ACTA ICHTHYOLOGICA ET PISCATORIA
Vol. XXVI, Fasc. 2 Szczecin 1996

Jadwiga *WIERZBICKA*[1], Teresa *ORECKA-GRABDA*[2]

Parasitology

MYXOBOLUS PORTUCALENSIS SARAIVA & MOLNAR, 1990 IN VARIOUS ORGANS OF EEL, *ANGUILLA ANGUILLA* (L.)

MYXOBOLUS PORTUCALENSIS SARAIVA & MOLNAR, 1990 W RÓŻNYCH NARZĄDACH WĘGORZA, *ANGUILLA ANGUILLA* (L.)

[1] **Division of Fish Diseases, Agricultural University of Szczecin, Poland**
[2] **Department of Animal Ecology, Szczecin University, Poland**

Morphology of *Myxobolus* representatives parasitic on the fins and various internal organs of eels, *Anguilla anguilla* (L.) originating from the Szczecin Lagoon and the Odra River estuary area (Poland) was studied. The sporozoans were found to represent a single species identified as *M. portucalensis* Saraiva & Molnar, 1990. The infection parameters were determined for the respective organs. The species studied have not been previously reported from the internal organs of the eel and the present record is the first from Poland.

INTRODUCTION

Eels have been known to host a total of four species of the genus *Myxobolus* Bütschli, 1882, namely: *M. dermatobius* (Ishii, 1915), *M. anguillae* (Fujita, 1929), *M. kotlani* Molnar, Lom & Malik 1986, and *M. portucalensis* Saraiva & Molnar, 1990. The two former species have been reported from the Japanese eel, *Anguilla japonica* Temmnick & Schlegel, 1846, while the latter two have occurred in the European eel, *Anguilla anguilla* (L.). Sporozoans *M. kotlani* were found in elvers cultured in Hungary, but previously caught off the shores of the western Europe (Molnar et al. 1986). *M. portucalensis* was recently described from the eels of the Este River in Northern Portugal (Saraiva and Molnar 1990).

It is evident from the original descriptions of the listed above species that their location in the hosts is very similar. They parasitize subcutaneous connective tissue. *M. anguillae* has been also recorded on the fins, as it was the case for *M. portucalensis*. On the other hand, Copland (1982) identified sporozoans found in the wall of alimentary tract of *A. anguilla* from English rivers as "*M. dermatobia*" (amended: *M. dermatobius*). Most often, however, the parasites inhabiting the internal organs of the eel were listed as *Myxobolus* sp. Their presence in the intestine and the gall bladder of *A. rostrata* (Le Sueur, 1817) from

Canada was recorded by Hanek and Molnar (1974). Subsequently, Hine (1978) observed spores of this genus in the liver and urinary bladder of *A. australis* Richardson, 1848 from New Zealand. He also recovered *Myxobolus* sp. from *A. dieffenbachii* Gray, 1842. From the European eel, protozoans of the genus *Myxobolus* were reported to occur in the intestinal wall (Køie 1988a, b), mesentery (Køie 1988b), and various internal organs (Saraiva and Chubb 1989). Also Saraiva and Molnar (1990) describing their new species *M. portucalensis*, located on the fins, mentioned about a single case of *Myxobolus* sp. occurring in the other organs (gills, stomach, and intestine). The material being too scarce prevented them from identifying it up to the species level.

Wierzbicka and Orecka-Grabda (1994) in their survey on the protozoan parasites of the European eel from the Szczecin Lagoon and the Odra River estuary (Poland) also stated the presence of *Myxobolus* sp. Their work was followed by a short note on this parasite by Wierzbicka et al. (1996).

The presently conducted work, based on relatively abundant material collected in the course of the above mentioned surveys, was aimed at detailed, comparative studying of the morphology of the *Myxobolus* representatives parasitizing various organs of the eel, as well as their identification up to the species level. There have not been hitherto studies conducted in the similar aspect.

MATERIAL AND METHODS

The eels, *Anguilla anguilla* (L.) originated from five areas of the Szczecin Lagoon (Piastowski Canal, Lubin, Trzebież, Stepnica, and Nowe Warpno) and from the Odra River estuary (Skolwiński Canal). More detailed data, as well as the map showing the collection sites were published in the work of Wierzbicka and Orecka-Grabda (1994). The material was acquired from the commercial catches at the summers of 1982 and 1983 (predominately). A total of 183 individuals measuring 34–84 cm and weighing 70–1200 g was studied. The eels represented age groups between 1+ and 11+ (larval period not included). In addition to that, in the summer of 1985 a total of 13 eels measuring 42–65 cm and weighing 120–530 g from Dąbie Lake (linked to the Odra River estuary) was studied.

The detailed necropsy performed, included microscopic examination of the material scrapped off: the skin, gills, alimentary tract, urinary bladder, and the gall bladder suspension. Those slides, where parasites were found, were stained using the Pappenheim method (May-Grünwald and Giemsa stains). The same method was used to treat smears containing spores isolated from the fins and the slides with imprints of the liver, spleen, and three sections of the kidney. In the way described above, a comparative material from various organs was collected on permanent preparations. In addition to that, heavily infected fins were preserved in 5% formalin. Some observations were conducted also on the live material.

RESULTS

The material studied yielded small, variable in size, oval or spherical plasmodia, macroscopically visible as white dots, occurring on the dorsal and anal fins (Fig. 1). They were recorded on four eels coming from the Szczecin Lagoon and the Skolwiński Canal (prevalence 2.2%) and on two eels from Dąbie Lake (prevalence 15.4%). The plasmodia were located under the epidermis and most often were evenly scattered on the entire area of the fins. The intensity of infection was, in most cases, high. Inside the plasmodia very numerous spores were located.

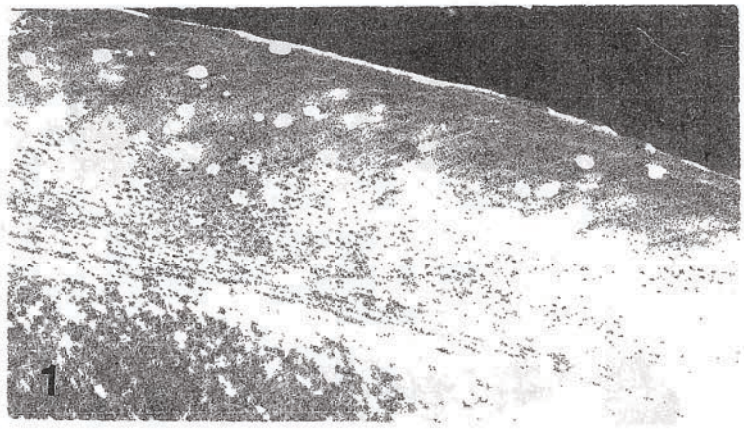

Fig. 1. Plasmodia of *Myxobolus portucalensis* on fin of *Anguilla anguilla*

The spores isolated from the fins were elliptical (in the sutural plane). Their margin was, in most cases, equipped with 10 delicate sutural marks, which were best visible in the posterior part of the spore (both on fresh and formalin-preserved preparations). The suture line was relatively wide and slightly protruding on the anterior and posterior ends. Elongated, pyriform, in most cases equal in length, polar capsules occupied a little more than half of the spore and their medial margins ran parallel to each other as far as to the opening (Fig. 2). The pores of the polar capsules were located close to each other and they did not cross. The filaments inside the capsules were, in most cases, in 10 turns. The dimensions of the stained spores are given in Tab. 1. Extruded polar filaments on those preparations were 96 μm long. In some spores the sporoplasm showed two intensively stained nuclei located side by side and relatively large, unstained vacuole.

Single or very few spores were found, in most cases, while studying the internal organs of the eels. Merely in few cases, more numerous concentrations of the spores were found. Only once a small, intact plasmodium containing four spores was found on the gills. The prevalence calculated separately for the respective organs was low: 2.7% for the gills,

2.7% for intestine, 12.0% for kidney, 7.0% for urinary bladder, 0.5% for liver and spleen. It is evident from the above, that the spores were found most often in the kidney, particularly in its terminal section (prevalence 9.2%). They were found in this organ, among other, in two fish having strongly infected fins.

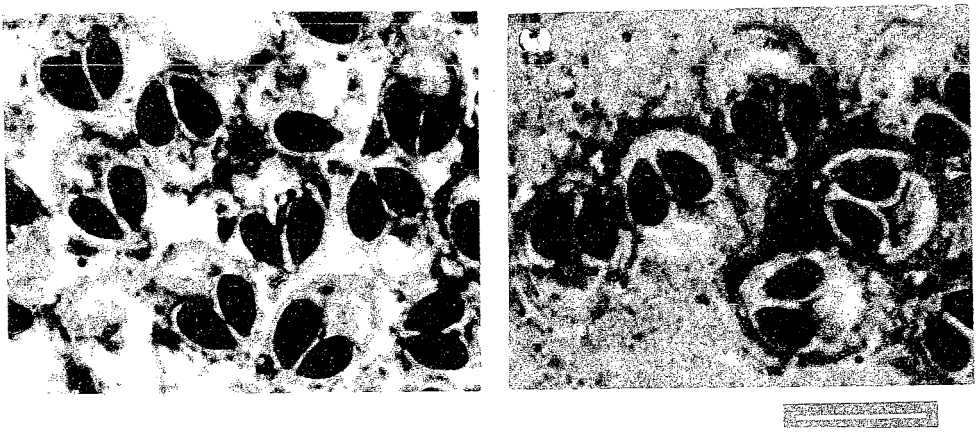

Fig. 2. Spores of *Myxobolus portucalensis* from fin of *Anguilla anguilla* (stained, scale bar 10 μm)

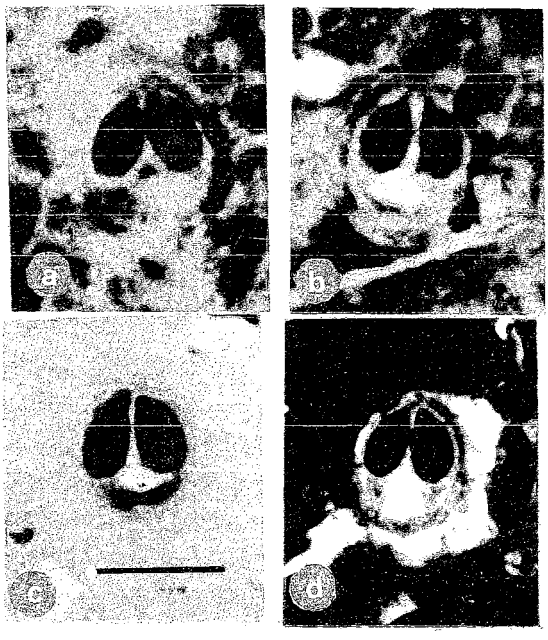

Fig. 3. Spores of *Myxobolus portucalensis* in various organs of *Anguilla anguilla*; a), b) from gills; c) from urinary bladder; d) from kidney (stained, scale bar 10 μm)

The morphology of the spores from the organs such as the gills (Fig. 3a, b), swim bladder (Fig. 3c), kidney (Fig. 3d) did not differ from the morphology of the spores parasitizing the fins (Fig. 2). Also the morphometric characteristics of the spores from the gills, swim bladder, kidney, liver, and intestine did not show differences compared to the protozoans inhabiting the fins (Tab. 1). It can be concluded from the above that the sporozoans of the genus *Myxobolus*, presently found in the various organs of the eel repre-

sent a single species.

The mentioned-above protozoans were recovered from the fish measuring 35–76 cm. The prevalence for all organs combined for the eels representing the Szczecin Lagoon was 16.9%, for those representing Skolwiński Canal—29.2%, while for those from Dąbie Lake it was 38.5%.

Table 1

Dimensions of spores of *Myxobolus portucalensis* Saraiva and Molanr, 1990 in various organs of *Anguilla anguilla* (L.)

Location	Spores		Polar capsules	
	Length [µm]	Width [µm]	Length [µm]	Width [µm]
Fins [n = 35]	10.11 (8.0–10.8)	7.65 (6.8–8.0)	5.41 (4.2–6.4)	2.97 (2.2–3.2)
Gills [n = 22]	10.22 (8.8–10.8)	7.98 (7.2–8.8)	5.35 (4.0–6.0)	2.99 (2.8–3.4)
Urinary bladder [n = 22]	10.07 (8.0–10.8)	7.76 (6.8–8.8)	5.59 (4.0–6.4)	3.07 (2.4–3.6)
Kidney [n = 22]	10.04 (9.2–10.8)	7.57 (7.2–8.0)	5.42 (4.4–6.4)	3.00 (2.8–3.6)
Liver [n = 3]	10.0–10.4	7.6–8.0	5.6	2.8–3.0
Intestine [n = 1]	9.6	7.6	5.4	2.9

DISCUSSION

Comparing the presently found sporozoans with the original descriptions of the four species of *Myxobolus* parasitizing eels, it is evident, that they most closely resemble *M. portucalensis*. The location of the polar capsules and their pores was identical as it was in *M. portucalensis* described by Saraiva and Molnar (1990), and different as it was in *M. kotlani*. The latter species, on the illustrations included in the work of Molnar et al. (1986), has the tips of its polar capsules slightly apart. In addition to that, spores of *M. kotlani* possessed 12 (14) sutural marks. In our material, the number of those marks and the number of polar filament turns (10 in most cases), as well as the length of the extruded filaments approximated very much those of *M. portucalensis*. It must be emphasized, however, that spores of *M. kotlani* and *M. portucalensis* are morphologically very similar.

The morphometric characteristics of the presently studied spores of *Myxobolus* from the fins and the internal organs of the eel, as well as their morphology did not show differences (Tab. 1). The dimensions of the spores in the present material were smaller compared to those of *M. portucalensis*. The differences were, in some extent, caused by different techniques of preparation making. The studies on *M. portucalensis* were conducted on fresh material (Saraiva and Molnar 1990), while the presently studied spores were studied on the stained preparations. This could cause certain shrinkage of the spores, particularly of their length. On the other hand, the dimensions of the presently found spores (Tab. 1) were almost identical with those of *M. kotlani*. The observations on the spores of *M. kotlani* were

originally done also on fresh material (Molnar et al. 1986), which means they were in fact smaller compared to ours.

Spores of *M. dermatobius* and *M. anguillae*, according to the original descriptions (Fujita 1929; Molnar et al. 1986; Šul'man 1984; Lom and Dyková 1992) were morphologically distinctly different. The sporozoans, however, described by Copland (1982) from the walls of stomach and intestine of *A. anguilla*, as *M. dermatobius* raised some doubts. Lom and Dyková (1992) justly questioned Copland (1982) protozoans' conspecificity with *M. dermatobius*. Copland (1982) did not include illustration of the spore which made identification up to the species level impossible.

Interesting are the results of the studies by Køie (1988a, b), who found *Myxobolus* sp. in the intestinal wall and mesentery of the European eel. Initially the author suggested it represented *M. kotlani* (Køie 1988a). In her next work Køie (1988b) believed that identity of the species needed confirmation. She included the illustration of the spores, which however, do not permit species-level identification.

The location of *M. portucalensis* deserves attention. This species was found by Saraiva and Molnar (1990) only on the margins of the pectoral and anal fins. On the other hand the sporozoans in the present material occurred on the entire surface of the dorsal and anal fins and in various internal organs of the fish. In addition, the cited authors observed the infection of eels up to 39 cm of length, while in the Szczecin Lagoon and in the Odra River estuary also older specimens were infected—up to 76 cm of length.

RECAPITULATION

1. The presently conducted study proved that the sporozoans of the genus *Myxobolus*, parasitic on the fins and in various internal organs of the European eel did not differ in the respect of their morphological and morphometric characteristics.
2. They were identified as *M. portucalensis* Saraiva and Molnar, 1990.
3. This species has not been reported from the internal organs of the eel and the present record constitutes the first record of this species in Poland.

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Jadwiga *WIERZBICKA*, Teresa *ORECKA-GRABDA*

MYXOBOLUS PORTUCALENSIS SARAIVA, MOLNAR, 1990 W RÓŻNYCH NARZĄDACH WĘGORZA, *ANGUILLA ANGUILLA* (L.)

STRESZCZENIE

Przeprowadzono porównanie morfologii *Myxobolus* pasożytujących na płetwach i w różnych narządach wewnętrznych węgorzy, *Anguilla anguilla* (L.) pochodzących z Zalewu Szczecińskiego i okolic ujścia rzeki Odry (Polska). Badania wykazały, że znalezione sporowce należą do jednego gatunku, który zidentyfikowano jako *M. portucalensis* Saraiva, Molanr, 1990. Podano też stopień zarażenia poszczególnych narządów tym pasożytem. Gatunek ten nie był dotychczas notowany w narządach wewnętrznych węgorza i został stwierdzony po raz pierwszy na terenie Polski.

Received: 14 November 1996

Authors' address:

Jadwiga Wierzbicka PhD DSc
Division of Fish Diseases
Agricultural University of Szczecin
Kazimierza Królewicza 4, 71-550 Szczecin, Poland

Teresa Orecka-Grabda PhD DSc Prof
Department of Animal Ecology
Szczecin University
Felczaka 3a, 71-412 Szczecin, Poland