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NEW GEOGRAPHIC RECORD OF *MYXOBOLUS PORTUCALENSIS* (SARAIVA & MOLNAR, 1990) AND *SPINITECTUS INERMIS* (ZEDER, 1800) IN EUROPEAN EEL (*ANGUILLA ANGUILLA*) PARASITE COMMUNITIES FROM LATVIA FRESHWATERS

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Deksne G., Aizups J., Zolovs M., Daukšte J., Kirjušina M. New geographic record of *Myxobolus portucalensis* (Saraiva & Molnar, 1990) and *Spinitectus inermis* (Zeder, 1800) in European eel (*Anguilla Anguilla*) parasite communities from Latvia freshwaters. *Acta Biol. Univ. Daugavp., 15 (2): 259 – 265.*

Because of European eel commercial interest its parasite fauna is well known and has been studied throughout its range. However commercial transportation of eels has been implicated in the introduction and spread of several potentially pathogenic and geographically new parasites. In the present study we describe the European eel parasite community with two new parasite species for eel from freshwaters of Latvia. The 75 European eels were collected from commercial fisherman in 6 freshwater sampling sites. The 19 parasite species comprised of 4 protists, 12 helminths, 1 copepod, 1 leech and 1 glochidia. This is a first report of *Myxobolus portucalensis* and *Spinitectus inermis* in eels from water bodies of Latvia and this is a new geographic record for those species. We found spores in fins of 28 eels with the overall prevalence 37% (95% CI 27-49%) and mean intensity 131.8. There were observed no significant differences in *M. portucalensis* prevalence between spring and autumn seasons. However the mean *M. portucalensis* intensity was significantly higher in autumn season (189 spores) comparing to observed in spring season (74 spores). Meanwhile only two male specimens of freshwater eel specialist *S. inermis* were found in the eel from Lake Usma in October. Further studies must be carried out related to parasite diversity, population dynamics and health status of eels, where mentioned species were detected, to determine their potential relation to the maintenance and spread of these parasites.

Key words: *Spinitectus inermis, Myxobolus portucalensis*, eel.

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INTRODUCTION

Because of European eel commercial interest its parasite fauna is well known and has been studied throughout its range. While parasite infracommunities of eels may be relatively poor, component communities can be quite rich and comprise both specialists and generalists (18). Meanwhile commercial transportation of eels has been implicated in the introduction and spread of several potentially pathogenic and geographically new parasites (14). After 2008 young yellow eels were regularly restocked in small amounts in eel stocked production lakes (lakes that have not been natural eel habitat), thus expanding the overall range of this species in Latvia (12). There are several studies on eel parasite fauna has been published in Latvia (9, 10, 11, 21, 22), but still little is known due to fragmentary studies, as mostly they were done in Lake Usma during 1999-2003. Since 1949 twenty-seven parasite species (3 of Protists, 3 of Monogenea, 2 of Trematoda, 3 of Cestoda, 5 of Nematoda, 7 of Acanthocephala, 3 of Crustacea, 1 of Mollusca) were registered in eel from 5 lakes (Lake Rusons, Liepaja, Usma, Razna and Puze), River Venta and Gulf of Riga (9, 11).

In the present study we describe the European eel parasite community with two new parasite species for eel from freshwaters of Latvia.

MATERIAL AND METHODS

The yellow eels were collected from commercial fisherman in 6 freshwater sampling sites. The eel traps and weir were used for eel catching. A total number of 75 eels were examined in spring (n=42) and autumn (n=33) seasons during October 2013 to November 2014. The eels were brought alive to the laboratory in tanks with water from original water body. Eels were euthanized by the neck-cut procedure which consists of cutting the spinal cord just behind the head, without disruption of the soft tissue and flow of blood to the brain (2). The length and weight of each eel were measured. A drop of fresh blood was taken from the dorsal aorta and a blood smear was air dried, and stained by Giemsa technique (8) with Diff-Quick stains (Bio-Optica, Milano, Italy). The full parasitological examination was done according to the method developed by Bykhovskaya-Pavlovskaya (5). Due to the fact that present study is a part of a bigger project that has different other tasks, some organs (heart, spleen, first arch of gills from left side) or parts of organs (liver, kidney, intestines, muscles, skin and fins) were used for histological studies.

Most of detected helminthes were washed in freshwater and stored in 70° or 96° alcohol. Specimens of all species were morphologically identified according to their key characteristics (3, 7, 13, 15).

We calculated prevalence, mean intensity and mean abundance of infection as defined by Bush *et al.* (4) for all detected parasite species. Relations between host body condition and intensity of the different parasite species were investigated by Spearman rank correlation test. Statistical analyses were performed with aid of ExcelXP and SPSS Statistics Version 21 (IBM Corporation, Chicago, Illinois). The 95% Confidence intervals (95%CI) were evaluated using Mid-P test with OpenEpi (Open Source Epidemiologic Statistics for Public Health, Version 2.3.1, open source calculator; 6).

RESULTS

All examined eels were females. The total body length for 75 collected eels ranged from 33 to 101 cm (mean 76.5 ± 14.5 cm), while body weight ranged from 70 to 1872 g (mean 910.9 ± 443.9 g).

The 19 parasite species comprised of 4 protists (*Trypanosoma granulosum*, Laveran and Mesnil, 1902; *Myxidium giardi* Cepede, 1882; *Myxobolus portucalensis* Saraiva and Molnar, 1990; *Trichodina* sp.), 12 helminths (*Pseudodactylogyrus anguillae* Ogawa and Egus, 1976; *P. bini* (Kikuchi,1929) Gusev, 1976;

Table 1. Measurements of *Myxobolus portucalensis* from fins of European eel (*Anguilla anguilla*) from Latvia freshwaters (all measurements given in micrometers)

Measurements	References		
	Present study	Saraiva and Molnar 1990	Wierzbicka and Orecka-Grabda 1996
Length of spores	9.4 – 10.6	11.3 – 15.0	8.0 – 10.8
Width of spores	6.7 – 7.6	7.5 – 10.0	6.8 – 8.0
Thickness of spores	5.8 – 6.3	5.6 – 7.5	-
Length of polar capsules	4.0 – 5.0	3.8 – 7.5	4.2 – 6.4
Width of polar capsules	2.5 – 3.5	2.5 – 3.8	2.2 – 3.2
Thickness of polar capsules	2.9 – 3.1	3.1 – 3.8	-

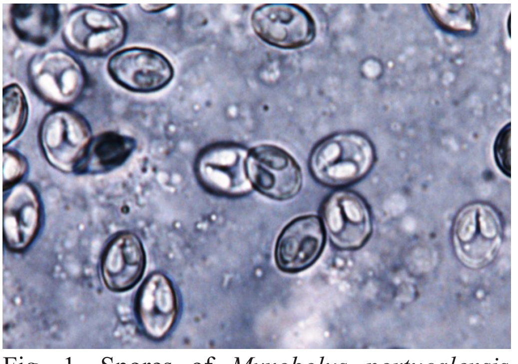

Fig. 1. Spores of *Myxobolus portucalensis* (Saraiva and Molnar, 1990) from fins of European eel (*Anguilla anguilla*) caught in Lake Usma, Latvia (600 x magnification).

Diplostomum sp.; *Sphaerostomum bramae* (Muller, 1776) Luhe, 1909; *Bothriocephalus claviceps* (Goeze, 1782) Rudolphi, 1810; *Proteocephalus macrocephalus* (Creplin, 1825) Nufer, 1905; *Anguillicola crassus* Kuwar, Niimi and Itagaki, 1974; *Camallanus lacustris* (Zoega, 1776) Railliet and Henry, 1915; *Raphidascaris acus* (Bloch, 1779) Railliet and Henry, 1915; *Spinitectus inermis* Zeder, 1800; *Pseudocapilaria tomentosa* (Dujardin, 1843) Moravec, 1987; *Acanthocephalus lucii* (Muller, 1776) Luhe, 1911), 1 copepod (*Ergasilus sieboldi* Nordmann, 1832), 1 leech (*Piscicola geometra* (Linnaeus, 1761) Blainville, 1818) and 1 *Anodonta* sp. glochidia. Overall the most prevalent species were *P. anguillae* (54%; 95%CI 43-66%) followed by *C. lacustris* (53%; 95%CI 42-64%) and *P. bini* (49%; 95%CI 38-60). The parasite species detected only in one fish was – *M. giardi*, *S. inermis*, *P. tomentosa* and *P. geometra*. However, the highest mean intensity observed was for *M. portucalensis* (131.8 ± 182.0) followed by *P. macrocephalus* (26.9 ± 44.4) and *S. bramae* (23.3 ± 36.9).

This is a first report of *M. portucalensis* and *S. inermis* in eels from water bodies of Latvia and this is a new geographic record for those species.

Myxobolus portucalensis is a myxosporean parasite of the subcutaneous connective tissue specific to eel. We found spores only in fins of 28 eels with the overall prevalence 37% (95%CI 27-49%) and mean intensity 131.8 from 4 out of 6 sampling sites (Fig. 1.). There were observed significant neagtive correlation of *M. portucalensis* mean intensity of and eel body weight ($r=-0.27$, $p<0.05$).

Most of the myxosporean measurements coincided with measurements of *M. portucalensis* from original description Saraiva and Molnar (1990) (Table 1.).

There was no significant difference observed between *M. portucalensis* prevalence in spring and autumn seasons while mean intensity

Table 2. *Myxobolus portucalensis* differences of prevalence, mean intensity, range and abundance in two sampling seasons

	Sampling season	
	Spring (March till May)	Autumn (September to November)
No of sampled eels/ No of *M. portucalensis* infected eels	42 / 14	33 / 14
Prevalence % (95% CI)	33 % (21-49%)	42% (27-59%)
Mean intensity	74	189
Mean abundance	25	80
Range	1-244	4-588

was notably higher in autumn season (Table 2.). Intensity of *M. portucalensis* infection decreased with the eel body weight decrease ($r=-0.27$, $p<0.05$).

Two male specimens of freshwater specialist *S. inermis* were found in the eel from Lake Usma in October (Fig. 2.). The obtained measurements of nematode coincided with Moravec (16) data.

DISCUSSIONS

In spite of the great significance of freshwater fishery, only little attention has been paid to the study of the parasite ecology. Most of the available data on parasite fauna of eel contained only in broader faunistic studies. The same concerned to the data from Latvia, where only a rather small number of these fishes have been examined for the presence of parasites. Overall 18 species of parasites were found in present study, in comparison to above shown data with a rather lower diversity in the parasite fauna of eel. Over 10 parasite species recorded in previous studies were lacking in the present study. However, the eel specific species *M. portucalensis* and *S. inermis* were recorded for the first time in Latvia.

Myxobolus portucalensis is a myxosporean parasite of the subcutaneous connective tissue specific to eel. We found spores only in fins. Other authors found spores in diverse organs: gills, skin, nasal fosse, eyes, stomach, intestine, liver, spleen, kidney and bile duct (1, 23). However, mentioned authors used different methods (smears and organs imprints staining methods) for spore, plasmodium and cysts detection. Nevertheless, prevalence varied in different organs and was low – from 12.0% for kidney to 7.0% for urinary bladder, 2.7% in gills and for intestine, 0.5% for liver and spleen (23). In the original description of *M. portucalensis* (19), protists werereported only from subcutaneous tissues, with a mean prevalence of 53.5%. Lower mean prevalence (37%) for *M. portucalensis* was observed in the present study, ranging from 6% to 50% in different sampling sites.

Intensity of *M. portucalensis* infection decreased with the eel body weight decrease. Our findings matched with other author findings regarding negative correlation between *M. portucalensis* intensity of infection and the host size (1, 23). Evidently, these differences were associated with the qualitative and quantitative changes in the food composition of these fishes of different size groups and differences in the source of infection.

Spinitectus inermis is the specific eel parasite widely spread in European river systems of the North, Baltic and Mediterranean Seas, but occurs only locally, particularly in lakes, pond systems and lower reaches of rivers (16). It is a rare species that is geographically widespread but patchy in occurrence and seldom appears able to persist in any habitat for a long period

(17). Although, investigation results in Ireland indicated that *S. inermis* was more prevalent in estuarine eel populations (14). The life cycle of this parasite is still unknown. Therefore it may be supposed that the intermediate hosts of *S. inermis* in the observed locality were either larvae of aquatic insects or benthic crustaceans which constituted here an important component of eel diet. Most probably also paratenic hosts (fish) were involved in the life cycle of *S. inermis* (15). According to Moravec (15), generally 2-9% of eels were infected in the side where this nematode occurs. In present study the prevalence of *S. inermis* was 1.3%. It was also rarely found in eel (overall prevalence 3%, intensity 1-12 nematodes per fish) in the study from Czechoslovakia where adult nematodes (gravid females and males) were recorded only in September (15). Higher prevalence (16.1%) and mean intensity (5.5) of *S. inermis* infection was reported from Portugal (20).

The eel parasites, recorded from lakes in Latvia, comprise the species known as pathogenic fish parasites (*T. granulosum*, *A. crassus*, *S. inermis, P. bini*) and other parasites, which occurred in large numbers and the pathogenicity of which has not yet been studied (*C. lacustris, B. claviceps*). Further studies must be carried out related to parasite diversity, population dynamics and health status of eels, where mentioned species were detected, to determine their potential relation to the maintenance and spread of these parasites.

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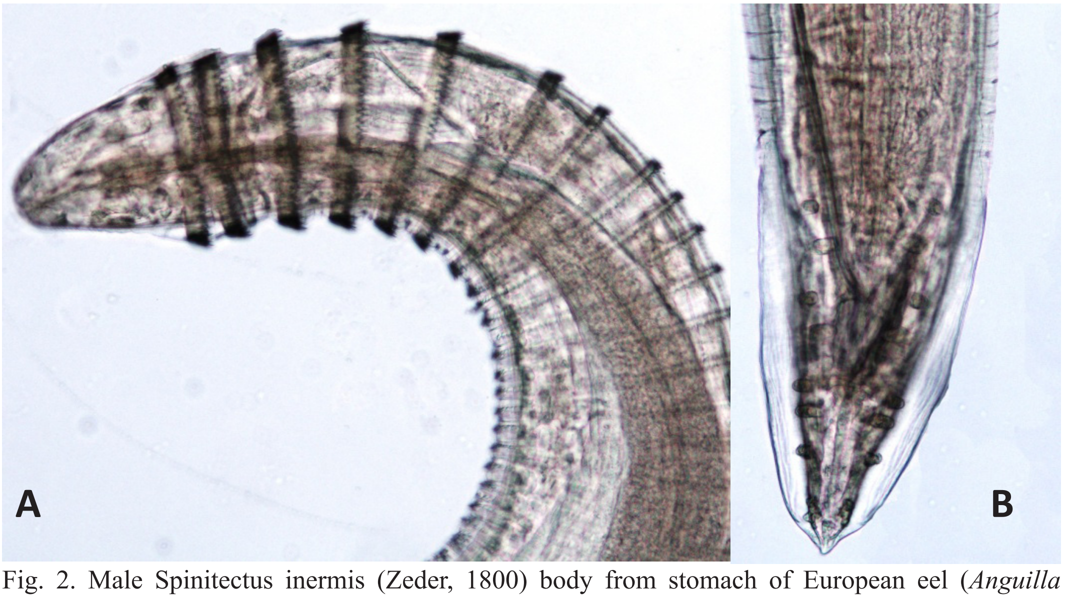

Fig. 2. Male Spinitectus inermis (Zeder, 1800) body from stomach of European eel (*Anguilla anguilla*) caught in Lake Usma, Latvia (100 x magnification). A - anterior end; B – posterior end.

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