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Contribution to the knowledge of the infection with Acanthocephala of a predatory Antarctic ice-fish *Chaenocephalus aceratus*

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Abstract: Adult females of a predatory fish, the blackfin icefish, *Chaenocephalus aceratus* examined at the South Shetland Islands and South Orkney Islands were by several orders of magnitude more infected with Acanthocephala than the males and immature females. Such phenomenon has not been observed in the neritic zone at South Georgia. Cystacanths of *Corynosoma hamanni* and *Corynosoma pseudohamanni* were the dominant parasites in Admiralty Bay, whereas *Corynosoma bullosum* was the dominant in the open sea off the South Shetland Islands and South Georgia, and in the sub-coastal waters off the South Orkney Islands. However, the dominance of *C. bullosum* was observed in several hosts in Admiralty Bay and the co-dominance of *C. bullosum*, *C. hamanni*, and *C. pseudohamanni* in one mature female in the neritic zone at the South Shetland Islands. Probably, these fish previously lived in the open sea. Cystacanths of *Corynosoma arctocephali* and *Corynosoma shackletoni* occurred in the fish in Admiralty Bay and off South Georgia. The former parasite was present also off the South Orkney Islands. One cystacanth of *Andracantha baylisi* was found off South Georgia. Two echinorhynchids, *Aspersentis megarhynchus* and *Metacanthocephalus dalmori*, occurred in the alimentary tracts of the fish caught in Admiralty Bay and one specimen of *Echinorhynchus petrotschenkoi* off the South Shetland Islands. The highest infection, amounting to 816 acanthocephalans, was found in a mature female in Admiralty Bay. One cystacanth of *C. hamanni* occurred in a single immature fish caught in the sub-coastal area off Deception Island.

Key words: West Antarctic, Acanthocephala, *Chaenocephalus aceratus*, infection, host sex.

Introduction

The blackfin icefish, *Chaenocephalus aceratus* (Lönnberg, 1906) (Actinopterygii: Perciformes: Channichthyidae), is the demersal predatory species occurring in relatively shallow water including coastal and neritic zones in the Western Antarctic (Gon and Heemstra 1990). It is a paratenic host of cystacanths of

Polymorphida (maturing in marine mammals and birds, occurring in fish in cysts at the mesentery) and the definitive host of adult Echinorhynchida occurring in the intestine (Zdzitowiecki 1991). Numerical data on infections of various fish, including *C. aceratus*, with acanthocephalans were published for four areas of the Western Antarctic: Admiralty Bay, King George Island (Zdzitowiecki 1986a, 1986b, Zdzitowiecki and Rokosz 1986), neritic zone at the South Shetland Islands (Zdzitowiecki 1990), coastal waters of the South Orkney Islands (Zdzitowiecki and White 1996), and neritic zone at South Georgia (Zdzitowiecki 1990). The infection parameters provided by the authors mentioned above were calculated for pooled samples and were not related to the fish sex or maturity. The present paper provides those missing data for all samples mentioned above with the addition of eight fish recently collected in Admiralty Bay, and one fish caught in the coastal water off Deception Island in March 2002.

Material and methods

The fish were caught using either fishing rods or bottom nets (active and passive gear). In total, 76 blackfin icefish, *Chaenocephalus aceratus*, were examined, including 28 specimens (20 in 1979 and 8 in 2007–2008), from Admiralty Bay; one (in 2002) off Deception Island in the coastal zone, 13 specimens (1 in 1979 and 12 in 1986) at South Shetland Islands in the neritic zone, 11 fish (in 1993) at the South Orkney Islands in the coastal zone, and 23 specimens (3 in 1977 and 20 in 1986) collected off South Georgia in the neritic zone. Standard length of the fish (SL) was measured. The length of adult males ranged from 23 cm to 43 cm, whereas that of adult females was from 44 cm to 56 cm. The smallest immature female was 18.8 cm long.

Acanthocephalans were usually collected alive using a dissecting microscope. Cystacanths were liberated from their cysts using an aqueous digestive solution (pepsin 1%, HCl 0.4%) and all specimens relaxed in a fresh water. Only fishes caught off the South Orkney Islands were preserved in a formaldehyde solution and the cystacanths were liberated using dissecting needles. Parasites were fixed and stored in 70–75% ethanol (material collected in 1977–1993 with addition of 5% of glycerin), dehydrated in graded ethanol, and cleared in beechwood creosote, oil of cloves, or benzyl alcohol. Determinations were done using either light microscope or dissecting microscope according to Zdzitowiecki (1991). Contracted specimens were dissected and identified based on proboscis armature visible in isolated proboscis receptacle. All acanthocephalan specimens (100%) were identified to species level.

Comparison between infections of males and females of *C. aceratus* in each area were based on mean abundance (relative density) of parasites (mean number of specimens per host examined).

Results and discussion

A list of species of acanthocephalans found in *Corynosoma aceratus* in Admiralty Bay during recent investigations agrees with that previously published (Zdzitowiecki 1986a, 1986b, Zdzitowiecki and Rokosz 1986). It includes two representatives of Echinorhynchida: *Aspersentis megarhynchus* (Linstow, 1892) and *Metacanthocephalus dalmori* Zdzitowiecki, 1983, and five of Polymorphida: *Corynosoma arctocephali* Zdzitowiecki, 1984, *Corynosoma bullosum* (Linstow, 1892), *Corynosoma hamanni* (Linstow, 1892), *Corynosoma pseudohamanni* Zdzitowiecki, 1984, and *Corynosoma shackletoni* Zdzitowiecki, 1978 (Table 1). Six adult female fish were extremely heavily infected (210–816 parasites) compared to two males (19 and 31 parasites respectively). *C. hamanni* and *C. pseudohamanni* were the dominant species in the majority of females, whereas *C. bullosum* was the dominant in one female. All females were infected with both echinorhychids, and one male with only *M. dalmori*. These results were similar to previous investigations (Zdzitowiecki 1986a, b; Zdzitowiecki and Rokosz 1986). According to those data *C. bullosum* was the dominant in three females (out of 14 examined in the Admiralty Bay in1979) and in one of six males (Zdzitowiecki 1986a). This single male was the only male host strongly infected by 161 parasite individuals. The intensity range in other males was 2–36. The maximum intensity in a mature female reached 569 acanthocephalans. Previous and new data were summarized for comparison with data from the fish caught in the neritic zone at the South Shetland Islands (Zdzitowiecki 1990). Three acanthocephalan species, *A. megarhynchus*, *M. dalmori*, and *C. shackletoni*, were absent in open sea fish. Two immature females (SL = 22 and 28.5 cm) were not infected by acanthocephalans, the third one (SL = 38 cm) was infected only with two specimens of *C. bullosum*. Three others polymorphids *C. arctocephali*, *C. hamanni*, and *C. pseudohamanni* were rare (intensity range 1–3) with the exception

Table 1

Acanthocephalans found in eight specimens of *Chaenocephalus aceratus* caught in Admiralty Bay in 2007–2008

SL (cm)	Sex	A.m.	M.d.	C.a.	C.b.	C.h.	C.p.	C.s.
39	male	–	–	–	1	4	14	–
42.5	male	–	1	1	3	15	10	1
48	female	11	9	–	181	42	43	2
48	female	9	25	9	16	330	336	2
48	female	2	4	1	5	85	113	–
50	female	78	7	20	8	429	261	13
51	female	5	83	37	28	148	385	12
52	female	45	6	29	12	132	358	2

A.m., *Aspersentis megarhynchus*; M.d., *Metacanthocephalus dalmori*; C.a., *Corynosoma arctocephali*; C.b., *C. bullosum*; C.h., *C. hamanni*; C.p., *C. pseudohamanni*; C.s., *C. shackletoni*.

of one mature female infected with 10 *C. arctocephali*, 105 *C. hamanni*, 112 *C. pseudohamanni*, and 145 *C. bullosum* (the total intensity 372). The latter species was the dominant one in all other hosts (three males and six of seven mature females). The intensity range of infection with *C. bullosum* of males was 6–69, and that of mature females 40–147. A single *Echinorhynchus petrotschenkoi* (Rodjuk, 1984) was recorded in one male host. The infection of females (maximum intensity 372 parasites) was clearly stronger than that of males (intensity range 6–70), but not so strong as in the fjord fish from Admiralty Bay (Table 2) . The only immature female (SL = 18.8 cm) caught in the costal zone at Deception Island was infected with a single specimen of *C. hamanni*.

Acanthocephalans were less abundant in *C. aceratus* at the South Orkney Islands (see also Zdzitowiecki and White 1996) than in fish at the South Shetland Islands and restricted to only four polymorphids (Table 3). The maximum total infection was 68 parasites (op. cit.). In contrast to coastal fish at the South Shetland Islands, *C. bullosum* was the dominant species and its maximum intensity in a mature female was 43. Only one of two males examined was infected and had 12 parasites. All nine females were mature and infected.

The infection in the neritic zone at South Georgia (see also Zdzitowiecki 1990) was less intensive (Table 3). Of nine mature females only four (44%) were infected and maximum intensity was 45. Surprisingly, males were a little more strongly infected (prevalence 85%, maximum intensity 33). The dominant parasite was *C. bullosum*, whereas other species occurred sporadically. *Corynosoma hamanni*, *C. pseudohamanni*, and echinorhynchids were absent. One specimen of a polymorphid absent in other areas studied, *Andracantha baylisi* (Zdzitowiecki, 1990), was found.

The presence of Polymorphida cystacanths in fishes is associated with the presence of intermediate hosts (Amphipoda) and final hosts (either marine mammals or birds) in the investigated areas. The present authors did not find Amphipoda in the alimentary tract of *C. aceratus* and this fish clearly became infected by feeding on smaller demersal fishes. Large mature females strongly accumulate cystacanths acquired from smaller fish eaten. Immature females and all males are smaller than mature females and probably most of them rarely eat fishes and become infected. Only rudiments of krill were observed by Zdzitowiecki (unpublished data) in the alimentary tract of such fish during previous investigations. However, some males feed on fish and their infection could be similar to that of some mature females. For example, one male caught in Admiralty Bay in 1979 was infected with 151 polymorphids and 10 *M. dalmori*.

The situation described above refers to the area of the South Shetland Islands and probably the South Orkneys (Tables 2 and 3). A dependence of infections upon sex was not observed in the neritic zone at South Georgia (Table 3). Probably, the prey of *C. aceratus* in this area is different from that at the South Shetland Islands (not including small demersal fishes). Another predatory fish occurring at

Table 2

Mean abundance and intensity range of Acanthocephala in males and females of *Chaenocephalus aceratus* in Admiralty Bay and in the neritic zone at the South Shetland Islands. Present results and earlier data according to Zdzitowiecki (1986a, b).

Parasite	Admiralty Bay			South Shetlands		
	Mean abundance		Intensity range (both sexes)	Mean abundance		Intensity range (both sexes)
	Males (n = 8)	Females (n = 20)		Males (n = 3)	Females (n = 10)	
Echinorhynchida (total)	1.38	22.50		0.33	–	
Aspersentis megarhynchus	–	12.65	1 – 93	–	–	–
Echinorhynchus petrotschenkoi	–	–		0.33	–	1
Metacanthocephalus dalmori	1.38	9.85	1–19	–	–	–
Polymorphida (total)	32.68	256.90		27.33	103.90	
Corynosoma arctocephali	0.25	4.65	1–4	–	1.20	1–10
Corynosoma bullosum	19.13	39.90	1–122	27.33	78.50	2–147
Corynosoma hamanni	4.75	78.15	2–55	–	11.90	1–105
Corynosoma pseudohamanni	8.50	131.65	1–263	–	12.30	1–112
Corynosoma shackletoni	0.05	2.55	1–6	–	–	–

Table 3

Mean abundance and intensity range of Acanthocephala in males and females of *Chaenocephalus aceratus* at the South Orkney Islands and South Georgia according to Zdzitowiecki (1990) and Zdzitowiecki and White (1996).

Parasites	South Orkneys			South Georgia		
	Mean abundance		Intensity range (both sexes)	Mean abundance		Intensity range (both sexes)
	Males (n = 2)	Females (n = 9)		Males (n = 14)	Females (n = 9)	
Polymorphida (total)	6.00	20.33		6.93	5.55	
Corynosoma arctocephali	1.00	0.22	1–2	–	0.44	1–2
Corynosoma bullosum	1.50	12.78	2–43	6.71	5.11	1–44
Corynosoma hamanni	2.50	6.00	1–18	–	–	–
Corynosoma pseudohamanni	1.00	1.33	1–7	–	–	–
Corynosoma shackletoni	–	–	–	0.07	–	1
Andracantha baylisi	–	–	–	0.14	–	1

South Georgia, *Dissostichus eleginoides* Smitt, was strongly infected there; the maximum intensity was 1001 (998 cystacanths of *C. bullosum* and three echinorhynchids) (Zdzitowiecki 1990).

According to Zdzitowiecki (1990) infection with the majority of acanthocephalan species takes place in the coastal zone and that of *C. bullosum* and *E. petrotschenkoi* in the neritic zone. The single mature female caught in the open sea at the South Shetland Islands which was strongly infected with *C. hamanni* (105 specimens) and *C. pseudohamanni* (112 specimens) probably visited the coastal

area and acquired parasites there. On the other hand, three mature females caught in 1979 and one in 2007 (Table 1) in Admiralty Bay were infected mainly with *C. bullosum*. Probably they previously lived in the open sea and visited coastal waters. These suppositions are confirmed with data on intermediate hosts of acanthocephalans. Seven species of amphipods found by Zdzitowiecki and Presler (2001) as intermediate hosts of *A. megarhynchus*, *C. hamanni*, and *C. pseudohamanni* live in shallow, sub-coastal waters, whereas one of two amphipod hosts of *C. bullosum*–*Waldeckia obesa* Chevreux, 1907, occurs in deeper waters.

The dominance of *C. bullosum* (a parasite of elephant seals *Mirounga leonina* (L.) in females of *C. aceratus* caught in the sub-coastal zone of the South Orkney Islands is not a result of its abundance, but of weak infections with *C. hamanni* and *C. pseudohamanni* (parasites of Weddell seals and leopard seals) in this area.

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