Occurrence of *Acanthocephalus minor* (Acanthocephala) in Two Types of the Goby, *Chaenogobius annularis*

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The forktongue goby, *Chaenogobius annularis* Gill, is widely distributed in Japan, and is divided into three types from morphological and ecological properties: freshwater, brackishwater and middle-reach types (Nakanishi, 1978a, b). Although eight species of helminths have been reported from this fish (see Kamegai and Ichihara, 1972), no information is available on the occurrence of parasites among these types. During the course of stomach content analysis of the fish from the Ryukei River, Hokkaido, we found *Acanthocephalus minor* Yamaguti, 1935 (Acanthocephala: Echinorhynchidae) in the intestine of the fish, and examined its occurrence in the freshwater and middle-reach types which were abundant in the river.

Materials and methods

On September 5~6, 1976, a total of 111 forktongue gobies was collected from the Ryukei River, Kami'iso-cho, Hokkaido, with a hand net. The fish were fixed in 10% formalin immediately after capture and brought to the laboratory. They were measured, weighed, and opened by a mid-ventral incision. Their intestines were removed and divided into four segments: fore-intestine, middle-intestine, hind-intestine and rectum. The number of *A. minor* recovered from each segment was recorded. The fish examined ranged from 6.9 to 15.2 cm in total length, and were all 1 year old or more.

Results

The incidence and intensity of *A. minor* in the two types of the forktongue goby are shown Table 1. The freshwater type was more frequently and heavily infected with this parasite than the middle-reach type. Worms were located mainly in the rectum (Fig. 1). In a heavy infection, the rectum was swollen with many worms.

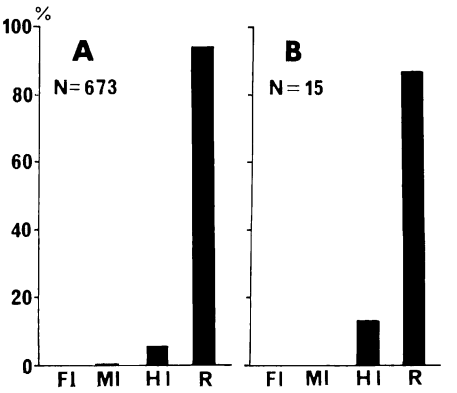

Fig. 1. Distribution of *Acanthocephalus minor* in the intestine of *Chaenogobius annularis*. A: Freshwater type. B: Middle-reach type. FI, fore-intestine; MI, middle-intestine; HI, hind-intestine; R, rectum.

Discussion

It is of interest that there was a marked difference in the occurrence of *A. minor* between the freshwater and middle-reach types of the fish collected from the same river. This may be caused by the differences in the habitats and foods of the types. Nakanishi (1978b) noted that, when both types coexist in a river, the freshwater type inhabits muddy pools, but that the middle-reach type lives in stony riffles and shoals. Such habitat segregation was also recognized by our field sampling. We caught most of specimens of the freshwater type from pools edged with rooted vegetation and those

Table 1. Occurrence of *Acanthocephalus minor* in two types of *Chaenogobius annularis*.

Type	No. of fish examined	No. of fish infected	Incidence[a]	Mean intensity[b]	Intensity range[c]
Freshwater type	55	43	78.2	15.7	1–179
Middle-reach type	56	10	17.9	1.5	1–3

[a] Percentage of fish infected; [b] mean number of worms per infected fish; [c] range of number of worms per infected fish.

of the middle-reach type from gravelly riffles. It is well known that there are differences in the occurrence and abundance of benthic invertebrates between pool and riffle (e.g., Tanaka, 1958; Mizuno and Gose, 1972). Since *Asellus hilgendorfi* Bovallius (Crustacea: Isopoda), the intermediate host of *A. minor*, is intolerable to rapid current, this isopod appears to be more abundant in pools than in riffles. The rooted vegetation on pool sides must also provide a habitat suitable for the isopod. Therefore, the pool-dwelling freshwater type is presumed to take more *A. hilgendorfi* as food and to become more heavily infected with the parasite than the riffle-dwelling middle-reach type. However, we did not find any *A. hilgendorfi* and its remains in the alimentary tracts of either type, and could not verify this speculation. Since the forktongue goby eats *A. hilgendorfi* mainly from March to May in the Ryukei River (Nagasawa, Egusa and Ishino, unpublished), there may be difference in the isopod intake between the two types during this period.

Most *A. minor* were attached to the rectum of the forktongue goby. A similar observation was made by Awakura (1972), who reported that this parasite was concentrated in the posteriormost intestinal region of some salmonid species and the threespine stickleback except for the case of heavy infection. These observations suggest that *A. minor* distinctly exhibits habitat specificity for the rectal region of fish. However, we do not know whether such posterior distribution of the parasite results from initial site preference or from backward migration with maturation as observed in other echinorhynchids (Bullock, 1963; Chubb et al., 1964; Awachie, 1966; Telda and Fernando, 1970; Amin, 1975), and further work is needed for clarification.

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ウキゴリ2型における鉤頭虫 *Acanthocephalus minor* の寄生状況

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1976年9月，北海道上磯町流渓川よりウキゴリ淡水型と中流型を採集し，両型における鉤頭虫 *Acanthocephalus minor* の寄生状況を比較した．その結果，本鉤頭虫の寄生率は中流型よりも淡水型のほうが高く，寄生数も同様の傾向が認められた．これは，淡水型と中流型がそれぞれ淵と瀬にすみわけており，前者が淵に多く分布する中間宿主のミズムシ *Asellus hilgendorfi* (等脚類) を多数捕食するためであると考えられた．また虫体は両型の直腸に集中的に寄生していたが，その原因は今のところ不明である．

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