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Seasonality of the Infection of *Acanthochondria brevicorpa* (Copepoda) on a Gobiid Fish *Acanthogobius hasta* off the South Coast of Korea

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한국 남해안의 풀망둑에 기생하는 요각류 *Acanthochondria brevicorpa* 감염률의 계절성

서 해 립
전남대 해양학과

The fish host, *Acanthogobius hasta*, was sampled monthly (April 1990 to March 1991) from Wando Islands, Korea, and examined for the parasitic copepod *Acanthochondria brevicorpa*. Prevalence was positively correlated with fish length; parasitic copepods were only found in fishes >24 cmTL. Distinct seasonal variation in prevalence and intensity of *A. brevicorpa* infection was observed, although no data were available in April, June and July 1990 when no *A. hasta* was caught. Averaged over all samples, of the 83 fishes caught, 34.9% were infected with a mean intensity of 3 copepods per host. No *A. brevicorpa* was found on the host between August and October. Ovigerous females of the copepod were found between February and May, with an abundance peak in May. Young copepodids (CI to CIII) of *A. brevicorpa* were not present throughout the year, but only late copepodids of CIV and CV were found on the fish in March and May. Results from the present study suggest that *A. brevicorpa* mainly produces larvae in spring, and may have a life cycle including additional hosts.

완도 해역에서 1990년 4월에서 1991년 3월까지 숙주 어류인 풀망둑을 월별 채집하여 기생성 요각류 *Acanthochondria brevicorpa*를 조사하였다. 감염률은 숙주 크기와 陽의 相關이었다. 기생성 요각류는 全長이 24 cm 이상되는 어류에서만 채집되었다. 숙주가 잡히지 않아 1990년 4, 6, 7월의 자료를 얻을 수 없었음에도 불구하고 *A. brevicorpa*의 감염률과 감염강도에서 뚜렷한 계절변동이 나타났다. 채집된 어류 83마리 중 34.9%가 요각류에 감염되었고, 평균 감염강도는 요각류 3마리이었다. 8월과 10월 사이에는 숙주에서 요각류가 전혀 발견되지 않았다. 抱卵한 요각류는 2월과 5월 사이에 나타났으며, 5월에 가장 많이 출현하였다. 요각류의 유생 중 CI에서 CIII 유생은 조사기간에 1마리도 채집되지 않았으며, 3월과 5월에 CIV와 CV 유생이 약간 발견되었을 뿐이었다. 본 연구결과에서 요각류 *A. brevicorpa*는 주로 봄에 生殖하고, 추가적인 숙주를 포함하는 生活環을 갖는 것으로 추정되었다.

INTRODUCTION

In coastal waters of the western North Pacific, the species of *Acanthochondria* were thought to be the important parasitic copepod on the gobiid fishes. There are three *Acanthochondria* species known in Korean waters: *Acanthochondria brevicorpa, Acanthochondria yui* and *Acanthochondria tchangi*. Of these, *A. brevicorpa* is the only species of Chondracanthidae parasitic on *Acanthogobius hasta* (Suh et al., 1992). Previous studies focused on its taxonomy and morphology, but its ecology has received scant attention (Yu, 1935; Izawa, 1986; Suh et al., 1992). Recently, Suh et al. (1993)

Table 1. Monthly changes in prevalence, relative density and mean intensity of *Acanthochondria brevicorpa* on the goby, *Acanthogobius hasta*. No host fish was caught in April, June and July 1990. Values in parentheses indicate numbers of ovigerous female

Month	Temp. (℃)	No. of fish examined	Prevalence (%)	Relative density	Mean intensity	No. of copepod cellected Adult female	Adult male	CV	CIV
May (1990)	15.3	9	100.0	11.1	11.1	96 (43)	94	3	1
August	24.3	6	0.0	0.0	0.0	0	0	0	0
September	23.0	7	0.0	0.0	0.0	0	0	0	0
October	17.7	10	0.0	0.0	0.0	0	0	0	0
November	12.4	2	50.0	0.5	1.0	1 (0)	1	0	0
December	11.3	9	22.2	0.2	1.0	2 (0)	2	0	0
January (1991)	9.4	10	10.0	0.1	1.0	1 (0)	1	0	0
February	7.5	14	57.1	0.9	1.6	13 (5)	13	0	0
March	10.0	16	50.0	1.3	2.5	18 (5)	17	2	0

reported the ecology of *A. yui* on a gobiid fish, *Acanthogobius flavimanus*. In the present study, I report ecological investigations on the seasonal variability of the prevalence, relative density, mean intensity and maturity of *A. brevicorpa* on *A. hasta* based on the year-round survey.

MATERIALS AND METHODS

Twelve trawl surveys were carried out at monthly intervals between April 1990 and March 1991 from a single station located in Wando Islands, southern Korea (34° 26'N, 126° 50'E). A detailed description of the sampling and analyzing methods was given by Suh et al (1993). Surface water temperature reached a maximum (24.3 ℃) in August and a minimum (7.5℃) in February (Table 1). The net was towed at 3 knots for about 1 hour on a trawl station during the daytime in order to examine monthly changes in fish abundance and size distribution. Gobies separated from the rest of catches were transported to the laboratory, where they were identified to the species, measured and dissected to examine the parasitic copepods. In total, 83 individuals of *Acanthogobius hasta* were sampled.

All *Acanthochondria brevicorpa* collected were present on the gills of the fish host *Acanthogobius hasta*. The copepods were then counted, preserved and sexed; a stereomicroscope was used to identify developmental stages. Lack of information on the developmental stages of *A. brevicorpa* led me to use the criteria of a congener *Acanthochondria yui* reported by Izawa (1986). The following three terms of the level of parasitic infection, according to Margolis et al. (1982), are used in this paper: prevalence (percentage of infested host), relative density (mean number of parasites per host examined), and mean intensity (mean number of parasites per infested host).

RESULTS AND DISCUSSION

Seasonality of Acanthochondria brevicorpa infection

Seasonal variability in prevalence, relative density and mean intensity is presented in Table 1. Except for April, June and July when no *Acanthogobius hasta* were caught, gobies were examined every month over a year. Prevalence fluctuated between 0 (August to October) and 100% (May), with an average 34.9% on a total of 83 gobies. During the months when the copepod infection was observed, mean intensity varied between 1.0 (November to January) and 11.1 (May) parasites per fish; the total number of copepods found being 265, with an average mean intensity of 4.7 copepods per infected goby. During a period of November to May, relative density ranged from 0.1 (January) to 11.1 (May), with an average 1.6 copepods per goby.

Population structure of *Acanthochondria brevicorpa* showed a pattern of monthly fluctuation

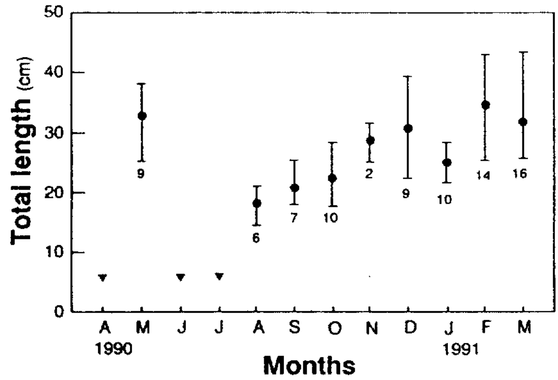

Fig. 1. Monthly changes in total length of fish (*Acanthogobius hasta*) examined. Total length is the mean value for the number of fish indicated below each point. Bars indicate range of total length. Triangles refer to months when no *A. hasta* were found.

(Table 1). Ovigerous females were present between February and May, but no fish host was caught in April. During the months when ovigerous females were encountered, others without egg sacs were also always present. The occurrence of the ovigerous females in May was greater than that of February/March; the figures in May, February/March were 44.8, 38.5 and 27.8%, respectively. Late copepodids of CIV and CV present in March and May make up the smallest part (0.02%, 6 out of 137) of the whole females throughout the year, while most females were found as the adult (Table 1). These results show that recruitment of *A. brevicorpa* mainly takes place in spring.

Length of the host and Acanthochondria brevicorpa infection

The gobiid fish *Acanthogobius hasta* examined varied in total length between 14.5 and 43.3 cm (Fig. 1). There were seasonal changes in size composition of *A. hasta* samples; mean total length of gobies caught was lowest in August (18.3 cmTL) and highest in February (34.4 cmTL). Although no gobies <24 cmTL carried the copepods, prevalence increased with length of goby. The general premise of increase in prevalence

Table 2. Prevalence of infection and mean intensity of *Acanthochondria brevicorpa* on different size classes of *Acanthogobius hasta*

Size class (mm)	No. of fish examined	Prevalence (%)	Mean intensity
12-<16	2	0.0	0.0
16-<20	6	0.0	0.0
20-<24	11	0.0	0.0
24-<28	19	31.5	3.6
28-<32	21	38.1	4.0
32-<36	6	60.0	1.7
36-<40	9	77.7	9.4
40-<44	9	83.3	3.0

of infection with the size of the host was evident in this study. However, mean intensity, which also varied with size of the host, was highest in the size class 36-<40 cmTL (9.4 copepods per fish), but dropped to 3.0 in the 40-<44 cmTL (Table 2).

The population of *Acanthochondria brevicorpa* in Wando Islands, Korea did not uniformly infect all individuals within host population of *Acanthogobius hasta* (Tables 1, 2). This implies that either their chances of infecting different host individuals were not equal, or some individuals of the host were more suitable than others. This may be associated with the biological history of the host fish. The copepods are able to locate some parts of the population more readily than others (Kabata, 1981). Fishes of a certain size (or age) group could be much more likely to be infected by the copepod if, for example, that size group migrated to an area inhabited by the copepod. As shown in Fig. 1, *A. hasta* population was spatially segregated by size. It has been known that *A. hasta* are engaged in foraging food in coastal waters throughout the year, and spawn in spring at the breeding burrows which was constructed by mature fishes in the tidal flat sediment (Chyung, 1977). The occurrence of adult females of *A. brevicorpa* was higher in February, March and May as compared with the other months, implying that main infection occurred in spring. Thus, seasonal changes in the prevalence and intensity of *A. brevicorpa* infection could be related to the breeding behavior of *A. hasta*.

Possibility of additional hosts

In the species belonging to the Chondracanthidae, the first infective stage was CI, incapable of surviving without the host (Kabata, 1981). In Japanese waters, Izawa (1986) found the all copepodite stages of *Acanthochondria yui* on *Acanthogobius flavimanus*, which were sampled in May. In spite of the lack of detailed information on life cycle of Chondracanthidae, Ho (1984) proposed that "chondracanthids live on one host only". This was not supported by Suh et al. (1993), who could not find young copepodids (CI to CIII) of *A. yui* on *A. flavimanus* throughout the year, but found only a few individuals of late copepodids of CIV and CV in April and May. This suggests the presence of another host during copepodids of CI to CIII of *A. yui*. The results of seasonal variation in *Acanthochondria brevicorpa* infection found in this study are very similar to recent records obtained from *A. yui* (Suh et al., 1993). The similarity between these results further supports the possibility of the presence of additional hosts at least during the stages of CI to CIII of *A. brevicorpa*, like *A. yui*. Thus it is suggested that *A. brevicorpa* in Korean waters have life cycle involving other hosts in addition to *Acanthogobius hasta*.

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REFERENCES

Chyung, M.-K., 1977. The Fishes of Korea. Iljisa Publ. Co., Seoul, 727pp. (in Korean).

Ho, J.-S., 1984. Accessory antennule and the origin of the Chondracanthidae (Poecilostomatoida). *Crustaceana, Suppl.* 7: 242-248.

Izawa, K., 1986. On the development of parasitic Copepoda. IV. Ten species of poecilostome cyclopoids, belonging to Taeniacanthidae, Tegobomolochidae, Lichomolgidae, Philoblennidae, Myicolidae, and Chondracanthidae. *Publ. Seto Mar. Biol. Lab.*, **31**: 81-162.

Kabata, Z., 1981. Copepoda (Crustacea) parasitic on fishes: Problems and perspectives. *Adv. Parasitol.*, **19**: 1-71.

Margolis, L., G. W. Esch, J. C. Holmes, A. M. Kuris, and G. A. Schad, 1982. The use of ecological terms in parasitology (Report of an ad hoc comittee of the American Society of Parasitologists). *J. Parasitol.*, **68**: 131-133.

Suh, H.-L., J.-D. Shim, and S.-D. Choi, 1992. Four species of Copepoda (Poecilostomatoida) parasitic on marine fishes of Korea. *Bull. Korean Fish. Soc.*, **25**: 291-300.

Suh, H.-L., J.-D. Shim, and S.-D. Choi, 1993. Ecology of *Acanthochondria yui* (Copepoda, Poecilostomatoida) on a gobiid fish *Acanthogobius flavimanus* in Wando Islands, Korea. *Bull. Korean Fish. Soc.*, **26**: 258-265. (in Korean with English abstract)

Yu, S. C., 1935. Studies on the parasitic copepods of China belonging the family Chondracanthidae. *Bull. Fan Mem. Inst. Biol.*, **6**: 1-16.

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