

**THE TOPOGRAPHIC SPECIFICITY  
OF *ACHTHERES PERCARUM* NORDMANN,  
1832 (COPEPODA: LERNAEOPODIDAE) IN THE PIKE-PERCH  
*STIZOSTEDION LUCIOPERCA* (L., 1758)**

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**ABSTRACT**

The location of the parasitic copepod *Achtheres percarum* in the pike-perch is described. 3262 individuals of this parasite were found, 2547 of them on the gills and 715 in the mouth. These copepods were usually found on the dorsal gill sectors (1 and 2), their numbers were decreasing from the outer to the inner branchial arches (counting from the operculum). The direction of water flow, and the structure and size of the branchial arches were considered to be the principal factors determining the distribution of *A. Percarum*.

**KEY WORDS:** parasitic copepods, *Achtheres percarum*, pike-perch, topographic specificity

**INTRODUCTION**

The way by which the external and internal parasites colonise various habitats in the host organism i.e. particular organs and tissues according to a specific distributional pattern is known as topographic specificity. Within the host, numerous parasitic species of crustaceans occupy specific niches that will provide suitable living conditions. The problem of the location of



copepods has been addressed by a number of authors, e.g. Kozikowska et al. 1956; Kabata & Couses 1977; Rokicki 1984; Starovoytov et al. 1985; Starovoytov 1986; Kabata 1987; Piasecki 1995; Rolbiecki & Rokicki 1996. However, the location of *A. percarum*, despite being a common parasite of the pike-perch, has been rarely mentioned in the relevant literature.

## MATERIAL AND METHOD

The present study was carried out from December 1991 to December 1992 and from December 1994 to March 1997. The fish were obtained from catches taken from the Gulf of Gdańsk between Krynica Morska and Jantar, and from the central part of the Vistula Lagoon.

With the aid of a stereoscopic microscope, the skin, mouth and gills of the fish were examined for the presence of copepods. All copepods found were preserved in 70% alcohol.

## RESULTS

Table 1

Distribution of male specimens of *Achteres percarum*

Site of occurrence and number of copepods			
Attached to fish		Attached to crustacean females	
mandible	1	maxilla II	3
maxilla	1	cephalothorax	5
operculum	1	trunk	4
branchial arch I, sector 1	1	sexual opening	13
branchial arch I, sector 2	1	egg bags	2
branchial arch II, sector 2	1	-	-
branchial arch II, sector 3	1	-	-
branchial arch III, sector 1	2	-	-
branchial arch III, sector 2	3	-	-
branchial arch III, sector 4	1	-	-
branchial arch IV, sector 1	1	-	-
branchial arch IV, sector 2	1	-	-
branchial arch IV, sector 3	1	-	-
Total	16	-	27



579 specimens of pike-perch were examined. The prevalence of infection was 58.1% with a mean intensity of 10.4 individuals and an intensity range of 1-35 individuals per fish. 3262 specimens of *A. percarum*, both males and females (adults and chalimus IV), were recorded in the gills and mouth of the fish. Only 43 males were present, 27 of them attached to females, and the other 16 not attached to females on the gills, maxilla, mandible and operculum of the fish (Table 1).

The copepods displayed a characteristic distribution within the gills and mouth of the host. 2547 parasites were recorded on the gills. The largest number of parasites was counted (starting from the operculum) on the I branchial arch, fewer on the II, fewer still on the III and least of all on the IV gill. *A. percarum* was the most numerous on the dorsal gill sectors (1 and 2) (Fig. 1). 715 copepods were noted in the mouth, of which 382 were settled on the mandible, 209 on the maxilla, 97 on the operculum and 27 on the tongue.

## DISCUSSION

*Achtheres percarum* is a typical brackish water species (Grabda 1962; 1967) and occurs in the perch and pike-perch (Wegener 1909; Kozikowska 1956; 1957; Grabda & Grabda 1959; Piasecki 1991; 1993; Valtonen et al. 1993). In the present study this copepod, a mesoparasite colonising the mouth and gills of fish, was found exclusively on the gills of pike-perch (78,1% of parasite individuals) and in the mouth the remainder 21,9%. There was a gradual drop in the number of copepods from the outer branchial arches towards the inner ones, a marked preference was shown for the sectors 1 and 2 of arches (Fig. 1). Kozikowska et al. (1956) recorded *A. percarum* in the mouth and gills of the pike-perch, and they also described the gradual fall in numbers of parasites from branchial arch I to IV. However, they found most of the parasites on the gill filaments (sectors 2 and 4, Fig. 1). Piasecki (1993), by contrast, have counted the largest numbers of copepods on the gill rakers (sectors 1 and 3, Fig. 1) and in the mouth.

The present paper covers 189 fish caught in 1990-91, in which most of the copepods were attached to the gill filaments, and 390 fish caught in 1993-97, in which the copepods were located mainly on the rakers. It turned out that the parasites were present in varying densities on the gill filaments and rakers, while the differences could be discerned only in the gill sectors.

The direction of water flow is the most important factor affecting the distribution of parasites in the mouth and gills (Llewellyn 1956; Llewellyn &



Owen 1960; Owen 1963; Starovoytov et al. 1985; Dorovskikh 1988). According to Starovoytov et al. (1985), water passes from the mouth to the gills when the pike-perch is actively respiring, principally between the II and III gill arch, and then vertically downwards through the gill slits. Copepods can also enter the fish with this stream of water. Though some parasites do manage to attach themselves to the walls of the fish mouth, most of them become attached to the gills, primarily the arch II and III. Studying the location of the monogenean *Ancyrocephalus paradoxus*, the same authors came to the conclusion that in order to avoid washing off the gills II and III, the parasites migrate to the neighbouring arches (I and IV), where the flow of water is not so fast. Nevertheless, in the case of *Achtheres percarum*, gill arch I carried the highest and IV the lowest number of parasites. Perhaps, the low number of these copepods on gill arch IV is due to their size - *A. percarum* is larger (1 cm in length) than *Ancyrocephalus paradoxus* - and that is why they colonise the largest gill, i.e. the first one.

Another important aspect possibly determining the location of these parasites is their means of attachment to the host. The prehensile organs of *A. percarum* - more efficient than the opisthohaptor of monogeneans - are the second maxilla, which end in a bulla-shaped „sucker” that grows permanently on to the host. That is why *A. percarum* is not so susceptible as *A. paradoxus* for washing off from the gills, and why it can colonise gills II and III.

The predilection of *A. percarum* for the dorsal sectors of the gills (1 and 2) can also be attributed to the direction of water flow, which, as has already been mentioned, escapes vertically downwards through the gill slits. The powerful flow of water in the ventral gill sectors (3 and 4) discourages colonisation of these sectors. Moreover, since gill sectors 1 and 2 present a larger surface area than do sectors 3 and 4, they are occupied by a larger number of parasites.

A further point of importance in the distribution of parasites is the structure of the gill apparatus in fish. In the pike-perch it consists of widely-spaced, small gill rakers, which allow copepod larvae to pass from the mouth to the gill filaments. In the perch, by contrast, the gill rakers are long and closely spaced, thus preventing copepods from reaching the aboral parts of the gill arches. Kozikowska et al. (1956) reported that in the perch, most *A. percarum* attach themselves to the mouth and gill rakers and only very few to the filaments.

The males of *A. percarum* are also to be found in distinct locations, which are practically the same as those of the females. The purpose of a male is to seek out a female, fertilise her and then die; thus he does not live long. That is why the majority of males (62,8%) were found actually attached to females.



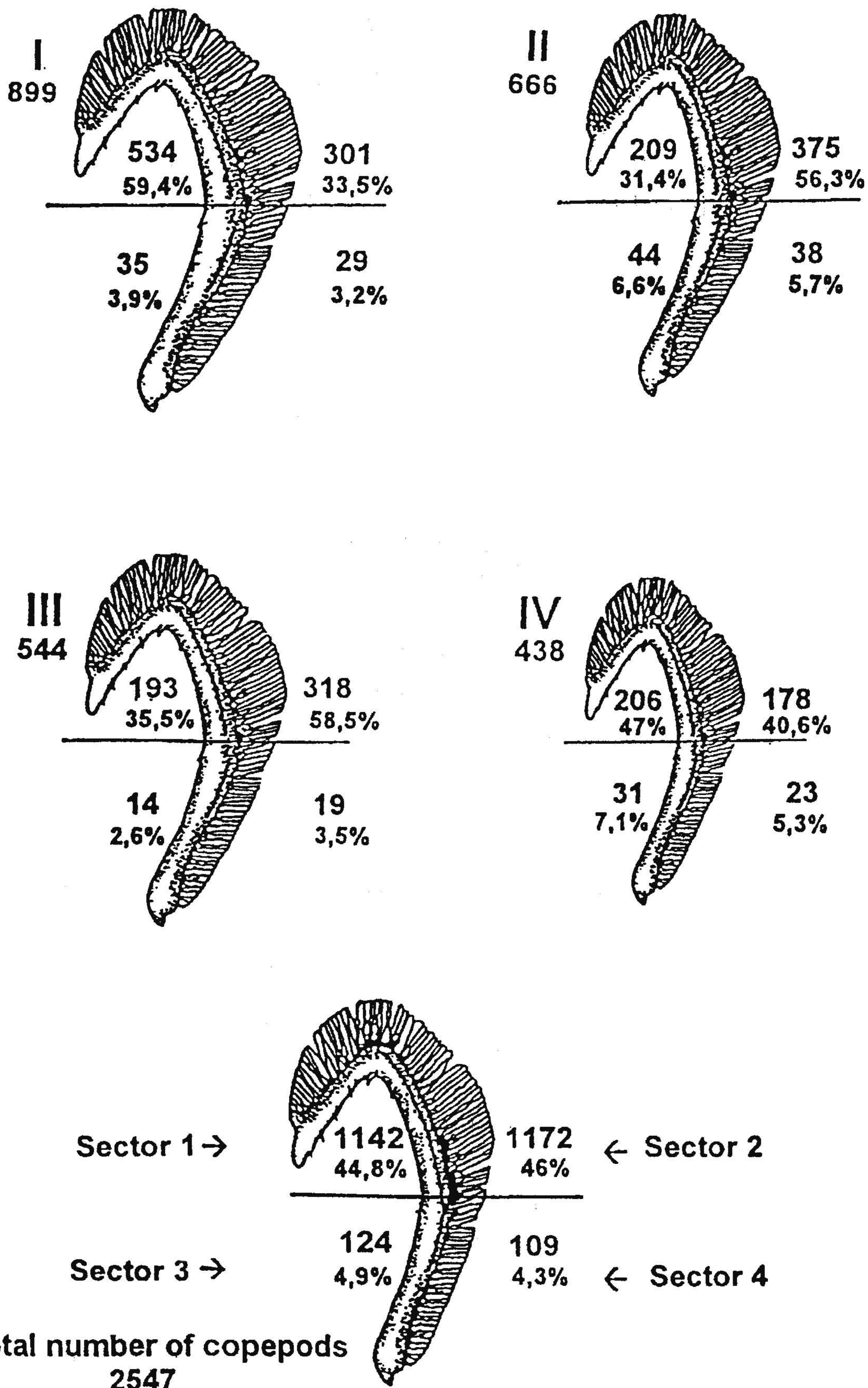


Fig. 1 The location of *Achtheres percarum* on the gills of pike-perch (number and percentage). The total number of copepods on each gill is given under its designation



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