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Research Article

THE FIRST RECORD OF THE NEMATODE *ANGUILLICOLA CRASSUS* (NEMATODA: DRACUNCULOIDEA) IN EEL OF THE GULF OF GDAŃSK (POLAND)

LESZEK ROLBIECKI ✉, JERZY ROKICKI, DOMINIKA WOJTKIEWICZ

Department of Invertebrate Zoology, University of Gdańsk
al. Marszałka Piłsudskiego 46, 81-378 Gdynia, Poland
rolbieck@ocean.univ.gda.pl ✉

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Abstract

The study of parasitic fauna of the Gulf of Gdańsk eel revealed the presence of the nematode *Anguillicola crassus*, not recorded in the area before. The relatively high level of infection (prevalence of 41.9%; mean intensity of 3.0 ind.) is indicative of the nematode posing a hazard for the Gulf of Gdańsk eel population. More than half of the infected eel showed anatomo-pathological changes typical of anguillicolosis.

INTRODUCTION

The nematode *Anguillicola crassus* is an eel swimbladder parasite. The nematode was introduced to Europe in the 1980's along with the eel, imported for consumption and stocking. The nematode had been earlier recorded solely in Far East countries (China and Japan) as a parasite of the Japanese eel (Kuwahara *et al.* 1974). In Europe, the nematode was first recorded in northern Germany (Neumann 1985). In a very short time after its introduction, the nematode attacked indigenous populations of the European eel (*A. anguilla*). At present, *Anguillicola crassus* is recorded almost all over Europe (Kennedy and Fitch 1990).

The European eel proved more sensitive to the *A. crassus* invasion than did

the Japanese eel, the original definitive host. In Japan, *A. crassus* is recorded in 10-40% of *A. japonica*. Although the nematode lives in the swimbladder and feeds on the host's blood, it does not seem to overly harm the original host. Presumably, the Japanese eel had evolved immunity to harmful effects of the parasite (Egusa 1979). On the other hand, the prevalence of infection in the European eel may be as high as 100%, intensity of infection reaching even 20 nematodes per fish. Such a heavy infection cannot remain without effect on the fish condition and produces symptoms known as anguillicolosis.

Since the first record of *A. crassus* in Poland in 1988 (Własow 1991), the nematode has been attracting the attention of numerous workers, fishermen, and fish culturists. The present study was aimed at investigating the extent of *A. crassus* infection in the Gulf of Gdańsk eel.

MATERIALS AND METHODS

The eel examined were caught in September 1997 and in May-October 1998. The temporal gaps resulted from seasonality in the eel fishery. A total of 372 individuals, measuring 48.5-65 cm, were examined. For technical reasons, the fish could neither be weighed nor aged. The eel was caught with hooks and lines off Rewa in the Gulf of Gdańsk. The nematodes collected were fixed and preserved in 70% ethanol.

RESULTS

The *Anguillicola crassus* infection prevalence and mean intensity were 41.9% and 3.0 individuals per fish, respectively. A total of 468 nematode individuals were isolated, of which 383 were adult (Fig. 1), 75 were preadult, and 10 were at L_4. The fish examined contained also very numerous L_2 stage larvae which, due to their high abundance and small size, were neither isolated, not counted. The nematodes were found to occur in the swimbladder wall, which housed the L_4 larvae, and in the swimbladder lumen, preferred by the other developmental stages. A single L_4 larva was found in the intestine lumen.

The highest prevalence and the highest mean intensity were recorded in July (Fig. 2). Adults as well as the L_5 and L_2 larvae were being found throughout the period of study. On the other hand, the L_4 larvae were present in September 1997 and from June until August.

The swimbladder of 50.8% of all the infected eel was pathologically changed. The most frequent symptoms included increased pigmentation, thickening, and strong hyperaemia of the swimbladder walls. In addition, the presence of dense,

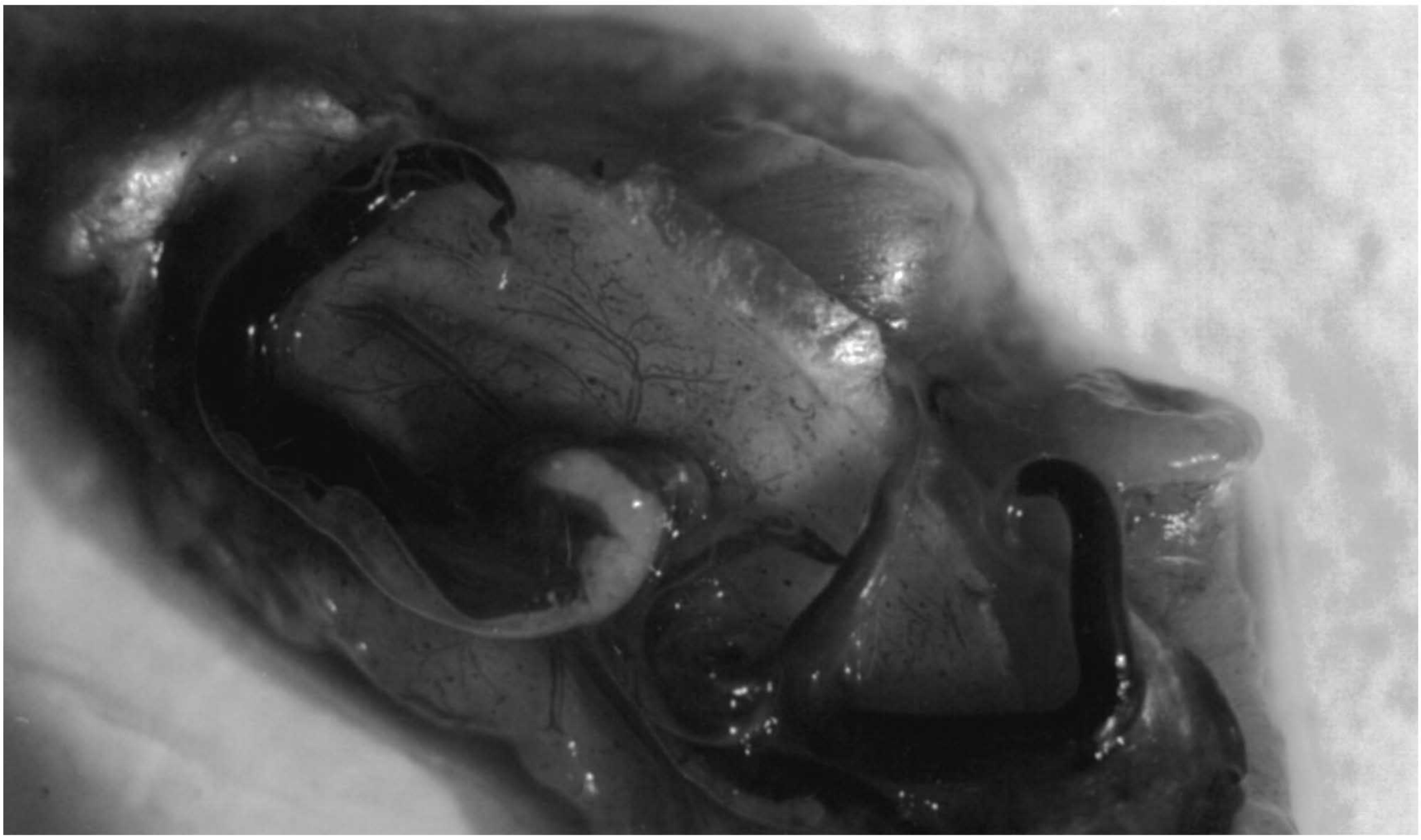

Fig. 1. An adult *Anguillicola crassus* in the eel swimbladder (Photo: Leszek Rolbiecki)

blood-resembling blackish fluid - a remnant of dead nematodes - as well as shrunk swimbladders devoid of air were observed in some infected eel as well.

DISCUSSION

In spite of the research carried out by Markowski (1933), Sołtyńska (1964), Rokicki (1975), and Sulgostowska (1993), the parasitic fauna of the Gulf of Gdańsk eel is still inadequately known.

The on-going study of the helminth fauna of that eel revealed the presence of the nematode *Anguillicola crassus*, the first record of the species in the area.

The nematode had already been recorded in other Polish water bodies, *e.g.*, the Masurian and Pomeranian Lake Districts, the Goczałkowice Dam reservoir on the Vistula (Własow *et al.* 1991, Grawiński 1994, Orecka-Grabda *et al.* 1994), the Vistula Lagoon (Rolbiecki *et al.* 1996, Własow *et al.* 1998), and the Szczecin Lagoon (Rząd 1998). The unpublished data of Vojtkova *et al.* and Rolbiecki showed the species to be present in the so-called Dead Vistula in 1990 and in 1996, respectively, while the unpublished data of Rolbiecki and Rokicki provided evidence of the species being present also in Lake Druzno in 1997. Doubtless, *A. crassus* occurs in other water bodies as well, but there are no detailed data on its distribution.

The level of infection, observed in this study (41.9% and 3.0 ind.) was high, although the prevalence in most Polish water bodies ranged from 65% in the

Szczecin Lagoon (Rząd 1998) to 100% in the Vistula Lagoon (Własow *et al.* 1998). Outside of Poland, too, the prevalence of infection was, as a rule, higher, to quote 69.1% in Lake Balaton (Molnár *et al.* 1994), 80% in the Rhine (Würtz *et al.* 1998), and 100% in Flanders (Belgium) (Belpaire *et al.* 1989). The lower infection in the Gulf of Gdańsk eel population could have resulted from the invasion process being at its initial stage only; it could have also been an outcome of local biotic conditions that would, perhaps, restrict the eel susceptibility to infection with the parasite.

The duration of the present study (a year) was too short for it to reveal seasonal trends in the parasite's occurrence. Nevertheless, the much higher level of infection recorded in July (Fig. 2) corresponds with data reported by Hartmann (1994) who also recorded the highest prevalence in summer. On the other hand, other workers observed no seasonal changes in the nematode's occurrence (Würtz *et al.* 1998). *A. crassus* is a warm water species, originating from tropical and subtropical freshwater reservoirs of the Far East, for which reason water temperature is a factor limiting its distribution. As reported by De Charleroy *et al.* (1990), at 20°C, the developmental cycle of the parasite is completed within less than two months.

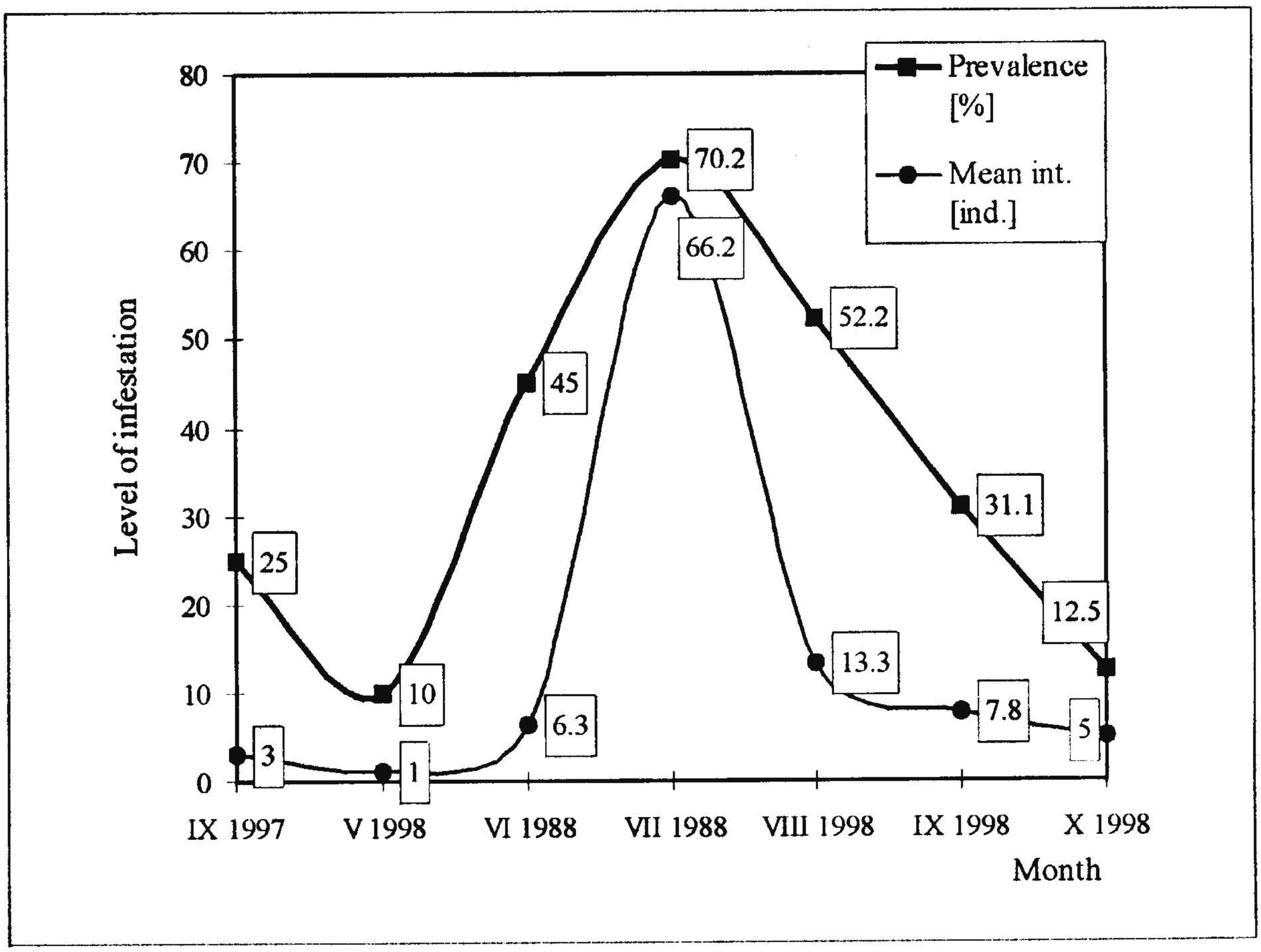

Fig. 2. Seasonal dynamics of *Anguillicola crassus* (adult, preadult, L4) in the Gulf of Gdańsk eel

More than half of the infected eel, examined in this study, showed pathologically changed swimbladder walls. Hartmann (1994) described such changes in as many as 80% of the fish examined. The swimbladder is an important fish organ. The auguillicolosis-affected eel often show anaemia as well as increased susceptibility to stressors such as transportation, storage, and oxygen depletion (Koie 1988, Molnár 1993). The malfunctioning swimbladder restricts the reproductive ability and survival potential of the fish. The infected eel are more susceptible to secondary bacterial infections (Banning and Haenen 1990). Swimbladder lesions may inhibit eel's migration to spawning grounds in the West Atlantic (Tesch 1995). Consequently, to avoid - or at least to reduce - the risk of anguillicolosis in an area, the imported eel to be stocked in that area should be checked before release. Combating *A. crassus* is very difficult due to a wide spectrum of its intermediate hosts; these include various crustacean taxa, predominantly copepods (Kennedy and Fitch 1990). An additional source of infection for the eel is provided by the so-called paratenic hosts, small fish (De Charleroy *et al.* 1990, Székely 1995) and even amphibians, insect larvae, and snails (Moravec 1996, Moravec and Škorníková 1998). Intermediate hosts, similarly to the paratenic ones, contain the third stage larvae, invasive for the eel. Another factor that enhances the distribution range of *A. crassus* is the catadromous life mode of the eel, whereby the parasite can be easily transported from one area to another. Although the nematode is a freshwater species, Hahlbeck (1991) reported its presence in saline water as well. Paratenic hosts do not migrate as extensively as the eel do, but they, too, may transfer the nematode from one area to the next.

To conclude, it can be inferred that *A. crassus* will be extending its distribution in Poland. Particularly susceptible to invasion are the eel dwelling in shallow, easily warming up, eutrophic freshwater reservoirs.

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