Epizootic Situation on Horse Helminthiases in the Northern Region of Kazakhstan

Assylbek A. Zhanabayev*, Baltabek K. Ibrayev, Lyudmila A. Lider, Altay E. Ussenbayev and Roman M. Bissengaliyev

Department of Veterinary Medicine, Saken Seifullin Kazakh Agrotechnical University, Astana, Republic of Kazakhstan.

**Corresponding author at: Department of Veterinary Medicine, Saken Seifullin Kazakh Agrotechnical University, Astana, Republic of Kazakhstan.*
E-mail: ass.zhanabayev@gmail.com.

Veterinaria Italiana 2023, **59** (1), 11-22. doi: 10.12834/VetIt.2740.17604.3
Accepted: 27.05.2022 | Available on line: 31.03.2023

Keywords
Parasitosis,
Dynamics of infection in horses,
Helminthiases,
Strongylatoses,
Invasive larvae.

Summary
The research relevance is predefined by the widespread distribution of parasitosis, including helminthiases, alongside constant depasture on the same areas of pastures, which annually causes massive re-infection of horses. In this regard, the research aims to identify the age, seasonal, and territorial dynamics of infection of horses with helminthiases in the context of the districts of the northern region of Kazakhstan. The primary research method was an experimental analysis that allowing to consider the dynamics and causes of horse helminthiases, associated with the prepatent period, the resistance of the organism, and the system of keeping and feeding horses. The study presents the results of studies of horse helminthiases on the territory of the Northern region of Kazakhstan, covering 4 regions that currently exist in 61 agricultural formations. Faecal samples of 4,395 horses were examined by scatological methods and 126 samples – by incomplete helminthological autopsy. As a result of coprolarvoscopic and coprological studies, it was found that in horses, the dominant representatives among the invasive larvae of strongylates are small and large palisade worms. In scatological studies, strongylatosis of the gastrointestinal tract was recorded in 63.9% of cases, oxyurosis in 40.8%, and parascariasis in 25.9%. The study also presents the results of post-mortem diagnostics, which was carried out during the slaughter or due to the death of the horse.

Introduction

The first steps in an analysis of helminthiases in Kazakhstan were done by K.I. Skryabin (1916), which was the first to identify 14 types of helminths in the Zhambyl region. Subsequently, studies by other scientists (Tinkler 2020; Zakharova and Protodyakonova 2022; Trogu *et al*. 2021; Kessler *et al*. 2021; Sánchez-López *et al*. 2021; Velichkin *et al*. 2002) identified and supplemented the typology with previously unknown parasites. N.T. Kadyrov studied horse helminth fauna in the north of the republic for 40-45 years, attributing the discovered helminths to 31 species of 17 families and 7 genera (Kadyrov and Aubakirov 1979; Kadyrov and Aubakirov 1981; Kadyrov *et al*., 1991; Kadyrov *et al*., 1997). The country occupying the 9th place in terms of territory in the world has 184 million hectares of pasture and hayfields, of which only 78-80 million are used for their intended purpose (Latko and Safiullin 2002). The rest of the areas of pastures and hayfields are either far removed or inaccessible. But despite this, parasitosis, including helminthiases, is widespread (Yatusevich and Sinyakov 2004; Andreev and Akbaev 2001; Smirnov 2003; Vlizlo *et al*. 2022). Historically developed traditions, when Kazakhs used pastures according to the seasons of the year (spring, summer, and autumn) to preserve herbage

Please refer to the forthcoming article as: Zhanabayev *et al*. 2023. Epizootic situation on horse helminthiases in the northern region of Kazakhstan. Vet Ital. doi: 10.12834/VetIt.2740.17604.3

and prevent diseases of infectious aetiology, are currently almost not used and forgotten (Bundina 1989; Bundina 2002; Ochirov 2003).

Nevertheless, according to the Statistics Agency of the Republic of Kazakhstan in 2020, more than 2.8 million horses are currently raised on pasture territories, apart from other farm animals. However, constant grazing in the same areas of pasture annually leads to massive re-infection of horses. Parasitosis, including helminthiases of animals, remains an unresolved problem of veterinary science in the world despite the available modern effective antiparasitic drugs, which depend on many objective and subjective factors (Horalskyi *et al*. 2022). In each country, including the conditions of the northern region of Kazakhstan, farm animals are infected with parasitosis, such as helminthiases, mainly in the summer-pasture period (Kolchyk *et al*. 2022). The developmental biology of all helminths without exception (nematodosis, cestodosis, arachnosis, entomoses) is associated with the external environment and its symbionts (Maksim'yuk *et al*. 2022). Therefore, in the external environment, eggs and larvae become invasive, posing a danger of infection of animals. Farm animal helminthiases cause significant, uncountable economic damage. The current struggle against helminthiases is insignificant as the coverage of the entire livestock is insignificant, which leads to their further spread.

This research was conducted within the framework of the budget programme 042 "Applied scientific research in the field of agro-industrial complex". The study demonstrates that in all agricultural formations, regardless of the form of ownership, horses (except for breeding from private owners) are infected with more than 45 parasitoses. The prevalence of extensiveness of invasion in most farms reaches 96-100%. A similar situation is developing in other branches of animal husbandry (sheep breeding, cattle breeding). The evidence base, for example, are outbreaks of coenurosis in the Nurinsky district of the Karaganda region, moniesiasis, nematodirosis, and hemonkhosis among sheep in the Ereimentau and Arshali districts of the Akmola region, strongylatosis and horse gastrophiliasis in all feeds without exception.

Furthermore, the antiparasitic drugs used by animal owners have not changed over the past 10-12 years despite the availability of modern highly effective therapeutic agents. In most cases, after the treatment measures are taken, the owners immediately move animals to the pasture, thereby contaminating the pasture areas with invasive elements, which, under favourable conditions, pose a danger of re-infection of the same animals (reinvasion). Therefore, a person can only partially decontaminate objects of the external environment (livestock buildings, some areas of pastures, drinking water, etc.) as with the thoughtless use of chemicals, irreparable damage will be caused to nature. Therefore, from this standpoint, helminthologists see another way for practical veterinary specialists and owners of the animals – to carry out medical and recreational measures concerning agricultural animals within the time frame established during research.

To establish scientifically grounded terms for deworming in each region, it is necessary to carry out appropriate studies, considering climatic conditions and the system of the introduction of animal husbandry. As it is known, in the northern region of the republic, animals use pasture lands for only 5-5.5 months (except for herd horse breeding). The rest of the time pets are kept in stables. However, the indicated 5 months are enough for animals to be infected and re-infected by an invasion developed in a pasture.

Materials and methods

Research on two projects of the Ministry of Education and Science of the Republic of Kazakhstan in 2009-2011 and 2012-2014 was carried out at the Department of Veterinary Medicine of the NJSC "Kazakh Agro-Technical University named after S. Seifullin" in the laboratory named after N.T. Kadyrov, Nur-Sultan, the Republican Veterinary Laboratory of the Ministry of Agriculture of the Republic of Kazakhstan, a clinical laboratory and more than 60 agricultural units with different forms of ownership of four regions of the northern region of Kazakhstan (North Kazakhstan, Akmola, Karaganda, and Kustanai). During this period of research, over 4.000 faeces samples and more than 200 sets of the gastrointestinal tract of horses belonging to various agricultural formations were examined.

Scatological studies of faecal samples from horses were carried out based on the flotation methods of Fülleborn and McMaster (for helminth eggs) and Berman-Orlov (for differentiation of invasive strongylate larvae) to establish the initial infection, as well as the study of each sample after dehelminthisation to determine the extensibility of the medicated feed mixture.

Fülleborn's method was performed as follows. First, a saturated 40% sodium chloride solution was prepared. For this, 400 g of salt was dissolved in 1 litre of boiling water, constantly stirring until completely dissolved. Then it was cooled, and filtered through a cotton filter. The solution was used cold, with a density of 1.36.

A preliminary investigated sample of faeces (3-5 g) was placed in a mortar (capacity 100-200 ml) and thoroughly ground with a pestle. After the build-

up of a homogeneous mass, the total volume of a saturated solution of sodium chloride was brought to 200 ml (20 times the volume). Then, it was filtered with a cylindrical beaker through a sieve. After 25-30 minutes, a sample was taken from the surface of the solution with a light touch of a metal loop (diameter – 7-8 mm), applied to a glass slide, covered with a covered glass, and viewed under a microscope.

McMaster method: the differences and advantages of this method compared to the previous one is as follows:

1. The research takes only 3-4 minutes (the Fülleborn method takes 20-30 minutes).
2. A saturated solution of sodium chloride is used not at 40%, but at 36% concentration (compared to the Fülleborn method, the NaCl savings per 1 liter prepared is 40 grams), where the specific gravity is 1.2.
3. Consumption for the study of 1 sample weighing 4 grams 60 ml (compared to 80 ml upon Fülleborn method for the same sample).

Accurate counting of helminth eggs is done in a counting chamber (by the Fülleborn method – from a glass slide without clear boundaries, but in three drops with an arithmetic mean deviation). These methods were used to detect nematode and cestode eggs. In cases of high cestodes presence degrees (anoplocephalidosis), the Darling method was used, which lies in combining the methods of sedimentation and flotation. For this, the faeces were mixed with water to a semi-liquid consistency and centrifuged for 3-5 minutes.

Therewith, the eggs of the helminths settled to the bottom. Then the liquid was decanted from the test tube, and Darling's liquid (glycerin mixed in equal parts with a saturated solution of sodium chloride) was added to the sediment.

The sediment was thoroughly mixed and centrifuged again for 3 min. During this procedure, helminth eggs floated to the surface from the sediment.

Then the film was removed with a metal loop, transferred to a glass slide and examined under a microscope. The Berman-Orlov, or coprolarvoscopic method, was used to differentiate invasive strongylate larvae of the gastrointestinal tract from dictyocaul larvae and other free-living nematodes. For this, samples of faeces taken from the animals' rectums were placed in a thermostat (for 9-11 days) or taken from a pasture (12-17 days depending on the ambient temperature) in the warm season. Faecal samples (10 g) wrapped in gauze were placed in the Berman-Orlov apparatus. Warm water was poured into the funnel (18-22°).

The apparatus filled with the sample was left at room temperature for 6-8 hours. During the indicated time, the strongylate larvae of the gastrointestinal tract and other larvae, according to the principle of thermotaxis, pass from the sample into the aquatic environment and settle down the tube to the bottom of the test tube. After the specified time had elapsed, the Ulengut tube was disconnected from the rubber tube and with a quick movement, without shaking the sediment, the liquid was poured into a Petri dish or, after sucking off the supernatant, it was shaken, then 1-3 drops of the sample were pipetted onto a glass slide and microscoped at low, then at high magnification.

Studies concerning invasive strongylate larvae were carried out according to the differential table of A.P. Velichkin (1984). During the study, the found helminth eggs belonged to 3 nematode families, namely *Strongylidae* (Figure 1): *Strongylus vulgaris*, *Strongylus edentatus*, *Strongylus equinus*, Trichonema spp., *Oxyuridae*: Oxyuris equi, and *Ascarididae*: *Parascaris equorum*. Furthermore, in some samples, eggs of the genus Anoplocephala (*Anoplocephala magna*, *Paranoplocephala mamillana*) were found.

During coprolarvoscopic studies, it was found that among the invasive strongylate larvae, the largest share (dominant) is occupied by *Ciatostominae* spp. (49-53%), followed by *Strongylus* (Delafondia) *vulgaris* (24-28%), then *Strongylus* (Alfortia) *edentatus* (12-19%), and only 1-4% being occupied by *Strongylus eguinus* (Figure 2).

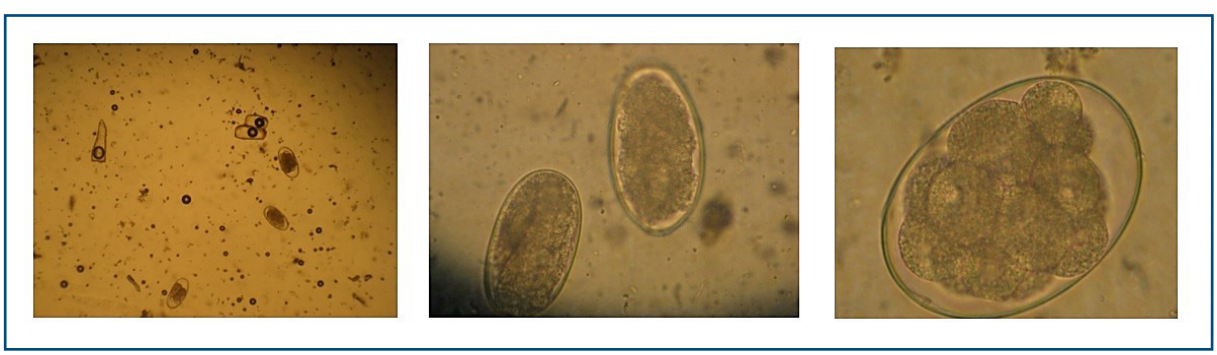

Figure 1. *Strongylata eggs in faecal samples of horses.*

Figure 2. *Invasive larvae: A* – Strongylus (Delafondia) vulgaris*; B* – Ciatostominae *spp.; C* – Strongylus (Alfortia) edentatus.

Table I. *Infection of horses with helminthiases in the Akmola region (2009-2019).*

District name, agricultural enterprises	Total examined, heads	During the study, eggs were found (head/percent):		
		Strongylus spp	*Oxyuris equi*	*Parascaris equorum*
Zhaksy district				
LLP "Karazhon"	167	158/94.6	83/49.7	52/31.3
Intensity of invasion, min/max	167	22-149	1-19	7-46
Tselinograd district				
JSC "Kuigenzhar"	54	–	3/6.3	–
Equestrian Centre "Tulpar"	44	39/88.6	33/75.0	21/47.7
Equestrian Centre "Kulager"	26	21/76.9	11/42.3	6/19.2
LLP "Kabanbai Batyra"	60	56/93.3	40/66.7	21/35.0
LLP "Zhalyn"	159	134/84.3	62/38.9	42/26.4
LLP "Mukhamedzhanov"	47	47/100.0	12/26.0	17/36.1
JSC "Rodina"	60	60/100.0	12/20.0	17/28.3
LLP "Suyurov"	42	42/100.0	31/73.8	19/45.2
LLP "Sunkar"	49	44/89.7	26/52.0	21/42.8
LLP "Prirechnoye"	38	32/82.0	14/35.8	17/43.6
Invasion intensity, min/max	579	17-1352	7-26	3-94
Arshalyn district				
LLP "Izhevskoe"	53	50/94.3	21/39.6	27/50.9
LLP "Novo-Aleksandrovskoe"	91	83/91.2	36/39.5	41/45.1
LLP "Novo-Vladimirskoe"	367	249/68.0	138/37.6	84/22.8
LLP "Saryoba"	229	207/90.4	96/41.9	62/27.1
Invasion intensity, min/max	748	8-846	3-19	6-82
Ereimentau district				
LLP "Novomarkovskoe"	82	75/91.5	44/53.6	28/34.1
LLP "Timofeevskoe"	112	108/96.4	49/43.1	43/38.9
LLP "Alem"	104	96/93.6	31/29.1	38/36.6
LLP "Torgayskoye"	139	113/81.3	67/48.2	41/29.5
LLP "Ulentinskoe"	114	114/100.0	62/54.3	42/36.8
Invasion intensity, min/max	551	29-1164	4-28	5-43
Korgalzhyn district				
LLP "Zhanteke"	51	44/88.0	26/52.0	21/42.0
Invasion intensity, min/max	51	14-261	1-14	2-37
Total in Akmola region	**2.088**	**1772/84.9**	**893/42.8**	**660/31.6**

Veterinaria Italiana 2023, **59** (1), 11-22. doi: 10.12834/VetIt.2740.17604.3

Results and Discussion

Infection of horses with helminthiases in Akmola and Karaganda regions

Scatological studies were carried out for 2,088 samples of horse faeces from 21 farms of the Akmola region with various forms of ownership. Thus, in the samples of faeces delivered from JSC "Rodina", LLP "Kabanbai Batyra", "Zhalyn", "Mukhamedzhanov", "Suyurov", "Izhevskoe", "Novo-Aleksandrovskoe", "Ulentinskoe", "Novomarkovskoe", "Timofeevskoe" and "Alem", the extent of invasion reaches from 96% to 100% (Table 1).

Scatological and clinical methods revealed oxyurosis (42.8%) in 1.707 animals. Oxyurosis was mainly recorded in stables. For example, in Equestrian Centre "Tulpar", where year-round stall maintenance is used, the extensiveness of invasion reaches up to 75%, while with herd keeping, the intensity is somewhat lower (LLP "Kabanbai Batyra" – 66.7%, LLP "Zhalyn" – 40%, LLP "Novomarkovskoe" – 53.6%, LLP "Torgayskoye" – 48.2% (Figure 3).

Figure 3. *Horses with oxyurosis in various households during the stall period and* Oxyuris equi *eggs in scrapings from perianal folds.*

The absence of nematodes or low extensiveness in JSC "Kuigenzhar" is related to the planned prophylactic treatments. In this farm, only 6.3% of oxyurosis was recorded. Parascariasis was recorded mainly in horses under 4 years of age. Thus, out of the studied 21 agricultural formations, in 18 parascariasis among horses is common from 19.2 to 50.9% (Table I).

A very high presence of invasive parasites is noted in Equestrian Centre "Tulpar", LLP "Zhalyn", LLP "Suyurov", LLP "Sunkar" and LLP "Izhevskoe", where horses were in the pasture in the daytime, and at night in summer pennages, where they feed from the floor (Figure 4).

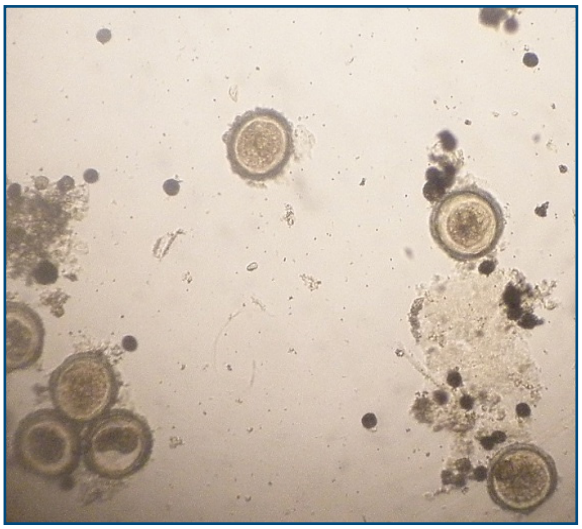

Figure 4. P. equorum *eggs in faecal samples.*

Table II. *Helminthiases of horses in the Karaganda region (2010-2019).*

Region name, agricultural enterprises	Total examined, heads	During the study, eggs were found (head/percent):		
		***Strongylus* spp**	***Oxyuris equi***	***Parascaris equorum***
Karaganda city and Karaganda region				
Horse breeding farm "Karat"	231	168/72.7	92/39.8	61/26.4
including:				
Fillies, young horses up to 5 years	19	3/15.7	6/31.6	2/10.5
Stud-horses				
LLP "Otkanzhar"	68	49/72.1	38/55.8	26/38.2
LLP "Tabys-Agro D"	37	7/18.9	9/24.3	3/8.1
Invasion intensity, min/max		19-641	3-21	4-52
Total in the Karaganda region	**355**	**227/63.9**	**145/40.8**	**92/25.9**

Thus, when examining 355 faecal samples, in 63.9% of cases strongylatoses of the gastrointestinal tract, in 40.8% – oxyurosis, and 25.9% – parascariasis were recorded. Oxyurosis and strongylatoses in horse breeding farm Karat and LLP "Otkanzhar" also had a high extent since horses did not receive medical treatment (Table II).

Parascariasis occurs among young horses in 10-38% of cases, which is also associated with grazing animals in a limited area.

Helminthiases of horses in the conditions of Kostanay and North Kazakhstan Regions

Coprological studies for helminthiases in the Kostanay region covered 2 large horse breeding farms (the "Kazakh tulpary" horse breeding farm and LLP "Karaman" (Karasu district), with more than 1.700 heads.

Out of 664 horse heads, 89.8% are contaminated with strongylatoses, 37.9% – with oxyurosis, and 19.4% with parascariasis. In the context of economic entities, a high (up to 100%) infection with strongylatoses is noted in "Kazakh tulpary", since horses are on permanent pastures in summer (Table III). Oxyurosis as a stable invasion in this breeding farm was recorded among young animals with a coverage of up to 62.6%, which is explained by direct infection during free-range keeping in enclosed pastures.

Parascariasis, as in other farms, was mainly recorded among foals and young animals of up to 3 years old with an extensiveness of 19.4%.

Coprolarvoscopic studies also confirm that small (*Ciatostominae*: *Trichonema* spp.) and large strongylids (*Strongylidae*: *S. vulgaris*, *S. edentatus*, and *S. equinus*) are dominant in horses. Strongylatosis (82%), oxyurosis (up to 32%) and parascariasis (up to 12%) were also registered in LLP "Karaman".

The resulting scatological studies once again indicate the absence of any deworming in these farms. Despite the northern location of the region, helminthiases are also widespread in this area. Scatological studies were carried out 1.325 samples of faeces belonging to 3 districts of this region (Table IV).

Veterinaria Italiana 2023, **59** (1), 11-22. doi: 10.12834/VetIt.2740.17604.3

Table III. *Horse helminthiases recorded in the context of districts of Kostanay region (based on the results of 2010-2018 research).*

Region name, agricultural enterprises	Total examined, heads	During the study, eggs were found (head/percent):		
		***Strongylus* spp**	***Oxyuris equi***	***Parascaris equorum***
Kostanay city and Kostanay region				
Pedigree horse farm "Kazakh tulpary": Growing horses, up to 3 years old	147	147/100.0	92/62.6	72/48.9
Grown horses	219	203/92.7	68/31.1	12/0.05
Invasion intensity, min/max	366	12-117	3-11	6-13
LLP "Karaman": Growing horses, up to 3 years of age	135	109/80.7	63/46.6	31/22.9
Grown horses	163	137/84.0	29/17.8	14/0.08
Invasion intensity, min/max	298	67-1103	12-19	6-74
Total in Kostanay region	**664**	**596/89.8**	**252/37.9**	**129/19.4**

Table IV. *Dynamics of infection of horses with helminthiases in the context of districts of the North Kazakhstan region (results of scatological studies for 2014-2019).*

District name, agricultural enterprises	Total examined, heads	During the study, eggs were found (head/percent):		
		***Strongylus* spp**	***Oxyuris equi***	***Parascaris equorum***
Zhambyl district				
Aituar rural district	134	131/97.8	63/47.0	43/32.1
Amangeldy rural district	209	202/96.7	82/39.2	51/24.4
Invasion intensity, min/max	343	12-117	3-11	6-13
By district	**343**	**333/97.1**	**145/42.2**	**94/27.4**
District named after Shal akyn				
Baluan rural district	167	156/93.4	69/41.3	58/34.7
Zhanazhol rural district	239	231/96.6	113/47.2	69/28.8
Invasion intensity, min/max	406	38-291	3-12	5-61
By district	**406**	**387/95.3**	**182/44.8**	**127/31.3**
Esil district				
Berlik rural district	218	204/93.6	49/22.4	66/30.3
Nikolaevsky rural district	358	324/90.5	93/25.9	106/29.6
Invasion intensity, min/max	576	64-928	2-16	6-49
By district	**576**	**528/91.7**	**142/24.7**	**172/29.9**
Total in the North Kazakhstan region	**1.325**	**1248/94.2**	**469/35.4**	**393/29.7**

Table IV indicates that in all 3 districts of the region, strongylatosis among horses had almost the same high extensiveness, which reached 94%. The invasion intensity during strongylatoses in the studied animals ranged from 12 to 928 specimens, which indicated a constant layering of the invasion (reinvasion). Oxyurosis affectd from 22% to 47% of the livestock.

Parascariasis among horses was recorded in 393 animals, which was 29.7% of the total studied horse population.

Age and seasonal dynamics of helminthiases in Northern Kazakhstan

The age dynamics of horse helminthiases were studied in two regions of the northern region of Kazakhstan (Table V).

This issue is largely related to the prepatent period of pathogens development, body resistance, the system of keeping and feeding horses.

Thus, in the Northern Kazakhstan conditions, all horses are susceptible to helminthiases. However, there are some features in the timing of infection and manifestation of strongylatosis. For example, in foals up to 6 months of age, cyatostominoses are always noted, which is explained by the short period of development of pathogens in the body (30-38 days).

With age (starting from 7-8 months), delafondiosis (*Strongylus vulgaris*) was detected in horses in the autumn-winter period.

Alfortia eggs (*Strongylus edentatus*) are found in cultured faecal samples older than 1.5 years. In general, in 2-3-year-old horses, strongylatosis resolves as mixinvasion.

Helminthiases, as in other regions of Kazakhstan, manifest themselves and have their features. In their epizootology, helminthiases have seasonal features (Table VI).

Thus, in Northern Kazakhstan, compared to the winter period, strongylatoses sharply decrease (up to 76-90%) with horses entering pasture in early spring, which is explained by the natural elimination of the parasites and the helminthagogue effect of last year's wormwood.

Postmortem diagnosis was incrementally carried out along with the slaughter or due to the death of the horse.

Photographs of different years are presented, which confirm the wide distribution of both helminthiases and parasitoses in general (Figure 5).

Research and development were carried out for 10 years within the framework of two research projects of the Ministry of Education and Science of the Republic of Kazakhstan to determine the epizootic situation of parasitosis of horses in the Northern region of Kazakhstan.

The research was carried out with the agricultural enterprises of 4 regions (Akmola, Karaganda, Kostanay, and North Kazakhstan). 3,905 heads of faecal samples were examined according to scatological methods (coproovoscopy: Fülleborn, Mc Master; coprolarvoscopy: Berman-Orlova) and 126 heads – according to the method of incomplete helminthological autopsy (Table VII).

Table VII shows that in all regions, strongylatosis among horses had a high extensiveness, which reaches 94%. The intensity of invasion during strongylatoses in the studied animals ranged from 12 to 928 specimens, which indicated the constant layering of invasion (reinvasion).

Up to 73.6% of the livestock were susceptible to oxyurosis. Parascariasis among horses was recorded in 393 animals, which was 30.9% of the total investigated horse population.

Anoplocephalidosis and gastrofiliasis were 7.1% and 83.6%, respectively.

Table V. *Age dynamics of horse helminthiases in the conditions of the Karaganda region.*

Farm name, age of horses	Studied livestock	Strongylatoses	Oxyurosis	Parascariasis
Akmola region				
Foals	43	29/67.4	14/32.6	11/25.6
Growing horses, under 1 year	74	71/95.9	28/37.8	22/29.7
Growing horses, from up to 2 years	51	36/70.6	19/37.6	16/31.4
Horses over 3 years old	63	52/82.5	18/28.7	4/6.3
Invasion intensity, min/max		19-641	3-21	4-52
Total	**231**	**188/79.1**	**79/34.2**	**53/23.3**
North-Kazakhstan region				
Foals	12	6/50.0	4/33.3	8/66.6
Growing horses, under 1 year	19	17/89.5	10/52.6	11/57.9
Growing horses, from up to 2 years	11	9/81.8	6/54.5	4/36.4
Horses over 3 years old	26	22/84.6	17/65.8	6/3.1
Invasion intensity, min/max		27-372	4-11	6-34
Total	**68**	**54/76.5**	**37/51.6**	**29/41.0**

Veterinaria Italiana 2023, **59** (1), 11-22. doi: 10.12834/VetIt.2740.17604.3

Table VI. *Seasonality of helminthiases in the conditions of northern Kazakhstan (according to the results of scatological studies in the period 2009-2019.*

Helminthiases	Studied livestock	Seasons (heads/%):			
		winter	spring	summer	autumn
Akmola region					
Strongylatoses	192	172/89.5	153/79.7	138/71.9	186/96.9
Parascariasis		53/27.6	38/19.8	49/25.5	63/32.8
Oxyurosis		89/46.4	65/33.8	52/27.0	57/29.7
Karaganda region					
Strongylatoses	216	208/96.3	196/90.7	177/81.9	202/93.5
Parascariasis		46/21.2	59/27.3	27/12.5	61/28.3
Oxyurosis		51/23.6	60/27.8	38/17.5	46/21.3
Kostanay region					
Strongylatoses	224	214/95.6	191/85.3	154/68.8	209/93.4
Parascariasis		79/35.3	83/37.1	56/25.0	60/26.8
Oxyurosis		96/42.9	113/50.4	63/28.1	82/36.6
North-Kazakhstan region					
Strongylatoses	147	144/97.9	113/76.8	96/65.4	107/72.8
Parascariasis		58/39.4	28/19.1	62/42.2	76/51.8
Oxyurosis		36/24.5	58/39.5	22/14.9	37/25.2

Table VII. *Horse parasitoses in northern Kazakhstan (2009-2019).*

Regions	Studied livestock, heads	Strongylatoses	Oxyurosis	Parascariasis	Anoplocephalidoses	Gastrofiliasis
		Invasion extensiveness, heads/%				
Akmola	2,088	1.772/84.9	893/42.8	660/31.6	225/10.8	1,772/92.2
Karaganda	318	220/69.2	136/42.7	89/27.9	11/3.5	85/41.5
Kostanay	174	161/92.2	128/73.6	63/36.2	–	158/91.3
North Kazakhstan	1.325	1.248/94.2	469/35.4	393/29.7	–	1,248/94.2
Total in northern Kazakhstan	3.905	3.401/87.1	1.626/41.6	1.205/30.9	236/7.1	3.263/83.6

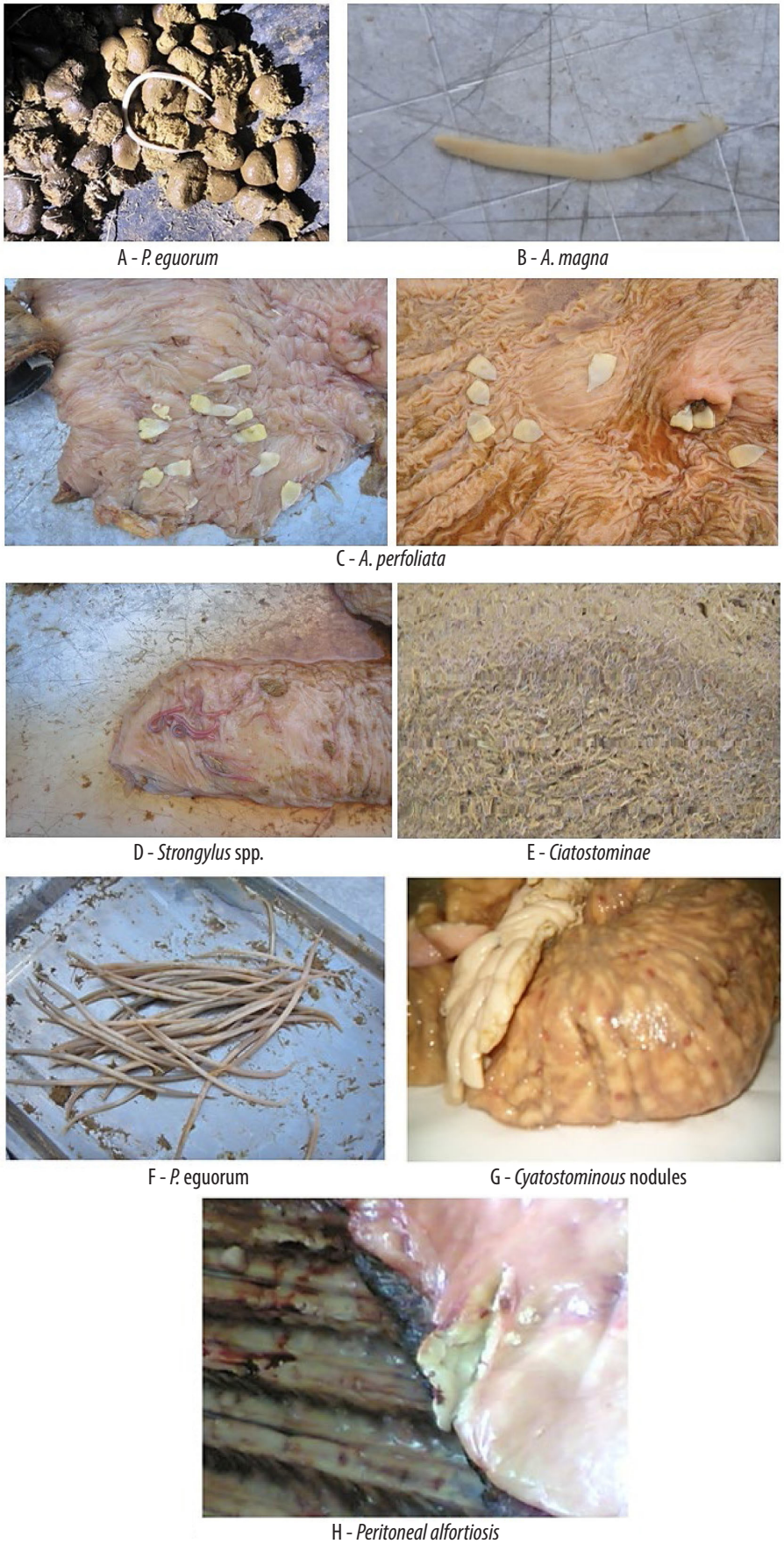

Figure 5. *Photographs of helminthiases and parasites in general, confirming their wide distribution, dated various years in the Republic of Kazakhstan.*

Veterinaria Italiana 2023, **59** (1), 11-22. doi: 10.12834/VetIt.2740.17604.3

Conclusions

In the Karaganda region, gastrointestinal strongilatosis was found in 63.9% of cases, 40.8% – oxyurosis, and 25.9% – parascariasis. Oxyurosis and strongylatoses in the Horse breeding farm "Karat" and LLP "Otkanzhar" also had a high extent since horses did not receive medical attention. Parascariasis occurs among young horses in 10-38% of cases, which was also associated with grazing animals in a limited area. In the Kostanay region, out of 664 horses, 89.8% were contaminated with strongylatosis, 37.9% with oxyurosis, and 19.4% with parascariasis. In the context of economic entities, a high (up to 100%) infection with strongilatosis was noted in "Kazakh tulpary", since horses in the summer period were always on pastures. Oxyurosis as a stable invasion in this breeding farm was recorded among young animals with a coverage of up to 62.6%, which was explained by direct infection during free-range keeping in enclosed pastures. Parascariasis, as in other farms, was mainly detected among foals and young animals up to 3 years old with an extensiveness of 19.4%. In the districts of the North Kazakhstan region, strongylatosis among horses had a high extensiveness, reaching up to 94%. The intensity of strongylatoses cases in the studied animals ranged from 12 to 928 specimens, which indicated a constant layering of the invasion (reinvasion). Oxyurosis affected 22-47% of the livestock. Parascariasis among horses was recorded in 393 animals, which was 29.7% of the total studied horse population. Horses in Northern Kazakhstan had some specific features in the timing of infection and manifestation of strongylatosis. Thus, for example, in foals up to 6 months of age, cyatostominosis was always detected, which was explained by the short period of development of pathogens in the body (30-38 days). With age (starting from 7-8 months), delafondiosis (*Strongylus vulgaris*) was recorded in horses in the autumn-winter period. Alfortia eggs (*Strongylus edentatus*) were found in cultured faeces samples of horses older than 1.5 years.

Acknowledgement

The study was carried out within the framework of projects 2008-2010 and 2012-2014. GF MES RK. No. 0106RK01274 and No. 0112RK01342.

References

Andreev M.V. & Akbaev M.Sh. 2001. Parasite fauna of horses in the Republic of Sakha and measures to combat them. *Veterinary,* **11**, 38-41.

Bundina L.A. 1989. Mixed helminthiases among horses of the Moscow region. *Proceed of VIGIS*, **49**, 85-88.

Bundina L.A. 2002. Infection of horses of the Moscow racetrack with helminthiases and the effectiveness of some anthelmintic drugs. *Veterinary,* **7**, 35-38.

Horalskyi L., Hlukhova H., Sokulskyi I. & Kolesnik N. 2022. Morphological features and morphometric parameters of the lungs of sexually mature horses (Equus Ferus Caballus L., 1758). *Ukrain J of Veter Scien,* **13**(1), 25-33. https://doi.org/10.31548/ujvs.13(1).2022.25-33

Kadyrov N.T. & Aubakirov S.A. 1979. Epizootology of the most important horse helminthiasis in the conditions of northern Kazakhstan. *Bull of Agricult Scien of Kazakhstan,* **12**, 153-155.

Kadyrov N.T. & Aubakirov S.A. 1981. Health improvement of horses from strongylatosis. *Bull of Agricult Scien of Kazakhstan,* **6**, 66-68.

Kadyrov N.T., Aubakirov S.A. & Ibraev B.K. 1991. Experience of combating parasitosis of horses. *Veterinary,* **10**, 42-44.

Kadyrov N.T., Aubakirov S.A. & Ibraev B.K. 1997. The effectiveness of antiparasitic drugs in horse parasitosis. *Veterinary,* **10**, 37-39.

Kessler S., Harder T.C., Schwemmle M. & Ciminski K. 2021. Influenza a viruses and zoonotic events—are we creating our own reservoirs? *Viruses*, **13**(11), art. no. 2250. https://doi.org/10.3390/v13112250

Kolchyk O., Illarionova T., Buzun A., Paliy A. & Palii A. 2022. Influence of probiotic microorganisms on microbial biofilms in feeds. *Scient Horiz*, **25**(1), 41-50. https://doi.org/10.48077/scihor.25(1).2022.41-50

Latko M.D. & Safiullin R.T. 2002. Mixed helminthiasis of horses in farms of different climatic zones. *Veterinary,* **2**, 28-30.

Maksim'yuk V., Sedilo G., Stadnytska O., Maksimyuk H. & Vorobets Z. 2022. Features of the imbalance in the mass of components of the uterine-vaginal mucus of cows due to the harmful effects of endogenous factors. *Scient Horiz.*, **25**(3), 9-15. https://doi.org/10.48077/scihor.25(3).2022.9-15

Ochirov P.B. 2003. Parasite fauna and parasitic diseases of horses in the arid zone of the South of Russia (Kalmykia). Stavropol State Agrarian Univerisity, Stavropol.

Sánchez-López C.M., Trelis M., Bernal D. & Marcilla A. 2021. Overview of the interaction of helminth extracellular vesicles with the host and their potential functions and biological applications. *Molec Immun,* **134**, 228-235. https://doi.org/10.1016/j.molimm.2021.03.020

Skryabin K.I. 1916. The characteristics of the helminthofauna of domestic animals of Turkestan. Tipolit. Bergman, Yurev.

Smirnov D.A. 2003. Parasitophauna and measures of combating the main helminthosis of horses in the central region of the Non-Black Earth Zone of the Russian. Ivanovo State Agricultural Academy, Ivanovo.

Tinkler S.H. 2020. Preventive chemotherapy and anthelmintic resistance of soil-transmitted helminths – can we learn nothing from veterinary medicine? *One Health*, **9**. https://doi.org/10.1016/j.onehlt.2019.100106

Trogu T., Canziani S., Salvato S., Tolini C., Grilli G., Chiari M., Farioli M. & Moreno A. 2021. Survey on the presence of viruses of economic and zoonotic importance in avifauna in Northern Italy. *Microorganisms*, **9**(9), art. no. 1957. https://doi.org/10.3390/microorganisms9091957

Velichkin A.P., Yakubovsky M.V. & Dlubakovsky V.I. 2002. Comparative analysis of infection in horses in the Russian Federation and in some European countries (review material). *Proceed of VIGIS,* **6**, 45-47.

Velichkin P.A. 1984. Distribution of mixed invasion of horses among the Oryol trotters. *Proceed of VIGIS,* **41**, 22-24.

Vlizlo V., Ostapiv D., Simonov M., Baumgartner W. & Tomchuk V. 2022. Hormonal regulation of the concentration of glucose and its derivatives in the blood of dairy cows during the transit period. *Ukrain J of Veter Scien,* **13**(4), 16-24. https://doi.org/10.31548/ujvs.13(4).2022.16-24

Yatusevich A.I. & Sinyakov M.P. 2004. Trichonematidosis of horses in the Republic of Belarus and measures to combat them. *Veter Med of Belarus,* **6**(1), 31-33.

Zakharova O.I. & Protodyakonova G.P. 2022. Epizootic situation of brucellosis of domestic northern reindeer in the Republic of Sakha (Yakutia). *IOP Confer Ser: Earth and Environ Scien*, **988**(4), art. no. 042079. https://doi.org/10.1088/1755-1315/988/4/042079.