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Helminths of horses in Karakalpakstan: seasonal, spatial and age dynamics

Amaniyaz J. Kaniyazov[1], Erkinjon B. Shakarboev[2]

1 *Nukus Branch of Samarkand State University of Veterinary Medicine, Animal Husbandry and Biotechnology*
2 *Institute of Zoology, Academy of Sciences of the Republic of Uzbekistan*

Corresponding author: Erkinjon B. Shakarboev (sh-erkinjon@mail.ru)

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Abstract

We studied 60 species of helminths from 29 genera, 17 families, 8 orders, 3 classes, and 2 phyla parasitize horses in various regions of Karakalpakstan. Horses have been shown to be hosts to 53 species of Nematoda, 5 species of Cestoda and 2 species of Trematoda. The prevalence of helminths ranges from 0.7% to 33.6% and the intensity of infection from 1 to 12,538 individuals. The article reveals the biocoenotic relationships between ungulates and their helminths established by trophic links and proves the character of formation of helminthofauna in ungulates under the influence of natural and anthropogenic factors in the Aral Sea region. Additionally, the seasonal and age dynamics of horse infection with parascaridosis and setariasis in Karakalpakstan is determined.

Keywords

Helminths, helminthiasis, horse, infection, seasonal and age dynamics, Karakalpakstan

Introduction

Despite technocratic transformations in all areas of life, there is still interest in horses throughout the world. Currently, horses play an important role in the development of physical culture and human health and contribute to improving aesthetic taste. According to recent studies, the use of horses in the treatment of children with

cerebral palsy has a very strong positive effect. Horses are irreplaceable sources of a number of biologically active substances in the biological and medical industry.

There are a large number of works by foreign researchers dedicated to the study of helminths of horses (Bundina 2001; Muromtseva 2004; Aytuganov 2006; Gerke 2007; Borisova 2016; Laugier 2012; Matthews 2014; Stratford 2014; Sharova 2007; Kanokova et al. 2008; Vislobokov 2009; Mashukov 2009; Umur & Açici 2009; Suleymanov 2009; Aripsheva 2010; Volkov 2010; Kuzmina 2012, Khasanova 2015; Tedla, Abichu 2018 Shodmonov 2019; Tyden et al. 2019; Sazmand et al. 2020; Devkota et al. 2021; Elghryani et al. 2023). All the authors note that at present, helminthiases of horses remain an urgent problem for veterinary medicine, as they impede the growth and development of young animals, affect physical qualities and performance, and sometimes cause horses' death.

In Uzbekistan, the species composition of helminths, their ecology, and life cycles were studied Y. S. Safaev (1973), S. Dadaev (1978), T. I. Ismailov (1980), E. B. Shakarboev (2009). These studies resulted in the identification of 54 species of helminths in horses in the southern, eastern and northern parts of Uzbekistan. However, these studies are outdated and cannot provide comprehensive information on the current species composition of ungulate helminths in the Aral Sea region, the age and seasonal dynamics of helminthiasis, and the ways of the formation of helminth fauna. Therefore, studying the modern species composition of ungulate helminths in Karakalpakistan, analyzing the bioecology of widespread species and the specific ways of the formation of helminth fauna, as well as developing research-based measures against infection, is highly important from theoretical and practical aspects.

Therefore, the aim was to check the current species diversity of horse helminths, their seasonal, spatial and age dynamics in Karakalpakistan.

Materials and methods

The research was carried out from 2016 to 2022 in large and small private farms in various districts of the Republic of Karakalpakstan. During this period, 174 individuals of ungulates were examined using the method helminthological dissection (Kotelnikov 1974; Romashov et al. 2003) of 143 horses (62 individuals with complete dissection and 81 with partial dissection). In addition, 395 samples of horse urine were examined using scatological methods (Fulleborn, Kalantaryan, Shcherbovich, Darling and sequential washing) (Guralp 1981; Demidov 1987; Hendrix 1998). The number of eggs and larvae in 1 gram of feces was calculated according to Stoll's method. 143 preanal fold smears and 162 blood samples from horses in the studied territories were examined in the Laboratory of General Parasitology at the Institute of Zoology, Academy of Sciences of the Republic of Uzbekistan, and the Veterinary Laboratory of the Republic of Karakalpakstan (Rózsa et al. 2000). The prevalence and intensity of infection were calculated according to Bush et al. (1997).

When specifying the species composition of helminths, the parasites' morphology, localization, and the type of host were considered according to Ivashkin & Dvoynos (1984), Dvoynos (1993), Dvoynos & Kharchenko (1994).

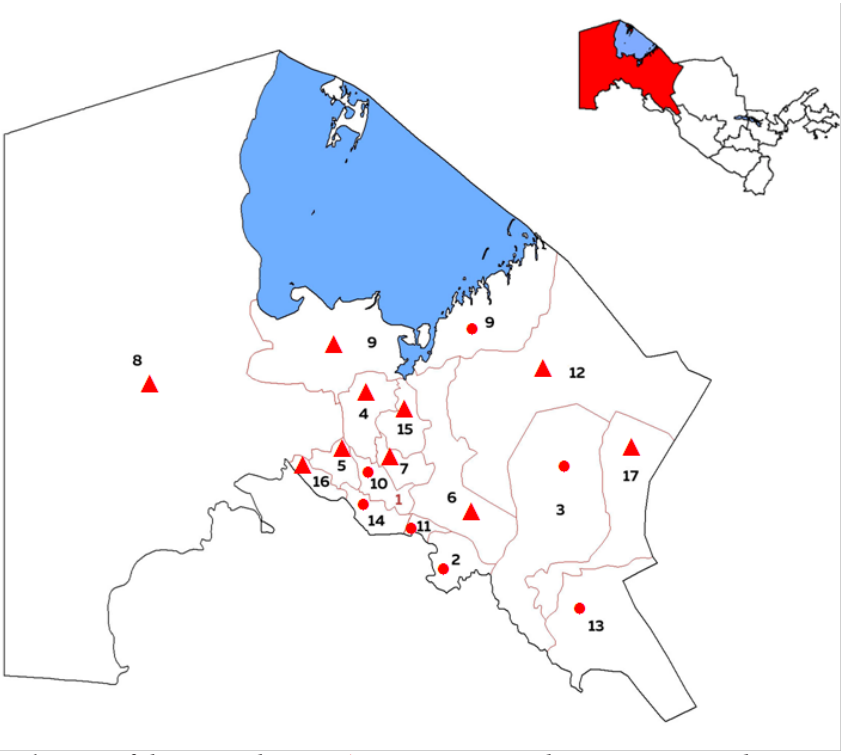

Figure 1. Map of the research area. ▲ – stationary studies; ● – route studies. 1 – Nukus city; 2 – Amudarya district; 3 – Beruni district; 4 – Bozatov district; 5 – Kanlikol district; 6 – Karaozak district; 7 – Kegeili district; 8 – Kungirot district; 9 – Moynok district; 10 – Nukus district; 11 – Takhyatosh district; 12 – Takhtakopir district; 13 – Tortkol district; 14 – Khojaly district; 15 – Chimboy district; 16 – Shumanoi district; 17 – Ellikkala district.

Result

The studies carried out in various territories of Karakalpakstan resulted in the identification of 60 species of helminths from 2 phyla, 3 classes, 8 orders, 17 families, and 29 genera parasitizing horses (Table 1).

The class Trematoda unites 2 species and makes up 3% of the total number of species; the class Cestoda consists of 5 species and makes up 8%; the class Nematoda is represented by 53 species and makes up 89% of the total number of species. Therefore, most of the 60 species of helminths identified in horses are of the class Nematoda, which is represented by 53 species (88.3%), the class Cestoda comprises 5 species (8.4%) and the class Trematoda – 2 species (3.4%). By their life cycles, 15 species are referred to biohelminths, and 45 species are referred to geohelminths.

Table 1. Taxonomy of ungulate helminths in Karakalpakstan

Class	Order	Family	Number of species
Trematoda	Fasciolida	Fasciolidae	1
	Schistosomatida	Schistosomatidae	1
Cestoda	Cyclophyllida	Taeniidae	2
		Anoplocephalidae	3
Nematoda	Rhabditida	Srtongyloididae	1
	Strongylida	Trichonematidae	36
		Trichostrongylidae	1
		Strongylidae	3
	Pseudaliida	Dictyocaulidae	1
	Ascaridida	Ascarididae	1
		Oxyuridae	1
		Cosmocercidae	1
	Spirurida	Gongylonematidae	1
		Habronematidae	3
		Filariidae	1
		Onchocercidae	2
		Setariidae	1
Total	8	17	60

The following prevalence of helminths was recorded in horses in Karakalpakstan (%): Trematoda – *F. gigantica* (9.7), *Sch. turkestanicum* (18.8); Cestoda – *A. perfoliata* (27.3), *A. magna* (24.5), *P. mamillana* (2.8), *T. hydatigena* (6.3), *E. granulosus* (9.1); Nematoda – *S. westeri* (3.5), *T. longibursatum* (27.2), *T. aegyptiacum* (26.5), *T. alveatum* (14.7), *T. calicatum* (27.2), *T. catinatum* (25.1), *T. coronatum* (26.5), *T. minutum* (23.0), *C. bicoronatum* (13.3), *C. mettami* (5.6), *C. euproctus* (6.3), *C. radiatum* (7), *C. elongatum* (11.1), *C. insigne* (4.1), *C. leptostomum* (2.0), *C. nassatum* (14.7), *C. triramozum* (3.5), *C. brevicapsulatum* (3.5), *C. adersi* (4.1), *C. ultrajectinum* (0.7), *P. imparidentatum* (3.5), *P. ratzii* (2.8), *P. skrjabini* (5.6), *P. skrjabini* (7.7), *P. poculatum* (3.5), *Sch. goldi* (4.0), *Sch. asimmetricum* (2.0), *Sch. labratum* (2.0), *Sch. labiatum* (2.8), *Sch. hybridum* (0.7), *G. capitatus* (2.8), *T. axei* (0.7), *S. equinus* (25.8), *A. edentates* (22.4), *D. vulgaris* (21.7), *T. serratus* (3.5), *T. brevicauda* (2.8), *T. tenuicollis* (0.7), *T. popowi* (5.6), *T. minor* (4.2), *D. arnfieldi* (12.6), *P. equorum* (33.6), *O. equi* (27.3), *P. vivipara* (16.1), *H. muscae* (14), *H. microstoma* (10.5), *D. megastoma* (3.5), *G. pulchrum* (11.2), *O. cervicalis* (12.6), *O. reticulata* (16.8%), *P. multipapillosa* (27.2) and *Setaria equina* (27.9).

We revealed that ungulates are highly infected with schistosomiasis, anoplocephalidosis, strongylatosis, alfortiosis, delafondiosis, trichonematosis, parascaridosis, oxyuriasis, parafilariasis, and setariasis. These data correspond to studies

conducted in other territories of Uzbekistan (Safaev 1973; Dadaev 1978; Ismailov 1980).

Of the 54 species of nematodes, 45 are geohelminths and 9 are biohelminths. The Nematoda geohelminths *D. vulgaris*, *A. edentatus*, *S. equinus*, *P. equorum*, *Trichonema* spp. and the biohelminths *P. multipapillosa* and *S. equina* show high intensity of infection. All the species mentioned above, as well as representatives of the genera *Oxyuris* and *Onchocerca*, are the most pathogenic parasites of horses (Safaev 1973; Sultanov et al. 1974, 1975; Dadaev 1978; Ismailov 1980; Dagnaw et al. 2016). Our research confirms these data.

There are several factors associated with the infection of ungulates with helminths. For example, various helminths with varying intensity of infection can be recorded in a stable and a herd. The main factors that influence the development of helminthiases in ungulates are hereditary susceptibility, level of care, type of nutrition, degree of exploitation, as well as medications taken by an animal (especially antibiotics and hormones) (Kaniyazov 2020).

Compared to data from other regions of Uzbekistan, our studies show a low level of infection of ungulates in Karakalpakstan (Ismailov 1980; Shakarboev 2009). In particular, *F. gigantica* was previously recorded in 12% of the animals, *T. hydatigena* in 9.5% and *E. granulosus* in 12.5%. The following Nematoda species have shown a significantly lower distribution (%): *S. equinus* (27.9), *D. vulgaris* (21.7), *A. edentatus* (22.4), *D. arnfieldi* (12.6), *T. serratus* (3.5), *T. brevicauda* (2.8), *P. equorum* (33.6), *O. equi* (27.3), *P. vivipara* (16.18), *O. cervicalis* (12.6) and *O. reticulata* (16.8).

We detected parascaridosis in 33.6% and setariasis in 27.9% of the horses studied. We also determined that the infection of horses with the nematode *P. equorum* does not vary strongly in different regions of Karakalpakstan (Table 2). The proportion of horses infected with parascaridosis ranges from 25.9 to 37.5% in the six studied regions of Karakalpakstan (the mean value was 32.6%).

Scatological and dissection studies showed a similar prevalence of parascaridosis among horses (32.6% and 33.6%, respectively), 86 of the 264 horses were infected with parascaridosis (Table 3).

Table 2. Prevalence of Nematoda *Parascaris equorum* among horses in various districts of Karakalpakstan (based on the results of scatological studies)

District	Number of studied individuals	Number of infected individuals	Prevalence, %
Bozatau	62	22	32.5
Takhtakupyr	45	14	31.1
Karauzak	39	12	30.7
Ellikkala	40	15	37.5
Kegeyli	51	16	31.4
Kungrad	27	7	25.9
Total	264	86	32.6

Table 3. Indicators of horse infection with the *Parascaris equorum* nematode, based on the results of scatological studies

Animals' age	Number of studied individuals	Number of infected individuals	Prevalence, %	Number of eggs from *P. equorum* eggs in 1 gram of faeces
Under two years	89	36	40.4	58.3±1.5
From two to five years	102	32	31.4	39.7±1.3
Over five years	73	18	24.6	7.4±1.1
Total	264	86	32.6	35.1±1.3

Our results suggest that the prevalence of Nematoda *P. equorum* is higher in young animals and gradually decreases with age. This feature is confirmed by other authors, who studied some groups of helminths (Ponamarev 1999; Khasanova 2015). Parascaridosis was recorded in all seasons (Table 4), while it increases from spring to winter.

Table 4. Seasonal dynamics of horse infection with the nematode *Parascaris equorum* (based on the results of scatological studies)

Seasons	Number of studied individuals	Number of infected individuals	Prevalence, %	Number of *Parascaris equorum* eggs in 1 gram of faeces
Spring (April)	264	52	19.7	37.7±1.4
Summer (July)	264	67	25.4	43.6±1.3
Autumn (October)	264	89	33.7	49.4±1.5
Winter (December – February)	264	93	35.2	42.3±1.4

The prevalence of the nematode *P. equorum* in the autumn and winter months was the highest. We determined the number of eggs in 1 g of feces also increased in fall and winter. Therefore, the highest occurrence of *P. equorum* nematodes in horses was recorded in the autumn and winter months; presumably, this is also a period in which a new generation of female worms begins to lay more eggs. Of the 143 horses studied, 40 were infected with the nematode *S. equina*. Of the 40 infected horses, 11 were under two years old, 17 between 2 and 5 and 12 were 5 years and older (Table 5). The data show that the occurrence and intensity of infection increase with horse age.

We revealed that setariosis infection in horses increases from spring to winter (Table 6).

Taking into account that it takes 8 to 10 months for Setaria to reach maturity, the presence of mature nematodes in the body of horses in autumn and winter shows that the epizootic process is based on certain patterns.

The study of mosquitoes (*Culex pipiens*, *Aedes maculipennis*), the intermediate hosts, showed that they were infected with Setaria larvae (Saparov 2016; Mona Mohammed I. Abdel Rahman 2020). In total, 12 (2.5%) of 465 individuals from mosquitoes C.pipiens and 7 (1.8%) of 382 individuals from *A. maculipennis* were infected with Setaria larvae. Blood-sucking dipteran insects have also been described as intermediate hosts for Nematoda from the genus *Setaria* by other researchers (Kabilov 1983).

The age and seasonal dynamics of the infection of horses with the nematodes *P. equorum* and *S. equina* were studied for the first time in the Aral Sea region. Our research team studied the prevalence of *S. equina* larvae in blood-sucking mosquitoes *C. pipiens* and *A. maculipennis*. The data obtained on the wide distribution of these nematodes among horses in the studied area are of some practical significance for planning measures to prevent infections.

Table 5. Age dynamics of horse infection with the nematode *Setaria equina* in Karakalpakstan

Animals' age	Number of studied individuals	Number of infected individuals	Prevalence, %	Intensity of infection, individuals
Under two years	48	11	22.9	2–11
From two to five years	59	17	28.8	3–15
Over five years	36	12	33.3	5–56
Total	143	40	27.9	2–56

Table 6. Seasonal dynamics of horse infection with the nematode *Setaria equina* in Karakalpakstan

Seasons	Number of studied individuals	Number of infected individuals	Prevalence, %	Number of *Parascaris equorum* eggs in 1 gram of faeces
Spring	27	4	14.8	2–12
Summer	23	5	21.7	2–11
Autumn	39	11	28.2	4–13
Winter	54	20	37.1	5–56
Total	143	40	27.9	2–56

Conclusions

We registered 60 species of helminths from 29 genera, 17 families, 8 orders, 3 classes, and 2 phyla parasitizing horses in various regions of Karakalpakstan. In Karakalpakstan, the prevalence of helminths in horses is 0.7–33.6%, the total intensity of infection is 1–12,538 individuals. Ungulates are highly infected with schistosomiasis, anoplocephalidosis, strongylatosis, alfortiosis, delafondiosis, trichonematosis, parascaridosis, oxyuriasis, parafilariasis, and setariasis.

Of the 264 horses examined by the scatological method, 86 were infected with the *Parascaris equorum*, 40.4% under two years of age, 31.4% from two to five years and 24.6% over five years. Parascaridosis occurs in horses in all seasons of the year. Research results show that the prevalence of Setaria in horses increases with age. Although the proportion of horses under 2 years of age infected with Setaria was 22.9%, animals aged 5 years and older showed a prevalence of 33.3%. The proportion of horses infected with sexually mature nematodes *Setaria equina* is 14.8% in spring, 21.7% in summer, 28.2% in autumn, and 37.1% in winter.

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