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## New data on the occurrence of fish endoparasitic worms off Adelie Land, Antarctica

**ABSTRACT:** In total, 18 species and larval forms of endoparasitic worms were found in 19 newly examined notothenioid fishes of three species, *Trematomus hansonii*, *Notothenia coriiceps* and *Chionodraco hamatus*, caught off Adelie Land. One digenean species, *Neolepidapedon trematomi*, was recorded in this area for the first time. A total list of endoparasitic worms prepared by Zdzitowiecki *et al.* (1998) increased from 20 to 21 species and larval forms and concerns 11 determined and one indetermined species of Digenea (the most diverse group), three larval forms of Cestoda, three species (one identified only to genus) of Acanthocephala, two species (one in the larval stage) and one larval form of Nematoda. All these species and forms, with the exception of the indetermined digenean, occur also in the deep Antarctica, in the Ross Sea and/or in the Weddell Sea. The prevalence and relative density of infection with each parasite in three host species is given based on summarized previous and new data.

**Key words:** Antarctica, Adelie Land, Acanthocephala, Cestoda, Digenea, fish parasites, infection, Nematoda.

### Introduction

A list of 20 species and larval forms of endoparasitic worms found in sub-coastal fishes off Adelie Land has been published by Zdzitowiecki *et al.* (1998), as a result of the examination of 13 notothenioid fish specimens belonging to four species, *Trematomus bernacchii* (one specimen), *T. hansonii* (4), *Notothenia coriiceps* (4) and *Chionodraco hamatus* (4). Eleven species and forms of parasites were recorded in this area for the first time, including one species described as new (Zdzitowiecki 1998). The remaining ones were previously reported as occurring near to Adelie Land (Johnston and Best 1937, Johnston 1938, Johnston and Mawson 1945, Prudhoe 1969, Prudhoe and Bray 1973). Fishes were not numerous enough for cal-

culations of the prevalence and relative density of the infection and only numbers of infected fishes, intensity ranges and mean intensities were given. Now, the present author has received from Dr. C. Ozouf-Costaz from the Muséum National d'Histoire Naturelle in Paris further parasitic worms collected by Dr. G. Lecointre in the same area. The present paper concerns new data on the occurrence of parasitic worms in fishes examined by Dr. Lecointre and indices of the infection of three fish species based on summarized previous and new data.

## Material and methods

In total, 19 fishes were caught between 19 and 28 January 1998 at 66°40'S 140°E. Fishes belonged to three of notothenioid species listed above, *T. hansonii* (4 specimens), *N. coriiceps* (14) and *C. hamatus* (1). Parasites were collected from fresh fishes. Identification of worms was based on the literature data cited by Zdzitowiecki *et al.* (1998) and comparison with specimens collected in various areas of the Antarctica. One digenean species found off the Adelie Land for the first time, *Neolepidapedon trematomi*, was identified according to Zdzitowiecki (1999). Parasites were collected mainly from the alimentary tract. New quantitative data for parasites known as occurring mainly in the body cavity (liver, mesentery and stomach's wall), plerocercoids, cystacanths of Acanthocephala and larval nematodes, are likely to be underestimated and are not used for calculations of the prevalence and relative density. In such cases these indices of infection were calculated based exclusively on data of Zdzitowiecki *et al.* (1998) and are of little value, because data from only four specimens of each of three fish species were taken into account. Exceptionally, the prevalence of plerocercoids and *Contracaecum* spp. in *C. hamatus* (equal to 100%) is given based on data from all five specimens examined.

## Systematic review

### Digenea

*Macvicaria pennelli* (Leiper et Atkinson, 1914)

Hosts: *T. hansonii* (1 of 4, intensity 1), *N. coriiceps* (2 of 14, intensity 1).

*Macvicaria microtestis* Zdzitowiecki et Cielecka, 1997

Hosts: *N. coriiceps* (10 of 14, intensity range 1–15, mean 3.7).

*Neolebouria terranovaensis* Zdzitowiecki, Pisano et Vacchi, 1993

Hosts: *N. coriiceps* (8 of 14, intensity range 1–91, mean 17), *C. hamatus* (1 of 1, intensity 29).

*Helicometra pisanoae* Zdzitowiecki, 1998

Hosts: *T. hansonii* (3 of 4, intensity range 1–41, mean 16.33).

*Lepidapedon garrardi* (Leiper et Atkinson, 1914)

Hosts: *T. hansonii* (2 of 4, intensity range 1–3, mean 2), *N. coriiceps* (3 of 14, intensity 1).

*Lepidapedon balgueriasi* Zdzitowiecki et Cielecka, 1997

Hosts: *T. hansonii* (1 of 4, intensity 1).

*Neolepidapedon trematomi* Prudhoe et Bray, 1973

Hosts: *T. hansonii* (2 of 4, intensity range 1–53, mean 27).

*Genolinea bowersi* (Leiper et Atkinson, 1914)

Hosts: *T. hansonii* (1 of 4, intensity 2), *N. coriiceps* (9 of 14, intensity range 1–13, mean 3.56), *C. hamatus* (1 of 1, intensity 6).

*Gonocerca phycidis* Manter, 1925

Hosts: *T. hansonii* (2 of 4, intensity range 1–2, mean 1.5).

*Elytrophalloides oatesi* (Leiper et Atkinson, 1914)

Hosts: *T. hansonii* (1 of 4, intensity 1), *N. coriiceps* (2 of 14, intensity 1), *C. hamatus* (1 of 1, intensity 2).

## Cestoda

Tetraphyllidean cercoid with bilocular bothridia

Hosts: *T. hansonii* (4 of 4, intensity range 7–48, mean 21.5), *N. coriiceps* (11 of 14, intensity range 1–84, mean 12.82), *C. hamatus* (1 of 1, intensity 185).

Tetraphyllidean cercoid with trilocular bothridia

Hosts: *T. hansonii* (1 of 4, intensity 7), *N. coriiceps* (4 of 14, intensity range 1–4, mean 2), *C. hamatus* (1 of 1, intensity 22).

Diphyllobothriid plerocercoid

Hosts: *N. coriiceps* (2 of 14, intensity range 1–2, mean 1.5), *C. hamatus* (1 of 1, intensity 52).

## Acanthocephala

*Metacanthocephalus campbelli* (Leiper et Atkinson, 1914)

Hosts: *T. hansonii* (1 of 4, intensity 1), *N. coriiceps* (7 of 14, intensity range 1–5, mean 2.43).

*Metacanthocephalus* sp. (= *M. johnstoni* and/or *M. rennicki*)

Hosts: *N. coriiceps* (8 of 14, intensity range 1–5, mean 2.13).

## Nematoda

*Ascarophis nototheniae* Johnston et Mawson, 1945

Hosts: *N. coriiceps* (3 of 14, intensity 1), *C. hamatus* (1 of 1, intensity 3).

*Contracaecum* spp. (larvae)

Hosts: *N. coriiceps* (2 of 14, intensity range 1–3, mean 2), *C. hamatus* (1 of 1, intensity 239).

*Pseudoterranova decipiens* (Krabbe, 1878) (larvae)

Hosts: *N. coriiceps* (2 of 14, intensity 1).

## Discussion

In total, 18 species and larval forms were recognized in the new sample of endoparasitic worms. Of which, one digenean, *Neolepidapedon trematomi*, was not present in the list previously published (Zdzitowiecki *et al.* 1998). Two identified species, a digenean *Derogenes johnstoni* Prudhoe *et Bray*, 1973 and an acanthocephalan *Corynosoma pseudohamanni* Zdzitowiecki, 1984 (cystacanth), as well as an indetermined digenean listed there, were not found in the present study. Data on the prevalence and relative density of infections of three fish species examined in numbers of 5–18 specimens (data of Zdzitowiecki *et al.* 1998 and new data together) are shown on the table I. It should be noted that a few parasites found in the single *Trematomus bernacchii* (Zdzitowiecki *et al.* 1998), i.e. *Genolinea bowersi* (one specimen), bilocular cercoid (3), diphyllbothriid plerocercoid (1) and *Ascarophis nototheniae* (2), occurred in all three host species listed on the table.

Of 21 species and larval forms, 11 identified and one indetermined species belong to Digenea (the most diverse group). All examined specimens of the three fish species were infected with Digenea. *T. hansonii* was infected with all 11 identified species, whereas *N. coriiceps* harboured nine identified and one indetermined species. Most digenean species and specimens found in these two hosts belong to the families Opcoelidae and Lepocreadiidae and occur in the intestine. Surprisingly, the recently described species, *Macvicaria microtestis*, was much more abundant than the "old" congeneric species, *M. pennelli*. *T. hansonii* is the only known host of *Helicometra pisanooae*. *C. hamatus* was infected with only four digenean species, one intestinal opcoelid and three hemiuroid species occurring in the stomach. However, the most numerous was the opcoelid, *Neolebouria terranovaensis*. All identified digenean species recognized in notothenioids off Adelie Land occur also in fishes in the deep Antarctic areas, in the Ross Sea (Zdzitowiecki *et al.* 199b) and/or in the Weddell Sea (Zdzitowiecki and Cielecka 1997a, 1997b; Zdzitowiecki 1997a, 1997b).

All three larval forms of cestodes occur in fishes around the Antarctica. Of forms recorded in the deep Antarctic areas, the tetraphyllidean cercoid with sub-cylindrical bothridia was not found off Adelie Land, nor in the Western Antarctica (Wojciechowska *et al.* 1994, Rocka 1999a). Two forms, tetraphyllidean cercoids with bilocular bothridia and diphyllbothriid plerocercoids, are very numerous in many fishes, especially predators (Prudhoe 1969, Rocka 1999a and others).

Of three acanthocephalan species, the prevalence of *Corynosoma pseudo-hamanni* (cystacanth) seems to be underestimated (probably the whole mesentery was not examined). It occurs around the Antarctica, including the Ross Sea (Zdzitowiecki *et al.* 1999a) and Weddell Sea (Zdzitowiecki 1996). The same is true for *Metacanthocephalus campbelli*. The final identification of *Metacantho-*

Table 1

Prevalence (%) and relative density (abundance) of infection with endoparasitic worms of three fish species off Adelie Land based on an amalgamation of data of Zdzitowiecki *et al.* (1998) and the present study.

| Parasite                                  | <i>T. hansonii</i><br>n = 8 | <i>N. coriiceps</i><br>n = 18 | <i>C. hamatus</i><br>n = 5 |
|---|-----------------------------|-------------------------------|----------------------------|
| <i>Macvicaria pennelli</i>                | 25.0%; 0.25                 | 16.7%; 0.17                   | —                          |
| <i>Macvicaria microtestis</i>             | 12.5%; 1.00                 | 77.8%; 4.33                   | —                          |
| <i>Neolebouria terranovaensis</i>         | 37.5%; 1.13                 | 61.1%; 8.11                   | 60%; 13.40                 |
| <i>Helicometra pisanae</i>                | 50.0%; 14.75                | —                             | —                          |
| <i>Lepidapedon garrardi</i>               | 62.5%; 2.50                 | 38.9%; 3.17                   | —                          |
| <i>Lepidapedon balgueriasi</i>            | 50.0%; 1.88                 | 11.1%; 0.33                   | —                          |
| <i>Neolepidapedon trematomi</i>           | 25.0%; 6.75                 | —                             | —                          |
| <i>Genolinea bowersi</i>                  | 50.0%; 1.13                 | 72.2%; 3.61                   | 40%; 2.40                  |
| <i>Derogenes johnstoni</i>                | 12.5%; 0.13                 | 5.6%; 0.06                    | 20%; 0.60                  |
| <i>Gonocerca phycidis</i>                 | 25.0%; 0.38                 | 5.6%; 0.11                    | —                          |
| <i>Elytrophalloides oatesi</i>            | 12.5%; 0.13                 | 22.2%; 0.33                   | 80%; 2.80                  |
| <i>Digenea indetermined</i>               | —                           | 5.6%; 0.06                    | —                          |
| <i>Tetraphyllidean cercoid bilocular</i>  | 100%; 67.00                 | 83.3%; 16.83                  | 100%; 481                  |
| <i>Tetraphyllidean cercoid trilocular</i> | 50.0%; 1.50                 | 38.9%; 0.83                   | 80%; 9.40                  |
| <i>Diphyllobothriid plerocercoid</i>      | 50%*; 1.50*                 | 50%*; 3.50*                   | 100%; 394*                 |
| <i>Metacanthocephalus campbelli</i>       | 25.0%; 0.25                 | 55.6%; 1.17                   | 20%; 0.20                  |
| <i>Metacanthocephalus sp.</i>             | —                           | 66.7%; 1.94                   | —                          |
| <i>Corynosoma pseudohamanni</i>           | —                           | 25%*; 0.50*                   | —                          |
| <i>Ascarophis nototheniae</i>             | 25.0%; 0.63                 | 33.3%; 0.61                   | 80%; 3.20                  |
| <i>Contraecum spp.</i>                    | 100%*; 6.50*                | 50.0%*; 3.25*                 | 100%; 647*                 |
| <i>Pseudoterranova decipiens</i>          | 25%*; 0.50*                 | 50%*; 0.50*                   | 25%*; 0.25*                |

\* — data based on the examination of four fish specimens.

*cephalus* sp. needs further investigation. This species also occurs in the Ross Sea (Zdzitowiecki *et al.* 1999a).

Of nematodes, *Ascarophis nototheniae* is an abundant species in notothenioids around the Antarctica (Holloway *et al.* 1967, Rocka 1999b). Larvae of *Contraecum* spp. are abundant in fishes in the whole Antarctica and sub-Antarctica, whereas larvae of *Pseudoterranova decipiens* are numerous in fishes in the Western Antarctica and in the sub-Antarctica, but much more rare in the Weddell Sea (Johnston and Mawson 1945, Palm 1999 and others).

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## Streszczenie

W rejonie Ziemi Adeli zbadano 19 ryb z trzech gatunków z nadrodziny Notothenioidea, *Trematomus hansonii* (cztery osobniki), *Notothenia coriiceps* (14) i *Chionodracon hamatus* (jeden). Stwierdzono występowanie 18 gatunków i form larwalnych robaków pasożytniczych, z których 17 było już wcześniej znalezione w rybach w omawianym rejonie, a jeden gatunek przywry digenetycznej, *Neolepidapedon trematomi*, stwierdzono po raz pierwszy. W ten sposób ogólna liczba gatunków i form larwalnych robaków pasożytniczych odnotowanych w rybach w okolicach Ziemi Adeli wzrosła z 20 do 21. Najbardziej zróżnicowaną grupą pasożytów okazały się przywry digenetyczne – 11 zdefiniowanych gatunków i jeden gatunek nieoznaczony. Z trzech stwierdzonych form larwalnych tasiemców, dwa to cercoidy przedstawicieli rzędu Tetraphyllidea, a trzecia to plerocerkoidy przedstawicieli rodziny Diphyllbothriidae. Spośród trzech gatunków kolecogłowów (jeden występuje w rybach w stadium cystakanta, a dwa w stadium dojrzałym), jeden jest tymczasowo oznaczony tylko do rodzaju *Metacanthocephalus*. Nicienie są reprezentowane przez dwa zdefiniowane gatunki (jeden w stadium larwalnym) i larwy przedstawicieli rodzaju *Contracaecum*. Wszystkie te gatunki i formy larwalne, z wyjątkiem nieoznaczonej przywry, występują także w głębokiej Antarktyce, w morzach Rossa i/lub Weddella. Zamieszczona jest kompletna lista robaków, pasożytów wewnętrznych, z uwzględnieniem ekstensywności ich występowania i względnego zagęszczenia w trzech wymienionych wyżej gatunkach ryb, oparta na łącznych wcześniejszych (Zdzitowiecki *et al.* 1998) i nowych danych.