Nematode Dioctophyme Renale Goeze, 1782 (Nematoda, Dioctophymatidae) in Predatory Mammals in Karakalpakstan

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ABSTRACT

The material for this work was collected in Karakalpakstan in 2018–2022. A total of 258 predatory mammals were examined. The nematode was recorded only in the jackal. The nematode Dioctophyme renale is a common helminth parasitising the jackal in Karakalpakstan. The studies showed that 24 out of 91 examined jackals (26.4%) were infected with nematodes. The intensity of infection was 11 individuals. Dioctophyme renale is a biohelminth, whose first intermediate host is the worm Lumbriculus variegatus from the subclass Oligochaeta, and the reservoir host is the catfish.

Keywords: Carnivora, dioctophymosis, Karakalpakstan, mammals.

1. Introduction

Dioctophyme renale Goeze, 1782 is a widely known giant worm parasitising kidneys. This is the largest of known nematodes up to 100 cm long and 1.2 cm wide [1]–[3]. This nematode is found all over the world as a parasite of domestic and wild carnivores, including martens [1], [4]. Studying the morphology, biology and distribution of the nematode Dioctophyme renale is important from the scientific and practical aspects. The right kidney affected by it undergoes changes, up to complete destruction [5]. Despite its wide distribution on the planet, each case in predatory mammals is of great importance as an opportunity to identify the range of hosts and natural foci.

The goal of this work is to study the spread of the nematode Dioctophyme renale in predatory mammals in Karakalpakstan and the prevalence and intensity of infection with this nematode among animals.

2. Materials and Methods

The research work was carried out from 2018 to 2022 on the territory of Karakalpakstan. During the specified period, 91 jackals Canis aureus, 62 foxes Vulpes vulpes, 41 wolves Canis lupus, 25 badgers Meles meles and 39 jungle cats Felis chaus from various regions of Karakalpakstan were studied using Skryabin’s [6] method. The kidneys and abdominal cavities of the animals were examined. The nematode was recorded only in the jackal. The worms were preserved using Barbagallo fluid.

The parasites were identified based on the morphological structure of their genitals, their size and colour and their location in the host. The final taxonomic key to the identification of this species is the presence of a bell-shaped copulatory bursa, without rays and a spicule, 0.5–0.6 cm long, in males [7].

3. Results and Discussion

The studies showed that 24 out of 91 examined jackals (26.4%) were infected with nematodes. Dioctophyme renale females are red, from 20 cm to 1 m long; males are smaller and lighter than females (Fig. 1).

The most typical cases are discussed below to provide a general idea of D. renale’s development in the jackal, as well as its prevalence and intensity of infection.

Of 12 jackals procured in the winter of 2018 and 2019 on the western shore of Lake Sudochye and the northern and southern shores of the Dautkul lake system, 1 female and 1 male were infected with the worms. The female had
2 nematodes in the right kidney—a male and a female. The kidney parenchyma was found completely destroyed, with only the capsule left. The left hypertrophied kidney was two times larger than the standard size. The male jackal had two nematodes in the left kidney, as well as a male and a female. The renal tissue remained in the anterior part of the organ; the remaining volume was 1.2–1.8 cm³. The size of the female worm (length 1.182 mm, diameter 9.4 mm) exceeded the sizes described in literary sources [5], [8].

In the autumn of 2019, 29 jackals from the left bank of the Amu Darya River and the northern shore of Lake Mashankul were studied. Two of them (female and male) proved to be infected with Dioctophyme renale. The intensity of infection was 6 worms in the female jackal and 7 individuals in the male. In the female jackal, the nematodes parasitised both kidneys, from which only the capsule remained. The equal sizes of males (3 individuals) and females (3 individuals) indicate primarily that worm larvae enter the host’s organism simultaneously in large numbers, that jackals are involved in the nematode’s life cycle in the early ontogenetic stages, and that larvae rapidly develop into the adult form. In the male jackal, the nematodes concentrated in the right kidney and were represented by 3 males and 4 females. The organ was almost destroyed.

A female jackal procured on the same territory in February 2020 was infected with 11 individual worms (5 males and 6 females), of which 9 were recorded in the right kidney and 2 in the abdominal cavity. The kidney was completely destroyed. The left kidney was almost 2.5 times larger than the standard size.

Two jackals (females) were procured in the winter of 2020 and 2021 in the Dautkul lake system area. One of them had a nematode individual in the right kidney. The kidney was two times smaller than the healthy one, although its tissue was preserved. The nematode was depressed—its walls lost elasticity and could be torn easily. Obviously, it died of the kidney’s sharp atrophy, while the jackal was still alive. In the second jackal, 3 nematodes were recorded in the right kidney; the organ was destroyed by 70%–75%.

The research team studied 47 jackals from the vicinity of the following lakes and lake systems: Lakes Zhyltyrbas, Sudochye and Akchakul and the Karajar lake system. 17 (36.2%) individuals were infected with Dioctophyme renale. In all cases, the nematodes were decomposed, and the kidneys were atrophied. Two jackal individuals had helminths in the abdominal cavity.

The life span of the parasite in the body of the definitive host does not exceed 8–12 months. This is confirmed by the kidney’s complete atrophy in about 10 months. Young predators get infected not earlier than at the age of two months [3].

Nematode D. renale has a complex life cycle. Its intermediate host is the blackworm Lumbriculus variegatus [9]. On the territory of Uzbekistan, including Karakalpakstan, this worm lives in all freshwater bodies, but prefers swampy ones, with stagnant water, and muddy or sandy bottoms [10], [11]. Its concentrations are recorded in shallow, well-heated areas of a water body.

Shallow bodies of water where temperatures exceed 28 °C–32 °C in summer concentrate in the southern part of Karakalpakstan, in particular, in the Amu Darya basin. 43 species of fish inhabit various bodies of water in Karakalpakstan [12]. In high water seasons, the rivers flood, and lakes and swamps on the floodplain are filled with water. Fish occupy these bodies of water and remain there until the water level drops critically, after which it becomes prey for predators. The probability of infection with D. renale through L. variegatus, which can be swallowed by the former’s definitive host with water while drinking, is very small. In this case, D. renale survives through the accumulation of parasitic larvae in the bodies of reservoir hosts—fish [9].

The infection of carnivores through reservoir hosts is the most probable scenario, if not the only possible one because fish occupies an important place in the diet of predatory mammals living in the Amu Darya River basin. In addition, if polychaetes were the main route of infection, the larva would as likely parasitise ungulates living in the same territory.

The research detected Dioctophyme larvae in the catfish, with a prevalence of 1.5%–3.7%. The intensity of infection is 15–20 individuals.

One atrophied kidney is in no way reflected in either the appearance of an otherwise healthy jackal individual or its physical condition (Yudin, 1981). Infected individuals are moderately fat. The uninfected kidney increases in size almost twice. The absolute weight of healthy kidneys in a jackal: left–72 g (lim 49–83, n = 8), right–54 (lim 38–79, n = 6); relative weight: left–2.8 g/kg (lim 2.1–3.8, n = 7), right–2.4 g/kg (lim 2.1–3.2, n = 6). In infected jackals, the absolute weight of the left kidney is 121 g (lim 110–138, n = 7), with relative weight–4.8 g/kg (lim 3.1–5.7, n = 6). The
data we obtained in the course of the study is consistent with the data of other authors [2], [13].

The habitation of additional and reservoir hosts in freshwater bodies restricts the dioctophymosis to the rivers of the lower basin of the Amu Darya. Favourable climatic conditions and a large number of shallow bodies of water, the jackal’s large population and wide distribution, as well as its seasonal change of biotopes [13], are optimal conditions for the nematode’s circulation and development of the nematode’s foci in this basin.

4. Conclusion

Based on what was said above, it is necessary to carefully monitor the spread of dioctophymosis in Karakalpakstan, especially in regions where freshwater fish is an important element of the people’s diet, to raise the knowledge of medical and veterinary specialists in this disease and to develop appropriate control measures.

ACKNOWLEDGMENT

The work was carried out within the framework of the program «Ways of the Development of Helminth Fauna in Vertebrates, Taxonomy and Improvement of Control Measures» implemented by the Academy of Sciences of the Republic of Uzbekistan. We express our gratitude to Academician D. A. Azimov for their help in the morphological identification of helminth species.

CONFLICT OF INTEREST

Authors declare that they do not have any conflict of interest.

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