

The intestinal parasites of the selected mammal species, living in zoological gardens and wild animal parks

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Parasite infections are still one of the main reasons for veterinary problems in zoological gardens. In our investigations, we aimed at updating our knowledge about internal parasite infections of mammals kept in captivity in Poland. From November 2006 to June 2007, 274 fecal samples from 53 mammal species were collected and then, examined, using standard flotation and sedimentation techniques. The investigated animals were kept in Warsaw, Łódź and Płock zoological gardens, and also in Park of Wild Animals in Kadzidłowo. In total, 9 species of roundworms (*Nematoda*) and 3 species of protozoans from *Eimeria* genus have been detected. The most common parasites have been found: gastro – intestinal nematodes from *Trichostrongylidae* and *Molineidae* family. The incidence of all parasitic invasions in the examined animals from zoos was equal to 20-28% whereas in the Park of Wild Animals in Kadzidłowo it was considerably higher (48%). *Baylisascaris transfuga*, the eggs of which have been found in faecal samples of polar bear, is a species which may be dangerous for human health.

KEY WORDS: intestinal parasites / zoological garden

Parasite infection of animals, living in zoological gardens and wild animal parks are nowadays still a serious veterinary problem. This is one of the reasons for losses of valuable animal species [1, 10]. There is a risk that new parasite species will be brought into zoos' area. The important role in parasites' spreading out is played by wild birds and free-living mammals. They have better living condition in zoological gardens (an access to food, warm places to hide during the winter season, etc.). Unfortunately, they can be also a reservoir of many parasitic diseases [18]. In many cases, the wild animals such as birds, martens, cats, rodents and invertebrates may be the additional parasitic invasion source (as intermediate host or vectors of parasites) [7, 12]. The exotic animals which have been kept in Polish climate condition for many generations assimilate our parasitic fauna that does

not occur in their natural environment [17]. On the other hand, the animals imported from different countries to Polish zoos may possess new parasite species [6, 19].

The earlier experiments, conducted in Belgium have shown that the type of animal paddock plays an important role in development of parasite invasion. The sandy and grassy paddock may be a reservoir of parasite forms [3, 7, 8]. That is why it is important to keep the adequate zoohygienical standards, the animals faeces should be removed every day away. Moreover, a particular care should be taken of employees, working with the infected animals, which may be carrier of parasite species, being also dangerous for other animals and human health [13, 15]. An *Echinococcus granulosus*, the cosmopolitan cestode, the larvae of which affect many mammal organs (especially liver) of the animals who are kept in the zoos is one of the discussed species. A man may be incidental intermediate host of this parasite. The disease may be dangerous, especially when hydatid cysts are situated in the brain, acute encephalitis may be fatal [5].

Therefore, it is necessary to study the pathogenicity of parasites, to keep control and apply deworming medicines to prevent, or to limit the spreading of invasion. The main aim of the present research was to identify the species composition of parasitic fauna, characteristic of the mammals kept in zoological gardens and wild animal parks.

Material and methods

The research material derived from 3 zoological gardens (Warsaw, Łódź and Płock) and from Wild Animal Park in Kadzidłowo. From November 2006 to June 2007 the fecal samples, which were collected from 53 mammals have been twice examined: in the autumn-winter season and summer-spring seasons. Standards coproscopy methods have been used (flotation and sedimentation). In total, 274 fecal samples have been examined, 64 came from Warsaw ZOO, 60 from Płock ZOO, 46 from Łódź ZOO and 104 from Kadzidłowo Park.

The eggs and oocysts, which have been found in the material were photographed, using Panasonic GP camera with LUCII computer program and then, diagnosed. In this research NICON ECLIPSE TE200 and OLIMPUS CX21 microscopes have been used.

Results and discussion

In fecal samples from the mammals, living in Warsaw ZOO, 4 parasite species belonging to *Nematoda* phylum (one being not determined) and 1 species belonging to *Apicomplexa* phylum, were found. In the material collected in the Łódź ZOO, invasion of 5 species from *Nematoda* (two species were specified, the remaining ones were only determined on the level of family or not identified at all) and one species of coccidia (specified as representative of *Eimeria* family) were recorded. In the samples collected from Płock ZOO, 7 species, were found, which belonged to *Nematoda* phylum (one identified on the level of family and one being not identified). In material coming from Kadzidłowo, the eggs of 9 parasite species, also belonging to *Nematoda* phylum have been recorded (4 of them were identified on the level of genus and 5 of them – on the level of family). Moreover, 2 *Protista* species were detected.

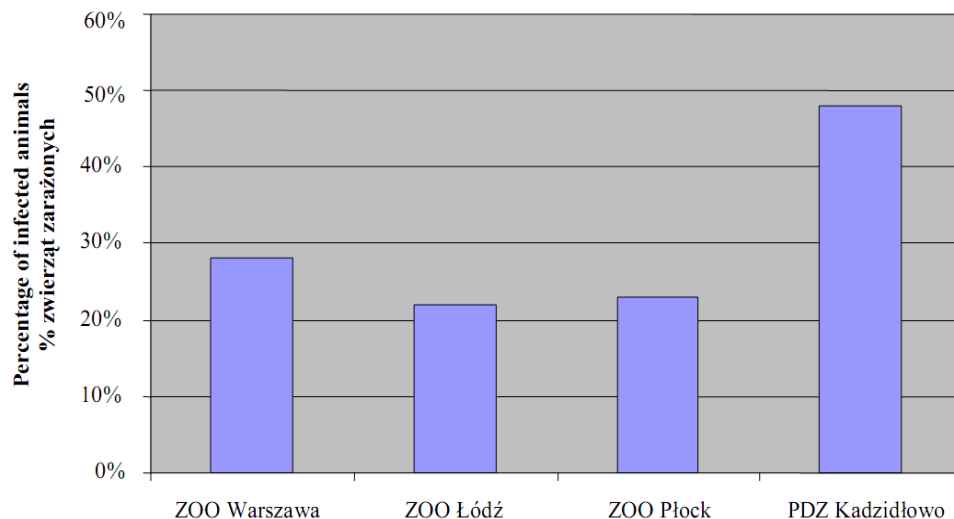


Fig. Extensiveness of parasite infections in four different places
Rys. Ekstensywność inwazji pasożytniczych w czterech badanych ośrodkach hodowlanych

In total, 9 species of *Nematoda* phylum and 4 species of *Apicomplexa* phylum were identified. In some cases, it was difficult to establish systematic position of parasites (*Trichostrongylidae* family). The eggs within the mentioned family are often not easily distinguished. The prevalence of parasite infections in mammals kept in zoological gardens was found on similar level (22-28%); it was higher in Kadzidłowo (ca. 48%) (Fig.). The results of fecal samples from mammals living in zoological gardens and wild animal parks are given in the Table.

The results of the studies in autumn-winter period are different than those ones, obtained in the spring-summer season. In the second stage of the studies, there were found the parasite eggs which were not recorded in the first period of the experiment and vice versa (few cases). The percentage of the infected animals (in relation to all the examined species) in the particular centres is illustrated in the figure. The most common parasite species occurred in the material, belonging to *Nematoda* phylum. The other authors suggested that the reason for this situation was caused by a simple life cycle of this parasite species [16, 17, 21]. Moreover, a high concentration of animals on paddocks may affect easy spreading out of invasion; it causes a considerable concentration of larvae or invading eggs on a small area [2]. Relatively high temperature and humidity of housing for animals are favourable for growth and development of parasite eggs and larvae. The sandy and grassy paddock may be a source of many roundworms at different stages; the wild birds and rats may bring them into the cages [4, 18]. Surprising, any invasion of parasite species belonging to *Trematoda* and *Cestoda* class has not been detected, probably due to their complicated larval development what is often impossible or very difficult in the zoological gardens' conditions because of the lack of intermediate hosts.

Table – Tabela

Results of faeces' examination from three zoological gardens (ZOO) and from Park of Wild Animals in Kadzidłowo

Zestawienie wyników badań kału zwierząt pochodzących z trzech ogrodów zoologicznych i Parku Dzikich Zwierząt w Kadzidłowie

Autumn-winter season Sezon jesienno-zimowy		Spring-summer season Sezon wiosenno-letni	
parasite species gatunek pasożyta	host species gatunek żywiciela	parasite species gatunek pasożyta	host species gatunek żywiciela
1	2	3	4
ZOO Warsaw – ZOO Warszawa			
<i>Isospora felis</i>	serval – serwal	<i>Isospora felis</i>	serval – serwal
<i>Toxascaris leonina</i>	lion – lew, snow-leopard – irbis (pantera śnieżna)	<i>Toxascaris leonina</i>	lion – lew, snow-leopard – irbis (pantera śnieżna)
<i>Trichuris vulpis</i>	African wild dog – likaon	<i>Trichuris vulpis</i>	African wild dog – likaon
<i>Baylisascaris transfuga</i>	Polar bear – niedźwiedź polarny	–	not examined (death of animal) – nie badano (śmierć zwierzęcia)
n.n.	South american coati – ostronos	–	–
ZOO Płock			
<i>Toxocara cati</i> , <i>Toxascaris leonina</i>	snow-leopard – irbis (pantera śnieżna)	<i>Toxocara cati</i> , <i>Toxascaris leonina</i>	snow-leopard – irbis (pantera śnieżna)
<i>Trichuris trichiura</i>	Lar gibbon – gibbon białoreki, Patas-monkey – koczokodan rudy	–	–
–	–	<i>Trichostrongylus axei</i>	donkey – osioł domowy, pony – kuc
n.n.	South american coati – ostronos	–	–
–	–	n.n.	Red kangaroo – kangur rudy
–	–	Roundworms from <i>Trichostrongylidae</i> family Nicienie z rodziny <i>Trichostrongylidae</i>	llama – lama

1	2	3	4
ZOO Łódź			
–	–	<i>Eimeria sp.</i>	Asian elephant – słoń indyjski
–	–	Roundworms from <i>Trichostrongylidae</i> family Nicienie z rodziny <i>Trichostrongylidae</i>	Asian elephant – słoń indyjski
–	–	<i>Parascaris equorum</i>	plains zebra – zebra stepowa
–	–	n.n.	tapir
–	–	<i>Toxocara sp.</i>	Nine-banded Armadillo – pancernik peba
–	–	<i>Trichostrongylus axei</i>	donkey – osioł domowy
Wild Animal Park in Kadzidlowo – Park Dzikich Zwierząt w Kadzidłowiu			
<i>Strongyloides papillosus</i>	moose –łoś	–	–
<i>Trichuris ovis</i>	moose –łoś	–	–
–	–	<i>Eimeria nina-kohl-yakimovi</i>	mouflon – muflon
–	–	<i>Eimeria faurei</i>	mouflon – muflon
–	–	Roundworms from <i>Trichostrongylidae</i> family Nicienie z rodziny <i>Trichostrongylidae</i>	mouflon – muflon
<i>Nematodirus sp.</i>	mouflon – muflon, deer – jeleń, moose –łoś	–	–
–	–	Roundworms from <i>Trichostrongylidae</i> family Nicienie z rodziny <i>Trichostrongylidae</i>	American bison – bizon, deer – jeleń, moose –łoś
Roundworms from <i>Trichostrongylidae</i> family Nicienie z rodziny <i>Trichostrongylidae</i>	mouflon – muflon, mountain hare – zając bielak, chamois – kozica, deer – jeleń, roe deer – sarna, reindeer – renifer	–	–
–	–	<i>Trichostrongylus axei</i>	Przewalski's horse – koń Przewalskiego
–	–	n.n.	European otter – wydra europejska
–	–	n.n.	European polecat – tchórz zwyczajny

„n.n.” – indeterminate *Nematoda* eggs – nieoznaczone jaja nicieni

„–” – no parasitic invasion – nie stwierdzono inwazji pasożytniczej

When evaluating the results of own studies, we considered the occurrence of periodical fluctuations in production of eggs of a given parasite; it is also important to take into consideration the fact of the temporary fluctuations of parasite eggs production and prepatent period since the time of the penetration of host's body by the parasite until his maturation. The coproscopy studies, performed during the discussed period give always negative results [18, 19]. In the Park of Wild Animals in Kadzidłowo where the living conditions of the animals are most similar to natural environment, the representatives of roundworms, belonging to *Trichostrongylidae* family constitute the most numerous group of the identified parasites. The invasion of the mentioned parasites has the greatest meaning, from medical point of view, for ruminants. It concerns also deer, roe-deer and fallow deer population kept, in captivity [15] as well as mammals living in zoological gardens [3]. The periodical larval hypobiosis is a phenomenon, characteristic of the parasite species belonging to *Trichostrongylidae* family, therefore the results of fecal samples examination from autumn-winter season were negative [4]. On the other hand, in the same material collected from the spring-summer season, probably thanks to the "spring rise" phenomenon, the parasite eggs were found. The intensity and extensiveness of the level of invasion could be also caused by deworming preparations. In the discussed zoological gardens and in Wild Animals' Park deworming was carried out with the application of various pharmaceutical products. The highest level of invasion in animals living in Kadzidłowo could result from a natural character of paddocks and contacts with animals and their faeces what was reported by the employees of the Park.

The evaluated and analyzed material did not contain any eggs of parasites which are found in the animals, living in the closed units outside the borders of Poland. In the own studies, the species belonging to *Nematoda* and *Apicomplexa* phylum were most frequently found in many mammal species. They include the species from *Toxocara* type, dog and cat worms from *Trichuris* type or coccidia from *Eimeria*. In fecal samples from polar bear, *Baylisascaris transfuga* eggs were found. The mentioned parasite species is rare in domesticated animals and may be dangerous for humans [9]. Establishment of species composition of parasites in the mammals, living in the zoos is possible when the research work is conducted with abundant animal material and when the test includes faeces, blood and urine. The application of modern techniques and diagnostic methods (PCR, immunological tests e.g. ELISA) and animal cross-section constitutes the basis for complete and reliable evaluation of parasitological situation [20]. The conducted studies were treated as preliminary ones, having a "screening" character. They allowed assessing the level of invasion intestinal parasites in the animals, living in the zoological gardens of central Poland.

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Pasożyty jelitowe wybranych gatunków ssaków przebywających w krajowych ośrodkach hodowli i ekspozycji zwierząt

Streszczenie

Celem przeprowadzonych badań było określenie składu helmitofauny ssaków przebywających w krajowych ośrodkach hodowli i ekspozycji zwierząt. W okresie od listopada 2006 do czerwca 2007 roku przebadano koproskopowo, metodami flotacji i sedimentacji, 274 próbek kału od 67 gatunków ssaków. Materiał badawczy pochodził od zwierząt z ogrodów zoologicznych w Warszawie, Płocku, Łodzi oraz z Parku Dzikich Zwierząt w Kadzidłowie. Najczęściej odnajdowanymi pasożytami były nicienie z rodziny *Trichostrongylidae* i *Molineidae*. Wykryto obecność 9 gatunków pasożytów należących do typu *Nematoda* oraz trzy pierwotniaki z rodzaju *Eimeria*. Badania wykazały, że ekstensywność wszystkich inwazji pasożytniczych u badanych zwierząt z ogrodów zoologicznych wynosiła 22-28%, natomiast z Parku Dzikich Zwierząt w Kadzidłowie była znacznie wyższa (48%). Niespotykanym pasożytem u zwierząt udomowionych i jednocześnie potencjalnie groźnym dla ludzi jest glista (*Baylisascaris transfuga*), której jaja znaleziono w kale niedźwiedzia polarnego. Przeprowadzone badania potraktowano jako wstępne, o charakterze „przesiewowym”. Uzyskane wyniki pozwoliły na ocenę stanu inwazji pasożytów jelitowych u zwierząt zamieszkujących ogrody zoologiczne centralnej Polski.