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Reighardia sternae (Diesing, 1864) – a pentastomid (Pentastomida) species new for the fauna of Poland

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Abstract: The Pentastomida are endoparasites occurring primary in vertebrates. In 2002–2003, a total of 38 sea gulls (10, 15, and 13 individuals of *Larus argentatus*, *L. canus*, and *L. ridibundus* respectively) from the environs of the Tricity Gdańsk-Sopot-Gdynia and the Gulf of Gdańsk coast were examined. One of the herring gulls (*L. argentatus*) was found to carry, in the intraclavicular air sac 12 specimens of *Reighardia sternae*, all of them ovigerous females. This is the first record of *R. sternae* from Poland.

Key words: *Reighardia sternae*, tongueworms, *Pentastomida*, herring gull, *Larus argentatus*, Baltic Sea, Poland

INTRODUCTION

The Pentastomida (tongueworms, linguatulids) are a poorly known group of animals the taxonomy and phylogenetic status of which are unclear and subject to an on-going discussion. They have been grouped together with helminths (Fröhlich 1789, Humbold 1811, Diesing 1850 after de Oliveira Almeida & Christoffersen 1999), annelids, mites, tardigrades, onychophorans, and myriapods (Osche 1963, Haugerud 1989). In various taxonomic systems they have been treated as a separate phylum (Walldorf 2001), an order within *Arachnida* (Brown & Neva 1983), or a class within the *Mandibulata* (Beaver et al. 1984). As a result of comparative research based on the analysis of spermatogenesis (spermatozoa ultrastructure in particular) and RNA ribosomal nucleotide sequence, pentastomids are currently regarded as a modified group (sub-class) of crustaceans, closely related to the *Branchiura* (Abele et al. 1989, Storch & Jamieson 1992). Moreover, Riley et al. (1978) considered pentastomids to have originally been fish parasites; however, as a result of predation by higher vertebrates (mainly reptiles), they became endoparasites of those.

Pentastomids grow to 1–16 cm in length; their body is elongated, worm-like in shape and consists of a short, conical cephalic part (with the mouth aperture and four depressions or processes containing chitinous hooks) and an elongated thorax. They were found to contain neither the excretory, circulatory, nor respiratory system (Bush et al. 2001). Pentastomids are exclusively endoparasitic and live mainly in vertebrates. So far, more than 130 species have been described, primarily from tropics and sub-tropical areas (de Oliveira Almeida & Christoffersen 1999). Adults settle in the respiratory system and body cavity of, mostly, reptiles (more than 90% of all the species) and more seldom in amphibians, birds, and mammals. Pentastomid larvae live in fish, amphibians, reptiles, mammals, and even insects (Self & Kuntz 1967, Ali et al. 1982, Riley 1986, Hoffman 1999). However, as reported by Riley (1986), some species exhibit a simple, single host-based, life cycle.

So far, Polish pentastomid records have concerned larval stages of *Linguatula serrata* (Frölich) (Dziekoński 1947) in cattle and unidentified species of *Linguatula* (adult?) in *Alopex lagopus* (L.) (Malczewski 1961).

The present paper describes another, new for the fauna of Poland, pentastomid species, *Reighardia sternae* (DIESING, 1864) found in a herring gull.

MATERIAL AND METHODS

In 2002–2003, a total of 38 dead gulls (10, 15, and 13 individuals of *Larus argentatus* Pontoppidan, *L. canus* L., and *L. ridibundus* L. respectively), collected in the Tricity Gdańsk-Sopot-Gdynia area (36 birds) and on the Gulf of Gdańsk coast (Baltic Sea) near Gdynia and Gdańsk (2 birds) were thoroughly examined for the presence of parasites, following the generally adopted procedures (Dubinina 1971). The parasites found were cleaned of mucus and blood, and fixed with a 9:1 mixture of glacial acetic acid and formalin. Subsequently, they were preserved in 70% ethanol. Further examination involved clearing the parasites in lactophenol.

RESULTS

The interclavicular sac (*saccus interclavicularis)* of a young (sexually immature, in the first year of life) herring gull (*Larus argentatus*) female found on the Gulf of Gdańsk coast contained 12 specimens of a pentastomid which, based on the description of Riley (1973), were identified as *Reighardia sternae* (Fig. 1 & 2). All the parasites were mature (ovigerous) females measuring from 43.7 mm to 53.9 mm in body length and from 1.89 to 2.53 mm in body width. The larvae-containing eggs measured 0.26–0.38 mm (mean: 0.28 mm) in length and 0.14–0.29 mm (mean: 0.19 mm) in width (30 specimens were measured). The anterior hook dimension ranges were as follows: 0.111–0.125 mm (h) and 0.031–0.032 mm (th); dimensions of the posterior hooks were found to range within 0.087–0.108 mm (h) and 0.029–0.032 mm (th) (Table 1 & Fig. 3).

Fig. 1. *Reinhardia sternae*, female from the air sacs of a herring gull, *Larus argentatus*.

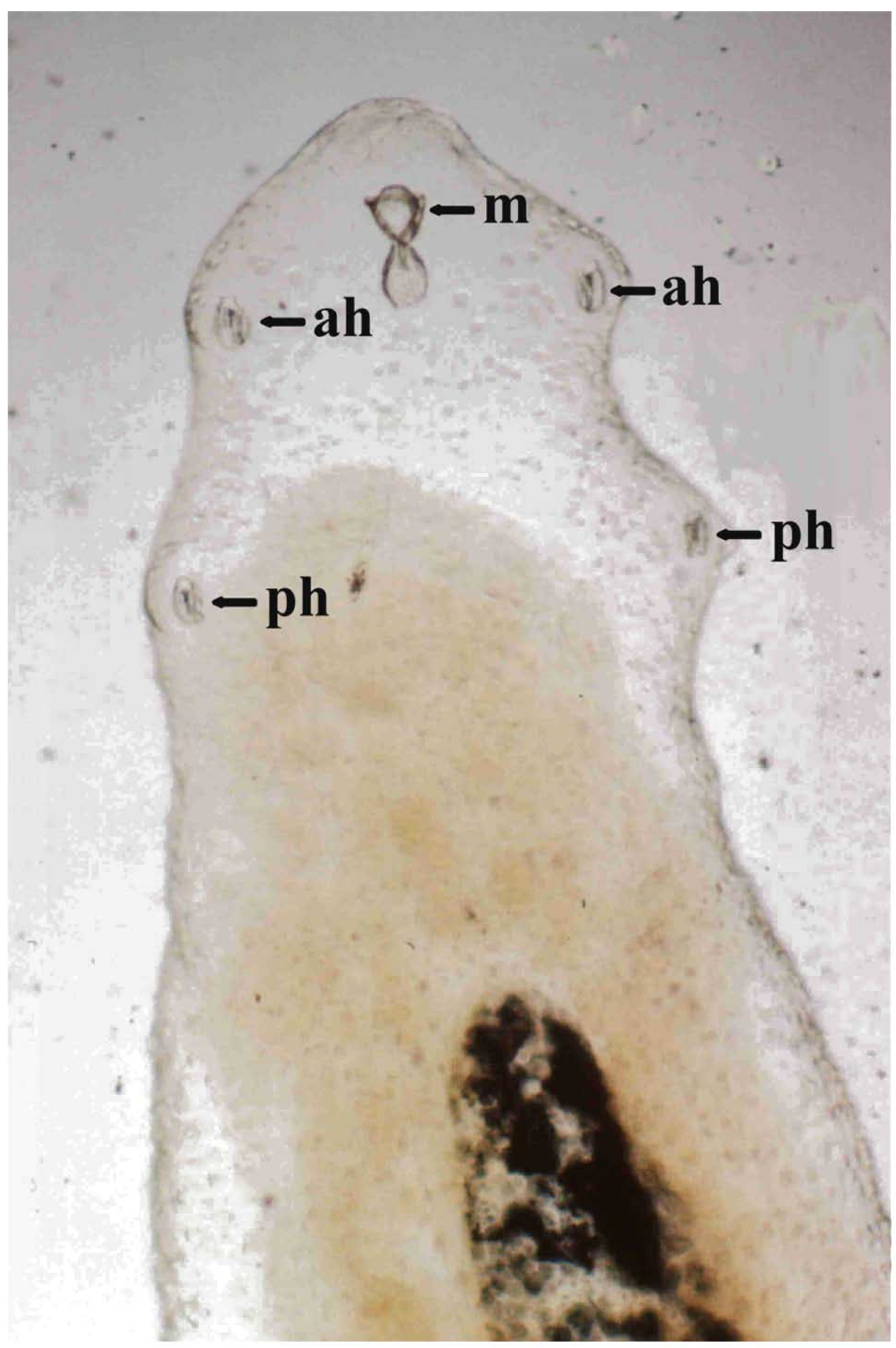

Fig. 2. Detail of ventral anterior region of *Reinhardia sternae*; m: mouth (supported by a Y-shaped chitinous structure), ah: anterior hooks, ph: posterior hooks.

Discussion

Pentastomids are rare bird parasites. Until today, as few as two species of the genus *Reighardia* have been described. Both are sea bird parasites. One is *Reighardia lomviae* Dyck found in the guillemot *Uria aalge* (Pontoppidian) on the North Atlantic (Dyck 1975). The other, *Reighardia sternae,* is a specific parasite of gulls and terns (*Laridae*), mostly in the Holarctic, but found also in tropical and Antarctic areas (e.g., Dubinina & Smogorzhevskaya 1956, Pemberton 1963, Bakke 1972, Baruš et al. 1978, Böckeler & Vauk-Hentzelt 1979, Böckeler 1984, Hoberg 1987). *R. sternae* was reported also from the alcid birds (family Alcidae): in the guillemot (*Uria aalge*) and puffin (*Fratercula arctica*) (L.) from North Atlantic (Threlfall 1971). The present finding of *R. sternae* is the first record of the parasite in the Polish coastal waters. Pentastomids should be expected to occur in other aquatic birds, as mentioned by Storer (2002).

Table 1. Morphometric data [mm] on *Reighardia sternae* females, after various authors;* – number of specimens in which hooks were measured, ** – see Fig. 3 for explanation of symbols.

Characters		Dubinina and Smogorzevskaya (1956) n=40	Riley (1973) n=20 n=4*	Bockeler & Vauk-Hautzelt (1979) n=208	Bockeler (1984) n=89	Hoberg (1987) n=3	Authors data n=12 n=6*
Body length		15–43	30–46	25–45	10–70	11.2–27.5	43.7–53.9
Body width		1.5–3	2.5	–	–	–	1.89–2.53
Length and width of eggs with primary larvae		0.25–0.33 0.13–0.24	–	–	–	0.235–0.325 0.155–0.200	0.26–0.38 0.14–0.29
Length of anterior hooks	h**	–	0.087–0.100	–	–	0.082–0.093	0.111–0.125
	th**	–	0.030–0.035	–	–	0.035–0.039	0.031–0.032
Length of posterior hooks	h**	–	0.092–0.106	–	–	0.082	0.087–0.108
	th**	–	0.030	–	–	0.032–0.034	0.029–0.032

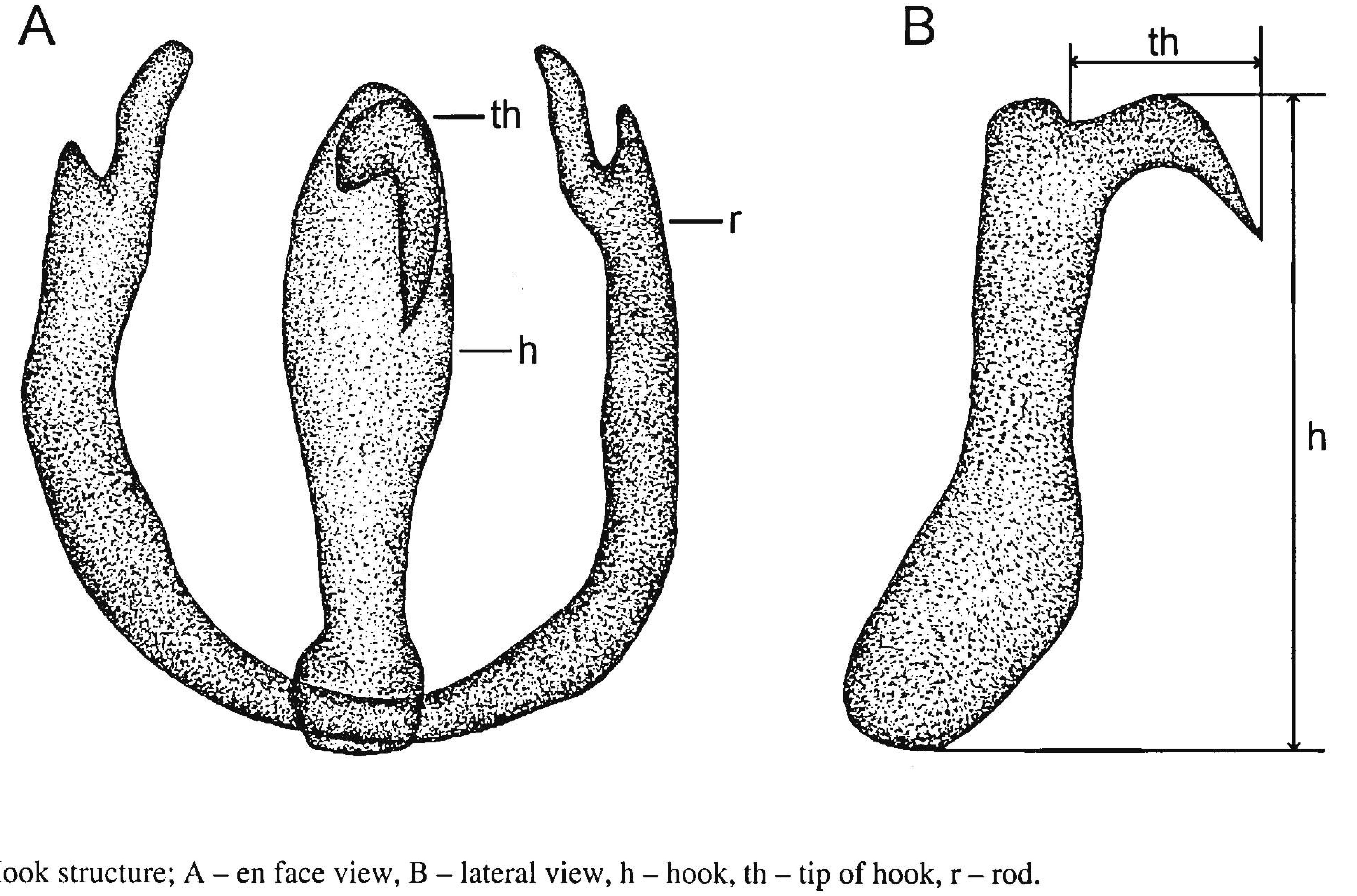

Fig. 3. Hook structure; A – en face view, B – lateral view, h – hook, th – tip of hook, r – rod.

Birds become infected with *R. sternae* by eating the parasite's egg with primary larvae; these hatch in the host's intestine and migrate to the body cavity to posterior air sacs, and from there to the interclavicular ones. In addition, mature females move via the lungs to the trachea and beak cavity to lay eggs there. The eggs are either swallowed by the host and excreted or, regurgitated, become a source of infection for other birds (Banaja et al. 1975, Böckeler 1984). It would seem that a single-host life cycle of *R. sternae* facilitates infection, thus resulting in a high prevalence level, the more so that the gulls' gregarious mode of life enhances parasite transmission between hosts. However, the proportions of infected birds reported in various papers have always been low and varied (depending on the host species, site, and bird collection site). The ranges reported amounted to, e.g., 0.5–8.9% in *Larus ridibundus* (Pemberton 1963, Creutz & Gottschalk 1969, Böckeler & Vauk-Hentzelt 1979, Baruš et al. 1978), 5.2–7.9% in *L. canus* (Bakke 1972, Böckeler 1984), 4.8–10% in *L. argentatus* (Riley 1972, Böckeler & Vauk-Hentzelt 1979), 8–12.3% in *L. marinus* (Böckeler & Vauk-Hentzelt 1979, Böckeler 1984), 11.1% in *Sterna hirundo* (Baruš et al. 1978), and 4.6–8.8% in *Rissa tridactyla* (Böckeler & Vauk-Hentzelt 1979, Böckeler 1984). Young, immature birds showed a heavier infection than adults (Bakke 1972, Böckeler 1984). Mean intensity, too, was low and did not exceed 10 parasites per infected bird. The low prevalence should be sought in the rarity of the parasite itself. In addition, the prolonged interaction frequently leads to a relative equilibrium of the host-parasite system, which may be manifested as a low level of host infection, particularly in adult specimens. On the other hand, the young birds' inadequate resistance results in their heavier infection. Numerous authors dealing with age-dependent parasite occurrence have frequently demonstrated infection parameters to be higher in young birds (Dubinin 1954, Bykhovskaya-Pavlovskaya 1962, Smogorzhevskaya 1976, Sitko 1993, Kanarek et al. 2003).

The problem of a potential occurrence of fish as intermediate hosts in the life cycle of *R. sternae* (Bakke 1972, Riley 1972) deserves mention. In addition, Banaja et al. (1976) are of the opinion that, for a parasite with a simple life cycle, *R. sternae* shows a low fecundity, manifested as a short period of egg laying (1–3 days) and low egg production (about 2900). In another study, Banaja et al. (1975) express their doubts as to parasite transmission under natural conditions in such a cycle, although they did keep the parasite through a single-host cycle. Perhaps the parasite's life cycle is complex (involving multiple hosts), which, in the absence of appropriate intermediate hosts, makes it rare and the chance of birds being infected is diminished. It is also possible that originally *R. sternae* went through a complex cycle that became shortened as an adaptation to changes in abiotic and biotic (e.g., disappearance or reduced availability of specific hosts) environmental factors. The change/shortening of the cycle could have produced a number of unfavourable changes for the parasite, such as the already mentioned reduced fecundity. At the same time, self-infection observed in *R. sternae* (Banaja et al. 1976) may be one of an adaptations to conditions of life. Another question is the fact that *R. sternae* is one of the few parasites that proceeds along a dual developmental pathway involving one or two hosts (definitive and intermediate) and both occur at the same population, which is also the case in, e.g., the tapeworm *Rodentolepis nana* (Stefański 1968), species of the genus *Archigetes* (Williams & Jones 1994) or the trematode *Opisthioglyphe ranae* (Grabda-Kazubska 1969).

Dimensions of the *R. sternae* females collected in this study are basically within the range of variability reported by other authors (Dubinina & Smogorzhevskaya 1956, Riley 1973, Bockeler & Vauk-Hautzelt 1979, Bockeler 1984, Hoberg 1987). Although the authors mentioned frequently reported the total length of the parasite only, their data allow to conclude on substantial variability (Table 1). The size differences observed could have stemmed from numerous factors. The causes of the variability could be sought in inter-population or intraspecific variability, in the structure of a group analysed (e.g., maturity of the parasites and the degree to which they are filled with eggs). It is also difficult to compare data of various authors who frequently examined a low number of specimens only. It was not always that the authors reported the number of specimens in which hooks were measured (Hoberg 1987) or the number of eggs measured (Dubinina & Smogorzhevskaya 1956, Hoberg 1987). Important may be also the type of fixative; some fixatives may cause specimens to shrink or expand. In this study, the mixture of glacial acetic acid and formalin was used, while other authors applied 10% formalin (Riley 1973) or 70% ethanol (Hoberg 1987); some authors failed to mention the fixative they were using (Dubinina & Smogorzevskaya 1956, Böckeler & Vauk-Hentzelt 1979, Böckeler 1984) – perhaps they measured dead but not fixed parasites.

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STRESZCZENIE

[*Reighardia sternae* (DIESING, 1864) – nowy gatunek Pentastomida dla fauny Polski]

Pentastomida są endopasożytniczą grupą zwierząt notowanych głównie u kręgowców. W latach 2002-2003 zbadano 38 mew (10 *Larus argentatus*, 15 *L. canus*, 13 *L. ridibundus*) pochodzących z okolic Trójmiasta i wybrzeża morskiego Zatoki Gdańskiej. U jednego osobnika mewy srebrzystej *L. argentatus* w międzyobojczykowym worku powietrznym znaleziono 12 osobników *Reighardia sternae*; były to wyłącznie dorosłe samice z jajami. Jest to pierwsze stwierdzenie *R. sternae* na terenie Polski.

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