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Influence of Originated Host and Water Temperature on the Infectivity and Growth of *Microcotyle sebastis* (Monogenea)

Ki Hong Kim*, Jae Bum Cho and Soo-Il Park

Department of Aquatic Life Medicine, College of Fisheries Sciences, Pukyong National University, Pusan 608-737, Korea

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To investigate the influence of originated host and water temperature on the infectivity and growth of *Microcotyle sebastis*, juveniles of Schlegel's black rockfish (*Sebastes schlegeli*) were exposed to the eggs of *M. sebastis* originated from Schlegel's black rockfish and black rockfish (*Sebastes inermis*) at 10 ℃ and 20 ℃. There were significant differences between the two isolates in the infectivity of eggs, and the growth of worms. The growth of *M. sebastis* was significantly affected by water temperature, and worms grew faster in 20 ℃ than in 10 ℃.

Key words: *Microcotyle sebastis*, rockfish, temperature, infectivity, growth

Introduction

Production of Schlegel's black rockfish, *Sebastes schlegeli*, from aquaculture has rapidly increased during the past decade, and Schlegel's black rockfish has become one of the important cultured marine fish in Korea. Black rockfish, *Sebastes inermis*, is another cultured marine rockfish, and the fingerlings of black rockfish are captured around the coastal areas and cultured in netpens in Korea. One problem associated with rockfish farming in Korea is the infestation with gill parasitizing monogeneans, *Microcotyle sebastis*.

M. sebastis belongs to the family Microcotylidae, which is a large monogenean family and comprises 39 genera and about 150 species according to the recent revision by Mamaev (1986). In the genus *Microcotyle*, 48 species are recorded, but the validity of the classification of them has not been confirmed yet. *M. sebastis* is a sanguinivorous polyopisthocotylean species. A small amount of blood is ingested by each worm, but mass infection could remove a significant amount of blood. Thoney (1986) suggested that heavy infection of polyopisthocotyleans on individual host can be pathogenic and cause mortalities.

The existence of intraspecific strains of helminths that differ in one or more ways such as structure, physiology, behavior, virulence, response to drugs, and host specificity has been recognized in nature (Haley, 1962), but little is known about intraspecific variability of *M. sebastis*. Thompson (1988) proposed that the term 'strain' should be used to refer to variants within a species of parasite that have been differentiated by using as many criteria as possible. Infectivity and growth of a parasite species are important criteria in characterizing helminth strains.

In the present study, influence of host origin and water temperature on the infectivity and growth of *M. sebastis* were investigated.

Materials and Methods

Naive fish. Juvenile Schlegel's black rockfish (body length: 5~6 cm) were obtained from a hatchery in Tongyoung, Korea, and determined to be free from infection with *M. sebastis* by examining 10 fish out of 80 fish. The fish were maintained in a flow-through laboratory system for 6 months prior to the experiment.

Infected fish. A number of netpen reared juvenile Schlegel's black rockfish (body length: 11~12 cm) were obtained from a local rockfish producer in Tongyoung, Korea. The presence of *M. sebastis* on the gills was confirmed by examining 10 fish out of 150 fish.

Black rockfish were purchased from a local marine product market and were confirmed to be heavily infected with *M. sebastis*.

*To whom correspondence should be addressed.

Collection of *M. sebastis* eggs. The water containing each rockfish species infestated with *M. sebastis* was filtered through Müller gauze (100 μm), and the eggs of *M. sebastis* were collected using a stereomicroscope. Collected eggs from each rockfish species were placed in separate vessels containing filtered seawater and incubated for 7 days at 20℃. The maturity of oncomiracidium in eggs was confirmed microscopically, and only mature eggs were used in the experiment.

Experimental infections. The naive juvenile Schlegel's black rockfish were separated into 5 groups of 6 individuals, and were transferred from holding tanks to 50 ℓ experimental fiberglass tanks and allowed to acclimate for 2 weeks before experimental infection. The experimental regime is shown in Table 1. At 4 weeks post-infection, all fish in each group were examined for the parasites. All recovered worms from each fish were counted, and the body length and clamp number of each worm, which were fixed in 70% hot ethanol, were measured microscopically.

Statistical test. Statistical analysis of the data was done on SPSS software (SPSS 7.5 for Windows, SPSS Inc.). The significance of differences in infectivity, worm length and clamp number among experimental groups was tested by one way analysis of variance (ANOVA), and Tukey's test was used to distinguish between the significantly different mean values. Probability values of less than 0.05 was considered significant.

Results

The microcotylid eggs originated from Schlegel's black rockfish showed considerably higher infection rate than the eggs from black rockfish (Table 2). The fish exposed by the eggs from Schlegel's black rockfish (groups I and II) or in group V, which was exposed by 4,000 eggs from black rockfish, showed significantly higher abundance than the fish exposed by 750 and 1500 eggs from black rockfish (Table 3). The prevalence and abundance were not affected significantly by the difference of water temperature from the comparing group I and group II.

The origin of *M. sebastis* eggs markedly influenced on the growth of worms, but did not affect significantly on the clamp number. The worms collected from the fish infected with the eggs from Schlegel's black rockfish were significantly larger than the worms collected from the fish infected with the eggs from black rockfish, but were not significantly different in clamp number (Fig. 1 and Table 4).

Table 1. Sources of *M. sebastis* eggs, exposed number of eggs, and water temperature in each experimental group

Groups	Source of eggs	Exposed number of eggs	Water temperature (℃)
Group I	Schlegel's black rockfish	750	10 ± 1
Group II	Schlegel's black rockfish	750	20 ± 1
Group III	Black rockfish	750	20 ± 1
Group IV	Black rockfish	1,500	20 ± 1
Group V	Black rockfish	4,000	10 ± 1

Table 2. Success rate of infection, prevalence and abundance of microcotylids in each experimental group of Schlegel's black rockfish

Groups	Success rate of infection (%)	Prevalence[1] (%)	Abundance[2]
Group I	9.87	100.0	12.33 ± 5.92
Group II	13.07	100.0	16.33 ± 4.37
Group III	1.33	66.7	1.67 ± 1.63
Group IV	1.00	83.3	2.50 ± 1.38
Group V	2.48	100.0	21.20 ± 11.45

[1]Prevalence: number of individuals of fish infected with *M. sebastis* ÷ number of fish examined
[2]Abundance: total number of *M. sebastis* recovered ÷ total number of fish examined

Table 3. Statistically significant levels between pairs of experimental groups in microcotylid abundance using Tukey's test

	Group II	Group III	Group IV	Group V
Group I	0.759	0.031*	0.049*	0.122
Group II	–	0.002*	0.003*	0.648
Group III		–	0.999	0.000*
Group IV			–	0.000*

(*, statistically significant at $p<0.05$)

Table 4. Statistically significant levels between pairs of experimental groups in body length and clamp number of recovered microcotylid worms using Tukey's test

	Group II	Group III	Group IV	Group V
Group I	0.000*	0.000*	0.000*	0.028*
	(0.000)*	(0.000)*	(0.000)*	(0.567)
Group II	–	0.000*	0.000*	0.000*
	–	(0.956)	(0.282)	(0.000)*
Group III		–	0.922	0.000*
		–	(0.795)	(0.000)*
Group IV			–	0.000*
			–	(0.000)*

(*, statistically significant at $p<0.05$)

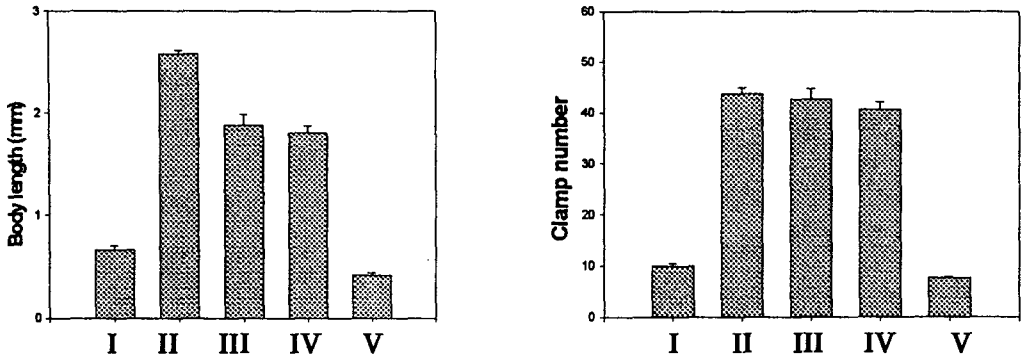

Fig. 1. Body length and clamp number of worms collected from the fish in each experimental groups of Schlegel's black rockfish (means ± SE).

Water temperature significantly affected both the growth of worms and clamp numbers. The worms recovered from the fish reared at 20℃, were markedly larger in body length and significantly higher in clamp numbers than the worms collected from the fish reared at 10℃ (Fig. 1 and Table 4).

Discussion

The results revealed that the infectivity and the growth of *M. sebastis* were significantly different according to the originated host of the eggs. Haley (1958) demonstrated that serial passage in golden hamsters of *Nippostrongylus brasiliensis* from rats resulted in a population of the parasite with a specificity different from that of the parent population. Parasite species, more often than free-living organisms, may experience considerable variation in the parameters influencing genetic structure due to variation in ecological factors among different definitive host species (Nadler, 1995). It can be conjectured, therefore, that *M. sebastis* parasitized on each species of rockfish have changed their host relationships through prolonged contact with the selective action of new or changed environments including host species.

It is well known that temperature affects the reproduction rate, growth rate and life span of monogeneans (Kamiso and Olson, 1986; Ogawa, 1988), and generally the growth rate of monogeneans has a positive correlation with the water temperature. In the present study, the growth of *M. sebastis* was significantly affected by the water temperature, also.

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