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New data on the parasites of the Eurasian otter (*Lutra lutra*)

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Abstract

The Eurasian otter *Lutra lutra* (Linnaeus, 1758) is a typical representative of carnivorous mammals from the family of mustelids (Mustelidae) which are closely connected with aquatic ecosystems. Parasitofauna of the otter is poorly identified, e.g. only two specimens have been examined in Poland for the presence of parasites. Currently, three species of parasites were found in one otter: the nematode *Oswaldocruzia filiformis* (Goeze, 1782), the acanthocephalan *Acanthocephalus ranae* (Schrank, 1788) and the skin mite from the Demodecidae family. *Demodex* sp. is a new species to science, while *O. filiformis* and *Demodex* sp. are new parasites for the otter throughout the species range. Furthermore, *A. ranae* was found for the first time in the otter from the area of Poland. The recorded helminths are typical parasites of amphibians and reptiles, and their occurrence in the Eurasian otter may result from postcyclic transmission from primary hosts.

INTRODUCTION

The Eurasian otter is a carnivorous mammal (Carnivora) from the Mustelidae family, which occurs throughout most of Europe, Asia, and North Africa. Although the species is rare in Poland, its range covers the whole country. It is an aquatic animal which occurs at the river banks, at the shores of ponds and lakes, but also at saline water bodies, including the Baltic coast (Mason & Macdonald 1986, Sikora 2004, Romanowski et al. 2011). The water environment provides food, which consists mainly of fish, as well as amphibians, reptiles, small birds, mammals, mollusks, crustaceans and aquatic insects (Mason & Macdonald 1986, Sikora 2004, Kruuk 2006). This type of lifestyle determines the role of otter in the ecosystems − a predator, which usually represents the top trophic level. Therefore, the species plays an important role in the circulation of parasites associated with aquatic environment whose life cycles are often very complex and require different hosts. On the other hand, it is not possible to acquire knowledge about life cycles of parasites, including common species and those important for the functioning of hosts in the colonized ecosystems, as well as economically important species, without identification of all hosts at different developmental stages of parasites. Predators are frequent hosts of adult, sexually reproducing stages, and therefore they are of particular importance in the aquatic environment. Furthermore, while acquiring parasites with the infected food, the predators may constitute a reservoir of many atypical species, and consequently the otter is a very interesting object of parasitological research. At the same time, knowledge about the otter's parasitofauna is very scanty.

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MATERIALS AND METHODS

Only one otter was examined (female, weight: 3.9 kg, body length: 64.1 cm, tail length: 34.2 cm, hind foot length: 7.1 cm). It was a dead specimen found on May 2013, in northern Poland (the Elbląg River, 54°12´N/19°22´E). The stomach was filled with remains of amphibians from the family of true frogs (Ranidae).

A standard helminthological dissection was performed. The collected helminths were fixed in a mixture of acetic acid and 40% formaldehyde (19:1), after which the nematode was cleared in lactophenol, while the acanthocephalan was stained in alcohol-borax carmine, dehydrated in the alcohol series and cleared in benzyl alcohol (Rolbiecki 2002, 2007).

Also hair and skin were examined for the presence of parasitic arthropods. The hair was first combed and screened, after which ca. 1-2 cm^2 fragments of skin were excised from different parts of the host body, including the head (ears, eyelids, sensory hair of the nose, nose tip, lips and chin region), the neck, abdomen, back, limbs, the genital-anal region, and the tail. The method of host skin fragments digestion was used for the recovery of skin mites (Izdebska 2004). Skin samples were preserved in 70% ethanol solution, and then exposed to digestion in 10% sodium hydroxide solution; the obtained samples were decanted and analyzed using the phase contrast microscopy. The specimens found were placed in Faure's solution.

RESULTS

One nematode *Oswaldocruzia filiformis* (Goeze, 1782) (Fig. 1) and one acanthocephalan *Acanthocephalus ranae* (Schrank, 1788) (Fig. 2) were found in the otter's stomach.

A total of 16 *Demodex* sp. (Fig. 3) specimens were found in the examined skin samples from the head regions (vibrissae and eyelids) and legs. The average size of adults in this species is 221 μm in length and 37 μm in width. Based on the analysis of morphoanatomic and morphometric traits, it has been determined that the specimens found belong to an unknown species, new to science, which needs to be described according to the criteria adopted in the taxonomy of Demodecidae.

Since *O. filiformis* is a new parasite for the entire range of the Eurasian otter, and *A. ranae* was found for the first time in the otter from the area of Poland, their dimensions have been presented in this paper.

Description of *Oswaldocruzia filiformis* (Fig. 1), female [measurements in mm].

Body length 19.9, maximum width 0.27. Cephalic vesicle consists of two parts, the anterior part is 0.041 long and 0.063 wide, the posterior part is 0.057 long and 0.055 wide. Distance of the nerve ring from the anterior extremity is 0.156. The excretory pore situated 0.416 away from the anterior extremity. Narrow, lateral alae are present only along the oesophagus. Oesophagus 0.51 × 0.07. Vulva situated 6.9 away from the posterior extremity; distance between sphincters 0.19. Tail conical 0.30 length, with terminal spike 0.016 long. Eggs (measured n=10) 0.083 × 0.055 (0.055-0.094 × 0.051-0.059), SD 0.016 × 0.002.

Description of *Acanthocephalus ranae* (Fig. 2), female [measurements in mm].

Body length 20.12, maximum width 1.87, the anterior part of the trunk is widened, narrowing posteriorly. Proboscis 0.42 long and 0.23 wide (at the posterior end), 0.27 wide (at center) and 0.16 wide (at the anterior end); the anterior part is rounded with no hooks present; proboscis consists of 14 longitudinal rows, 4-5 hooks in each row. Length of hooks (counted at the anterior end of proboscis): first blade 0.067 (0.066-0.070), SD 0.002, second blade 0.069 (0.066-0.074), SD 0.003, third blade 0.071 (0.066-0.075), SD 0.004, fourth hooks 0.068 (0.066-0.070), SD 0.002, fifth blade 0.043 (0.039-0.047), SD 0.004; well-developed roots, sometimes invisible (fifth hook situated at the base of the proboscis). If there are 5 hooks in a row, the fifth hook is always much smaller, undeveloped. Proboscis receptacle 0.80 long and 0.24 wide. Neck trapezoidal, 0.15 long, 0.30 wide (at the posterior end). Lemnisci 1.09, 1.09 long and 0.18, 0.15 wide. Eggs (measured n=10) 0.130 × 0.016 (0.073-0.161 × 0.015-0.018), SD 0.030 × 0.002.

DISCUSSION

Three species were found in the examined otter: nematode (*O. filiformis*), acanthocephalan (*A. ranae*) and mite (*Demodex* sp.). *O. filiformis* and *Demodex* sp. are new parasites for the otter within its entire range, and *A. ranae* is new to the otter from Poland. *Demodex* sp. is a new species to science.

The state of research on parasites of otters from the region of Poland is incomplete and limited to two

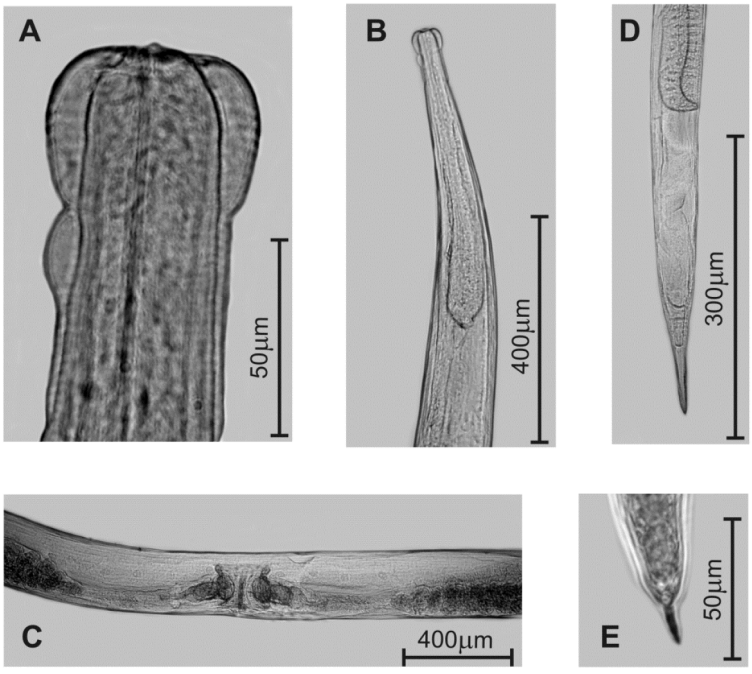

Fig. 1. *Oswaldocruzia filiformis*, female, A: head end, B: anterior end, C: region of vulva, D: tail, E: tip of tail

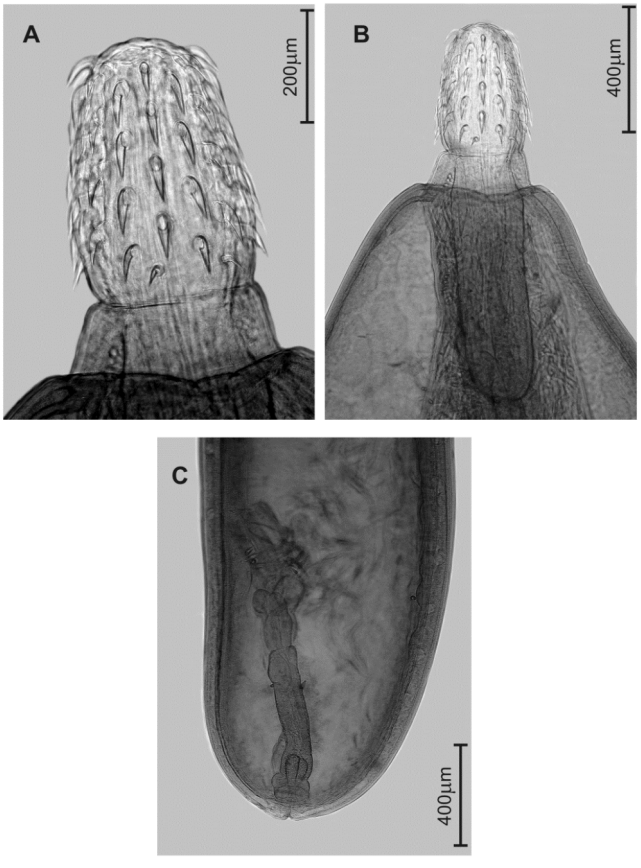

Fig. 2. *Acanthocephalus ranae*, female, A: proboscis, B: anterior end, C: posterior end of the reproductive system

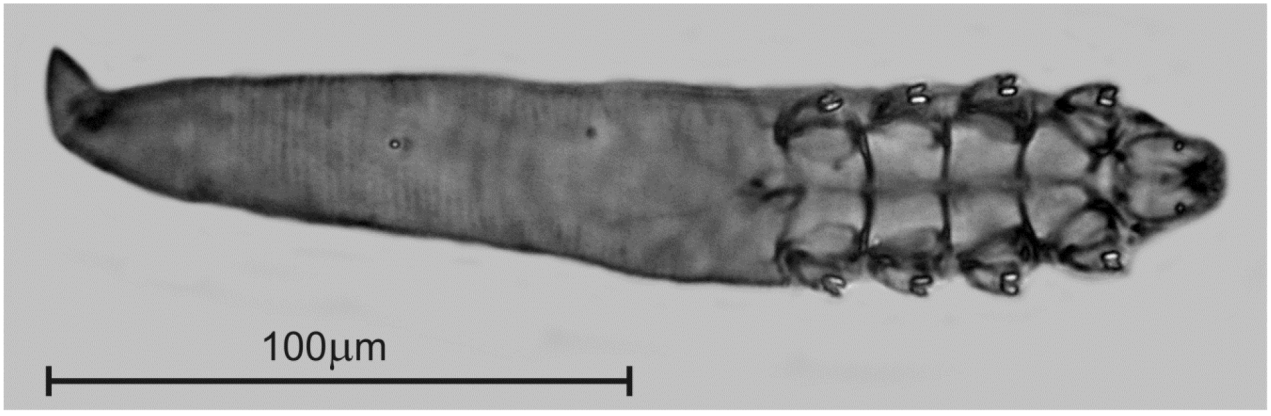

Fig. 3. *Demodex* sp., female

specimens – one examined for helminthofauna, and the other one – for the presence of external parasites (Haitlinger & Łupicki 2009, Hildebrand et al. 2011). Furthermore, one internal parasite was found in the otter from Poland – the fluke *Pseudamphistomum truncatum* (Rudolphi, 1819) (see Hildebrand et al. 2011). Also feces of otters from Białowieża Forest were examined. Eggs of Digenea were found in 30% of the studied samples and were represented by *Alaria alata* (Goeze, 1782), *Opistorchis* sp. or *Metorchis* sp., the tapeworm *Diphyllobothrium latum* (Linnaeus, 1758) and the nematode *Aonchotheca putori* (Rudolphi, 1819); also flukes and oocysts Coccidiomorpha were found, but they were not identified to the species level (Górski et al. 2006, 2010). Outside the borders of Poland, the otter is becoming an increasingly frequent object of parasitological, including mostly helminthological studies (e.g. Shimalov et al. 2000, Torres et al. 2004, Dmitrova et al. 2008). This results from, inter alia, the fact that the increasing number of otters in many water bodies has a strong impact on other animal species (Loy et al. 2009, Romanowski et al. 2011).

The nematode *O. filiformis* described in this study is a common parasite of amphibians and reptiles from different genera occurring in Europe and Asia (e. g. Skrjabin 1954, Ryzhikov et al. 1980, Anderson 2000). The nematode has also been found in Poland: in 11 species of amphibians, 5 species of reptiles (Pojmańska et al. 2007, Okulewicz et al. 2008), and in the brown trout *Salmo trutta fario* Linnaeus, 1758 (see Popiołek et al. 2004, Grabda-Kazubska & Okulewicz 2005). The acanthocephalan *A. ranae* is a common parasite of amphibians, sometimes also found in reptiles, birds and mammals in Europe and Asia (Petrochenko 1956, Ryzhikov et al. 1980, Torres et al. 2004, Pojmańska et al. 2007, Dimitrova et al. 2008). *A. ranae* was also found in the USA, but this founding is not confirmed (Golvan 1994). In Poland, the parasite has been found in 10 species of amphibians, 2 species of reptiles and the mallard *Anas platyrhynchos* Linnaeus, 1758 (see Pojmańska et al. 2007). *A. ranae* was found in the otter from Bulgaria and Romania (Dmitrova et al. 2008, Dimitrova & Dimitrova 2012).

The occurrence of parasites (helminths), unusual for mammals, in the otter may result from their postcyclic transmission from definitive hosts. This phenomenon occurs when the mature form of a parasite during the egg-laying period becomes a victim of another vertebrate together with its host. The parasite is usually digested, but it may also stay alive for some time (and produce offspring) in a new host. In such a case, a new host added to the cycle is referred to as a postcyclic host. Postcyclic parasitism prolongs the procreation, which increases the number of offspring and consequently the chance of closing the parasitic life cycle (Niewiadomska et al. 2001, Kennedy 2006). Helminths found in this study were alive females with eggs. The food composition of otters changes depending on habitats and seasons. In spring, the otter often feeds on amphibians (e.g. Brzeziński et al. 2006, Lanszki et al. 2009, Smiroldo et al. 2009, Pagacz & Witkucz 2010) which, as evidenced by the current results, can be a source of infection with parasites.

Parasitic arthropods represent a separate group of mammals' parasites due to different mechanisms of transmission and strategies of parasitism compared to helminths. Most of them have direct life cycles and usually are transmitted directly between individual organisms within the host population without additional hosts involved. Furthermore, the aquatic environment was the primary habitat of helminths and only some of them, in the course of evolution, infected terrestrial hosts while preserving

some of the developmental stages associated with the aquatic life. Although the evolution of the largest arthropod taxa took place in the terrestrial environment and most of the parasitic arthropods represent parasitofauna of terrestrial hosts, it appears that mammals (similarly to the otter) secondarily adapted to water environment, retaining at least some of the parasitic arthropods typical of the related terrestrial mammals. This might have been caused by the long-term evolution of the parasite-host relationship, where a parasite and a mammal are so strongly connected with each other that the former stayed with the host irrespective of the habitat of the latter, gradually developing new adaptations. Parasitofauna of other aquatic mammals, i.e. beavers (Castoridae) and pinnipeds (Pinnipedia), is an excellent example of the aforementioned relationships. They preserved Phthiraptera or fur mites − hair parasites characteristic of mammals. And thus, adaptations of sucking lice associated with seals evolved in the form of setae on the body modified into spines and scales, which facilitates the gas exchange in the water (Izdebska & Rolbiecki 2010). Furthermore, there are 18 species of fur mites from the genus *Schizocarpus* connected with the Canadian beaver *Castor canadensis* Kuhl, 1820, and 38 species connected with the European beaver *Castor fiber* Linnaeus, 1758 (see Bochkov & Saveljev 2012). The fur mite *Lutracarus canadensis* Fain et Yunker, 1980 was described from the Canadian otter *Lutra canadensis* Schreber, 1777 (see Fain & Yunker 1980). Aquatic mammals may acquire parasites during even a brief stay on the land, which is evidenced by the presence of ticks on beavers (Haitlinger 1991). Skin mites are typical, often specific parasitofauna of mammals; they live in different layers and structural elements of the skin, e.g. epidermis, hair follicles and glands (Izdebska 2012). Skin provides a stable habitat, and this applies also to mammals living in the aquatic environment, therefore mites have been found even in pinnipeds − the itch mite *Sarcoptes scabiei* (De Geer, 1778) (see Dailey 2005), and two specific species – *Demodex phocidi* Desch et al., 2003 from the harbor seal *Phoca vitulina* Linnaeus, 1758 (see Desch et al. 2003) and *D. zalophi* Dailey et Nutting, 1980 from the California sea lion *Zalophus californianus* (Lesson, 1828) (see Dailey & Nutting 1980). Some mites (Halarachnidae) have adapted to internal parasitism and live in nasal passages of pinnipeds (Izdebska & Rolbiecki 2010). In this context, the state of knowledge about parasitic arthropods appears very scanty. So far, only the ticks *Ixodes canisuga* Johnston, 1848, *I. hexagonus* Leach, 1815*, I. ricinus* (Linnaeus, 1758) (see Haitlinger & Łupicki 2009, Christian 2012) and the biting louse *Lutridia exilis* (Nitzsch, 1861) (see Jefferies et al. 1989, Haitlinger & Łupicki 2009) have been identified. The three last species were found in the otter from Poland (Haitlinger & Łupicki 2009). Species from the family of fur and skin mites have not been found. *Demodex* sp. described in this study is the first demodecid mite found the subfamily Lutrinae and a new species to science, probably specific to *L. lutra.* So far only two species from this group (common in mammals) have been described from other Mustelidae – *D. melesinus* Hirst, 1921 from the European badger *Meles meles* (Linnaeus, 1758) and *D. ermineae* Hirst, 1919 from the ermine *Mustela erminea* Linnaeus, 1758 (see Hirst 1919, 1921, Izdebska 2005).

In conclusion, parasitofauna of the otter represents an interesting connection between the elements typical for parasites of aquatic vertebrates, and those characteristic of the related terrestrial mammals, and is represented by both parasites specific to the otter, and those acquired with food.

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