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TOPOGRAPHIC SPECIFICITY OF *DIPLOZOON PARADOXUM* NORDMANN, 1832 (MONOGENEA: DIPLOZOIDAE) IN THE BREAM, *ABRAMIS BRAMA* (LINNAEUS, 1758) IN THE VISTULA LAGOON, POLAND

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SPECYFICZNOŚĆ TOPOGRAFICZNA *DIPLOZOON PARADOXUM* NORDMANN, 1832 (MONOGENEA: DIPLOZOIDAE) U LESZCZA *ABRAMIS BRAMA* (LINNAEUS, 1758) Z ZALEWU WIŚLANEGO, POLSKA

A b s t r a c t. Location of the monogenean *Diplozoon paradoxum* on the branchial arches of the Vistula Lagoon bream is described. The highest number of parasites was found on the first gill arch, followed by the numbers recorded on the second and third arches; the lowest numbers of the monogenean were typical of the fourth arch. About 70% of the monogeneas were found to dwell on the dorsal part of the branchial arch. It is concluded that the distribution of parasites is controlled by the direction of water flow through the gills as well as the size of the gill arch occupied by the helminths.

INTRODUCTION

Topographic (or topic) specificity is the process of selection, by parasites, of location in a host; it is demonstrated by both external and internal parasites. The process has already been described for various monogenean species by, i.a., RAMASAMY et al. 1985, STAROVOJTOV 1986, 1995, STAROVOJTOV et al. 1985, DOROVSKIKH 1988, DZIKA and SZYMAŃSKI 1989, JENSEN and JOHNSEN 1992, ROLBIECKI and ROKICKI 1996, BUCHMAN and ULDAL 1997, ROLBIECKI 1998. However, only a few records of *Diplozoon paradoxum* location were published. Moreover, the published data are incomplete, based on a very low number of parasites observed, for which reason they require supplementing with more detailed descriptions.

MATERIALS AND METHODS

Within December 1994 – March 1997, a total of 376 bream individuals (9-59.2 cm; 5-3800 g) were examined. The bream were caught in the Polish part of the Vistula Lagoon with zander-bream gill nets and fykes.

The monogeneans collected were fixed in a 1:19 mixture of formaldehyde and acetic acid and preserved in 70% ethanol.

The branchial arches examined were divided into two sections: dorsal and ventral.

RESULTS AND DISCUSSION

The adult *Diplozoon paradoxum* were found to occur in 71.8% of the bream individuals examined. A total of 2465 parasites were collected. The infestation intensity ranged from 1 to 26 individuals, the mean intensity being 9.1 individuals. The monogeneans were found on all four gill arches, the first arch being most heavily occupied. Lower numbers of the monogeneans were collected from the second and the third arch, the lowest numbers being typical of the fourth arch. The dorsal arch section harboured 68.6% of the monogeneans, 31.4% of them occurring on the ventral section (fig. 1). A single arch hosted usually from 1 to 4 (6 at the most) monogeneans. At the highest monogenean density, they were placed 10 to 20 mm apart. The right and left side arches yielded 1199 and 1266 monogeneans, respectively.

Diplozoon paradoxum is common in fresh and brackish waters in numerous cyprinids, the bream being a preferred host (PROST 1966, KHOTENOVSKIJ 1985). A parasite consists of a pair of individuals joined together by their hermaphroditic reproductive systems, whereby the permanent cross-fertilisation is ensured. Similarly to numerous other monogeneans, it shows location specificity within the host's gills.

The present study showed the numbers of *Diplozoon paradoxum* individuals to decrease from the external (closest to the operculum) to the centrally located gill arches. Similarly, WILES (1968) recorded the bream to house 38.9% of the monogeneans on the first branchial arch, 30.1% being found on the second arch; however, the third and fourth arches were occupied by 15.5% each. That author described also the parasite's location in the roach, gudgeon, and thunderfish. Depending on the species, the heaviest infestation was recorded on the first, second, or thirds gill arch, the lowest number of parasites being always typical of the fourth arch. In another study, OWEN (1963) found most mongeneans in the roach to be present on the second arch, the fourth arch showing the weakest infestation. Direction of the water flow was identified as the most important factor controlling the monogenean location in the gills (RAMASAMY 1985, STAROVOJTOV et al. 1985,

DOROVSKIKH 1988). The invasive *D. paradoxum* larvae reach the gill arches mostly via the mouth, when a fish actively breathes. Once in the gills, the parasites move from one arch to the other or into the area where the water flow is at its slackest, to prevent themselves from being rinsed out. Unfortunately, the breathing mechanism of the bream has not been described. Perhaps the major flow passes through the fourth branchial arch, or between the third and the fourth arch. It seems, however, that the major stream of water should be passed primarily through those gills having the largest respiratory area (the first, second, or third arch), the smallest respiratory area gill arch (the fourth) having more restricted contact with the flow.

The low number of monogeneans found on the fourth, smallest, gill arch, amounting to a half of that found on the remaining arches, might have been caused by other factors, such as food availability or the size of the location occupied by a parasite (STAROVOJTOV 1986). The parasite population must have evolved mechanisms controlling their density on individual branchial arches. *D. paradoxum* is a large monogenean (up to 1 cm in length) which occupies a relatively large area on the gill arch. The breams examined usually haboured 4 monogeneans, 6 at the most, on a gill arch, the parasites being always placed a distance apart from one another to have enough living space. Due to its size, the fourth arch has the lowest potential as a food source, so it cannot accommodate as many parasites as the other arches do.

All the arches showed more parasites to have been located in the dorsal sections, the ventral sections housing half as many monogeneans (fig. 1). In this context, data reported by WILES (1968) who found as few as 76, 64, and 297 parasites in the bream, roach, and thunderfish, respectively, are difficult to comment upon. The partitioning of the monogeneans between individual gill arches and their sections seems to implicate the direction of water flow through the gills to be the controlling factor, the direction of outflow being apparently more important here. In many fish species, e.g., in zander (*Stizostedion lucioperca*) or rudd (*Scardinius erythrophthalmus*), the water leaving the branchial cavity is directed vertically downwards (around the ventral section of the gill arches) through the branchial opening (STAROVOJTOV et al. 1985, DOROVSKIKH 1988). Before they evolve the proper attachment organs (clamps), the diorpae attach to a host's gills using hooks at first and the secretion of the posterior adhesive glands later (KHOTENOVSKIJ 1985). As the larval attachment organs are relatively weak, the larvae are forced to migrate to areas where the flow is slacker, i.e., to the dorsal sections of the branchial arches. Some of the diporpae only manage to hold fast to the ventral section before they form the clamps. Presumably, the adult forms, too, find it difficult to overcome the strong flow of water around the ventral section, for which reason they avoid it.

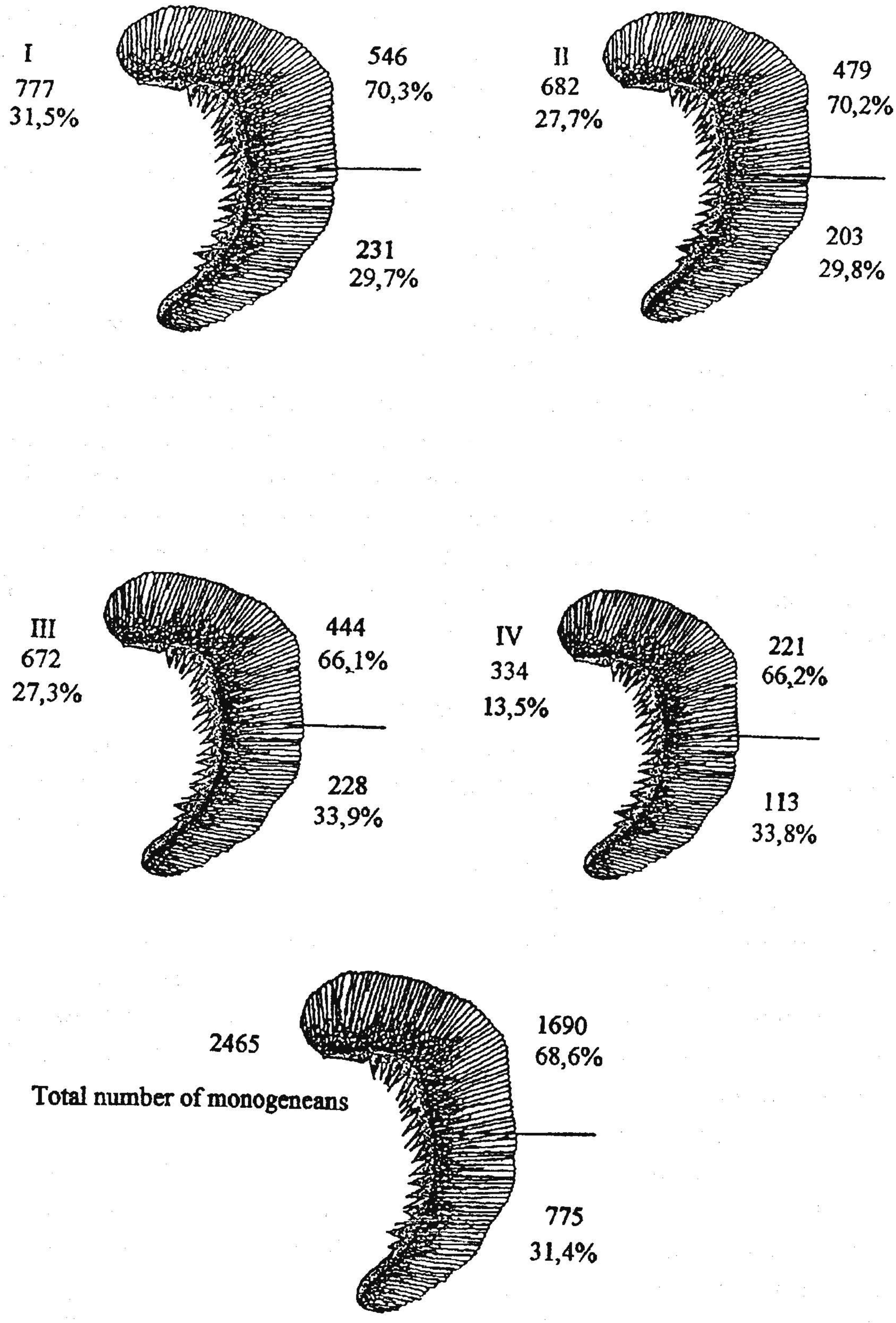

Fig. 1. Location of *Diplozoon paradoxum* on bream gills (numbers and per cent distribution)

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