기 생 충 학 잡 지 제24권 제 1 호
The Korean Journal of Parasitology
Vol. 24, No. 1, 1~11, June, 1986

Larval Anisakids collected from the Yellow Corvina in Korea

Jong-Yil Chai, Yeon Myung Chu, Woon-Mok Sohn and Soon-Hyung Lee
Department of Parasitology and Institute of Endemic Diseases, College of Medicine, Seoul National University, Seoul 110, Korea

INTRODUCTION

Anisakid nematodes (Family Anisakidae) such as *Anisakis*, *Terranova*, *Contracaecum*, *Porrocaecum*, *Raphidascaris* spp. are parasitic in the stomach of fish-eating birds and/or (marine) mammals (Oshima, 1972; Overstreet, 1978). Their larvae (3rd stage) are encysted in marine fishes or squids. It is well known that these larvae, when introduced into human gastrointestinal tract, can cause eosinophilic granuloma at the gut wall and elicit the clinical manifestation of acute abdomen.

Human anisakiasis was first identified in the Netherlands (van Thiel *et al.*, 1960) and is known to occur in many countries where marine fishes are consumed raw or under improperly cooked conditions. Especially in Japan, 1,859 proven cases were described for a period of 21 years (1960~1981) (Koyama *et al.*, 1982). Only 10 cases were reported in Korea (Kim *et al.*, 1971; Cho *et al.*, 1980; Seo *et al.*, 1984; Paik *et al.*, 1984), however, the incidence is believed higher and increasing.

As to the taxonomy or classification of larval anisakids found in fishes or squids many reports are available in Japan. The larval types recorded are 3 (I, II and III) in the genus *Anisakis*, 2 (A and B) in *Terranova*, more than 10 (A, B, C, D, II, III, IV, V and others) in *Contracaecum*, and more than 1 in *Raphidascaris* or *Raphidascaroides* (Yamaguti, 1939 & 1941; Koyama *et al.*, 1969; Kagei *et al.*, 1970). In Korea, however, no reports are available on the taxonomy of larval anisakids. The present study was, therefore, performed to classify the morphological types of larval anisakids found in the yellow corvina (*Pseudosciaena manchurica*) caught in the western coast (=Yellow Sea), Korea.

* This study was supported by the Clinical Research Grant (1986) of Seoul National University Hospital.

MATERIALS AND METHODS

Total 30 yellow corvina (*P. manchurica*), 40~50cm in length, caught in the Yellow Sea were purchased from a local market in Seoul. They were transported to the laboratory and their thorax and abdomen were opened. Encapsulated nematode larvae were isolated from the liver, stomach, intestine, air bladder, and from their walls such as the liver capsule, omentum, anterior and posterior abdominal walls.

A total of 1,068 larvae, or 35.6 larvae per fish, were collected. They were liberated in physiological saline with a pin under stereomicroscope, fixed with hot 10% formalin, cleared in lactophenol, mounted in glycerin-jelly, and observed.

RESULTS

Almost all (1,026 out of 1,068) of the nematode larvae collected were identified to be anisakid larvae. Identification of other 42 was impossible because of total or partial degeneration.

Among the larval anisakids, the most frequent type was *Anisakis* type I (Berland, 1961) (859 in number; 80.4%) and the next in the decreasing order was *Contracaecum* type D′ (new type)

(77; 7.2%), *Contracaecum* type C′(new type) (55; 5.1%), *Contracaecum* type D(Koyama *et al.*, 1969) (18; 1.7%), *Contracaecum* type A (Koyama *et al.*, 1969) (13; 1.2%), *Contracaecum* type V(Yamaguti, 1935) (3; 0.28%) and *Raphidascaris* sp.(Koyama *et al.*, 1969) (1;0.09 %). The results of morphometry and their characteristic features are described as follows.

DESCRIPTION OF THE LARVAE

Anisakis type I of Berland(1961) and Koyama *et al.*(1969)(Table 1 & Figs. 1~4)

Table 1. Measurements of *Anisakis* type I larvae in comparison with those of Koyama *et al.* (1969)

	Measurement in mm(average)	
	Present specimens*	Koyama *et al.* (1969)
Length	13.4~25.0 (20.7)	19.0~36.0 (28.4)
Width	0.23~0.54 (0.41)	0.26~0.58 (0.45)
Esophagus(total)	1.86~2.70 (2.36)	2.30~4.04 (3.34)
Muscular part	1.27~1.89 (1.65)	1.25~2.78 (2.22)
Ventricular Part	0.57~0.83 (0.71)	0.65~1.50 (1.12)
Tail	0.07~0.12 (0.10)	0.08~0.16 (0.12)
α	43.7~66.3 (50.6)	41.4~82.0 (63.21)
β_1	7.02~9.92 (8.73)	6.57~10.29 (8.50)
β_2	10.01~14.70 (12.5)	10.0~18.5 (12.84)
β_3	25.5~39.4 (29.2)	18.7~32.2 (25.51)
γ	167.6~271.3 (213.4)	158.8~381.3 (250.03)

* 30 specimens were measured.

Legend for all tables:

$$\alpha=\frac{\text{Body length}}{\text{Body width}};\ \beta_1=\frac{\text{Body length}}{\text{Oesophagus}};$$

$$\beta_2=\frac{\text{Body length}}{\text{Muscular part of oesophagus}};$$

$$\beta_3=\frac{\text{Body length}}{\text{Ventriculus}};\ \gamma=\frac{\text{Body length}}{\text{Tail}};$$

$$X=\frac{\text{Body length}}{\text{Ventricular appendix}};$$

$$Y=\frac{\text{Body length}}{\text{Intestinal caecum}};$$

$$Z=\frac{\text{Ventricular appendix}}{\text{Intestinal caecum}}$$

Its anterior end armed with a prominent boring tooth on the lip mass(Fig. 1). Interlabia not observed. Excretory pore opened between two subventral lips. Esophagus consists of a muscular part, and a glandular ventriculus which ends obliquely at its junction with the intestine(Fig. 2). Intestine widest in the middle portion of the body but becomes narrower in the terminal portion. Genital anlage not observed(Fig. 3). Tail short and bluntly ending with a mucron (Fig. 4). Anal gland present. Cuticular striations observed at every 5~8μm distance through the whole length of the body. From the posterior end of the muscular esophagus a renette cell

Table 2. Measurements of *Contracaecum* type A in comparison with those by Koyama *et al.* (1969)

	Measurement in mm(average)	
	Present specimens*	Koyama *et al.* (1969)
Length	6.4~10.7 (7.8)	5.0~13.2 (9.1)
Width	0.07~0.17 (0.12)	0.11~0.25 (0.20)
Esophagus(total)	0.62~1.08 (0.79)	0.53~0.96 (0.78)
Muscular part	0.59~0.99 (0.71)	0.47~0.88 (0.71)
Ventricular part	0.03~0.11 (0.073)	0.04~0.09 (0.07)
Intestinal cecum	0.09~0.19 (0.13)	0.08~0.24 (0.16)
Ventricular appendage	0.57~0.91 (0.73)	0.57~1.13 (0.86)
Tail	0.06~0.12 (0.09)	0.07~0.13 (0.10)
α	48.6~98.7 (68.1)	33.9~55.0 (45.5)
β_1	8.2~11.1 (10.0)	8.71~14.66 (11.58)
β_2	9.2~12.3 (11.0)	9.6~16.3 (12.8)
β_3	68.0~240.3 (124.9)	67.8~165.0 (130.0)
γ	57.2~133.1 (89.0)	61.0~184.3 (91.0)
X	9.2~13.0 (10.8)	8.5~12.4 (10.6)
Y	40.0~88.0 (61.5)	40.4~93.3 (56.9)
Z	4.3~7.0 (5.9)	3.7~7.6 (5.4)

* 13 specimens were measured.

located longitudinally in the left side of the pseudocoel, but not extending beyond the middle portion of the body.

Contracaecum* type A of Koyama *et al. (1969) (Table 2 & Figs. 5~8)

Boring tooth distinct on the lip mass (Fig. 5). Interlabia observed. Excretory pore opened just behind the nerve ring. Esophagus consists of a long muscular part and a short glandular ventriculus. Intestinal cecum extending anteriorly but very short and small (Fig. 6). Ventricular appendage much longer than the intestinal cecum. Genital anlage present with many convolutions (Fig. 7). Tail relatively long and 15~30 minute spines recognized at its terminal portion (Fig. 8). A very small and short renette cell located longitudinally in the left side of the pseudocoel.

***Contracaecum* type C′** (New Type) (Table 3 & Figs. 9~12)

Boring tooth and interlabia present (Fig. 9). Excretory pore opened behind the nerve ring. Esophagus consists of its muscular part and a small ventricular part. Intestinal cecum extended anteriorly up to the middle portion of the muscular esophagus (Fig. 10). Ventricular appendage a little longer than the intestinal cecum. Genital anlage distinct with many convolutions (Fig.

Table 3. Measurements of *Contracaecum* type C′ in comparison with type C of Koyama *et al.* (1969)

	Measurements in mm (average)	
	Present specimens* (type C′)	Koyama *et al.* (1969) (type C)
Length	5.0~13.9 (8.2)	12.7~33.0 (24.0)
Width	0.08~0.23 (0.14)	0.25~0.58 (0.37)
Esophagus (total)	0.91~1.54 (1.16)	1.72~3.37 (2.54)
Muscular part	0.75~1.45 (1.08)	1.60~3.08 (2.36)
Ventricular part	0.04~0.17 (0.077)	0.12~0.29 (0.18)
Intestinal cecum	0.48~0.55 (0.66)	0.68~1.48 (0.96)
Ventricular appendage	0.54~1.26 (0.93)	0.58~1.34 (0.85)
Tail	0.06~0.08 (0.07)	0.11~0.24 (0.14)
α	43.8~123.7 (62.1)	50.8~47.5 (64.9)
β_1	6.0~10.7 (7.3)	7.38~10.29 (9.45)
β_2	6.3~11.5 (7.8)	7.9~11.0 (10.2)
β_3	39.3~177.0 (118.2)	101.3~174.7 (133.3)
γ	81.5~200.5 (117.1)	100.4~270.1 (171.4)
X	8.0~15.3 (9.7)	20.2~35.4 (28.2)
Y	9.5~21.1 (13.0)	18.4~31.8 (25.0)
Z	1.0~1.7 (1.4)	0.7~1.1 (0.9)

* 30 specimens were measured.

Table 4. Measurements of *Contracaecum* type D in comparison with those by Koyama *et al.* (1969)

	Measurements in mm (average)	
	Present specimens*	Koyama *et al.* (1969)
Length	9.5~22.1 (15.5)	10.1~18.9 (15.0)
Width	0.16~0.34 (0.24)	0.14~0.36 (0.27)
Esophagus (total)	1.26~2.08 (1.64)	1.08~2.08 (1.62)
Muscular part	1.16~1.95 (1.54)	1.00~1.98 (1.51)
Ventricular part	0.07~0.16 (0.11)	0.08~0.17 (0.11)
Intestinal cecum	0.48~0.95 (0.73)	0.46~0.99 (0.71)
Ventricular appendage	0.49~0.97 (0.76)	0.44~0.96 (0.69)
Tail	0.14~0.29 (0.21)	0.12~0.24 (0.15)
α	44.7~77.8 (62.9)	45.5~96.4 (55.6)
β_1	7.9~11.1 (9.1)	7.50~11.25 (9.29)
β_2	8.3~11.9 (9.7)	8.1~12.3 (10.0)
β_3	105.5~195.5 (140.5)	100.0~236.3 (136.4)
γ	47.5~138.1 (74.5)	60.6~148.3 (101.0)
X	15.1~23.6 (19.7)	17.5~34.5 (21.7)
Y	16.9~25.3 (20.5)	14.8~27.0 (21.1)
Z	0.9~1.3 (1.0)	0.5~1.5 (1.0)

* 18 specimens were measured.

11). Tail short and enveloped with a sheath devoid of terminal mucron (Fig. 12). But in its inner side very minute bristle-like projections, 20~30 in number, recognizable. A relatively long renette cell extended from the posterior portion of the esophagus to the middle portion of the body.

Contracaecum* type D of Koyama *et al. (1969) (Table 4 & Figs. 13~16)

Boring tooth prominent and interlabia present (Fig. 13). Excretory pore opened nearby the level of the nerve ring. Esophagus consists of its muscular part and a small ventricular part. Intestinal cecum extended anteriorly up to the middle portion of the muscular esophagus. Ventricular appendage nearly as long as intestinal cecum (Fig. 14). Genital anlage distinct (Fig. 15). Tail ensheathed, relatively long and slender, with a small mucron at its end (Fig. 16). In inner side of the sheath, 7~20 small terminal spines recognizable. Relatively small renette cell located from the posterior part of the esophagus to the middle portion of the body.

***Contracaecum* type D′** (New type) (Table 5 & Figs. 17~20)

Boring tooth and interlabia present (Fig. 17).

Table 5. Measurements of *Contracaecum* type D′ found in this study

	Measurements in mm (average)
Length	5.7~15.2 (9.8)
Width	0.09~0.23 (0.16)
Esophagus (total)	0.86~1.86 (1.33)
Muscular part	0.77~1.79 (1.23)
Ventricular part	0.07~0.15 (0.10)
Intestinal cecum	0.34~1.25 (0.73)
Ventricular appendage	0.43~1.64 (1.02)
Tail	0.08~0.16 (0.12)
α	50.1~75.8 (64.2)
β_1	6.9~9.5 (8.2)
β_2	8.8~11.0 (9.9)
β_3	115.2~198.2 (160.0)
σ	158.8~320.2 (255.3)
X	19.0~32.8 (27.2)
Y	18.0~32.2 (26.0)
Z	0.8~1.2 (1.0)

* 30 specimens were measured.

Excretory pore opened immediately behind the nerve ring. Esophagus consists of a long muscular part and a short ventriculus. Intestinal cecum relatively shorter than the ventricular appendage (Fig. 18). Genital anlage distinct (Fig. 19). Tail ensheathed, longer than type C′

Table 6. Measurements of *Contracaecum* type V in comparison with previous reports

	Measurements in mm (average)		
	Present specimens*	Yamaguti (1935)	Kagei *et al.* (1970)
Length	12.5~15.0 (14.2)	10.8~16.5	11.2~21.4 (16.1)
Width	0.34~0.50 (0.41)	—	0.41~0.82 (0.58)
Esophagus (total)	0.85~1.13 (0.98)	0.75~1.15	0.89~1.65 (1.16)
Muscular part	0.71~1.04 (0.89)	—	0.81~1.54 (1.07)
Ventricular part	0.08~0.10 (0.09)	—	0.05~0.13 (0.09)
Intestinal cecum	0.11~0.17 (0.15)	0.1~0.25	0.13~0.24 (0.18)
Ventricular appendage	3.93~5.10 (4.48)	3.3~4.5	3.06~7.90 (5.35)
Tail	0.19~0.22 (0.20)	0.13~0.18	0.13~0.29 (0.19)
α	30.0~37.5 (34.7)	—	20.8~35.8 (27.8)
β_1	13.2~15.6 (14.5)	—	10.2~19.4 (13.9)
β_2	14.4~17.1 (16.0)	—	11.0~21.3 (15.0)
β_3	125.1~187.6 (159.6)	—	103.5~314.8 (178.9)
σ	62.6~79.0 (69.8)	—	58.7~139.5 (84.7)
X	2.9~3.4 (3.2)	—	2.1~4.7 (3.0)
Y	87.9~113.7 (96.7)	—	56.9~118.5 (89.4)
Z	26.0~35.7 (30.6)	—	17.7~43.5 (29.7)

* 3 specimens were measured.

but shorter than type D, ending without a mucron (Fig. 20). In inner side of the sheath, several to 20 terminal spines present. Renette cell extending from the posterior portion of the esophagus to the middle portion of the body.

Contracaecum* type V of Yamaguti** (1935) **and Kagei *et al. (1970) (Table 6 & Figs. 21～24)

Boring tooth and interlabia present (Fig. 21). Excretory pore opened immediately behind the nerve ring. Relatively short muscular part and a small ventriculus constitute the esophagus. Intestinal cecum very short (Fig. 22). Ventricular appendage greatly longer (about 30 times) than the intestinal cecum (Fig. 23). Genital anlage not observed. Tail ensheathed, long and slender, ending with a tiny mucron (Fig. 24). Large renette cell located from the posterior esophageal level to the middle portion of the body.

Raphidascaris* sp. of Koyama *et al. (1969) (Table 7 & Figs. 25～28)

Boring tooth prominent but interlabia absent (Fig. 25). Excretory pore opened behind the nerve ring. Esophagus consists of a long muscular portion and a short ventriculus. Intestinal cecum absent but ventricular appendage distinctly seen (Fig. 26). Genital anlage present (Fig. 27). Tail short and point-ended, and having a mucron (Fig. 28). Renette cell observed from the posterior part of the esophagus to the middle level of the body.

Table 7. Measurements of *Raphidascaris* sp. in comparison with those by Koyama *et al.* (1969)

	Measurements in mm (average)		
	Present specimens*	Koyama *et al.* (1969)	
Length	8.19	7.9～9.6	(8.6)
Width	0.23	0.22～0.32	(0.25)
Esophagus (total)	0.83	0.74～1.01	(0.87)
Muscular part	0.77	0.68～0.94	(0.81)
Ventricular part	0.06	0.04～0.10	(0.07)
Ventricular appendage	0.45	0.38～0.62	(0.48)
Tail	0.14	0.08～0.13	(0.11)
α	35.6	25.9～39.1	(34.4)
β_1	9.9	8.6～11.6	(9.9)
β_2	10.6	9.2～12.6	(10.5)
β_3	136.5	93.0～210.0	(122.9)
σ	58.5	67.1～105.0	(78.2)
X	18.2	14.0～22.6	(17.9)

* 1 specimen

DISCUSSION

In the present study the most common type of larval anisakid encysted in the yellow corvina was *Anisakis* type I, which is the dominant agent causing human anisakiasis (Koyama *et al.*, 1982). Other types known to infect human, *Anisakis* type II (Kagei *et al.*, 1978) or *Terranova* type A (Koyama *et al.*, 1972; Seo *et al.*, 1984), were not collected in the present study. Interestingly, however, 6 other kinds of larvae were found together with *Anisakis* type I. Five of them belonged to the genus *Contracaecum*, having intestinal cecum and ventricular appendage. Remaining one belonged to *Raphidascaris*, having ventricular appendage while lacking intestinal cecum (Yamaguti, 1961; Koyama *et al.*, 1969).

In *Contracaecum*, as many as 17 or more larval types have been reported, although their taxonomic significance is not acknowledged in all types. Yamaguti (1935 & 1941) listed 5 types (I～V) of *Contracaecum* from various kinds of marine fishes, and Koyama *et al.* (1969) described 4 types (A～D). Meanwhile Kiguchi *et al.* (1970) reported their 6 types (A～F) and Otsuru *et al.* (1969) their A, B two types. Kagei *et al.* (1970) reviewed all these and suggested that some of them should be morphologically identical. Hence, they reduced them into 10; type A, B, C, D of Koyama *et al.*, type II, III, IV, V of Yamaguti, type B of Otsuru *et al.* and type C of Kiguchi *et al.* Three out of five *Contracaecum* types found in this study were compatible with each of type A and D of Koyama *et al.* and type V of Yamaguti on the bases of morphometrical data (Table 2, 4 and 6) as well as characteristic morphological features (Table 8). However, two other kinds, designated type C′ and D′ respectively, were not compatible with ever-reported types and considered new in the literature.

The type C′ is similar to the type C of Koyama (1969) in that they have a very short tail

Table 8. Comparative morphological features of anisakid larvae collected from the yellow corvina

Body organs	*Anisakis* type I	*Contracaecum* type					*Raphidascaris* sp.
		A	C′	D	D′	V	
Boring tooth	+	+	+	+	+	+	+
Interlabia	−	+	+	+	+	+	−
Excretory pore	between subventral lips	behind nerve ring					behind nerve ring
Ventricular appendage	−	+	+	+	+	+	+
Intestinal cecum	−	+ (short)	+ (long)	+ (long)	+ (long)	+ (short)	−
Genital organ	−	+	+	+	+	+	+
Tail	short round	long slender	short	long slender	long slender	long slender	short pointed
Mucron	+	+ (15~30 small spines)	−	+	−	+	+

+; present −; absent

without a mucron and reveal nearly identical morphometrical indices (relative size of organ); $\alpha, \beta_1, \beta_2, \beta_3, \gamma$, X, Y and Z (Table 3). But the former is characterized by its smaller size, presence of boring tooth, and reverse size ratio of intestinal cecum to ventricular appendage (Table 3). The type D′ resembles the type D of Koyama *et al.* (1969) but differs by smaller body size, shorter tail, absence of a mucron at its pointed end, and longer ventricular appendage than intestinal cecum. The type C′ and D′ are different from the type II of Yamaguti and type B of Koyama *et al.* (1969) in that they have genital organs while not in the latters (Kagei *et al.*, 1970). The type III of Yamaguti (1935) has a minute spine at its pointed end but not so in the type C′ and D′. In terms of body size, and presence of a mucron and genital organs, the type C′ and D′ appear to be similar to the type IV of Yamaguti (1935). However, morphological description of the latter is too insufficient to justify the identity between them. The type B of Otsuru *et al.* (1969) and type C of Kiguchi *et al.* (1970) are different from the type C′ and D′ in that the type B of Otsuru *et al.* (1969) has no boring tooth instead of having a small mucron and the type C of Kiguchi *et al.* (1970) has poorly developed genital organs.

Only one specimen of *Raphidascaris* larva was collected in this study, which suggests a rare occurrence of this type in the yellow corvina. *Raphidascaris* and *Raphidascaroides* are morphologically similar each other but the former lacks the interlabia while not in the latter (Yamaguti, 1961). As for *Raphidascaris* Yamaguti (1941) described A and B two larval types, however, their taxonomic significance has not been validated yet.

So far as larval anisakids in the yellow corvina are concerned there are few literature to compare with the present results. In Korea, Chun *et al.* (1968) collected total 3,044 anisakid larvae from 44 yellow corvinas (*P. manchurica*) caught in the western and southern seas, but they did not classify morphological types. In Japan, there has been a great number of reports on larval anisakids collected in the fish but none on the yellow corvina.

SUMMARY

Larval anisakids found in the yellow corvina (*Pseudosciaena manchurica*), a marine fish caught in the Yellow Sea, were classified by their morphological types. Total 1,068 anisakid larvae were collected from 30 fish examined, with the average number per fish of 35.6. They were classified into *Anisakis* type I larvae of Berland (859 in number, 80.4%), *Contracaecum* type A of Koyama *et al.* (13, 1.2%), *Contracaecum* type

C′(new type) (55, 5.1%), *Contracaecum* type D of Koyama *et al.*(18, 1.7%), *Contracaecum* type D′(new type) (77, 7.2%), *Contracaecum* type V of Yamaguti(3, 0.28%), *Raphidascaris* sp. of Koyama *et al.*(1, 0.09%) and unidentified (42, 3.9%). *Contracaecum* type C′ and D′ were considered new in the literature.

REFERENCES

Berland, B.(1961) Nematodes from some Norwegian marine fishes. *Sarcia*, **2**: 1-50.

Cho, S.Y., Chi, J.G., Kim, I.S., Min, Y.Y., Chun, W.C., Son, J.H. and Kim, K.H. (1980) A case of human anisakiasis in Korea. *Seoul J. Med.*, **21**(2): 203-208.

Chun, S.K., Chung, B.K. and Ryu, B.S.(1968) On the infection rate of *Anisakis*-like larvae isolated from various marine fishes. *Bull. Korean Fisheries Soc.*, **1**(1): 1-7.

Kagei, N., Sakaguchi, Y., Katamine, D. and Ikeda, Y. (1970) Studies on anisakid nematoda(Anisakinae) II. *Contracaecum* sp. (type-V of Yamaguti) found in marine fishes (Appendix: List and main features of the larvae of *Contracaecum* spp. recorded from marine fishes and squids caught off the Japan and its offshore Islands). *Bull. Inst. Publ. Health*, **19**(4): 243-251 (in Japanese).

Kagei, N., Sano, M., Takahashi, Y., Tamura, Y. and Sakamoto, M. (1978) A case of acute abdominal syndrome caused by *Ansakis* type II larva. *Japanese J. Parasit.*, **27**(5): 427-437.

Kiguchi, S., Kosugi, H., Hirabayashi, H. and Hayashi, S. (1970) Six types of *Contracaecum* larvae (Nematode) found in the sea fishes in Japan. *Yokohama Igaku*, **21**: 421-427 (in Japanese).

Kim, C.H., Chung, B.S., Moon, Y.I. and Chun, S. H. (1971) A case report on human infection with *Anisakis* sp. in Korea. *Korean J. Parasit.*, **9**(1): 39-43 (in Korean).

Koyama, T., Kobayashi, A., Kumada, M., Komiya, Y., Oshima, T., Kagei, N., Ishii, T. and Machida, M. (1969) Morphological and taxonomical studies on Anisakinae larvae found in marine fishes and squids. *Japanese J. Parasit.*, **18**(5): 466-487 (in Japanese).

Koyama, T., Kumada, M., Suzuki, H., Ohnuma, H., Karasawa, Y., Ohbayashi, M. and Yokogawa, M. (1972) *Terranova*(Nematoda: Anisakidae) infection in man II. Morphological features of *Terranova* sp. larva found in human stomach wall. *Japanese J. Parasit.*, **21**(4): 257-261.

Koyama *et al.* (1982) [Cited from Fujino, T., Ooiwa, T. and Ishii, Y. (1984) Clinical, epidemiological and morphological studies on 150 cases of acute gastric anisakiasis in Fukuoka Prefecture. *Japanese J. Parasit.*, **33**(2):73-92 (in Japanese)].

Oshima, T. (1972) *Anisakis* and anisakiasis in Japan and adjacent area. *Progress of Medical Parasitology in Japan*, **4**: 305-393.

Otsuru, M., Shiraki, T. and Kenmotsu, M. (1969) On the morphological classification and experimental infection of Anisakinae larvae found in marine fishes around the northern sea of Japan. *Japanese J. Parasit.*, **18**(4):105-106.

Overstreet, R.M. (1978) Marine maladies? Worms, germs, and other symbionts from the northern gulf of Mexico. Mississippi-Alabama Sea Grant Consortium, MASGP-78-021, 72-80pp.

Paik, A.L., Hong, S.R., Paik, I.K., Ko, I.H., Lee, J., Paik, I.W., Paik, N.W. and Chai, J.Y. (1984) Anisakiasis in terminal ileum. *Korean. J. Path.*, **18**(4):453-456 (in Korean).

van Thiel, P.H., Kuipers, F.C. and Roskam, R.T.H. (1960) A nematode parasitic to herring, causing acute abdominal syndromes in man. *Trop. Geogr. Med.*, **2**: 97-113.

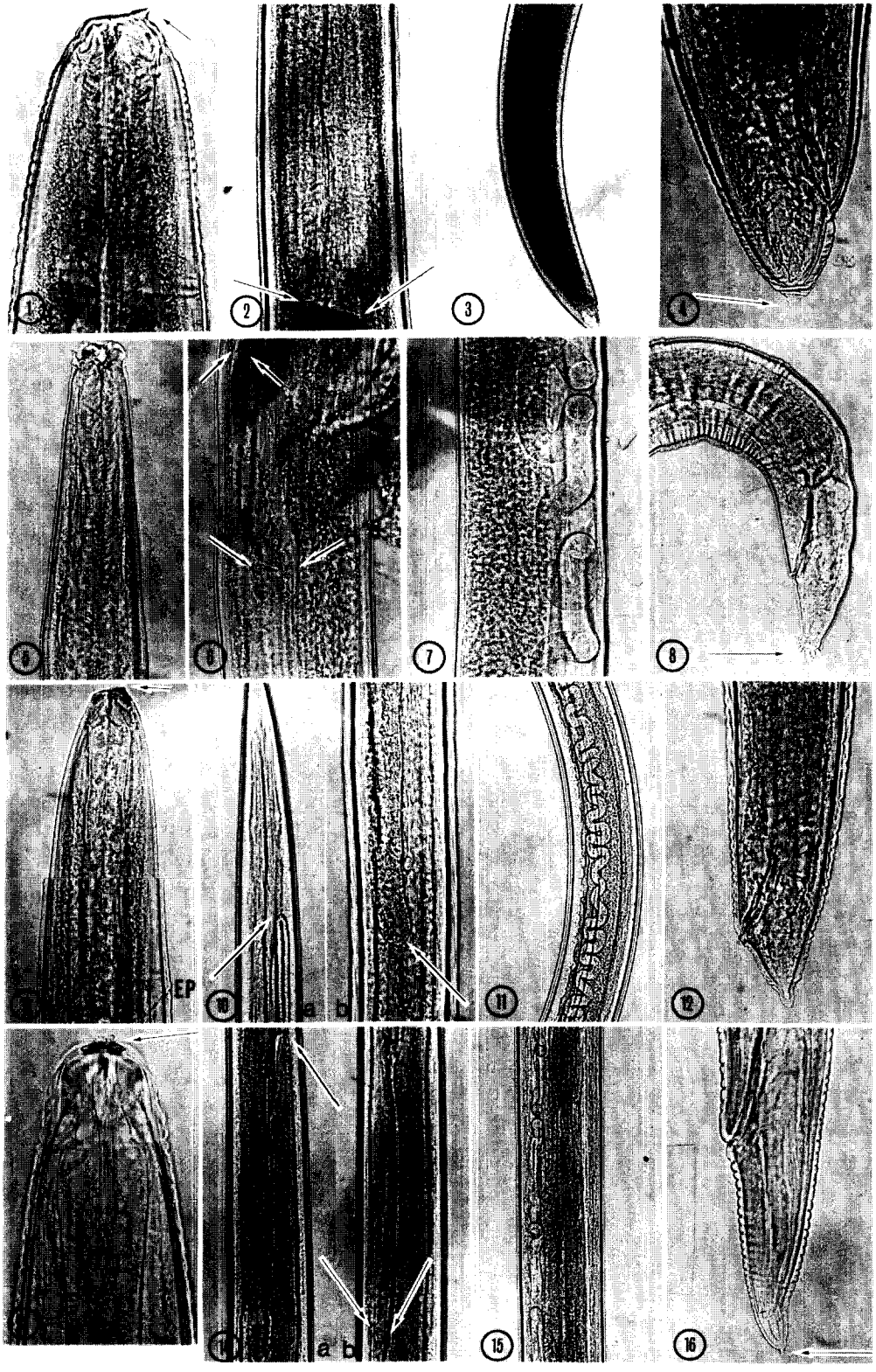
Yamaguti, S. (1935) Studies on the helminth fauna of Japan 9. Nematodes of fishes. I. *Japanese J. Zool.*, **6**:337-386.

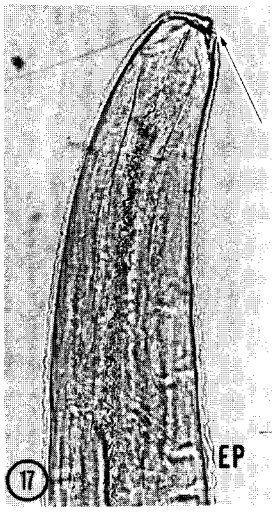
Yamaguti, S. (1941) Studies on the helminth fauna of Japan 9. Nematodes of fishes. II. *Japanese J. Zool.*, **9**:343-396.

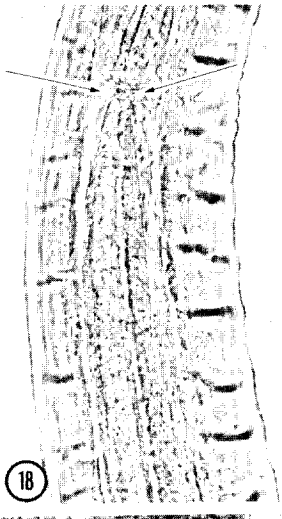
Yamaguti, S. (1961) Systema helminthum. **III**. The nematodes of vertebrates. I & II. Interscience Publ. Inc.

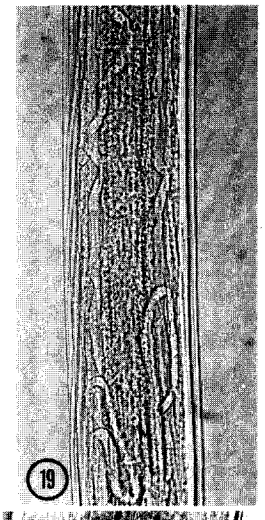
EXPLANATIONS FOR FIGURES

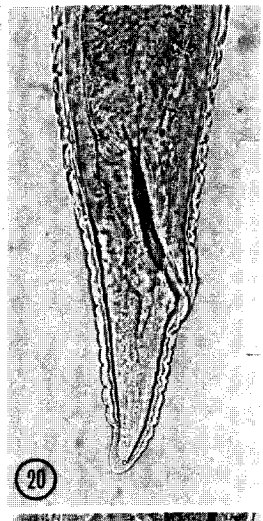
Fig. 1. *Anisakis* type I larva, anterior portion. Boring tooth is prominent (arrow) on the lip mass. ×200.
Fig. 2. *Ibid*, ventricular portion. Note the large size of ventriculus and its oblique junction with the intestine (arrows) ×100.
Fig. 3. *Ibid*, posterior portion. There is no recognizable genital organ. ×40.
Fig. 4. *Ibid*, terminal portion. The tail is broad and round, ending with a mucron (arrow). ×200.
Fig. 5. *Contracaecum* type A of Koyama *et al.* (1969) head portion. ×200.
Fig. 6. *Ibid*, near ventricular portion. Note the short intestinal cecum (arrows; up) and small ventriculus (arrows; down). ×200.
Fig. 7. *Ibid*, middle portion of the body. Convoluted genital anlage is seen. ×200.
Fig. 8. *Ibid*, terminal portion, consisted of about 10-20 minute spines (arrow). ×200.
Fig. 9. *Contracaecum* type C′ (new type), head portion. Boring tooth (arrow), interlabia and excretory pore (EP) are seen. ×200.
Fig. 10. (a) *Ibid*, anterior portion. Intestinal cecum (arrow) extended up to the middle portion of muscular esophagus. ×100.
(b) *Ibid*, below the ventricular level. Ventricular appendage (arrow) is seen. ×200.
Fig. 11. *Ibid*, middle portion of the body. Genital organ is seen with convolutions. ×100.
Fig. 12. *Ibid*, terminal portion. Note the short but pointed tail without a mucron. ×200.
Fig. 13. *Contracaecum* type D of Koyama *et al.* (1969) head portion. Boring tooth (arrow) and interlabia are present. ×200.
Fig. 14. (a) *Ibid*, esophago-ventricular level. Note anteriorly extended intestinal cecum (arrow) and small ventriculus(V). ×100.
(b) *Ibid*, post-ventricular level. Note the nearly equal length of ventricular appendage (arrows) and intestinal cecum in Fig. 14a. ×100.
Fig. 15. *Ibid*, middle portion of the body. Genital organ is seen on the left side of intestinal tract (IN). ×100.
Fig. 16. *Ibid*, terminal portion. Long and slender tail has a small mucron (arrow) at its pointed end. ×200.
Fig. 17. *Contracaecum* type D′ (new type), anterior portion. Boring tooth (arrow) and interlabia are present. Excretory pore (EP) is seen just behind the nerve ring. ×200.
Fig. 18. *Ibid*, esophageal level. Note the anteriorly extended intestinal cecum (arrows). ×200.
Fig. 19. *Ibid*, middle portion of the body. Note the genital organs. ×100.
Fig. 20. *Ibid*, terminal portion. Relatively long and slender tail with no mucron is seen. ×200.
Fig. 21. *Contracaecum* type V of Yamaguti, head portion. Note boring tooth (arrow) and long muscular esophagus (ME). Excretory pore (EP) is seen behind the nerve ring. ×40.
Fig. 22. *Ibid*, esophago-ventricular portion. Note the short intestinal cecum (arrows). ×100.
Fig. 23. *Ibid*, posterior portion of the body. There is no genital organ. Note the long ventricular appendage (arrow) reaching to this level. ×40.
Fig. 24. *Ibid*, terminal portion. Note the long and slender tail with a tiny mucron (arrow). ×100.
Fig. 25. *Raphidascaris* sp., anterior portion. Note boring tooth (arrow) but there is no interlabia. Long muscular esophagus is seen. ×200.
Fig. 26. *Ibid*, ventriculo-intestinal junction. Note the ventricular appendage (arrows). ×200.
Fig. 27. *Ibid*, middle portion of the body. Note the genital organs. ×200.
Fig. 28. *Ibid*, terminal portion. Tail is relatively short and has a pointed end with a mucron. ×200.

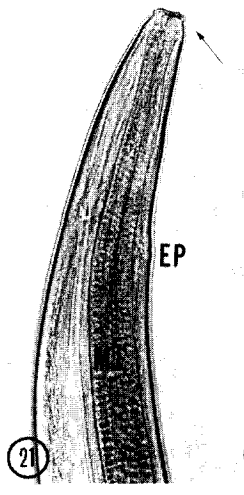

1
2
3
4
5
6
7
8
9
EP
10
a
b
11
12
13
a
b
15
16

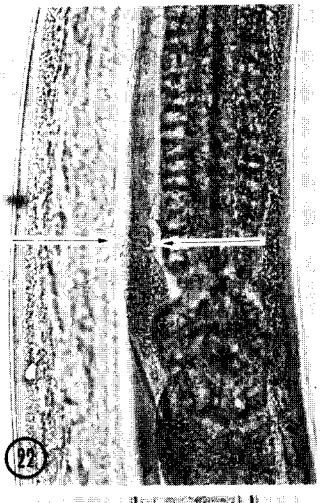

EP
17

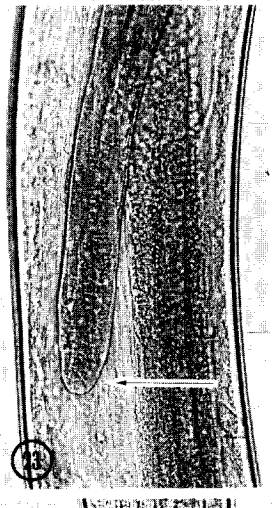

18

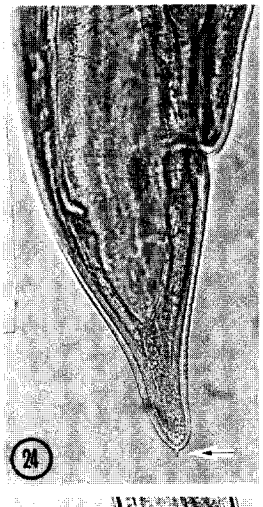

19

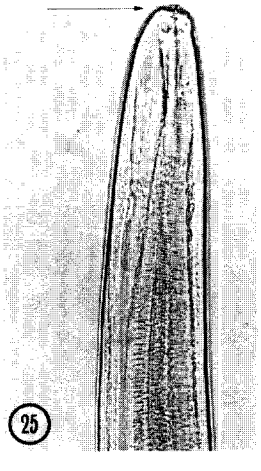

20

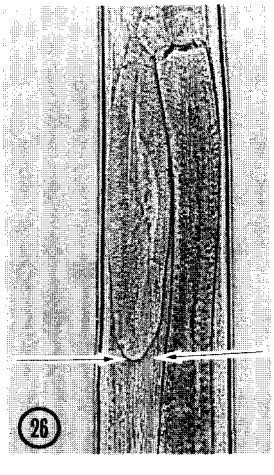

EP
21

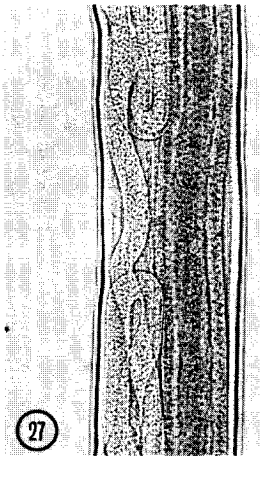

22

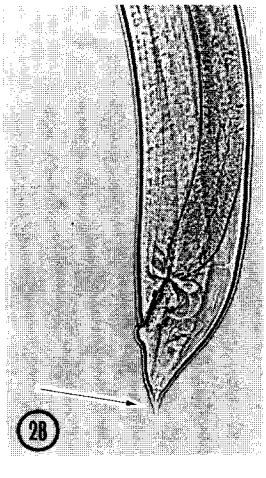

23


24


25


26


27


28

=국문초록=

참조기에서 수집된 아니사키스幼蟲의 分類

서울대학교 의과대학 기생충학교실 및 풍토병연구소
채종일 · 추연명 · 손운목 · 이순형

우리나라 서해지방에서 잡힌 참조기(*Pseudosciaena manchurica*)에서 아니사키스幼蟲을 수집하여 형태학적으로 分類하였다. 참조기 30마리에서 총 1,068마리의 아니사키스幼蟲이 검출되어 참조기 1마리당 평균 35.6마리의 幼蟲感染을 보였다. 이들은 형태학적으로 Berland의 *Anisakis* I형 859마리 (80.4%), Koyama *et al.*의 *Contracaecum* A형 13마리(1.2%), 새로운 형인 *Contracaecum* C′형 55마리(5.1%), Koyama *et al.*의 *Contracaecum* D형 18마리(1.7%), 새로운 형인 *Contracaecum* D′형 77마리(7.2%), Yamaguti의 *Contracaecum* V형 3마리(0.28%), Koyama *et al.*의 *Raphidascaris* sp. 1마리(0.09%) 및 종류불명 42마리(3.9%)로 분류하였다. *Contracaecum* C′형과 D′형은 이미 알려진 종류와는 뚜렷한 차이를 보였으며 문헌상 새로운 형태로 생각되었다.