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***Anisakis simplex* (Nematoda: Anisakidae) larvae infection
in Chum salmon (*Oncorhynchus keta*) from Namdae River,
Korea in 2008**

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***Anisakis simplex* (Nematode : Anisakidae) larvae infection in Chum salmon (*Oncorhynchus keta*) from Namdae River, South Korea in 2008**

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ABSTRACT

The prevalence and intensity of *Anisakis simplex* larvae in Chum salmon (*Oncorhynchus keta*) from the Namdae River, Korea in 2008 were investigated. 120 fish samples in total were collected during October~November 2008. All of chum salmon samples caught in Namdae River were infected with *A. simplex* larvae (100 %) and the average intensity of infection was 69.65±48.58 (larvae/host). Based on the morphological analysis, this nematode was considered as *A. simplex* third stage larvae (L-3 larvae). The nematodes were found mostly in muscle (98.00 %). Intensity of infection and the length of larvae tended to increase with the increase of host body length.

Key words : *Anisakis simplex*, *Oncorhynchus keta*, chum salmon

INTRODUCTION

Anisakis simplex (Nematode: Anisakidae) is one of the common parasites of marine organisms world-wide. Their life cycles involve crustaceans, fishes, cephalopods and marine mammals. These organisms act as intermediate, paratenic or transport hosts and definitive hosts. Occurrence and prevalence of *A. simplex* larvae is a great importance for human health (Ancillo *et al.*, 1997, Audicana *et al.*, 2002, Eguia *et al.*, 2003, Gomez *et al.*, 2004), economic reasons (Inoue *et al.*, 2000) and ecological aspect (Konisi and Sakurai, 2002; Klimpel *et al.*, 2004, 2007; Podolska *et al.*, 2006).

The infection of *Anisakis* sp. in salmonid has been reported in several studies (Sugawara *et al.*, 2004; Sepulveda *et al.*, 2004; Urawa and Fujisaki, 2006; Kim *et al.*, 2007). However, still scarce information about *A. simplex* infection in Korea exist at present time, although the occurrences of anisakidosis have been reported. The aims of this research are to investigate the prevalence, intensity and distribution of *A. simplex* larvae in Chum salmon (*O. keta*) from the Namdae River, Korea.

MATERIALS AND METHODS

Sample collection:

One hundred and twenty fish samples in total were collected during October~ November 2008. The fish were caught using a river-blocking set net at the mouth of the river. Whole fish were transported to the laboratory and immediately frozen until examination.

Samples examination and population descriptor

Each of fish sample were thawed, measured fork length and body weight, sexed and examined for the parasites (Table 1). The examination of Anisakid worm was conducted on body cavity, internal organ and muscle. The visceral organ were separated and carefully observed with

a stereo microscope. Fish muscle were sliced, and then observed with the naked eye under candle light. Collected parasites were washed with 0.9 % NaCl solution, then preserved in 5 % glycerin in 70 % ethanol for morphological analysis. For light microscopic observation, whole part of the worm will cleared in glycerin-phenol-lactic acid-distilled water solution (2:1:1:1) and individually mounted on slides using Canada balsam. Light microscope and Leica Application Suite program were used for observing the morphological characters. Population descriptor used are prevalence (a number of host infected with parasites divided by the number of host examined, expressed as percentage) and mean intensity (average of infection of parasite among the infected fish) (Bush *et al.*, 1997).

RESULTS AND DISCUSSION

All of chum salmon samples caught in Namdae River were infected with *Anisakis simplex* larvae (100 %) and the average intensity of infection was 69.65 ± 48.58 (larvae/host). Totally 8,358 larvae have been collected from 120 fish sample (male =58 fishes, female =62 fishes). Based on the morphological analysis, this nematode was considered as *A. simplex* third stage larvae (L-3 larvae). The nematodes were found mostly in muscle surrounding the visceral organs (98.00 %), with the mean intensity 68.26 ± 47.83 (larvae/host). Only a few of anisakid larvae were found in pyloric caeca, liver and others organ (Table 2). Similar results were reported by Sugawara *et al.* (2004) and Urawa & Fujisaki (2006). They reported the high prevalence and mean intensity of *A. simplex* in adult chum salmon returning to the Chitose River, Japan and it was increased year by year.

Deardorff and Kent (1989) investigated wild and pen-reared salmon. They reported that wild-caught salmon were infected *A. simplex* in high prevalence (100%) with mean intensity of 14 ± 1.2 (larvae/host). Of the *A. simplex* found in this study, 87% were recovered from the edible musculature. Several studies have shown a high prevalence of *Anisakis* spp. on salmonid species and mostly found in musculature. In contrast, *A. simplex* larvae can occur in body cavity, liver, kidney and gonad in the others host. The majority of larvae were associated with the visceral organs, mesenteries, and peritoneum (Wharton *et al.*, 1999).

The highest mean intensity of *A. simplex* infection occurs in chum salmon with 55.1-60.0 cm of body length, while the lowest mean intensity occur in chum salmon with body length less than 50 cm. Intensity of infection and the length of larvae tended to increase with the increase of body length. (Fig.1). Intensity distribution of *A. simplex* infecting Chum salmon in Namdae River showed negative binomial curve. Most of the host were infected with 21 ~ 100 parasites (66.67%) and only 3.3% of the host were infected more than 200 parasites (Fig. 2). The highest number of *A. simplex* larvae recorded from one fish was 229. The average body length of the total *A. simplex* larvae examined was 24.60 ± 2.449 mm.

Several studies reported the differences of prevalence and intensity of *A. simplex* infection in various fish species from different regions (Strommes and Andersen, 1998; Manfredi *et al.*, 2000; Abollo *et al.*, 2001). Occurrence of *A. simplex* can be used as biological indicator for several ecological studies. A long term survey is necessary for providing useful information on chum salmon populations in Korea.

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Table 1. Sampling date, the number and fork length of fish samples

Sampling Date	Number of samples	Fork length (cm)
October 29, 2008	30	62.3 ± 5.00
November 5, 2008	30	57.5 ± 3.78
November 21, 2008	40	56.1 ± 5.32
November 28, 2008	20	60.3 ± 4.32
Total	120	58.73 ± 5.31

Table 2. The distribution and intensity of *A. simplex* in chum from Namdae River, Korea

Organ	%	Intensity (mean ±SD, (range))
Liver	0.66	1.53 ± 1.06 (1- 5)
Muscle	98.0	68.26 ± 47.83 (8-228)
Body cavity	0.39	1.14 ± 0.35 (1-2)
Pyloric caeca	0.85	2.03 ± 1.64 (1-8)
Others	0.10	1.0
Total	100	69.65 ± 48.58 (9-229)

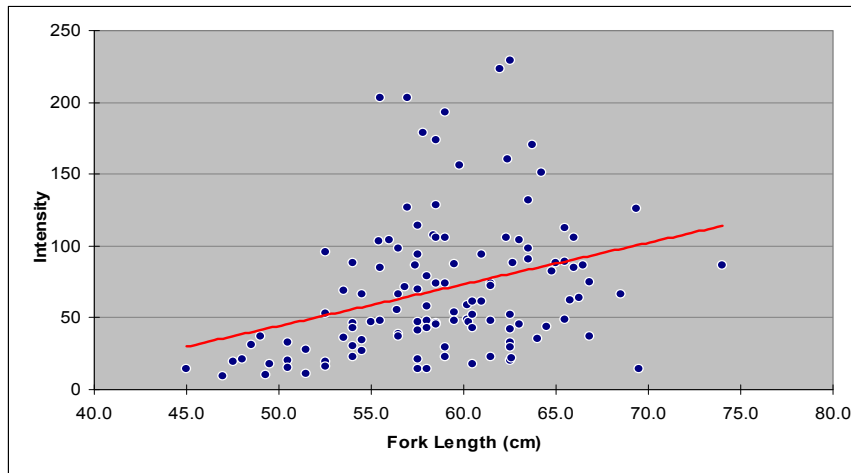


Fig. 1. Relationship between intensity of *A. simplex* and the host length (fork length).

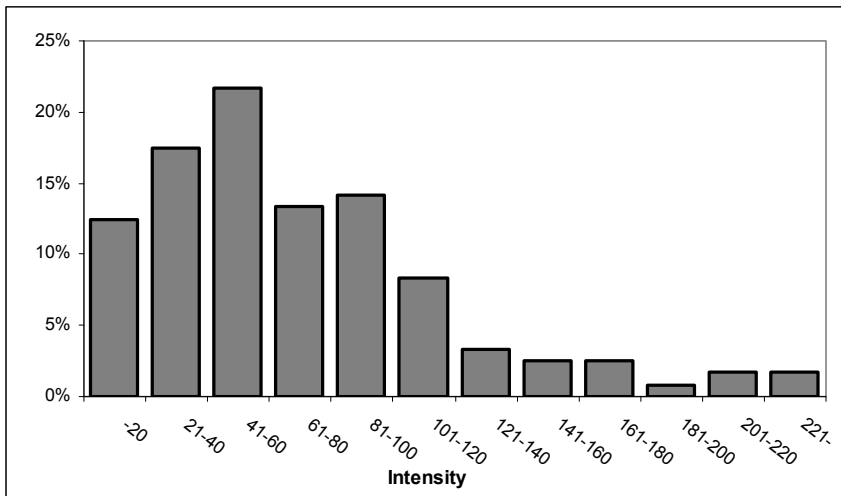


Fig. 2. Intensity distribution of *A. simplex* in chum salmon from Namdae River in 2008