HELMINTHOLOGIA, 42, 1: 45 – 48, 2005

Nematode infections of the European bitterling (*Rhodeus sericeus* Pallas, 1776: Cypriniformes)

M. DÁVIDOVÁ[1], M. ONDRAČKOVÁ[1, 2], V. BARUŠ[2], M. REICHARD[2], B. KOUBKOVÁ[1]

[1]Department of Zoology and Ecology, Faculty of Science, Masaryk University Brno, Kotlářská 2, 611 37 Brno, Czech Republic; [2]Institute of Vertebrate Biology, Academy of Sciences of the Czech Republic, Květná 8, 603 65 Brno, Czech Republic, E-mail: *martinad@sci.muni.cz*

Summary

A record of nematode parasites in bitterling fish is reported. Two nematode species were recorded parasitizing the European bitterling (*Rhodeus sericeus*). Infections were very rare (prevalence 0.82 %, mean intensity of infection 1). Bitterling was found to be a new suitable definitive host for *Pseudocapillaria* (*Pseudocapillaria*) *tomentosa*, but it appears to be unsuitable host for *Philometra* sp. Morphometric characteristics of recorded nematodes are presented. It is suggested and discussed that infrequent and extremely low nematode infections in this host reflect their feeding specialization (strict phyto- and detritophagy).

Key words: Acheilognathinae; *Pseudocapillaria tomentosa*; *Philometra* sp.; host feeding specialization

Introduction

The European bitterling (*Rhodeus sericeus* Pallas, 1776; Cyprinidae, Acheilognathinae) is a small freshwater fish inhabiting lentic and riverine waters, with an unusual spawning relationship with freshwater mussels (Baruš & Oliva, 1995). It has a disjunctive distribution in Europe and Far East and is the only bitterling species occurring in Europe. According to Moravec (2001a), 24 species of metazoan parasites were noted to parasitize bitterling in the Czech and Slovak Republics. Within the parasite community, for 11 parasite species bitterling represents a definitive host, whereas the other 13 species exploit bitterling as an intermediate or paratenic host.
Nematode infections are rare in bitterling (Vismanis *et al.*, 1987; Gelnar *et al.*, 1994; Moravec, 1994, 2001a, b; Baruš *et al.*, 1997; Kadlec *et al.*, 2002).

Material and Methods

To investigate the metazoan parasite fauna of bitterling, a total of 1212 fish (Standard Length, SL = 8 – 51 mm) were collected from June 1998 to July 2003 from 11 localities in Morava River basin (Czech Republic, Danube basin). Localities included rivers (Morava River, Kyjovka River), oxbow lakes (separated from the Morava River after channelization) and borrow pits (artificial ponds created during dyke construction in the floodplain of the Dyje River) (Table 1).
All the nematodes found were removed from the intestine, liver or body cavity and fixed in glycerine-alcohol mixture 1:9 (Moravec, 1994). For examination, the specimens were

Table 1. Survey of localities, number of examined fish specimens of bitterling (*Rhodeus sericeus*) and their Standard length (Mean, Standard Deviation, Range), respectively

	Locality	Standard length			
		N	Mean	SD	Range
River	Kyjovka River	384	30.45	11.11	9-55
	Morava River	222	29.72	10.46	9-51
Oxbow lakes	D2	30	24.22	2.04	21-30
	D4	30	30.07	2.56	22-34
	Moravská Nová Ves	74	27.75	7.27	14-49
	Tvrdonice	31	26.89	3.43	21.5-36
Borrow pits	Čapí Dolní	320	26.00	8.62	8-47
	Dědava	30	26.77	3.43	22-33
	Helpůn	30	28.48	2.80	22-34
	Melanbon	30	27.45	3.36	22-36
	Rohlík	31	24.65	2.81	21-32

cleared in a glycerine-water solution and later embedded in glycerine jelly. The nematodes were measured using Olympus BX 50 microscope with a phase-contrast, differential interference contrast (DIC according to Nomarski) and digital image analysis. All measurements are given in millimetres. Epidemiological characteristic as prevalence, abundance and intensity of infection were used according to Bush *et al.* (1997). Collected material has been deposited in the Department of Parasitology, Faculty of Science, Masaryk University, Brno, Czech Republic.

Results

Nematode infection was found in ten specimens of bitterling, exclusively in summer (June – August) and only in fish from two localities. Total prevalence (0.82 %), mean abundance (0.008) and mean intensity (1) of nematode infection reached very low values. Within collection, two nematode species were determined. Epidemiological parameters of these two species mentioned below relate entirely to localities with the documented presence of nematode.

Pseudocapillaria (*Pseudocapillaria*) *tomentosa* (Dujardin, 1843) Moravec, 1987

Adult specimens (1 male, 1 female), subadult (1 female) and three larvae (L_4) were found in the intestine of six bitterling (SL = 43 – 49 mm; mean 45.7 mm) from the Kyjovka River (June 23, 2003). Parasite infection reached prevalence 1.56 %, mean intensity of infection 1 and mean abundance 0.016. One subadult specimen (female) and one larva (L_4) were found in the intestine of two fishes (SL = 23 and 25 mm) from borrow pit Dědava (July 18, 2003), prevalence 6.7 %, mean abundance 0.067.

Male: Body length 2.530, maximum body width 0.059. Spicule well sclerotized, length 0.275 and width 0.009-0.011 (Figs. 1, 2). Spicular sheath long, narrow, non-spiny. Tail rounded, provided with two large, round ventrolateral lobes (Fig. 3).

Ovigerous female: Body length 7.837, maximum body width 0.056. Vulva is situated at distance 0.050 behind oesophagus end, only anterior lip slightly elevated. Size of fully developed egg: length 0.064, width 0.040, outer layer with distinct irregular rough sculpture on surface (Fig. 4). Posterior end of body rounded, anus subterminal, length of tail 0.010.

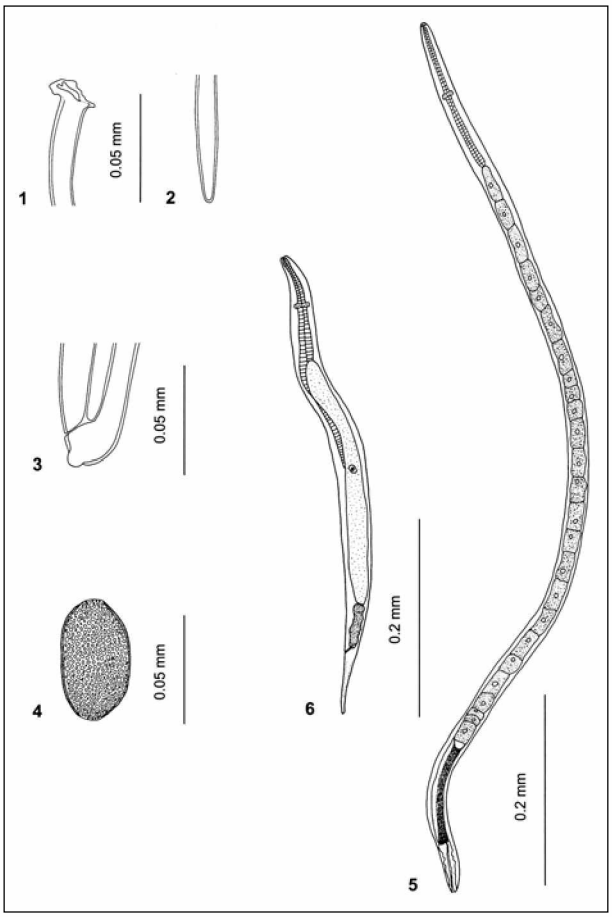
Larva (L_4): Body length 0.777 – 0.950, body width 0.043 – 0.056. Head end narrowed. Stichosome consisting of single row of 21 – 25 stichocytes. Length of entire oesophagus 0.667 – 0.777 (*i.e.* 81.8 – 85.8 % of the total body length). Muscular oesophagus 0.131 – 0.134 long. Intestine short, dark in colour. Rectum 0.008 – 0.009 long. Posterior end of body rounded, anus nearly terminal (Fig. 5).

Philometra sp.

One advanced larva (L_3) and one juvenile female were found in the body cavity and liver of two bitterling (SL = 26 and 30 mm) from the Kyjovka River (August 15, 2000 and August 13, 2001), prevalence 0.52 %, mean abundance 0.005.

Juvenile female: Body length 7.854 and maximum width 0.125. Whitish to yellow in colour. Both body ends rounded, lateral caudal projections well developed.

Larva (L_3): Body length 0.455 and maximum width 0.028. Whitish in colour. Oesophageal gland 0.253 in length (representing 55.6 % of the body length). Tail conical, 0.055 long (representing 12.1 % of the body length). Maximum width of the top of tail 0.002 with three minute projections 0.001 long (Fig. 6).



Figs. 1 – 5. *Pseudocapillaria tomentosa* (1, 2 – proximal and distal ends of spicule; 3 – tail of male; 4 – fully developed egg; 5 – larva L_4). Original

Fig. 6. *Philometra* sp. (advanced larva L_3). Original

Discussion

Regional fauna of the European bitterling is composed by 24 metazoan parasites (Moravec, 2001a). With the exception of two monegenean species, *Dactylogyrus bicornis* Malewitzkaja, 1941 and *Gyrodactylus rhodei* Žitňan, 1964, found only in the bitterling, all other bitterling parasites has been found in a wide range of fish hosts. Our findings of one nematode species, *P. tomentosa*, extend the list of

recorded metazoan parasites of the bitterling. Nematode specimens (*P. tomentosa* and *Philometra* sp.) examined in our material correspond morphometrically to descriptions by Moravec (1994, 2001b).

Pseudocapillaria tomentosa is a typical freshwater parasite frequently found in 17 cyprinid fishes in the Czech Republic (Moravec, 2001a). As shown in a recently established population of the tubenose goby, *Proterorhinus marmoratus* (Pallas, 1811), *P. tomentosa* is a generalist easily adapting to new host species (Koubková & Baruš, 2000). This nematode is usually located in the rectum and posterior part of the intestine (Moravec, 2001b). Records of adult, juvenile and larval specimens of *P. tomentosa* in the host intestine indicate that bitterling represents a suitable definitive host for this nematode species.

Only juvenile and larva of *Philometra* sp. were found and therefore a reliable determination of the particular species was not possible. Fish community in the locality (Kyjovka River) is dominated by bitterling *Rhodeus sericeus*, bleak *Alburnus alburnus*, Prussian carp *Carassius auratus* and white bream *Abramis bjoerkna*, whilst gudgeons *Gobio gobio* and *G. albipinatus* are rare (Reichard *et al*., 2002). This suggests that the recorded species is probably *Philometra ovata* (Zeder, 1803). Because only larval nematodes were found, we could suppose that the bitterling is unsuitable host for *Philometra* and females cannot attain gravidity in bitterling. The extremely low rates of prevalence, intensity of infection and abundance of *Philometra* in the bitterling host are further evidence for this assumption.

Nematode infection of bitterling was so rare that very high number of fish hosts was necessary to examine for their record. As stated by Moravec (1994, 2001b), the life cycle of *P. tomentosa* is realized without an intermediate host but often and effectively with a paratenic host (oligochaetes), whilst philometroids are generally developed with obligatory intermediate hosts (cyclopoid copepods). Food is an important source of new parasites acquirement in the fish. We suggest that the explanation of infrequent and extremely low nematode infection of bitterling is due to their food composition and high site loyalty (Peňáz *et al.*, 1978). For the short period between yolk sack absorption and the age of two months (SL 8.5 – 15 mm), bitterling feed on small zooplankton and minute larvae of aquatic insect. Later on, this short living fish is strictly phytophagous or detritophagous. In adult fish, animal food is represented sporadically and considered as accidental (Przybylski, 1996). Our finding of ten nematodes in fish of the standard length 23 – 49 mm confirms this. The low infection rates document extremely rare contact of nematode infective stages and fish host caused by trophic transmission.

As stated by Moravec (2001b), fish acquired new infections of *P. tomentosa* all year round, but gravid females with mature eggs in uteri occurred only in the warm period (April to October). Presence of adult female, but also larvae, in the bitterling in June and July corresponds with this seasonal pattern. New infections of philometroids in cyprinid fishes generally occur in June and July and the first step of their development in fish hosts takes place in August to September (Moravec, 1994). Our finding of juvenile specimen and larva of *Philometra* sp. in liver and body cavity of the bitterling in August agree with a detailed description of biology of the species (Moravec, 1994).

In spite of uninhabited niches in the bitterling host, the process of co-accommodation of adult helminths (e.g. digeneans, tapeworms and nematodes) is limited or almost eliminated because bitterling do not prey on the helminth's intermediate hosts.

Acknowledgements

We would like to thank P. Jurajda from the Institute of Vertebrate Biology, Academy of Sciences of the Czech Republic, Brno, for his kind help with electrofishing. We thank L. Lichtenbergová and M. Dušková for their help with collecting material.

MD, MO and BK were supported by Grant Agency of the Czech Republic (Project No. 524/ 02/0924) and Research Project of the Masaryk University (No. MSM 143-1000-10). VB was supported by Grant Agency of the Czech Republic (Project No. 524/03/0061). MR was supported by an internal grant from ASCR (Project No. Z6093917-I026).

References

BARUŠ, V., OLIVA, O. (1995): *Fauna of the Czech and Slovak Republics. Lamprey (Petromyzontes) and Fishes (Osteichthyes). Part II.* Academy of Sciences of the Czech Republic, Prague

BARUŠ, V., MORAVEC, F., ŠPAKULOVÁ, M. (1997): The Red Data List of helminths parasiting fishes of the orders Cypriniformes, Siluriformes and Gadiformes in the Czech Republic and Slovak Republic. *Helminthologia*, 34: 35 – 44

BUSH, A. O., LAFFERTY, K. D., LOTZ, J. M., SHOSTAK A. W. (1997): Parasitology meets ecology on its own terms: Margolis *et al.* Revisited. *J. Parasitol.*, 83: 575 – 583

GELNAR, M., KOUBKOVÁ, B., PLÁŇKOVÁ, H., JURAJDA, P. (1994): Report on metazoan parasites of fishes of the river Morava with remarks on the effect of water pollution. *Helminthologia*, 31: 47 – 56

KADLEC, D., ŠIMKOVÁ, A., JARKOVSKÝ, J., GELNAR, M. (2002): Parasite community of freshwater fish under flood conditions. *Parasitol. Res.*, 89: 272 – 283

KOUBKOVÁ, B., BARUŠ, V. (2000): Metazoan parasites of the recently established tubenose goby (*Proterorhinus marmoratus*: Gobiidae) population from the South Moravian reservoir, Czech Republic. *Helminthologia*, 37: 89 – 95

MORAVEC, F. (1994): *Parasitic Nematodes of Freshwater Fishes of Europe*. Academia, Prague

MORAVEC, F. (2001a): *Checklist of Metazoan Parasites of Fishes of the Czech Republic and the Slovak Republic (1873-2000)*. Academia, Prague

MORAVEC, F. (2001b): *Trichinelloid Nematodes Parasitic in Cold-blooded Vertebrates*. Academia, Prague

PEŇÁZ, M., PROKEŠ, M., WOHLGEMUTH, E. (1978): Fish

fry community of the Jihlava River near Mohelno. *Acta Sci. Nat. Brno*, 12: 1 – 36
PRZYBYLSKI, M. (1996): The diel feeding pattern of bitterling, *Rhodeus sericeus amarus* (Bloch) in the Wieprz-Krzna canal, Poland. *Pol. Arch. Hydrobiol.,* 43: 203 – 212
REICHARD, M., JURAJDA, P., ONDRAČKOVÁ, M. (2002): Interannual variability in seasonal dynamics and species composition of drifting young-of-the-year fishes in two European lowland rivers. *J. Fish Biol.*, 60: 87 – 101
VISMANIS, K. O., LOMAKIN, V. V., ROJTMAN, V. D., SEMENOVÁ, M. K., TROFIMENKO, V. JA. (1987): Nemathelminthes. In BAUER, O. N. (Ed): *Identification Key to Parasites of Fresh-water Fishes. Part 2*. Publ. House Nauka, Leningrad

RECEIVED JANUARY 7, 2004

ACCEPTED MARCH 11, 2004