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Research Article

**OCCURRENCE OF THE ASIATIC NEMATODE *ANGUILLICOLA CRASSUS* IN EUROPEAN EEL FROM THE ŁEBSKO LAGOON (CENTRAL COAST, POLAND)**

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**Abstract**

The Łebsko Lagoon (regarded locally as a coastal lake) is situated on the central Polish coast and is connected with the Baltic Sea. The occurrence of *A. crassus* in eels from Łebsko was studied. Nearly 84% of the examined eels were infected with nematodes at a mean intensity of 7.6 individuals. The level of infection has increased in recent years from 54% in 2001 to 100% in 2003, which is confirmation of the successful spread of *A. crassus*. The nematodes were transmitted to the eels by many species of crustacean (intermediate host) and other invertebrates and fish (paratenic host) through the food web.

## INTRODUCTION

*Anguillicola crassus* Kuwahara, Niimi and Itagaki, 1974 is a natural parasitic nematode of the swim bladder of the Japanese eel, *Anguilla japonica*. *A. crassus* was introduced from the Southeast Asia to Europe in the 1980s in live *A. japonica* imported for consumption and aquaculture.

Once introduced to the European ecosystem, *A. crassus* spread rapidly among local eel populations. Young eels became infected by feeding on invertebrates, while older eel were also infected by fish. The life cycle of this nematode includes one intermediate host – predominantly copepods and ostracods (De Charleroy *et al.* 1990, Kennedy and Fitch 1990, Moravec and Konecny 1994) and paratenic hosts such as other invertebrates, aquatic insects (Moravec 1996, Moravec and Skorikova 1998, Palikova and Navratil 2001) and many species of fish (De Charleroy *et al.* 1990, Haenen and Van Banning 1990, Thomas and Ollevier 1992a, Höglund and Thomas 1992, Moravec and Konecny 1994, Rolbiecki 2002).

This parasite is normally found in freshwater and brackish water basins (Haenen and Van Banning 1990, Kennedy and Fitch 1990, Höglund and Thomas 1992).

*A. crassus* in eels and another fish species are well known from the Baltic (Höglund and Thomas 1992, Höglund *et al.* 1992, Reimer *et al.* 1994, Rolbiecki *et al.* 2000, Zander and Reimer 2002), the Vistula Lagoon (Rolbiecki *et al.* 1996, Własow *et al.* 1998, Rolbiecki 2002), the Szczecin Lagoon (Garbacik-Wesołowska *et al.* 1994), and the central coast rivers Wieprza in Darłowo and Rega near Trzebiatowo (Pilecka-Rapacz 2000). This species was noted also in the coastal lakes Bukowo, Kopań and Łebsko (Morozińska-Gogol – unpubl. data).

The current study focuses on the nematode occurrence and parameters of infection in eels from the Łebsko Lagoon.

## STUDY AREA

Łebsko Lagoon (regarded locally as a coastal lake) is located on the central coast of Poland within the Słowiński National Park, which was designated by UNESCO in 1977 as part of the World Network of Biosphere Reserves.

With an area of 7142 ha, the Łebsko Lagoon is the largest coastal lake in Poland. The lagoon is a shallow water body (max. depth - 6.3 m, average depth – 1.6 m), surrounded by reeds and sedges, which provide good shelter for a rich variety of migratory and breeding water birds. The reservoir is separated from the Baltic Sea by a narrow strip of land (Mierzeja Łebska) and is connected with

the sea by the Łeba River. The lagoon is situated only 30 cm above sea level, and inflows of seawater occur when the winds blow from the north and northwest.

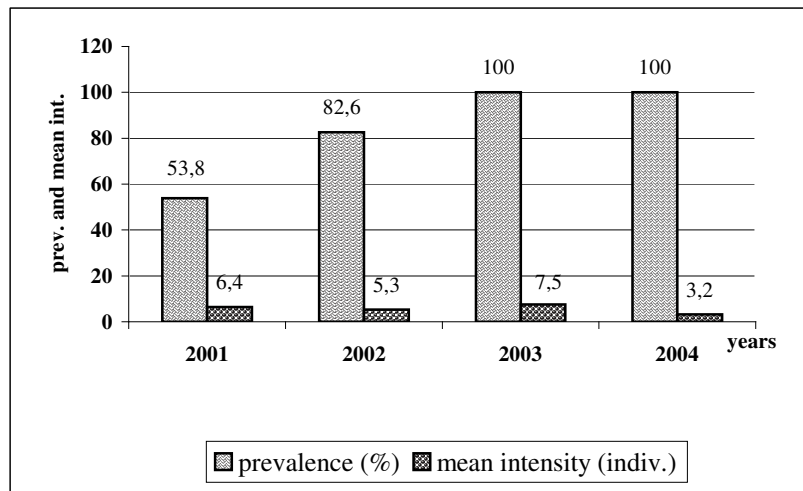
Many fish species, both freshwater and marine, are found here, and the following are commercially exploited in Łebsko: bream *Abramis brama* (L.); roach *Rutilus rutilus* (L.); tench *Tinca tinca* (L.); crucian carp *Carassius carassius* (L.); German carp *Carassius auratus gibelio* (Bloch, 1783); rudd *Scardinius erythrophthalmus* (L.); perch *Perca fluviatilis* (L.); eel *Anguilla anguilla* (L.); zander *Stizostedion lucioperca* (L.); pike *Esox lucius* (L.); various salmonids.

## MATERIAL AND METHODS

The eels were caught by fishermen in Łebsko Lagoon from July 2001 to July 2004. Fishing for this species is ongoing.

In total, 62 eels were examined for anguillicolosis. All of the fish were weighed (range 110.3-992.6 g) and measured (length range 40-81 cm).

The swim bladders were removed and dissected. Nematodes were collected from the lumen and wall of the swim bladder under a dissecting microscope. The largest specimens were visible with the naked eye. The parasites recovered were fixed and preserved using methods commonly applied with nematodes (Bylund *et al.* 1980).

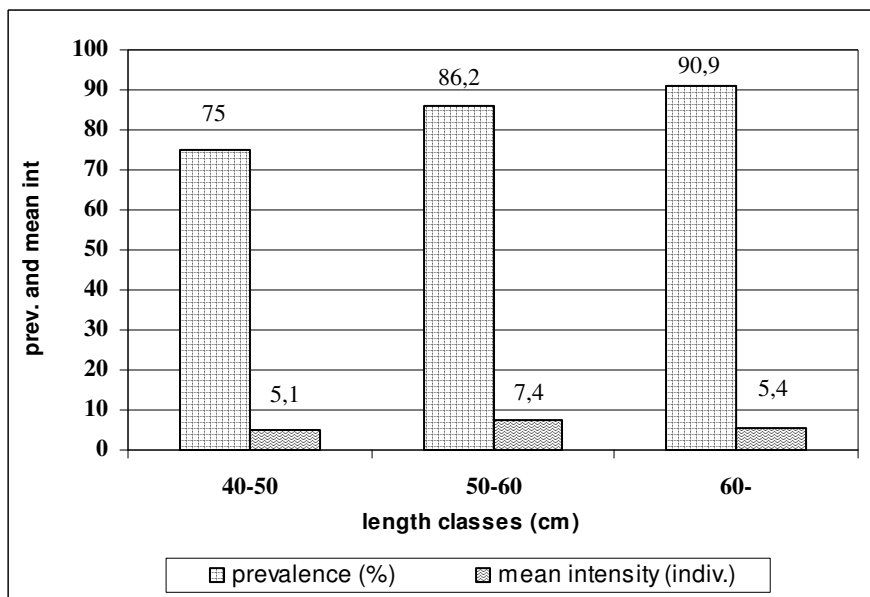


**Fig. 1.** Changes in the prevalence and mean intensity of *A. crassus* infections in eel from Łebsko Lagoon from 2001 to 2004.

## RESULTS

*A. crassus* were found throughout the investigations. Nearly 84% of the examined eels were infected with nematodes at a mean intensity of 7.63 individuals (range 1-27 indiv.). Changes in the infection level were observed. The prevalence of infection increased from 2001 to 2004 (Fig. 1). In 2001, nearly 54% of the eels were infected at a mean intensity of 6.4 individuals (range 1-13 indiv.). In 2002, 83% were infected at an intensity of 5.3 indiv. (range 1-20 indiv.), while in 2003 and 2004 the infection prevalence increased to 100% of the eels at mean intensities of 7.5 and 3.2 indiv., respectively (ranges 1-27 and 1-15 indiv.).

Generally, prevalence increased with eel length from 75 to 91%, but the highest intensity was observed in the medium length class at 7.4 indiv. (Fig. 2).



**Fig. 2.** Infection of eel from Łebsko Lagoon according to length class.

## DISCUSSION

The eel is an important component of estuarine and freshwater ecosystems and a significant commercial fish species. Eels feed on invertebrates, mostly insect larvae and crustaceans, while the largest specimens also feed on fish (Brylińska 1991). Since *A. crassus* were found only in eels in Łebsko, invertebrates were probably the principal infection link. Fish were rarely the

cause of infection and then only in the Baltic (Höglund and Thomas 1992, Reimer *et al.* 1994).

As in the present study, Sures and Streit (2001) observed a higher prevalence of infection with *A. crassus* in eels from the River Rhine than previously. Würtz *et al.* (1998) and Sures *et al.* (1999) reported prevalence rates that ranged from 60 to 80%, and Sures and Streit (2001) found *A. crassus* in 90% of the eels. Investigations in the River Rhine and Łebsko Lagoon confirm that the spread of *A. crassus* across European ecosystems is rapid and successful and continues today.

Thomas and Ollevier (1992b) reported that there were no seasonal changes in the prevalence or mean intensity of *A. crassus* in European eel. It is possible that eels could become infected throughout the year. Nematodes were also collected in all seasons in Łebsko Lagoon, but due to the small sample sizes, seasonal changes in the parameters of infection could not be studied.

*A. crassus* was also noted in the fry of European eel. Pilecka – Rapacz (2000) observed that 33-40% of the fry (length range 10.3-32 cm) from the Pomeranian rivers Wieprza and Rega were infected. The smallest infected eel was 13.2 cm in length, and the infection level increased with length. Lefebvre *et al.* (2002) suggested that medium sized and the largest eels are more heavily infected. This trend was also observed in Łebsko Lagoon.

## CONCLUSIONS

- The spread of *A. crassus* in the Baltic and coastal lakes is facilitated by the absence of native swim bladder parasites and the broad specificity of *A. crassus*, which has many intermediate and paratenic host species. Nematodes are transmitted to the eels via many species of invertebrates and fish through the food web.
- The level of infection increased in recent years from 54% to 100%; this is confirmation of the successful spread of *A. crassus*.
- The prevalence of infection increased with eel body length.

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