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TREMATODES FROM GREENLAND

BY

AUGUST BRINKMANN JR.

WITH 17 FIGURES AND 3 TABLES

KØBENHAVN
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BIANCO LUNOS BOGTRYKKERI A/S
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"To the Memory of GEORG MARIUS REYNALD LEVINSEN pioneer in the research on trematodes from the Arctic."

Abstract

The present investigation deals with trematodes from Greenland — mainly from fishes. Previous investigations in this field have been reviewed and historical and biological commented upon.

The present material was mainly collected personally in 1962 at Godhavn (W. Greenland). Of the until then known 20 species from Greenland, 11 species were refound and a further 19 species were encountered as new to the area — hereof 2 *nova species*. Where necessary further descriptions have been given with systematic discussions based upon anatomy. Further, appropriate lists of trematodes with their hosts, and hosts with their trematodes have been given.

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I. Introduction

Knowledge of the trematodes of fishes in North-American eastern waters and North-European western and eastern waters has increased continuously over the years and this fauna is today fairly well-known. Much less is known as regards the trematodes of fishes in north-western Atlantic waters, especially along the coast of Iceland and Greenland. A contribubution towards remedying this has always been my desire.

In 1955 I had an opportunity to visit Iceland and its waters (BRINKMANN 1956) and to make a survey of the trematodes abundant there. Since then a re-survey of the trematodes of fishes in Greenland waters has been my aim. A grant from "Meltzers Höyskolefond" (University of Bergen) made possible a summer sojurn in West Greenland in 1962. The "Universitetets Arktiske Station" (Arctic Station of the University of Copenhagen) at Godhavn (69°14½′ N, 53°31½′ W.) on Disko island was chosen as the center for my investigation as here laboratory facilities and a sea going vessel were available, and further, the station is situated not far from Egedesminde where LEVINSEN (1881) some eighty years previously undertook his collecting.

It is my pleasant duty to thank the trustees of "Meltzers Höyskolefond", the board of the "Universitetets Arktiske Station" and its officers who made this investigation possible.

II. Previous investigations

The first record of trematodes from Greenland was given by O. FABRICIUS in his well known *Fauna Groenlandica* of 1780. Of the trematodes mentioned here only three species, however, can be identified with certainty (Table I, column I).

Seventy seven years later, the number of trematodes known from Greenland had not increased, as will appear from the younger REINHARDT's list (1857) in RINK (1857). REINHARDT draws attention to the strong possibility that "*Distomum seriale*" listed from Greenland by FABRICIUS, in reality was described from specimens he actually collected later in Norway, when he wrote up his *Fauna Groenlandica*, and had not with certainty previously been observed in Greenland. Further, REINHARDT

Table

I FABRICIUS 1780	II REINHARDT 1857	III LÜTKEN 1875	IV LEVINSEN 1881
302. *Hirudo hippoglossi*	*Phylline hippoglossi* (MÜLL.) (*Onchocotyle appendiculata* DIESING)*	*Phylline hippoglossi* (FABR.) *Onchocotyle borealis* VAN BEN.	
			Gyrodactylus Grønlandicus LEV. n. sp.
			Gasterostomum armatum MOLIN.*
			Distomum furcigerum OLSSON
			Distomum Somateriæ LEV. n. sp.**
			Distomum pygmæum LEV. n. sp.
			Distomum simplex RUD. ? OLSSON
			Distomum oculatum LEV. n. sp.
			Distomum sobrinum LEV. n. sp.
312. *Fasciola hepatica**	*Distomum hepaticum* LIN.	*Distomum hepaticum* L. Fluke from *Phoca barbata.*	
			Distomum appendiculatum RUD. MOLIN
		Fluke from *Lumpenus aculeatus.*	
			Distomum mollissimum LEV. n. sp.
			Distomum varicum (O. F. MÜLLER)
			Distomum Mülleri LEV. n. sp.
		Fluke from *Mergus serrator.*	*Monostomum verrucosum* ZEDER
314. *Fasciola umblae*	*Distomum seriale* (RUD.)**	*Distomum seriale* (RUD.)	

* Collected from sheep, but FABRICIUS regarded this species as not endemic.

* Ought to have been included in REINHARDT's list as it previously had been mentioned from Greenland by DIESING (1850). Material

* The furcocercous cerca ria of this species appear to be *Bucephalus crux* LEV n. sp. described on his p 31 (80).

1.

V Odhner 1905	VI Ditlevsen 1914	VIII Present material. Species previously recorded and species new to the Greenland Fauna
	Epibdella hippoglossi (O. F. Müller)	*Entobdella hippoglossi* (Müller, 1776) Johnston, 1856
Squalonchocotyle borealis (Van Ben.)*	*Squalonchocotyle borealis* (v. Ben.)	*Squalonchocotyle borealis* (Van Beneden, 1853) Cerfontaine, 1899
	Gyrodaetylus groenlandicus (Levinsen)	
	Prosorhynchus squamatus (Odhner)	*Prosorhynchynchus squamatus* Odhner, 1905
Steringophorus (n.g.) *furciger* (Olss.)	*Steringophorus furciger* (Olsson)	*Steringophorus furciger* (Olsson, 1868) Odhner, 1905
	Gymnophallus somateriæ (Levinsen)	
	Gymnophallus bursicolæ (Odhner)	
Gymnophallus choledochus Odhn.	*Gymnophallus choledochus* (Odhner)	*Gymnophallus choledochus* Odhner, 1900
	Spelotrema pygmæum (Levinsen)	
	Podocotyle atomon (Rud.)	*Podocotyle atomon* (Rudolphi, 1802) Odhner, 1905
Acanthopsolus (n.g.) *oculatus* (Levins.)	*Acanthopsolus oculatus* (Levinsen)	*Neophasis oculatus* (Levinsen, 1881) Dawes, 1946
	Stephanochasmus sobrinus (Levinsen)	
	Fasciola hepatica (Linn.)	
Orthosplachnus arcticus n.g. n. sp.**	*Orthosplachnus arcticus* (Odhner)	
Hemiurus levinseni n. sp.	*Hemiurus Levinseni* (Odhner)	*Metahemiurus levinseni* (Odhner, 1905) Skrjabin & Guschanskaja, 1954
Brachyphallus (n.g.) *crenatus* (Rud.)	*Brachyphallus crenatus* (Rud.)	
	Lecithaster gibblsus (Rud.)	*Lecithaster gibbosus* (Rudolphi, 1802) Lühe, 1901
	Derogenes varicus (O. F. Müller)	*Derogenes varicus* (Müller, 1784) Looss, 1901
Genarches mülleri (Levins.)	*Genarches Mülleri* (Levinsen)	*Genarches mülleri* (Levinsen, 1881) Looss, 1902
	Catatropsis verrucosa (Fröhlich)	
* Odhner p. 372 mentions "Mir liegen Exemplare sowohl von Spitzber-		*Acanthocotyle verrilli* Goto, 1899

(Continued)

Table 1.

I FABRICIUS 1780	II REINHARDT 1857	III LÜTKEN 1875	IV LEVINSEN 1881
	of this species must have been present in Copenhagen as VAN BENEDEN (1858, p. 55) mentions the loan of such material from ESCHERICHT. VAN BENEDEN also correctly identified it as *Onchocotyle borealis*. ** REINHARDT'S comment on this (translated from Danish) is: "The presence of this intestinal worm from Greenland is not quite certain. FABRICIUS has described this in *Fauna Groenlandica* from specimens investigated in Norway, and included this only since he thought he had observed something akin in Greenland".		** Concluding the description of this species LEVINSEN p. 24(73) mentions a rather similar metacercaria from *Saxicava rugosa*. ODHNER (1905, p. 313), who had this material at hand, showed it to be the metacercaria of the closely related species *Gymnophallus bursicola* ODHNER, 1905.

Continued.

V Odhner 1905	VI Ditlevsen 1914	VIII Present material Species previously recorded and species new to the Greenland fauna
gen (Treuerenberg-Bai) wie von der grönländischen Ostküste vor. Selbst habe ich die Art im Nördlichen Norwegen zu Tromsö gesammelt". Odhner's Greenland specimens most probably refer to old Copenhagen Museum material on loan, since Lütken (1875) lists the species from Greenland. ** Odhner p. 339 mentions "und zwar altes Spiritusmaterial, dass dem Kopenhagener Museum entstammt und von Olrik an der Westküste Grönlands (Godhavn) in der "leber" von *Phoca barbata* gefunden ist". Obvious this must be the undetermined flukes mentioned from the same host by Lütken (1875). As this material was not mentioned by Reinhardt (1857) it must have been collected between 1857 and 1875. The collector is stated to be Olrik, and this can then only be C. M. S. Olrik, inspector general of Northern Greenland who served there from 1846 to 1866. *** Odhner p. 353 mentions "von mir selbst an unserer schwedischen Westküste gesammelt ist, teils dem Kopenhagener Museum entstammt. Unter dem Kopenhagener Material findet sich auch ein einziges Exemplar, das in *Lumpenus aculeatus* (= *L. maculatus* Fries) auf Grönland (footnote: Nähere Angaben über den Fundort fehlen) gefunden ist". Obvious this is the very fluke mentioned by Lütken (1875) from the same host.		*Squalonchocotyle berlandi* n. sp. *Otodistomum veliporum* (Creplin, 1837) Stafford, 1904 *Stephanostomum davisi* n. sp. *Diptherostomum microacetabulum* Shulman-Albova, 1952 *Diptherostomum* sp. *Steganoderma pycnorganum* Rees, 1953 *Lepidophyllum steenstrupi* Odhner, 1902 *Fellodistomum fellis* (Olsson, 1868) Nicoll, 1909 *Fellodistomum agnotum* Nicoll, 1909 *Anisorchis opisthorchis* Poljansky, 1955 *Neophasis pusilla* Stafford, 1904 *Neophasis lageniformis* (Lebour 1910) Miller, 1941 *Lepidapedon elongatum* (Lebour, 1908) Nicoll, 1915 *Plagioporus idoneus* (Nicoll, 1909) Price, 1934 *Podocotyle reflexa* (Creplin, 1825) Odhner, 1905 *Gonocerca phycidis* Manter, 1925 *Gonocerca crassa* Manter 1934 *Gymnophallus deliciosus* (Olsson, 1893) Odhner, 1900
	VII Baer 1956	
	Echinoparyphium groenlandicum n. sp. *Apatemon gracilis minor* (Yamaguti, 1933)	

failed to include "*Onchocotyle appendiculata*", already mentioned from Greenland by DIESING (1850), (Table I, column II).

The latter omission was corrected eighteen years later by LÜTKEN (1875) who listed "*Onchocotyle borealis*", which VAN BENEDEN (1858) had proved was in reality a new species, from the gills of the Greenland shark. He further mentions a few undetermined flukes, obviously from museum specimens present in Copenhagen (Table I, column III).

The first trained zoologist to provide a survey of the trematodes of Greenland, based on personal collections and investigations, was G. M. R. LEVINSEN. In the years 1875–1877 he stayed at Egedesminde for the purpose of collecting marine invertebrates. This was of course impossible in winter time on account of the ice, and in this part of the year he then concentrated on collecting and studying trematodes from fishes, the few fish species customarily caught through holes in the ice for consumption, mainly the father lasher and the ogac. Some eider ducks were searched as well. Thirteen species of trematodes were collected, of which seven appeared new to science. His results were published in 1881, (Table I, column IV), a basic and high-ranking research work for its period.

VANHÖFFEN (1897) gave a list of the Greenland trematodes known up till then. As DITLEVSEN (1914) points out, this list is in reality LÜTKEN's list of 1875 (less one species) and completely overlooks LEVINSEN's contribution. The only trematode species which VANHÖFFEN actually saw (collected ?) was "*Onchocotyle borealis*" from carcasses of Greenland sharks (l.c. p. 222).

As a member of a Swedish zoological expedition (KOLTHOFF) to the European arctic in the summer 1900, T. ODHNER visited West Spitzbergen and East Greenland, i.a. collecting trematodes. The results were published in his dissertation in 1905. Of the 25 trematodes here mentioned, only 5 had actually been collected by ODHNER at East Greenland, and only 1 appeared new to the Greenland fauna. To this he adds 3 previously undetermined species from Greenland which he had at hand as a loan from the Copenhagen Zoological Museum (Table I, column V). For comparison he further had the type material of LEVINSEN, also on loan from the same museum. The value of ODHNER's contribution to the knowledge of the Greenland trematodes lies thus not so much in the rather slight increase of known endemic species, as in the revision of LEVINSEN's and older material which, together with other arctic-boreal material, furnished the anatomical basis for his indispensable contribution to the trematode systematics in general.

On bibliographical data DITLEVSEN (1914) compiled a list of the 20 trematode species known from Greenland up till then (Table I, column VI). From then until today nobody seems to have cared for the Greenland trematodes, as far as I am aware, apart from BAER (1956) who reported

two species of trematodes from birds (Table I, column VII). A full synopsis of previous and present results is given in Table I.

III. Material

The material here presented was collected during the summer of 1962, mainly from fishes caught in the Disko Bugt (West Greenland) close to the port of Godhavn. For the sake of efficiency my young colleague, cand. real. BJÖRN BERLAND, and I shared the same material of presumptive hosts, being interested, respectively, in nematodes and trematodes. In this way we were both at each others' service in the search for helminths.

During our stay at Godhavn the following species were searched for nematodes and trematodes, 98 specimens in all:

ELASMOBRANCHII: *Acanthorhinus carcharias* (GUNNERUS, 1766) BLAINVILLE, 1816 (Syn. *Somniosus microcephalus* (BLOCH & SCHNEIDER, 1801))
Raja radiata DONOVAN, 1806
Raja hyperboreus COLLETT, 1879

TELEOSTEI: **Mallotus villosus* (MÜLLER, 1777)
Salvelinus alpinus (LINNAEUS, 1758)
Gadus callarias LINNAEUS, 1758
Gadus ogac RICHARDSON, 1836
**Boreogadus saida* (LEPECHIN, 1774)
**Lumpenus lampretaeformis* (WALBAUM, 1792)
Lycodes reticulatus REINHARDT, 1838
Anarhichas lupus LINNAEUS, 1758
Anarhichas minor OLAFSEN, 1772
Anarhichas latifrons STEENSTRUP, 1842
Sebastes marinus (LINNAEUS, 1758)
Acanthocottus scorpius (LINNAEUS, 1758)
**Triglops pingelii* REINHARDT, 1838
Leptagonus decagonus (BLOCH & SCHNEIDER, 1801)
**Gasterosteus aculeatus* LINNAEUS, 1758
Reinhardtius hippoglossoides (WALBAUM, 1792)

AVES: **Phalacrocorax carbo* (LINNAEUS, 1758)
Somateria mollissima (LINNAEUS, 1758)
**Cepphus grylle* (LINNAEUS, 1758)
Larus glaucoides MEYER, 1822

MAMMALIA: **Phoca groenlandica* FABRICIUS, 1776

* No trematodes encountered in these hosts.

To the material collected from the above mentioned hosts were added some further trematode specimens accidentally collected by BJÖRN BERLAND during previous visits to East- and West Greenland waters on board Norwegian Fishery Research vessels. The following hosts were found parasitized:

ELASMOBRANCHII: *Acanthorhinus carcharias* (GUNNERUS, 1766), syn. as above
Raja radiata DONOVAN, 1806

TELEOSTEI: *Gadus callarias* LINNAEUS, 1758
Gadus ogac RICHARDSON, 1836
Anarhichas lupus LINNAEUS, 1758
Anarhichas minor OLAFSEN, 1772
Anarhichas latifrons STEENSTRUP, 1842
Seabastes marinus (LINNAEUS, 1758)
Hippoglossus hippoglossus (LINNAEUS, 1758)
Reinhardtius hippoglossoides (WALBAUM, 1792)

The technique used for collecting, fixing and staining is the same as given previously (BRINKMANN 1952).

IV. Monogenoidea BYCHOWSKY, 1947

Monopisthocotylea ODHNER, 1912

Acanthocotylidae PRICE, 1936

Acanthocotyle verrilli GOTO, 1899*

Syn. *Acanthocotyle borealis* BRINKMANN, 1940

Previous records in Greenland: None

Present records and material:

Raja radiata, inf. 1 of ?, ventr. surf. of skin, W. Greenland (62°05′ N., 50°40′W.) 3.5.62, col. Berl., det. A.Br.jr, U.B.Z.M. No. 47980

Raja radiata, inf. 1 of 4, ventr. surf. of skin, W. Greenland, Skarvefjeld bank (S.E. off Godhavn) 13.9.62, col. et det. A.Br. jr., U.B.Z.N. No. 47981.

In all instances where the host species was properly identified by the author himself (STAFFORD, 1904; BRINKMANN, 1940, 1952, 1956 and POLJANSKY, 1955) this appears to be *Raja radiata* only. The host species given by GOTO (1899), MANTER (1926) and PRICE (1938) are all somewhat dubious from a specific point of view. *Acanthocotyle verrilli* thus appears to be rather host specific and follows *Raja radiata* to the northern limits of its distribution.

Capsalidae BAIRD. 1853

Entobdella hippoglossi (MÜLLER, 1776) JOHNSTON, 1856

Syn. See DAWES (1947).

Previous records in Greenland: "*Hirudo Hippoglossi* MÜLLER" in FABRICIUS, 1780, l.c. p. 322 from "*Pleuronectes hippoglossi*". Locality not given.

Present records and material:

Hippoglossus hippoglossus, inf. 1 of ?, surf. of skin, E. Greenland off Skjoldungen 23.7.59, col. Berl., det. A.Br.jr. U.B.Z.M. No. 47982

Raja radiata or *Reinhardtius hippoglossoides*, inf. 1 of 4, surf. of skin, W. Greenland, Skarvefjeld bank (S.E. off Godhavn) 12.9.62, col. et det. A.Br.jr. U.B.Z.M. No. 47983.

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* The reference by YAMAGUTI (1936) of this species to a new genus and subfamily appears somewhat premature. The anatomical characteristics on which this separation is based are so far not sufficiently elucidated.

Nobody concerned with this species seems to forget to mention its being reported from Greenland. This gives the impression that it has repeatedly been put on record from these waters. This is not so and the information in the literature exclusively is based upon FABRICIUS (1780) through DIESING (1850).

Of the present two records the latter is of some interest. It consists of a single little specimen only, 4 mm long by 1.5 mm wide. This specimen was certainly removed from a specimen of *Raja radiata*. Having thus been collected from a batoidean host, it was first supposed to be a specimen of *Entobdella bumpusii*, especially as this species had been reported from the relatively nearby Labrador waters (PRICE, 1939, l.c. p. 73). This possibility however had to be ruled out soon as the present specimen exhibited papillation of its haptoral ventral surface, the first pair of haptoral hooks appeared spearhead-shaped, and were only about half the size of the second pair. The close examination thus indeed revealed the parasite to be a young specimen of *Entobdella hippoglossi*. However, the host species remained confusing: how could this species be found on a starry ray?

The explanation appears to be quite simple. The single specimen of starry ray had on the preceeding day been brought to the laboratory in a fish-basket together with a few specimens of *Reinhardtius hippoglossoides*. Most probably the parasite had dislodged from one of these and been stuck to the ray. If so, this pleuronectid is a new host for *E. hippoglossi*. However, the parasite was never encountered on any of all the specimens of *R. hippoglossoides* searched. It may be mentioned that *E. hippoglossi*'s common host — *Hippoglossus hippoglossus* — is abundant together with *R. hippoglossoides* in the very same waters, though we had no opportunity to search the halibut for the parasite.

Polyopisthocotylea ODHNER, 1912

Hexabothriidae PRICE, 1942

Squalonchocotyle* borealis (VAN BENEDEN, 1853) CERFONTAINE, 1899

(Figs. 1–3)

Syn. *Onchocotyle appendiculata* DIESING, 1850, in part
Onchocotyle somniosi CAUSEY, 1926
Squalonchocotyle somniosi (CAUSEY, 1926) GUBERLET, 1933

* I still maintain the sound view put forward by SPROSTON (1948) that as none of the generic criteria at present employed was given by VAN BENEDEN and HESSE (1863) in their original description of *Erpocotyle laevis*, the generic name *Erpocotyle* has to be suppressed, unless the original specimens are found and redescribed. So far this has not been done. Even though I regard it rather probable that *Squalonchocotyle vulgaris* CERFONTAINE is identical with *Erpocotyle laevis* VAN BENEDEN & HESSE, i.e. the former being then a synonym for the latter, this has so far not been proved

Previous records in Greenland: *Onchocotyle appendiculata* DIESING (= *Polystoma appendiculata* KUHN, 1829) in DIESING "Systema Helminthum I", 1850, l.c. p. 419, from *Laemargus borealis* on the gills, Greenland (KRØYER).**

Onchocotyle borealis VAN BENEDEN in LÜTKEN "A revised catalogue of the Entozoa of Greenland", 1875, l.c. p. 182, from *Somniosus microcephalus* on the gills. Locality in Greenland not mentioned.

Onchocotyle borealis VAN BENEDEN in VANHÖFFEN, 1897, l.c. p. 222 and 226. W. Greenland, Ikerasak.

Squalonchocotyle borealis (VAN BENEDEN) in ODHNER, 1905, l.c. p. 372"— von der grönländischen Ostküste".

Present records and material:

Acanthorhinus carcharias, inf. 1 of ?, gills, E. Greenland off Umîvik 31.8.61, col. Berl. det. A.Br. jr., U.B.Z.M. No. 47984

Acanthorhinus carcharias, inf. 1 of 1, gills, W. Greenland, Skarvefjeld bank (S.E. off Godhavn) 9.9.62, col. et det. A.Br.jr., U.B.Z.M. No. 47985.

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beyond reasonable doubt. YAMAGUTI (1963) accepted the generic name *Erpocotyle*, apparently on the assumption that "PALOMBI (1949) redescribed and figured the type species in considerable detail". This assumption is incorrect. PALOMBI — writing in Italian — does not mention anywhere in his paper that he has had access to the original material or new material of his own. His "redescription" of *E. laevis* is in fact a compilation of CERFONTAINE's (1899) and GUBERLET's (1933) descriptions of *Squalonchocotyle vulgaris*, and PALOMBI's figures are all reproduced from the same two sources.

** As DIESING (1850) mentions KRØYER's find *before* the latter had published anything about it, DIESING must have obtained this information as a personal communication from KRØYER himself or another (Danish?) zoologist aware of KRØYER'S find. KRØYER (1852–53, p. 926) mentions "*Onchocotyle appendiculata* KUHL" from *Laemargus borealis*, but *not* especially from Greenland. He doubts the identity of his specimens with "*Onchocotyle appendiculata* KUHL" as this originally was collected and described from *Scyllium* (KUHN 1828). His doubts were confirmed, and its identity with *O. borealis* proven by VAN BENEDEN (1858). VAN BENEDEN must have been aware of KRØYER's find as given by DIESING (1850), or from KRØYER (1852–53). The fact is that VAN BENEDEN borrowed the Copenhagen material from professor ESCHRICHT — probably upon application — and did mention that the label of the material gave the locality as Greenland, but did not state host-species. The contact between the two must have been rather close as it was also through ESCHRICHT that VAN BENEDEN in 1861 obtained a seiwhale-skeleton (*Balaenoptera laticeps* = *B. borealis*) from Finmarken for the Museum of Natural History in Brussels.

It is curious that J. T. REINHARDT (1857) in his list does not mention the parasite from Greenland. The probable explanation of this is that REINHARDT did not know about this material, as it probably at that time was not kept at the Zoological Museum but at ESCHRICHT's Zootomical-Physiological Museum. Only after ESCHRICHT's death in 1863, were these collections transferred and incorporated in the Zoological Museum. Accordingly LÜTKEN (1875) does mention it. The three first mentioned records above obviously all refer to the same single find and material.

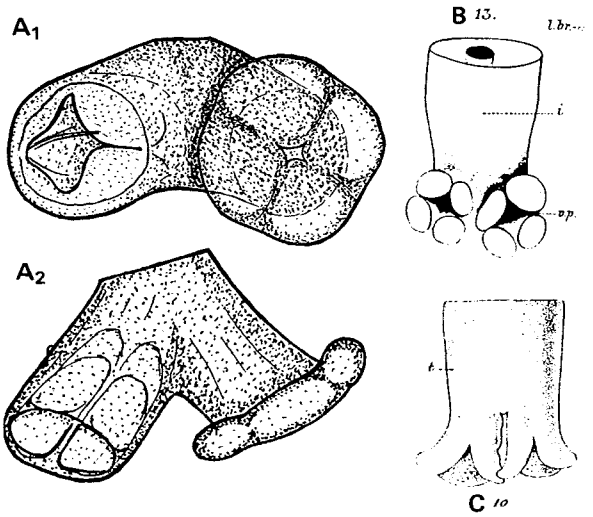

Fig. 1. *Squalonchocotyle borealis*, opisthaptor appendix cut off with its two suckers. A. From present material, left sucker closed (contracted), right one open (relaxed), A_1 face view, A_2 side view. B. From CERFONTAINE (1899, fig. 13). C. From VAN BENEDEN (1853, fig. 10).

Previous authors all give "the gills" as habitat of the parasite. This must not be understood as the gill filaments only. The present material was mainly collected from the filaments, but some specimens were also found fastened to the smooth surface of gill septae and gill chamber.

Undoubtedly the best descriptions of the parasite have been given by VAN BENEDEN (1853 and 1858) and CERFONTAINE (1899). However, further anatomical data are called for to widen the basis for trustworthy comparison with species of the same and closely related genera described later.

The maximal length of the present specimens is 23 mm (opisthaptor included, appendix excluded) with a maximal width of 3 mm. In the opisthaptor the mouth of the appendix suckers appears smooth in the contracted state, this state being prevalent in most specimens after fixation. The inside wall of the contracted sucker bulges centrally, giving the appearance of four internal cushions. In the extended state of the appendix suckers the inside is turned out so that the mouth of the suckers is formed by the previous inside bulges appearing as four lips. This is in fact an old observation mentioned by CERFONTAINE (1899) but his illustration hereof (Pl. XVII, fig. 13) is somewhat misleading and also departs from VAN BENEDEN's illustration (1853, fig. 10) of the same — a fact which has caused some confusion. The truth of the matter, as observed in a single specimen of the present material, is apparent from fig. 1 A (1 face view, 2 side view) showing the two suckers of the same

appendix, the one of which is contracted (closed), the other extended (open). This explains the difference between CERFONTAINE's and VAN BENEDEN's illustrations of the same object, here reproduced as fig. 1 B and C, respectively.

The anteriorly directed oesophageal diverticulum ventral to the oesophagus is conspicious, but is only seen in serial sections. The oesophagus proper further shows lateral bulges or shallow diverticulae. The two main intestinal crura possess small ventral diverticulae, but otherwise only bulges. From the posterior union of the two crura and caudad, intestinal diverticulae are absent. The intestine proceeds into the opisthaptor giving off one branch which enters the appendix and another one in the opposite direction, within the opisthaptor proper. Both branches are saccular lacking lateral diverticulae.

The numerous testes occupy the intercaecal field in the posterior half of the body proper. The small vasa efferentia unite in each side of the body to form a small-caliber right and left vas deferens which both take a dorso-anteriorly course and enter a seminal vesicle, or in other words unites as a common wide vas deferens (fig. 2). This wide median part of vas deferens lies in the intercaecal field ventro-medially following a winding course anteriorly with its loops in the transversal plane. It enters the cirrus pouch just posterior to the point where the oesophagus joins the two intestinal crura.

The female reproductive organs occupy the intercaecal field in the middle of body, just anterior to the testes (fig. 2). The ovary is irregularly shaped with a slightly lobed anterior part, containing the youngest ova, in one side* of the body. At the same level in the other side, somewhat dorsally, the seminal receptacle is found. From its anterior part the ovary bends posteriorly, forming a few broad loops, filling the intercaecal field posterior to the seminal receptacle and anterior to the testes. In its course it shows ova of increasing size viz. age. The oviduct leaves the ovary in the median plane between the seminal receptacle and the anterior part of the ovary. The oviduct joins the canal leading to or from the seminal receptacle and continues briefly to a point where the vitelline reservoir joins in and proceeds with a short single loops which opens into the ootype. At the joining-point of the oviduct and vitelline reservoir, a genito-intestinal canal gives off, taking a transversal course, just anterior to the ovary, and then opens into the intestinal caeca of this side.

* VAN BENEDEN's fig. 2 (1853) gives a view from the *dorsal* side showing the ovary in the right and the receptacle in the left side of body. In my four mounted specimens, three show the ovary in the right side and receptaculum in left side. whereas in the fourth specimen (fig. 2) this is inverted. *Situs inversus* thus appears to be fairly common.

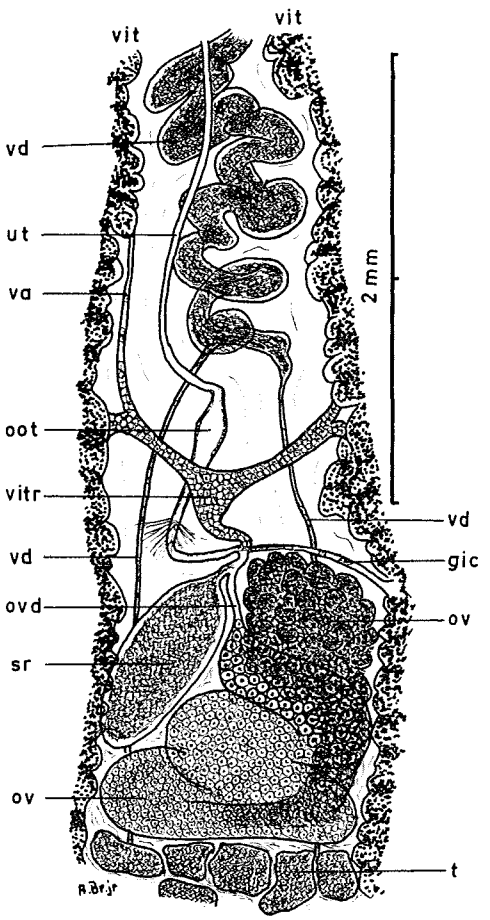

Fig. 2. *Squalonchocotyle borealis*, central part of genital system viewed from the ventral side. Medial border line of intestinal crura not visible as covered by ventromedial vitelline follicles.

The ootype is elongate, dorsally situated slightly anterior to the vittelline reservoir. Numerous unicellular glands empty into the posterior part of the ootype. These are located as a complex lateral to the anterior part of the seminal receptacle, between this and the intestinal caecum of this side, and show long eosinophilic ducts leading to the ootype. From the ootype the uterus, relatively small in caliber, takes a ventromedial direct course anteriorly to the genital pore lying just behind the point where the oesophagus joins the intestinal crura. In the uterus a few eggs were observed, all with a single polar filament at each end. They were not united to form a chain. The eggsshell proper, filaments excluded, measured approx. 0.25 mm in length.

The two vaginae are small-calibered canals arising in each side of the body from the transversal part of the vitelline reservoir and proceeding anteriorly along the medial side of the intestinal crura, partly covered by the vitelline follicles. During their course they widen, more or less extended by received sperms, and appear somewhat convoluted. Internally they are covered by what in sections appears as a rugged, cuticularized epithelium. Distally, however, the vaginae are inconspicious and rather difficult to observe in mounted specimens. The vaginal apertures are ventrally situated, slightly posterior to the level of the genital pore and laterally to the intestinal crura.

The vitellaria extends from a level slightly posterior to the vaginal apertures to a posterior level where the intestinal crura unite at the attachment of the opisthaptor. Vitelline follicles cover the main part of the intestinal crura with diverticulae. The oesophagus, the anterior part of intestinal crura and the intestinal caeca in the opisthaptor with the appendix are not covered by vitelline follicles. The yolk duct of each side runs, from anterior and posterior, medially close to the intestinal crura uniting at the level of ootype. From here the duct proceeds transversally, widens, and in the median line unites with its mate from the opposite side to form a ventral median Y-shaped vitelline reservoir, the stem of which opens into the oviduct (fig. 2).

It is striking how previous and present descriptions of *S. borealis* bring to mind *S. dollfusi* (PRICE, 1942) SPROSTON, 1946 (= *S. abbreviata* forma D of DOLLFUS, 1936). General shape and size conform and so do the hooks of the haptoral suckers. The internal pattern of sexual organs is almost identical in the two species, as will be seen when comparing the present fig. 2 with DOLLFUS' fig. 20 (1936). Also the size of egg (filaments excluded) is practically the same. The main differences seem to be that in *S. dollfusi* the eggs appear in chains, which they certainly do not in *S. borealis*, and further the fact that in the former the distal part of the vaginae are conspicious and club-shaped, whereas in the latter they are inconspicious and rather difficult to observe in mounted specimens.

The two species appear to be valid, but there can be no doubt that they are very closely related. So are in fact also their hosts, respectively the Greenland shark and *Echinorhinus brucus* (BONNATERRE, 1788).

Far more striking, however, is the likeness between *S. borealis* and *S. somniosi* (CAUSEY, 1926) GUBERLET, 1932. The fact is that the specific validity of *S. somniosi* is far from proven beyond doubt. Personally I am convinced that the two species are identical and shall state my reasons below.

CAUSEY (1926) points out his species' similarity to *S. borealis* from the same host in European waters, but finds that it differs from the latter

in certain respects. Regarding size, CAUSEY gives this as 17–28 mm for *S. somniosi* and 20 mm for *S. borelalis*. VAN BENEDEN (1853) certainly gave the size of the latter as 25–30 mm, and BYCHOWSKY (1957) also mentions 30 mm specimens from the Murman waters. Regarding size there actually seems to be no significant difference.

POLJANSKY (1955) states that the differences between the two species is insignificant. According to him the only difference seems to be that in *S. omniosi* the eggs are described as having a single filament at one pole only, whereas in *S. borealis* there is a filament at each pole. PRICE (1942) reviewed CAUSEY's type-specimens and gave — as CAUSEY had not done — an illustration of the egg. PRICE's fig. 5 E shows that the egg in fact was equipped with a filament at each pole, the filament at one pole having, however, accidentally been bent back along the egg proper, a fact apparently not observed by CAUSEY. As the egg thus exhibits a filament at each pole, the only separating characteristic recognized by POLJANSKY vanishes.

PRICE also mentions that the principal difference between the two species is the nature of the large haptoral hooks. In *S. somniosi* the blade or claw is inserted into the root of the hook in much the same manner as in the rajonchocotylids, whereas in *S. borealis* the insertion of the blade is more or less typical for the squalonchocotylids. These are extremely doubtful characteristics, and even if they exist, do not necessarily warrant the validity of *S. somniosi* as a distinct species.

Another difference mentioned by CAUSEY, is that in *S. borealis* the mouth of the haptoral suckers is distinctly divided into four lobes or lips, whereas in *S. somniosi* no corresponding lobes could be traced. This is no difference at all, as CAUSEY is not referring to homologous types of suckers in the two species. CAUSEY really confused the haptoral suckers proper and the haptoral appendix suckers, thus comparing the appendix suckers of *S. borealis* — as described by VAN BENEDEN and CERFONTAINE — with the haptoral suckers proper in S. *somniosi* as observed by himself.

As previously mentioned, the lobation described by VAN BENEDEN and by CERFONTAINE concerns the appendix suckers only, and their lobation is only apparent when the suckers are open, as shown above (fig. 1). In fact, CAUSEY did not describe the appendix suckers of *S. somniosi* at all. Hereby also this separating characteristic mentioned by CAUSEY vanishes.

As regards the further external differences of the opisthaptor mentioned by CAUSEY, I cannot confirm them as valid when compared with the present material of *S. borealis*.

CAUSEY (1926, p. 199 right) reproduces a copy of VAN BENEDEN's drawing (1853, fig. 5) of the female reproductive system of *S. borealis* to

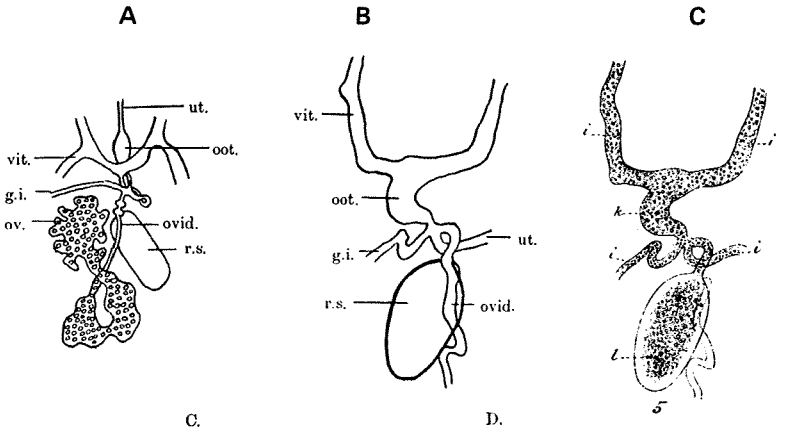

Fig. 3. Central part of genital system in *Squalonchocotyle somniosi* and *S. borealis*.
A. *S. somniosi* reproduced from CAUSEY (1926, text-fig. C).
B. *S. borealis* reproduced from CAUSEY (1926, text-fig. D) as he redrew it from VAN BENEDEN (1853, fig. 5).
C. *S. borealis* reproduced from VAN BENEDEN (1853, fig. 5).
Further explanation see text.

be compared with the corresponding parts (p. 199 left) of *S. somniosi* as observed by himself. However, CAUSEY's copy-drawing is unfortunately rather dubious as regards the connections between the seminal receptacle and oviduct (fig. 3). What is worse, is that he deviated from the lettering given by VAN BENEDEN in his illustration. What VAN BENEDEN correctly determined as vitelline reservoir (k = Vitellosac), CAUSEY wrongly regarded as the ootype, when in fact VAN BENEDEN's illustration did not show the ootype at all. Of the two lower ducts, identified by VAN BENEDEN as vitelline ducts (i = Vitelloducte), CAUSEY correctly identified the one as the genito-intestinal canal, bu the other wrongly as the uterus. In reality the latter duct is the distal part of the oviduct leading to the ootype, which was not, however, drawn by VAN BENEDEN. Given these misinterpretations it is easy to understand why CAUSEY thought he had observed basic differences between the two species. However, they are based upon his erroneous interpretation of VAN BENEDEN. In fact there appear to be no significant differences whatsoever as regards the pattern of the compared parts of the two species.

The fact that monogenoidea are found in Western North American waters does not necessarily mean that they are new species, if no morphological differences can be ascertained. BONHAM (1950) has thus in a convincing manner shown that f. i. *Onchocotyle striata* MILLER from *Squalus suckly* in reality is our old friend *S. abbreviata* (OLSSON), and *Rajonchocotyle ovata* GUBERLET and *R. wehri* PRICE in reality are *R. batis* CERFONTAINE. Along the same lines, there remain no comparative anatomical

points in which *S. somniosi* differs from *S. borealis*; they must be regarded as identical, the former thus being a synonym for the latter.

The biological significance of the comparative anatomy of the vaginae and the morphology of eggs in the *Hexabothriidae*

It is generally accepted that the *Batoidei* (*Hypotremata*) have their phylogenetic origin within the *Selachii* (*Pleurotremata*) by way of the *Rhinidae* (= *Squatinidae*) of the *Squaloidea*. It is then reasonable to anticipate that the phylogenetic basic pattern of the hexabothriid vaginae prevails in species parasitizing the *Selachii*. As in the latter species only one single pattern (fig. 4 A) is encountered, this pattern may be regarded as being the primary type, i.e. the oldest pattern. This view is supported by the fact that this type A pattern is found in the only hexabothriid species, *Squalonchocotyle callorhynchi* MANTER 1955, parasitizing host of the archaic group *Holocephali*.

Whereas thus the type A pattern seems to be the only one present in species parasitizing the *Holocephali* and *Selachii*, three further types (fig. 4 B–D) are found in the species parasitizing the *Batoidei*. BYCHOWSKY (1957, p. 407 Rus. ed. & 1961, p. 490 Americ. ed.) reported separate and uniting vaginae in apparently the same species. BRINKMANN (1971 & 1972) in a closer examination of BYCHOWSKY's material, found that in this new species (*Squalonchocotyle rajae* BRINKMANN 1971) the type A pattern, i.e. the squalonchocotylid pattern, was predominant (BRINKMANN, 1971 & 1972, fig. 2 F–I) but the types B and D pattern were also met with (fig. 2, A–D). It seems in fact that the vaginal pattern found in *S. rajae*, gives an image of the pattern of evolution within the whole squalonchocotylid group, i.e. we are here observing an evolutionary trend in action.

It is rather interesting to note that such a variation of the vaginal pattern is found in a squalonchocotylid which parasitizes the *Batoidea*. Only here a variation or an evolution from the primary pattern A appears to have taken place. This must have a cause, a cause which might be found in the benthal way of life of the host. Of course this can not be proved, but this hypothesis is supported by the presence of morphologically different egg types in the different hexabothriid genera.

The chance the hexabothriid egg has of infesting a new host specimen depends on the anchoring device of the eggs and the number of eggs shed per volume of habitated water. Accordingly, well-developed egg anchoring devices are more important for eggs shed in the vast volumes of pelagic waters habitated by the *Selachii*, less important for eggs shed in the (in volume) more limited benthal waters habitated by the *Batoidei*.

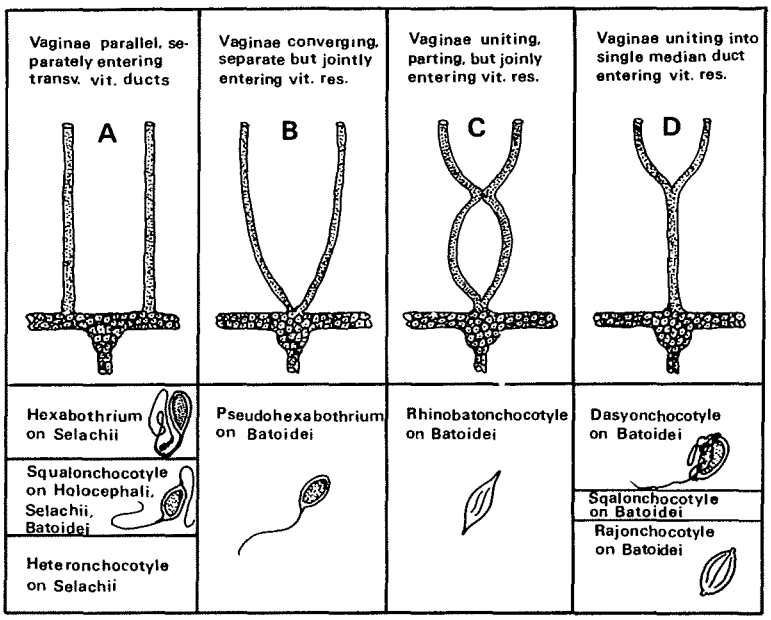

Fig. 4. The hexabothrid pattern of vaginae and eggtypes, probably indicating (from A to D) the phylogeny of the main genera of the family *Hexabothridae*. (Note: The hexabothriumegg is from *H. caniculae* copied from GUBERLET (1933, plate IV, fig. 6). YAMAGUTI (1963, plate 76, fig. 478b) copied the same illustration, but erroneously gave the species as *Erpocotyle* (*Squalonchocotyle*) *catenulata*).

From this line of reasoning it is in fact suggestive that the eggs of all selachian hexabothriids are equipped with uni- or bipolar filaments, often in chains. Further, that in batoidea hexabothriids such anchoring devices appear to have evolutionarily reduced to single unipolar filaments, short polar elongations or polar knobs only. The only exception to this is the eggs of *S. rajae*.

If the host habitat, changing from pelagic to benthal waters, has influenced the evolutionary trend of egg pattern, it may also have influenced the morphology of other internal organs, such as the vaginal pattern.

Squalonchocotyle berlandi n. sp.

(Fig. 5)

Present records and material:

Raja radiata, inf. 0 of 1,	W. Greenland, Fyllas Banke 28.4.61
– – , – 0 – 1,	– – Fiskenæsset bank (62°05′ N. 50°40′ W.) 3.5.62

Raja radiata, inf. 1 of 4, gills, W. Greenland, Skarvefjeld bank (SE off Godhavn) 12.9.62, col. et det. A. Br. jr., U.B.Z.M. No. 47986

Raja hyperborea – 0 – 1, – – , Skarvefjeld bank (SE off Godhavn) 21.8.62

The material consists of three specimens in total preparation only, so that the internal anatomy could not be elucidated in as much detail as desirable.

Haptors included, the mounted specimens range in length from 6 to 10 mm, the width being 2.5 to 3 mm. Prohaptor is a non-papillated oral sucker wider than long (0.45–0.6 by 0.27–0.4 mm) with inconspicious preoral membrane. Opisthaptor of common hexabothriid type. Haptoral suckers with membraneous flange, inner surface with parallel ridges but not papillated. All haptoral suckers and sclerites of nearly equal size, the sclerites measuring — disregarding curvature — 0.5–0.66 mm. Haptoral appendix rather long, up to one third of the total length of body proper. Appendix suckers of common type with hooklets about 0.055 mm, the shape of which could not be ascertained.

Pharynx globular 0.1–0.16 mm in diameter. Oesophagus inconspicuous and intestine of common hexabothriid type concealed by vitelline follicles. The vitellaria reaches anteriorly to the level of genital pore, posteriorly entering opisthaptor with appendix in which it covers the intestinal caecum nearly to its extreme.

The genital complex in the middle of body proper is of the common type (fig. 5). A long, slender seminal receptacle is present in its usual place. The slenderness may be due to the fact that it was only discretely filled with spermatozoa.

Rather characteristic is the unusual long stemmed vitelline reservoir (fig. 5, vitr) of the same type as found in *S. rajae*. The anterior end of this is entered by a transversal vitelline duct from each side, respectively, at a level just anterior to the ootype and rather far anterior to ovary and seminal recepticle. The vaginae could not be observed in their whole length, but it appears that they unite as the vitelline reservoir anteriorly is entered by *a single midventral common vaginal canal.* My friend Prof. EUZET, who had the specimen for control found that it obviously exhibits the "rajonchocotylid" pattern of vaginae, i.e. type D fig. 4.

Two to three uterine eggs were present, measuring 0.18–0.25 mm in length, filaments excluded. The bipolar filaments were relatively short, i.e. with a length corresponding to half the length of egg proper. They

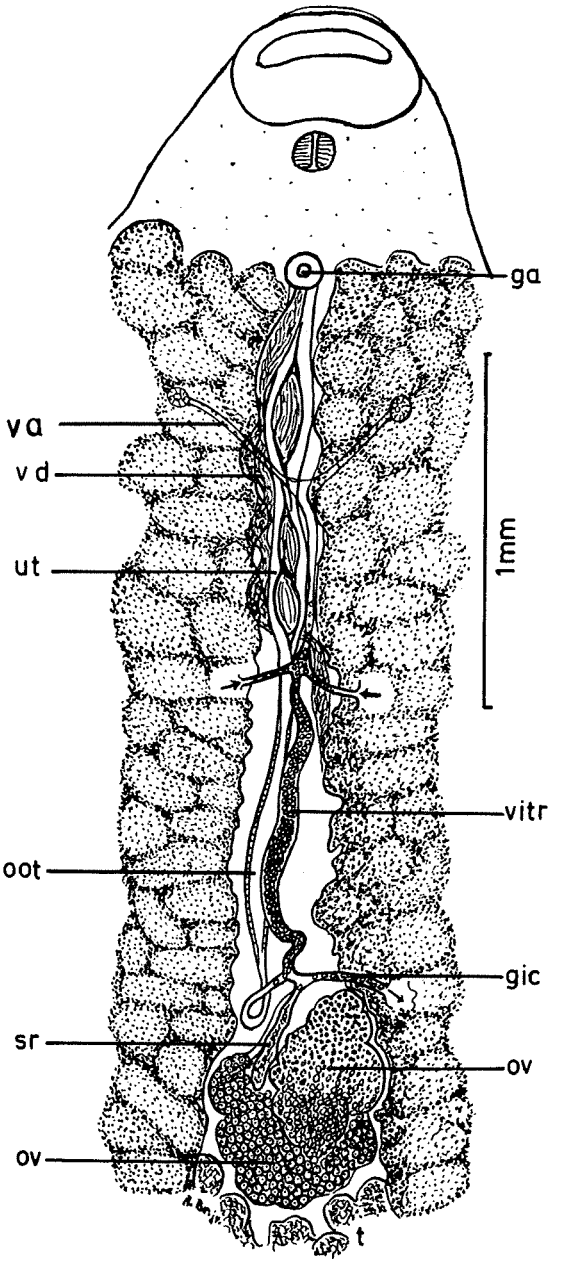

Fig. 5. *Squalonchocotyle berlandi*, central part of genital system viewed from the ventral side.

were not united in a chain and exhibited no meridional ridges, thus not being of the "rajonchocotylid" type.

It should also be mentioned that in my Norwegian material I have a squalonchocotylid specimen which exhibits the very same characteristics, i.e. eggs with short polar filament at each end and "rajonchocotylid" pattern of vaginae, as also confirmed by Prof. EUZET. This specimen (U.B.Z.M. No. 44234, Ullsfjord-Tromsö 7.8.55) was collected by my pupil Mr. B. BERLAND, wherefore the species here described has been named in his honour.

The presence of an unarmed cirrus, haptoral suckers with sclerites of nearly equal size and egg with a filament at each pole (bipolar), certainly indicates that the present specimens must be assigned to the genus *Squalonchocotyle* sensu SPROSTON. Within this genus the vaginal pattern has hitherto — without exceptions — been that of two parallel vaginae separately entering the transverse vitelline ducts (fig. 4 A). However, BYCHOWSKY (1957 & 1961) and BRINKMANN (1971 & 1972) have shown that in *S. rajae* some specimens may exhibit a vaginal pattern where the two vaginae unite to form a median ventral common duct before entering the vitelline reservoir (fig. 4 D), i.e. the "rajonchocotylid" pattern. Also in the present species the proximal parts of the two vaginae unite to form a common vaginal duct.

This characteristic separates the present species from all other known species of the genus *Squalonchocotyle*, *S. rajae* excepted. Accordingly, the two species (*S. berlandi* and *S. rajae*) appear related and both are parasites of rays. The two species are easily separated, *S. berlandi* with no chain formation of eggs, contrary to *S. rajae* with eggs in chain.

As the present species was collected from *R. radiata*, it should be mentioned that POLJANSKY (1955) reported *Rajonchocotyloides emarginata* (OLSSON, 1876) PRICE, 1940 from *R. radiata* and *R. clavata* in the Barents Sea. He gave no description however, and must thus have found that his specimens coincided with PRICE's description (1940). This does not mean that PRICE's and POLJANSKY's specimens coincided with "*Onchocotyle emarginata* OLSSON, 1876", even if PRICE regards his description as a redescription of OLSSON's species.

PRICE stated about OLSSON's and his single specimens that: "So far as May be determined from the original description and figures, the eggs were ovoidal and not provided with polar prolongations, — "and further — both specimens were from the same host, and show such obvious similarity in the extension of the vitellaria into the haptoral appendix, makes it unlikely that the specimen described in this paper could represent a species distinct from that described by OLSSON".

I can not agree as long as the pattern of vaginae is unknown in both specimens and the lack or presence of polar egg filament(s) is unknown

in OLSSON's specimen. OLSSON himself (1876, p. 12) confused uterus and vagina, stating: "*Vagina* ovula compluria (septem ibi numeravi, biserialia) elliptica long. vix 0,20 mm latit. 0,12 intus fovens". This does not permit PRICE to conclude that the egg was not provided with polar prolongations.

In fact we do not know — and will never know — what "*Onchocotyle emarginata* OLSSON, 1876" really is. We have here to recall that at OLSSON's time (1876) the only known species were "*Onchocotyle appendiculata* (KUHN)" and "*Onchocotyle borealis* V. BENED.", hereto "*Onchocotyle abbreviata* n. sp." described by himself in his paper. Accordingly, OLSSON described his "*Onchocotyle emarginata* n. sp." in relation to these, so that it at that time could be separated from these alone. OLSSON's "*O. emarginata*" may have been the same species as described by PRICE (1940), but it may just as well have been the *S. berlandi* here described, the size of egg proper and the extension of the vitellaria into the haptoral appendix being the same. It may also have been something else. I have thus in my possession a squalonchocotylid (U.B.Z.M. No. 42929) personally collected from *R. clavata* in Swedish Skagerrak waters (Kristineberg) with the egg showing unipolar filament.

V. Trematoda RUDOLPHI, 1808
Digenea VAN BENEDEN, 1858
Gasterostomata ODHNER, 1905
Bucephalidae POCHE, 1907
Prosorhynchus squamatus ODHNER, 1905

Syn. *Gasterostomum armatum* MOLIN, 1861 in part.

NAGATY (1937) and DAWES (1947) tried to compile a list of synonyms for th *Prosorhynchinae*-species, but these are not trustworthy, as they f.i. confuse valid species such as *P. crucibulum*, *P. aculeatus* and *P. squamatus*. So far our knowledge of the group is not sufficient to prepare a trustworthy list. When ZHUKOV (1963) reports "*P. crucibulum* (RUDOLPHI, 1819)" — not adding ODHNER, 1905 — from the *Myoxocephalidae* of the waters of Providence Bay/St. Lawrence Gulf (southern entrance to the Bering Strait) he obviously used this name *sensu lato*, i.e. including *P. squamatus*. In fact his specimens must be *P. squamatus*, since *P. crucibulum* is a parasite of the conger eel and they do not penetrate to these northern waters from the Pacific.

Previous records in Greenland: *Gasterostomum armatum* MOLIN *in* LEVINSEN, 1881, l.c. p. 27 (76) from *Acanthocottus scorpius* (L.) in intestine and pyloric caeca. Egedesminde. *Bucephalus crux* LEV. n., *ibidem*, from *Modiolaria discor* (L.) (*Lamellibranchia*) as bucephalous cercariae emitted and sporocysts of liver and gonads. Egedesminde.

Present records and material:

Acanthocottus scorpius,	inf. 1	of	3,	intest. and, pyl. caeca		W. Greenland, Godhavn 21.8.62, col. et det. A.Br.jr., U.B.Z.M. No. 47987
—	—	,	2–	2,	—	, W. Greenland, Godhavn 25.8.62, col. et det. A. Br. jr., U.B.Z.M. No. 47988
—	—	,	0–	3,		, W. Greenland, Godhavn 29.8.62, 9.9.62, 11.9.62

Anarhichas minor (the only *Anarhichas* specimen in which it was recorded)	, inf. 1 of 1,	intest. and, pyl. caeca	W. Greenland, Godhavn 12.9.62, col. et det. A. Br. jr., U.B.Z.M. No. 47989

The morphology of the present specimens conforms with the description given by ODHNER (1905) and I have nothing to add. Alive in the pyloric content of host, this gasterostome showed a peculiar "peristaltic" movement along the body. Whether this movement represented locomotion or food intake only, could not be ascertained.

In this place it seems pertinent to give a summary of the present state of knowledge as regards the host species of *P. squamatus* as related to its life cycle. As the only known bucephalous cercaria and the only known gasterostome digenea in arctic waters respectively appeared to be *Bucephalus crux* LEVINSEN from *Modiolaria discor* (L.) and *P. squamatus* ODHNER (= *Gasterostomum armatum* MOLIN *in* LEVINSEN) from *Acanthocottus scorpius*, ODHNER (1905) inferred that *Bucephalus crux* had to be the larvae of *P. squamatus*. This view was supported by LEBOUR (1908) who also pointed out that the second intermediate host appeared to have been omitted in the life cycle. However, ISSAITSCHIKOV (1928 and 1933) found that the striped seasnail (*Liparis liparis* (L.)), in Soviet western arctic waters was infected with *Metacercaria prosorhynchi sqamati** in cysts of skin, fins, gills etc. That this fish represented the second intermediate host was proven by CHUBRIK (1952), who further found that *Mytilus edulis* L. also served as a first intermediate host.**

A summary presents itself as follows:

FIRST INTERMEDIATE HOST
(*Lamellibranchia*)
Modiolaria discor (L.), arctic-boreal and circumpolar
Mytilus edulis L., cosmopolitan but never high-arctic

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* For the sake of completeness it should be mentioned that DOLLFUS (1951) described *Metacercaria prosorhynchi aculeati* (*Skrjabiniella aculeatus* (ODHNER, 1905)) encysted on the snout and gill arches of small fishes (*Sparisoma cretense*, *Rupiscartes atlanticus* and *Blennius sanguinolentus*) from coastal waters of Senegal.

** From *Mytilus edulis* L., COLE (1935) reported a gasterostome larva "*Bucephalus mytili*", in North Wales coastal waters. His description of this in no point differs from LEVINSEN's somewhat inadequate description of *B. crux*, for which it thus ultimately may turn out to be a synonym. COLE, especially, pointed out that the anterior end of *B. mytili* was equipped with very minute spines and rightly regarded his specimens as *Prosorhynchinae* larvae. As *B. mytili* was encountered in waters well within the range of distribution of *Conger conger*, whereas the finds of LEVINSEN and CHUBIRK were made in waters well beyond this range, it can not be excluded that *B. mytili* may be the larva of *P. crucibulum* or P. (*Skrjabiniella*) *aculeatus* which are parasites of the conger eel.

SECOND INTERMIDIATE HOST
(*Teleostei*)

North-Western Hemisphere waters:

Liparis liparis, (ISSAITSCHIKOV 1928)

North-Eastern Hemisphere waters:

Liparis gibbus, (ZHUKOV 1963)

Podothecus acipenserinus, (ZHUKOV 1963)

Myoxocephalus axillaris, (ZHUKOV 1963, inf. 14 per cent)

M. platycephalus, (ZHUKOV 1963, inf. 18.7 per cent)

M. verrucosus, (ZHUKOV 1963, inf. 29.3 per cent)

FINAL HOST
(*Teleostei*)

Norty-Western Hemisphere waters:

Gadus morhua maris-albi, (SHULMAN & SHULMAN-ALBOVA 1953, inf. 6.25 per cent)

Eleginus navaga, (SHULMAN & SHULMAN-ALBOVA 1953, inf. 6.6 per cent)

Brosmius brosme, (STAFFORS 1903 & 1904, MILLER, 1941, single case)

Hippoglossus hippoglossus, (STAFFORD 1903 & 1904, single case)

Hippoglossoides platessoides, (POLJANSKY 1955, inf. 13.3 per cent)

North-Eastern Hemisphere waters:

Gadus morhua macrocephala, (ZHUKOV 1963, inf. 15 per cent)

Pleuronectes stellatus, (ZHUKOV 1963)

Hexagrammus stelleri, (ZHUKOV 1963)

Melletes papilio, (ZHUKOV 1963, inf. 38.8 per cent)

Enophrys diceratus, (ZHUKOV 1963, inf. 16.6 per cent)

	Blepsias bilobus, (ZHUKOV 1963)
Gymnacanthus tricuspis, (POLJANSKY 1955, inf. 6.7 per cent)	*Gymnacanthus tricuspis*, (ZHUKOV 1963)
Acanthocottus scorpius, (OLSSON 1876, LEVINSEN 1881, ODHNER 1905, STAFFORD 1903 & 1904, LEBOUR 1908, ISSAITSCHIKOV 1928, SHULMAN & SHULMAN-ALBOVA 1953, inf. 81.2 per cent, POLJANSKY 1955, inf. 53.4 per cent, CHUBRIK 1952, BRINKMANN 1956)	*Myoxocephalus polyacanthocephalus*, (ZHUKOV 1936)
	M. axillaris, (ZHUKOV 1963, inf. 38 per cent)
	M. verrucosus, (ZHUKOV 1963, inf. 100 per cent)
Acanthocottus bubalis, (NICOLL 1907)	
Oncocottus quadricornis, (SHULMAN & SHULMAN-ALBOVA 1953, inf. 1 of 2)	
	Alcichthys alcicornis, (LAYMAN 1930)
	Podothecus acipenserinus, (ZHUKOV 1963)
Hemitripterus americanus, (STAFFORD 1903 & 1904)	*Hemitripterus villosus*, (LAYMAN 1930)
Liparis liparis, (MARKOWSKI 1933, POLJANSKY 1955, inf. 3 of 7)	*Liparis gibbus*, (ZHUKOV 1963)
Anarhichas lupus, (POLJANSKY 1955, inf. 20 per cent)	
Anarhichas minor, (Present paper)	
Zoarcer viviparus, (SHULMAN & SHULMAN-ALBOVA 1953, inf. 2 of 9)	
	Conger myriaster, (OZAKI 1924)

From this summary it appears that more fish species serve as second intermediate hosts in Far Eastern waters (5 species) than in Western waters (1 species). The number of final hosts is about the same in the west as in the east. However, in the east the main host *Myoxocephalus verrucosus* is 100 per cent infected and 4 other host species are from 15 to 40 per cent infected, whereas the main host in the west *Acanthocottus scorpius* is up

to 81 persent infected and no other host species here reaches a 15 per cent infection. These facts seem to indicate that *P. squamatus* has been introduced into the western waters by way of the Arctic Ocean from eastern waters, thus having an eastern origin. This inference is supported — and supports — the common assumption that the main host group, the *Cottidae*, originated in the Northern Pacific Ocean and that the Atlantic *Cottidae* have their origin in the Pacific *Cottidae*, (EKMAN, 1953). That a considerable part of the North Atlantic boreal and arctic fauna derived from the North Pacific has been substantiated by P. SCHMIDT (1904–1905), JORDAN (1905) and DJAKONOV (1945).

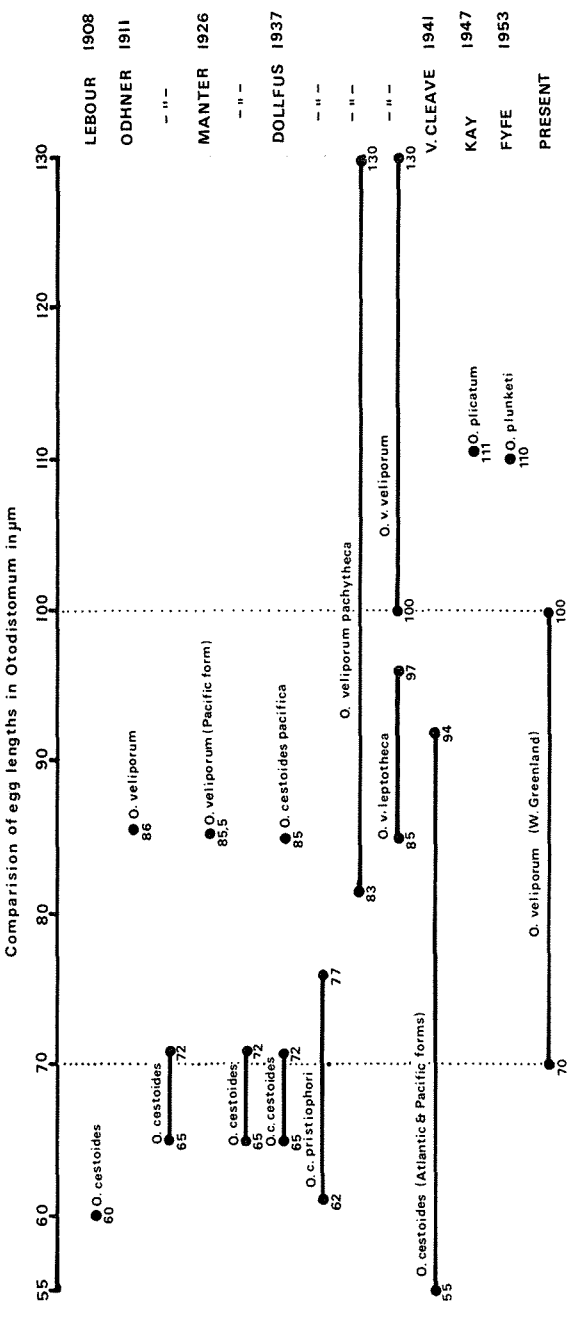
Prosostomata ODHNER, 1905
Azygiidae ODHNER, 1911
Otodistomum veliporum (CREPLIN, 1837) STAFFORD, 1904;
sensu DAWES 1947.

Syn. Se DAWES 1947, further
Otodistomum plicatum KAY, 1947.
Otodistomum plunketi FYFE, 1953.
Previous records in Greenland: None.
Present records and material:

Raja hyperborea,	inf. 1 of 1,	stomach,	W. Greenland, Skarvefjeld bank (SE off Godhavn) 21.8.62 col. et det. A. Br. jr., U.B.Z.M. No. 47990
Raja radiata	, – 1 – 3,	–	, As above 12.9.62, U.B.Z.M. No. 47991
– —	, – 0 – 1,		, As above 13.9.62.
– —	, – 1 – ?,	–	, W. Greenland, Fyllas Banke 28.4.61, col. Berl. det. A. Br. jr U.B.Z.M. No. 47992.

The present specimens conform with previous descriptions as summarized by DAWES (1947). However, the eggs of 5 specimens in total mounts — all from the same *R. radiata* individua (No. 47991) — measured 0.07–0.1 mm in length.

Competent helminthologists (ODHNER, 1911; MANTER, 1926; DOLLFUS, 1937; VAN CLEAVE & VAUGHN, 1941; SKRJABIN & GUSCHANSKAJA, 1958) who had actual material at hand, have through the years tried to substantiate the existence of at least two distinct species, i.e. *O. veliporum*


Comparision of egg lengths in Otodistomum in µm
55
60
70
80
90
100
110
120
130
LEBOUR 1908
ODHNER 1911
– " –
MANTER 1926
– " –
DOLLFUS 1937
– " –
– " –
– " –
V. CLEAVE 1941
KAY 1947
FYFE 1953
PRESENT
O. cestoides 60
O. cestoides 65 72
O. cestoides 65 72
O. c. cestoides 65 72
O. c. pristiophori 62 77
O. cestoides (Atlantic & Pacific forms) 55 94
O. veliporum 86
O. veliporum (Pacific form) 85,5
O. cestoides pacifica 85
O. veliporum pachytheca 83 130
O. v. leptotheca 85 97
O. veliporum (W. Greenland) 70 100
O. v. veliporum 100 130
O. plicatum 111
O. plunketi 110

(CREPL.) and *O. cestoides* (VAN BENED.) and possible sub-species thereof based mainly upon the differences in egg size. DAWES (1947) is not convinced, and accepts so far a single species *O. veliporum* (CREPL.) only. Even if further *Otodistomum* species have been described (*O. plicatum* KAY, 1947 and *O. plunketi* FYFE, 1953), I am inclined to favour DAWES view, as no specific morphological characteristics — which could not be due to contraction or relaxation of the specimens in question — have ever been pointed out. So far the specific differences have been based on egg size, but this is probably not of specific value as regards the *Otodistomum* species. Egg size may be of sub-specific value, indicating different strains. The egg length data hitherto published have been summarized in the following diagram.

As will appear from this diagram, LEBOUR, ODHNER, MANTER and even DOLLFUS, all had reasons to believe in the presence of two valid species. Thus as they registered egg length differences, the maximum egg length (77 μm) of *O. cestoides* is less than the minimum egg length (83 μm) of *O. veliporum*. Later however, VAN CLEAVE & VAUGHN (1941) found this gap bridged in their material and refer all of it to the species *O. cestoides*. The present material confirms this bridging, so it appears to me that in reality we are confronted with a single species — *Otodistomum veliporum* — of worldwide distribution. Slight morphological differences observed in specimens from different hosts of different geographical location may possibly warrant the recognition of sub-species.

Egg size has generally been considered as fairly constant within, and characteristic for, the single species. The present case shows that this is not without exceptions — but why? ODHNER (1911) and MANTER (1926) found that *O. veliporum* and *O. cestoides* attained maturity at a length of 15 mm and 11 mm respectively. DOLLFUS (1937) and VAN CLEAVE & VAUGHN (1941) found that *O. veliprum* and *O. cestoides* attained a maximum length of 78 mm and 69 mm respectively. With such an immense size range for a mature trematode — to my knowledge the largest known — it may not be so astonishing that larger specimens exhibits larger eggs than smaller ones do. It is my impression that larger host specimens have larger otodistomids than smaller ones have, but unfortunately I have no measurements of host and parasite to substantiate this impression.

Acanthocolpidae LÜHE, 1909

Stephanostomum davisi n. sp.

(Fig. 6)

Previous records in Greenland: None.

Present records and material:

Sebastes marinus, inf. 1 of 2, intestine, S. Greenland (Davis Strait off Nanortalik) 8.5.61, col. Berl. det. A. Br. jr., U.B.Z.M. No. 47997

— — , – 0 – 3, W. Greenland, Skarvefjeld bank (SE off Godhavn) 2.9.62

The body of the parasite appears ribbon-like, about 4.5 mm long and 0.4 mm broad, with a truncated anterior and a rounded posterior extremity. On either side of prepharynx a pigment spot may be encountered, which may or may not be remnants of epe-spots. The cuticle of the anterior part of the body is covered with spines. They are thickly set from the oral sucker to the level of pharynx and then decrease in number towards the ventral sucker, disappearing on the dorsal side while a few are found scattered on the ventral side. Short stout oral spines are present, but neither their number nor the number of rows could be ascertained. The terminal oral sucker is 0.17 mm long and 0.225 mm wide, slightly smaller than the ventral sucker, which is 0.251 mm long and 0.228 mm wide and situated at the end of the anterior fourth of body. The prepharynx is long, twice to thrice as long as the pearshaped pharynx (0.21 mm long), which may be markedly telescoped into itself just anterior to the pharynx (fig. 6 B). Pharyngeal glands opens into the posterior end of the pharynx. The oesophagus is extremely short and the intestinal caeca are long reaching the posterior end of body. The intestinal bifurcation is found just in front of the genital pore, slightly anterior to the ventral sucker. Close to the anterior margin of the ventral sucker the genital pore is situated in the median line. From the genital pore the cirrus pouch extends, with its short pars prostatica, dorsally and posteriorly to the ventral sucker and ends with a pyriforme seminal vesicle (about 0.3 mm long and 0.13 mm wide) at its base. The distance between the ventral sucker and the seminal receptacle corresponds to the diameter of the ventral sucker. The metraterm joins the cirrus anterior to the ventral sucker close to the genital atrium.

In the posterior quarter of the body the two ovoid testes (0.41–0.43 mm long and 0.283 mm broad) are located, one behind the other, fairly close together and even touching each other. Laterally only, they may be separated by a few vitelline follicles. The globular ovary (diam. 0.155

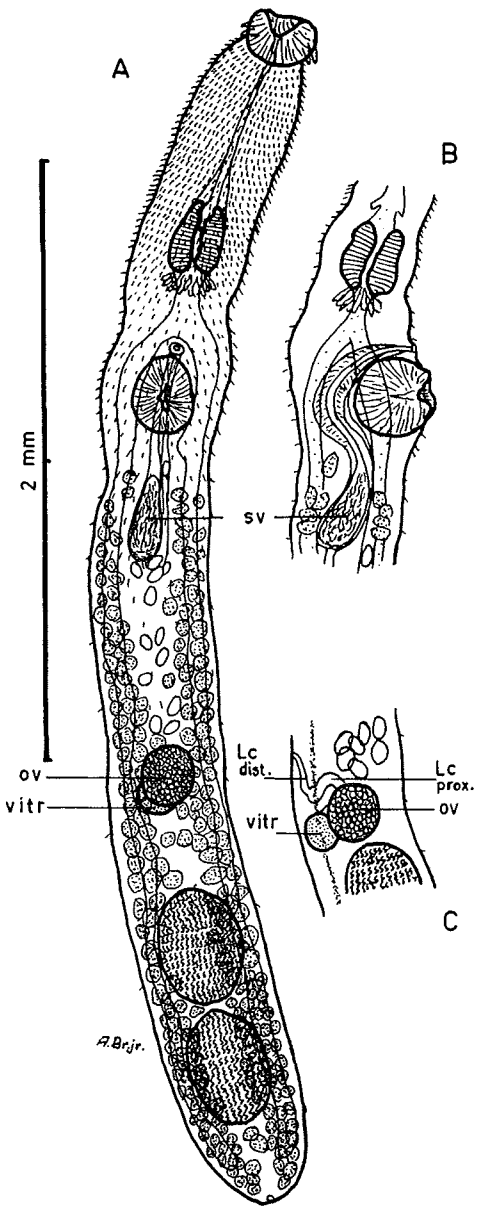


Fig. 6. *Stephanostomum davisi*, viewed from the ventral side (A), the right side in the ventral sucker region (B) and in the gonad region (C).

mm) is ventrally situated, closely, (fig. 6 C) but more often slightly (fig. 6 A) anterior to testes. A conspicious vitelline reservoir lies dorsally to the ovary and in front of this, also dorsally to the ovary, the Laurer's canal is found. This has a dorsal pore, a narrow distal and a somewhat

inflated poriximal part, as demonstrated by LEBOUR (1908) and YAMAGUTI (1934), respectively, from *S. triglae* and *S. japonicus*. The winding uterus is confined to the intercaecal field anterior to the ovary. There are relatively few eggs, measuring 0.094 mm in length and 0.06 mm in breadth.

The relatively large vitelline follicles extend along the caeca from the level of the anterior end of the seminal vesicle to the extreme posterior end. This lateral band of vitelline follicles is uninterrupted in the fields lateral to the gonads. Between the gonads a few follicles are found, which partly separate them but never wholely. The excretory system was not observed, apart from its tubular posterior vesicle which opened terminally.

Over the years a large number of *Stephanostomum*-species have been recorded, CABALLERO in his survey (1952) mentioning 30 species. Very few of these can be identified by a single characteristic only and most have to be identified upon combinations of characteristics. It must be borne in mind that the evaluation of many of the characteristics used are rather dependent upon the state of contraction or relaxation of the parasite at the moment of fixation, as f.i. whether the ovary touches the anterior testis or not, whether the testes touch each other or not and whether the anterior extension of the vitelline follucles reaches the mid-level of cirrus pouch or anterior or posterior end of seminal vesicle. Probably some of the species today regarded as valid may ultimately turn out to be synonyms of previous known species, this also as regards *S. davisi*, which accordingly has to be regarded as provisionally named.

As the present species does not properly fit the descriptions of previous known species, it is here regarded as a new species. Apart from the number and arrangement of oral spines — which unfortunately could not be elucidated — the present species resembles *S. japonicum* (YAMAGUTI, 1934) MANTER & VAN CLEAVE, 1951 more closely than any other species. Size, shape, measurements and relative position of organs practically conform with *S. japonicum*, but it differs from this as its cuticular spines are restricted to the anterior third of body and its vitelline follicles have their anterior limitation on a level with the anterior end of the seminal vesicle. From *S. casum*, which YAMAGUTI (1934) found especially resembles *S. japonicum*, *S. davisi* differs by its more slender form, its ovary not touching the anterior testis and its eggs being larger.

Further, *S. davisi* shows some resemblance to *S. californicum*, *S. carangium*, *S. baccatum*, *S. triglae* and *S. lebourae*. From *S. californicum* it differs by its smaller cirrus pouch and its smaller gonads which are also more posteriorly situated. It differs from *S. carangium* by having larger eggs and by the fact that its vitelline follicles do not anteriorly reach the level of the anterior border of the ventral sucker.

It is of special interest to compare *S. davisi* with the North Atlantic forms *S. baccatum*, *S. triglae* and *S. lebourae* as one might suspect it identity with one of these. It differs from *S. baccatum* by its more slender form and its eggs not being pointed at one end as described by NICOLL (1951) from *S. baccatum*. It differs from *S. triglae* by its smaller gonads, shorter Laurer's canal and its vitelline follicles not extending anteriorly as far as the ventral sucker. It differs from *S. lebourae* by its cuticular spines being much more restricted to the anterior third of body and its cirrus pouch being much shorter.

Zoogonidae ODHNER, 1911, *sensu* DOLLFUS 1952

Diptherostomum microacetabulum SHULMAN-ALBOVA, 1952

(Fig. 7 A–C)

Syn. *Pseudozoogonoides microacetabulum* (SHULMAN-ALBOVA, 1952) ZHUKOV, 1957.

Previous records in Greenland: None.

Present records and material:

Anarhichas lupus, inf. 1 of 2, intestine,	W. Greenland, Godhavn 29.8.62, col. et det. A. Br. jr., U.B.Z.M. No. 54251
Anarhichas minor, – 1 – 1, – (the only *Anarhichas* specimens in which it was recorded)	, As above 12.9.62, U.B.Z.M. No. 54252

A detailed description was given by SHULMAN-ALBOVA (1952) but will be supplemented here.

The present specimens measured 1.0–1.1 mm in length and 0.40–0.44 mm in greatest breadth, which appeared on a level with the ventral sucker and cirrus pouch. The body was covered with minute spines or scales, not easily observed however. The ventral sucker was centrally situated and of the same size as the oral one (0.16–0.18 mm diam.). The pharynx measured 0.04 mm in length and was so closely connected to the oral sucker that no prepharynx could be observed. The thin-walled oesophagus, 2–3 times as long as the pharynx, opens into the caecal bifurcation dorsally to the cirrus pouch. The intestinal caeca extended posteriorly at most to the level of the posterior margin of the ventral sucker. The anterior part of the caeca, dorsally to the cirrus pouch, was thin-walled like the oesophagus, but widens posteriorly and appears to be covered by glandula-like cells. The excretory vesicle was sac-like, rather small and, like the posterior part of caeca, covered with glandula-like cells.

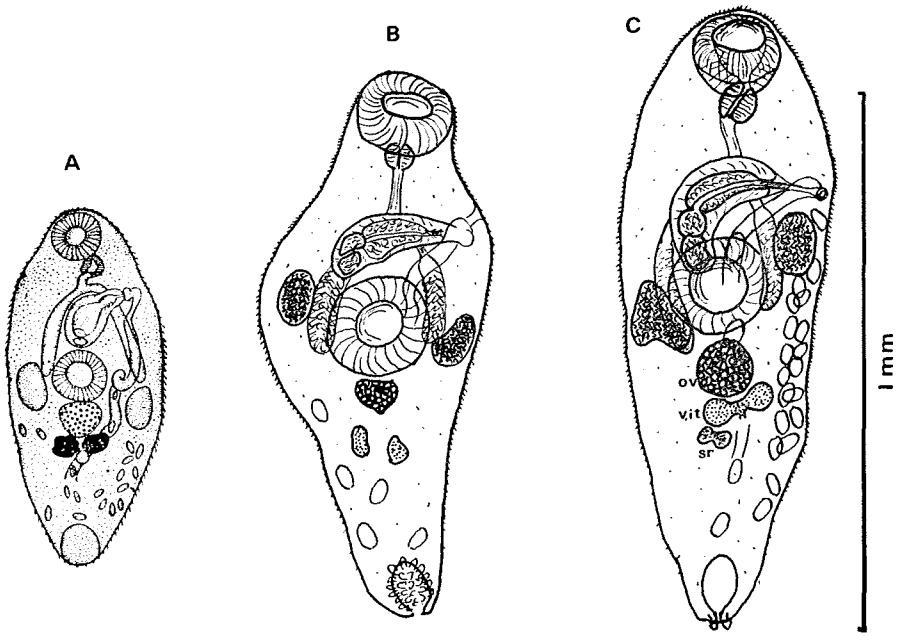


Fig. 7. *Diptherostomum microacetabulum*. A. Illustration reproduced from SHULMAN-ALBOVA (1952). B. Present material ventral view of pressed specimen (only a few eggs have been indicated). C. Present material ventral view of slightly pressed specimen (only along the midline and the left side the uterine eggs have been drawn). Note: Double vitellarium and seminal receptacle.

The genital pore is found ventrally, leftsided and submarginal on a level with the bifurcation of the intestine. From the genital atrium the sickle-shaped and prominent cirrus pouch extended in a curve beyond the midline ventrally to the intestinal bifurcation and its posterior end may overlap the anterior part of the ventral sucker. In the cirrus pouch pars prostatica is well developed and so is the hourglass-shaped seminal vesicle at its base. The invaginated cirrus appeared armoured with spinlets. One testis is situated in each lateral to the ventral sucker and ventral to the intestinal caecae. Close posterior to the ventral sucker the globular ovary (0.08–0.10 mm diam.) is located in the midline of the body. The vitellaria forms *two* compact globular masses of vitelline follicles, one in each side of the midline posterior to the ovary. Short vitelline ducts from these unite before entering the oviduct.

A long winding uterus fills the posterior $^2/_3$ of the body anteriorly to the level of the testes. Along the sides of the body the uterine coils contain the younger eggs and because of their thin shell the miracidium inside takes staining. This lateral part of uterine coils with stained eggs (miracidia) may call to mind the lateral vitelline follicles as found in this

place in many other trematodes. The distal part of uterus takes a course along the axis of body, passing dorsally to the ventral sucker before entering the only slightly developed metraterm which opens into the genital atrium. The eggs are rather large (0.06 by 0.03 mm), nearly as large as the vitelline globular mass. They are thin-shelled and contain a miracidium. Closely posterior to the vitellarium there is a distinct seminal receptacle.

The present species was originally described by SHULMAN-ALBOVA (1952) under the rather unfortunate name *Diptherostomum microacetabulum*. It was assigned to the genus *Diptherostomum* STOSSICH, 1904, as it exhibited two compact vitellaria as characteristic for this genus. As further the type species of the genus *D. brusinae* STOSSICH, 1904, and especially *D. magnacetabulum* YAMAGUTI, 1938, possesses a rather large ventral sucker, her new species was given the specific name "*microacetabulum*", as compared with these species. However, the ventral sucker is far from small. In fact, it is at least as large as the oral sucker. ZHUKOV (1957) found it as large or even larger than the oral sucker. Moreover, it was centrally situated and without anteriorly and posteriorly marginal thickenings, this in contrast to the two other species in which the ventral sucker has such lip-like thickenings and is located to the posterior half of the body. These differences and its general likeness to the genus *Zoogonoides*, led ZHUKOV (1957) to establish a new genus for it, the genus *Pseudozoogonoides*. As the present species at first glance appears rather like *Z. viviparus* and as both are parasites of the *Anarhichidae*, it has probably often been identified as the latter.

When I do not follow ZHUKOV — in spite of regarding his evalution as pertinent — it is only to avoid further complications of a complicated matter. The genus *Diptherostomum* appears to be a more practical than natural genus, the sole uniting characteristic being the presence of *two* compact vitellaria.

D. microacetabulum has further been recorded by SHULMAN & SHULMAN-ALBOVA (1953) and POLJANSKY (1955) from the Barents Sea. As further hosts POLJANSKY mentions *Hippoglossoides platessoides*, *Anarhichas minor* and *Lysichthys denticulatus*.

Diptherostomum sp.

(Fig. 8)

Previous records in Greenland: None.

Present records and material:

Anarhichas minor, inf. 1 of ?, gallbladder, E. Greenland (off Umivik) 23.7.59,

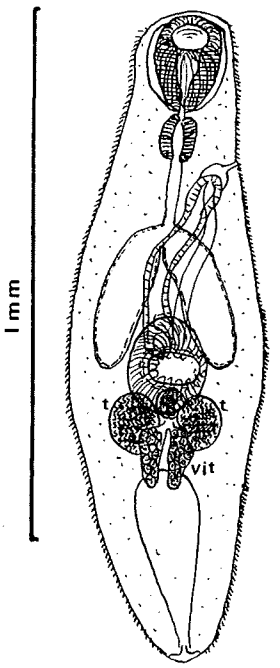


Fig. 8. *Diptherostomum* sp. Compared with fig. 7 it shows double vitellarium as this, however testes on level with ovary and larger excretory vesicle.

(the only *Anarhichas* specimen in which it was recorded)	col. Berl. det. A. Br. jr., U.B.Z.M. No. 54253

The present specimens measured 0.9–1.3 mm in length and 0.23–0.40 mm in greatest breadth, the latter appearing level with anterior margin of the ventral sucker. The body was covered with scale-like, minute spines easily observed, in contrast to *D. microacetabulum*. The longitudinal slight oval ventral sucker was situated with its anterior margin on a level with midbody. The oral sucker varied from globular (0.66 mm diam.) to longitudinally oval and appeared to be surrounded by a translucent tissue area. A prepharynx was not present and the pharynx proper was slightly longitudinally oval (max. length 0.27 mm, max. breadth 0.25 mm). The following thin-walled oesophagus opened into the bifurcated intestine at a point in the middle between the pharynx and ventral sucker, dorsally to the cirrus pouch. Posteriorly the two caeca, dorsally to the ventral sucker, reached the central level of this or slightly beyond, to just anterior to the testes. The caeca appeared wide and thin-walled. The rather large sac-like excretory vesicle extended anteriorly to well beyond the posterior margin of vitellarium.

The two slightly oval testes (0.08–0.12 mm long) are situated side by side dorso-posteriorly to the ventral sucker, overlapping its posterior margin. The globular ovary (0.06 mm diam.) is found in the midline between the anterior parts of testes and dorsally to the posterior part of the ventral sucker. The vitellarium consists of two well-defined triangular clusters of vitelline follicles, but apparently is not as compact as in *D. microacetabulum*. Their anterior ends just overlap the posterior part of the testes. A short vitelline duct leaves each of these, and unites in the midline to a short common vitelline duct which enters the oviduct just posterior to the ovary. Neither the uterus and its course, nor eggs could be observed.

The genital pore appeared leftsided marginal at level with the posterior end of the pharynx. Unfortunately the morphology of the cirrus pouch, seminal vesicle etc. could not be elucidated on the present material.

The general morphology with the presence of two distinct nearly compact vitellaria indicates that the specimen belong to the genus *Diptherostomum* STOSSICH, 1904. As however the presence and shape of the cirrus, seminal vesicle, seminal receptacle, extension of uterus and eggs could not be ascertained, I shall content myself with recording the specimens as *Diptherostomum* sp. only.

Of course in more ways they resemble *D. microacetabulum*. However they differ from this species in the following points:

1) Parasite of the gallbladder.
2) Easily observed cuticular spines.
3) More posteriorly situated ventral sucker.
4) Wide thin-walled intestinal caeca.
5) Testes side by side level with — or posterior to — the ovary.
6) Large excretory vesicle.

Steganodermatidae DOLLFUS, 1952

Steganoderma pycnorganum REES, 1953

Syn. *Steganoderma spinosa* POLJANSKY, 1955.

Previous records in Greenland: None.

Present records and material:

Anarhichas minor, inf. 1 of ?, gallbladder, W. Greenland, Fyllas Banke 10.8.59, col. Berl. det. A. Br. jr., U.B.Z.M. No. 56686

— — — 1 – 1, — , W. Greenland, Godhavn col. et det. A. Br. jr.,

(the only *Anarhichas* specimens in which it was recorded)	U.B.Z.M. No. 56687 (on slide no. 54264 together with *Fellodistomum fellis*)

The species has been described in detail by REES (1953), POLJANSKY (1955) and BRINKMANN (1956).

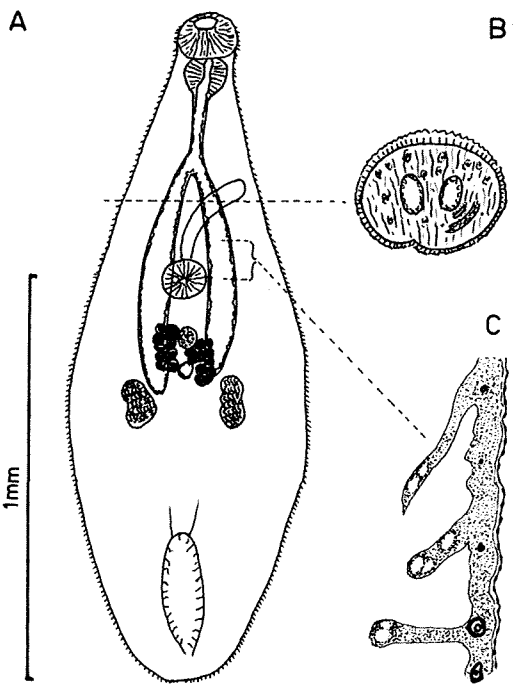


Fig. 9. *Lepidophyllum steenstrupi*. A. Immature young specimen showing laceolate outline of body. B. Transversal section of body showing thicker mucous layer on the dorsal side. C. Intestinal epithelial cells with luminal vacuolated prolongations.

Lepidophyllum steenstrupi ODHNER, 1902

(Figs. 9–10)

Previous records in Greenland: None.

Present records and material:

Anarhichas lupus, inf. 2 of 2, urinary bladder,	W. Greenland, Godhavn 29.8.62, col. et det. A. Br. jr., U.B.Z.M. No. 47993
— — , – 1 – 1, —	, As above 8.9.62, U.B.Z.M. No. 47994

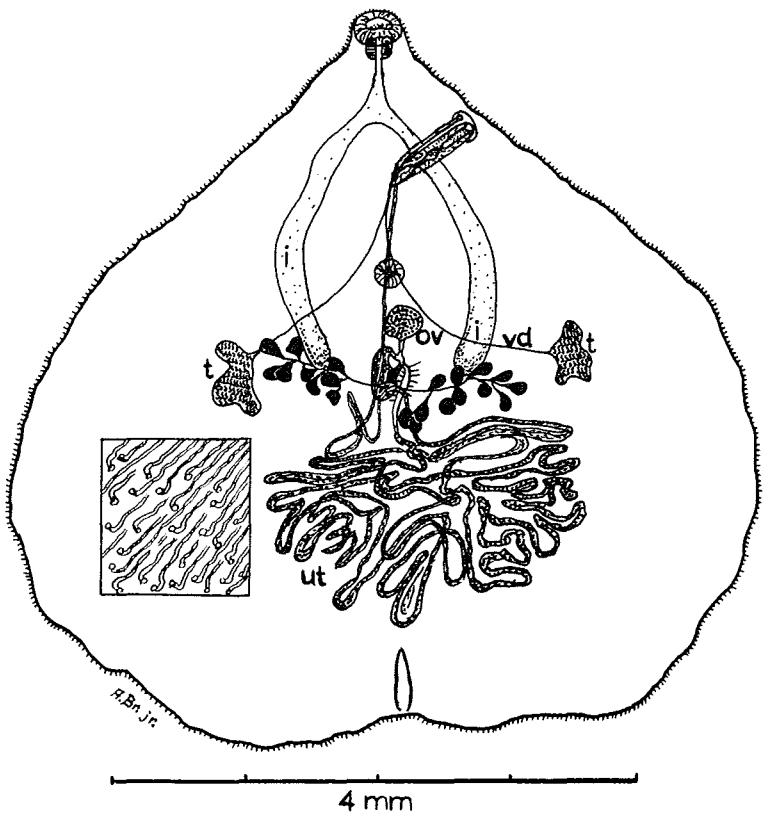


Fig. 10. *Lepidophyllum steenstrupi*, mature older specimen showing pear- to heart-shaped outline of body. Radially arranged excretory capillaries drawn in square only.

Anarhichas lupus,	inf. 1 of 1,	urinary bladder,		As above 11.9.62, U.B.Z.M. No. 47994
—	— , – 1 – 1,	—		, As above 11.9.62, U.B.Z.M. No. 47995
Anarhichas latifrons–	0 – 2,			, As above 12–13.9.62.
Anarhichas minor,	– 2 – 2,	—		, W. Greenland, Skarvefjeld bank (SE off Godhavn) 12.9.62, col. et det. A. Br. jr., U.B.Z.M. No. 47996

The parasite is rather common in *Anarhichas lupus*. *Anarhichas minor* is not a new host for the parasite, as ODHNER (1911 p. 241) mentions material from this host, under its synonym *A. pantherinus*, present in the Copenhagen Museum, collected by STEENSTRUP from Iceland. This is the

source which REES (1953) was unable to trace and it is the source which induced DAWES (1947) to mention the parasite from Denmark.

Up to 13 specimens were encountered in the present material from the same host individua, however in most only a few parasites were present. They appear uncoloured or whitish alive, with only a small brown patch in the middle, due to egg-content, and are accordingly not always easy to spot sticking to the epithel of the urinary bladder. When the bladder is opened under normal saline in a Petri dish they are, however, easily found.

Generally I can confirm the descriptions given by previous authors which have had personal material at hand, (ODHNER, 1902, 1911 ; STAFFORD, 1903, 1904; MILLER, 1941 and REES, 1953). Some supplementary observations will be given, however.

The body is leaf-like, but the shape of body varies with increasing size. Immature specimens (1.6 mm in length and 0.6 mm in breadth) are lanceolate (fig. 9 A), and so are also mature young specimens just with only a few eggs. In these the anterior half of the body can be somewhat more slender than the posterior half. Specimens of average size (2–3.5 mm in length and 1.45–2 mm in breath) have developed a characteristic pear-shaped outline of the body which in the largest specimens (5–5.5 mm in length and 4.5–6 mm in breadth) develops further into an inverted heart-shape, and the width may exceed the length (fig. 10). It may appear somewhat bewildering that ODHNER, in his original illustration (1902, fig. 3), drew the body outline in a double line with the cuticular spines in between the two lines. This is explained from the present material by the fact that the whole body, as appears from serial sections, is covered by mucus (?) between the spines. This mucous layer is especially prominent on the anterior dorsum of the parasite (fig. 9 B). As the dermal layer of the parasite is not especially rich in secretory cells this mucus may have been secreted from the mucous membrane of the urinary bladder of the host, possibly as a response to the irritation caused by the parasite. The cuticular spines are dispersed in transverse rows all over the surface, suckers excluded. They are pyramidal, 2–3 times higher than basal width.

The oral sucker is generally somewhat larger than the ventral sucker and pharynx which are the same size. Compared with the size of the ventral sucker, the oral sucker is relatively larger in the larger specimens than in the smaller specimens. The mouth leads into the pharynx, a prepharynx being only observed in serial sections. The oesophagus is twice to nearly thrice the length of the pharynx. Midway between the oral and the ventral suckers, in larger specimens somewhat more anteriorly it bifurcates into the two intestinal crura which extend posteriorly to the level of the testes and seminal receptacle. The lateral wall of the crura

only may exhibit shallow pouches. The free surface of the intestinal epithelial cells extends vacuolated cytoplasmic prolongations into the lumen of caeca (fig. 9 C). Morphological variations of the intestinal cells of *Fasciola hepatica* have long been known (SOMMER, 1880 and MÜLLER, 1923) and it has recently been shown (THORSELL & BJÖRKMAN, 1965) that this are due to the presence of secretory- and non-secretory cells. In the present species the peculiarities of the intestinal epithelium may have the same explanation.

The excretory vesicle is O-shaped, the main excretory canal of each side entering its anterior end. ODHNER (1911a) mentions the excretory tubules as constituting a subcutaneous network. Be that as it may, the excretory system is well-developed and the excretory capillaries from the flame bulbs proceed radially (fig. 10, square) towards the central field of the body (ventral sucker to seminal receptacle). The well-developed excretory system of this urinary bladder parasite may be viewed in the light of the rather specialized ionic milieu of urine in marine teleosts. This view is supported by the fact that the parasite appears coated in mucus as mentioned above. Soft-skinned animals harbouring a wet milieu which presents them with osmotic problems are often found to have developed an external mucus layer to relieve them in these problems as, f.i. is known from fresh water fishes.

The genital atrium lies on the left dorsal side, somewhat medially to the lateral margin, on a level with the bifurcation of the intestine. The female duct opens into the genital atrium medially to the male duct. A metraterm is only feebly developed. The testes are symmetrically arranged laterally at the level of the posterior ends of the caeca. Their lateral margins are slightly lobed. The vasa efferentia originate from the medial side of the testes, passing anteromedially without forming a common vas deferens, but uniting however as they enter the cirrus pouch in the mid-line. The cirrus pouch is relatively much larger in smaller than in larger specimens. In smaller specimens the posterior end of the cirrus pouch is found in the midline on a level with the ventral sucker, whereas in larger specimens its posterior end lies midway between the oral and ventral sucker. Within the cirrus pouch the male duct widens to form two succeeding seminal vesicles, the posterior one being the larger. They are connected by a narrow tubular section and the anterior smaller vesicle opens into the ejaculatory duct. The same arrangement has been described from *Steganoderma pycnorganum* by REES (1953). In all available specimens the cirrus appeared invaginated and the invaginated surface of cirrus appeared papillated.

The ovary is almost median, just posterior to the ventral sucker. In most specimens it is rounded in outline but in a few it appears slightly lobated. Just posterior to the ovary, and about the same size as this, the

slightly sausage-shaped seminal receptacle is found. The Laurer's canal could unfortunately not be identified. The very short oviduct is joined by the canal from the seminal vesicle and common vitelline duct before entering the inconspicuous ootype. From the ootype the uterus proceeds posteriorly and in the central field of the posterior half of the body, between ootype and excretory vesicle, exhibits an asteroid cluster of uterine loops. From here it proceeds anteriorly in the midline just dorsal to the ventral sucker, bends left and medially parallel to the cirrus pouch and widens into the metraterm.

The vitellaria is made up of two symmetrically arranged clusters of vitelline follicles situated at the posterior ends of the caeca. In all specimens where the exact number of follicles in each cluster could safely be counted, there appeared to be 9 follicles in the right side and 12 in the left side, this in accordance with ODHNER (1911 a). The main vitelline ducts from each side unite in the midline, forming a short anteriorly directed common vitelline duct.

The *Lepidophyllum*-species and the generic relations within the family *Steganodermatidae*

ODHNER's original description (1902) has later been supplemented by himself (1911), further by STAFFORD (1904), MILLER (1941), REES (1953) and finds have also been mentioned by SHULMAN & SHULMAN-ALBOVA (1953), POLJANSKY (1955) and BRINKMANN (1956).

In his original description ODHNER (1902, fig. 3) gave an illustration of a young, just mature specimen, far from fully grown. ODHNER (1911 a) is fully aware of this mentioning that his original description was based upon young specimens. Thus his illustration is adequate for young specimens, but absolutely inadequate for fully grown specimens. This inadequate illustration of his has been copied during the years by later authors (DAWES, 1946, fig. 45 G; YAMAGUTI, 1953, fig. 53; SKRJABIN, 1957, fig. 46 a.o.). MILLER (1941) gave an illustration of his own, but unfortunately this is also of a young specimen. As far as I am aware, no proper illustration of *Lepidophyllum steenstrupi* has ever been published, which is why one is given here (fig. 10).

This lack of a proper illustration has during the years caused inconvenience to the authors concerned. So YAMAGUTI (1934) describing *Paralepidophyllum pyriforme* n. sp. n. gen., mentions its resemblance to *Steganoderms sebastodis* and *Lepidophyllum steenstrupi.* He certainly was impressed by its resemblance to the genus *Lepidophyllum*, naming his new genus *Paralepidophyllum.* It is understandable that YAMAGUTI refers his species to a new genus as it departs so much from ODHNER's figure of *L. steenstrupi*, if much less from ODHNER's description. *Parale-*

pidophyllum appears congeneric with *Lepidophyllum*, the species thus being *L. pyriforme* (YAMAGUTI, 1934). It is easily distinguished from alls other members of this genus as its ventral sucker is twice as large as the oral one and its marginal genital pore lies on a level with its pharynx. ZHUKOV (1957) further described three new *Lepidophyllum*-species (*L. armatum*, *L. brachycladium* and *L. pleuronectini*) from eastern waters, all of which appear valid. The genus *Lepidophyllum* is thus represented by 5 species, one from western waters and four from eastern waters. Here we are again faced — as in the case of the *Prosorhynchinae* — with an example of a trematode genus of North Pacific origin.

The following diagnosis for the genus *Lepidophyllum* ODHNER, 1911, is suggested:

Steganodermatidae DOLLFUS, 1952; *Lepidophyllinae* DOLLFUS, 1952. Body flat foliate elliptical to pyriform or inverted cordiform, entirely covered with small spines. Oral sucker terminal, with ventral inclination. Ventral sucker small to moderate in anterior half of body. Pharynx small to moderate. Oesophagus short. Intestinal caeca relatively short, at most reaching midbody at the level of the conspicuous seminal receptacle. Genital pore sinistral, marginal to sub-marginal, ventral or dorsal. Ovary unlobed median between ventral sucker and seminal receptacle. Vitelline follicles in symmetrical clusters in front of or medial to testes, always posterior to anterior margin of ventral sucker. Uterus confined to post testicular area. Parasites of the excretory system of marine fishes.

In 1904 STAFFORD described a new zoogonoid, *Steganoderma formosum* n. sp. n. gen., rather briefly. MANTER (1926) gave, from new material, an adequate description of this species and also the generic diagnosis. He did not regard *Steganoderma* congeneric with *Lecithostaphylus*, as the former differs from the latter by its very small pharynx, long oesophagus, long elongate cirrus, well developed Laurer's canal and well-developed excretory bladder. MILLER (1941) however, who re-examined STAFFORD's material (single specimen of *S. formosum* only), ignored MANTER's view of 1926 and regarded *Lecithostaphylus* as a synonym for *Steganoderma*. Later however, MANTER (1947) modified his diagnosis of the genus *Steganoderma* to include the genera *Proctophantastes* and *Lecitohstaphylus* of ODHNER.

Before MANTER had widened his diagnosis, YAMAGUTI (1934, p. 97 note) — without stating his reasons (DAWES, 1946, p. 250) — listed *Lecithostaphylus* as a synonym for *Steganoderma*. Accordingly, he suppressed the sub-family *Lecithostaphylinae* of ODHNER in favour of *Steganodermatinae* n. comb., a step apparently also taken by PRICE according to BAER & JOYEUX (1961). This was rejected by FANTHAM (1938), but DOLLFUS (1952) agreed with YAMAGUTI and MANTER. In the same DOLLFUS advanced his sound view as regards the systematic relations within the family *Zoogonidae* ODHNER, dividing it into two families,

Zoogonidae ODHNER (sensu DOLLFUS) and *Steganodermatidae* DOLLFUS. This may be reviewed and supplemented as follows:

Fam. *Zoogonidae* ODHNER, 1911, sensu DOLLFUS, 1952 (Syn. *Zoogodae* ODHNER, 1911, in part), with *compact* vitellarium.

Sub-fam. *Zoogoninae* ODHNER, 1911, sensu DOLLFUS, 1952 (Syn. *Zoogoninae* ODHNER, 1911, in part), with *single compact* vitellarium. Genera: *Zoogonus*, *Zoogonoides*, *Zoonogenus*, *Neozoogenus*.

Sub-fam. *Diptherostominae* DOLLFUS, 1952 (Syn. *Zoogoninae* ODHNER, 1911, in part), with *two compact* vitellaria. Genera: *Diptherostomum*, *Pseudozoogonoides*.

Fam. *Steganodermatidae* DOLLFUS, 1952 (Syn. *Lecithostaphylinae* ODHNER, 1911 and *Steganodermatinae* YAMAGUTI, 1934), with *folliculate* vitellaria. Genera: *Lepidophyllum* (incl. *Paralepidophyllum*) *Steganoderma* (incl. *Proctophantastes*, *Lecithostaphylus*, *Nordosttrema*), *Deretrema*, *Diplangus*, *Urinatrema*, *Brachyenteteron*, *Pseudochetosoma*,* *Botulisaccus***, *Manteroderma****.

As MANTER (1954) has pointed out, the best criteria for the separation of the *Steganodermatidae* genera are so far not clear and the caecal length may prove unsuitable as a generic characteristic. Be this as it may, so far we have to operate with the characteristics available for provisional systematic grouping. The genera *Diplangus*, *Urinatrema*, *Botulisaccus* and *Manteroderma* are all well-defined and easily recognized. This does not appear to be the case as regards the genera *Brachyenteron*, *Steganoderma*, *Deretrema* (incl. *Pseudochetosoma*) and *Lepidophyllum* and here problems arise.

DOLLFUS (1952) indicates the necessity of a separate sub-family (*Lepidophyllinae*) for the genus *Lepidophyllum* within the *Steganodermatidae*, versus the remaining genera of the family, but especially related to these by the genus *Brachyenteron*. With the present knowledge of the genus *Lepidophyllum* (*L. steenstrupi*, *L. pyriforme*, *L. armatum*, *L. brachycladium*, *L. pleuronectini*), the question that arises is whether this

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* MANTER (1954) doubts the generic validity of *Pseudochetosoma* DOLLFUS, 1952, as it appears so closely related to the genus *Deretrema* LINTON, 1910.

** *Botulisaccus* CABALLERO, BRAVO & GROCOTT, 1955, was referred by its authors to the family *Monorchiidae* ODHNER, 1911, but was by BAER & JOYEUX (1961) without comment transferred to the closely related family *Zoogonidae* ODHNER, 1911.

*** The genus *Manteroderma* was established by SKRJABIN (1957) for those members of the genus *Steganoderma* (sensu MANTER 1947) which exhibited marginal genital pore and intestinal caeca nearly reaching the posterior end of body. Thus the genus *Steganoderma* (sensu SKRJABIN 1957) was limited to those species which exhibited submedian genital pore and short intestinal caeca.

genus shares combinations of morphological characteristics with other genera of the family of a lower taxonomic entity allowing for a separate sub-family. From this point of view it appears that the combination of relatively short intestinal caeca and (sub) marginal genital pore is shared by the genera *Brachyenteron*, *Deretrema* (incl. *Pseudochetosoma*) and *Lepidophyllum*. Accordingly the following diagnosis of the sub-family *Lepidophyllinae* DOLLFUS, 1952 is suggested:

Steganodermatidae genera with intestinal caeca never reaching beyond the testes and with submarginal to marginal genital pore.

Fellodistomatidae ODHNER, 1911, emend. NICOLL, 1935

Steringophorus furciger (OLSSON, 1868) ODHNER, 1905

Syn. *Distomum furcigerum* OLSSON, 1868

Leioderma furcigerum (OLSSON, 1868) STAFFORD, 1904.

Previous records from Greenland: *Distomum furcigerum* OLSSON in LEVINSEN, 1881, l.c. p. 12 (61) from intestine of *Acanthocottus scorpius*. Egedesminde.

Present records and material:

Hippoglossus hippoglossus,	inf.	1 of	?, intestine,	W. Greenland 9.8.59, col. Berl. det. A. Br. jr., U.B.Z.M. No. 54254
—	—	, – 1 –	?, —	, W. Greenland 24.4.61, col. Berl. det. A. Br. jr., U.B.Z.M. No. 54255
Anarhichas latifrons		, – 1 –	?, —	, W. Greenland col. Berl. det. A. Br. jr., U.B.Z.M. No. 54256
Reinhardtius hippoglossoides		– 1 –	?, —	, W. Greenland, Holsteinsborg Dyb 21.4.61, col. Berl. det. A. Br. jr., U.B.Z.M. No. 54258
—	—	, – 1 –	1, —	, W. Greenland, Skarvefjeld bank

(SE off Godhavn)
2.9.62,
col. Berl. det.
A. Br. jr.,
U.B.Z.M. No. 54257

Upon OLSSON (1868), LEVINSEN (1881) and personally collected material ODHNER (1905) gave an adequate description of the species and established the genus *Steringophorus*.

The species appears widely distributed in Atlantic boreo-arctic waters west and east. It has a wide range of hosts as given by DAWES (1947) and POLJANSKY (1955). In the present material the halibut seems to be a new host.

Fellodistomum fellis (OLSSON, 1868) NICOLL, 1909

Syn. *Distoma fellis* OLSSON, 1868
Fellodistonum incisum (RUDOLPHI, 1809) of STAFFORD 1904.
Previous records in Greenland: None.
Present records and material:

Anarhichas lupus, inf. 1 of ?, gallbladder, W. Greenland, Fyllas Banke 9.8.59, col. Berl. det. A. Br. jr., U.B.Z.M. No. 54259

— — , – 2 – 2, — , W. Greenland, Godhavn 29.8.62, col. et det. A. Br. jr., U.B.Z.M. No. 54260

— — , – 0 – 1, , W. Greenland, Godhavn 8.9.62.

Anarhichas minor, – 1 – ?, — , E. Greenland, Umîvik 23.7.59, col. Berl. det. A. Br. jr., U.B.Z.M. No. 54261

— — , – 1 – ?, — , W. Greenland, Fyllas Banke 10.8.59, col. Berl. det. A. Br. jr., U.B.Z.M. No. 54262

– — , – 1 – ?, — , W. Greenland 25.4.61, col. Berl. det. A. Br. jr., U.B.Z.M. No. 54263

Anarhichors minor, inf. 1 of 1, gallbladder, W. Greenland, Godhavn 20.8.62, col. et det. A. Br. jr., U.B.Z.M. No. 54264

— — , – 0 – 2, , As above 12.9.62.

Upon OLSSON (1868) and LEBOUR (1908) and personally collected material NICOLL (1909) gave an adequate description of the species and established the genus *Fellodistomum*. The species is well-known from Atlantic boreo-arctic waters west and east, but is here reported from Greenland waters for the first time. This find was of course expected, as the hosts (*Anarhichas lupus* and *A. minor*), first intermediary host (*Nucula tenuis*, according to CHUBRIK, 1952) and second intermediary host (*Ophiura sarsi*, according to TAUSON, 1917) are all abundant along the Greenland coasts (POSSELT, 1898 and MORTENSEN, 1913). Two specimens of *A. latifrons* examined did not harbour this trematode.

Fellodistomum agnotum NICOLL, 1909

Syn. *Fellodistonum fellis* (OLSSON, 1868) NICOLL, 1909 in part according to DAWES (1947).

Steringophorus agnotum (NICOLL, 1909) according to DOLFUSS (1952)

Previous records in Greenland: None.

Present records and material:

Anarhichas lupus, inf. 1 of ?, gallbladder, W. Greenland, Fyllas Banke 9.8.59, col. Berl. det. A. Br. jr., U.B.Z.M. No. 54265

— — , – 1 – 2, duct. choled. W. Greenland, Godhavn 29.8.62, col. et det. A. Br. jr., U.B.Z.M. No. 54266

— — , – 0 – 1, , As above 8.9.62,

— — , – 1 – 1, duct. choled. As above 11.9.62, col. et det. A. Br. jr., U.B.Z.M. No. 54267

Anarhichas minor, – 1 – ?, gallbladder, E. Greenland, Umîvik 23.7.59, col. Berl. det. A. Br. jr., U.B.Z.M. No. 54268

— — , – 1 – ?, — , W. Greenland, Fyllas Banke 10.8.59,

col. Berl. det. A. Br. jr.,
U.B.Z.M. No. 54269

Anarhichas minor, inf. 1 of ?, gallbladder, W. Greenland 25.4.61,
col. Berl. det. A. Br. jr.,
U.B.Z.M. No. 54270

— — , – 1 – 1, duct. choled., , W. Greenland, Godhavn , 20.8.62,
col. et det. A. Br. jr.,
U.B.Z.M. No. 56685

— — , – 0 – 2, , As above 12.9.62.

Fellodistonum agnotum was recorded by NICOLL (1909) along with *F. fellis* and described as a new species. DOLLFUS (1952), POLJANSKY (1955) and BRINKMANN (1956) regarded the species as valid. DAWES (1947) however, doubts its validity and lists it as a synonym for *F. fellis*.

DOLLFUS (1952) transferred *F. agnotum* (along with *F. sebastodis* YAMAGUTI & MATUMURA, 1942) to the genus *Steringophorus* ODHNER, 1905, as he found the uterus in these confined to posterior to the testes. This is a rather precarious characteristic, as in the present material I also find large parts of the uterus anterior to the testes. YAMAGUTI (1958) solved the problem by regarding the genus *Steringophorus* as a synonym for the genus *Fellodistomum*. The two genera, as related to the species here in question, are, however, easily separated. DAWES (1947) has here drawn attention to the characteristic that in the genus *Steringophorus* the vitellaria are almost entirely confined to the region behind the ventral sucker. The present material shows that in *S. furciger* the vitellaria extends from the midlevel of the ventral sucker *posteriorly*, whereas in *F. fellis* and *F. agnotum* it extends *anteriorly* from the same level.

The infestation of the two host species with the two parasites in different northern waters may be of interest:

Table 2.

	Anarhichas lupus		*Anarhichas minor*	
	F. fellis	*F. agnotum*	*F. fellis*	*F. agnotum*
Barents Sea (POLJANSKY, 1955)	100 %	33.3 %	75 % (6 of 8)	25 % (2 of 8)
Icelandic waters (BRINKMANN, 1956)	90 % (9 of 10)	62.5 % (5 of 8)	100 % (2 of 2)	no record
Greenland waters (Present)	75 % (3 of 4)	60 % (3 of 5)	66.6 % (4 of at least 6)	66.6 % (4 of at least 6)

The percentage of host specimens parasitized by the two species may indicate *F. fellis* to be more abundant in eastern Atlantic boreo-arctic waters, whereas *F. agnotum* appears more abundant in more western waters. The records are so scanty, however, that it would be too risky to draw any conclusion with reasonable safety.

Allocreadiidae STOSSICH, 1903

Anisorchis opisthorchis POLJANSKY, 1955

(Fig. 11 A–D)

Previous records in Greenland: None*

Present records and material:

Leptagonus decagonua, inf. 0 of 1,		W. Greenland, Godhavn 21.8.62
—	— , – 3 - 10, intestine,	W. Grennland, Skarvefjeld bank (SE off Godhavn)3.9.62, col. et det. A. Br. jr., U.B.Z.M. No. 56688
—	— – 0 - 2,	, W. Greenland, Godhavn, 11.9.62.

SHULMAN & SHULMAN-ALBOVA (1953) mention this species from the White Sea as "*A. opistorchis* POLJANSKY". However, POLJANSKY first appears to have published his find with adequate description in his paper (1955) on fish parasites of the Barents Sea. Further ZHUKOV (1963)

* It should be mentioned that LEVINSEN (1881, bottom p. 21(70)) writes: "I Kropshulen hos *Aspidophorus decagonus* fandt jeg et enkelt Exemplar af en til samme Distomgruppe hørende Art af en meget plump Form. Længde 6–7 mm, Bredde 2 mm. Sugeskiven, som laa i Legemets førstef$^1/_3$–$^1/_4$, havde en Diameter omtrent 2 Gange saa stor som Mundens. Af Excretionsorganet saas en enkelt, meget bred Stamme i Bagkroppen, og de to store Sædstokke laa bag hinanden." In authors translation: "In the coeloma of *Aspidophorus decagonus* I found a single rather plump specimen belonging to the same Distomid group. Length 6–7 mm, breadth 2 mm. The diameter of the ventral sucker, which lies in the anterior third to fourth part of the body, was about twice that of the mouth sucker. Of the excretory system a single broad stem was observed in the hind part of the body and the large testes were lying behind the other".

This specimen observed by LEVINSEN may or may not have been a specimen of *A. opisthorchis*. Size of body, location of ventral sucker, testes in tandem and host species favour such a possibility. However, its ventral sucker appeared twice as large as the mouth sucker, this in contrast to in *A. opisthorchis* where the ventral sucker is only half the size of the mouth sucker. Further LEVINSEN mentions the posterior part of the excretory system, which certainly is difficult to observe in *A. opisthorchis* because of the tandem testes in the extreme posterior part of body.

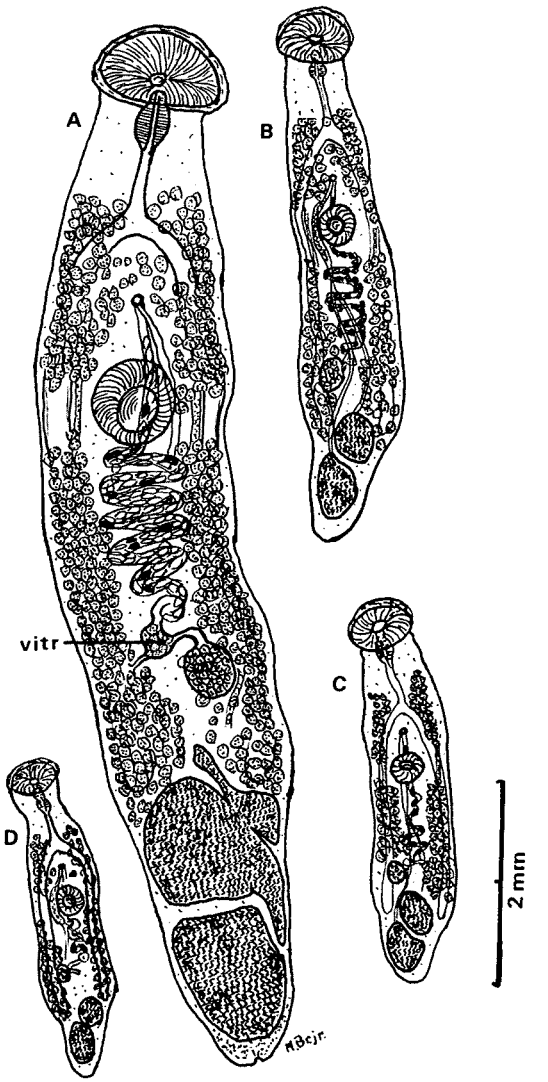

Fig. 11. *Anisorchis opisthorchis*. A. Large specimen with more than hundreds of eggs. B. Smaller specimen with 43 eggs. C. Smaller specimen with 15 eggs. D. Smallest specimen with two shelled eggs only.

reports the species from other hosts, i.e. *Blepsias bilobus* (Cuv. & Val.) and *Podothecus acipenserinus* (Pallas), from the Beering Sea. The species thus appears to have a circumpolar distribution.

From the present material — four specimens in total mounts — some supplementary morphological details shall be given. The present specimens slightly pressed measured 3.2–10.5 mm in length and 0.7–1.8 mm in breadth. The mouth sucker appeared funnel-shaped, transversally oval in outline and bordered with a characteristic rim. The pharynx's anterior

end is closely connected to the bottom of the funnel (the mouth) so that in total mounts it always appears covered by the ventral posterior margin of the mouth sucker. The intestinal caeca reach posteriorly to the level of the anterior most testis. The ventral sucker is situated between the second and third fifth of body from the anterior. The testes lies behind another or slightly diagonal in the extreme posterior end of body. A vas deferenc leaves each testis, runs anteriorly and the two of them unite and enter the posterior end of the cirrus pouch at a level shortly behind the posterior margin of the ventral sucker.

The ovary lies in the right side with its oviduct medially and entering the vitelline reservoir (fig. 11, vitr.). The vitelline follicles of each side are connected to a longitudinal, common vitelline duct running parallel and medially to the caecum of the same side. This is most easily observed in the areas lateral to the ventral sucker where vitelline follicles are scarce or lacking. At a level closely anterior to the ovary the longitudinal vitelline duct of each side gives off a transversal vitelline duct which enters the vitelline reservoir from each side.

The shape of the excretory system, not mentioned by POLJANSKY (1955) and asked for by YAMAGUTI (1958), proved in my specimens also impossible to elucidate. The size of eggs varied slightly measuring 0.045–0.065 mm by 0.09–0.1 mm. The number of eggs varied according to the size of specimens, a 3.2 mm specimen having only 2 shelled eggs, a 3.7 mm specimen having 15 eggs, a 5.4 mm specimen ca. 43 eggs and the largest specimen 10.5 mm, exhibiting more than a hundred eggs. The parenchyma of body exhibited characteristic large spherical cells (0.02 mm diam.) scattered, but abundant.

Neophasis pusilla STAFFORD, 1904
(Fig. 12 A–D)

Previous records in Greenland: None.
Present records and material:

Anarhichas lupus,	inf. 0 of 1,	W. Greenland (Berl.) 9.8.59
—	— , – 0 - 4,	W. Greenland, Godhavn 29.8.–12.9.62
Anarhichas minor,	– 0 - ?,	E. Greenland (Berl.) off Umîvik 23.7.59
—	— , – 1 - ?, gallbladder,	W. Greenland, Fyllas Banke 10.8.59 col. Berl. det. A. Br. jr., U.B.Z.M. No. 47998

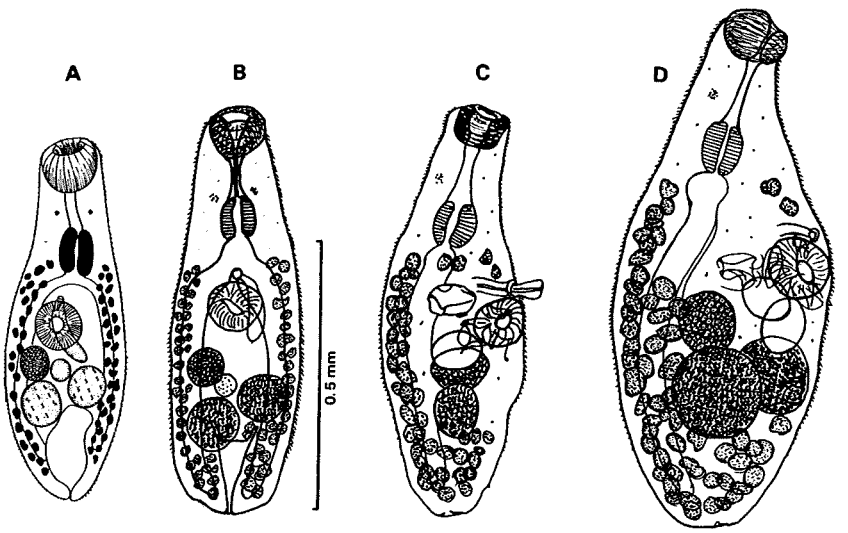

Fig. 12. *Neophasis pusilla*. A. Illustration reproduced from CABALLERO (1952) after MILLER (1941). B. Present material 0.74 mm specimen ventral view, note seminal receptacle between ovary and testes and pyramidal excretory vesicle. C. Nearly rightside view, note extended cirrus without spines, large broad-oval egg and collapsed eggs on level with ventral sucker. D. 0.95 mm specimen nearly rightside view, note intestinal or oesophageal bulge connected to pharynx.

Anarhichas minor,	– 0 - ?,	, W. Greenland (Berl.) 25.4.61
—	— , – 0 - 3,	, W. Greenland, Godhavn 20.8–12.9.62
Anarhichas latifrons	– 0 - 1,	, W. Greenland (Berl.) 9.8.59
—	— , – 0 - 2,	, W. Greenland, Godhavn 12.–13.9.62.

The original and rather unsatisfactory description was given by STAFFORD (1904), but this was somewhat improved by MILLER's (1941) reexamination of the original material. The species has never been reported found since 1904 unless it has been hidden under the name of *Acanthopsolus lageniformis* LEBOUR, 1910, a name which by many authors is regarded as a synonym (ODHNER, 1911; DAWES, 1947; CABALLERO, 1952).

While sorting out spirit specimens of *Fellodistomum fellis* and *F. agnotum* from a single sample (Berl.) of gallbladder trematodes from *A. minor*, some small insignificant trematodes — not being juvenile speci-

mens of fellodistomids — were found. They harmonized incredibly with STAFFORD's and MILLER's original illustration and description of *N. pusilla*, as will appear from fig. 12 A–B on comparison. In spite of the previous poor description it was obvious that STAFFORD's old species had been encountered, not from the urinary bladder but from the gall-bladder.

The present specimens conform generally with the descriptions given by STAFFORD and MILLER. Some supplementary details shall be mentioned however. The club-shaped body is rather characteristic and is almost circular in transversal section. In length it measured 0.69–0.95 mm. The smallest specimen containing eggs measured 0.77 mm in length. The close set cuticular spines were found to be progressively smaller posteriorly, and very sparse or lacking in the posteriormost fifth of body. The ventral sucker is situated at midbody, equidistant from both ends. The oral sucker, pharynx and ventral sucker are of nearly equal size, about 0.09 mm in diameter, the pharynx being slightly smaller. The thin-walled prepharynx is in some specimens telescoped at the entrance to the pharynx. The oesophagus may be described as short and wide (fig. 12 B), but it is not distinct and may just as well be interpreted as a bulging part of the caecal union connected to the pharynx. The intestinal bifurcation is found on a level with the genital pore and the two caeca extend to the posterior extremity of the body. The excretory vesicle has the appearance of an inverted pyramid, the main excretory vessels of each side entering it at its anterior corners (fig. 12 B).

The vitellaria is not especially well-developed. In immature specimens (0.69–0.74 mm by length) without eggs, the vitelline follicles are confined to the space lateral to the caeca. In older egg-containing specimens it is also most prominent lateral to the caeca but extends dorsally with scattered follicles from side to side. Ventrally some follicles are found ventral to the caeca but the ventral intercaecal field is here free of vitelline follicles. The eggs are few, broad oval 0.09 by 0.075 mm and slightly smaller than the ventral sucker.

Neophasis lageniformis (LEBOUR, 1910) MILLER, 1941
(Fig. 13 A–C)

Syn. *Distomum* sp. LEBOUR, 1908
Acanthopsolus anarrhichiae NICOLL, 1909, appears to be a *nomen nudum.*
Acanthopsolus lageniformis LEBOUR, 1910.
Previous records in Greenland: None.
Present records and material:

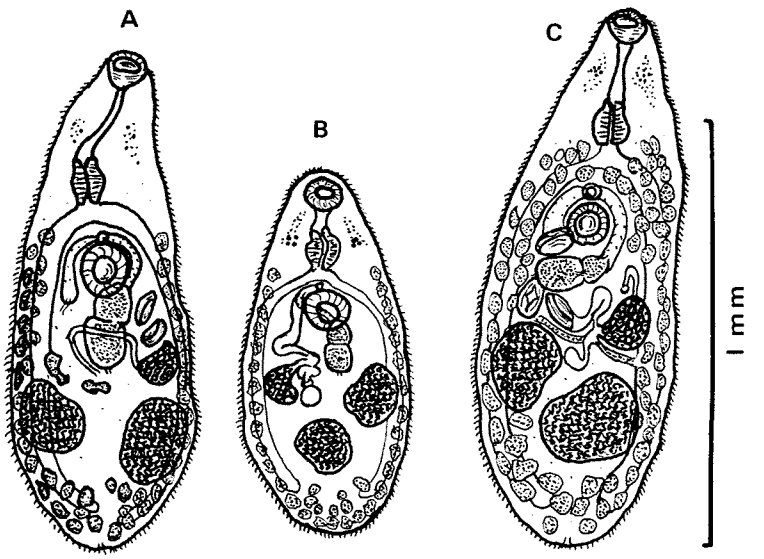

Fig. 13. *Neophasis lageniformis*. A. Ventral view of 1.2 mm specimen with two eggs. B. Dorsal view of 0.85 mm specimen in male phase, seminal receptacle has just developed. C. Ventral view of 1.3 mm specimen with three eggs, seminal receptacle and Laurer's canal seen. Remnants of eye pigment wide spread in all three specimens.

Anarhichas minor, inf. 1 of 2, intestine, W. Greenland, Godhavn 12.9.62, col. et det. A. Br. jr., U.B.Z.M. No. 47999

(All other *Anarhichas* specimens as listed under *N. pusilla*, were found negative).

A detailed description of the parasite — carcaria and adults — was given by LEBOUR (1910) and I have little to add.

The present three specimens measured 0.85–1.30 mm in length and had 2–3 eggs. The smallest specimen had no eggs, but its bipartite seminal vesicle appeared well-developed and filled with sperms, the specimen thus being in its male phase. LEBOUR's (1910) metacercaria from *Buccinum* and smallest specimen from specimen from *Anarhichas*, measured respectively 0.50 mm and 0.54 mm in length. Metacercaria found by KØIE (1969) measured 0.55 mm according to her fig. 2, and showed well developed testes and sperm-filled seminal vesicle. From this it is inferred that the present smallest specimen represents a recent infection.

KØIE's fig. 2 shows star-shaped larval eye-spots, agreeing well with LEBOUR's description. The shape explains why remnants of larval eye pigment in the adults is rather widespread (fig. 13).

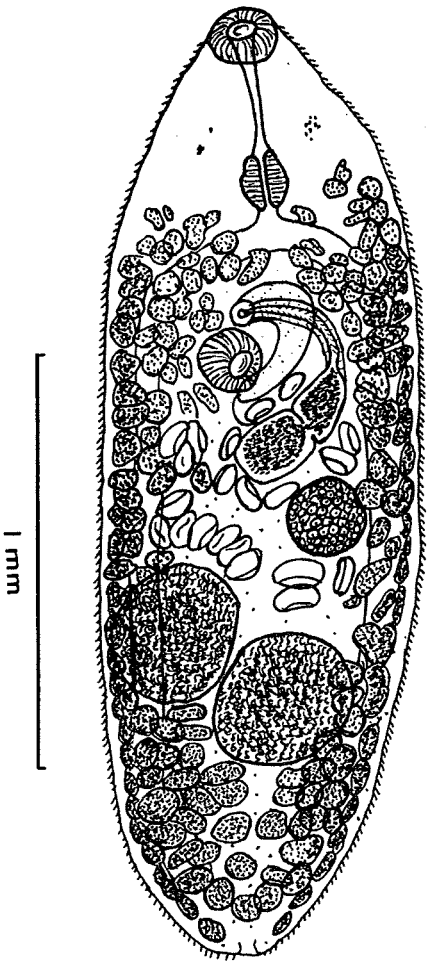

Fig. 14. *Neophasis oculatus.*

The species is well-known from Russian northern seas. In the White Sea SHULMAN & SHULMAN-ALBOVA (1953) found *A. lupus* 40.8–73.3 percent in different areas. In the Barents Sea POLJANSKY (1955) found *A. lupus* and *A. minor*, respectively 53.3 and 50 percent infected.

Neophasis oculatus (LEVINSEN, 1881) DAWES, 1946
(Fig. 14)

Syn. *Distomum oculatum* LEVINSEN, 1881
Acanthopsolus oculatus (LEVINSEN, 1881) ODHNER, 1905
Previous records in Greenland: *Distomum oculatum* LEV. n. sp. in LEVIN-

SEN, 1881, l.c. p. 15 (64) from intestine and pyloric caeca of *Acanthocottus scorpius*. Egedesminde.
Acanthopsolus (n.g.) *oculatus* LEVINS. (in ODHNER, 1905, l.c. p. 329) "... indem ein von mir im Jahre 1900 auf Franz-Josephs-Fjord (Ostgrönland) obduziertes *Lycodes pallidus* ...".
Present records and material:

Acanthocottus scorpius, inf. 0 of 7,		W. Greenland, Godhavn 21.8.–9.9.62
—	— , – 1 - 1, intestine,	As above 11.9.62, U.B.Z.M. No. 48000

A single specimen was collected from 1 of 8 Father lashers, so that it is rather uncommon. A detailed description of the parasite was given by ODHNER (1905) and I have little to add. The present specimen measured 2.3 mm in length, and contained at least 21 eggs. Length of eggs 0.115 mm, thus in accordance with ODHNER. Like him, I could not spot any seminal receptacle.

ODHNER (1905) mentions that he only found this species in Swedish waters 3–4 times, this in spite of the numerous Father lashers searched by him here. POLJANSKY (1955) regards this trematode as a *true arctic species* as outside Greenland waters it is also found in *Myoxocephalus quadricornis* (L.) and *Lycodes agnostus* (?) of the Russian northern seas (the Barents- & White Sea, etc.). LEVINSEN (1881) — quoted by ODHNER and POLJANSKY — regards smaller specimens of the Father lasher as the intermediary host, as these were often found with metacercariae incysted in the skin.

The genus *Neophasis* STAFFORD 1904, its synonym *Acanthopsolus* ODHNER 1905 and its three species

MILLER (1941) who re-investigated STAFFORD's material is to the opinion that the characteristics presented by STAFFORD are sufficient for the recognition of the genus *Neophasis*. This seems doubtful. It was ODHNER (1905) who supplemented LEVINSEN's description of "*Distomum oculatum*" and on new material gave a full description of this species and a serviceable generic diagnosis of his genus *Acanthopsolus*. This diagnosis was later slightly modified by LEBOUR (1910) also to include her *A. lageniformis*. It is only on these diagnoses that the genus *Acanthopsolus* or *Neophasis* can be recognized.

ODHNER (1911, p. 240 footnote) discussed rather emotionally, upon its "freilich sehr durftigen Beschreibung", the priority of *Neophasis* to *Acanthopsolus*. Neither STAFFORD nor MILLER gave sufficient information about the size of egg, presence of seminal vesicle in cirrus pouch or not,

presence of seminal receptacle or not, the latter of which was, however, drawn in their illustrations. Such information would have been of major importance in a generic diagnosis.

SKRJABIN (1954) regards *Acanthopsolus* ODHNER, 1905 as the genus, listing *Neophasis* STAFFORD as a questionable synonym. However, most research workers (e.g. ISSAITSCHIKOW 1928; POPOVA, 1941; DAWES, 1947; CABALLERO, 1952; SHULMAN-ALBOVA, 1952; POLJANSKY, 1955; YAMAGUTI, 1958) have accepted *Neophasis* as the genus with priority, disregarding the fact that it is so ill described that it can not be identified unreservedly from the description. When in the present paper I retain the generic name *Neophasis*, it is not on the basis of STAFFORD and MILLRE, but because I have refound *N. pusilla* and certainly find it a valid species.

MILLER (1941) recognized *three* species (*N. pusilla*, *N. lageniformis* and *N. oculatum*). CABALLERO (1952) recognized *two* species (*N. pusilla* (syn. *A. lageniformis*) and *N. oculatum*). DAWES (1947) mentions: "it is my belief that further study will resolve them into a single species, *Neophasis pusilla*".

It appears to me that all three species are valid. They are, however, difficult to separate upon their descriptions alone; it is much easier when one has material of all three at hand, for comparison. None of them can be identified on a single characteristic only, their identification depends on combinations of different characteristics. These may be summarized as given in table 3.

In table 3 characteristics as extension of vitellaria and relative position of testes used by CABALLERO (1952) have been omitted. CABALLERO based his differentiation of *N. oculatus* and *N. pusilla* upon the extension of vitelline follicles. Provided *N. lageniformis* is regarded as a synonym for *N. pusilla*, this is generally correct. They are not conspecific, however, and slight variations appear within all three species, wherefore this characteristic is of doubtful value. So is also the relative position of testes. They may by the slightest pressure slide from a side by side position. In *N. lageniformis* (fig. 13) specimen A exhibits the characteristic side by side position of testes as mentioned by LEBOUR (1910), whereas in the specimens B and C they have slid apart.

Lepocreadiidae NICOLL, 1935

Lepidapedon elongatum (LEBOUR, 1908) NICOLL, 1915

Syn. *Lepodora elongata* LEBOUR, 1908
?*Lepodora gadi* YAMAGUTI, 1934
?*Lepidapedon gadi* (YAMAGUTI, 1934) YAMAGUTI, 1938
Previous records in Greenland: None.
Present records and material:

Table 3.

	Neophasis pusilla STAFFORD	*Neophasis lageniformis* (LEBOUR)	*Neophasis oculatus* (LEVINSEN)
Length of body	MILLER: 0.6 mm Present specimens max. 0.95 mm	LEBOUR: 0.54–1.30 mm Present specimens max. 1.30 mm	LEVINSEN: 2.0–2.5 mm ODHNER: max. 1.75 mm Present specimens 2.3 mm
Cuticular spines or scales	Lacking on posterior fifth of body	All over the body	All over the body
Eye-spots	Granulae of pigment limited to a spot	Granulae of pigment rather scattered. LEBOUR: "central mass of pigment with smaller flecks radiating irregularly from it"	Granulae of pigment limited to a spot
Position of ventral sucker	Middle of body	Only in anterior half of body	Between anterior first and second third of body
Oral sucker/ Ventral sucker	OS < VS	OS < VS	OS = VS
Cirrus	Not spined	Spined	Spined
Bipartite seminal vesicle	Not observed	Present	Present
Seminal receptacle	Present	Present	Not present
Number of eggs	Present specimens: 4–7	LEBOUR: 4–8 Present specimens: 2–3	LEVINSEN: max. 40 ODHNER: 10–15 < 20 Present specimen: 21
Length of eggs	MILLER: 0.08 (?) mm Present specimens: 0.09 mm	LEBOUR: 0.08–0.10 mm Present specimens: 0.09 mm	ODHNER: 0.115–1.35 mm Present specimen: 0.115 mm
Egg length/ ovarydiam./ suckerdiam.	Eggl. = ovaryd. = suckerd.	Eggl. < ovaryd. Eggl. = suckerd.	Eggl. < ovaryd. = suckerd.

Gadus callarias, inf. 1 of ?, pyloric caeca, E. Greenland 18.9.59, col. Berl. det. A. Br. jr., U.B.Z.M. No. 56693

This rather well-known trematode (LEBOUR, 1908; DAWES, 1947; CABALLERO, BRAVO HOLLIS & GROCOTT, 1955 a.o.) might easily by confused with *L. gadi* (YAMAGUTI, 1934) and *L. microcotyleum* (ODHNER, 1905 mss) DOLLFUS, 1953, both also found in the cod of northern Atlantic waters. The two latter may or may not be synonyms for the former.

YAMAGUTI (1934) described *L. gadi* from *Gadus macrocephalus* TILESIUS from the Sea of Japan and discussed its specificity in relation to *L. rachion* only, having at that time probably overlooked *L. elongatum* from the cod of western waters. *L. gadi* has later, according to SKRJABIN & KOVAL (1960), been reported from far-eastern Soviet waters (AKHMEROV, 1951; ZHUKOV, 1953 and STRELKOV, 1956), as well as from the White Sea (SHULMAN & SHULMAN-ALBOVA, 1953) and from the Barents Sea (POLJANSKY, 1955).

According to YAMAGUTI *L. gadi* is characterized by a distinct preoral lip, which is not present in *L. elongatum* and *L. microcotyleum*, and certainly not in the present specimens. The egg-size of *L. gadi* is 0.066–0.078 mm by 0.045–0.051 mm (YAMAGUTI) and 0.064–0.071 mm by 0.034–0.043 mm (ZHUKOV). This corresponds well with the egg-size of *L. elongatum* which is 0.066 mm by 0.036 mm (DAWES, 1947) and 0.065–0.07 mm by 0.03–0.035 mm in the present specimens. This supports HANSON's view (1950) that *L. gadi* is a synonym for *L. elongatum.*

L. microcotyleum was described by DOLLFUS (1953), who relied partly on ODHNER (1905, p. 337) and his material from Swedish waters, but also on material of his own from the Faroes and Iceland (Akureyri). His records from Iceland was unfortunately overlooked by BRINKMANN (1956). DOLLFUS furthermore regards "*Distomum* sp." and *L. elongatum* mentioned by LINTON (1901 and 1940) from Massachusetts and *L. elongatum* mentioned by DOGIEL (1936) from the Barents Sea as in reality being *L. microcotyleum.* He gave the egg-size for his species as 0.08 mm by 0.054 mm, a size far beyond those found in the present material, but otherwise they appear fairly alike.

Opecolidae OZAKI, 1925

Plagioporus idoneus (NICOLL, 1909) PRICE, 1934

Syn. *Lebouria idonea* NICOLL, 1909.
Previous records in Greenland: None.
Present records and material:

Anarhichas lupus, inf. 1 of ?,		gallbladder ,	W.Greenland, Fyllas Banke 9.8.59, col. Berl. det. A. Br. jr., U.B.Z.M. No. 56689 (on slides 54265 together with *Fellodistomum agnotum*)
Anarhichas minor, –	1 - ?,	intestine ,	W. Greenland, Fyllas Banke 10.8.59, col. Berl. det. A. Br. jr., U.B.Z.M. No. 56690
— — , –	1 - ?,	gallbladder,	W. Greenland 25.4.61, col. Berl. det. A. Br. jr., U.B.Z.M. No. 56691
Anarhichas latifrons, inf. 1 - ?, (All other *Anarhichas* specimens as listed under *N. pusilla*, were found negative)		intestine ,	W. Greenland 9.8.59, col. Berl. det. A. Br. jr., U.B.Z.M. No. 56692

The species is well-known, also from the White- and Barents Sea (Shulman & Shulman-Albova, 1953 and Poljansky, 1955).

Podocotyle atomon (Rudolph, 1802) Odhner, 1905
(Fig. 15)

Syn. *Fasciola Atomon* Rudolphi, 1802
Distoma Atomon R., in Rudolphi 1808
?*Distoma Atomon* Rud., in Olsson 1868
Distomum simplex Rud.? Oolsson, in Levinsen 1881
Allocreadium atomon (Rud.), in Odhner 1901
Podocotyle levinseni Issaitschikow, 1928
Podocotyle odhneri Issaitschikow, 1928

Previous records in Greenland: *Distomum simplex* Rud.? Olsson in Levinsen, 1881, l.c. p. 18(67), from *Acanthocottus scorpius* (L.) and *Gymnacanthus tricuspis* Reinh. in intestine. Egedesminde.
Present records and material:

Acanthocottus scorpius, inf. 0 of 7,			W. Greenland, Godhavn 21.8.–9.9.62
— — , –	1 - 1,	intestine,	As above 11.9.62, col. et det. A. Br. jr., U.B.Z.M. No. 56694

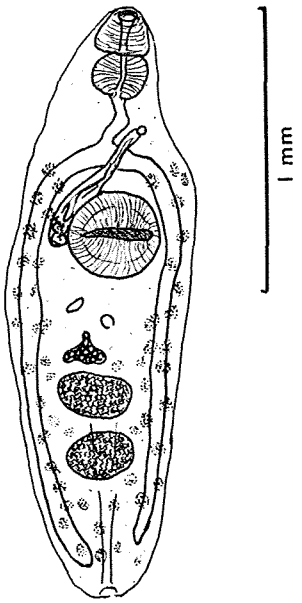

Fig. 15. *Podocotyle atomon*, var. *odhneri*?

The species is well-known and widespread (ODHNER, 1905; MANTER, 1926; MILLER, 1941, DAWES, 1947 a.o.). Within certain limits it appears rather variable as pointed out by POLJANSKY (1955, fig. 15). He further appears to regard *P. levinseni* ISSAITSCHOKOW, 1918, and *P. odhneri* ISSAITSCHIKOW, 1928, as variants of *P. atomon* and I concur.

LEVINSEN mentions that the species was frequently found in the intestine of the Father lasher. In the present material it was only encountered in 1 of 8 specimens of this host, and then in a form with poorly developed vitellaria, just as in *P. odhneri* ISSAITSCHIKOW (comp. fig. 15 with ISSAITSCHIKOW's fig. 7). It is interesting that ISSAITSCHIKOW described his *P. odhneri* from *Gymnacanthus tricuspis* (REINHARDT), which is conspecific with *Phobetoris ventralis* LÜTKEN, from which also LEVINSEN reported the present parasite.

LEVINSEN found the arctic amphipode *Euthemisto libellula* (MANDT) carrying metacercaria cysts of this species. At Egedesminde this amphipode appeared to constitute the main food of the Father lasher. In its stomach he found free cysts containing 1.5 mm metacercaria and newly liberated specimens at 2 mm length. As LEVINSEN's paper was published in Danish, these interesting observations have been overlooked by later authors — ODHNER (1905) excepted — and this secondary intermediate host is not mentioned by OUSPENSKAIA in her table II (1960).

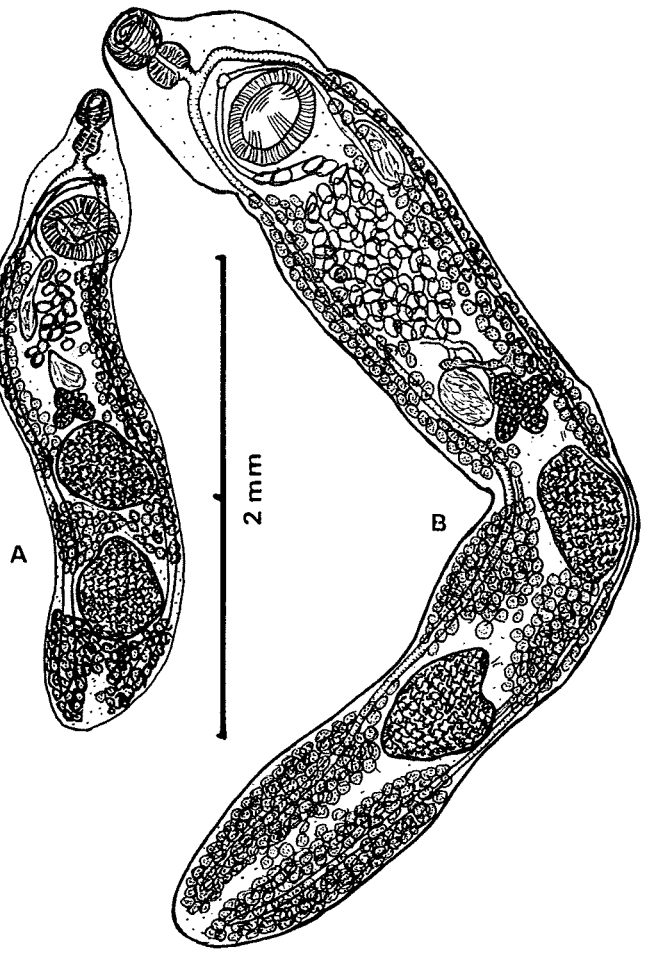

Fig. 16. *Podocotyle reflexa*. A. Small specimen (*P. reflexa olssoni*). B. Large specimen (*P. reflexa reflexa*).

Podocotyle reflexa (CREPLIN, 1825) ODHNER, 1905
(Fig. 16 A–B)

Syn. *Distomum reflexum* CREPLIN, 1825
Distoma simplex RUD.?, in OLSSON 1868
Distomum simplex RUDOLPHI (?), in LINTON 1898
Sinistroporus productus STAFFORD, 1904
Sinistroporus simplex RUD., in STAFFORD 1904
Podocotyle olssoni ODHNER, 1905
Podocotyle olssoni ODHNER, 1905, in MANTER 1926
Podocotyle reflexa CREPLIN, 1825, in MILLER 1941

Previous records in Greenland: None.

Present records and material:

Gadus ogac	, inf. 0 of 2,		W. Greenland (Berl.), Fiskenæsset 29.7.59 and Danas bank 30.7.59
— —	, – 0 - 2,		W. Greenland, Godhavn 21.8. & 7.9.62
— —	, – 1 - 1,	intestine, app. pyl.	W. Greenland Godhavn 25.8.62, col.et det. A. Br. jr., U.B.Z.M. No. 56695
Gadus callarias,	– 0 - ?,		E. Greenland (Berl.) 18.8.59 W. Greenland (Berl.) 8.8.59 & 25.4.61
— —	, – 0 -14,		W. Greenland, Godhavn 22.8, 23.8., 25.8., 8.9., 11.9., 12.9.62
— —	, – 1 - 1,	intestine,	W. Greenland, Godhavn 1.9.62, col. et det. A. Br. jr., U.B.Z.M. No. 56696
— —	, – 1 - 1,	— ,	W. Greenland, Godhavn 9.9.62 col. et det. A. Br. jr., U.B.Z.M. No. 56697
Sebastes marinus	, inf. 0 of 2,	,	W. Greenland (Berl.), "Bank of no name" off Nanortalik 8.5.61
— —	, – 1 - 3,	app. pyl.,	W. Greenland, Skarvefjeld bank (SE off Godhavn) 2.9.62, col. et det. A. Br. jr., U.B.Z.M. No. 56698
Anarhichas lupus, (No other *Anarhichas*-specimens or other species were found infected)	– 1 - 1,	intestine,	W. Greenland, Godhavn 11.9.62, col. et det. A. Br. jr., U.B.Z.M. No. 56699

A serviceable description of the species was first given by ODHNER (1905), CREPLIN's original description of 1825 being rather poor. Apart from ODHNER's statement that the oesophagus was short — not longer than the pharynx — and that the seminal vesicle reached posteriorly to

a point halfway between the ventral sucker and the ovary, no really good characteristics were given. The species is always larger than *P. atomon*, up to 7 mm and with a linear cylindrical body. The testes appear nearly as broad as the body and the vitellaria are broken opposite each testis, here leaving the intestinal caeca easily visible, but otherwise filling the intertesticular space. Commonly the body is somewhat constricted about the level of the testes. These characteristics were in fact already observed by OLSSON in his "*Distoma simplex* RUD.?" and appear from his fig. 81. The length of body is rather variable from 2.8–7 mm, as will also appear from MANTER (1926, fig. 50) and MILLER (1941, fig. 11).

MANTER (1926) found that his specimens and LINTON's (1898) "*Distomum simplex* RUDOLPHI (?)" fitted the description of *P. olssoni* as given by ODHNER. In my view, however, *P. olssoni* in reality is a small *P. reflexa.*

The *Podocotyle*-species of Atlantic boreo-arctic waters

The taxonomy of the *Podocotyle*-species has always been confusing; it still is even after PARK's paper of 1937. This is not the place for a penetrating taxonomic survey of the species. Here only the mutual relations of the species reported from western waters concerned shall be discussed.

ODHNER (1905) differentiated between *three* species (*P. atomon*, *P. reflexa* and *P. olssoni*), whereas ISSAITSCHIKOW (1928) distinguished between *seven* species (*P. atomon*, *P. atomon var. dispar*, *P. sygnathi*, *P. levinseni*, *P. odhneri*, *P. olssoni*, and *P. reflexa*). The present situation is that later Russian helminthologists (SHULMAN & SHULMAN-ALBOVA, 1953; POLJANSKY, 1953 and ZHUKOV, 1960 & 1963) preferably restrict their identification to only *two* species (*P. atomon* and *P. reflexa*) as these appear easy to separate and furthermore their life cycle is known (HUNNINEN & CABLE, 1943 and OUSPENSKAIA, 1960). The same line will be followed here.

In the latter half of the 19th century OLSSON (1868) reported "*Distoma Atomon* RUD." and what he regarded as "*Distoma simplex* RUD.?" from Norwegian and Swedish coastal waters. Later LEVINSEN (1881) reported "*Distomum simplex* RUD. ? OLSSON" from Greenland waters, supplemented OLSSON's description, but stressed certain differences to which we shall return below.

ODHNER (1905) on material of his own and on OLSSON's and LEVINSEN's publications, as well as on material collected by these authors and available in the museums of Copenhagen and Uppsala, decided that LEVINSEN's specimens in reality were *P. atomon.*, and OLSSON's specimens probably *Distomum simplex* RUD. As the description given by RUDOLPHI (1809) is poor and the material lost, so that a verification of identity was

impossible, ODHNER decided to describe "*Distomum simplex* RUD.? OLSSON" as a new species, i.e. *P. olssoni* ODHNER, 1905.

Comparing LEVINSEN's fig. 1 (1881, Tab. III) with ODHNER's fig. 9 (1905, Taf. II — drawn from LEVINSEN's Copenhagen material) it is obvious that ODHNER was correct in his conclusion, the species certainly being *P. atomon*. As to OLSSON's "*Distoma simplex* RUD.?" being a new species *P. olssoni* — as asserted by ODHNER, it is far from certain that this conclusion is correct.

The main differences LEVINSEN found in his specimens versus OLSSON's specimens, are as follows:

OLSSON 1868 "*Distoma simplex* RUD.?"	LEVINSEN 1881 "*Distomum simplex* RUD.? OLSSON"
Distance mouth sucker to ventral sucker $^1/_6$–$^1/_7$ of body length "Peculiar is, that lateral to the testes the body is habitually constricted at both lateral margins — here vitelline follicles are lacking — and thus is divided into three segments" (translated from Swedish).	Distance mouth sucker to ventral sucker $^1/_3$–$^1/_5$ of body length "I cannot recall having seen the constrictions lateral to the testes mentioned by OLSSON" (translated from Danish).

These are rather significant differences, which leads to the conclusion of there must be two different species, a conclusion drawn by ODHNER as mentioned above.

As further differences shall be mentioned:

P. atomon	*P. reflexa* & *P. olssoni* ("*Distoma simplex* RUD.?" OLSSON)
Body *flattened.*	Body *cylindrical.*
Distance mouth sucker to ventral sucker about $^1/_4$ of body length.	Distance mouth sucker to ventral sucker about $^1/_7$ of body length.
Testes relatively *small*, not occupying more than one half the cross-section of the body.	Testes *large*, occupying the greater part of the body in cross-section.
Vitellaria *unbroken* (covering the intestinal caeca) and do not come together between the testes. Body not constricted at level with the testes.	Vitellaria *broken* lateral to each testes (uncovering the intestinal caeca) and come together between the testes. Body commonly constricted at level with the testes.

The two groups are thus distinct. As to the specific differences between *P. reflexa* and *P. olssoni* these are said to be:

P. reflexa	*P. olssoni*
Oesophagus longer than the pharynx.	Oesophagus as long as or even shorter than the pharynx.
Cirrus pouch (seminal vesicle included) reaching with half its length past the ventral sucker. (ODHNER: Cirrusbeutel . . . mit seiner halben Länge den Bauchsaugnapf überragend).	Cirrus pouch (seminal vesicle included) reaching at least about half way between ventral sucker and ovary. (ODHNER: Cirrusbeutel . . . wenigstens bis mitten zwischen Bauchsaugnapf und Keimstock nach hinten reichens).

As regards the first characteristic — even if it has been used by many authors — it may be said to be rather dubious as the preacetabular part of body is rather contractible and extensible. The second characteristic as stated for *P. reflexa*, does not necessarily involve that the cirrus pouch not reach about halfway between the ventral sucker and the ovary. Accordingly, specimens of both stipulated species will always appear to exhibit the very same relations in these matters, and thus can not be separated from each other. It is my experience and conclusion that *P. olssoni* is to be regarded as a synonym for *P. reflexa*, i.e. *P. olssoni* in reality being the smaller specimens of *P. reflexa*. The synonymity for these species has been arranged in accordance herewith.

Halipegidae POCHE, 1925

Derogenes varicus (MÜLLER, 1784) Looss, 1901

Syn. See DAWES (1947). When however he gives *D. crassum* MANTER, 1934, as a synonym, this is incorrect.

Previous records in Greenland: *Distomum varicum* (O. F. MÜLLER) in LEVINSEN, 1881, l.c. p. 5(54), from *Acanthocottus scorpius* (L.) and *Gadus ogac* RICHARDSON in stomach. Egedesminde.

Present records and material:

(As this species is common and widespread in many fishes, only positive finds are recorded).

Acanthocottus scorpius, inf. 2 of 3,	stomach,	W. Greenland,		Godhavn 21.8.62, col. et det. A. Br. jr., U.B.Z.M. No. 56700
—	— , - 1 - 1,	—	,	As above 9.9.62, U.B.Z.M. No. 56701
—	— , - 1 - ,	—	,	As above 11.9.62, U.B.Z.M. No. 56702

Lycodes reticulatus	, inf.	2 of 2,	stomach,	W. Greenland, Skarvefjeld bank (SE off Godhavn) 2.9.62 col. et det. A. Br. jr., U.B.Z.M. No. 56703
Anarhichas lupus	, –	1 - 2,	—	, W. Greenland, Godhavn 29.8.62, col. et det. A. Br. jr., U.B.Z.M. No. 56704
— —	, –	1 - 1,	—	, As above 8.9.62, U.B.Z.M. No. 56705
Anarhichas minor	, –	1 - 1,	—	, As above 20.8.62, U.B.Z.M. No. 56706
— —	, –	1 - 2,	—	, As above 12.9.62, U.B.Z.M. No. 56707
Anarhichas latifrons	, –	1 - ?,	—	, W. Greenland 9.8.59, col. Berl. det. A. Br. jr., U.B.Z.M. No. 56708
Gadus ogac	, –	1 - ?,	oesoph.,	W. Greenland, col. Berl. det. A. Br. jr., U.B.Z.M. No. 56709
— –	, –	1 - 1,	stomach,	W. Greenland, Godhavn 7.9.62, col. et det. A. Br. jr., U.B.Z.M. No. 56710
Gadus callarias	, –	5 - 9,	—	, W. Greenland, Godhavn 22.8., 25.8., 1.9., 11.9., 13.9.62, col. Berl. det. A. Br. jr., U.B.Z.M. Nos. 56711–56715
Hippoglossus hippoglossus,	–	1 - ?,	—	E. Greenland off , Skjoldungen 23.7.59, col. Berl. det. A. Br. jr., U.B.Z.M. No. 56716
— —	, –	1 - ?,	—	, W. Greenland 9.8.59, col. Berl. det. A. Br. jr., U.B.Z.M. No. 56717

Reinhardtius hippoglossoides, inf. 4 of 4, stomach, W. Greenland, Skarvefjeld bank (SE off Godhavn) 3.9., 7.9.62, col. et det. A. Br. jr., U.B.Z.M. Nos. 56718–56719

Salvelinus alpinus , – 1 - 4, — , W. Greenland, Eqaluit (Disko west) 28.8.62, col. et det. A. Br. jr., U. B.Z.M. No. 56720

This trematode is so well known that comments are unnecessary. It shoul d be mentioned that OUSPENSKAIA (1960) gave *Eupagurus pubescens* (KRØYER) as harbouring the metacercaria in the Barents Sea.

Genarches mülleri (LEVINSEN, 1881) Looss, 1902

Syn. *Distomum Mülleri* LEV. n. sp. 1881
Progonus mülleri (LEVINSEN, 1881) Looss, 1899
Genarchopsis muelleri (LEVINSEN, 1881) YAMAGUTI, 1958.
YAMAGUTI (1958) suppressed the genus *Genarches* Looss, 1902, replacing it as *Genarchopsis* OZAKI, 1925. I can not follow him, as OZAKI (1925) established his genus *Genarchopsis* as closely related to *Genarches*, but not identical. The genus *Genarchopsis* is characterized by eggs bearing single long polar filaments, but no such filament exists in *G. mülleri*. The latter can thus not be transferred to the genus *Genarchopsis* as YAMAGUTI has done.

Previous records in Greenland: *Distomum Mülleri* Lev. n. sp. in LEVINSEN, 1881, l. c.p. 7(56) from *Acanthocottus scorpius* (L.) and *Gadus ovak* RICH. in stomach. Egedesminde.

Genarches mülleri (LEVINS.) in ODHNER, 1905, l.c.p. 365 from *Acanthocottus scorpius* (L.) in stomach. Franz-Josephs-Fjord, E. Greenland.

Present records and material:

Gadus ogac, inf. 1 of ?, stomach, W. Greenland, Fiskenæsset 27.7.57, col. Berl. det. A. Br. jr., U.B.Z.M. No. 56721

(All other fishes were found negative).

This arctic species has been adequately described by LEVINSEN (1881) and ODHNER (1905), summarized by DOLLFUS (1953) and SKRJABIN & GUSCHANSKAJA (1955), and I have nothing to add.

The single specimen encountered in the present material occurred together with many specimens of *Derogenes varicus* (U.B.Z.M. No. 54295). It is morphologically easily confused with the latter, especially when the characteristic posterior union of intestinal caeca is obscured. Accordingly, the main differences shall here be stressed as follows:

Derogenes varicus	*Genarches mülleri*
Preoral lobe *present.*	Preoral lobe *lacking.*
Intestinal caeca with separate posterior ends, i.e. *not united.*	Intestinal caeca posteriorly *united.*
Vitellaria *larger* than ovary and testes.	Vitellaria *smaller* than ovary and testes.
Pars prostatica *conspicuous*, as long as diameter of ventral sucker.	Pars prostatica *inconspicuous*, shorter than diameter of oral sucker
Genital papilla or cone muscular and *prominent.*	Genital papilla less muscular and *inconspicuous.*
After fixation eggshells keep their *oval outline smooth.*	After fixation eggshells do not keep their oval outline, which becomes *mostly wrinkled.*

Outside Greenland waters the species has been found in other arctic waters, such as off W. Spitzbergen (ODHNER, 1905), the Barents- and the White Sea (ISSAITSCHIKOW, 1928 & 1933; SHULMAN & SHULMAN-ALBOVA, 1953 and POLJANSKY, 1955) in many fishes.

NICOLL (1915) mentions the species in his list of fish trematodes from British marine fishes, but this may be incorrect as it is not repeated by DAWES (1947). The latter author redrew (1947, fig. 50 B) the species from ODHNER (1905), incorrectly however, with the caeca ending blind- and separately, i.e. not united, instead of being united posteriorly, as shown in ODHNER's illustration (1905, fig. 8, Taf. IV).

LINTON (1940) has a dubious report of the species from Massachusetts waters. According to his drawings, the vitellaria are larger than the ovary and testes and there appears to be a prominent muscular genital papilla, characteristics which do not conform with *G. mülleri.*

The intermediate host of *G. mülleri* in the Barents Sea is according to OUSPENSKAJA (1960) *Caprella septentrionalis* KØYER, 1843 (syn. *Squilla lobata* FABRICIUS, 1780, according to G. O. SARS, 1895). This caprellid is also rather abundant in Greenland waters, from which it was originally described.

Gonocerca phycidis MANTER, 1925
(Fig. 17 A–B)

Previous records in Greenland: None.
Present records and material:

Hippoglossus
hippoglossus, inf. 1 of ?, stomach, W. Greenland 9.8.59, col. Berl. det. A. Br. jr., U.B.Z.M. No. 56722

This species — with northern and southern deep water distribution — was originally described by MANTER (1925) from the halibut (and *Urophycis chuss*) from the coast of Maine. He returned to the species in later papers (1934 & 1954), broadening his description and stating it to be rather similar to *G. crassa* MANTER, 1934.

The present specimens from a single halibut were here collected together with many *Derogenes varicus*, and spirit specimens of the two species were difficult to separate. In total mounts, however, this was easily performed. My specimens correspond well with MANTER's descriptions, especially with his illustration (1934), and I have nothing to add.

Gonocerca crassa MANTER, 1934
(Fig. 17 C–D)

Previous records in Greenland: None.
Present records and material:

Gadus ogac , inf. 1 of ?, intestine, W. Greenland, Danas Banke 30.7.59, col. Berl. det. A. Br. jr., U.B.Z.M. No. 56725

Gadus callarias , – 2 - ?, stomach, W. Greenland 8.8.59 and 25.4.61, col. Berl. det. A. Br. jr., U.B.Z.M. Nos. 56723–56724

Brosmius brosme , – 1 - ?, oesoph., W. Greenland, 7.9.61, col. Berl. det. A. Br. jr., U.B.Z.M. No. 56726

Sebastes marinus , – 2 - ?, — , W. Greenland, Nanortalik 8.5.61 col. Berl. det. A. Br. jr., U.B.Z.M. No. 56727

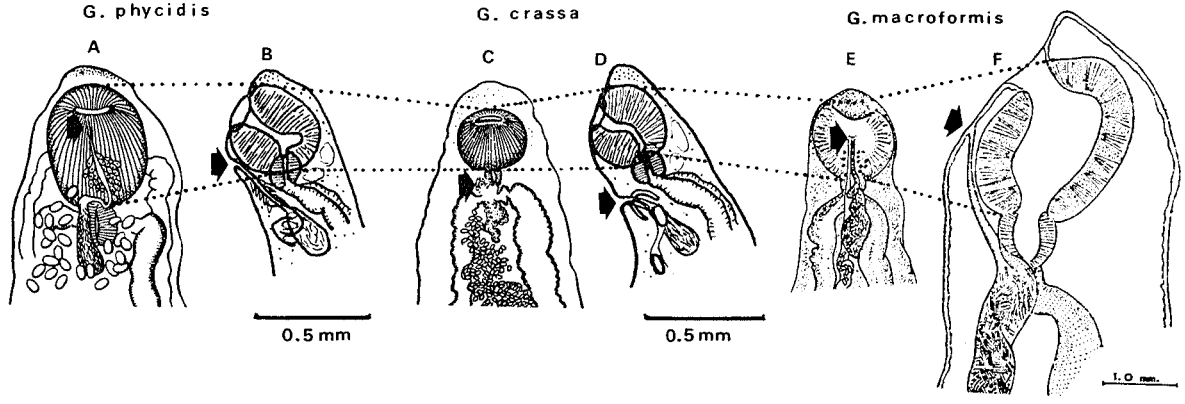

Fig. 17. *Gonocerca phycidis:* A. From MANTER, 1926. B. Present material opt. sag. sect. *Gonocerca crassa:* C. From MANTER, 1934. D. Present material opt. sag. sect. *Gonocerca macroformis:* E & F. From WOLFGANG & MYERS, 1954. Arrows indicate location of genital pore.

Hippoglossus hippo-glossus, inf. 2 of ?, oesoph.,	W. Greenland 9.8.59 and 24.4.61, col. Berl. det. A. Br. jr., U.B.Z.M. No. 56728–56729.

This species has been adequately described by MANTER (1934), YAMAGUTI (1938) and REES (1953) from the waters east of Iceland. It has further been reported from the White Sea by SHULMAN & SHULMAN-ALBOVA (1953). All the above-mentioned fish species are here recorded for the first time as hosts for this trematode.

The differentiation between the Atlantic boreo-arctic *Gonocerca* species

SKRJABIN & GUSCHANSKAJA (1955) gave a key for the identification of the different *Gonocerca* species, mainly based upon the extension of the pharynx and the form of vitellaria. As these characteristics to a certain extent depend upon the state of body contraction, other characteristics have also to be considered. Accordingly the following comparative illustration, based upon previous and present drawings, may be helpful (fig. 17).

In *G. phycidis* and *G. macroformis* the genital pore (arrow) is located midventral to the oral sucker, just posterior to the ventral lip of the oral orifice, whereas in *G. crassa* it is located behind the posterior end of the oral sucker, midventral to the pharynx. The latter species is further characterized by a much more conspicuous stout, short and broad genital cone within the genital atrium, easily observed. The two former are easily separated by the shape of their intestinal caeca. In *G. phycidis* the caeca are uniform along their whole length, whereas in *G. macroformis* each caeca has an anterior oesophagus-like part followed by a broad-lumened thin-walled posterior part.

Metahemiurus levinseni

(ODHNER, 1905) SKRJABIN & GUSCHANSKAJA, 1954

Syn. *Distoma appendiculatum* RUD., MOLIN in OLSSON 1868 in part
Distomum appendiculatum RUD. MOLIN in LEVINSEN 1881
Apoblema appendiculatum (RUD.) in JUEL 1889 in part
Hemiurus levinseni ODHNER, 1905.

Previous records in Greenland: *Distomum appendiculatum* RUD. MOLIN in LEVINSEN, 1881, l.c.p. 9(58) from stomach of *Acanthocottus scorpius* (L.) and *Gadus ogac* RICH., Egedesminde, W. Greenland. *Hemiurus levinseni* n. sp. in ODHNER, 1905, l.c.p. 348 from *Boreogadus saida* (LEPECHIN). Kejser Franz Josephs Fjord, E. Greenland.

Present records and material:

Gadus callarias,	inf.	0	of	?, ,	W. Greenland (Berl.) 8.8.59
—	—	, –	0 -	?, stomach,	W. Greenland 25.4.61, col. Berl. det. A. Br. jr., U.B.Z.M. No. 56732
—	—	, –	0 -	14, ,	W. Greenland, Godhavn 22.8., 23.8., 8.–12.9.62
—	—	, –	1 -	2, stomach,	W. Greenland, Godhavn 25.8.62, col. et det. A. Br. jr., U.B.Z.M. No. 56730
—	—	, –	1 -	1, — ,	As above 1.9.62, U.B.Z.M. No. 56731
Gadus ogac		, –	0 -	?,	W. Greenland, (Berl.) Fiskenæsset 29.7.59 and Danas Banke 30.7.59
—	–	, –	0 -	2,	W. Greenland, Godhavn 21.8. and 7.9.62
—	–	, –	1 -	1, stomach,	W. Greenland, Godhavn 25.8.62, col. et det. A. Br. jr., U.B.Z.M. No. 56733

This species has been adequately described by ODHNER (1905), MANTER (1926) a.o. SKRJABIN & GUSCHANSKAJA (1954) regarded it as belonging to a distinct subgenus — *Metahemiurus* — within the genus *Hemiurus* RUD., and their arguments for this appear adequate and useful to me.

Of the many host species listed in the literature (SKRJABIN & GUSCHANSKAJA, 1954 and YAMAGUTI, 1958) I found only the cod infected. Even the 8 father lashers and 4 *Gadus saida* — originally also given as hosts in Greenland waters (LEVINSEN, 1881 and ODHNER, 1905) — I searched were found without this parasite. MANTER (1926) considers this species to be the most common hemiurid species in arctic marine fishes. The present finds support this statement, as in fact it was the only hemiurid species encountered by me in Greenland waters. The species appears to have a circumpolar boreo-arctic distribution, with many host species also in far eastern boreo-arctic waters (ZHUKOV, 1963).

Lecithaster gibbosus (RUDOLPHI, 1802) LÜHE, 1901

Syn. See ODHNER, 1905.

Previous records in Greenland: *Distomum mollissimum* LEV. n. sp. in

LEVINSEN, 1881, l.c.p. 10(59) from the intestine of *Acanthocottus scorpius* (L.). Egedesminde.
Present records and material:

Salvelinus alpinus, inf. 5 of 9, intestine, W. Greenland, Eqaluit (Nordre Laksebugt, Disko west) 28.8.62, col. et det. A. Br. jr., U.B.Z.M. No. 56734

This well known trematode has been adequately described by LEBOUR (1908) and I have nothing to add.

In northern waters it has been recorded from the Barents Sea (POLJANSKY, 1955), the White Sea (SHULMAN & SHULMAN-ALBOVA, 1953), the Bering Sea (ZHUKOV, 1963) and the sea of Okhotsk (ZHUKOV, 1960) and must be regarded as circumpolar in its distribution.

Microphallidae VIANA, 1924

Gymnophallus deliciosus (OLSSON, 1893) ODHNER, 1900

Syn. *Distoma deliciosum* OLSSON, 1893
Previous records in Greenland: None.
Present records and material:

Larus glaucoides, inf. 1 of 1, gallbladder, W. Greenland, Fortunebay (Disko west of Godhavn) 8.9.62, col. et det. A. Br. jr., U.B.Z.M. No. 56735

First report from Greenland.

Gymnophallus choledochus ODHNER, 1900

Previous records in Greenland: *Gymnophallus choledochus* ODHN. in ODHNER, 1905, l.c.p. 313 from *Somateria spectabilis* in Kejser Franz Josephs Fjord, E. Grønland.
Present records and material:

Somateria mollisima, inf. 1 of 1, gallbladder, W. Greenland, Fortunebay (Disko west of Godhavn) 8.9.62, col. et det. A. Br. jr., U.B.Z.M. No. 56736

The species has been properly described ODHNER (1905) and its variability by ISSAITSCHIKOW (1924).

List of hosts and their parasites

PISCES

Elasmobranchii

Dalatidae	*Acanthorhinus carcharias* (Gunnerus, 1766) Blainville, 1816 (syn. *Somniosus microcephalus* (Bloch & Schneider, 1801) Leseur, 1818)	
		Squalonchocotyle borealis
Rajidae	*Raja radiata* Donovan, 1806	
		Acanthocotyle verrilli
		Squalonchocotyle berlandi
		Otodistomum veliporum
	Raja hyperborea Collett, 1878	
		Squalonchocotyle berlandi
		Otodistomum veliporum

Teleostei

Salmonidae	*Salvelinus alpinus* (L.)	
		Derogenes varicus
		Lecithaster gibbosus
Gadidae	*Gadus callarias* L.	
		Lepidapedon elongatum
		Podocotyle reflexa
		Derogenes varicus
		Gonocerca crassa
		Metahemiurus levinseni
	Gadus ogac Richardson, 1836	
		Podocotyle reflexa
		Derogenes varicus
		Gonocerca crassa
		Genarches mülleri
		Metahemiurus levinseni
	Brosmius brosme (Ascanius, 1772)	
		Gonocerca crassa
Lycodinae	*Lycodes reticulatus* Reinhardt, 1838	
		Derogenes varicus
Anarhichadidae	*Anarhichas lupus* L.	
		Diptherostomum microacetabulum
		Lepidophyllum steenstrupi
		Fellodistomum fellis
		Fellodistomum agnotum

		Neophasis pusilla
		Plagioporus idoneus
		Podocotyle reflexa
		Derogenes varicus
	Anarhichas minor OLAFSEN, 1782	
		Prosorhynchus squamatus
		Diptherostomum microacetabulum
		Diptherostomum sp.
		Steganoderma pycnorganum
		Lepidophyllum steenstrupi
		Fellodistomum fellis
		Fellodistomum agnotum
		Neophasis pusilla
		Neophasis lageniformis
		Plagioporus idoneus
		Derogenes varicus
	Anarhichas latifrons STEENSTRUP, 1842	
		Diptherostomum microacetabulum
		Lepidophyllum steenstrupi
		Steringophorus furciger
		Neophasis pusilla
		Plagioporus idoneus
		Derogenes varicus
Scorpaenidae	*Sebastes marinus* (L.)	
		Stephanostomum davisi
		Gonocerca crassa
Cottidae	*Acanthocottus scorpius* (L.)	
		Prosorhynchus squamatus
		Neophasis oculatus
		Podocotyle atomon
		Derogenes varicus
Agonidae	*Leptagonus decagonus* (BLOCH & SCHNEIDER, 1801)	
		Anisorchis opisthorchis
Pleuronectidae	*Hippoglossus hippoglossus* (L.)	
		Entobdella hippoglossi
		Steringophorus furciger
		Derogenes varicus
		Gonocerca phycidis
	Reinhardtius hippoglossoides (WALBAUM, 1792)	
		Entobdella hippoglossi
		Steringophorus furciger
		Derogenes varicus
	Aves	
Laridae	*Larus glaucoides* MEYER, 1822	
		Gymnophallus deliciosus
Fuligulidae	*Somateria mollissima* L.	
		Gymnophallus choledochus

List of parasites and their hosts

MONOGENOIDEA

Monopisthocotylea

Acanthocotylidae	*Acanthocotyle verrilli* Goto, 1899	13
	Raja radiata	
Capsalidae	*Entobdella hippoglossi* (Müller, 1776) Johnston, 1856	13
	Hippoglossus hippoglossus	
	Reinhardtius hippoglossoides	

Polyopisthocotylea

Hexabothriidae	*Squalonchocotyle borealis* (Van Beneden, 1853) Cerfontaine 1899	14
	Acanthorhinus carcharias	
	Squalonchocotyle berlandi n. sp.	23
	Raja radiata	
	Raja hyperborea	

TREMATODA

Gasterostomata

Bucephalidae	*Prosorhynchus squamatus* Odhner, 1905	28
	Acanthocottus scorpius	
	Anarhichas minor	

Prosostomata

Azygiidae	*Otodistomum veliporum* (Creplin, 1837) Stafford, 1904	32
	Raja radiata	
	Raja hyperborea	
Acanthocolpidae	*Stephanostomum davisi* n. sp.	35
	Sebastes marinus	
Zoogonidae	*Diptherostomum microacetabulum* Schulmann-Albova, 1952	38
	Anarhichas lupus	
	Anarhichas minor	
	Anarhichas latifrons	
	Diptherostomum sp.	40
	Anarhichas minor	
Steganodermatidae	*Steganoderma pycnorganum* Rees, 1953	42
	Anarhichas minor	
	Lepidophyllum steenstrupi Odhner, 1912	43
	Anarhichas lupus	
	Anarhichas minor	
	Anarhichas latifrons	

Abbreviations used in the figures

gic . . . . . genito-intestinal canal
i . . . . . intestine
Lc . . . . . LAURER's canal
oot . . . . ootype
ov . . . . . ovary
ovd . . . . oviduct
sr . . . . . seminal receptacle
sv . . . . . seminal vesicle
t . . . . . testis
ut . . . . . uterus
va . . . . . vagina
vd . . . . . vas deferens
vit . . . . . vitellarium
vitr . . . . vitelline reservoir

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