[Jap. J. Parasit., Vol. 25, No. 3, 148-152, 1976]

Larval Anisakid Nematodes from the Prawns, *Pandalus* spp.

TADASHI SHIRAKI, HIDEO HASEGAWA, MINORU KENMOTSU
and
MASAMITSU OTSURU
Department of Medical Zoology, Niigata University School of Medicine, Niigata

(Received for publication; January 21, 1976)

The larvae of *Anisakis* (Anisakidae : Nematoda) have been found in various invertebrates including the euphausiids (Uspenskaya, 1963; Oshima *et al.*, 1969; Smith, 1971; Shimazu and Oshima, 1972; Kagei, 1972; Sluiters, 1973, 1974), the amphipods (Uspenskaya, 1963), the brachiurans (Decapoda) (Uspenskaya, 1963) and arrow worms (Chaetognatha) (Reimer *et al.*, 1971) besides the marine fishes. From the macrurans (Decapoda), however, the larval stage of *Anisakis* has never been known though *Contracaeoum* adults and larvae (Margolis and Butler, 1954; Hutton *et al.*, 1959, 1962; Kruse, 1959; Uspenskaya, 1963) and *Terranova* larva (Uspenskaya, 1963) were reported.

In order to demonstrate the larval spirurid nematodes harbouring various terrestrial and marine crustaceans, investigations have been carried out for several years in our laboratory. During those surveys, some *Anisakis*-like larvae were unexpectedly recovered from two species of marine prawns. This paper deals with some discussions concerning their identification and epidemiological significance.

Materials and Methods

Two species of the prawn, *Pandalus borealis* Krφyer and *P. kessleri* Czerniavski, were obtained from the dealers in Niigata (1973, 1975) and Hokkaido (1975), respectively. The locality and number of prawns examined are shown in Table 1. The prawns were divided into viscera of cephalotharaxes and abdominal muscles, then digested with the artificial gastric fluid separately. Only the viscera of cephalothoraxes were examined in many cases. The collected nematodes were fixed with 70% ethanol and preserved. On the microscopical examination, worms were cleared and mounted with 50% glycerin.

Results

As shown in Table 1, five and two *Anisakis*-like larvae were collected from the cephalothoraxes of 5,046 *Pandalus borealis* and 724 *P. kessleri*, respectively. Specimens were generally recovered in degenerated condition and only fragments of body were obtained in three cases (Specimen Nos. 3, 4, 7). The worms are slender and tapered in both extremities. The head consists of three pseudolabia, and a boring tooth protrudes between two ventrolateral lips (Nos. 1, 2, 5, 6) (Fig. 1). The boring tooth is conical and somewhat inclines ventrally. The junction between ventriculus and intestine is oblique in specimen No. 1, the only one which possesses complete ventriculus. Each worm has a rounded tail with a mucron at its tip (Fig. 2), and two anal glands are seen. Morphometric data are given in Table 2.

Discussion

According to the traditional knowlege on the life cycle of *Anisakis* (Kagei, 1969; Oshima, 1969), the invertebrates are considered to serve as the first intermediate host, in which the larvae stay as the second

Table 1 Surveys of anisakid larvae in the prawns

Species of prawn	Locality	Date	No. of prawns examined	No. of anisakid larvae recovered
Pandalus borealis	Off Sado Isl. (Niigata) (The Sea of Japan)	Jan., 1973	146	2
〃	〃	June, 1975	328	0
〃	〃	June, 1975*	734	0
〃	〃	June, 1975*	678	0
〃	〃	July, 1975*	1,165	3
〃	〃	Sept., 1975*	746	0
〃	〃	Oct., 1975*	1,249	0
Pandalus kessleri	Lake Saroma(Hokkaido) (The coast of the Sea of Okhotsk)	July, 1975	724	2
Total			5,770	7

* The viscera of cephalothoraxes were only examined.

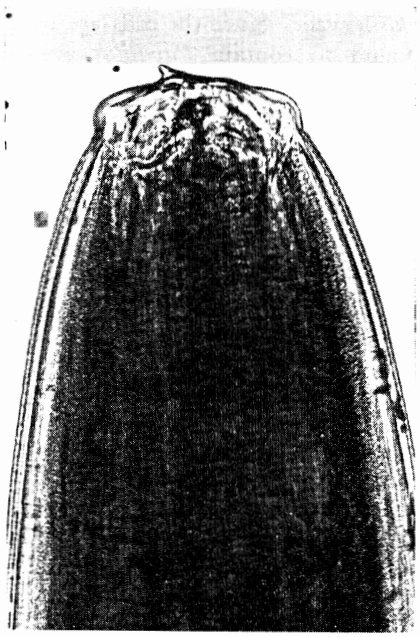

Fig. 1 Anterior extremity of anisakid larva from *Pandalus* prawn. (Specimen No. 1, × 177)

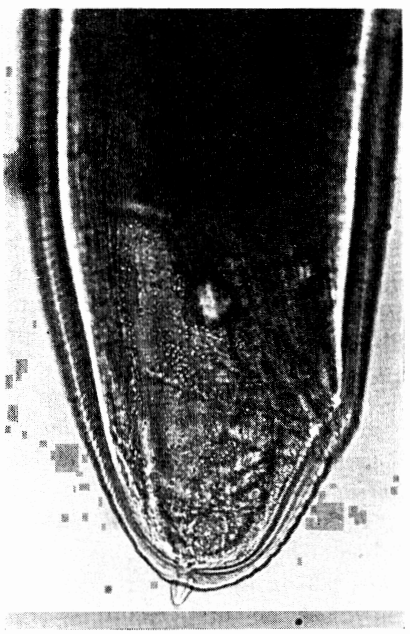

Fig. 2 Posterior extremity of anisakid larva from *Pandalus* prawn. (Specimen No. 2, × 177)

stage, and the second intermediate host, i.e. fish, is necessary for these larvae to attain the third stage. Recently, the investigators (Oshima *et al.*, 1969) expressed some doubts on this hypothesis because some of the larvae from the euphausiids were morphologically undistinguishable from the third-stage larvae in fishes. The present specimens also have the morphological characteristics similar to those of the third-stage larvae of *Anisakis* (Type I of Berland, 1961), showing the evidences as follows: (1) The body length, 15.9–31.7 mm, is never shorter than that of the smallest third-stage larva

Table 2 Morphometric data of anisakid larvae from prawns

No.	Body length (B.L.)	Body width (% to B. L.)	Esophagus length (% to B. L.)	Ventriculus length (% to B. L.)	Tail length (% to B. L.)	Width of annulation (mean)
	mm	mm	mm	mm	mm	μ
1	31.7	0.54 (1.70)	( )	0.90 (2.84)	0.14 (0.44)	8.7
2	23.8	0.40 (1.68)	( )	( )	0.14 (0.59)	7.0
3	(14.7)*	0.44 ( )	( )	( )	0.10 ( )	7.4
4	(3.3)*	( )	( )	( )	0.12 ( )	
5	20.4	0.39 (1.91)	( )	( )	0.11 (0.54)	6.5
6	15.9	0.55 (3.46)	1.28 (8.05)	0.67 (4.21)	0.11 (0.69)	6.5
7	(17.8)*	0.70 ( )	( )	0.70 ( )	0.11 ( )	7.4

Nos. 1, 2 from *P. kessleri* and Nos. 3–7 from *P. borealis*.
Blanks (unfilled) show to be unmeasurable.
* Length of flagment.

ever known from fishes, 12.6 mm (Sakaguchi and Katamine, 1971); (2) The boring tooth is conical and somewhat inclines ventrally (Shiraki, 1974); (3) The tail has a mucron at its tip (Koyama *et al.*, 1969); (4) The length and proportion of tail are within the range of the third-stage larvae from fishes (Shiraki, 1974); (5) The width of annulation is identical with that of the third-stage larvae from fishes, 6.5–8.5 μ (Shiraki, 1974). On the other hand, the body width of Nos. 6 and 7 is wider than that of No. 1, the longest among seven present specimens; this seems to cast some doubts as to whether all of them belong to the same species or not. However, other morphological features of Nos. 6 and 7, e.g. striation and tail, are identical to those of the other specimens. The authors are of the present opinion that all of present specimens belong to *Anisakis* (Type I), and this may be the first record of *Anisakis* larvae from the macrurans. Further investigation with more specimens would be necessary for strict identification. The degeneration of the larvae seems to be caused by the process of digestion with magnetic stirrer. Therefore, it is also necessary to improve the method for recovery of the larvae.

Pandalus borealis is prolific in deep waters (200–600 m depth) of the northern Sea of Japan where many cods (i.e. *Gadus morphua* and *Theragra chalcogramma*) live and are usually infected with a large number of *Anisakis* larvae. Since the cods are occasionally found to contain *Pandalus* prawns in their stomachs, it is probable that some of the *Anisakis* larvae parasitizing cods originate from this prawn and the larvae may be concentrated in covetous cods though the incidence of infection of them in prawns is very low. *Pandalus kessleri* live in the shallower waters around the Sea of Okhotsk and is also considered to serve as an intermediate host of *Anisakis*.

Summary

The anisakid larvae collected from two species of the prawn, *Pandalus borealis* and *P. kessleri* were recorded. These larvae bear a very close resemblance to the third stage of *Anisakis* larvae (Type I of Berland, 1961) which are found in various marine fishes. *Pandalus* prawns are supposed to serve as the intermediate hosts of *Anisakis*. This may be the first report of *Anisakis* larvae from the macrurans.

Acknowlegement

The authors are indebted to Dr. T. Shimazu of Shinshu University for the helpful discussions and to Mr. K. Endo, Dr. M. Maehana and Mrs. M. Watanabe for the efforts to supply the materials.

References

1) Berland, B. (1961): Nematodes from some Narwegian marine fishes. Sarsia, 2, 1–50.
2) Hutton, R. F., Sogandares-Bernal, F., Eldred, B., Ingle, R. M. and Woodburn, K. D. (1959): Investigations on the parasites and diseases of saltwater shrimps (Penaeidae) of sports and commercial importance to Florida. Fla. St. Bd. Conserv. Mar. Lab., Tech. Ser. No. 26, 1–38.
3) Hutton, R. F., Ball, T. and Eldred, B. (1962): Immature nematodes of the genus *Contracaecum* Railliet and Henry, 1912, from shrimps. J. Parasit., 48, 327–332.
4) Kagei, N. (1969): Life cycle of nematodes of the genus *Anisakis*. Saishin-Igaku (Advances in med. Science), 24, 389–400. (In Japanese)
5) Kagei, N. (1972): Survey of *Anisakis* larvae in the marine crustacea. Proceedings of the 33 rd annual meeting of the eastern branch of Jap. Soc. Parasit., p. 6. (In Japanese)
6) Koyama, T., Kobayashi, A., Kumada, M., Komiya, Y., Oshima, T., Kagei, N., Ishii, T. and Machida, M. (1969): Morphological and taxonomical studies on Anisakidae larvae found in marine fishes and squids. Jap. J. Parasit., 18, 466–487. (In Japanese)
7) Kruse, D. N. (1959): Parasites of the commercial shrimps, *Penaeus aztecus* Ives, *P. duorarum* Burkenroad, and *P. setiferus* (Linnaeus). Tulane Stud. Zool., 7, 123–144.
8) Margolis, L. and Butler, T. H. (1954): An unusual and heavy infection of a prawn, *Pandalus borealis* Krφyer, by a nematode, *Contracaeum* sp. J. Parasit. 40, 649–655.
9) Oshima, T. (1969): Study on the first intermediate host of *Anisakis*. Saishin-Igaku (Advances in med. Science), 24, 401–404. (In Japanese)
10) Oshima, T., Shimazu, T., Koyama, H. and Akahane, H. (1969): On the larvae of the genus *Anisakis* (Nematoda: Anisakinae) from the euphausiids. Jap. J. Parasit., 18, 241–248. (In Japanese)
11) Reimer, L. W., Berger, Ch., Heuer, B., Lainka, H., Rosenthal, I. and Scharnweber, I. (1971): On the distribution of larvae of helminths in plankton of the North Sea. Parazitol., 5, 542–550. (In Russian)
12) Sakaguchi, Y. and Katamine, D. (1971): Survey of anisakid larvae in marine fishes caught from the East China Sea and the South China Sea. Trop. Med. (Nagasaki), 13, 159–169. (In Japanese)
13) Shimazu, T. and Oshima, T. (1972): Some larval nematodes from euphausiid crustaceans. In "Biological oceanography of the northern north Pacific Ocean" p. 403–409. (A. Y. Takenouchi *et al.* ed. Idemitsu Shoten, Tokyo)
14) Shiraki, T. (1974): Larval nematodes of family Anisakidae (Nematoda) in the northern Sea of Japan. Acta Med. Biol. 22, 57–98.
15) Sluiters, J. F. (1973): Study on the life-cycle of *Anisakis* sp. Parasitol., 67, xxviii.
16) Sluiters, J. F. (1974): *Anisakis* sp. larvae in the stomachs of herring (*Clupea harengus* L.). Z. Parasitenk., 44, 279–288.
17) Smith, J. W. (1971): *Thysanoessa inermis* and *T. longicaudata* (Euphausiidae) as first intermediate hosts of *Anisakis* sp. (Nematoda: Ascaridata) in the northern North Sea, to the north of Scotland and at Faroe. Nature, 234, 478.
18) Uspenskaya, A. V. (1963): Parasite fauna of benthic crustaceans from the Barents Sea. Izdatelstvo Akademya Nauk SSSR, Moscow and Leningrad, 127 pp. (In Russian)

タラバエビ類より得たアニサキス様幼線虫

白木　公　長谷川英男　監物　実　大鶴正満
（新潟大学医学部医動物学教室）

ホッコクアカエビ（*Pandalus borealis* Krφyer）5,046個体，ホッカイエビ（*P. kessleri* Czerniavski）724個体より，アニサキス様幼線虫を各5，2個体得た．これらの幼虫はその形態から，魚類に寄生する *Anisakis* I型幼虫と同種であると考えられる．前記のタラバエビ類は *Anisakis* の中間宿主になり得ると推測される．なお本報は，長尾類（甲殻綱十脚目）より *Anisakis* 幼虫を証明した最初のものであると思われる．