Oceanological and Hydrobiological Studies
International Journal of Oceanography and Hydrobiology

Volume 41, Issue 3

ISSN 1730-413X
eISSN 1897-3191

(99–102)
2012

VERSITA

DOI: 10.2478/s13545-012-0032-0
Short communication

Received: November 07, 2011
Accepted: December 23, 2011

Nematodes found in the European anchovy (*Engraulis encrasicolus*), a rare visitor to the Baltic Sea

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Key words: European anchovy, *Engraulis encrasicolus*, parasites, *Hysterothylacium aduncum,* Baltic Sea.

Abstract

The European anchovy, *Engraulis encrasicolus* (Linnaeus, 1758), enters the Baltic Sea only occasionally. Little is known about the parasites that inhabit this fish in the northern part of its natural range (north-eastern Atlantic). This study is based on 32 anchovies sampled in autumn 2006 from a substantial bycatch accompanying sprat in the Gulf of Gdańsk (southern Baltic Sea).

The fish were examined using standard parasitological procedures, and yielded 10 L3 larvae of the nematode *Hysterothylacium aduncum* (Rudolphi, 1802). The prevalence and the intensity (mean and range) were 21.9%, 1.4, and 1–4, respectively.

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INTRODUCTION

The European anchovy, *Engraulis encrasicolus* (Linnaeus, 1758), is a common, pelagic, school-forming fish of wide geographic range and high commercial importance. The species occurs along the eastern coast of the Atlantic; its range extends from the southern coast of Norway along the European and African Atlantic shores down to Angola. The species is also found throughout the Mediterranean, Black, and Azov Seas (Whitehead et al. 1988), but it is very rare to find it in the Baltic Sea and specifically in the Polish Exclusive Economic Zone. Two documented records (1976 and 1996–2004; Draganik and Wyszyński 2004, Grygiel 2009) were associated with sprat. Recorded sightings from the Gulf of Gdańsk were described by Skóra (2000a,b, 2003). Other records include the one described in this paper (2006), and one from 2007, reported by Grygiel (2009).

The European anchovy feeds mainly on plankton, including copepods, cirripeds, and mollusc larvae, as well as fish eggs and larvae (e.g., Whitehead et al. 1988, Raab et al. 2011).

The findings reported here constitute the first record from the Baltic Sea.

MATERIALS AND METHODS

A substantial (hundreds of specimens per haul) bycatch of European anchovy, *Engraulis encrasicolus*, was recorded on 27 December 2006 during sprat fishing in the Gulf of Gdańsk, off the Hel Peninsula (fisheries quadrants S4 and S5). Thirtytwo individuals (13.5 – 16.2 cm long) were preserved in formalin and subsequently subjected to standard parasitological examination. The organs examined included gills, eyes, body cavity, stomach, intestine, pyloric caeca, swim bladder, liver, heart, and muscles. The parasites

found (nematodes only) were fixed in a mixture of glacial acetic acid and 36% – 38% formaldehyde and cleared in lactophenol. Six nematodes were embedded in glycerol-gelatine (Rolbiecki 2002), while the remaining ones were, after identification, placed in 70% ethanol.

RESULTS

Seven fish (14.5 – 15.7 cm long) yielded a total of 10 L3 larvae of *Hysterothylacium aduncum* (Rudolphi, 1802). Prevalence, mean intensity, and intensity range were 21.9%, 1.4, and 1–4, respectively. One individual (15.1 cm) contained 4 nematodes on the liver. The remaining fish each carried one nematode on the pyloric caeca. The nematodes were not encysted. The larval cuticle was transversely striated. The tail was conical with a sharp tip. The subsequent larval stage (L4) was visible under the cuticle; it showed a well-developed mucron in the form of a "cactus tail". The principal meristic features of the larvae found were as follows (in mm): length of body 5.5 – 12.5 (mean 8.87), maximum width of body 0.12 – 0.29 (mean 0.18), length of oesophagus 0.60 – 1.33 (mean 1.00), length of ventricular appendix 0.25 – 0.62 (mean 0.43), length of intestinal caecum 0.11 – 0.80 (mean 0.39), distance of nerve ring from anterior extremity 0.18 – 0.34 (mean 0.26), distance of excretory pore from anterior extremity 0.19 – 0.35 (mean 0.26), and length of tail 0.10 – 0.18 (mean 0.14). The nematodes' dimensions were consistent with published descriptions of the parasites (Moravec 1994, Navone et al. 1998).

DISCUSSION

The materials examined contained only the L3 larvae of *Hysterothylacium aduncum* (Raphidascarididae). Their prevalence was relatively high (21.9%), accompanied by a low intensity of 1 – 4 (mean 1.4). The parameters of infection of *H. aduncum* L3 larvae in European anchovy outside the Baltic Sea varied. Off the coast of Gibraltar (Atlantic), the prevalence and intensity were 4.5% and 1 – 6, respectively (Rello et al. 2009). In the Mediterranean Sea these parameters were 3.7% – 20.43% and 1 – 78, respectively (Cuéllar et al. 1991, Rello et al. 2009, Martínez and Casadevall 2010). In the Adriatic they reached 26.2% and 3.1, respectively (Fioravanti et al. 2006). In the Black Sea, however, the prevalence ranged from 92% to 100% and the intensity from 1 to as many as 1200 (Tolgay 1965, Shchepkina 1985, Gayevskaya 2004, Tuncel and Akmirza 2006, Gayevskaya et al. 2010), whereas the prevalence values in the Sea of Marmara were lower than 10% (jointly for *Hysterothylacium* (=*Contracaecum*) *aduncum* and *Anisakis simplex* (Rudolphi, 1809)) (cf. Tuncel and Akmirza 2006). It should be emphasized that no *H. aduncum* was found in the European anchovy off the Catalan coast (Gutiérrez-Galindo et al. 2010).

The *H. aduncum* L3 larvae have also been frequently reported in other anchovy species. For instance, the Argentine anchoita, *Engraulis anchoita* Hubbs et Marini, 1935, occurring in the Atlantic off the Argentine coast, showed variable prevalence (6.15% – 75.91%) and mean intensity (1.75 – 33.33), depending on the area and the period of capture (Navone et al. 1998, Timi 2003, Timi and Poulin 2003). In addition, Timi (2003) reported a mean abundance range of 1.09 – 15.20. The Japanese anchovy, *Engraulis japonicus* Temminck et Schlegel, 1846, from the north-western and central Pacific showed nematode prevalence of 26.0% – 41.4% (jointly for *H. aduncum* and *A. simplex*) (Kino et al. 1993).

The literature (e.g., Fioravanti et al. 2006, Rello et al. 2009, Martínez and Casadevall 2010) shows *H. aduncum* to be, in addition to *Anisakis simplex* (Anisakidae), the most frequent parasite of the European anchovy. In many countries anchovies are consumed by humans, so anchovies are often the subject of parasitological studies. It should also be mentioned that the European anchovy is examined mainly for the presence of anisakid nematodes, particularly *A. simplex* (see Fioravanti et al. 2006, Martínez and Casadevall 2010, De La Torre Molina et al. 2000), since it is the most common cause of anisakiasis (Ishikura et al. 1993). *H. aduncum* cannot be ruled out as a human pathogen either (Fernandez-Caldas et al. 1998, Yagi et al. 1996).

Anchovies in various seas were found to be infected by other parasites, representing Protozoa, Myxozoa, Monogenea, Digenea, Cestoda, Nematoda, Acanthocephala, Copepoda, and Isopoda (see Ginetsinskaya 1970, Gayevskaya et al. 1975, Bray 1990, Duszynski et al. 2003, Strona et al. 2010).

The nematodes found in this study were not encysted. As shown in the literature, *H. aduncum* retrieved from the fish body cavity are either encysted (e.g., Køie 1993, Moravec 1994, Rakauskas et al. 2008, Gayevskaya et al. 2010) or non-encysted (e.g., Berland 1961, Navone et al. 1998, Rakauskas et al. 2008). Perhaps the European anchovy examined in this study were at an early stage of infection,

whereby the larvae had not had time to produce cysts. Alternately, perhaps they had already begun their migration to the intestinal lumen and/or to the muscles and had left the cysts earlier. However, no cyst remains were found in the fish examined. It is also possible that the presence of cysts is host specific.

To summarise, it has to be emphasised that the European anchovy is an important link in the dispersal and persistence of the *H. aduncum* population in the North Atlantic.

ACKNOWLEDGEMENTS

We would like to thank the reviewers for helpful comments and suggestions regarding the manuscript.

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