaries. Ripe eggs are present in great quantities in the middle part of the body. They are oval. At one end each ripe egg bears a plug of considerable dimensions and two very long filaments (1,5). The dimensions of eggs: length 0.041-0.045 mm., breadth 0.022-0.027 mm. Filaments up to 0.22 mm. In the ova, coiled embryos are found.

Males: The number of males in this species is always 3-4 times smaller than the number of females which explains the fact that Van Beneden and Nicoll did not find males. The posterior end of body is coiled ventrally. The males are smaller than females. Length is 3.68-4.29 mm., breadth at the anterior end 0.038-0.046 mm., at the beginning of spicula 0.063-0.075 mm. The cuticular annulations are shaped as in females. Distance from the cloacal opening to posterior end 0.072-0.084 mm. Structure of lips, pharynx and oesophagus is the same as in females. Total length of oesophagus together with pharynx 0.23 mm. The nerve ring is well defined. There are two unequal spicula (Fig. 1,6). The bigger one is 0.50-0.59 long and 0.005 mm. thick. It is surrounded by a muscular sheath. The distal end of this spicula tapers gradually and it never presents a wider shape. The second spicula is much smaller and bent. The length is 0.080-0.083 mm. It is pointed at the distal end and slightly widened at the proximal end where it reaches 0.011 mm. of breadth. There are 4 pairs of preanal and 5 pairs of postanal papillae. Their form is stalk-like. From the opening of the cloaca and further ahead on the ventral side stretches a longitudinal cuticular ridge. They turn toward the lateral side of the worm and then toward the dorsal side. There are 6 ridges, each of which is composed of one row of linear thickenings of cuticula.

Host and localization: The stomach of Melanogrammus aeglefinus and of Gadus morrhua morrhua. Out of 100 samples of Melanogrammus aeglefinus the parasites were found in 36 specimens (36%). Out of 140 codfish samples - in only

4 specimens (2.8%). The intensity of infection by parasites varied from 1-47 specimens. Comparative remarks: Regardless of the extremely incomplete descriptions given by Van Beneden, 1871, and Nicoll, 1907, there can be no doubt that the parasite studied by us is identical with this species. As reason for this opinion let us mention the characteristics indicated by both authors for the females (regardless of the dimensions). (1) Sharp annulation of cuticula; (2) presence of two rudimentary lips; (3) presence in the ripe eggs of only one plug with two long filaments. For males of A. morrhuae the characteristic thing is the big difference in dimensions of spicula. The bigger spicula exceeds the smaller one by about 6 times.

Ascarophis arctica, Poljansky, sp.n.

During the study of Zoarces viviparus we discovered in the stomach of this fish small nematodes belonging to the genus Ascarophis. We had about 100 specimens, males and females, of this nematode in our material. The investigation proved that this was a new species for which we propose the name A. arctica.

Females: Small threadlike worms. Length 7.2-11.6 mm.; breadth anteriorly 0.042-0.063 mm.; in the middle 0.067-0.114 mm. Cuticular annulation not well developed (Fig. 2,1). Distance between annuli 0.004 mm. At the anterior end at both sides of the mouth two poorly developed stick-like lips can be located (Fig. 2,2). The tail end is turned up toward the dorsal side (2,3). Distance anus-posterior end 0.038-0.042 mm. The mouth opening leads to a tube-like pharynx, length 0.10-0.11 mm. and opening into a long oesophagus. The length of oesophagus with pharynx 2.4-3.5 mm. In the oesophagus we can distinguish the anterior part distinctly separated and muscular (0.28-0.30 mm.) and the posterior part longer, glandular (2,1). The well-developed nerve ring surrounds the anterior part of the oesophagus (2,2). Vulva is located in the posterior half

of body. The relation $\frac{\text{front end-vulva}}{\text{back end-vulva}}$ varies from 1.29 to 2.24. Uterus and ovaries are double. Mature eggs are present in quantities in the middle part of the body, forming 2-3 rows, in the uterus. The form of the eggs is characteristic. Oval, provided with two plugs at the poles, the filaments being long and numerous (up to 10 on each side.) (Fig. 2,4). Dimensions of the eggs: Length 0.040-0.043 mm.; breadth 0.021-0.023 mm. Inside of the eggs are found coiled embryos.

Males: The posterior end of the body is ventrally coiled. Males are smaller than females, Length 4.0-7.56 mm.; breadth at anterior end 0.034-0.051 mm.; at the beginning of spicula 0.046-0.067 mm. The annulations of cuticula are less developed than in the female body. Distance cloaca opening posterior end 0.063-0.11 mm. The structure of lips, pharynx and oesophagus is the same. The total length of oesophagus with the pharynx 1.33-2.52 mm.; length of pharynx 0.086-0.11 mm.; length of the muscular part 0.24-0.26 mm. Nerve ring is well defined. Two unequal spicula. The first one is very long - 0.50-0.78 mm., the breadth being 0.006-0.007 mm. The spicula is surrounded by a well-developed strong musculature ring of diameter 0.018 mm. The distal end of the bigger spicule is bent and pointed (Fig. 2,5,60). The second spicule is much smaller. Length 0.068-0.092 mm. It is less bent and pointed at distal end and widening on proximal end. Breadth at proximal end 0.013-0.014 mm. There are 4 pairs of preanal and 5 pairs of postanal papillae which are stalked. From the cloacal opening and further ahead on ventral side there are well-developed longitudinal ridges.

Host and localization: Zoarcetes viviparus, stomach. Out of 85 fishes the parasites were found in 30 specimens (34.9%). Intensity of infection: 1-41 specimens per fish.

Comparative remarks. A. arctica shows a considerable similarity with A. morrhuae but it differs from the same by the following well-developed marks: (1) A. arctica's cuticular annulations are less developed; (2) the long spicula of males A. arctica shows certain widening and bending absent in A. morrhuae; (3) the eggs of A. arctica have two plugs with numerous filaments at each pole; A. morrhuae have only one plug and two filaments. Besides that A. arctica has bigger dimensions of males and females.

As far as the relationship of our species to what was described by Markowski, 1938 as Cyctidicola skrjabini, species found in the baltic Zoarces viviparus is concerned, we will return to this subject later.

Ascarophis filiformis Poljansky, sp.n.

In the stomach of Gadus morrhuae were occasionally found small thread-like nematodes belonging to genus Ascarophis and representing a new species. Only once this parasite was found in the stomach of haddock. In our material were 3 mature females, 10 juvenile females and 9 mature males. With respect to the fact that this new species has apparently the longest body within the genus Ascarophis we called it A. filiformis.

Females: Long, thread-like worms. Length of mature animals 20.6-26.5 mm.; breadth in the anterior part 0.080-0.084 mm.; in the middle 0.12 mm. Cuticula smooth. At the anterior end at both sides of the mouth two poorly developed rod-like lips (Fig. 3,1). The posterior end is turned up a little toward the dorsal side (Fig. 3,2). Distance anus-posterior end 0.084-0.096 mm. The mouth opening leads into a tubular pharynx 0.14-0.16 mm. long which opens to the oesophagus. Total length of oesophagus and pharynx together 2.9-3.2 mm. The anterior part of oesophagus about 0.30 mm. is muscular, the posterior part glandular. The separation of these two sections is distinct. The nerve ring,

located slightly behind the junction of pharynx and oesophagus, is well defined. Vulva is located near the middle of the body. The ratio $\frac{\text{front end-vulva}}{\text{back end-vulva}}$ in our specimens is 0.8-1.3. In immature females the vulva is always found behind the middle of the body. The eggs, when ripe, exist in large quantities and are located in 2-3 rows in uterus. They are oval with clearly defined membrane. On one pole there is a large plug with two large filaments (Fig. 3,3). Dimensions of eggs: Length 0.045-0.047 mm.; breadth 0.029-0.031 mm. Length of filaments 0.025 mm. Inside of the eggs is found a coiled embryo.

Males: The posterior end, as in other species of Ascarophis, is strongly coiled ventrally. The males are considerably smaller than females. Length 9.6-11.4 mm.; breadth of the anterior end 0.067-0.093 mm.; at the beginning of spicula 0.076-0.10 mm. Cuticular rings absent. Distance from cloacal opening to posterior end is 0.076-0.10 mm. The structure of lips, pharynx and oesophagus the same as in females. Total length of oesophagus with pharynx 2.19-3.06 mm. Length of pharynx alone 0.12-0.16 mm. Nerve ring well defined. Two unequal spicula (Fig. 3,4). Length of the bigger one 0.27-0.34 mm.; breadth 0.009 mm.; the distal end bent in form of a bow and pointed. The second smaller spicula is only 0.084-0.10 mm. of length, it is also arched, pointed at distal end and widened at proximal end; breadth in the proximal part 0.013 mm. There are 4 pairs of preanal and 5 pairs of postanal stemlike papillae (3,4). The last pair (5th) is less developed than the other 4 pairs. Between the preanal and first three postanal papillae are found numerous thickenings of cuticula, which look like flat additional papillae. From the cloacal opening and posteriorly on ventral side are found longitudinal ridges which turn up to the lateral surface and are directed dorsally, disappearing gradually. The number of the ridges varies around ten; each ridge is formed by a row of longitudinal thickenings of cuticula.

Host and location. Gadus morrhua, stomach. Out of 140 examined codfishes the parasites were found in 8 (5.7%). Intensity of infection varying between 1-3 specimens. Only one female A. filiformis was found in the stomach of haddock (out of 100 fishes examined).

Comparative remarks. A. filiformis differs in many respects from the above described species, A. morrhuae and A. arctica. The main differences are: (1) larger dimensions, especially of females, (2) absence of cuticular annulations, (3) much smaller length of the big spicula (in this A. filiformis is close to Capillospirura skrjabini (Layman, 1933)).

Regarding the structure of eggs, A. filiformis is close to A. morrhuae and differs from A. arctica.

Capillaria salvelini Poljansky, sp.n.

In the posterior part of the small intestine of a schooner (Salvelinus alpinus), caught in a stream by the sea, were a small number of little round-worms. Amongst the 6 discovered worms there were 3 mature females and 3 mature males. This had allowed to study their structure and to establish that these worms belong to the new species of a polymorphic genus, Capillaria Zeder, 1800 (family Trichuridae Railliet, 1915). Numerous representatives of this genus are parasitic in the digestive tract of various mammals, birds, reptiles, amphibians and fishes.

Females: Relatively large (for the representatives of genus Capillaria, parasitic in fishes). The length of mature female reaches 13.5 mm. The anterior part of the body (till the junction of the oesophagus with the intestine) as it is typical of Capillaria, is considerably narrower than the posterior part. Width of the anterior part reaches 0.038 mm., posterior 0.097 mm. Smooth cuticle. Digestive tract, with the exception of the anterior region, consists

of one single row of large cells perpendicularly arranged towards the long axis of the animal. Length of digestive tract 4.0-5.3 mm. The oesophagus joins the intestine in the anterior half of the body. The relationship of the length of digestive tract to the postoesophageal region is 1:1.5-1.8. The junction of the digestive tract and the intestine is 0.15-0.20 mm. anterior to the vulva. Anal opening subterminal, slightly shifted ventrally.

The genital system is typical of Capillaria. The ovary begins 0.1-0.15 mm. from the posterior end. The number of mature eggs, placed in the uterus in a single row, is about 50. The opening of the vulva is in the anterior part of the body. Its distance from the anterior end on our specimens is 4.2-5.4 mm. The length of the vagina is 0.11-0.14 mm. The vulva forms no swelling on the exterior surface of the body (ill. 4,1). The size of mature eggs is considerable. Their length reaches 0.067 mm.; width 0.033 mm. Immature eggs in the beginning of the uterus are smaller. Their length is 0.050 mm.; width 0.025 mm. The structure of the eggs is very characteristic. On both poles they are supplied with plugs which are not protruding onto the surface of the egg. The egg membrane in its optical section shows sharply expressed lines. On the surface the egg membrane is covered with very thin and short hairlike appendages. Inside a mature egg there is an undeveloped egg cell.

Males: Length of a mature male reaches 8.0 mm. Width in anterior part 0.03 mm.; at the base of spicule 0.07 mm. Smooth cuticle. Length of digestive tract 2.6-3.7 mm. The relationship of the length of digestive tract to the postoesophageal region is 1:1.2-1.9. Structure of oesophagus is typical, i.e. consists of a single row of cells. Cloacal opening terminal. On the posterior end there are two small, yet sharply distinguished lobes (ill. 4,3). Length of the spicule 0.30-0.43 mm. (ill. 4,4), its diameter in the middle part is

0.013 mm. Structure of the spicule is very characteristic: its proximal part forms a swelling (ill. 4,5) and around the proximal part of the spicule there is a very thin, spirally coiled thread (ill. 4,5) extending distally for 0.17 mm. The sheath of the spicule is well outlined, its diameter is 0.038 mm. The walls of the sheath are smooth; not spined.

Host and locality: Salvelinus alpinus, posterior part of middle intestine. Of 6 specimens examined, C. salvelini were found in one.

Comparative notes: C. salvelini is very different from other species of the same genus known to be parasitic in fish. The most essential distinction is the characteristic structure of spicule in males. There is a certain resemblance of C. salvelini to C. tuberculata (v. Linstow, 1914) from Acipenser ruthenus (Volga) and C. Lewaschoffi Heinze (1933) from Pelecus cultratus (Volga). This resemblance consists of the approximation in size of the animals, relationship of the length of the digestive tract to the post-oesophageal region, and form and structure of egg membrane.

R. E. Shulman has acquainted me with her collection of parasites of fishes of White Sea. Among the parasitic nematodes in this collection there was found one species of Capillaria from the intestine of Coregonus lavaretus pidschian, very similar to C. salvelini. This species, described by R. E. Shulman under the name of C. coregoni, has also a spicule with a spiral thread at its proximal part. It is distinguished from C. salvelini by a generally smaller size, also by smaller size of the eggs and a different relationship between the length of the digestive tract and the postoesophageal region.

Some general remarks on genera Ascarophis and Capillospirura and their systematic position in Class Nematoda.

The exact position of Ascarophis morrhuae in the class could not be established until now, because of the lack of description of male specimens and

incomplete description of females. In the report of York and Mapleston (1926, 385) this genus was related to the prospective group of the "insufficiently studied Spiruroidea". Skrjabin, Shichobalova and Sobolev (1949:252) also placed A. morrhuae among the species which are not yet ascribed to any particular family and they write the following concerning the genus Ascarophis: "Insufficiency of descriptions makes it difficult to find for this genus a position among Spiruroidea".

The above description of males and females of A. morrhuae shows that the prospective placement of this species into the sub-order of Spirurata was correct. The structure of males and females of A. morrhuae shows great similarity with the representatives of Capillospirura Skrjabin. This genus was described by Skrjabin (1924) according to the females found in the intestine of sturgeons of Volga; actually, at the beginning only one species of this genus was found: C. ovotrichuria. The males were later studied and described by Ivanov and Murigin (1937), Dogel and Bihovsky (1939); the further details on the morphology of this species is given in the work of Bauer (1948). As suggested by Bauer, the parasitic nematodes of some fishes from L. Bajkal and the far-eastern sickle (Oncorhynchus gorbuscha) described earlier by Lajman (1933) under the name of Cystidicola (Pseudocystidicola) skrjabini, were included into the genus of Capillospirura. The sub-genus Pseudocystidicola was proclaimed by Skrjabin (1946) as an independent genus. Therefore, genus Capillospirura includes at present 2 species: C. ovotrichuria and C. skrjabini.

The resemblance of the species of Capillospirura and Ascarophis (not only A. morrhuae, but also of the two described above: A. arctica and A. filiformis) is very great. The anterior part of the body and the digestive system are built according to the same plan: two stick-like lips; narrow, tubular pharynx and long oesophagus, consisting of muscular and glandular tissues. Males develop

two spicules of unequal length, 4 pairs of preanal and 5 pairs of postanal papillae, well expressed cuticular combs. Females have double uterus, the eggs are supplied with plugs (one or two) and filaments. There is no particular distinguishing traits to point to the distinction between Ascarophis and Capillospirura. Lines on the cuticle cannot be considered as the basis for distinguishing of the two, because in different species it is expressed in different degrees, forming a sequence from A. morrhuae with sharply expressed annulations, to A. filiformis with a smooth cuticle. The same is with the structure of the eggs. There is a sequence of variations from the kind with one plug and two filaments (A. ovotrichuria, A. skrjabini) and, finally, kinds with two plugs and numerous filaments (A. arctica). It seems that the number of plugs on the mature eggs as well as the number of filaments can be used as a reliable distinguishing trait, but it cannot be considered as a basis for separation of Ascarophis and Capillospirura.

Marcowski (1938) found Cystidicola skrjabini (Capillospirura skrjabini) in Zoarces viviparus from Baltic Sea. He found only females. There is no evidence however that Marcowski dealt with the same species as Lajman, who described it first. The species studied by Marcowski has 4 filaments on each pole of the egg, while according to the description of Lajman's there are to be found only two filaments. The size of eggs observed by Marcowski is considerably smaller than the one described by Lajman. All that leads to the conclusion that Marcowski dealt with some other species of the same genus, and not with the Capillospirura skrjabini. The solution of this problem will be possible only after finding the males of the species, parasitic in Zoarces viviparus of Baltic Sea.

The above presented considerations and analysis of the morphology of Ascarophis and Capillospirura obviously point towards the necessity of uniting them. According to the rules of nomenclature, it is necessary to change the

Capillospirura into the synonyms, keeping the name of Ascarophis proposed by Van-Beneden in 1871. In the table below are compared some of the most important features of presently known European and Asiatic species (Footnote: in last few years several species of Ascarophis were described by Australian explorers of Antarctic. We did not have the chance to get acquainted with the literature concerned). The species of Capillospirura, changed into their synonyms, are also included in this table.

Let us consider the diagnosis of Ascarophis as given by Van Beneden along with the present data on the morphology of this genus, including Capillospirura Skrjabin.

Small, hairlike nematodes. Cuticle smooth or annulated. On the sides of the mouth opening two "stick-like" lips. Short, tubular, widening anteriorly, pharynx. Long oesophagus, sharply distinguished from the intestine. The posterior part of the body of males is curled ventrally. Two uneven spicules, 4 pairs of preanal and 5 pairs of postanal, stalked papillae. Cuticular combs well expressed. Anal opening shifted ventrally. Double uterus. Mature eggs possess one or two plugs with well-developed filaments. Parasitic in fish intestine.

One can suppose that the genus Ascarophis is of marine origin, with a very wide geographical distribution. Majority of species are parasitic in marine fishes (A. morrhuae, A. arctica, A. filiformis). One species (A. ovotrichuria) in migrating fishes. Appearance of A. ovotrichuria on the purely freshwater fish (sturgeon) in Siberian rivers (Bauer, 1948) should be considered as a secondary phenomenon, as well as appearance of the same species in Lake Zajsan, Kaz SSR, (Dogelm Smirnova and Roznicenko, 1945). Probably the same explanation can be applied to A. skrjabini, found by Lajman in some of the fishes of Lake Bajkal.

Let us concentrate, as a conclusion, on the discussion of the question of the position of genus Ascarophis in class Nematoda. The belonging of genus Ascarophis to the order of Spirurida and sub-order Spirurata Railliet is doubtless. Presence of lips (2), structure of pharynx, absence of (sucker), presence of tail papillae (preanal and postanal) are the evidences that make us refer Ascarophis to the family of Rhabdochonidae, established by Skrjabin (1946). In this family, Ascarophis naturally belongs to subfamily Cystidicolinae Skrjabin - the presence of filaments on the eggs serves as a basis for this last classification. The only feature that does not fit the diagnosis of this subfamily given by Skrjabin is the presence of annulated cuticle in some of species of Ascarophis, while the characteristic of Cystidicolinae, according to the diagnosis, is smooth cuticle. This trait, however, could hardly be considered in the diagnosis of the subfamily, because it often occurs that closely related species have smooth cuticle on one side, and annulated on the other.

In further studies of Spirurata parasitic in fishes, the investigation of parasites of fishes of far-eastern seas (knowledge of which is very scarce at present) will be of greatest interest to both systematics and zoogeography.

Footnote: After the present article has been sent to the printers, an article of Gordon A. 1951, Parasitology, 41, No. 3-4, has been received, where the author describes a male of Ascarophis morrhuae, according to one specimen. The description presented by Gordon in its essentials overlaps with our observations presented above.

Comparison of several diagnostic features of European and Asiatic species of genus Ascarophis Van Beneden (lengths, in mm.)

Diagnostic features	<u>A. morrhuae</u> Van Beneden, 1871		<u>A. cyotrichuria</u> (Skrjabin, 1924) Accord. to Ivanov & Murigan, 1937		<u>A. skrjabini</u> (Layman, 1933) Accord. to Layman, 1933		<u>A. arctica</u> Pol. sp.n.		<u>A. filiformis</u> Pol. sp.n.	
	♀♀	♂♂	♀♀	♂♂	♀♀	♂♂	♀♀	♂♂	♀♀	♂♂
Body length	5.35-7.24	3.68-4.29	7.5-11.1	4.82-6.0	4.1-8.9	4.96-6.56	7.2-11.6	4.0-7.56	20.6-26.5	9.6-14.9
Total length: oesoph. & phar.	1.23-1.72	1.22-1.37	1.345		1.81-2.61		2.4-3.5	1.32-2.52	2.91-3.18	2.19-3.06
Length of phar.	0.072-0.092	0.071-0.092	0.105		0.108-0.165		0.10-0.11	0.086-0.11	0.14-0.16	0.12-0.16
Width of ant. end	0.042-0.052	0.038-0.046					0.042-0.063	0.034-0.051	0.080-0.084	0.067-0.093
Width of mid region	0.095-0.14	0.063-0.075	0.135	0.105	0.078-0.098		0.067-0.114	0.046-0.067	0.12	0.067-0.11
Spicula I		0.50-0.59		0.175-0.225		0.221-0.378		0.50-0.78		0.27-0.34
Spicula II		0.080-0.083		0.070-0.085		0.0675-0.0945		0.068-0.092		0.084-0.10
Distance vulva from ant. end	3.06-4.02		} Vulva in the mid- region of the body		5.266		4.08-5.93		11.6-11.7	
Ratio: Ant. end-vulva Post. end-vulva	1.09-1.41				1.66		1.29-2.24		In mid-region of body	
Egg size:	L:0.041-0.045 W:0.022-0.027		L:0.022-0.043 W:0.015-0.025		L:0.054-0.059 W:0.027-0.029		L:0.040-0.043 W:0.021-0.023		L:0.045-0.047 W:0.029-0.031	
No. plugs on mature eggs	1		2		2		2		1	
Filaments on the eggs:	2 v. long fila- ments		2 long filaments on each pole		2 long filaments on each pole		Up to 10 long filaments on each pole		2 v. long filaments	
Characteristics of cuticle:	Well defined annu- lation of ant. third		Poorly defined annulation		Poorly defined annulation		Poorly defined annulation		Smooth	
Host:	Cod, haddock		Sturgeons		Some Bajkal fishes, Far-East salmon, eelpouts(?)		Eelpout		cod, haddock	