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Cestodes in fishes at the Heard Island (Subantarctic)

ABSTRACT: Thirty four specimens of bony fishes (5 species) and four specimens of skates (2 species) were examined. Skates were infected with adult representatives of *Phyllobothrium* sp. (Tetraphyllidea) and *Macrobothridium* sp. (Diphylleida). Bony fishes were infected with three morphological forms of tetraphyllidean cercoids (with mono- and bilocular bothridia, and bothridia undivided with hook-like projections), diphyllobothrid plerocercoids and one pseudo-phyllidean species, *Bothriocephalus antarcticus* sp.n. This species, as well as two species found in skates, seems to be endemic for the Kerguelen subregion.

K e y w o r d s: Subantarctic, cestodes, fish infection, tetraphyllidean cercoids.

Introduction

Up to now, only one cestode maturing in bony fishes, *Bothriocephalus kerguelensis* Prudhoe, 1969 and one larval form of Tetraphyllidea have been reported from fishes coming from the Kerguelen subregion (Prudhoe 1969); in this paper some morphological data are given. All other reports lack such data and forms listed in them are not recognizable. Cestodes (usually larval forms) were determined only to the generic, family or even order levels (Parukhin and Lyadov 1981, 1982, Lyadov 1985, Parukhin 1989, Gayevskaya, Rodyuk and Parukhin 1990). All materials were collected from bony fishes, data from elasmobranchs were absent.

The present paper concerns data on the morphology and occurrence of larval and adult forms of cestodes in bony fishes and skates at the Heard Island.

Material and methods

Cestodes were collected from preserved viscera of fishes caught during the Aurora Australis Cruise, Heard Island Plateau, August—October, 1993. Viscera of 38 fishes from four families were examined: Nototheniidae — *Notothenia squamifrons* Guenther (5 specimens) and *Dissostichus eleginoides* Smitt (8); Channichthyidae — *Channichthys rhinoceratus* Richardson (11) and *Champscephalus gunnari* Loennberg (5); Congiopodidae — *Zanclorhynchus spinifer* (Guenther) (5); Rajidae — *Bathyraja eatonii* (Guenther) (3) and *Bathyraja murrayi* (Guenther) (1). All specimens of *D. eleginoides* and skates were immature.

Most of viscera were fixed in formaline, postfixed and stored in 75% ethanol. Some guts were opened along, put into fresh water for one hour, and then fixed and stored in 75% ethanol. Viscera were examined after half a year of preservation.

Cestodes were stained in carmin acid, dehydrated in graded ethanol, cleared in beechwood creosote and examined as whole mounts in Canada balsam.

All dimensions are given in millimetres. Indices of infection have not been calculated, because of low number of examined fishes of each species. Thus, only number of infected hosts and parasites found in them is given.

Results

Systematic review

1. *Phyllobothrium* sp. (Tetraphyllidea, Phyllobothriidae), Fig. 1.

Host: *Bathyraja eatonii* (two fishes infected with 2 and 17 cestodes, respectively).

Habitat: small intestine (spiral valve).

Description: Two strobilae and 2 separate proglottids contain uterus but without eggs, other specimens consist of several sterile or young hermaphroditic proglottids. Specimens with young uterus are not shorter than 20. Dimensions of young hermaphroditic proglottids are $0.24 - 0.65 \times 0.53 - 0.74$, whereas young uterine proglottids, $2.0 - 3.0 \times 1.0 - 1.4$.

Scolex globular, $0.55 - 0.68 \times 0.64 - 0.87$, with four sessile, strongly folded bothridia. Each bothridium with apical sucker, $0.11 - 0.14$ in diameter. Neck, $1.5 - 3.9 \times 0.21 - 0.28$.

Spherical testes, $0.06 - 0.15 \times 0.048 - 0.108$; 120—140 in number in each proglottid. Cirrus-sac, $0.24 - 0.52 \times 0.12 - 0.18$, sac-like, thin-walled, situated diagonally.

The sperm duct strongly coiled inside and outside of cirrus-sac. Genital pores lateral, irregularly alternate in anterior third of proglottid length.

The ovary bilobed, $0.25 - 0.84 \times 0.39 - 0.74$. Each lobe has a reticular structure with numerous projections. Vitelline glands, $0.038 - 0.095 \times 0.018 - 0.033$, arranged in two lateral, not confinement fields. The vagina thin-walled with seminal receptacle in its proximal part.

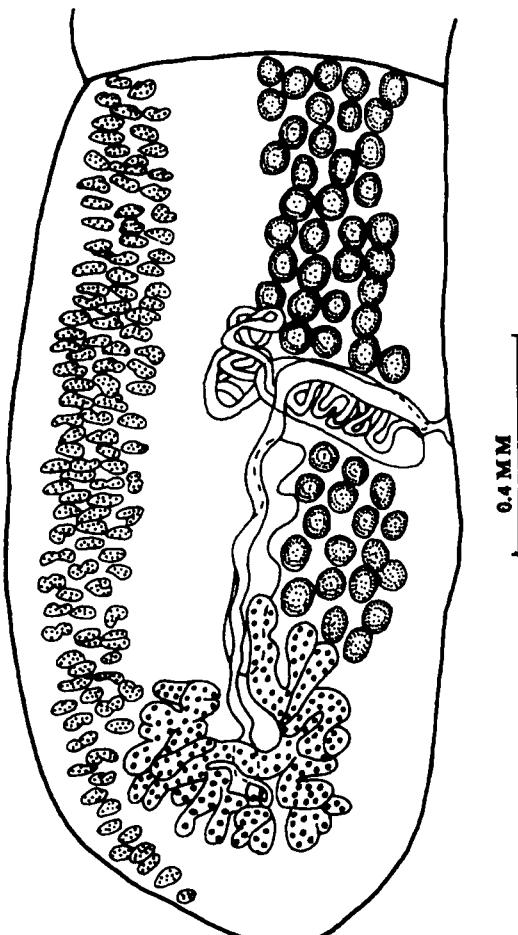


Fig. 1. *Phyllobothrium* sp. Proglottid (vitellaria omitted on the poral side).

Remarks: The species seems to be an undescribed one, separate from four species occurring in the Antarctic skates in the South Georgian and South Shetlands areas described by Wojciechowska (1991). However, it is assigned only to the generic level because of the scarcity of the material (immature specimens have been only tentatively assigned to the form described above).

2. *Macrobothridium* sp. (Diphyllidea, Macrobothriidae), Fig. 2.

Host: *Bathyraja eatonii* (one fish infected with one cestode).

Habitat: small intestine (spiral valve).

Description: The material consists of scolex together with three sterile proglottids. Scolex consists of head proper and cephalic peduncle. Head, 0.71×0.74 , bears one dorsal and one ventral oval bothridium. In anterior part of head there is situated a muscular rostellum armed in dorsal and ventral group of hooks. Each group consists of 10–12 large hooks, $0.078–0.13$, arranged in two rows, and 9 smaller ones on either side, $0.02–0.06$. Peduncle unarmed, 0.28×0.16 .

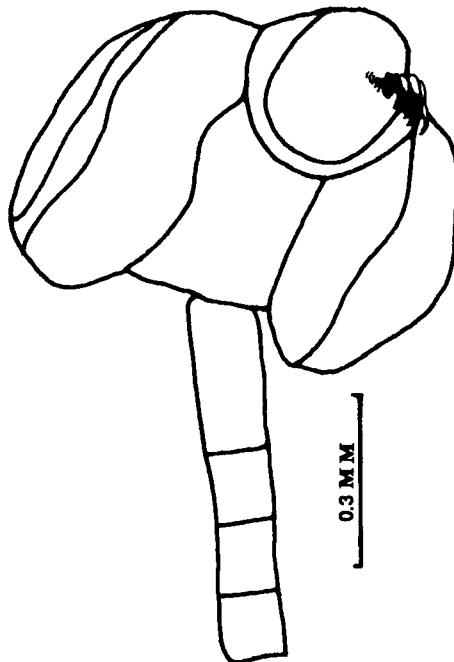


Fig. 2. *Marcobothridium* sp. Scolex; schema (most of hooks destroyed)

Remarks: The species seems to be hitherto undescribed being now the second representative of the genus. The first one, *M. rhynchobati* Khalil et Abdul-Salam, 1989, is described from *Rhynchobatus granulatus* at the Kuwait, Arabian Gulf (Khalil and Abdul-Salam 1989). However, the present material is insufficient (one incomplete specimen in poor condition) for giving the specific name.

3. Tetraphyllidean cercoids with monolocular bothridia.

Host: *Champscephalus gunnari* (1,1 and 4 in three fishes), *Channichthys rhinoceratus* (3, 4, 7 in three fishes).

Habitat: all parts of the intestine, except rectum.

Description: Dimensions of cercoids $4.0 - 5.0 \times 0.75 - 1.23$. Bothridia sessile, each with sucker, 0.18–0.22 in diameter. Apical sucker present, 0.16–0.19 in diameter. Most of cercoids invaginated.

Remarks: Cercoids are very similar to those described by Wojciechowska (1993) from bony fishes occurring in the West Antarctic as Cercoid I, Cercoid II and Cercoid III. All forms, including presently found, seem to be larval representatives of the genus *Phyllobothrium*. Unfortunately, the identification (or not) of this form with *Phyllobothrium* sp. described above is not possible based on the material available.

4. Tetraphyllidean cercoids with bilocular bothridia.

Host: *Notothenia squamifrons* (2, 3, 8, 9 and 22 in four fishes), *Champscephalus gunnari* (1, 2, 4, 4, 15, 23, in six fishes), *Channichthys rhinoceratus* (about 2970 in

eleven fishes, intensity: 1 to about 896). Two invaginated cercoids were found in one specimen of *Bathyraja murrayi*.

Habitat: intestine, mainly large intestine.

Description: Dimensions of cercoids, $0.37 - 0.94 \times 0.18 - 0.37$. Bothridia sessile, $0.12 - 0.18 \times 0.08 - 0.12$; anterior loculi, $0.062 - 0.095 \times 0.062 - 0.108$, posterior loculi, $0.055 - 0.095 \times 0.071 - 0.108$. Apical sucker present, 0.06–0.08 in diameter.

Remarks: Cercoids are very similar to those described by Wojciechowska (1993) from bony fishes occurring in the West Antarctic as Cercoid IV and Cercoid V. It is possible that all these forms are larvae of the genera *Pseudanthobothrium* and *Anthobothrium*. However, mature forms of genera mentioned were not reported from elasmobranchs in the Kerguelen region.

5. Tetraphyllidean cercoids with undivided bothridia and hook-like projections.

Host: *Champscephalus gunnari* (about 300 in one fish).

Habitat: pyloric caeca and anterior half of the small intestine.

Description: Dimensions of cercoids, 0.7×0.3 . They have four leaf-like bothridia, 0.34×0.13 , each with sucker, 0.058–0.074 in diameter and a pair of hook-like projections, 0.025–0.035. Apical sucker lacking. Only two specimens were fully extended.

Remarks: Cercoid seems to be identical (or very closely related) with form occurring in the same host species in South Georgian area described by Wojciechowska (1993) as Cercoid VII. This larval form is possibly the larval form of the genus *Dinobothrium*. However, such a parasite have not been reported from the Antarctic and Subantarctic so far.

6. *Bothrioccephalus antarcticus* sp.n. (Pseudophyllidea, Bothrioccephalidae), Fig. 3.

Host: *Champscephalus gunnari* (5 specimens infected), *Channichthys rhinoceratus* (3).

Habitat: anterior half of the small intestine.

Description: The material consists of fragments of strobilae and separate scolices. The longest fragment of strobila is 110 long, maximum width 2.

Scolex elipsoidal with apical disc, 0.6–0.13 in length and 0.5–0.7 in width. Segmentation of the strobila beginning immediately behind scolex. External metamerism is difficult to correlate with the internal one.

One genital set is usually present in proglottid but frequently, double genital set is visible in one proglottid. Dimensions of mature proglottids, $0.34 - 0.75 \times 2.13 - 2.63$.

There are four longitudinal excretory canals, which are united with one another by a network of transverse connections.

Male genital system: Testes, $0.07 - 0.10 \times 0.06 - 0.09$, form two lateral fields. Total, 80–100 testes in proglottid with single genital set; number of testes increases in proglottids with double set to 100–120. There are 6–7 testes visible in the transverse section of proglottid. In the sagittal section 4–5 testes are visible in proglottids with single genital set, whereas 6–7 in proglottids with double set.

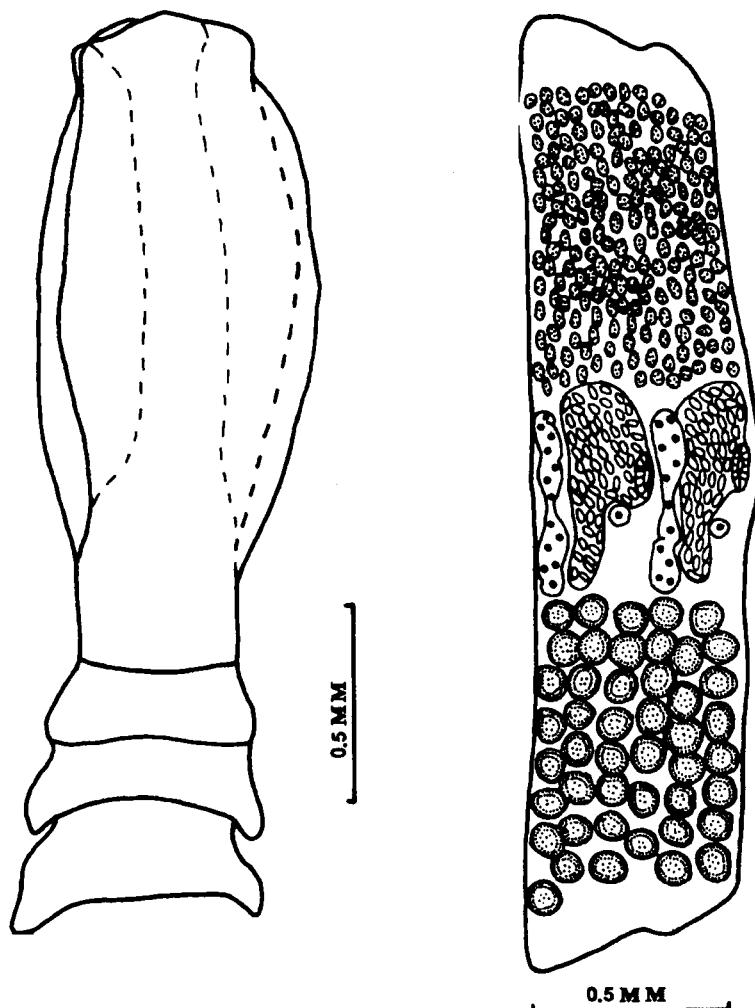


Fig. 3. *Bothriocephalus antarcticus* sp.n. a) scolex; b) proglottid with double genital set (vitellaria and excretory canals omitted on the right side)

The cirrus-sac, $0.107 - 0.133 \times 0.047 - 0.063$ in the sagittal section, thin-walled, club-shaped (in transversal and sagittal views). The sperm duct is strongly coiled around the proximal end of the cirrus-sac. Genital pores situated near the median line, irregularly alternate to it.

Female genital system: Ovary bilobed, $0.083 - 0.166 \times 0.33 - 0.46$. Vitelline glands, $0.033 - 0.047 \times 0.023 - 0.040$, form two lateral fields. Each field consists of two layers disposed ventrally and dorsally to testes. Uterine pores lie in median line in front of proglottid (in proglottid with double set the second lies at the centre of proglottid). The eggs operculate, $0.060 - 0.066 \times 0.042 - 0.047$. Holotype no 1621 and paratypes (part in British Museum in London) are in Institute of Parasitology, Warsaw).

Remarks: Five species belonging to the genus *Bothriocephalus* have been reported from the southern hemisphere but only one, *B. kergulensis* Prudhoe, 1969 from Subantarctic (Prudhoe 1969).

B. kergulensis differs from *B. antarcticus* sp.n. in: total number of testes (25–30 against 80–120), number of testes in transverse section (4–5 against 6–7), length of cirrus-sac (0.25 against 0.133) and its length/width ratio (4:1 against 2:1), length of ovary (0.4 against maximally 0.166). Additionally, presently described species occurs in representatives of the family Channichtyidae whereas *B. kergulensis* was described as a parasite of *Notothenia cyanobrancha* and *N. rossii*, family Nototheniidae (see Prudhoe 1969).

7. Plerocercoids of Diphyllobothriidae

Host: *Notothenia squamifrons* (one fish infected with 1 parasite), *Dissostichus eleginoides* (one fish infected with four parasites).

Habitat: cysts on the mesentery.

Remarks: Plerocercoids were found occasionally because only fragments of the mesentery were examined. It is not possible to determine a real intensity of infection.

Discussion

The occurrence of tetraphyllidean cercoids and diphyllobothriid plerocercoids in fishes of the Kerguelen subregion (environs of various islands and sea mounts, including the Heard Island) were reported by Prudhoe (1969), Parukhin and Lyadov (1981, 1982), Lyadov (1985), Parukhin (1989) and Gayevskaya, Rodyuk and Parukhin (1990). Only Prudhoe (1969) described and figured bilocular cercoid which is similar to that described presently.

Two other tetraphyllidean larvae presently described have not been previously reported from Kerguelen subregion. However, they could be found by various authors listed above who did not present any morphological data some tetraphyllidean larval forms listed.

Nobody have previously reported any adult cestodes from skates living in the Kerguelen subregion and both parasites presently described are new for this area and probably for the science.

Bothriocephalus antarcticus sp.n. is the second species from the order Pseudophyllidea occurring in the Kerguelen area and the first at the Heard Island. Lyadov (1985) and Parukhin (1989) reported the occurrence of *Bothriocephalus* sp. and *Eubothrium* sp. in not specified fishes caught in various areas of the Kerguelen subregion including environs of the Heard Island but without any morphological data. It should be noted that one bothriocephalid species, *Parabothriocephalus johnstoni* Prudhoe, 1969, was reported from the Antarctic gadiform fish, *Coryphaenoides* (= *Macrourus*) *whitsoni* caught at the continental slope at the Antarctic continent (Prudhoe 1969).

Finally, the present authors are of the opinion that all three cestode species found in the adult stage, *Phyllobothrium* sp., *Macrobothridium* sp. and *Bothrioccephalus antarcticus* sp.n., are endemics of the Kerguelen subregion.

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Streszczenie

W okolicach wyspy Heard (Subantarktyka) zbadano 38 ryb z 7 gatunków, w tym 34 ryby kostnoszkieletowe (5 gatunków) i 4 płaszczki (2 gatunki). Z trzech badanych płaszczyków *Bathyraja eatonii*, dwie były zarażone *Phyllobothrium* sp. (Tetraphyllidea), a trzecia *Macrobothridium* sp. (Diphyliddea). U jednej badanej płaszczki z gatunku *B. murrayi* znalezione dwa cerkoidy z dwukomorowymi botridiami (larwy Tetraphyllidea), którymi ryba najprawdopodobniej świeżo zaraziła się.

U ryb kostnoszkieletowych stwierdzono występowanie trzech form morfologicznych cerkoidów Tetraphyllidea. Były to cerkoidy z jedno- i dwukomorowymi botridiami oraz cerkoidy z botridiami niepodzielonymi i zaopatrzonymi w apikalne wyrostki. Ponadto, u ryb kostnoszkieletowych znaleziono niezidentyfikowane plerocerkoidy Diphyllobothriidae oraz dorosłych przedstawicieli Pseudophyllidea. Te ostatnie reprezentowały nowy gatunek, *Bothrioccephalus antarcticus*. Ten gatunek, podobnie jak i dwa gatunki stwierdzone u płaszczyków, wydają się być endemicami dla subregionu kerguelenńskiego.