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FORMATION OF THE PARASITOFAUNA OF THE PRZHEVALSKY REACLIMATIZED HORSE IN KAZAKHSTAN

ANNOTATION

The study of regional features of territorial parasitic-faunal complexes allows us to predict the risks of implementing projects related to the conservation movement of animals (introduction and reintroduction). The article presents the data of studies of intestinal parasites of Przhevalsky horses contained in the territory of the state National Natural Park "Altyn-Emel". Three types of nematodes were found to be parasitized in Przewalski's horses: Strongylus equines Muller, 1780; Alfortia (Strongylus) edentates (Looss, 1900) Skrjaibin, 1933; Trichonema (Cyathostomum) catinatum Looss, 1900. Przhevalsky's horses could have brought them with them from the Munich Zoo, since they were registered in all mixed Przhevalsky's horses in Belarus, Ukraine and Russia or could have been purchased from local horses. Since they graze on the same pastures, they go to the same watering holes. Przhevalsky's horses become infected alimentally by ingesting invasive larvae, more often on pastures and at watering from stagnant reservoirs. It is likely that in the following years a number of new species of parasites may be registered in Przewalski's horses, the owners of which are currently local horses.

The research was carried out within the framework of the program-targeted financing "Development of the wildlife cadastre of the arid territories of the Balkhash – Alakol basin for the development of measures for the conservation and sustainable use of wildlife resources" 2023-2025. The source of funding is the Ministry of Science and Higher Education of the Republic of Kazakhstan.

***Ключевые слова**: лошадь Пржевальского, местные лошади, паразиты, эймерии, гельминты, нематоды.*

***Key words:** Przewalski's horse, local horses, parasites, eimeria, helminths, nematodes..*

Introduction. Przewalski's horse – Түзат немесе Пржевальский жылқысы – Equus przewalskii Poljakov, 1881 [1-6]. Przhevalsky's horse was first discovered on the territory of Kazakhstan. In 1879, the head of the Zaisan border post, A.K. Tikhonov, presented the scientist and traveler Nikolai Przhevalsky with a skull and the skin of a wild horse, previously unknown to science. St. Petersburg scientist Ivan Polyakov described a new type of horse based on them, which he named after Przhevalsky. Later, by genetic analysis, it was revealed that domestic horses have 64 chromosomes, and Przewalski's horses have 66.

After the disappearance of these animals in the wild, only 11 horses and a single thoroughbred mare, Eagle III, who lived in Askania Nova, were able to participate in reproduction and obtaining normal offspring in zoos. The history of this horse is very interesting. In 1947, the government of the Mongolian People's Republic presented a wild filly of Przhevalsky's horse named Altai as a gift to Stalin, who gave it to Voroshilov, and he, in turn, transferred it to Askania Nova, where the mare received the nickname

Eagle III. It was the only wild horse in the world that lived in captivity and was born in freedom. Therefore, it was considered an international standard.

Thus, the entire modern world population of Przewalski's horses comes from only 12 individuals. Because of inbreeding, it was extremely difficult to reproduce them: there were frequent cases of stillbirth, developmental abnormalities and deformities, curvature of the legs, "open mouth" and hereditary diseases.

In Kazakhstan, work on reintroduction began in 2002. The National Park "Altyn-Emel" was visited by French scientists, employees of the Institute of Zoology of the Republic of Kazakhstan and specialists of the Munich and Almaty zoos, who positively assessed the territory for the possible release of Przhevalsky's horses. However, they were not interested in the parasitological situation of the area. And Przewalski's horses were not examined for carrying parasites in the Munich Zoo. And already in July 2003, the first delivery of animals from the Munich Zoo took place. The horses were delivered in three batches, four stallions and four mares arrived. They were transported to Almaty in transport cages by plane, and then within 5 hours they were transported by motor transport to the place of release – the Kolbastau cordon 350 kilometers from Almaty.

The horses imported from Germany were initially released into an aviary with an area of 3 hectares, inside which a sanitary sector with a canopy, a hay compartment was built, there were feeders for grain and salt, as well as a drinking bowl.

Gradually, the horses began to break through the fence and go outside, they grazed in the steppe, and returned to the aviary at night. But they were all zoo animals, their immunity was weakened, and our sharply continental climate was very different from the humid climate of Germany. As a result, three mares died from pyroplasmosis, two more died from an accident, one horse ran away to the kulans. Two individuals and a litter of three foals were preserved, but they were all males, so the question arose about the import of another group of horses.

The second group of Przewalski's horses arrived at Altyn-Emel in April 2008: three mares and three stallions. According to zoologists, the merger of the two groups happened quickly.

Immediately after the import from Germany, all horses were vaccinated against pyroplasmosis, but the German drug "Carbezia" proved ineffective in Kazakhstan, so subsequently two mares still died from this disease. Only after the use of local drugs, such cases stopped. Another stallion was killed by wolves, one was lost in the steppe, one male foal was born. In general, 14 horses were transferred to the national park by the German side, but at least 30 founders are needed to create a full-fledged population. The difficulties were due to the predominance of males in the litter and due to the fact that all couples were related to each other.

Przhevalsky's horses are very unpretentious – they are not afraid of cold, heat, can not drink or eat for a long time, make multi-kilometer crossings, are very careful, are gifted with excellent sense of smell, vision and hearing, are socially well-oriented and tenderly treat members of their group. In case of loss of one of the members of the herd, the horses neigh and look for him.

In total, there were 13 Przewalski horses in the national park in 2018. But at a meeting with the participation of the authorized body – the Forestry and Wildlife Committee – it was decided to transfer the horses to the newly organized Tarbagatai State National Park, where these animals also once lived. After that, eight horses were transferred for temporary detention to the Almaty Zoo, and now a harem free group remains in Altyn-Emel.

The second significant place for the future reintroduction of Przhevalsky horses in Kazakhstan is the Altyn Dala State Nature Reserve in the Kostanay region.

The steppe territory of the Altyn Dala State Nature Reserve in the Kostanay region has been chosen as the horse release zone. The reserve was established in 2012, its total area is 489,766 hectares. Before release, the animals will stay at the Wild Ungulates Reintroduction Center on the reserve territory for a year. This center was established within the framework of the Altyn Dala environmental initiative and is managed by the Kazakhstan Association for the Conservation of Biodiversity (KACB). Since 2017, work has been carried out here on the reintroduction of the kulan. Thus, the center already has all the necessary infrastructure and staff to accommodate new species of ungulates.

The Przewalski horse reintroduction project is carried out in partnership between the Committee of Forestry and Wildlife of the Ministry of Ecology and Natural Resources of the Republic of Kazakhstan, the Prague Zoo, the KACB, the Frankfurt Zoological Society, the Nuremberg Zoo, the Berlin Zoo and the National Park "Hortobad". On February 28, 2024, a Memorandum of Understanding was signed between

the partners, which sets out obligations for the reintroduction of at least 40 wild horses from Europe to Kazakhstan over the next 4-5 years.

The number of Przewalski's horses in the world today is about 2 thousand individuals [7-13].

Przewalski's horses were imported to Belarus, Ukraine and Russia from the Paris Zoo. However, in the zoo they were not examined for parasite carriers. And at the place of release of horses after decades, they were examined for helminths. As a result, 30 helminths were detected in Przewalski's horses in Belarus [14], 39 helminths in Ukraine [14] and 3 helminths in Russia [15] (table 1). We have registered 22 parasites in the study of local horses: 1 type of protozoa and 21 types of helminths [16-20].

Research materials and methods. In February 2023, 8 samples of Przhevalsky's horse feces contained in the Altyn-Emel state research and production center were delivered to the parasitology laboratory.

Stool samples (5 g) were taken from Przewalski's horse. The feces were collected in plastic jars and stored in a 2.5 % solution of potassium bicarbonate for further processing in the laboratory of the Institute. Lifetime parasitological studies of bear feces were carried out according to the method of Fulleborn. Feces were thoroughly ground in a porcelain cup with 15-20 ml of ammonium nitrate solution with a density of 1.3. They were kept for 45 minutes. Then the upper film was removed from the liquid with a wire loop, applied to a slide, drops of distilled water were added, covered with a cover glass and examined under a microscope.

When determining helminth eggs, the shape, size, color, thickness and structure of the shell were taken into account; the presence of caps on one of the poles, miracidia or eggs with yolk, tubercle or spike, filaments in trematodes; a pear-shaped apparatus with an oncosphere in cestodes; plugs at the poles, crushing balls or larvae of nematodes in the center.

The intensity of infection was determined by counting the number of oocysts of eimeria and helminth eggs in 20 fields of view of the microscope.

The species belonging of helminths was determined by morphological features using definitional tables with verification of the correctness of the diagnosis of suborders and families, then by the table of genera, for which classical determinants and monographs were used [14].

Results and their discussion. As a result of the study, three types of helminths were registered in Przewalski's horse: *Alfortia edentates, Strongylus equines, Trichonema catinatum* (table 1). In Kazakhstan, for the first time, these helminths are registered in Przhevalsky horses, that is, the identified helminths are new for horses of Przhevalsky Kazakhstan. From whom can Przewalski's horses borrow helminths. They could have brought them from the Munich Zoo. There are also local horses on the pastures. These animals feed on the same herbaceous plants and use the same watering holes. The identified helminths are common to equine. It is quite obvious that local horses became the source of the helminthic invasion of Przewalski's horses [16-20].

Conclusion. In Kazakhstan, 3 types of helminths have been registered in Przhevalsky's horses (*Alfortia edentates, Strongylus equines, Trichonema catinatum*). *Alfortia edentates*. Przhevalsky's horses could have brought them with them from the Munich Zoo, since in all reintroductions of Przhevalsky's horses in Belarus, Ukraine and Russia they were registered or could have been purchased from local horses. Since they graze on the same pastures, they go to the same watering holes. *Strongylus equines.* Przewalski's horses could have brought them with them from the Munich Zoo or could have been purchased from local horses. Przhevalsky's horses become infected alimentally by ingesting invasive larvae, more often on pastures and at watering from stagnant reservoirs. *Trichonema catinatum.* Przewalski's horses could have bought them from local horses. Because they are not found in all reintroduced animals: for example, they are undetected in Russia. It is likely that in the following years a number of new species of parasites will be registered in Przewalski's horses, the owners of which are currently local horses (Table 1) [16-20].

Table 1 – м Parasites registered in Przewalski's horse and local horses

al num	Parasites	Hosts	
		Przewalski 's horse	ς ⌣ ɣ

		Chernobyl (Ukraine)	Askania Nova (Belarus)	Orenburg Tarpania (Russia)	Altyn-Emel (Kazakhstan)	
1	2	3	4	5	6	7
1	Eimeria priadko Berkinbayev et Baitursinov, 1987	-	-	-	-	+
2	Anoplocephala perfoliata (Goeze, 1782) Blanchard, 1848	+	+	-	-	-
3	Oxyuris equi (Schrank, 1788)	+	+	-	-	
4	Parascaris equorum (Goeze, 1782)	+	+	-	-	-
5	Strongylus equines Muller, 1780	-	+	+	+	+
6	Alfortia (Strongylus) edentates (Looss, 1900) Skrjaibin, 1933	+	+	+	+	+
7	Delafondia (Strongylus) vulgaris (Looss, 1900) Skrjabin, 1933	+	+	-	-	-
8	Triodontophorus brevicauda Boulenger, 1916	+	+	-	-	+
9	Triodontophorus nipponicum Yamaguti, 1943	+	+	-	-	
10	Triodontophorus serratus (Looss, 1902)	+	+	-	-	-
11	Triodontophorus tenuicollis Boulenger, 1916	+	+	-	-	-
12	Craterostomum (Cylicostomum) acuticaudatum (Kotlán, 1919)	+	+	-	-	-
13	Craterostomum (Cylicostomum) pateratum (Yorke and Macfie, 1919)	-	+	-	-	-
14	Trichonema (Cyathostomum) catinatum Looss, 1900	+	+	-	+	+
15	Trichonema (Coronocyclus) coronatum Looss, 1900	+	+	-	-	+
16	Trichonema (Coronocyclus) labiatum Looss, 1900	+	+	-	-	+
17	Trichonema (Coronocyclus) labratum Looss, 1900	+	+	-	-	+
18	Trichonema (Coronocyclus) sagittatus (Kotlan, 1920)	-	+	-	-	-
19	Trichonema (Cylicostephanus) calicatum Looss, 1900	+	+	-	-	+
20	Trichonema (Cylicostephanus) minutum (Yorke et Macfie, 1918)	+	+	-	-	-
21	Trichonema (Cylicostephanus) hybridus (Kotlan, 1920)	-	+	-	-	-
22	Trichonema (Cylicostephanus) longibursatum (Yorke et Macfie, 1918)	+	+	-	-	+
23	Trichonema (Cylicostephanus) goldi (Boulenger, 1917)	+	+	-	-	-
1	2	3	4	5	6	7
24	Trichonema (Cylicostephanus) asymetricus Theiler, 1923	-	+	-	-	-

25	Trichonema (Cylicostephanus) bidentatus (Boulenger, 1920)	+	+	-	-	-
26	Trichonema (Cylicostephanus) radiatus (Looss, 1910)	-	+	-	-	-
27	Trichonema (Cylicostephanus) elongatus (Looss, 1900)	-	+	-	-	-
28	Trichonema (Cylicostephanus) insigne (Boulenger, 1917) Erschow, 1939	+	+	-	-	+
29	Trichonema (Cylicostephanus) leptostomum (Kotlan, 1920)	+	+	-	-	-
30	Trichonema (Cylicostephanus) nassatum (Looss, 1900) Erschow, 1939	+	+	-	-	+
31	Trichonema (Cylicostephanus) ashworthi Le Roux, 1924	+	+	-	-	-
32	Trichonema (Cylicostephanus) ultrajectinus Ihle, 1920	+	+	-	-	-
33	Trichonema (Cylicostephanus) poculatum Looss, 1900	+	+	-	-	-
34	Trichonema aegyptiacum Railliet, 1923	-	-	+	-	+
35	Trichonema caragandicum Funikova, 1939	-	-	-	-	+
36	Trichonema serratus (Looss, 1900) Looss, 1902	-	-	-	-	+
37	Trichonema tenuicollis Boulenger, 1916	-	-	-	-	+
38	Cylicodontophorus bicoronatum (Looss, 1900) Erschow, 1939	+	+	-	-	+
39	Cylicodontophorus euproctum Boulenger, 1917	+	+	-	-	-
40	Cylicodontophorus mettami (Leiper, 1913)	+	+	-	-	-
41	Cylicodontophorus ornatum (Kotlan, 1919) Erschow, 1939	-	-	-	-	+
42	Cylicodontophorus pateratum (Yorke et Macfie, 1919) Erschow, 1939	-	-	-	-	+
43	Cylicodontophorus sagittatum (Kotlan, 1919) Erschow, 1939	-	-	-	-	+
44	Pteriostomum imparidentatum Quiel, 1919	-	+	-	-	-
45	Pteriostomum ratzii Kotlan, 1919	+	+	-	-	-
46	Gyalocephalus capitatus Looss, 1900	+	+	-	-	+
47	Skrjabinagia lyrota (Sjoberg, 1926) Andreeva, 1957	-	-	-	-	+
48	Probstmayria vivipara (Probstmayr, 1865)	-	+	-	-	-
	Total:	30	39	3	3	22

Alfortia edentatus – has an oral capsule with a dorsal groove, teeth are missing. The female reaches a length of 32-40 mm, the male – 23.0-26.5 mm; has two equal spicules. The helminth parasitizes in the large intestine. Females lay oval-shaped eggs. The larvae develop in the external environment and become invasive after 5-6 days. The larvae are enclosed in a finely textured case and can overwinter on pasture. Przewalski's horses are infected in an alimentary way. Helminth larvae migrate from the intestine under the parietal leaf of the peritoneum of the host, where they cause small hematomas, in which they reach 30-40 mm. Then the parasites migrate into the intestinal walls, from where after 1 month, having reached puberty, they enter the lumen of the intestines.

Strongylus equinus are roundworms that reach a size of up to 5 cm. In the external environment, the development of all strongylides occurs in the same way. After maturation, stage I larvae emerge from the eggs, which, under favorable conditions, molt twice and become invasive after 1-2 weeks (stage III). Przewalski's horses become infected with strongylidosis in an alimentary way. The animal swallows, larvae with grass, the destruction of the protective shell occurs in the small intestine. Animals develop anemia, arteritis and thrombosis of intestinal vessels, mesenteric vessel aneurysms, liver lesions, spastic and thromboembolic colic.

Trichonema catinatum – parasitize in the wall of the caecum and colon. Invasive larvae penetrate into the thickness of the intestinal mucosa, curl up there into a ring, and nodules ranging in size from poppy seeds to millet grains ("poppy intestines") form around them. The larvae gradually grow in these nodules for 1.5-2 months. Then they rupture the wall of the cysts, enter the lumen of the caecum and colon and develop into mature males and females. The larvae of trichonemas injure the intestinal mucosa, as a result of which serous, fibrinous or hemorrhagic colitis develops. This "opens the gates" to pathogenic microbes (streptococci, staphylococci, etc.) that cause septic process, metastasis formation; peritonitis, arthritis, etc. may develop. Incised larvae cause general intoxication of the body.

Control of the number of parasites in nature.

Controlling the number of parasites in the pasture can also prevent over-infection of animals. It is possible to use several control options:

Manure removal from the pasture should be carried out once a week in winter and twice a week in summer.

Levada must be cleaned daily. Manure removal is especially important during warm autumn and humid summers, as these conditions contribute to the survival and spread of helminths in the pasture.

Ideally, each horse should have 1 km^2 per head for grazing.

Mixed grazing of cattle and small cattle and wild horses is a good idea, since cattle nematodes do not develop in horses, and vice versa.

Pastures need to be harrowed only in very dry conditions in order to expose the larvae and eggs of helminths to drying and exposure to sunlight. It is also possible to start grazing on such a pasture only after 2-5 months.

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ТҮЙІН

Аумақтық паразиттік-фауналық кешендердің аймақтық ерекшеліктерін зерттеу жануарлардың табиғатты қорғау қозғалысына (интродукция және реинтродукция) байла нысты жобаларды іске асыру тәуекелдерін болжауға мүмкіндік береді. Мақалада "Алтын Емел" мемлекеттік ұлттық табиғи паркінің аумағында ұсталатын Пржевальск жылқыларының ішек паразиттерін зерттеу деректері келтірілген. "Алтын Емел" МҰТП-де Пржевальский жылқыларында нематодтардың үш түрінің тоғышарық етуі анықталды: *Strongylus equines* Muller, 1780; *Alfortia (Strongylus) edentates* (Looss, 1900) Skrjaibin, 1933; *Trichonema (Cyathostomum) catinatum* Looss, 1900. Пржевальский жылқылары оларды Мюнхен хайуанаттар бағынан ала келуі мүкін, өйткені Беларуссиядағы, Украинадағы және Ресейдегі барлық әкелінген Пржевальский жылқыларында олар тіркелген немесе жергілікті жылқылардан жұқтырып алуы мүмкін. Олар бірдей жайылымдарда жайылып жүреді және бір суаттан су ішеді. Пржевальский жылқылары инвазиялық дернәсілдерді жұту кезінде, көбінесе жайылымдарда және тұрақты су қоймаларынан суару кезінде алиментарлы түрде жұқтырылады. Болашақта Пржевальский жылқыларында паразиттердің бірқатар жаңа түрлері тіркелуі мүмкін, олардың иелері қазіргі уақытта жергілікті жылқылар болып табылады.

РЕЗЮМЕ

Изучение региональных особенностей территориальных паразитарно-фаунистических комплексов позволяет прогнозировать риски реализации проектов, связанных с природоохранным перемещением животных (интродукция и реинтродукция). В статье представлены данные исследований кишечных паразитов лошадей Пржевальского, содержащихся на территории государственного национального природного парка «Алтын-Эмель». В ГНПП у лошадей Пржевальского выявлено паразитирование трех видов нематод: *Strongylus equines* Muller, 1780;

Alfortia (Strongylus) edentates (Looss, 1900) Skrjaibin, 1933; *Trichonema (Cyathostomum) catinatum* Looss, 1900. Лошады Пржевальского их могли привезти собой из Мюнхенского зоопарка, так как во всех перемешенных лошадей Пржевальского в Белоруссии, Украины и России они зарегистрированы или могли приобрести от местных лошадей. Так как они выпасаются одних и тех же пастбищах, ходит одни и те водопои. Лошади Пржевальского заражаются алиментарно при заглатывании инвазионных личинок, чаще на пастбищах и при водопое из стоячих водоемов. Вполне вероятно, что в последующие годы у лошадей Пржевальского могут зарегистрирован ряд новых видов паразитов, обладателями которых в настоящее время являются местные лошади.