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Prevalence of Anisakin Nematodes in Fish from Southern Baltic Sea

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A b s t r a c t

Nematodes from the superfamily Ascaridoidea (families Anisakidae and Raphidascarididae) are worldwide distributed parasites. Their live cycles include many species of water invertebrates and teleostean fish as intermediate hosts, and fish, sea mammals or fish-eating birds being definitive hosts. Humans can be infected with some of these parasites after consumption of raw or wrongly processed fish. The parasitological investigations of fish (herring, cod and flatfish) from southern Baltic (ICES 24–26) provided in the years 80 and 90 showed their infection with larvae of several anisakid species: *Anisakis simplex* s. str., *Contracaecum osculatum* C and *Hysterothylacium auctum*. Sporadically *Pseudoterranova decipiens* and *Raphidascaris acus* were also found. Larvae of *Anisakis simplex* were noted mainly in herrings, *C. osculatum* primarily in cods and *H. auctum* in flounders. Additionally, preserved herrings (marinated, smoked) were also investigated and sporadically live larvae of *A. simplex* were found. The main etiological agent of human anisakidosis worldwide is *A. simplex*. Although the live cycle of this nematode cannot be completed in the Baltic Sea – this nematode is brought to the Baltic by infected herring migrating from the North Sea for spawning in coastal waters of the Southern Baltic – the prevalence and intensity of infection with larvae of this nematode species were the highest in fish investigated by us. The results obtained suggest the possibility of the human infection with *A. simplex* larvae in Poland.

K e y w o r d s: anisakids, Baltic Sea fish, anisakidosis

Introduction

Nematodes from the superfamily Ascaridoidea (families: Anisakidae and Raphidascarididae), commonly named anisakids, are parasites of many water organisms. Low specificity in the choice of hosts, both intermediate and definitive, causes that their geographical distribution is wide. Anisakids of biological and economical importance in the aquatic environment comprise among other groups the genera: *Anisakis*, *Pseudoterranova* and *Contracaecum* demanding sea mammals (*Contracaecum* also fish eating birds) as definitive hosts, and genus *Hysterothylacium* occurring both as larvae and adults in fish. Many species of water invertebrates and teleostean fish can serve as intermediate hosts for these nematodes.

In fish anisakid larvae occur encapsulated in and on the viscera or free in the body cavity, beneath the liver serosa or within the parenchyma of the liver and also in muscles. Their occurrence in edible parts of fish determines the health hazard for humans consuming raw or inadequately cooked fish. Over 20 000 cases of anisakidosis have been reported in the world. Most of them have been noted in Japan where eating of raw fish is very common, but also in Europe (mostly The Netherlands, then Germany and France), northern America and other regions (Thiel *et al.*, 1960; Jackson, 1975; Lorenz and Warzok, 1988; Petithory and Marty, 1988; Ischikura and Namiki, 1989; Ischikura *et al*., 1992). The most often anisakidosis is caused by *A. simplex* followed by *P. decipiens*, and very rarely by *C. osculatum* (Ischikura *et al*., 1992; Schaum and Müller, 1967). Moreover, single cases caused by *H. auctum* have been also reported (Petter, 1969; Yagi *et al*., 1996).

Generally, the clinical symptoms of anisakidosis are not characteristic: nausea, vomiting, abdominal and epigastric pain, diarrhea *etc.* (Ischikura *et al*., 1992). Thus it is possible that the number of cases of this disease is higher but they might be misdiagnosed as some other gastrointestinal diseases.

The most abundant anisakid species in southern Baltic Sea is *A. simplex*. Although the life cycle of this parasite cannot be completed in the Baltic Sea as its main intermediate hosts – many species of euphausiids, may survive in the water of higher salinity than this in Baltic, this parasite is brought in great number by herring belonging to the spring coastal spawning stock "W", swimming up for spawning from the feeding grounds out of Baltic (Grabda, 1974; Myjak *et al*., 1996a; Myjak *et al*., 1996b; Rokicki *et al*., 1997).

The aim of our studies was: 1. Evaluation of the infection level of fish (herring, cod, flounder and sprat) from southern Baltic with anisakid nematodes. 2. Ascertainment whether eating of preserves from herring (marinated, salted, smoked *etc.*) available in markets can be the reason of anisakidosis of humans in our country.

Experimental

Material and Methods

Investigation of fish. The investigations were performed in the years 1987–1994. A total number of 31,091 herring (Myjak *et al*., 1996b), 3,036 cod (Myjak *et al*., 1994), 1,598 flounder and 3,401 sprats were analyzed. Most fish originated from fishing grounds of Polish Economic Zone, rarely from Danish and Swedish ones. The samples were obtained both from commercial and scientific catches. The level of extra-intestinal infection with anisakid larvae of particular fish species was determined: – in particular fishing grounds; – in particular months; – in dependence on fish body length (cod, flounder and sprat) or age (herring).

In the case of herring an age and affiliation to particular spawning stocks were determined on the basis of otholits analysis.

Investigation of preserves. 39 kinds of preserves from herring were investigated, each of them several times. The preserves originated from different manufacturers. Both preserves made from gutted herring, as well as from ungutted ones were investigated.

Gutted herring – 30 preserves were tested: marinated, salted, spiced fillets and also ready-to-eat dishes – 140 samples.

Not gutted herring – 9 preserves were tested: salted (34 samples) and smoked (40 specimens).

Muscles of fish were digested with artificial digestive juice (1% pepsin in 1% HCl) and larvae were counted and collected.

Results

Herring

Herring examined belonged to the following spawning stocks:

- spring coastal herring – "W" – coming for spawning season to the southern coast of Baltic from the feeding grounds in Kattegat, Skagerrak or North Sea. Spawning time: spring;
- spring open sea herring – "WM" – Baltic stock, feeding and spawning in the Baltic Sea. Spawning time: spring;
- autumn herring – "J" – Baltic stock, feeding and spawning in the Baltic Sea. Spawning time: autumn.

Herring investigated was found to be infected mainly with *Anisakis simplex* larvae (prevalence from 0 to 86% in sample, intensity of infection from 1 to 157, average of 8 larvae per infected fish), very rarely with *Hysterothylacium auctum*, *Contracaecum osculatum* and *Raphidascaris acus* – Figure 1.

Anisakis simplex larvae occurred almost exclusively in herring from spawning group "W". A pronounced seasonal character in the prevalence of herring infected was obtained; higher prevalence of infection was observed in south-western fishing grounds in comparison to south-eastern and open sea ones – Figure 2.

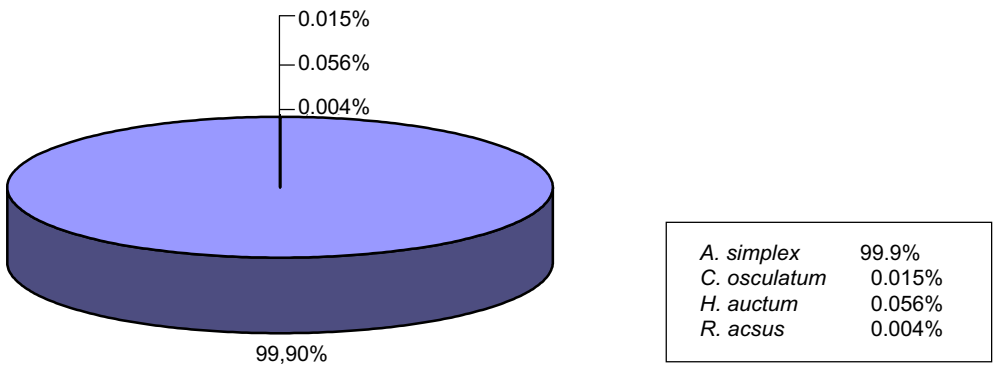

Fig. 1. The per cent contribution of particular anisakid species found in herring examined

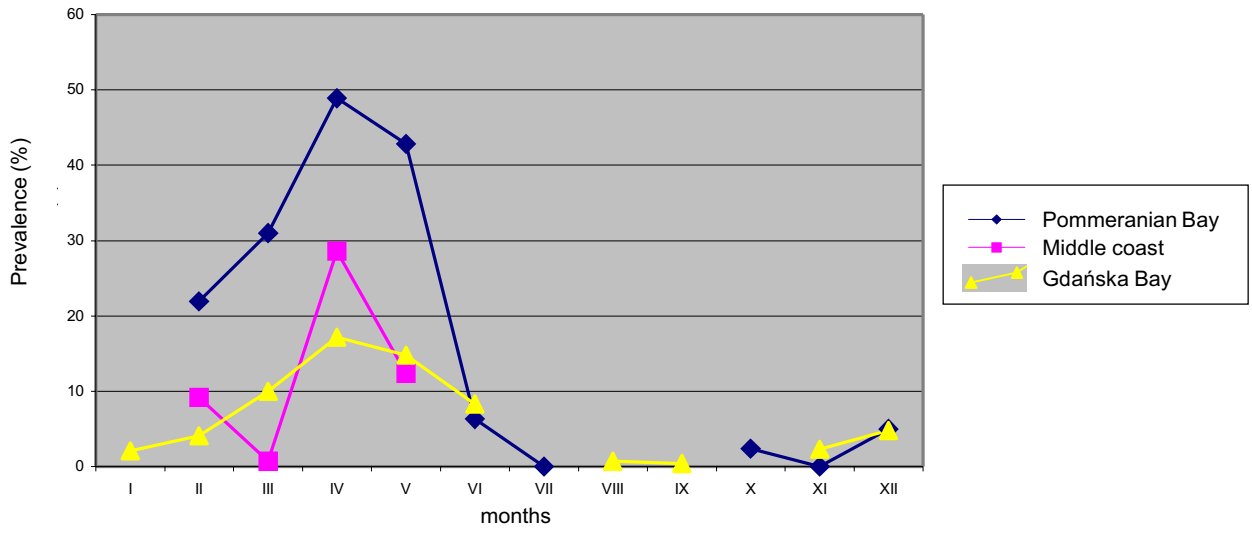

Fig. 2. The prevalence of infection with *A. simplex* larvae of herring caught in different fishing grounds in following months of the year

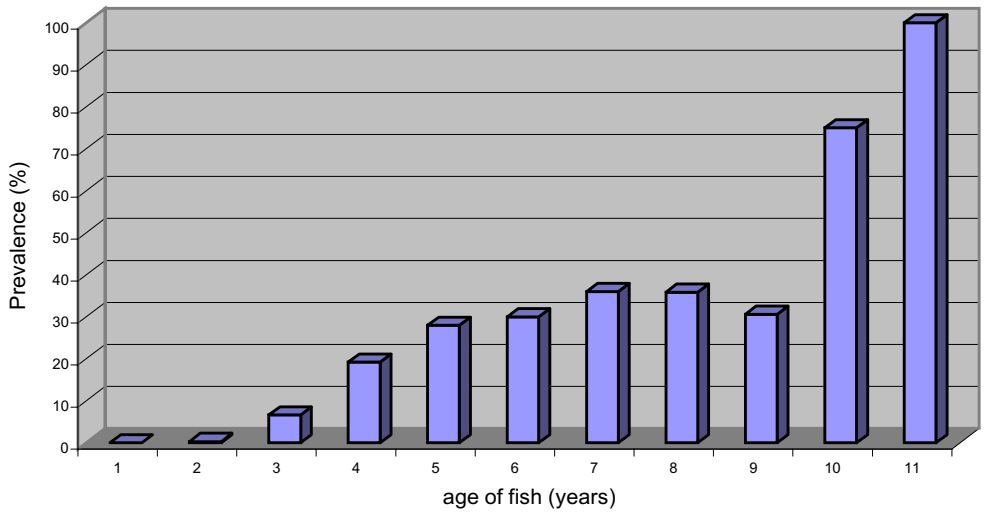

Fig. 3. The prevalence of infection of herring "W" caught from March to May in particular age groups of fish

Both prevalence and intensity of infection with *A. simplex* larvae increased with age of fish – Figure 3.

Larvae occurred mostly along the intestine, and in pylogic region, but in 12% of infected fish larvae were fixed in muscles – such larvae have been potentially danger for humans eating raw or underdone fish.

Cod

Only 4% of cod were found to be infected with extra-intestinal anisakid larvae, mainly *C. osculatum* (prevalence: 2.57%) more rarely with *A. simplex* (0.92%) and *H auctum* (0.49%) and only once with *Pseudoterranova decipiens*. The per cent contribution of particular anisakid species found in cod examined is shown on Figure 4.

The prevalence of infection were found to be higher in fish from northern fishing grounds (Nos 130–141) then from southern ones (Nos 101–109) – Figure 5.

The seasonality in parasite occurrence was not recorded.

Parasites were found only in fish >= 33 cm in length (body length permitted in commercial catches) – Figure 6. All parameters of infection increased with fish body length.

98% of larvae were located just beneath the liver serosa or within the liver parenchyma, only 2% on pyloric processes or on the peritoneum. The presence of aniskid larvae in the liver of cod do not threaten human's health, because it is seldom eaten raw.

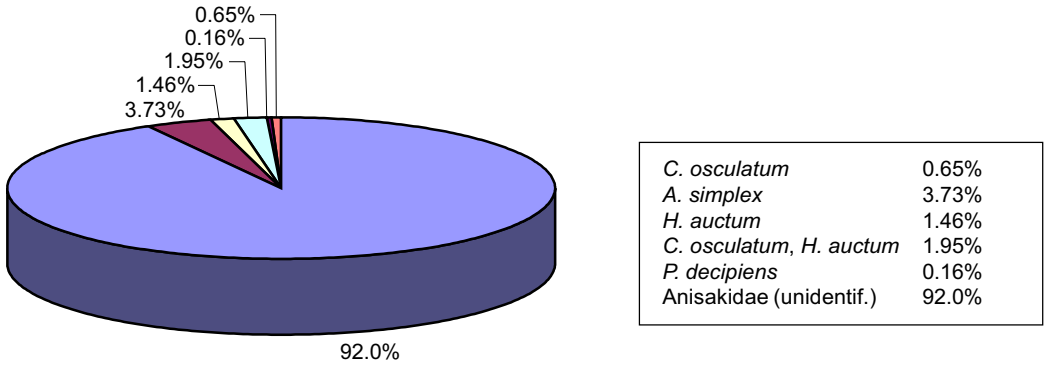

Fig. 4. The per cent contribution of particular anisakid species found in cod examined

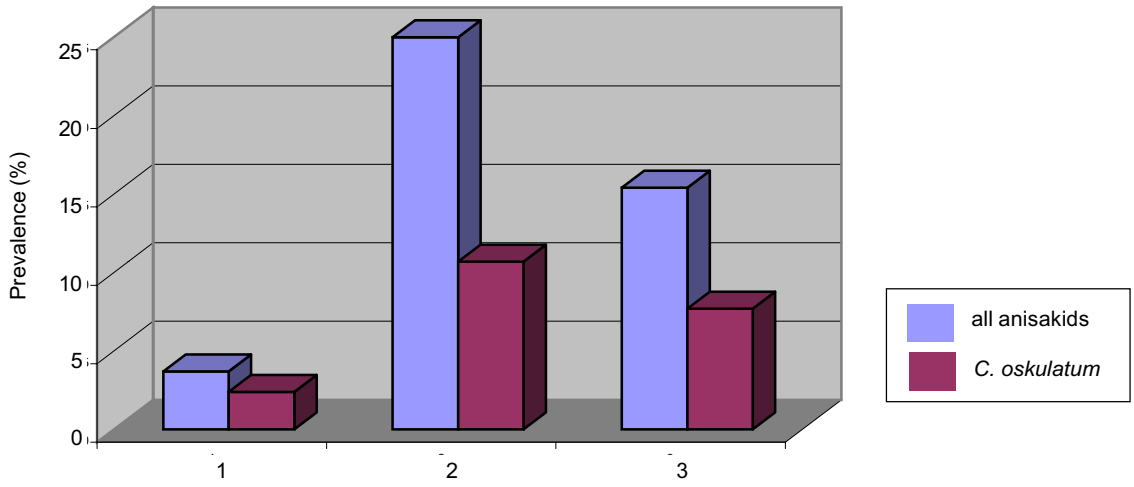

Fig. 5. The prevalence of infection of cod caught in Polish – southern Baltic (1), Swedish – northern Baltic (2) and Danish/Swedish – western Baltic (3) fishing grounds

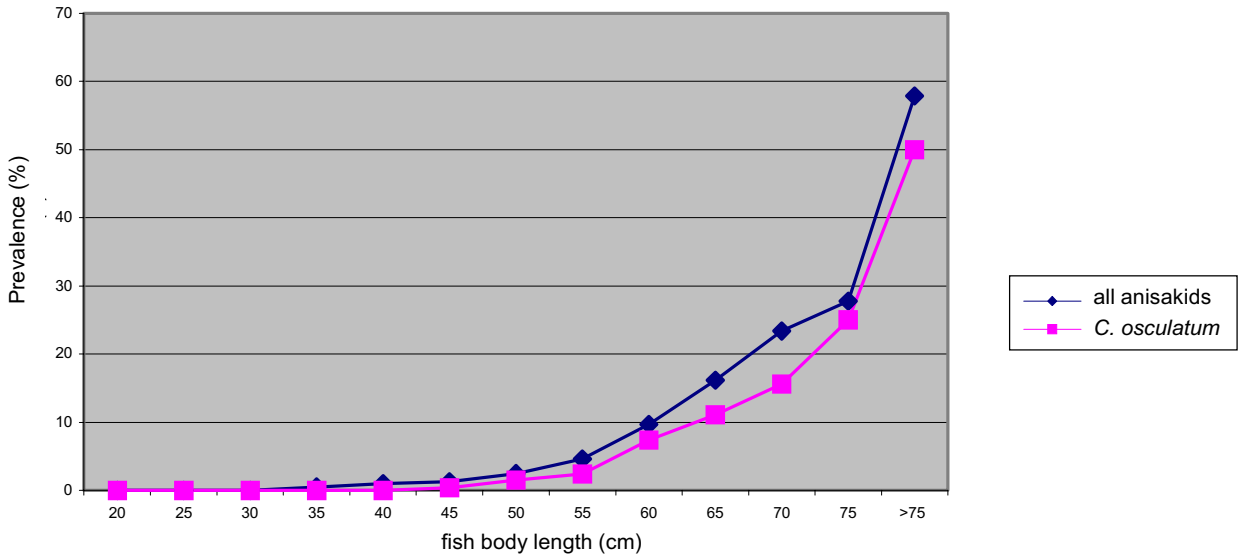

Fig. 6. The prevalence of infection of cod in relation to their body lenght

Flounder

Anisakid larvae were found very seldom: *A. simplex* in four fish (0.25%, intensity: 1, 1, 2 and 6 spec.) and *C. osculatum* in two ones (0.12%, intensity 1 spec.). *H. auctum* were noted oftener (5.26%, mean intensity 1.48).

Sprat

No anisakid species were found in this fish species.

Preserves from herring

In 6 from among 39 kinds of preserves (15.4%) the presence of *A. simplex* larvae in muscles was ascertained after their digestion with artificial stomach juice. There were found mainly in salted and smoked not gutted herring but they were also found in one wrapping of salted fillet and in one container of ready-to-eat fillets in spiced pickle. Almost all larvae were dead, but two *A. simplex* larvae found in container of ready-to-eat fillets in spiced pickle were alive.

Results of herring and cod investigations were published in: Myjak *et al*., 1994, Myjak *et al.* 1996b.

Results of investigations concerning a part of flounder and sprat (1102 and 450 specimens, respectively) were published in: Myjak *et al.*, 1996a.

Conclusions

The most numerously represented anisakid species in southern Baltic Sea was *Anisakis simplex* while the most infected fish species from among investigated was herring. The data showed that eating of raw, semi-raw herring, as well as some preserves from herring available in retail market, could be the source of infection with *A. simplex* larvae of humans in Poland.

Eating of cod, flounder and sprat caught in southern Baltic in practice do not threaten with anisakidosis for humans.

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