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The occurrence of *Pomphorhynchus laevis* (Müller, 1776) (Acanthocephala) and the age of the flounder (*Platichthys flesus*, L.)

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Summary

576 flounders were collected from the Pomeranian Bay, Gulf of Gdańsk and the open sea off Łeba in the period from March 1997 to February 1999. 105 flounders were collected in October 1999 from Lake Łebsko. 143 out of 681 fish were infected. 1557 acanthocephalans of *Pomphorhynchus laevis* were recovered. The mean intensity of infection and prevalence were calculated. One can conclude that the intermediate host Gammaridae plays a significant role in the occurrence of *P. laevis*, and thus in the prevalence and intensity of infection. The age of the fish and the occurrence of *P. leavis* were correlated. Young fish, no older than one year, were infected by *P. leavis*. Three- and four-year-old fish were the most susceptible to infection. Older fish, aged five years or more, were less susceptible. Only one encapsulated acanthella was found on the gonads; there was therefore a possibility that *Platichthys flesus* could act as a paratenic host. In the Skagerrak or in the north-western Baltic Sea *P. laevis* commonly occurs in the form of encapsulated larvae. This life cycle strategy is probably due to the presence or absence of predators of *P. flesus* and the final host of *P. laevis*.

Key words: flounder; *Platichthys flesus*; *Pomphorhynchus laevis*

Introduction

The flounder (*Platichthys flesus* (L.)) is one of the definitive hosts of the acanthocephalan *Pomphorhynchus laevis* (Müller, 1776). *P. laevis* is widespread in different fish species in Europe and Asia and normally parasitizes both freshwater and marine fish. In acute infections this parasite may block the lumen, de prive the host of nourishment, as a result of which the host may die. *P. laevis* may also occur in encapsulated form in the liver and mesenteries (Køie, 1999) and in the body cavity and gonads (Monroe *et al.*, 1989). The intermediate hosts for this parasite are amphipods and crustaceans, mainly of the genus *Gammarus*: *G. pulex* (L.) (Kennedy 1996), *G. locusta* (L.) and *G. zaddachi* (Sexton, 1912) (Munro *et al.*, 1989). In all species acanthellae of *P. laevis* were noted in the haemocel.

The aim of this study was to discover the correlation between the prevalence and intensity of *Pomphorhynchus leavis* infection and the age of flounders (*Platichthys flesus* (L.)), and the life cycle strategy.

Materials and Methods

576 samples of fish were collected from the Pomeranian Bay, the Gulf of Gdańsk and the open sea off Łeba from March 1997 to February 1999. 105 samples were collected in October 1999 from Lake Łebsko. The analysis included all age classes of flounder from younger than one year to eight years old. The fish were divided into eight classes. Because there were very few fish older than six years they have been placed together in a single class (>6). The weight and length of every flounder were recorded. The sex and the age were determined by examination of gonads and otoliths. The body cavity and internal organs were thoroughly examined for *Pomphorhynchus laevis*. The parasites collected were fixed in 70 % ethanol, then cleared in glycerine for two weeks. They were identified and classified according to Bauer (1987). The intensity of infection

and prevalence were calculated according to Margolis *et al.* (1982).

Results

143 out of 681 fish were infected. 1557 acanthocephalans of *Pomphorhychus laevis* were recovered. *P. laevis* inhabits the lower part of the gut, mainly the rectum, where its spiny proboscis is embedded in the mucosal epithelium and penetrates the intestinal wall, whereas the rest of the body remains inside the lumen of the intestine. Only one encapsulated acanthella was found attached to the gonad. The data indicate that fish aged one year and less were not infected by acanthocephalans.

Table. 1. **Intensity of infection of *P. laevis* in each age class of the fish**

Age class	<1	1	2	3	4	5	6	>6
No. of examined fish	62	84	92	173	93	35	22	20
Intensity of infection	0	0	1-46	1-96	1-49	1-25	1-22	1-17

The highest mean intensity of infection was observed in 3-year-old fish (14.7), the lowest in fish >6 years old (4.14). There were variations in the mean intensity in the age classes. The highest difference between the mean intensity in two consecutive age classes was in 3- and 4- year-old fish. The prevalence of *P. laevis* infection increased with age, from 19.5 % in 2-year-old fish to 63.6 % in 6-year-old flounders. In older fish it dropped to 35 %. Prevalence increased regularly up to a maximum in 6-year-old fish, but fell away in older fish.

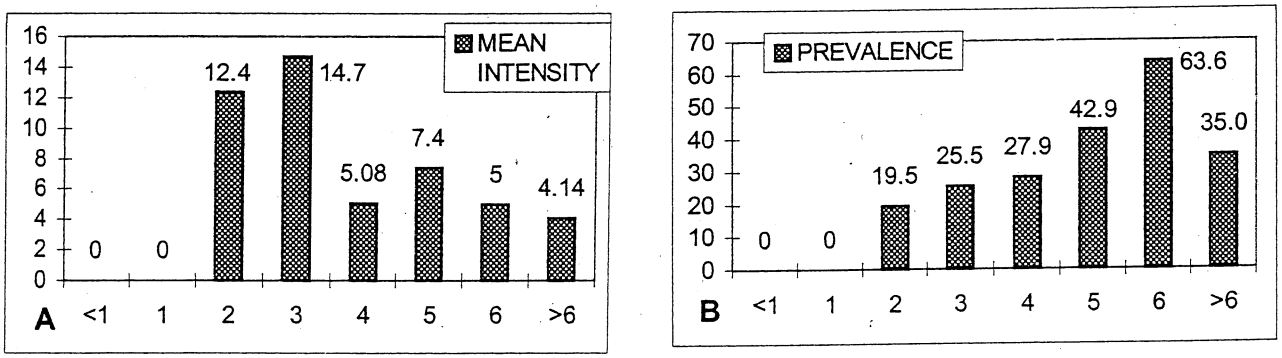

Fig. 1. Mean intensity of infection (A) and prevalence (B) of *P. laevis* in each age class

Discussion

Comparison with studies by Janiszewska (1938) on flounders from Puck Bay near Hel, shows the same rise in the prevalence of infection in two-year-old fish in relation to one-year-old and younger animals. In the case of older fish, an upward tendency was observed, in contrast to Janiszewska, who reported irregular fluctuations in the prevalence of *P. laevis*. These differences can be described as dependent on the season, and on the numbers and composition of benthic species and their behaviour (Mulicki, 1947; Kostrzewska-Szlakowska and Szlakowski, 1990; Ostrowski, 1996). This dependence may vary in each of the areas studied. Janiszewska examined flounders from Puck Bay only, while the present study included fish from four areas. The increase in the prevalence of infection with age may be due to the fact that the longer the definitive host lives, the higher the possibility of its being exposed to the intermediate host of *P. laevis*. Hence, more fish become infected by this parasite. Kennedy (1996) described a similar dependence: he found that the highest prevalence occurred on the larger size categories of flounders and continued to rise until the fish were 8 years old. The same relationship was described by Mulicki (1947), who reported that the percentage of infected fish rises in proportion to their length.

This picture of the distribution of the mean intensity of infection and the prevalence *P. laevis* is probably connected with the feeding habit of *Platichthys flesus*. The diet of fish less than one year old consisted mainly of Baccilariophyceae (Mulicki, 1947) and Calanoida (Kostrzewska-Szlakowska and Szlakowski, 1990) but not Gammaridae. When the fish grow they start to eat small gammarids. The highest prevalence of infected *Gammarus* spp. was reported in specimens 6-10 mm in length (Hine and Kennedy, 1974) - these are rather too large for the smaller flounders to consume.

Fish of medium age (3-4) are the least fastidious in their choice of food. They consume different kinds of animals (Mulicki, 1947), which may be the reason for the gradual increase in the occurrence of *P. laevis*. The greater numbers of fish that live, the more food is consumed, and the greater exposure to infected gammarids. In spite of this, a high percentage of uninfected fish was found in each age class of fish examined from the same territory. So there is a considerable possibility that the infection is connected directly with individual food preferences, and indirectly with

the varying proportion of gammarids in the flounders diet. Therefore, in the case of fish older than 6 years, if infected, the observed intensity is probably lower than in younger fish, even though Mulicki (1947) reported that gammarids are an important component of the flounders diet.

Where fish prefer Gammaridae as food (the intermediate host of *P. laevis*), this could lead to intestinal blockage and subsequent death. This hypothesis might explain the sudden decrease in the mean intensity in 4- year-old flounders (5.08) in relation to the value for the 3-year-old fish (14.7). Janiszewska (1938) also noted a maximum mean intensity of infection in this age group. *P. laevis* is found in large numbers in the intestine: as many as 96 acanthocephalans per fish have been recorded, and on one occasion Janiszewska counted 64 parasites in a single host. These large numbers may cause intestinal blockage and even prevent defecation (Rohde, 1984); they may also cause perforation of the intestinal wall. These effects of the parasite may clearly affect the digestive process in the fish. Mulicki (1947) observed that food was absent from the alimentary tract of highly infected fish. All these factors can affect the state of health of the fish, and can lead to death. So only those fish with a small number of parasites can survive. An intensity of 22-25 specimens of *P. laevis* per 5- or 6-year-old fish is probably the maximum number of acanthocephalans that has no influence on fish mortality. In fish older than 6 years, the intensity was only 1-4 parasites per fish. Only one specimen from this age class was infected by 17 *P. laevis*. Comparison between the present results and those of Janiszewska (1938) suggests that the intensity of acanthocephalan infection (1-2 parasites per fish) has not changed in the Gulf of Gdańsk during the last 50 years.

One may conclude that the intermediate host Gammaridae plays a significant role in the life cycle of *P. laevis*, and thus in the prevalence and intensity of infection. A correlation was found between the age of the fish and the occurrence of *P. laevis*. Fish less than one year old did not become infected with *P. laevis*. Three- and four-year-old flounders were the most susceptible to infection; fish five years or older, less so.

Only one encapsulated acanthella was found on the gonads; there was therefore a possibility that *Platichthys flesus* could act as a paratenic host. In the Skagerrak or in the northwestern Baltic Sea *P. laevis* commonly occurs in the form of encapsulated larvae (Køie, 1999). This life cycle strategy is probably due to the presence or absence of predators of *P. flesus* and the final host of *P. laevis*.

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